Manual de referência do GNU Guix

Usando o Gerenciador de Pacotes Funcional GNU Guix

Desenvolvedores do GNU Guix

Edição ba3a031
21 November 2024

Sumário

1 Introdução

GNU Guix[1] é uma ferramenta de gerenciamento de pacotes e distribuição do sistema GNU. O Guix facilita a instalação, a atualização ou a remoção de pacotes de software, a reversão para um conjunto de pacotes anterior, a compilação de pacotes a partir do código-fonte e geralmente ajuda na criação e manutenção de ambientes de software.

Você pode instalar o GNU Guix sobre um sistema GNU/Linux existente, onde ele complementa as ferramentas disponíveis sem interferência (veja Capítulo 2 [Instalação], Página 4) ou você pode usá-lo como uma distribuição de sistema operacional independente, *Guix System*[2]. Veja Seção 1.2 [Distribuição GNU], Página 2.

1.1 Gerenciando software do jeito do Guix

O Guix fornece uma interface de gerenciamento de pacotes de linha de comando (veja Capítulo 5 [Gerenciamento de pacote], Página 36), ferramentas para ajudar no desenvolvimento de software (veja Capítulo 7 [Desenvolvimento], Página 79), utilitários de linha de comando para uso mais avançado (veja Capítulo 9 [Utilitários], Página 177), bem como interfaces de programação Scheme (veja Capítulo 8 [Interface de programação], Página 100). O *build daemon* é responsável por compilar pacotes em nome dos usuários (veja Seção 2.2 [Configurando o daemon], Página 6) e por baixar binários pré-compilados de fontes autorizados (veja Seção 5.3 [Substitutos], Página 47).

Guix inclui definições de pacotes para muitos pacotes GNU e não-GNU, todos os quais respeitam a liberdade de computação do usuário (`https://www.gnu.org/philosophy/free-sw.html`). É *extensível*: os usuários podem escrever suas próprias definições de pacotes (veja Seção 8.2 [Definindo pacotes], Página 101) e disponibilizá-los como módulos de pacotes independentes (veja Seção 8.1 [Módulos de pacote], Página 100). Também é *personalizável*: os usuários podem *derivar* definições de pacotes especializados das existentes, incluindo da linha de comando (veja Seção 9.1.2 [Opções de transformação de pacote], Página 180).

Nos bastidores, a Guix implementa a disciplina *gerenciamento de pacotes funcional* pioneira da Nix (veja Capítulo 23 [Agradecimentos], Página 772). No Guix, o processo de compilação e instalação de pacotes é visto como uma *função*, no sentido matemático. Essa função recebe entradas, como scripts de compilação, um compilador e bibliotecas, e retorna um pacote instalado. Como uma função pura, seu resultado depende apenas de suas entradas – por exemplo, não pode fazer referência a um software ou scripts que não foram explicitamente passados como entradas. Uma função de compilação sempre produz o mesmo resultado ao passar por um determinado conjunto de entradas. Não pode alterar o ambiente do sistema em execução de qualquer forma; por exemplo, ele não pode criar, modificar ou excluir arquivos fora de seus diretórios de compilação e instalação. Isto é conseguido através da execução de processos de compilação em ambientes isolados (ou *containers*), onde somente suas entradas explícitas são visíveis.

O resultado das funções de compilação do pacote é mantido (*cached*) no sistema de arquivos, em um diretório especial chamado *armazém* (veja Seção 8.9 [O armazém], Página 154).

[1] "Guix" é pronunciado como "geeks", ou "iks" usando o alfabeto fonético internacional (IPA).

[2] Costumávamos nos referir ao Guix System como "Guix System Distribution" ou "GuixSD". Agora consideramos que faz mais sentido agrupar tudo sob o banner "Guix", pois, afinal, o Guix System está prontamente disponível através do comando `guix system`, mesmo se você estiver usando uma distribuição diferente por baixo!

Cada pacote é instalado em um diretório próprio no armazém – por padrão, em `/gnu/store`. O nome do diretório contém um hash de todas as entradas usadas para compilar esse pacote; Assim, a alteração uma entrada gera um nome de diretório diferente.

Essa abordagem é a fundação para os principais recursos do Guix: suporte para atualização transacional de pacotes e reversão, instalação por usuário e coleta de lixo de pacotes (veja Seção 5.1 [Recursos], Página 36).

1.2 Distribuição GNU

O Guix vem com uma distribuição do sistema GNU que consiste inteiramente de software livre[3]. A distribuição pode ser instalada por conta própria (veja Capítulo 3 [Instalação do sistema], Página 22), mas também é possível instalar o Guix como um gerenciador de pacotes em cima de um sistema GNU/Linux instalado (veja Capítulo 2 [Instalação], Página 4). Quando precisamos distinguir entre os dois, nos referimos à distribuição independente como Guix System.

A distribuição fornece pacotes GNU principais, como GNU libc, GCC e Binutils, além de muitos aplicativos GNU e não GNU. A lista completa de pacotes disponíveis pode ser acessada online (`https://www.gnu.org/software/guix/packages`) ou executando `guix package` (veja Seção 5.2 [Invocando guix package], Página 37):

```
guix package --list-available
```

Nosso objetivo é fornecer uma distribuição prática e 100% de software livre, baseada em Linux e outras variantes do GNU, com foco na promoção e forte integração de componentes do GNU e ênfase em programas e ferramentas que ajudam os usuários a exercer essa liberdade.

Os pacotes estão atualmente disponíveis nas seguintes plataformas:

`x86_64-linux`
: Arquitetura Intel/AMD `x86_64`, kernel Linux-Libre.

`i686-linux`
: Arquitetura Intel de 32 bits (IA32), kernel Linux-Libre.

`armhf-linux`
: Arquitetura ARMv7-A com hard float, Thumb-2 e NEON, usando a interface binária de aplicativos EABI hard-float (ABI) e o kernel Linux-Libre.

`aarch64-linux`
: Processadores ARMv8-A little-endian de 64 bits, kernel Linux-Libre.

`i586-gnu`
: GNU/Hurd (`https://hurd.gnu.org`) sobre a arquitetura Intel de 32 bits (IA32).

  Esta configuração é experimental e está em desenvolvimento. A maneira mais fácil de você tentar é configurando uma instância de `hurd-vm-service-type` na sua máquina GNU/Linux (veja [transparent-emulation-qemu], Página 531). Veja Capítulo 22 [Contribuindo], Página 720, sobre como ajudar!

[3] O termo "free" em "free software" se refere à liberdade fornecida aos usuários desse software (`https://www.gnu.org/philosophy/free-sw.html`). A ambiguidade no termo em inglês não ocorre na tradução para português "livre".

`mips64el-linux (sem suporte)`
: processadores little-endian MIPS de 64 bits, especificamente a série Loongson, n32 ABI e kernel Linux-Libre. Esta configuração não é mais totalmente suportada; em particular, não há trabalho em andamento para garantir que esta arquitetura ainda funcione. Caso alguém decida que deseja reviver esta arquitetura, o código ainda estará disponível.

`powerpc-linux (sem suporte)`
: processadores PowerPC big-endian de 32 bits, especificamente o PowerPC G4 com suporte AltiVec e kernel Linux-Libre. Esta configuração não é totalmente suportada e não há trabalho em andamento para garantir que esta arquitetura funcione.

`powerpc64le-linux`
: processadores little-endian 64 bits Power ISA, kernel Linux-Libre. Isso inclui sistemas POWER9 como o placa-mãe RYF Talos II (`https://www.fsf.org/news/talos-ii-mainboard-and-talos-ii-lite-mainboard-now-fsf-certified-to-respect-`
Esta plataforma está disponível como uma "prévia de tecnologia": embora seja suportada, substitutos ainda não estão disponíveis na fazenda de construção (veja Seção 5.3 [Substitutos], Página 47), e alguns pacotes podem falhar na construção (veja Seção 22.11 [Rastreando Bugs e Mudanças], Página 751). Dito isso, a comunidade Guix está trabalhando ativamente para melhorar esse suporte, e agora é um ótimo momento para experimentá-lo e se envolver!

`riscv64-linux`
: processadores little-endian RISC-V de 64 bits, especificamente RV64GC, e kernel Linux-Libre. Esta plataforma está disponível como uma "prévia de tecnologia": embora seja suportada, substitutos ainda não estão disponíveis na build farm (veja Seção 5.3 [Substitutos], Página 47), e alguns pacotes podem falhar na compilação (veja Seção 22.11 [Rastreando Bugs e Mudanças], Página 751). Dito isto, a comunidade Guix está trabalhando ativamente para melhorar este suporte, e agora é um ótimo momento para experimentá-lo e se envolver!

Com o Guix System, você *declara* todos os aspectos da configuração do sistema operacional, e o Guix cuida de instanciar a configuração de maneira transacional, reproduzível e sem estado (veja Capítulo 11 [Configuração do sistema], Página 236). O Guix System usa o kernel Linux-libre, o sistema de inicialização Shepherd (veja Seção “Introduction ” em *The GNU Shepherd Manual*), os conhecidos utilitários do GNU e cadeia de ferramentas, bem como o ambiente gráfico ou os serviços de sistema do sua escolha.

Guix System is available on all the above platforms except `mips64el-linux`, `powerpc-linux`, `powerpc64le-linux` and `riscv64-linux`.

Para obter informações sobre como portar para outras arquiteturas ou kernels, veja Capítulo 21 [Portando], Página 719.

A construção desta distribuição é um esforço cooperativo e você está convidado a participar! Veja Capítulo 22 [Contribuindo], Página 720, para obter informações sobre como você pode ajudar.

2 Instalação

Você pode instalar a ferramenta de gerenciamento de pacotes Guix sobre um sistema GNU/Linux ou GNU/Hurd existente[1], conhecido como *distro estrangeiro*. Se, em vez disso, você quiser instalar a distribuição completa e autônoma do sistema GNU, *Guix Sistema*, veja Capítulo 3 [Instalação do sistema], Página 22. Esta seção se preocupa apenas com a instalação do Guix em uma distro estrangeira.

> **Importante:** Esta seção se aplica somente a sistemas sem Guix. Segui-la para instalações Guix existentes sobrescreverá arquivos importantes do sistema.

Quando instalado sobre uma distro alheia. GNU Guix complementa as ferramentas disponíveis sem interferência. Seus dados residem exclusivamente em dois diretórios, geralmente `/gnu/store` e `/var/guix`; outros arquivos no seu sistema, como `/etc`, são deixados intactos.

Uma vez instalado, o Guix pode ser atualizado executando `guix pull` (veja Seção 5.7 [Invocando guix pull], Página 57).

2.1 Instalação de binários

This section describes how to install Guix from a self-contained tarball providing binaries for Guix and for all its dependencies. This is often quicker than installing from source, described later (veja Seção 22.2 [Compilando do git], Página 721).

> **Importante:** Esta seção se aplica somente a sistemas sem Guix. Segui-la para instalações Guix existentes sobrescreverá arquivos importantes do sistema.

Algumas distribuições GNU/Linux, como Debian, Ubuntu e openSUSE fornecem Guix por meio de seus próprios gerenciadores de pacotes. A versão do Guix pode ser mais antiga que ba3a031, mas você pode atualizá-la depois executando '`guix pull`'.

Aconselhamos os administradores de sistema que instalam o Guix, tanto a partir do script de instalação quanto por meio do gerenciador de pacotes nativo de sua distribuição estrangeira, a também ler e seguir regularmente os avisos de segurança, conforme mostrado pelo `guix pull`.

Para Debian ou derivados como Ubuntu ou Trisquel, chame:

```
sudo apt install guix
```

Da mesma forma, no openSUSE:

```
sudo zypper install guix
```

Se você estiver executando o Parabola, depois de habilitar o repositório pcr (Parabola Community Repo), você pode instalar o Guix com:

```
sudo pacman -S guix
```

O projeto Guix também fornece um script de shell, `guix-install.sh`, que automatiza o processo de instalação binária sem o uso de um gerenciador de pacotes de distro estrangeiro[2]. O uso de `guix-install.sh` requer Bash, GnuPG, GNU tar, wget e Xz.

The script guides you through the following:

- Baixando e extraindo o tarball binário

[1] O suporte ao Hurd é atualmente limitado.

[2] `https://git.savannah.gnu.org/cgit/guix.git/plain/etc/guix-install.sh`

- Setting up the build daemon
- Disponibilizando o comando 'guix' para usuários não root
- Configuring substitute servers

Como root, execute:

```
# cd /tmp
# wget https://git.savannah.gnu.org/cgit/guix.git/plain/etc/guix-install.sh
# chmod +x guix-install.sh
# ./guix-install.sh
```

O script para instalar o Guix também está empacotado no Parabola (no repositório pcr). Você pode instalá-lo e executá-lo com:

```
sudo pacman -S guix-installer
sudo guix-install.sh
```

Nota: Por padrão, `guix-install.sh` configurará o Guix para baixar binários de pacotes pré-construídos, chamados *substitutes* (veja Seção 5.3 [Substitutos], Página 47), das fazendas de construção do projeto. Se você escolher não permitir isso, o Guix construirá *tudo* a partir da fonte, tornando cada instalação e atualização muito cara. Veja Seção 5.3.7 [Confiança em binários], Página 51, para uma discussão sobre por que você pode querer construir pacotes a partir da fonte.

Para usar substitutos de `bordeaux.guix.gnu.org`, `ci.guix.gnu.org` ou um espelho, você deve autorizá-los. Por exemplo,

```
# guix archive --authorize < \
     ~root/.config/guix/current/share/guix/bordeaux.guix.gnu.org.pub
# guix archive --authorize < \
     ~root/.config/guix/current/share/guix/ci.guix.gnu.org.pub
```

Quando terminar de instalar o Guix, veja Seção 2.4 [Configuração de aplicativo], Página 17, para configurações extras que você pode precisar e Capítulo 4 [Começando], Página 33, para seus primeiros passos!

Nota: O tarball da instalação binária pode ser (re)produzido e verificado simplesmente executando o seguinte comando na árvore de código-fonte do Guix:

```
make guix-binary.system.tar.xz
```

... que, por sua vez, executa:

```
guix pack -s system --localstatedir \
  --profile-name=current-guix guix
```

Veja Seção 7.3 [Invocando guix pack], Página 92, para mais informações sobre essa ferramenta útil.

Caso você queira desinstalar o Guix, execute o mesmo script com o sinalizador `--uninstall`:

```
./guix-install.sh --uninstall
```

Com `--uninstall`, o script exclui irreversivelmente todos os arquivos Guix, configuração e serviços.

2.2 Configurando o daemon

Durante a instalação, o *build daemon* que deve estar em execução para usar o Guix já foi configurado e você pode executar comandos `guix` no seu programa de terminal, veja Capítulo 4 [Começando], Página 33:

```
guix build hello
```

Se isso ocorrer sem erros, sinta-se à vontade para pular esta seção. Você deve continuar com a seção seguinte, Seção 2.4 [Configuração de aplicativo], Página 17.

No entanto, agora seria um bom momento para substituir versões desatualizadas do daemon, ajustá-lo, executar compilações em outras máquinas (veja Seção 2.2.2 [Configuração de descarregamento de daemon], Página 8) ou iniciá-lo manualmente em ambientes especiais como "chroots" (veja Seção 12.1 [Acessando um sistema existente via chroot], Página 650) ou WSL (não necessário para imagens WSL criadas com Guix, veja Capítulo 16 [Imagens do sistema], Página 697). Se você quiser saber mais ou otimizar seu sistema, vale a pena ler esta seção.

Operações como compilar um pacote ou executar o coletor de lixo são todas executadas por um processo especializado, o build daemon, em nome dos clientes. Apenas o daemon pode acessar o armazém e seu banco de dados associado. Assim, qualquer operação que manipule o armazém passa pelo daemon. Por exemplo, ferramentas de linha de comando como `guix package` e `guix build` se comunicam com o daemon (*via* chamadas de procedimento remoto) para instruir o que fazer.

As seções a seguir explicam como preparar o ambiente do daemon de compilação. Veja Seção 5.3 [Substitutos], Página 47, para informações sobre como permitir que o daemon baixe binários pré-compilados.

2.2.1 Configuração do ambiente de compilação

Em uma configuração multiusuário padrão, o Guix e seu daemon – o programa `guix-daemon` – são instalados pelo administrador do sistema; `/gnu/store` é de propriedade de `root` e `guix-daemon` é executado como `root`. Usuários desprivilegiados podem usar ferramentas Guix para criar pacotes ou acessar o armazém, e o daemon fará isso em seu nome, garantindo que o armazém seja mantido em um estado consistente e permitindo que pacotes construídos sejam compartilhados entre os usuários.

Quando `guix-daemon` é executado como `root`, você pode não querer que os próprios processos de compilação de pacotes também sejam executados como `root`, por razões óbvias de segurança. Para evitar isso, um conjunto especial de *usuários de compilação* deve ser criado para uso pelos processos de construção iniciados pelo daemon. Esses usuários de compilação não precisam ter um shell e um diretório inicial: eles serão usados apenas quando o daemon der um privilégio `root` nos processos de compilação. Ter vários desses usuários permite que o daemon ative processos de compilação distintos sob UIDs separados, o que garante que eles não interfiram uns com os outros - um recurso essencial, pois as compilações são consideradas funções puras (veja Capítulo 1 [Introdução], Página 1).

Em um sistema GNU/Linux, um conjunto de usuários de construção pode ser criado assim (usando a sintaxe Bash e os comandos `shadow`):

```
# groupadd --system guixbuild
# for i in $(seq -w 1 10);
```

```
do
  useradd -g guixbuild -G guixbuild           \
          -d /var/empty -s $(which nologin)   \
          -c "Guix build user $i" --system    \
          guixbuilder$i;
done
```

O número de usuários de compilação determina quantos trabalhos de compilação podem ser executados em paralelo, conforme especificado pela opção `--max-jobs` (veja Seção 2.3 [Invocando guix-daemon], Página 13). Para usar `guix system vm` e comandos relacionados, você pode precisar adicionar os usuários de compilação ao grupo `kvm` para que eles possam acessar `/dev/kvm`, usando `-G guixbuild,kvm` em vez de `-G guixbuild` (veja Seção 11.16 [Invocando guix system], Página 616).

The `guix-daemon` program may then be run as `root` with the following command[3]:

```
# guix-daemon --build-users-group=guixbuild
```

Dessa forma, o daemon inicia os processos de compilação em um chroot, sob um dos usuários `guixbuilder`. No GNU/Linux, por padrão, o ambiente chroot contém nada além de:

- um diretório `/dev` mínimo, criado principalmente independentemente do `/dev` do hospedeiro[4];
- o diretório `/proc`; mostra apenas os processos do contêiner desde que um espaço de nome PID separado é usado;
- `/etc/passwd` com uma entrada para o usuário atual e uma entrada para o usuário `nobody`;
- `/etc/group` com uma entrada para o grupo de usuários;
- `/etc/hosts` com uma entrada que mapeia `localhost` para `127.0.0.1`;
- um diretório `/tmp` com permissão de escrita.

O chroot não contém um diretório `/home`, e a variável de ambiente `HOME` é definida como o inexistente `/homeless-shelter`. Isso ajuda a destacar usos inapropriados de `HOME` nos scripts de construção de pacotes.

Tudo isso geralmente é suficiente para garantir que os detalhes do ambiente não influenciem os processos de construção. Em alguns casos excepcionais em que mais controle é necessário — normalmente sobre a data, kernel ou CPU — você pode recorrer a uma máquina de construção virtual (veja [build-vm], Página 533).

Você pode influenciar o diretório onde o daemon armazena árvores de build *via* a variável de ambiente `TMPDIR`. No entanto, a árvore de build dentro do chroot é sempre chamada `/tmp/guix-build-`*name*`.drv-0`, onde *name* é o nome da derivação—por exemplo, `coreutils-8.24`. Dessa forma, o valor de `TMPDIR` não vaza dentro de ambientes de build, o que evita discrepâncias em casos em que os processos de build capturam o nome de sua árvore de build.

---

[3] If your machine uses the systemd init system, copying the *prefix*`/lib/systemd/system/guix-daemon.service` file to `/etc/systemd/system` will ensure that `guix-daemon` is automatically started. Similarly, if your machine uses the Upstart init system, copy the *prefix*`/lib/upstart/system/guix-daemon.conf` file to `/etc/init`.

[4] "Principalmente" porque enquanto o conjunto de arquivos que aparece no `/dev` do chroot é corrigido, a maioria desses arquivos só pode ser criada se o hospedeiro os possuir.

O daemon também respeita as variáveis de ambiente `http_proxy` e `https_proxy` para downloads HTTP e HTTPS que ele realiza, seja para derivações de saída fixa (veja Seção 8.10 [Derivações], Página 156) ou para substitutos (veja Seção 5.3 [Substitutos], Página 47).

Se você estiver instalando o Guix como um usuário sem privilégios, ainda é possível executar `guix-daemon` desde que você passe `--disable-chroot`. No entanto, os processos de construção não serão isolados uns dos outros, e nem do resto do sistema. Assim, os processos de construção podem interferir uns nos outros, e podem acessar programas, bibliotecas e outros arquivos disponíveis no sistema — tornando muito mais difícil visualizá-los como funções *puras*.

2.2.2 Usando o recurso de descarregamento

Quando desejado, o daemon de compilação pode *offload* compilações de derivação para outras máquinas executando Guix, usando o `offload` *build hook*[5]. Quando esse recurso é habilitado, uma lista de máquinas de compilação especificadas pelo usuário é lida de `/etc/guix/machines.scm`; toda vez que uma compilação é solicitada, por exemplo via `guix build`, o daemon tenta descarregá-la para uma das máquinas que satisfazem as restrições da derivação, em particular seus tipos de sistema — por exemplo, `x86_64-linux`. Uma única máquina pode ter vários tipos de sistema, seja porque sua arquitetura o suporta nativamente, via emulação (veja [transparent-emulation-qemu], Página 531), ou ambos. Os pré-requisitos ausentes para a compilação são copiados por SSH para a máquina de destino, que então prossegue com a compilação; em caso de sucesso, a(s) saída(s) da compilação são copiadas de volta para a máquina inicial. O recurso de offload vem com um agendador básico que tenta selecionar a melhor máquina. A melhor máquina é escolhida entre as máquinas disponíveis com base em critérios como:

1. A disponibilidade de um slot de build. Uma máquina de build pode ter tantos slots de build (conexões) quanto o valor do campo `parallel-builds` do seu objeto `build-machine`.
2. Sua velocidade relativa, conforme definida pelo campo `speed` do seu objeto `build-machine`.
3. Sua carga. A carga normalizada da máquina deve ser menor que um valor limite, configurável por meio do campo `overload-threshold` de seu objeto `build-machine`.
4. Disponibilidade de espaço em disco. Mais de 100 MiB devem estar disponíveis.

O arquivo `/etc/guix/machines.scm` geralmente se parece com isso:

```
(list (build-machine
        (name "eightysix.example.org")
        (systems (list "x86_64-linux" "i686-linux"))
        (host-key "ssh-ed25519 AAAAC3Nza...")
        (user "bob")
        (speed 2.))     ;incredibly fast!

      (build-machine
```

[5] Este recurso está disponível somente quando Guile-SSH (`https://github.com/artyom-poptsov/guile-ssh`) está presente.

```
(name "armeight.example.org")
(systems (list "aarch64-linux"))
(host-key "ssh-rsa AAAAB3Nza...")
(user "alice")

;; Lembre-se de que 'guix offload' é gerado por
;; 'guix-daemon' como root.
(private-key "/root/.ssh/identity-for-guix")))
```

No exemplo acima, especificamos uma lista de duas máquinas de compilação, uma para as arquiteturas `x86_64` e `i686` e uma para a arquitetura `aarch64`.

De fato, esse arquivo é – não surpreendentemente! – um arquivo de Scheme que é avaliado quando o hook `offload` é iniciado. Seu valor de retorno deve ser uma lista de objetos de `build-machine`. Embora este exemplo mostre uma lista fixa de máquinas de compilação, pode-se imaginar, digamos, usando DNS-SD para retornar uma lista de possíveis máquinas de compilação descobertas na rede local (veja Seção "Introduction" em *Using Avahi in Guile Scheme Programs*). O tipo de dados de `build-machine` está detalhado abaixo.

`Data Type` [build-machine]

Esse tipo de dados representa máquinas de compilação nas quais o daemon pode descarregar compilações. Os campos importantes são:

`name` O nome de host da máquina remota.

`systems` O sistema digita os tipos que a máquina remota suporta, por exemplo, `(list "x86_64-linux" "i686-linux")`.

`user` The user account on the remote machine to use when connecting over SSH. Note that the SSH key pair must *not* be passphrase-protected, to allow non-interactive logins.

`host-key` Essa deve ser a SSH *chave pública do host* da máquina no formato OpenSSH. Isso é usado para autenticar a máquina quando nos conectamos a ela. É uma string longa que se parece com isso:

```
ssh-ed25519 AAAAC3NzaC...mde+UhL hint@example.org
```

Se a máquina estiver executando o daemon OpenSSH, `sshd`, a chave do host poderá ser encontrada em um arquivo como `/etc/ssh/ssh_host_ed25519_key.pub`.

Se a máquina estiver executando o daemon SSH do GNU lsh, `lshd`, a chave do host estará em `/etc/lsh/host-key.pub` ou em um arquivo semelhante. Ele pode ser convertido para o formato OpenSSH usando o `lsh-export-key` (veja Seção "Converting keys" em *LSH Manual*):

```
$ lsh-export-key --openssh < /etc/lsh/host-key.pub
ssh-rsa AAAAB3NzaC1yc2EAAAAEOp8FoQAAAQEAs1eB46LV...
```

Vários campos opcionais podem ser especificados:

`port` (padrão: `22`)
O número da porta para o servidor SSH na máquina.

`private-key` (padrão: `~root/.ssh/id_rsa`)
: O arquivo de chave privada SSH a ser usado ao conectar-se à máquina, no formato OpenSSH. Esta chave não deve ser protegida com uma senha.

  Observe que o valor padrão é a chave privada *da usuário root*. Verifique se ele existe se você usar o padrão.

`compression` (padrão: `"zlib@openssh.com,zlib"`)
`compression-level` (padrão: `3`)
: Os métodos de compactação no nível SSH e o nível de compactação solicitado.

  Observe que o descarregamento depende da compactação SSH para reduzir o uso da largura de banda ao transferir arquivos de e para máquinas de compilação.

`daemon-socket` (padrão: `"/var/guix/daemon-socket/socket"`)
: O nome do arquivo do soquete do domínio Unix `guix-daemon` está escutando nessa máquina.

`overload-threshold` (default: `0.8`)
: O limite de carga acima do qual uma máquina de offload potencial é desconsiderada pelo agendador de offload. O valor traduz aproximadamente o uso total do processador da máquina de build, variando de 0,0 (0%) a 1,0 (100%). Ele também pode ser desabilitado definindo `overload-threshold` para `#f`.

`parallel-builds` (padrão: `1`)
: O número de compilações que podem ser executadas paralelamente na máquina.

`speed` (padrão: `1.0`)
: Um "fator de velocidade relativo". O agendador de descarregamento tenderá a preferir máquinas com um fator de velocidade mais alto.

`features` (padrão: `'()`)
: Uma lista de strgins que denotam recursos específicos suportados pela máquina. Um exemplo é `"kvm"` para máquinas que possuem os módulos KVM Linux e o suporte de hardware correspondente. As derivações podem solicitar recursos pelo nome e serão agendadas nas máquinas de compilação correspondentes.

Nota: No Guix System, em vez de gerenciar `/etc/guix/machines.scm` de forma independente, você pode escolher especificar máquinas de compilação diretamente na declaração `operating-system`, no campo `build-machines` de `guix-configuration`. Veja [guix-configuration-build-machines], Página 279.

O comando `guix` deve estar no caminho de pesquisa nas máquinas de compilação. Você pode verificar se este é o caso executando:

```
ssh build-machine guix repl --version
```

Há uma última coisa a fazer quando o `machines.scm` está em vigor. Como explicado acima, ao descarregar, os arquivos são transferidos entre os armazéns das máquinas. Para

que isso funcione, primeiro você precisa gerar um par de chaves em cada máquina para permitir que o daemon exporte arquivos assinados de arquivos do armazém (veja Seção 5.11 [Invocando guix archive], Página 66):

```
# guix archive --generate-key
```

Nota: Este par de chaves não está relacionado ao par de chaves SSH mencionado anteriormente na descrição do tipo de dados `build-machine`.

Cada máquina de construção deve autorizar a chave da máquina principal para que ela aceite itens do armazém que recebe do mestre:

```
# guix archive --authorize < master-public-key.txt
```

Da mesma forma, a máquina principal deve autorizar a chave de cada máquina de compilação.

Todo esse barulho com as chaves está aqui para expressar relações de confiança mútua de pares entre a máquina mestre e as de compilação. Concretamente, quando o mestre recebe arquivos de uma máquina de compilação (e *vice-versa*), seu daemon de compilação pode garantir que eles sejam genuínos, não tenham sido violados e que sejam assinados por uma chave autorizada.

Para testar se sua configuração está operacional, execute este comando no nó principal:

```
# guix offload test
```

Isso tentará se conectar a cada uma das máquinas de compilação especificadas em `/etc/guix/machines.scm`, certificar-se de que o Guix esteja disponível em cada máquina, tentará exportar para a máquina e importar dela e relatará qualquer erro no processo.

Se você quiser testar um arquivo de máquina diferente, basta especificá-lo na linha de comando:

```
# guix offload test machines-qualif.scm
```

Por fim, você pode testar o subconjunto das máquinas cujo nome corresponde a uma expressão regular como esta:

```
# guix offload test machines.scm '\.gnu\.org$'
```

Para exibir o carregamento atual de todos os hosts de compilação, execute este comando no nó principal:

```
# guix offload status
```

2.2.3 Suporte a SELinux

O Guix inclui um arquivo de políticas do SELinux em `etc/guix-daemon.cil` que pode ser instalado em um sistema em que o SELinux está ativado, para rotular os arquivos do Guix e especificar o comportamento esperado do daemon. Como o Guix System não fornece uma política básica do SELinux, a política do daemon não pode ser usada no Guix System.

2.2.3.1 Instalando a política do SELinux

Nota: O script de instalação binária `guix-install.sh` se oferece para executar as etapas abaixo para você (veja Seção 2.1 [Instalação de binários], Página 4).

Para instalar a política, execute esse comando como root:

```
semodule -i /var/guix/profiles/per-user/root/current-guix/share/selinux/guix-daemon.ci
```

Então, como root, renomeie o sistema de arquivos, possivelmente depois de torná-lo gravável:

```
mount -o remount,rw /gnu/store
restorecon -R /gnu /var/guix
```

Neste ponto, você pode iniciar ou reiniciar `guix-daemon`; em uma distribuição que usa systemd como seu gerenciador de serviços, você pode fazer isso com:

```
systemctl restart guix-daemon
```

Depois que a política é instalada, o sistema de arquivos foi rotulado novamente e o daemon foi reiniciado, ele deve estar em execução no contexto `guix_daemon_t`. Você pode confirmar isso com o seguinte comando:

```
ps -Zax | grep guix-daemon
```

Monitore os arquivos de log do SELinux enquanto executa um comando como `guix build hello` para se convencer de que o SELinux permite todas as operações necessárias.

2.2.3.2 Limitações

Esta política não é perfeita. Aqui está uma lista de limitações ou peculiaridades que devem ser consideradas ao implementar a política SELinux fornecida para o daemon Guix.

1. `guix_daemon_socket_t` isn't actually used. None of the socket operations involve contexts that have anything to do with `guix_daemon_socket_t`. It doesn't hurt to have this unused label, but it would be preferable to define socket rules for only this label.
2. `guix gc` cannot access arbitrary links to profiles. By design, the file label of the destination of a symlink is independent of the file label of the link itself. Although all profiles under `$localstatedir` are labelled, the links to these profiles inherit the label of the directory they are in. For links in the user's home directory this will be `user_home_t`. But for links from the root user's home directory, or `/tmp`, or the HTTP server's working directory, etc, this won't work. `guix gc` would be prevented from reading and following these links.
3. O recurso do daemon de escutar conexões TCP pode não funcionar mais. Isso pode exigir regras extras, porque o SELinux trata os soquetes de rede de maneira diferente dos arquivos.
4. Atualmente, todos os arquivos com um nome correspondente à expressão regular `/gnu/store/.+-(guix-.+|profile)/bin/guix-daemon` recebem o rótulo `guix_daemon_exec_t`; isso significa que *qualquer* arquivo com esse nome em qualquer perfil poderá ser executado no domínio de `guix_daemon_t`. Isto não é o ideal. Um invasor pode criar um pacote que forneça esse executável e convencer um usuário a instalar e executá-lo, o que o eleva ao domínio de `guix_daemon_t`. Nesse ponto, o SELinux não poderia impedir o acesso a arquivos permitidos para processos nesse domínio.

   Você precisará renomear o diretório store após todas as atualizações para `guix-daemon`, como após executar `guix pull`. Supondo que o store esteja em `/gnu`, você pode fazer isso com `restorecon -vR /gnu`, ou por outros meios fornecidos pelo seu sistema operacional.

   Poderíamos gerar uma política muito mais restritiva no momento da instalação, para que apenas o nome do arquivo *exato* do executável `guix-daemon` atualmente instalado seja rotulado com `guix_daemon_exec_t`, em vez de usar um amplo expressão regular.

A desvantagem é que o root precisaria instalar ou atualizar a política no momento da instalação sempre que o pacote Guix que fornece o executável `guix-daemon` em execução efetiva for atualizado.

2.3 Invocando `guix-daemon`

O programa `guix-daemon` implementa todas as funcionalidades para acessar o armazém. Isso inclui iniciar processos de compilação, executar o coletor de lixo, consultar a disponibilidade de um resultado da compilação etc. É normalmente executado como `root`, assim:

```
# guix-daemon --build-users-group=guixbuild
```

Este daemon também pode ser iniciado seguindo o protocolo de "ativação de soquete" do systemd (veja Seção "Service De- and Constructors" em *The GNU Shepherd Manual*).

Para detalhes sobre como configurá-lo, veja Seção 2.2 [Configurando o daemon], Página 6.

Por padrão, `guix-daemon` inicia processos de compilação sob diferentes UIDs, obtidos do grupo de compilação especificado com `--build-users-group`. Além disso, cada processo de compilação é executado em um ambiente chroot que contém apenas o subconjunto do armazém do qual o processo de compilação depende, conforme especificado por sua derivação (veja Capítulo 8 [Interface de programação], Página 100), mais um conjunto de diretórios de sistema específicos. Por padrão, o último contém `/dev` e `/dev/pts`. Além disso, no GNU/Linux, o ambiente de compilação é um *container*: além de ter sua própria árvore de sistema de arquivos, ele tem um espaço de nome de montagem separado, seu próprio espaço de nome PID, espaço de nome de rede, etc. Isso ajuda a obter compilações reproduzíveis (veja Seção 5.1 [Recursos], Página 36).

Quando o daemon executa uma compilação em nome do usuário, ele cria um diretório de compilação em `/tmp` ou no diretório especificado por sua variável de ambiente `TMPDIR`. Esse diretório é compartilhado com o contêiner durante a compilação, embora dentro do contêiner, a árvore de compilação seja sempre chamada de `/tmp/guix-build-`*`name`*`.drv-0`.

O diretório de compilação é excluído automaticamente após a conclusão, a menos que a compilação falhe e o cliente tenha especificado `--keep-failed` (veja Seção 9.1.1 [Opções de compilação comum], Página 177).

O daemon escuta conexões e gera um subprocesso para cada sessão iniciada por um cliente (um dos subcomandos `guix`). O comando `guix processes` permite que você tenha uma visão geral da atividade no seu sistema visualizando cada uma das sessões e clientes ativos. Veja Seção 9.16 [Invocando guix processes], Página 231, para mais informações.

As seguintes opções de linha de comando são suportadas:

`--build-users-group=`*`grupo`*

Obtém os usuários do *grupo* para executar os processos de compilação (veja Seção 2.2 [Configurando o daemon], Página 6).

`--no-substitutes`

Não use substitutos para compilar produtos. Ou seja, sempre crie coisas localmente, em vez de permitir downloads de binários pré-compilados (veja Seção 5.3 [Substitutos], Página 47).

Quando o daemon é executado com `--no-substitutes`, os clientes ainda podem habilitar explicitamente a substituição por meio da chamada de procedimento remoto `set-build-options` (veja Seção 8.9 [O armazém], Página 154).

`--substitute-urls=`*urls*
: Consider *urls* the default whitespace-separated list of substitute source URLs. When this option is omitted, '`https://bordeaux.guix.gnu.org` `https://ci.guix.gnu.org`' is used.

  Isso significa que os substitutos podem ser baixados de *urls*, desde que assinados por uma assinatura confiável (veja Seção 5.3 [Substitutos], Página 47).

  Veja Seção 5.3.3 [Obtendo substitutos de outros servidores], Página 48, para mais informações sobre como configurar o daemon para obter substitutos de outros servidores.

`--no-offload`
: Não use compilações de offload para outras máquinas (veja Seção 2.2.2 [Configuração de descarregamento de daemon], Página 8). Ou seja, sempre compile as coisas localmente em vez de descarregar compilações para máquinas remotas.

`--cache-failures`
: Armazena em cache as compilações que falharam. Por padrão, apenas compilações bem-sucedidas são armazenadas em cache.

  Quando essa opção é usada, o `guix gc --list-failures` pode ser usado para consultar o conjunto de itens do armazém marcados como com falha; O `guix gc --clear-failures` remove os itens do armazém do conjunto de falhas em cache. Veja Seção 5.6 [Invocando guix gc], Página 54.

`--cores=`*n*
`-c` *n*
: Usa *n* núcleos de CPU para compilar cada derivação; `0` significa todos disponíveis.

  O valor padrão é `0`, mas pode ser substituído pelos clientes, como a opção `--cores` de `guix build` (veja Seção 9.1 [Invocando guix build], Página 177).

  O efeito é definir a variável de ambiente `NIX_BUILD_CORES` no processo de compilação, que pode então usá-la para explorar o paralelismo interno — por exemplo, executando `make -j$NIX_BUILD_CORES`.

`--max-jobs=`*n*
`-M` *n*
: Permite no máximo *n* tarefas de compilação em paralelo. O valor padrão é `1`. Definir como `0` significa que nenhuma compilação será executada localmente; em vez disso, o daemon descarregará as compilações (veja Seção 2.2.2 [Configuração de descarregamento de daemon], Página 8) ou simplesmente falhará.

`--max-silent-time=`*segundos*
: Quando o processo de compilação ou substituição permanecer em silêncio por mais de *segundos*, encerra-o e relata uma falha de compilação.

  The default value is `3600` (one hour).

  O valor especificado aqui pode ser substituído pelos clientes (veja Seção 9.1.1 [Opções de compilação comum], Página 177).

`--timeout=`*segundos*
: Da mesma forma, quando o processo de compilação ou substituição durar mais que *segundos*, encerra-o e relata uma falha de compilação.

  O valor padrão é 24 horas.

O valor especificado aqui pode ser substituído pelos clientes (veja Seção 9.1.1 [Opções de compilação comum], Página 177).

`--rounds=`*N*

Compila cada derivação *n* vezes seguidas e gera um erro se os resultados consecutivos da compilação não forem idênticos bit a bit. Observe que essa configuração pode ser substituída por clientes como `guix build` (veja Seção 9.1 [Invocando guix build], Página 177).

Quando usado em conjunto com `--keep-failed`, uma saída de comparação é mantida no armazém, sob `/gnu/store/...-check`. Isso facilita procurar por diferenças entre os dois resultados.

`--debug` Produz uma saída de depuração.

Isso é útil para depurar problemas de inicialização do daemon, mas pode ser substituído pelos clientes, por exemplo, a opção `--verbosity` de `guix build` (veja Seção 9.1 [Invocando guix build], Página 177).

`--chroot-directory=`*dir*

adiciona *dir* ao chroot de compilação.

Isso pode alterar o resultado dos processos de compilação – por exemplo, se eles usam dependências opcionais encontradas em *dir* quando estão disponíveis, e não o contrário. Por esse motivo, não é recomendável fazê-lo. Em vez disso, verifique se cada derivação declara todas as entradas necessárias.

`--disable-chroot`

Desabilita compilações em chroot.

O uso dessa opção não é recomendado, pois, novamente, isso permitiria que os processos de compilação obtivessem acesso a dependências não declaradas. Porém, é necessário quando o `guix-daemon` está sendo executado em uma conta de usuário sem privilégios.

`--log-compression=`*tipo*

Compacta logs de compilação de aconrdo com *tipo*, que pode ser um entre `gzip`, `bzip2` e `none`.

A menos que `--lose-logs` seja usado, todos os logs de build são mantidos em *localstatedir*. Para economizar espaço, o daemon os compacta automaticamente com gzip por padrão.

`--discover[=yes|no]`

Se deve descobrir servidores substitutos na rede local usando mDNS e DNS-SD.

Este recurso ainda é experimental. No entanto, aqui estão algumas considerações.

1. Pode ser mais rápido/menos caro do que buscar em servidores remotos;
2. Não há riscos de segurança, apenas substitutos genuínos serão usados (veja Seção 5.3.4 [Autenticação de substituto], Página 50);
3. Um invasor anunciando `guix publish` na sua LAN não pode fornecer binários maliciosos, mas pode descobrir qual software você está instalando;
4. Os servidores podem servir substitutos via HTTP, sem criptografia, para que qualquer pessoa na LAN possa ver qual software você está instalando.

Também é possível habilitar ou desabilitar a descoberta de servidor substituto em tempo de execução executando:

```
herd discover guix-daemon on
herd discover guix-daemon off
```

`--disable-deduplication`
: Desabilita "deduplicação" automática de arquivos no armazém.

  Por padrão, os arquivos adicionados ao armazém são automaticamente "deduplicados": se um arquivo recém-adicionado for idêntico a outro encontrado no armazém, o daemon tornará o novo arquivo um link físico para o outro arquivo. Isso pode reduzir notavelmente o uso do disco, às custas de um leve aumento na carga de entrada/saída no final de um processo de criação. Esta opção desativa essa otimização.

`--gc-keep-outputs[=yes|no]`
: Diz se o coletor de lixo (GC) deve manter as saídas de derivações vivas.

  Quando definido como `yes`, o GC manterá as saídas de qualquer derivação ativa disponível no armazém—os arquivos `.drv`. O padrão é `no`, o que significa que as saídas de derivação são mantidas somente se forem acessíveis a partir de uma raiz do GC. Veja Seção 5.6 [Invocando guix gc], Página 54, para mais informações sobre raízes do GC.

`--gc-keep-derivations[=yes|no]`
: Diz se o coletor de lixo (GC) deve manter as derivações correspondentes às saídas vivas.

  Quando definido como `yes`, como é o caso por padrão, o GC mantém derivações—ou seja, arquivos `.drv`—desde que pelo menos uma de suas saídas esteja ativa. Isso permite que os usuários acompanhem as origens dos itens em seu armazém. Defini-lo como `no` economiza um pouco de espaço em disco.

  Dessa forma, definir `--gc-keep-derivations` como `yes` faz com que a vivacidade flua das saídas para as derivações, e definir `--gc-keep-outputs` como `yes` faz com que a vivacidade flua das derivações para as saídas. Quando ambos são definidos como `yes`, o efeito é manter todos os pré-requisitos de compilação (as fontes, o compilador, as bibliotecas e outras ferramentas de tempo de compilação) de objetos ativos no armazém, independentemente de esses pré-requisitos serem acessíveis a partir de uma raiz GC. Isso é conveniente para desenvolvedores, pois economiza reconstruções ou downloads.

`--impersonate-linux-2.6`
: Em sistemas baseados em Linux, personifique o Linux 2.6. Isso significa que a chamada de sistema `uname` do kernel relatará 2.6 como o número da versão.

  Isso pode ser útil para criar programas que (geralmente de forma errada) dependem do número da versão do kernel.

`--lose-logs`
: Não mantenha logs de build. Por padrão, eles são mantidos em *`localstatedir`*`/guix/log`.

`--system=`*system*
: Assuma *system* como o tipo de sistema atual. Por padrão, é o par arquitetura/kernel encontrado no momento da configuração, como `x86_64-linux`.

`--listen=`*endpoint*
: Ouça conexões em *endpoint*. *endpoint* é interpretado como o nome do arquivo de um soquete de domínio Unix se ele começar com `/` (sinal de barra). Caso contrário, *endpoint* é interpretado como um nome de host ou nome de host e porta para ouvir. Aqui estão alguns exemplos:

  `--listen=/gnu/var/daemon`
  : Ouça conexões no soquete de domínio Unix `/gnu/var/daemon`, criando-o se necessário.

  `--listen=localhost`
  : Ouça as conexões TCP na interface de rede correspondente a `localhost`, na porta 44146.

  `--listen=128.0.0.42:1234`
  : Ouça as conexões TCP na interface de rede correspondente ao `128.0.0.42`, na porta 1234.

  Esta opção pode ser repetida várias vezes, nesse caso `guix-daemon` aceita conexões em todos os endpoints especificados. Os usuários podem informar aos comandos do cliente a qual endpoint se conectar definindo a variável de ambiente `GUIX_DAEMON_SOCKET` (veja Seção 8.9 [O armazém], Página 154).

  > **Nota:** O protocolo daemon é *unauthenticated and unencrypted*. Usar `--listen=`*host* é adequado em redes locais, como clusters, onde apenas nós confiáveis podem se conectar ao daemon de compilação. Em outros casos em que o acesso remoto ao daemon é necessário, recomendamos usar soquetes de domínio Unix junto com SSH.

  Quando `--listen` é omitido, `guix-daemon` escuta conexões no soquete de domínio Unix localizado em *`localstatedir`*`/guix/daemon-socket/socket`.

2.4 Configuração de aplicativo

Ao usar Guix sobre uma distribuição GNU/Linux que não seja um Guix System — uma chamada *distro alheia* — algumas etapas adicionais são necessárias para colocar tudo no seu lugar. Aqui estão algumas delas.

2.4.1 Locales

Pacotes instalados *via* Guix não usarão os dados de localidade do sistema host. Em vez disso, você deve primeiro instalar um dos pacotes de localidade disponíveis com Guix e então definir a variável de ambiente `GUIX_LOCPATH`:

```
$ guix install glibc-locales
$ export GUIX_LOCPATH=$HOME/.guix-profile/lib/locale
```

Observe que o pacote `glibc-locales` contém dados para todos os locais suportados pela GNU libc e pesa cerca de 930 MiB[6]. Se você precisar apenas de alguns locais, poderá definir

[6] O tamanho do pacote `glibc-locales` é reduzido para cerca de 213 MiB com desduplicação de armazém e ainda mais para cerca de 67 MiB ao usar um sistema de arquivos Btrfs compactado em zstd.

seu pacote de locais personalizados por meio do procedimento `make-glibc-utf8-locales` do módulo `(gnu packages base)`. O exemplo a seguir define um pacote contendo os vários locais UTF-8 canadenses conhecidos pela GNU libc, que pesa cerca de 14 MiB:

```
(use-modules (gnu packages base))

(define my-glibc-locales
  (make-glibc-utf8-locales
   glibc
   #:locales (list "en_CA" "fr_CA" "ik_CA" "iu_CA" "shs_CA")
   #:name "glibc-canadian-utf8-locales"))
```

A variável `GUIX_LOCPATH` desempenha um papel similar a `LOCPATH` (veja Seção "Locale Names" em *The GNU C Library Reference Manual*). Há duas diferenças importantes, no entanto:

1. `GUIX_LOCPATH` é honrado apenas pela libc no Guix, e não pela libc fornecida por distros estrangeiras. Assim, usar `GUIX_LOCPATH` permite que você tenha certeza de que os programas da distro estrangeira não acabarão carregando dados de localidade incompatíveis.
2. libc sufixa cada entrada de `GUIX_LOCPATH` com `/X.Y`, onde `X.Y` é a versão libc—por exemplo, `2.22`. Isso significa que, caso seu perfil Guix contenha uma mistura de programas vinculados a diferentes versões libc, cada versão libc tentará carregar apenas dados de localidade no formato correto.

Isso é importante porque o formato de dados de localidade usado por diferentes versões da libc pode ser incompatível.

2.4.2 Name Service Switch

Ao usar o Guix em uma distro alheia, nós *recomendamos fortemente* que o sistema use o *daemon de cache de serviço de nomes* da biblioteca C do GNU, `nscd`, que deve ouvir no soquete `/var/run/nscd/socket`. Caso não faça isso, os aplicativos instalados com Guix podem falhar em procurar nomes de máquina e contas de usuário, ou até mesmo travar. Os próximos parágrafos explicam o porquê.

A biblioteca GNU C implementa um *name service switch* (NSS), que é um mecanismo extensível para "pesquisas de nomes" em geral: resolução de nomes de host, contas de usuários e muito mais (veja Seção "Name Service Switch" em *The GNU C Library Reference Manual*).

Sendo extensível, o NSS suporta *plugins*, que fornecem novas implementações de pesquisa de nomes: por exemplo, o plugin `nss-mdns` permite a resolução de nomes de host `.local`, o plugin `nis` permite a pesquisa de contas de usuários usando o Network information service (NIS), e assim por diante. Esses "serviços de pesquisa" extras são configurados em todo o sistema em `/etc/nsswitch.conf`, e todos os programas em execução no sistema honram essas configurações (veja Seção "NSS Configuration File" em *The GNU C Reference Manual*).

Quando eles realizam uma pesquisa de nome — por exemplo chamando a função `getaddrinfo` em C — os aplicativos primeiro tentam se conectar ao nscd; em caso de sucesso, o nscd realiza pesquisas de nome em seu nome. Se o nscd não estiver em execução, eles realizam a pesquisa de nome sozinhos, carregando os serviços de pesquisa de nome em

seu próprio espaço de endereço e executando-o. Esses serviços de pesquisa de nome — os arquivos `libnss_*.so` — são `dlopen`'d, mas podem vir da biblioteca C do sistema host, em vez da biblioteca C à qual o aplicativo está vinculado (a biblioteca C vem do Guix).

E é aqui que está o problema: se seu aplicativo estiver vinculado à biblioteca C do Guix (por exemplo, glibc 2.24) e tentar carregar plugins NSS de outra biblioteca C (por exemplo, `libnss_mdns.so` para glibc 2.22), ele provavelmente travará ou terá suas pesquisas de nome falhando inesperadamente.

Executar `nscd` no sistema, entre outras vantagens, elimina esse problema de incompatibilidade binária porque esses arquivos `libnss_*.so` são carregados no processo `nscd`, não nos próprios aplicativos.

2.4.3 Fontes X11

A maioria dos aplicativos gráficos usa o Fontconfig para localizar e carregar fontes e executar renderização do lado do cliente X11. O pacote `fontconfig` no Guix procura fontes em `$HOME/.guix-profile` por padrão. Assim, para permitir que aplicativos gráficos instalados com o Guix exibam fontes, você precisa instalar fontes com o Guix também. Pacotes de fontes essenciais incluem `font-ghostscript`, `font-dejavu` e `font-gnu-freefont`.

Depois de instalar ou remover fontes, ou quando notar que um aplicativo não encontra fontes, talvez seja necessário instalar o Fontconfig e forçar uma atualização do cache de fontes executando:

```
guix install fontconfig
fc-cache -rv
```

Para exibir texto escrito em chinês, japonês ou coreano em aplicativos gráficos, considere instalar `font-adobe-source-han-sans` ou `font-wqy-zenhei`. O primeiro tem várias saídas, uma por família de idiomas (veja Seção 5.4 [Pacotes com múltiplas saídas], Página 52). Por exemplo, o comando a seguir instala fontes para idiomas chineses:

```
guix install font-adobe-source-han-sans:cn
```

Programas mais antigos como `xterm` não usam Fontconfig e, em vez disso, dependem da renderização de fontes do lado do servidor. Tais programas exigem a especificação de um nome completo de uma fonte usando XLFD (X Logical Font Description), como este:

```
-*-dejavu sans-medium-r-normal-*-*-100-*-*-*-*-*-1
```

Para poder usar esses nomes completos para as fontes TrueType instaladas no seu perfil Guix, você precisa estender o caminho da fonte do servidor X:

```
xset +fp $(dirname $(readlink -f ~/.guix-profile/share/fonts/truetype/fonts.dir))
```

Depois disso, você pode executar `xlsfonts` (do pacote `xlsfonts`) para garantir que suas fontes TrueType estejam listadas lá.

2.4.4 Certificados X.509

O pacote `nss-certs` fornece certificados X.509, que permitem que programas autentiquem servidores Web acessados por HTTPS.

Ao usar uma Guix em uma distro alheia, você pode instalar esse pacote e definir as variáveis de ambiente relevantes de forma que os pacotes saibam onde procurar por certificados. Veja Seção 11.12 [Certificados X.509], Página 604, para informações detalhadas.

2.4.5 Pacotes Emacs

Quando você instala pacotes do Emacs com o Guix, os arquivos Elisp são colocados no diretório `share/emacs/site-lisp/` do perfil no qual eles são instalados. As bibliotecas Elisp são disponibilizadas para o Emacs por meio da variável de ambiente `EMACSLOADPATH`, que é definida ao instalar o próprio Emacs.

Além disso, as definições de autoload são avaliadas automaticamente na inicialização do Emacs, pelo procedimento específico do Guix `guix-emacs-autoload-packages`. Este procedimento pode ser invocado interativamente para que pacotes Emacs recém-instalados sejam descobertos, sem precisar reiniciar o Emacs. Se, por algum motivo, você quiser evitar o carregamento automático dos pacotes Emacs instalados com o Guix, você pode fazer isso executando o Emacs com a opção `--no-site-file` (veja Seção "Init File" em *The GNU Emacs Manual*).

> **Nota:** A maioria das variantes do Emacs agora são capazes de fazer compilação nativa. A abordagem adotada pelo Guix Emacs, no entanto, difere muito da abordagem adotada pelo upstream.
>
> O Upstream Emacs compila pacotes just-in-time e normalmente coloca arquivos de objetos compartilhados em uma pasta especial dentro do seu `user-emacs-directory`. Esses objetos compartilhados dentro da referida pasta são organizados em uma hierarquia plana, e seus nomes de arquivo contêm dois hashes para verificar o nome do arquivo original e o conteúdo do código-fonte.
>
> O Guix Emacs, por outro lado, prefere compilar pacotes antes do tempo. Objetos compartilhados retêm muito do nome do arquivo original e nenhum hashe é adicionado para verificar o nome do arquivo original ou o conteúdo do arquivo. Crucialmente, isso permite que o Guix Emacs e os pacotes construídos contra ele sejam enxertados (veja Capítulo 19 [Atualizações de segurança], Página 710), mas, ao mesmo tempo, o Guix Emacs não tem a verificação baseada em hash do código-fonte embutido no Emacs upstream. Como esse esquema de nomenclatura é trivial de explorar, desabilitamos a compilação just-in-time.
>
> Observe ainda que `emacs-minimal`—o Emacs padrão para construir pacotes—foi configurado sem compilação nativa. Para compilar nativamente seus pacotes emacs antes do tempo, use uma transformação como `--with-input=emacs-minimal=emacs`.

2.5 Atualizando o Guix

Para atualizar o Guix, execute:

```
guix pull
```

Veja Seção 5.7 [Invocando guix pull], Página 57, para maiores informações.

Em uma distribuição estrangeira, você pode atualizar o daemon de compilação executando:

```
sudo -i guix pull
```

seguido por (supondo que sua distribuição use a ferramenta de gerenciamento de serviço systemd):

```
systemctl restart guix-daemon.service
```

No sistema Guix, a atualização do daemon é obtida reconfigurando o sistema (veja Seção 11.16 [Invocando guix system], Página 616).

3 Instalação do sistema

Esta seção explica como instalar o Guix System em uma máquina. Guix, como gerenciador de pacotes, também pode ser instalado sobre um sistema GNU/Linux em execução, veja Capítulo 2 [Instalação], Página 4.

3.1 Limitações

Consideramos que o Guix System está pronto para uma ampla gama de casos de uso de "desktop" e servidores. As garantias de confiabilidade que ele fornece – atualizações e reversões transacionais, reprodutibilidade – tornam-no uma base sólida.

Cada vez mais serviços de sistema são fornecidos (veja Seção 11.10 [Serviços], Página 268).

No entanto, antes de prosseguir com a instalação, esteja ciente de que alguns serviços dos quais você depende ainda podem estar faltando na versão ba3a031.

Mais do que um aviso de isenção de responsabilidade, este é um convite para relatar problemas (e histórias de sucesso!) e se juntar a nós para melhorá-los. Veja Capítulo 22 [Contribuindo], Página 720, para mais informações.

3.2 Considerações de Hardware

GNU Guix se concentra em respeitar a liberdade computacional do usuário. Ele é construído em torno do kernel Linux-libre, o que significa que apenas o hardware para o qual existem drivers e firmware de software livre é suportado. Hoje em dia, uma ampla gama de hardware disponível no mercado é suportada no GNU/Linux-libre – de teclados a placas gráficas, scanners e controladores Ethernet. Infelizmente, ainda existem áreas onde os fornecedores de hardware negam aos usuários o controle sobre sua própria computação, e tal hardware não é suportado no Guix System.

Uma das principais áreas onde faltam drivers ou firmware gratuitos são os dispositivos WiFi. Os dispositivos WiFi que funcionam incluem aqueles que usam chips Atheros (AR9271 e AR7010), que corresponde ao driver `ath9k` Linux-libre, e aqueles que usam chips Broadcom/AirForce (BCM43xx com Wireless-Core Revisão 5), que corresponde a o driver livre Linux `b43-open`. Existe firmware livre para ambos e está disponível imediatamente no Guix System, como parte do `%base-firmware` (veja Seção 11.3 [Referência do operating-system], Página 247).

O instalador avisa você antecipadamente se detectar dispositivos que *não* funcionam devido à falta de firmware ou drivers gratuitos.

A Free Software Foundation (`https://www.fsf.org/`) administra *Respects Your Freedom* (`https://www.fsf.org/ryf`) (RYF), um programa de certificação para produtos de hardware que respeitem sua liberdade e privacidade e garantam que você tenha controle sobre seu dispositivo. Recomendamos que você verifique a lista de dispositivos certificados RYF.

Outro recurso útil é o site H-Node (`https://www.h-node.org/`). Ele contém um catálogo de dispositivos de hardware com informações sobre seu suporte no GNU/Linux.

3.3 Instalação em um pendrive e em DVD

Uma imagem de instalação ISO-9660 que pode ser gravada em um pendrive ou gravada em um DVD pode ser baixada em ‘`https://ftp.gnu.org/gnu/guix/guix-system-install-ba3a031.x86_64-li`
onde você pode substituir `x86_64-linux` por um dos seguintes:

`x86_64-linux`
: para um sistema GNU/Linux em CPUs de 64 bits compatíveis com Intel/AMD;

`i686-linux`
: para um sistema GNU/Linux de 32 bits em CPUs compatíveis com Intel.

Certifique-se de baixar o arquivo `.sig` associado e verificar a autenticidade da imagem em relação a ele, seguindo estas linhas:

```
$ wget https://ftp.gnu.org/gnu/guix/guix-system-install-ba3a031.x86_64-linux.iso.sig
$ gpg --verify guix-system-install-ba3a031.x86_64-linux.iso.sig
```

Se esse comando falhar porque você não possui a chave pública requerida, execute este comando para importá-lo:

```
$ wget https://sv.gnu.org/people/viewgpg.php?user_id=15145 \
      -qO - | gpg --import -
```

e execute novamente o comando `gpg --verify`.

Observe que um aviso como "Esta chave não está certificada com uma assinatura confiável!" é normal.

Esta imagem contém as ferramentas necessárias para uma instalação. Ele deve ser copiado *como está* para um pendrive ou DVD grande o suficiente.

Copiando para um pendrive

Insira um pendrive de 1 GiB ou mais em sua máquina e determine o nome do dispositivo. Supondo que o pendrive seja conhecido como `/dev/sdX`, copie a imagem com:

```
dd if=guix-system-install-ba3a031.x86_64-linux.iso of=/dev/sdX status=progress
sync
```

O acesso a `/dev/sdX` geralmente requer privilégios de root.

Gravando em um DVD

Insira um DVD virgem em sua máquina e determine o nome do dispositivo. Supondo que a unidade de DVD seja conhecida como `/dev/srX`, copie a imagem com:

```
growisofs -dvd-compat -Z /dev/srX=guix-system-install-ba3a031.x86_64-linux.iso
```

O acesso a `/dev/srX` geralmente requer privilégios de root.

Inicializando

Feito isso, você poderá reiniciar o sistema e inicializar a partir do pendrive ou DVD. O último geralmente requer que você entre no menu de inicialização do BIOS ou UEFI, onde você pode optar por inicializar a partir do pendrive. Para inicializar a partir do Libreboot, mude para o modo de comando pressionando a tecla `c` e digite `search_grub usb`.

Infelizmente, em algumas máquinas, o meio de instalação não pode ser inicializado corretamente e você só verá uma tela preta após a inicialização, mesmo depois de esperar dez

minutos. Isto pode indicar que sua máquina não consegue executar o Sistema Guix; talvez você queira instalar o Guix em uma distribuição estrangeira (veja Seção 2.1 [Instalação de binários], Página 4). Mas não desista ainda; uma possível solução alternativa é pressionar a tecla `e` no menu de inicialização do GRUB e anexar `nomodeset` à linha de inicialização do Linux. Às vezes, o problema da tela preta também pode ser resolvido conectando um monitor diferente.

Veja Seção 3.8 [Instalando Guix em uma VM], Página 31, se, em vez disso, você quiser instalar o Guix System em uma máquina virtual (VM).

3.4 Preparando para instalação

Depois de inicializar, você pode usar o instalador gráfico guiado, o que facilita o início (veja Seção 3.5 [Instalação gráfica guiada], Página 24). Alternativamente, se você já está familiarizado com GNU/Linux e deseja mais controle do que o instalador gráfico oferece, você pode escolher o processo de instalação "manual" (veja Seção 3.6 [Instalação manual], Página 26).

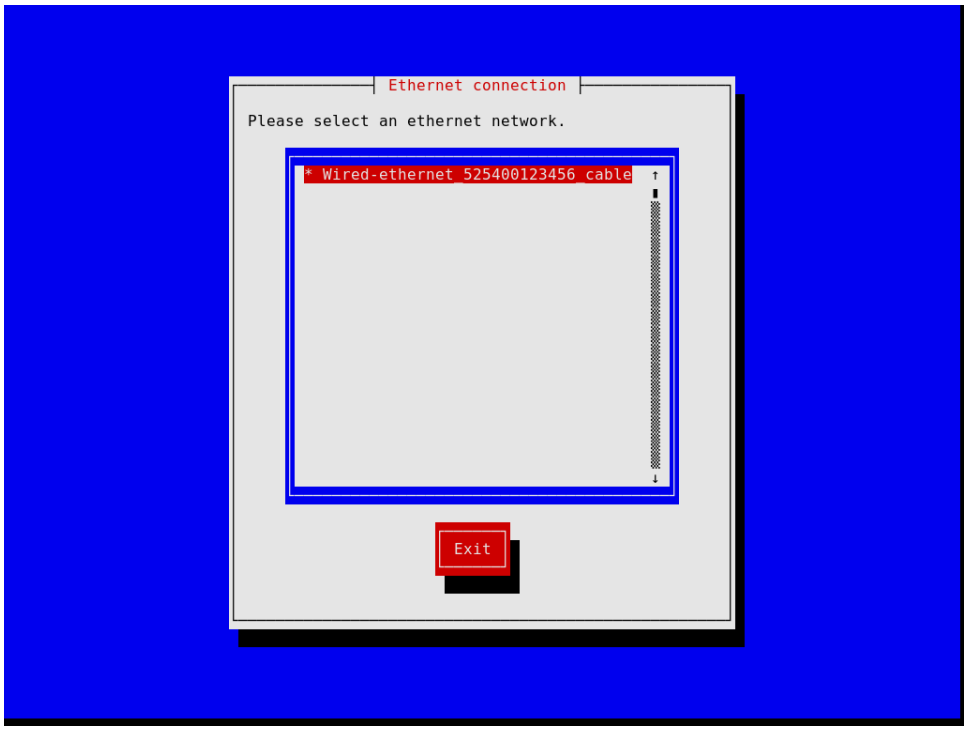
O instalador gráfico está disponível em TTY1. Você pode obter shells root em TTYs 3 a 6 pressionando *`ctrl-alt-f3`*, *`ctrl-alt-f4`*, etc. TTY2 mostra esta documentação e você pode acessá-la com *`ctrl-alt -f2`*. A documentação pode ser navegada usando os comandos do leitor de informações (veja *Stand-alone GNU Info*). O sistema de instalação executa o daemon do mouse GPM, que permite selecionar texto com o botão esquerdo do mouse e colá-lo com o botão do meio.

> **Nota:** A instalação requer acesso à Internet para que quaisquer dependências ausentes na configuração do sistema possam ser baixadas. Consulte a seção "Rede" abaixo.

3.5 Instalação gráfica guiada

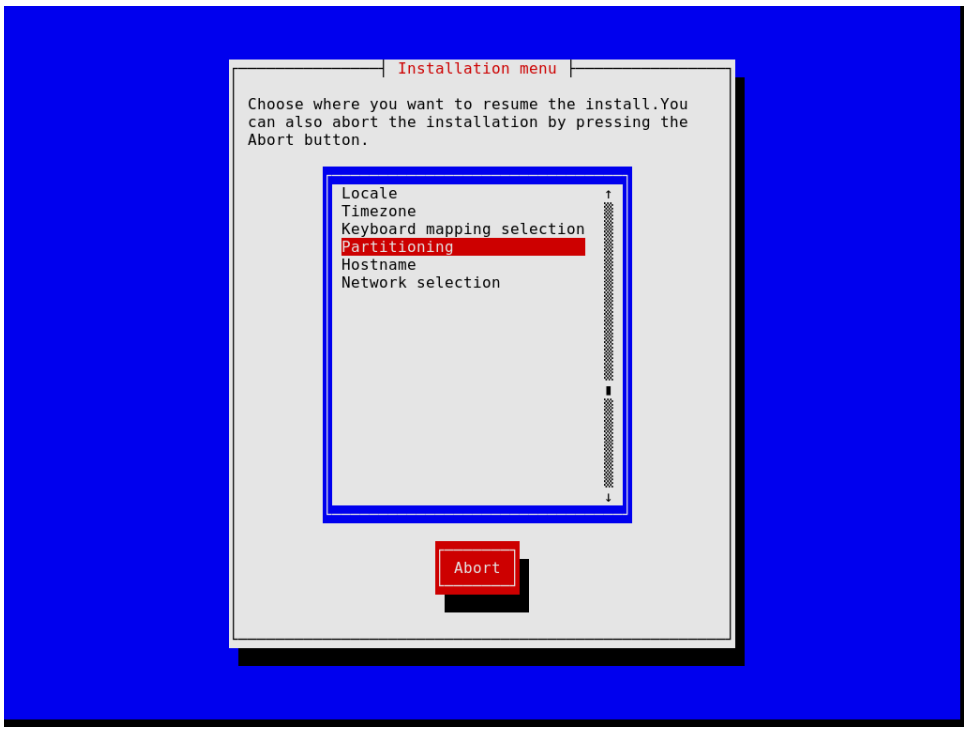
O instalador gráfico é uma interface de usuário baseada em texto. Ele guiará você, com caixas de diálogo, pelas etapas necessárias para instalar o GNU Guix System.

As primeiras caixas de diálogo permitem que você configure o sistema conforme você o utiliza durante a instalação: você pode escolher o idioma, o layout do teclado e configurar a rede que será usada durante a instalação. A imagem abaixo mostra a caixa de diálogo de rede.



As etapas posteriores permitem particionar seu disco rígido, conforme mostrado na imagem abaixo, escolher se deseja ou não usar sistemas de arquivos criptografados, inserir o nome do host e a senha root e criar uma conta adicional, entre outras coisas.

Observe que, a qualquer momento, o instalador permite sair da etapa de instalação atual e retomar uma etapa anterior, conforme imagem abaixo.



Quando terminar, o instalador produz uma configuração do sistema operacional e a exibe (veja Seção 11.2 [Usando o sistema de configuração], Página 238). Nesse ponto você pode clicar em "OK" e a instalação continuará. Se tiver sucesso, você pode reiniciar no novo sistema e aproveitar. Veja Seção 3.7 [Após a instalação do sistema], Página 31, para saber o que vem a seguir!

3.6 Instalação manual

Esta seção descreve como você instalaria "manualmente" o GNU Guix System em sua máquina. Esta opção requer familiaridade com GNU/Linux, com o shell e com ferramentas de administração comuns. Se você acha que isso não é para você, considere usar o instalador gráfico guiado (veja Seção 3.5 [Instalação gráfica guiada], Página 24).

O sistema de instalação fornece shells raiz nos TTYs 3 a 6; pressione *`ctrl-alt-f3`*, *`ctrl-alt-f4`* e assim por diante para alcançá-los. Inclui muitas ferramentas comuns necessárias para instalar o sistema, mas também é um sistema Guix completo. Isso significa que você pode instalar pacotes adicionais, caso precise, usando `guix package` (veja Seção 5.2 [Invocando guix package], Página 37).

3.6.1 Layout de teclado, rede e particionamento

Antes de instalar o sistema, você pode querer ajustar o layout do teclado, configurar a rede e particionar o disco rígido de destino. Esta seção irá guiá-lo através disso.

3.6.1.1 Disposição do teclado

A imagem de instalação usa o layout de teclado qwerty dos EUA. Se quiser alterá-lo, você pode usar o comando `loadkeys`. Por exemplo, o comando a seguir seleciona o layout do teclado Dvorak:

```
loadkeys dvorak
```

Consulte os arquivos em `/run/current-system/profile/share/keymaps` para obter uma lista de layouts de teclado disponíveis. Execute `man loadkeys` para obter mais informações.

3.6.1.2 Rede

Execute o seguinte comando para ver como são chamadas suas interfaces de rede:

```
ifconfig -a
```

... ou, usando o comando `ip` específico do GNU/Linux:

```
ip address
```

As interfaces com fio têm um nome que começa com '`e`'; por exemplo, a interface correspondente ao primeiro controlador Ethernet integrado é chamada '`eno1`'. As interfaces sem fio têm um nome que começa com '`w`', como '`w1p2s0`'.

Conexão cabeada

Para configurar uma rede com fio execute o seguinte comando, substituindo *interface* pelo nome da interface com fio que você deseja usar.

```
ifconfig interface up
```

... ou, usando o comando `ip` específico do GNU/Linux:

```
ip link set interface up
```

Conexão sem fio

Para configurar a rede sem fio, você pode criar um arquivo de configuração para a ferramenta de configuração `wpa_supplicant` (sua localização não é importante) usando um dos editores de texto disponíveis, como `nano`:

```
nano wpa_supplicant.conf
```

Como exemplo, a sub-rotina a seguir pode ir para este arquivo e funcionará para muitas redes sem fio, desde que você forneça o SSID e a senha reais da rede à qual está se conectando:

```
network={
  ssid="my-ssid"
  key_mgmt=WPA-PSK
  psk="the network's secret passphrase"
}
```

Inicie o serviço sem fio e execute-o em segundo plano com o seguinte comando (substitua *interface* pelo nome da interface de rede que deseja usar):

```
wpa_supplicant -c wpa_supplicant.conf -i interface -B
```

Execute `man wpa_supplicant` para obter mais informações.

Neste ponto, você precisa adquirir um endereço IP. Em uma rede onde os endereços IP são atribuídos automaticamente *via* DHCP, você pode executar:

```
dhclient -v interface
```

Tente executar ping em um servidor para ver se a rede está funcionando:

```
ping -c 3 gnu.org
```

Configurar o acesso à rede é quase sempre um requisito porque a imagem não contém todos os softwares e ferramentas que podem ser necessários.

Se você precisar de acesso HTTP e HTTPS para passar por um proxy, execute o seguinte comando:

```
herd set-http-proxy guix-daemon URL
```

onde *URL* é a URL do proxy, por exemplo `http://example.org:8118`.

Se desejar, você pode continuar a instalação remotamente iniciando um servidor SSH:

```
herd start ssh-daemon
```

Certifique-se de definir uma senha com `passwd` ou configurar a autenticação de chave pública OpenSSH antes de efetuar login.

3.6.1.3 Particionamento de disco

A menos que isso já tenha sido feito, o próximo passo é particionar e então formatar a(s) partição(ões) de destino.

A imagem de instalação inclui várias ferramentas de particionamento, incluindo Parted (veja Seção "Overview" em *GNU Parted User Manual*), `fdisk` e `cfdisk`. Execute-a e configure seu disco com o layout de partição que você deseja:

```
cfdisk
```

Se o seu disco usa o formato GUID Partition Table (GPT) e você planeja instalar o GRUB baseado em BIOS (que é o padrão), certifique-se de que uma partição de inicialização do BIOS esteja disponível (veja Seção "BIOS installation" em *manual do GNU GRUB*).

Se você preferir usar o GRUB baseado em EFI, uma partição de sistema EFI (ESP) FAT32 *EFI System Partition* é necessária. Essa partição pode ser montada em `/boot/efi`, por exemplo, e deve ter o sinalizador `esp` definido. Por exemplo, para `parted`:

```
parted /dev/sda set 1 esp on
```

Nota: Não tem certeza se deve usar o GRUB baseado em EFI ou BIOS? Se o diretório `/sys/firmware/efi` existir na imagem de instalação, então você provavelmente deve executar uma instalação EFI, usando `grub-efi-bootloader`. Caso contrário, você deve usar o GRUB baseado em BIOS, conhecido como `grub-bootloader`. Veja Seção 11.15 [Configuração do carregador de inicialização], Página 610, para mais informações sobre bootloaders.

Depois de terminar de particionar o disco rígido de destino, você precisa criar um sistema de arquivos na(s) partição(ões) relevante(s)[1]. Para o ESP, se você tiver um e presumindo que seja `/dev/sda1`, execute:

```
mkfs.fat -F32 /dev/sda1
```

Para o sistema de arquivos raiz, ext4 é o formato mais amplamente usado. Outros sistemas de arquivos, como Btrfs, suportam compressão, que é relatada como um bom complemento para a desduplicação de arquivos que o daemon executa independentemente do sistema de arquivos (veja Seção 2.3 [Invocando guix-daemon], Página 13).

[1] Atualmente, o Guix System suporta apenas sistemas de arquivos ext4, btrfs, JFS, F2FS e XFS. Em particular, o código que lê UUIDs e rótulos do sistema de arquivos funciona apenas para esses tipos de sistema de arquivos.

De preferência, atribua um rótulo aos sistemas de arquivos para que você possa se referir a eles de forma fácil e confiável nas declarações `file-system` (veja Seção 11.4 [Sistemas de arquivos], Página 251). Isso normalmente é feito usando a opção `-L` de `mkfs.ext4` e comandos relacionados. Então, assumindo que a partição raiz de destino esteja em `/dev/sda2`, um sistema de arquivos com o rótulo `my-root` pode ser criado com:

```
mkfs.ext4 -L my-root /dev/sda2
```

Se você estiver planejando criptografar a partição raiz, você pode usar os utilitários Cryptsetup/LUKS para fazer isso (veja `man cryptsetup` para mais informações).

Supondo que você queira armazenar a partição raiz em `/dev/sda2`, a sequência de comandos para formatá-la como uma partição LUKS seria algo como isto:

```
cryptsetup luksFormat /dev/sda2
cryptsetup open /dev/sda2 my-partition
mkfs.ext4 -L my-root /dev/mapper/my-partition
```

Feito isso, monte o sistema de arquivos de destino em `/mnt` com um comando como (novamente, assumindo que `my-root` é o rótulo do sistema de arquivos raiz):

```
mount LABEL=my-root /mnt
```

Monte também quaisquer outros sistemas de arquivos que você gostaria de usar no sistema de destino em relação a este caminho. Se você optou por `/boot/efi` como um ponto de montagem EFI, por exemplo, monte-o em `/mnt/boot/efi` agora para que ele seja encontrado por `guix system init` depois.

Por fim, se você planeja usar uma ou mais partições swap (veja Seção 11.6 [Espaço de troca (swap)], Página 259), certifique-se de inicializá-las com `mkswap`. Supondo que você tenha uma partição swap em `/dev/sda3`, você executaria:

```
mkswap /dev/sda3
swapon /dev/sda3
```

Alternativamente, você pode usar um arquivo de swap. Por exemplo, supondo que no novo sistema você queira usar o arquivo `/swapfile` como um arquivo de swap, você executaria[2]:

```
# Este é 10 GiB de espaço de swap. Ajuste "count" para alterar o tamanho.
dd if=/dev/zero of=/mnt/swapfile bs=1MiB count=10240
# Por segurança, torne o arquivo legível e gravável somente pelo root.
chmod 600 /mnt/swapfile
mkswap /mnt/swapfile
swapon /mnt/swapfile
```

Observe que se você criptografou a partição raiz e criou um arquivo de swap em seu sistema de arquivos, conforme descrito acima, a criptografia também protegerá o arquivo de swap, assim como qualquer outro arquivo naquele sistema de arquivos.

[2] Este exemplo funcionará para muitos tipos de sistemas de arquivos (por exemplo, ext4). No entanto, para sistemas de arquivos copy-on-write (por exemplo, btrfs), as etapas necessárias podem ser diferentes. Para detalhes, veja as páginas do manual para `mkswap` e `swapon`.

3.6.2 Prosseguindo com a instalação

Com as partições de destino prontas e a raiz de destino montada em `/mnt`, estamos prontos para começar. Primeiro, execute:

```
herd start cow-store /mnt
```

Isso torna `/gnu/store` copy-on-write, de modo que os pacotes adicionados a ele durante a fase de instalação são gravados no disco de destino em `/mnt` em vez de mantidos na memória. Isso é necessário porque a primeira fase do comando `guix system init` (veja abaixo) envolve downloads ou compilações para `/gnu/store` que, inicialmente, é um sistema de arquivos na memória.

Em seguida, você precisa editar um arquivo e fornecer a declaração do sistema operacional a ser instalado. Para isso, o sistema de instalação vem com três editores de texto. Recomendamos o GNU nano (veja *GNU nano Manual*), que suporta realce de sintaxe e correspondência de parênteses; outros editores incluem mg (um clone do Emacs) e nvi (um clone do editor original BSD `vi`). Recomendamos fortemente armazenar esse arquivo no sistema de arquivos raiz de destino, digamos, como `/mnt/etc/config.scm`. Se isso não for feito, você perderá seu arquivo de configuração depois de reinicializar o sistema recém-instalado.

Veja Seção 11.2 [Usando o sistema de configuração], Página 238, para uma visão geral do arquivo de configuração. As configurações de exemplo discutidas nessa seção estão disponíveis em `/etc/configuration` na imagem de instalação. Assim, para começar com uma configuração de sistema fornecendo um servidor de exibição gráfica (um sistema "desktop"), você pode executar algo como estas linhas:

```
# mkdir /mnt/etc
# cp /etc/configuration/desktop.scm /mnt/etc/config.scm
# nano /mnt/etc/config.scm
```

Você deve prestar atenção ao que seu arquivo de configuração contém e, em particular:

- Certifique-se de que o formulário `bootloader-configuration` se refere aos alvos nos quais você deseja instalar o GRUB. Ele deve mencionar `grub-bootloader` se você estiver instalando o GRUB da maneira legada, ou `grub-efi-bootloader` para sistemas UEFI mais novos. Para sistemas legados, o campo `targets` contém os nomes dos dispositivos, como `(list "/dev/sda")`; para sistemas UEFI, ele nomeia os caminhos para partições EFI montadas, como `(list "/boot/efi")`; certifique-se de que os caminhos estejam montados no momento e que uma entrada `file-system` esteja especificada em sua configuração.
- Certifique-se de que os rótulos do seu sistema de arquivos correspondam ao valor dos respectivos campos `device` na sua configuração `file-system`, supondo que sua configuração `file-system` use o procedimento `file-system-label` no seu campo `device`.
- Se houver partições criptografadas ou RAID, certifique-se de adicionar um campo `mapped-devices` para descrevê-las (veja Seção 11.5 [Dispositivos mapeados], Página 256).

Depois de terminar de preparar o arquivo de configuração, o novo sistema deve ser inicializado (lembre-se de que o sistema de arquivos raiz de destino é montado em `/mnt`):

```
guix system init /mnt/etc/config.scm /mnt
```

Isso copia todos os arquivos necessários e instala o GRUB em `/dev/sdX`, a menos que você passe a opção `--no-bootloader`. Para mais informações, veja Seção 11.16 [Invocando guix

system], Página 616. Este comando pode disparar downloads ou compilações de pacotes ausentes, o que pode levar algum tempo.

Após a conclusão desse comando – e esperamos que com sucesso! – você pode executar o comando `reboot` e inicializar no novo sistema. A senha `root` no novo sistema está inicialmente vazia; as senhas de outros usuários precisam ser inicializadas executando o comando `passwd` como `root`, a menos que sua configuração especifique o contrário (veja [user-account-password], Página 263). Veja Seção 3.7 [Após a instalação do sistema], Página 31, para o que vem a seguir!

3.7 Após a instalação do sistema

Sucesso, agora você inicializou no Guix System! Você pode atualizar o sistema sempre que quiser executando:

```
guix pull
sudo guix system reconfigure /etc/config.scm
```

Isso cria uma nova *geração* sistema com os pacotes e serviços mais recentes.

Agora, veja Seção 11.1 [Começando com o Sistema], Página 236, junte-se a nós no `#guix` na rede IRC Libera.Chat ou no `guix-devel@gnu.org` para compartilhar sua experiência!

3.8 Instalando Guix em uma Máquina Virtual

Se você deseja instalar o Guix System em uma máquina virtual (VM) ou em um servidor virtual privado (VPS) em vez de na sua máquina favorita, esta seção é para você.

Para inicializar uma VM QEMU (`https://qemu.org/`) para instalar o Guix System em uma imagem de disco, siga estas etapas:

1. Primeiro, recupere e descompacte a imagem de instalação do sistema Guix conforme descrito anteriormente (veja Seção 3.3 [Instalação em um pendrive e em DVD], Página 23).
2. Crie uma imagem de disco que irá conter o sistema instalado. Para criar uma imagem de disco formatada em qcow2, use o comando `qemu-img`:

   ```
   qemu-img create -f qcow2 guix-system.img 50G
   ```

   O arquivo resultante será muito menor que 50 GB (normalmente menos de 1 MB), mas aumentará à medida que o dispositivo de armazenamento virtualizado for preenchido.
3. Boot the USB installation image in a VM:

   ```
   qemu-system-x86_64 -m 1024 -smp 1 -enable-kvm \
     -nic user,model=virtio-net-pci -boot menu=on,order=d \
     -drive file=guix-system.img \
     -drive media=cdrom,readonly=on,file=guix-system-install-ba3a031.sistema.iso
   ```

   `-enable-kvm` é opcional, mas melhora significativamente o desempenho, veja Seção 11.18 [Executando Guix em uma VM], Página 629.
4. Agora você está como root na VM, prossiga com o processo de instalação. Veja Seção 3.4 [Preparando para instalação], Página 24, e siga as instruções.

Quando a instalação estiver concluída, você pode inicializar o sistema que está na sua imagem `guix-system.img`. Veja Seção 11.18 [Executando Guix em uma VM], Página 629, para saber como fazer isso.

3.9 Compilando a imagem de instalação

A imagem de instalação descrita acima foi criada usando o comando `guix system`, especificamente:

```
guix system image -t iso9660 gnu/system/install.scm
```

Dê uma olhada em `gnu/system/install.scm` na árvore de origem e veja também Seção 11.16 [Invocando guix system], Página 616, para mais informações sobre a imagem de instalação.

3.10 Construindo a imagem de instalação para placas ARM

Muitas placas ARM exigem uma variante específica do bootloader U-Boot (`https://www.denx.de/wiki/U-Boot/`).

Se você criar uma imagem de disco e o bootloader não estiver disponível de outra forma (em outra unidade de inicialização, etc.), é aconselhável criar uma imagem que inclua o bootloader, especificamente:

```
guix system image --system=armhf-linux -e '((@ (gnu system install) os-with-u-boot) (@
```

`A20-OLinuXino-Lime2` é o nome do quadro. Se você especificar um quadro inválido, uma lista de quadros possíveis será mostrada.

4 Começando

Presumivelmente, você chegou a esta seção porque instalou o Guix sobre outra distribuição (veja Capítulo 2 [Instalação], Página 4) ou instalou o Guix System autônomo (veja Capítulo 3 [Instalação do sistema], Página 22). É hora de começar a usar o Guix e esta seção tem como objetivo ajudar você a fazer isso e dar uma ideia de como é.

Guix é sobre instalar software, então provavelmente a primeira coisa que você vai querer fazer é realmente procurar por software. Digamos que você esteja procurando por um editor de texto, você pode executar:

```
guix search text editor
```

Este comando mostra a você um número de *pacotes* correspondentes, cada vez mostrando o nome do pacote, versão, uma descrição e informações adicionais. Depois de descobrir qual você quer usar, digamos Emacs (ah ha!), você pode prosseguir e instalá-lo (execute este comando como um usuário regular, *não precisa de privilégios de root*!):

```
guix install emacs
```

Você instalou seu primeiro pacote, parabéns! O pacote agora está visível no seu *perfil* padrão, `$HOME/.guix-profile`—um perfil é um diretório que contém pacotes instalados. No processo, você provavelmente notou que o Guix baixou binários pré-compilados; ou, se você escolheu explicitamente *não* usar binários pré-compilados, então provavelmente o Guix ainda está compilando software (veja Seção 5.3 [Substitutos], Página 47, para mais informações).

A menos que você esteja usando o Guix System, o comando `guix install` deve ter mostrado esta dica:

```
dica: Considere definir as variáveis de ambiente necessárias executando:

     GUIX_PROFILE="$HOME/.guix-profile"
     . "$GUIX_PROFILE/etc/profile"

Alternativamente, consulte `guix package --search-paths -p "$HOME/.guix-profile"'.
```

De fato, agora você deve informar ao seu shell onde `emacs` e outros programas instalados com Guix podem ser encontrados. Colar as duas linhas acima fará exatamente isso: adicionará `$HOME/.guix-profile/bin`—que é onde o pacote instalado está—à variável de ambiente `PATH`. Você pode colar essas duas linhas no seu shell para que elas entrem em vigor imediatamente, mas o mais importante é adicioná-las a `~/.bash_profile` (ou arquivo equivalente se você não usar Bash) para que as variáveis de ambiente sejam definidas na próxima vez que você gerar um shell. Você só precisa fazer isso uma vez e outras variáveis de ambiente de caminhos de busca serão cuidadas de forma semelhante—por exemplo, se você eventualmente instalar `python` e bibliotecas Python, `GUIX_PYTHONPATH` será definido.

Você pode continuar instalando pacotes à vontade. Para listar os pacotes instalados, execute:

```
guix package --list-installed
```

Para remover um pacote, você executaria, sem surpresa, `guix remove`. Um recurso diferenciador é a capacidade de *reverter* qualquer operação que você fez—instalação, remoção, atualização—simplesmente digitando:

```
guix package --roll-back
```

Isso ocorre porque cada operação é, na verdade, uma *transação* que cria uma nova *geração*. Essas gerações e a diferença entre elas podem ser exibidas executando:

```
guix package --list-generations
```

Agora você conhece os conceitos básicos de gerenciamento de pacotes!

> **Indo além:** Veja Capítulo 5 [Gerenciamento de pacote], Página 36, para mais informações sobre gerenciamento de pacotes. Você pode gostar do gerenciamento de pacotes *declarativo* com `guix package --manifest`, gerenciar *perfis* separados com `--profile`, excluir gerações antigas, coletar lixo e outros recursos interessantes que serão úteis à medida que você se familiarizar com o Guix. Se você for um desenvolvedor, veja Capítulo 7 [Desenvolvimento], Página 79, para ferramentas adicionais. E se estiver curioso, veja Seção 5.1 [Recursos], Página 36, para dar uma olhada nos bastidores.
>
> Você também pode gerenciar a configuração de todo o seu ambiente *pessoal* — seus "arquivos dot" de usuário, serviços e pacotes — usando o Guix Home. Veja Capítulo 13 [Home Configuration], Página 652, para saber mais sobre isso!

Depois de instalar um conjunto de pacotes, você vai querer *atualizá-los* periodicamente para a versão mais recente e melhor. Para fazer isso, você primeiro vai puxar a revisão mais recente do Guix e sua coleção de pacotes:

```
guix pull
```

O resultado final é um novo comando `guix`, em `~/.config/guix/current/bin`. A menos que você esteja no Guix System, na primeira vez que você executar `guix pull`, certifique-se de seguir a dica que o comando imprime e, similar ao que vimos acima, cole estas duas linhas no seu terminal e `.bash_profile`:

```
GUIX_PROFILE="$HOME/.config/guix/current"
. "$GUIX_PROFILE/etc/profile"
```

Você também deve instruir seu shell a apontar para este novo `guix`:

```
hash guix
```

Neste ponto, você está executando um Guix novinho em folha. Você pode então prosseguir e realmente atualizar todos os pacotes que você instalou anteriormente:

```
guix upgrade
```

Ao executar este comando, você verá que os binários são baixados (ou talvez alguns pacotes são construídos) e, eventualmente, você acaba com os pacotes atualizados. Se um desses pacotes atualizados não for do seu agrado, lembre-se de que você sempre pode reverter!

Você pode exibir a revisão exata do Guix que está usando atualmente executando:

```
guix describe
```

As informações exibidas são *tudo o que é necessário para reproduzir exatamente o mesmo Guix*, seja em um momento diferente ou em uma máquina diferente.

> **Indo além:** Veja Seção 5.7 [Invocando guix pull], Página 57, para mais informações. Veja Capítulo 6 [Canais], Página 69, sobre como especificar *canais* adicionais para extrair pacotes, como replicar Guix e muito mais. Você também pode achar `time-machine` útil (veja Seção 5.8 [Invocando guix time-machine], Página 61).

Se você instalou o Guix System, uma das primeiras coisas que você vai querer fazer é atualizar seu sistema. Depois de executar `guix pull` para obter o Guix mais recente, você pode atualizar o sistema assim:

```
sudo guix system reconfigure /etc/config.scm
```

Após a conclusão, o sistema executa as versões mais recentes de seus pacotes de software. Assim como para pacotes, você sempre pode *reverter* para uma geração anterior *de todo o sistema*. Veja Seção 11.1 [Começando com o Sistema], Página 236, para aprender como gerenciar seu sistema.

Agora você sabe o suficiente para começar!

Recursos: O restante deste manual fornece uma referência para todas as coisas do Guix. Aqui estão alguns recursos adicionais que você pode achar úteis:

- Veja *O Livro de Receitas do GNU Guix*, para uma lista de receitas no estilo "como fazer" para uma variedade de aplicações.
- O GNU Guix Reference Card (`https://guix.gnu.org/guix-refcard.pdf`) lista em duas páginas a maioria dos comandos e opções que você precisará.
- O site contém vídeos instrucionais (`https://guix.gnu.org/en/videos/`) que abordam tópicos como o uso diário do Guix, como obter ajuda e como se tornar um colaborador.
- Veja Capítulo 14 [Documentação], Página 694, para aprender como acessar a documentação no seu computador.

Esperamos que você goste do Guix tanto quanto a comunidade gosta de criá-lo!

5 Gerenciamento de pacote

O propósito do GNU Guix é permitir que os usuários instalem, atualizem e removam facilmente pacotes de software, sem precisar saber sobre seus procedimentos de construção ou dependências. O Guix também vai além desse conjunto óbvio de recursos.

Este capítulo descreve os principais recursos do Guix, bem como as ferramentas de gerenciamento de pacotes que ele fornece. Junto com a interface de linha de comando descrita abaixo (veja Seção 5.2 [Invocando guix package], Página 37), você também pode usar a interface Emacs-Guix (veja *The Emacs-Guix Reference Manual*), após instalar o pacote `emacs-guix` (execute o comando `M-x guix-help` para começar com ele):

```
guix install emacs-guix
```

5.1 Recursos

Aqui presumimos que você já deu os primeiros passos com o Guix (veja Capítulo 4 [Começando], Página 33) e gostaria de ter uma visão geral do que está acontecendo nos bastidores.

Ao usar o Guix, cada pacote acaba no *armazém de pacotes*, em seu próprio diretório — algo que lembra `/gnu/store/xxx-package-1.2`, onde `xxx` é uma string base32.

Em vez de se referir a esses diretórios, os usuários têm seu próprio *perfil*, que aponta para os pacotes que eles realmente querem usar. Esses perfis são armazenados dentro do diretório home de cada usuário, em `$HOME/.guix-profile`.

Por exemplo, `alice` instala o GCC 4.7.2. Como resultado, `/home/alice/.guix-profile/bin/gcc` aponta para `/gnu/store/...-gcc-4.7.2/bin/gcc`. Agora, na mesma máquina, `bob` já tinha instalado o GCC 4.8.0. O perfil de `bob` simplesmente continua a apontar para `/gnu/store/...-gcc-4.8.0/bin/gcc`—ou seja, ambas as versões do GCC coexistem no mesmo sistema sem nenhuma interferência.

O comando `guix package` é a ferramenta central para gerenciar pacotes (veja Seção 5.2 [Invocando guix package], Página 37). Ele opera nos perfis por usuário e pode ser usado *com privilégios normais de usuário*.

O comando fornece as operações óbvias de instalação, remoção e atualização. Cada invocação é, na verdade, uma *transação*: ou a operação especificada é bem-sucedida ou nada acontece. Portanto, se o processo `guix package` for encerrado durante a transação, ou se ocorrer uma queda de energia durante a transação, o perfil do usuário permanecerá em seu estado anterior e continuará utilizável.

Além disso, qualquer transação de pacote pode ser *revertida*. Então, se, por exemplo, uma atualização instalar uma nova versão de um pacote que acabe tendo um bug sério, os usuários podem reverter para a instância anterior de seu perfil, que era conhecida por funcionar bem. Da mesma forma, a configuração global do sistema no Guix está sujeita a atualizações transacionais e roll-back (veja Seção 11.1 [Começando com o Sistema], Página 236).

Todos os pacotes no repositório de pacotes podem ser *garbage-collected*. O Guix pode determinar quais pacotes ainda são referenciados por perfis de usuário e remover aqueles que comprovadamente não são mais referenciados (veja Seção 5.6 [Invocando guix gc], Página 54). Os usuários também podem remover explicitamente gerações antigas de seus perfis para que os pacotes aos quais eles se referem possam ser coletados.

Guix adota uma abordagem *puramente funcional* para gerenciamento de pacotes, conforme descrito na introdução (veja Capítulo 1 [Introdução], Página 1). Cada nome de diretório de pacote `/gnu/store` contém um hash de todas as entradas que foram usadas para construir aquele pacote—compilador, bibliotecas, scripts de construção, etc. Essa correspondência direta permite que os usuários tenham certeza de que uma determinada instalação de pacote corresponde ao estado atual de sua distribuição. Também ajuda a maximizar a *reprodutibilidade da construção*: graças aos ambientes de construção isolados que são usados, uma determinada construção provavelmente produzirá arquivos de bits idênticos quando executada em máquinas diferentes (veja Seção 2.3 [Invocando guix-daemon], Página 13).

Essa base permite que o Guix suporte *transparent binary/source deployment*. Quando um binário pré-construído para um item `/gnu/store` está disponível em uma fonte externa—um *substituto*, o Guix apenas o baixa e descompacta; caso contrário, ele constrói o pacote a partir da fonte, localmente (veja Seção 5.3 [Substitutos], Página 47). Como os resultados da construção são geralmente reproduzíveis bit a bit, os usuários não precisam confiar em servidores que fornecem substitutos: eles podem forçar uma construção local e *desafiar* os provedores (veja Seção 9.12 [Invocando guix challenge], Página 225).

O controle sobre o ambiente de construção é um recurso que também é útil para desenvolvedores. O comando `guix shell` permite que os desenvolvedores de um pacote configurem rapidamente o ambiente de desenvolvimento correto para seu pacote, sem ter que instalar manualmente as dependências do pacote em seu perfil (veja Seção 7.1 [Invocando guix shell], Página 79).

Todo o Guix e suas definições de pacote são controlados por versão, e `guix pull` permite que você "viaje no tempo" no histórico do próprio Guix (veja Seção 5.7 [Invocando guix pull], Página 57). Isso torna possível replicar uma instância do Guix em uma máquina diferente ou em um ponto posterior no tempo, o que por sua vez permite que você *replique ambientes de software completos*, enquanto retém o *rastreamento de procedência* preciso do software.

5.2 Invocando `guix package`

O comando `guix package` é a ferramenta que permite aos usuários instalar, atualizar e remover pacotes, bem como reverter para configurações anteriores. Essas operações funcionam no *perfil* de um usuário—um diretório de pacotes instalados. Cada usuário tem um perfil padrão em `$HOME/.guix-profile`. O comando opera apenas no próprio perfil do usuário e funciona com privilégios de usuário normais (veja Seção 5.1 [Recursos], Página 36). Sua sintaxe é:

```
guix package opções
```

Principalmente, *opções* especifica as operações a serem executadas durante a transação. Após a conclusão, um novo perfil é criado, mas as *gerações* anteriores do perfil permanecem disponíveis, caso o usuário queira reverter.

Por exemplo, para remover `lua` e instalar `guile` e `guile-cairo` em uma única transação:

```
guix package -r lua -i guile guile-cairo
```

Para sua conveniência, também fornecemos os seguintes aliases:

- `guix search` é um alias para `guix package -s`,
- `guix install` é um alias para `guix package -i`,

- `guix remove` é um alias para `guix package -r`,
- `guix upgrade` é um alias para `guix package -u`,
- e `guix show` é um alias para `guix package --show=`.

Esses aliases são menos expressivos que `guix package` e oferecem menos opções, então em alguns casos você provavelmente desejará usar `guix package` diretamente.

`guix package` também suporta uma *abordagem declarativa* em que o usuário especifica o conjunto exato de pacotes que estarão disponíveis e passa a ele *via* a opção `--manifest` (veja [profile-manifest], Página 41).

Para cada usuário, um link simbólico para o perfil padrão do usuário é criado automaticamente em `$HOME/.guix-profile`. Este link simbólico sempre aponta para a geração atual do perfil padrão do usuário. Assim, os usuários podem adicionar `$HOME/.guix-profile/bin` à sua variável de ambiente `PATH` e assim por diante. Se você não estiver usando o sistema Guix, considere adicionar as seguintes linhas ao seu `~/.bash_profile` (veja Seção "Bash Startup Files" em *The GNU Bash Reference Manual*) para que os shells recém-gerados obtenham todos as definições corretas de variáveis de ambiente:

```
GUIX_PROFILE="$HOME/.guix-profile" ; \
source "$GUIX_PROFILE/etc/profile"
```

Em uma configuração multiusuário, os perfis de usuário são armazenados em um local registrado como *garbage-collector root*, para o qual `$HOME/.guix-profile` aponta (veja Seção 5.6 [Invocando guix gc], Página 54). Esse diretório geralmente é *localstatedir*`/guix/profiles/per-user/`*usuário*, onde *localstatedir* é o valor passado para `configure` como `--localstatedir` e *usuário* é o nome do usuário. O diretório `per-user` é criado quando `guix-daemon` é iniciado, e o subdiretório *usuário* é criado por `guix-package`.

As seguintes *opções* podem ser usadas:

`--install=`*pacote* `...`
`-i` *pacote* `...`

Instale os *pacote*s especificados.

Cada *pacote* pode especificar um nome de pacote simples como `guile`, opcionalmente seguido por uma arroba e número de versão, como `guile@3.0.7` ou simplesmente `guile@3.0`. Neste último caso, a versão mais recente prefixada por `3.0` é selecionada.

Se nenhum número de versão for especificado, a versão mais recente disponível será selecionada. Além disso, tal especificação *pacote* pode conter dois pontos, seguido pelo nome de uma das saídas do pacote, como em `gcc:doc` ou `binutils@2.22:lib` (veja Seção 5.4 [Pacotes com múltiplas saídas], Página 52).

Pacotes com um nome correspondente (e opcionalmente versão) são procurados entre os módulos de distribuição GNU (veja Seção 8.1 [Módulos de pacote], Página 100).

Alternativamente, um *pacote* pode especificar diretamente um nome de arquivo de armazém como `/gnu/store/...-guile-3.0.7`, conforme produzido por, por exemplo, `guix build`.

Às vezes, os pacotes têm *propagated-inputs*: são dependências que são instaladas automaticamente junto com o pacote necessário (veja [package-propagated-inputs], Página 105, para obter informações sobre entradas propagadas em definições de pacote).

Um exemplo é a biblioteca GNU MPC: seus arquivos de cabeçalho C referem-se aos da biblioteca GNU MPFR, que por sua vez se refere aos da biblioteca GMP. Assim, ao instalar o MPC, as bibliotecas MPFR e GMP também são instaladas no perfil; a remoção do MPC também remove o MPFR e o GMP — a menos que eles também tenham sido explicitamente instalados pelo usuário.

Além disso, os pacotes às vezes dependem da definição de variáveis de ambiente para seus caminhos de pesquisa (veja a explicação de `--search-paths` abaixo). Quaisquer definições de variáveis ambientais ausentes ou possivelmente incorretas são relatadas aqui.

`--install-from-expression=`*exp*
`-e` *exp* Instale o pacote avaliado por *exp*.

exp deve ser uma expressão de Scheme avaliada como um objeto `<package>`. Esta opção é particularmente útil para desambiguar variantes de um pacote com o mesmo nome, com expressões como `(@(gnu packages commencement) guile-final)`.

Observe que esta opção instala a primeira saída do pacote especificado, o que pode ser insuficiente quando for necessária uma saída específica de um pacote de múltiplas saídas.

`--install-from-file=`*arquivo*
`-f` *arquivo*
Instale o pacote avaliado pelo código em *arquivo*.

Por exemplo, *arquivo* pode conter uma definição como esta (veja Seção 8.2 [Definindo pacotes], Página 101):

```
(use-modules (guix)
             (guix build-system gnu)
             (guix licenses))

(package
  (name "hello")
  (version "2.10")
  (source (origin
            (method url-fetch)
            (uri (string-append "mirror://gnu/hello/hello-" version
                                ".tar.gz"))
            (sha256
             (base32
              "0ssi1wpaf7plaswqqjwigppsg5fyh99vdlb9kzl7c9lng89ndq1i"))))
  (build-system gnu-build-system)
  (synopsis "Hello, GNU world: An example GNU package")
  (description "Guess what GNU Hello prints!")
  (home-page "http://www.gnu.org/software/hello/")
```

```
  (license gpl3+))
```

Os desenvolvedores podem achar útil incluir um arquivo `guix.scm` na raiz da árvore de origem do projeto que pode ser usado para testar instantâneos de desenvolvimento e criar ambientes de desenvolvimento reproduzíveis (veja Seção 7.1 [Invocando guix shell], Página 79).

O *arquivo* também pode conter uma representação JSON de uma ou mais definições de pacote. Executar `guix package -f` em `hello.json` com o seguinte conteúdo resultaria na instalação do pacote `greeter` após construir `myhello`:

```
[
  {
    "name": "myhello",
    "version": "2.10",
    "source": "mirror://gnu/hello/hello-2.10.tar.gz",
    "build-system": "gnu",
    "arguments": {
      "tests?": false
    },
    "home-page": "https://www.gnu.org/software/hello/",
    "synopsis": "Hello, GNU world: An example GNU package",
    "description": "GNU Hello prints a greeting.",
    "license": "GPL-3.0+",
    "native-inputs": ["gettext"]
  },
  {
    "name": "greeter",
    "version": "1.0",
    "source": "mirror://gnu/hello/hello-2.10.tar.gz",
    "build-system": "gnu",
    "arguments": {
      "test-target": "foo",
      "parallel-build?": false
    },
    "home-page": "https://example.com/",
    "synopsis": "Greeter using GNU Hello",
    "description": "This is a wrapper around GNU Hello.",
    "license": "GPL-3.0+",
    "inputs": ["myhello", "hello"]
  }
]
```

`--remove=`*pacote* `...`
`-r` *pacote* `...`

Remova os *pacote*s especificados.

Quanto a `--install`, cada *pacote* pode especificar um número de versão e/ou nome de saída além do nome do pacote. Por exemplo, '`-r glibc:debug`' removeria a saída de `glibc`.

`--upgrade[=`*regexp* `...]`
`-u [`*regexp* `...]`

Atualize todos os pacotes instalados. Se um ou mais *regexp*s forem especificados, atualize apenas os pacotes instalados cujo nome corresponda a um *regexp*. Veja também a opção `--do-not-upgrade` abaixo.

Note que isso atualiza o pacote para a versão mais recente dos pacotes encontrados na distribuição atualmente instalada. Para atualizar sua distribuição, você deve executar regularmente `guix pull` (veja Seção 5.7 [Invocando guix pull], Página 57).

Ao atualizar, as transformações de pacote que foram aplicadas originalmente ao criar o perfil são automaticamente reaplicadas (veja Seção 9.1.2 [Opções de transformação de pacote], Página 180). Por exemplo, suponha que você instalou o Emacs pela ponta do seu branch de desenvolvimento com:

```
guix install emacs-next --with-branch=emacs-next=master
```

Na próxima vez que você executar `guix upgrade`, o Guix puxará novamente a ponta do branch de desenvolvimento do Emacs e compilará `emacs-next` a partir desse checkout.

Observe que opções de transformação como `--with-branch` e `--with-source` dependem do estado externo; cabe a você garantir que elas funcionem conforme o esperado. Você também pode descartar transformações que se aplicam a um pacote executando:

```
guix install pacote
```

`--do-not-upgrade[=`*regexp* `...]`

Quando usado junto com a opção `--upgrade`, *não* atualize nenhum pacote cujo nome corresponda a um *regexp*. Por exemplo, para atualizar todos os pacotes no perfil atual, exceto aqueles que contêm a substring "emacs":

```
$ guix package --upgrade . --do-not-upgrade emacs
```

`--manifest=`*arquivo*
`-m` *arquivo*

Crie uma nova geração do perfil a partir do objeto manifest retornado pelo código Scheme em *arquivo*. Esta opção pode ser repetida várias vezes, em cujo caso os manifestos são concatenados.

Isso permite que você *declarando* o conteúdo do perfil em vez de construí-lo por meio de uma sequência de `--install` e comandos similares. A vantagem é que *arquivo* pode ser colocado sob controle de versão, copiado para máquinas diferentes para reproduzir o mesmo perfil, e assim por diante.

arquivo deve retornar um objeto *manifest*, que é aproximadamente uma lista de pacotes:

```
(use-package-modules guile emacs)

(packages->manifest
 (list emacs
       guile-2.0
       ;; Usa uma saída de pacote específica.
```

```
                (list guile-2.0 "debug")))
```

Veja Seção 8.4 [Escrevendo manifestos], Página 117, para obter informações sobre como escrever um manifesto. Veja [export-manifest], Página 46, para aprender como obter um arquivo de manifesto de um perfil existente.

`--roll-back`

Reverta para a *geração* anterior do perfil, ou seja, desfaça a última transação.

Quando combinado com opções como `--install`, a reversão ocorre antes de qualquer outra ação.

Ao reverter da primeira geração que realmente contém pacotes instalados, o perfil é feito para apontar para a *geração zero*, que não contém arquivos além de seus próprios metadados.

Após ter revertido, instalar, remover ou atualizar pacotes sobrescreve gerações futuras anteriores. Assim, o histórico das gerações em um perfil é sempre linear.

`--switch-generation=`*padrão*

`-S` *padrão* Mude para uma geração específica definida por *padrão*.

padrão pode ser um número de geração ou um número prefixado com "+" ou "-". O último significa: mover para frente/para trás por um número especificado de gerações. Por exemplo, se você quiser retornar para a última geração após `--roll-back`, use `--switch-generation=+1`.

A diferença entre `--roll-back` e `--switch-generation=-1` é que `--switch-generation` não fará uma geração zero, então se uma geração especificada não existir, a geração atual não será alterada.

`--search-paths[=`*tipo*`]`

Relata definições de variáveis de ambiente, na sintaxe Bash, que podem ser necessárias para usar o conjunto de pacotes instalados. Essas variáveis de ambiente são usadas para especificar *caminhos de busca* para arquivos usados por alguns dos pacotes instalados.

Por exemplo, o GCC precisa que as variáveis de ambiente `CPATH` e `LIBRARY_PATH` sejam definidas para que ele possa procurar cabeçalhos e bibliotecas no perfil do usuário (veja Seção "Environment Variables" em *Usando o GNU Compiler Collection (GCC)*). Se o GCC e, digamos, a biblioteca C estiverem instalados no perfil, então `--search-paths` sugerirá definir essas variáveis como *perfil*`/include` e *perfil*`/lib`, respectivamente (veja Seção 8.8 [Caminhos de pesquisa], Página 151, para obter informações sobre especificações de caminho de pesquisa associadas a pacotes.)

O caso de uso típico é definir essas variáveis de ambiente no shell:

```
$ eval $(guix package --search-paths)
```

tipo pode ser um dos seguintes: `exact`, `prefix` ou `suffix`, o que significa que as definições de variáveis de ambiente retornadas serão configurações exatas ou prefixos ou sufixos do valor atual dessas variáveis. Quando omitido, *tipo* assume como padrão `exact`.

Esta opção também pode ser usada para calcular os caminhos de busca *combinados* de vários perfis. Considere este exemplo:

```
$ guix package -p foo -i guile
```

```
$ guix package -p bar -i guile-json
$ guix package -p foo -p bar --search-paths
```

O último comando acima relata sobre a variável `GUILE_LOAD_PATH`, embora, considerados individualmente, nem `foo` nem `bar` levariam a essa recomendação.

`--profile=`*perfil*
`-p` *perfil* Use *perfil* em vez do perfil padrão do usuário.

perfil deve ser o nome de um arquivo que será criado após a conclusão. Concretamente, *perfil* será um mero link simbólico ("symlink") apontando para o perfil real onde os pacotes estão instalados:

```
$ guix install hello -p ~/code/my-profile
...
$ ~/code/my-profile/bin/hello
Olá, mundo!
```

Tudo o que é preciso para se livrar do perfil é remover este link simbólico e seus irmãos que apontam para gerações específicas:

```
$ rm ~/code/my-profile ~/code/my-profile-*-link
```

`--list-profiles`
Liste todos os perfis dos usuários:

```
$ guix package --list-profiles
/home/charlie/.guix-profile
/home/charlie/code/my-profile
/home/charlie/code/devel-profile
/home/charlie/tmp/test
```

Ao executar como root, liste todos os perfis de todos os usuários.

`--allow-collisions`
Permitir pacotes de colisão no novo perfil. Use por sua conta e risco!

Por padrão, `guix package` relata como um erro *collisions* no perfil. Colisões acontecem quando duas ou mais versões ou variantes diferentes de um determinado pacote acabam no perfil.

`--bootstrap`
Use o bootstrap Guile para construir o perfil. Esta opção é útil somente para desenvolvedores de distribuição.

Além dessas ações, `guix package` suporta as seguintes opções para consultar o estado atual de um perfil ou a disponibilidade de pacotes:

`--search=`*regexp*
`-s` *regexp* Liste os pacotes disponíveis cujo nome, sinopse ou descrição correspondem a *regexp* (sem distinção entre maiúsculas e minúsculas), classificados por relevância. Imprima todos os metadados dos pacotes correspondentes no formato `recutils` (veja *manual GNU recutils*).

Isso permite que campos específicos sejam extraídos usando o comando `recsel`, por exemplo:

```
$ guix package -s malloc | recsel -p name,version,relevance
```

```
name: jemalloc
version: 4.5.0
relevance: 6

name: glibc
version: 2.25
relevance: 1

name: libgc
version: 7.6.0
relevance: 1
```

Da mesma forma, para mostrar o nome de todos os pacotes disponíveis sob os termos da GNU LGPL versão 3:

```
$ guix package -s "" | recsel -p name -e 'license ~ "LGPL 3"'
name: elfutils

name: gmp
...
```

Também é possível refinar os resultados da pesquisa usando vários sinalizadores `-s` para `guix package`, ou vários argumentos para `guix search`. Por exemplo, o comando a seguir retorna uma lista de jogos de tabuleiro (desta vez usando o alias `guix search`):

```
$ guix search '\<board\>' game | recsel -p name
name: gnubg
...
```

Se omitissemos `-s game`, também teríamos pacotes de software que lidam com placas de circuito impresso; remover os colchetes angulares em torno de `board` adicionaria ainda mais pacotes relacionados a teclados.

E agora um exemplo mais elaborado. O comando a seguir procura bibliotecas criptográficas, filtra as bibliotecas Haskell, Perl, Python e Ruby e imprime o nome e a sinopse dos pacotes correspondentes:

```
$ guix search crypto library | \
    recsel -e '! (name ~ "^(ghc|perl|python|ruby)")' -p name,synopsis
```

Veja Seção “Selection Expressions” em *manual GNU recutils*, para obter mais informações sobre *expressões de seleção* para `recsel -e`.

`--show=`*pacote*

Exibe detalhes sobre *pacote*, retirados da lista de pacotes disponíveis, no formato `recutils` (veja *GNU Recutils Manual*).

```
$ guix package --show=guile | recsel -p name,version
name: guile
version: 3.0.5

name: guile
version: 3.0.2
```

```
name: guile
version: 2.2.7
...
```

Você também pode especificar o nome completo de um pacote para obter detalhes apenas sobre uma versão específica dele (desta vez usando o alias `guix show`):

```
$ guix show guile@3.0.5 | recsel -p name,version
name: guile
version: 3.0.5
```

`--list-installed[=`*regexp*`]`
`-I [`*regexp*`]`

Lista os pacotes instalados mais recentemente no perfil especificado, com os pacotes instalados mais recentemente mostrados por último. Quando *regexp* for especificado, liste apenas os pacotes instalados cujo nome corresponda a *regexp*.

Para cada pacote instalado, imprima os seguintes itens, separados por tabulações: o nome do pacote, sua string de versão e a parte do pacote que está instalada (por exemplo, `out` para a saída predefinida, `include` para os seus cabeçalhos, etc.) e o caminho deste pacote no armazém.

`--list-available[=`*regexp*`]`
`-A [`*regexp*`]`

Lista de pacotes atualmente disponíveis na distribuição para este sistema (veja Seção 1.2 [Distribuição GNU], Página 2). Quando *regexp* for especificado, liste apenas os pacotes disponíveis cujo nome corresponda a *regexp*.

Para cada pacote, imprima os seguintes itens separados por tabulações: seu nome, sua string de versão, as partes do pacote (veja Seção 5.4 [Pacotes com múltiplas saídas], Página 52) e o local de origem de sua definição.

`--list-generations[=`*padrão*`]`
`-l [`*padrão*`]`

Retorne uma lista de gerações junto com suas datas de criação; para cada geração, exiba os pacotes instalados, com os pacotes instalados mais recentemente mostrados por último. Observe que a geração zero nunca é mostrada.

Para cada pacote instalado, mostre os seguintes itens, separados por tabulações: o nome de um pacote, sua string de versão, a parte do pacote que está instalada (veja Seção 5.4 [Pacotes com múltiplas saídas], Página 52) e a localização deste pacote em o armazém.

Quando *padrão* é usado, o comando retorna apenas gerações correspondentes. Os padrões válidos incluem:

- *Inteiros e números inteiros separados por vírgula.* Ambos os padrões denotam números de geração. Por exemplo, `--list-generations=1` retorna o primeiro.

  E `--list-generations=1,8,2` gera três gerações na ordem especificada. Não são permitidos espaços nem vírgulas finais.

- *Intervalos.* `--list-generations=2..9` mostra o gerações especificadas e tudo mais. Observe que o início de um intervalo deve ser menor que o seu final.

  Também é possível omitir o ponto final. Por exemplo, `--list-generations=2..` retorna todas as gerações começando pela segunda.
- *Duração.* Você também pode visitar os últimos *N* dias, semanas, ou meses passando um número inteiro junto com a primeira letra da duração. Por exemplo, `--list-generations=20d` lista gerações com até 20 dias.

`--delete-generations[=`*padrão*`]`
`-d [`*padrão*`]`

Quando *padrão* for omitido, exclua todas as gerações, exceto a atual.

Este comando aceita os mesmos padrões de `--list-Generations`. Quando *pattern* for especificado, exclua as gerações correspondentes. Quando *padrão* especifica uma duração, as gerações *mais antigas* que a duração especificada correspondem. Por exemplo, `--delete-generations=1m` exclui gerações com mais de um mês.

Se a geração atual corresponder, ela será *não* excluída. Além disso, a geração zero nunca é excluída.

Observe que a exclusão de gerações impede a reversão para elas. Conseqüentemente, este comando deve ser usado com cuidado.

`--export-manifest`

Escreva na saída padrão um manifesto adequado para `--manifest` correspondente ao(s) perfil(s) selecionado(s).

Esta opção destina-se a ajudá-lo a migrar do modo operacional "imperativo" — executando `guix install`, `guix upgrade`, etc.—para o modo declarativo que `--manifest` ofertas.

Observe que o manifesto resultante *aproxima* o que seu perfil realmente contém; por exemplo, dependendo de como seu perfil foi criado, ele pode se referir a pacotes ou versões de pacotes que não são exatamente o que você especificou.

Tenha em mente que um manifesto é puramente simbólico: ele contém apenas nomes de pacotes e possivelmente versões, e seu significado varia com o tempo. Se você quiser "fixar" canais nas revisões que foram usadas para construir o(s) perfil(es), veja `--export-channels` abaixo.

`--export-channels`

Escreva na saída padrão a lista de canais usados pelo(s) perfil(s) selecionado(s), em um formato adequado para `guix pull --channels` ou `guix time-machine --channels` (veja Capítulo 6 [Canais], Página 69) . .

Juntamente com `--export-manifest`, esta opção fornece informações que permitem replicar o perfil atual (veja Seção 6.3 [Replicando Guix], Página 70).

No entanto, observe que a saída deste comando *aproxima* o que foi realmente usado para construir este perfil. Em particular, um único perfil pode ter sido construído a partir de diversas revisões diferentes do mesmo canal. Nesse caso,

`--export-manifest` escolhe a última e escreve a lista de outras revisões em um comentário. Se você realmente precisa escolher pacotes de análises de canais diferentes, você pode usar inferiores em seu manifesto para fazer isso (veja Seção 5.9 [Inferiores], Página 63).

Juntamente com `--export-manifest`, este é um bom ponto de partida se você estiver disposto a migrar do modelo "imperativo" para o modelo totalmente declarativo que consiste em um arquivo de manifesto junto com um arquivo de canais fixando o canal exato revisão(ões) que você deseja.

Finalmente, como `guix package` pode realmente iniciar processos de construção, ele suporta todas as opções de construção comuns (veja Seção 9.1.1 [Opções de compilação comum], Página 177). Ele também oferece suporte a opções de transformação de pacotes, como `--with-source`, e as preserva em atualizações (veja Seção 9.1.2 [Opções de transformação de pacote], Página 180).

5.3 Substitutos

Guix suporta implantação transparente de origem/binário, o que significa que ele pode construir coisas localmente ou baixar itens pré-construídos de um servidor, ou ambos. Chamamos esses itens pré-construídos de *substitutos*—eles são substitutos para resultados de construção local. Em muitos casos, baixar um substituto é muito mais rápido do que construir coisas localmente.

Substitutos podem ser qualquer coisa resultante de uma construção de derivação (veja Seção 8.10 [Derivações], Página 156). Claro, no caso comum, eles são binários de pacotes pré-construídos, mas tarballs de origem, por exemplo, que também resultam de construções de derivação, podem estar disponíveis como substitutos.

5.3.1 Official Substitute Servers

`bordeaux.guix.gnu.org` e `ci.guix.gnu.org` são ambos front-ends para farms de build oficiais que constroem pacotes do Guix continuamente para algumas arquiteturas e os disponibilizam como substitutos. Essas são a fonte padrão de substitutos; que podem ser substituídos passando a opção `--substitute-urls` para `guix-daemon` (veja [`guix-daemon --substitute-urls`], Página 13) ou para ferramentas de cliente como `guix package` (veja [client `--substitute-urls` option], Página 178).

URLs substitutos podem ser HTTP ou HTTPS. HTTPS é recomendado porque as comunicações são criptografadas; por outro lado, usar HTTP torna todas as comunicações visíveis para um bisbilhoteiro, que pode usar as informações coletadas para determinar, por exemplo, se seu sistema tem vulnerabilidades de segurança não corrigidas.

Substitutos das build farms oficiais são habilitados por padrão ao usar o Guix System (veja Seção 1.2 [Distribuição GNU], Página 2). No entanto, eles são desabilitados por padrão ao usar o Guix em uma distribuição estrangeira, a menos que você os tenha habilitado explicitamente por meio de uma das etapas de instalação recomendadas (veja Capítulo 2 [Instalação], Página 4). Os parágrafos a seguir descrevem como habilitar ou desabilitar substitutos para a build farm oficial; o mesmo procedimento também pode ser usado para habilitar substitutos para qualquer outro servidor substituto.

5.3.2 Autorização de servidor substituto

Para permitir que o Guix baixe substitutos de `bordeaux.guix.gnu.org`, `ci.guix.gnu.org` ou um espelho, você deve adicionar a chave pública relevante à lista de controle de acesso (ACL) de importações de arquivo, usando o comando `guix archive` (veja Seção 5.11 [Invocando guix archive], Página 66). Fazer isso implica que você confia que o servidor substituto não será comprometido e servirá substitutos genuínos.

> **Nota:** Se você estiver usando o Guix System, pode pular esta seção: O Guix System autoriza substitutos de `bordeaux.guix.gnu.org` e `ci.guix.gnu.org` por padrão.

As chaves públicas para cada um dos servidores substitutos mantidos pelo projeto são instaladas junto com o Guix, em *prefix*`/share/guix/`, onde *prefix* é o prefixo de instalação do Guix. Se você instalou o Guix a partir da fonte, certifique-se de verificar a assinatura GPG de `guix-ba3a031.tar.gz`, que contém este arquivo de chave pública. Então, você pode executar algo como isto:

```
# guix archive --authorize < prefix/share/guix/bordeaux.guix.gnu.org.pub
# guix archive --authorize < prefix/share/guix/ci.guix.gnu.org.pub
```

Uma vez que isso esteja pronto, a saída de um comando como `guix build` deve mudar de algo como:

```
$ guix build emacs --dry-run
A seguinte derivações seriam compiladas:
   /gnu/store/yr7bnx8xwcayd6j95r2clmkdl1qh688w-emacs-24.3.drv
   /gnu/store/x8qsh1hlhgjx6cwsjyvybnfv2i37z23w-dbus-1.6.4.tar.gz.drv
   /gnu/store/1ixwp12fl950d15h2cj11c73733jay0z-alsa-lib-1.0.27.1.tar.bz2.drv
   /gnu/store/nlma1pw0p603fpfiqy7kn4zm105r5dmw-util-linux-2.21.drv
...
```

para algo como:

```
$ guix build emacs --dry-run
112.3 MB seriam baixados:
   /gnu/store/pk3n22lbq6ydamyymqkkz7i69wiwjiwi-emacs-24.3
   /gnu/store/2ygn4ncnhrpr61rssa6z0d9x22si0va3-libjpeg-8d
   /gnu/store/71yz6lgx4dazma9dwn2mcjxaah9w77jq-cairo-1.12.16
   /gnu/store/7zdhgp0n1518lvfn8mb96sxqfmvqrl7v-libxrender-0.9.7
...
```

O texto mudou de "As seguintes derivações seriam construídas" para "112,3 MB seriam baixados". Isso indica que os substitutos dos servidores substitutos configurados são utilizáveis e serão baixados, quando possível, para construções futuras.

O mecanismo de substituição pode ser desabilitado globalmente executando `guix-daemon` com `--no-substitutes` (veja Seção 2.3 [Invocando guix-daemon], Página 13). Ele também pode ser desabilitado temporariamente passando a opção `--no-substitutes` para `guix package`, `guix build` e outras ferramentas de linha de comando.

5.3.3 Obtendo substitutos de outros servidores

Guix pode procurar e buscar substitutos de vários servidores. Isso é útil quando você está usando pacotes de canais adicionais para os quais o servidor oficial não tem substitutos, mas

outro servidor os fornece. Outra situação em que isso é útil é quando você prefere baixar do servidor substituto da sua organização, recorrendo ao servidor oficial apenas como um fallback ou descartando-o completamente.

Você pode dar ao Guix uma lista de URLs de servidores substitutos e ele irá verificá-los na ordem especificada. Você também precisa autorizar explicitamente as chaves públicas dos servidores substitutos para instruir o Guix a aceitar os substitutos que eles assinam.

No Guix System, isso é obtido modificando a configuração do serviço `guix`. Como o serviço `guix` faz parte das listas padrão de serviços, `%base-services` e `%desktop-services`, você pode usar `modify-services` para alterar sua configuração e adicionar as URLs e chaves substitutas que você deseja (veja Seção 11.19.3 [Referência de Service], Página 634).

Como exemplo, suponha que você queira buscar substitutos de `guix.example.org` e autorizar a chave de assinatura desse servidor, além do padrão `bordeaux.guix.gnu.org` e `ci.guix.gnu.org`. A configuração do sistema operacional resultante será algo como:

```
(operating-system
 ;; ...
 (services
  ;; Suponha que estamos começando com '%desktop-services'. Substitua-o
  ;; pela lista de serviços que você está realmente usando.
  (modify-services %desktop-services
    (guix-service-type config =>
                       (guix-configuration
                        (inherit config)
                        (substitute-urls
                         (append (list "https://guix.example.org")
                                 %default-substitute-urls))
                        (authorized-keys
                         (append (list (local-file "./key.pub"))
                                 %default-authorized-guix-keys)))))))
```

Isso pressupõe que o arquivo `key.pub` contém a chave de assinatura de `guix.example.org`. Com essa alteração em vigor no arquivo de configuração do seu sistema operacional (digamos `/etc/config.scm`), você pode reconfigurar e reiniciar o serviço `guix-daemon` ou reinicializar para que as alterações entrem em vigor:

```
$ sudo guix system reconfigure /etc/config.scm
$ sudo herd restart guix-daemon
```

Se você estiver executando o Guix em uma "distribuição estrangeira", você deve seguir os seguintes passos para obter substitutos de servidores adicionais:

1. Edite o arquivo de configuração de serviço para `guix-daemon`; ao usar systemd, normalmente é `/etc/systemd/system/guix-daemon.service`. Adicione a opção `--substitute-urls` na linha de comando `guix-daemon` e liste as URLs de interesse (veja [daemon-substitute-urls], Página 13):

   ```
   ... --substitute-urls='https://guix.example.org https://bordeaux.guix.gnu.org
   https://ci.guix.gnu.org'
   ```

2. Reinicie o daemon. Para systemd, é assim:

   ```
   systemctl daemon-reload
   systemctl restart guix-daemon.service
   ```

3. Autorize a chave do novo servidor (veja Seção 5.11 [Invocando guix archive], Página 66):

```
guix archive --authorize < key.pub
```

   Novamente, isso pressupõe que `key.pub` contém a chave pública que `guix.example.org` usa para assinar substitutos.

Agora você está pronto! Os substitutos serão preferencialmente retirados de `https://guix.example.org`, usando `bordeaux.guix.gnu.org` e então `ci.guix.gnu.org` como opções de fallback. Claro que você pode listar quantos servidores substitutos quiser, com a ressalva de que a pesquisa de substitutos pode ser desacelerada se muitos servidores precisarem ser contatados.

> **Troubleshooting:** Para diagnosticar problemas, você pode executar `guix weather`. Por exemplo, executando:
>
> ```
> guix weather coreutils
> ```
>
> não apenas informa qual dos servidores atualmente configurados tem substitutos para o pacote `coreutils`, mas também informa se um desses servidores não está autorizado. Veja Seção 9.15 [Invocando guix weather], Página 229, para mais informações.

Observe que também há situações em que é possível adicionar a URL de um servidor substituto *sem* autorizar sua chave. Veja Seção 5.3.4 [Autenticação de substituto], Página 50, para entender esse ponto.

5.3.4 Autenticação de substituto

Guix detecta e gera um erro ao tentar usar um substituto que foi adulterado. Da mesma forma, ele ignora substitutos que não são assinados, ou que não são assinados por uma das chaves listadas na ACL.

Há uma exceção, no entanto: se um servidor não autorizado fornecer substitutos que sejam *bit-for-bit idênticos* aos fornecidos por um servidor autorizado, então o servidor não autorizado se torna elegível para downloads. Por exemplo, suponha que escolhemos dois servidores substitutos com esta opção:

```
--substitute-urls="https://a.example.org https://b.example.org"
```

Se a ACL contiver apenas a chave para '`b.example.org`', e se '`a.example.org`' servir os substitutos *exatamente os mesmos*, então o Guix baixará os substitutos de '`a.example.org`' porque ele vem primeiro na lista e pode ser considerado um espelho de '`b.example.org`'. Na prática, máquinas de construção independentes geralmente produzem os mesmos binários, graças às construções reproduzíveis em bits (veja abaixo).

Ao usar HTTPS, o certificado X.509 do servidor é *não* validado (em outras palavras, o servidor não é autenticado), ao contrário do que os clientes HTTPS, como navegadores da Web, geralmente fazem. Isso ocorre porque o Guix autentica as próprias informações substitutas, conforme explicado acima, que é o que nos importa (enquanto os certificados X.509 são sobre autenticação de ligações entre nomes de domínio e chaves públicas).

5.3.5 Configurações de proxy

Os substitutos são baixados por HTTP ou HTTPS. As variáveis de ambiente `http_proxy` e `https_proxy` podem ser definidas no ambiente de `guix-daemon` e são honradas para downloads de substitutos. Observe que o valor dessas variáveis de ambiente no ambiente

onde `guix build`, `guix package` e outros comandos de cliente são executados não tem *absolutamente nenhum efeito.*

5.3.6 Falha na substituição

Mesmo quando um substituto para uma derivação estiver disponível, às vezes a tentativa de substituição falhará. Isso pode acontecer por vários motivos: o servidor substituto pode estar offline, o servidor substituto pode ter sido excluído recentemente, a conexão pode ter sido interrompida, etc.

Quando os substitutos estão habilitados e um substituto para uma derivação está disponível, mas a tentativa de substituição falha, o Guix tentará construir a derivação localmente dependendo se `--fallback` foi fornecido ou não (veja [opção de compilação comum `--fallback`], Página 178). Especificamente, se `--fallback` for omitido, nenhuma construção local será executada e a derivação será considerada como tendo falhado. No entanto, se `--fallback` for fornecido, o Guix tentará construir a derivação localmente, e o sucesso ou fracasso da derivação dependerá do sucesso ou fracasso da construção local. Observe que quando os substitutos estão desabilitados ou nenhum substituto está disponível para a derivação em questão, uma construção local *sempre* será executada, independentemente de `--fallback` ter sido fornecido ou não.

Para ter uma ideia de quantos substitutos estão disponíveis no momento, você pode tentar executar o comando `guix weather` (veja Seção 9.15 [Invocando guix weather], Página 229). Este comando fornece estatísticas sobre os substitutos fornecidos por um servidor.

5.3.7 Confiança em binários

Hoje, o controlo de cada indivíduo sobre a sua própria computação está à mercê de instituições, empresas e grupos com poder e determinação suficientes para subverter a infraestrutura informática e explorar as suas fraquezas. Embora o uso de substitutos possa ser conveniente, encorajamos os usuários a também construírem por conta própria, ou até mesmo executarem seu próprio build farm, de modo que os servidores substitutos executados pelo projeto sejam um alvo menos interessante. Uma maneira de ajudar é publicando o software que você constrói usando `guix publish` para que outros tenham mais uma opção de servidor para baixar substitutos (veja Seção 9.11 [Invocando guix publish], Página 221).

Guix tem as bases para maximizar a reprodutibilidade da construção (veja Seção 5.1 [Recursos], Página 36). Na maioria dos casos, compilações independentes de um determinado pacote ou derivação devem produzir resultados idênticos em termos de bits. Assim, através de um conjunto diversificado de construções de pacotes independentes, podemos fortalecer a integridade dos nossos sistemas. O comando `guix challenge` visa ajudar os usuários a avaliar servidores substitutos e ajudar os desenvolvedores a descobrir sobre compilações de pacotes não determinísticos (veja Seção 9.12 [Invocando guix challenge], Página 225). Da mesma forma, a opção `--check` de `guix build` permite aos usuários verificar se os substitutos instalados anteriormente são genuínos, reconstruindo-os localmente (veja [build-check], Página 189).

No futuro, queremos que o Guix tenha suporte para publicação e recuperação de binários de/para outros usuários, de forma peer-to-peer. Se você gostaria de discutir este projeto, entre em contato conosco em `guix-devel@gnu.org`.

5.4 Pacotes com múltiplas saídas

Frequentemente, os pacotes definidos no Guix têm uma única *saída* — ou seja, o pacote fonte leva a exatamente um diretório no armazém. Ao executar `guix install glibc`, instala-se a saída padrão do pacote GNU libc; A saída padrão é chamada `out`, mas seu nome pode ser omitido conforme mostrado neste comando. Neste caso específico, a saída padrão de `glibc` contém todos os arquivos de cabeçalho C, bibliotecas compartilhadas, bibliotecas estáticas, documentação de informações e outros arquivos de suporte.

Às vezes é mais apropriado separar os vários tipos de arquivos produzidos a partir de um único pacote fonte em saídas separadas. Por exemplo, a biblioteca GLib C (usada pelo GTK+ e pacotes relacionados) instala mais de 20 MiB de documentação de referência como páginas HTML. Para economizar espaço para usuários que não precisam, a documentação vai para uma saída separada, chamada `doc`. Para instalar a saída principal do GLib, que contém tudo menos a documentação, seria executado:

```
guix install glib
```

O comando para instalar sua documentação é:

```
guix install glib:doc
```

Embora a sintaxe de dois pontos funcione para especificação de linha de comando de saídas de pacotes, ela não funcionará ao usar uma *variável* de pacote no código do Scheme. Por exemplo, para adicionar a documentação do `glib` aos pacotes instalados globalmente de um `operating-system` (veja Seção 11.3 [Referência do operating-system], Página 247), uma lista de dois itens, sendo o primeiro a *variável* de pacote e o segundo o nome da saída a ser selecionada (uma string), devem ser usados:

```
(use-modules (gnu packages glib))
;; glib-with-documentation é o símbolo de Guile para o pacote glib
(operating-system
 ...
 (packages
  (append
   (list (list glib-with-documentation "doc"))
         %base-packages)))
```

Alguns pacotes instalam programas com diferentes "pegadas de dependência". Por exemplo, o pacote WordNet instala ferramentas de linha de comando e interfaces gráficas de usuário (GUIs). Os primeiros dependem exclusivamente da biblioteca C, enquanto os últimos dependem apenas do Tcl/Tk e das bibliotecas X subjacentes. Nesse caso, deixamos as ferramentas de linha de comando na saída padrão, enquanto as GUIs ficam em uma saída separada. Isso permite que usuários que não precisam de GUIs economizem espaço. O comando `guix size` pode ajudar a descobrir tais situações (veja Seção 9.9 [Invocando guix size], Página 214). `guix graph` também pode ser útil (veja Seção 9.10 [Invocando guix graph], Página 216).

Existem vários desses pacotes de múltiplas saídas na distribuição GNU. Outros nomes de saída convencionais incluem `lib` para bibliotecas e possivelmente arquivos de cabeçalho, `bin` para programas independentes e `debug` para informações de depuração (veja Capítulo 17 [Instalando arquivos de depuração], Página 705). A saída de um pacote está listada na terceira coluna da saída de `guix package --list-available` (veja Seção 5.2 [Invocando guix package], Página 37).

5.5 Invocando `guix locate`

Há tantos softwares gratuitos por aí que, mais cedo ou mais tarde, você precisará procurar por pacotes. O comando `guix search` que vimos antes (veja Seção 5.2 [Invocando guix package], Página 37) permite pesquisar por palavras-chave:

```
guix search video editor
```

Às vezes, você deseja descobrir qual pacote fornece um determinado arquivo, e é aí que entra `guix locate`. Veja como você pode encontrar o comando `ls`:

```
$ guix locate ls
coreutils@9.1       /gnu/store/...-coreutils-9.1/bin/ls
```

É claro que o comando funciona para qualquer arquivo, não apenas para comandos:

```
$ guix locate unistr.h
icu4c@71.1          /gnu/store/.../include/unicode/unistr.h
libunistring@1.0    /gnu/store/.../include/unistr.h
```

Você também pode especificar *padrões de globo* com curingas. Por exemplo, aqui está como você procuraria pacotes que fornecem arquivos `.service`:

```
$ guix locate -g '*.service'
man-db@2.11.1        .../lib/systemd/system/man-db.service
wpa-supplicant@2.10  .../system-services/fi.w1.wpa_supplicant1.service
```

O comando `guix locate` depende de um banco de dados que mapeia nomes de arquivos para nomes de pacotes. Por padrão, ele cria automaticamente esse banco de dados, caso ele ainda não exista, percorrendo os pacotes disponíveis *localmente*, o que pode levar alguns minutos (dependendo do tamanho do seu armazém e da velocidade do seu dispositivo de armazenamento).

> **Nota:** Por enquanto, `guix locate` constrói seu banco de dados baseado em conhecimento puramente local – o que significa que você não encontrará pacotes que nunca chegaram ao sue armazém. Eventualmente, ele suportará o download de um banco de dados pré-construído para que você possa encontrar mais pacotes.

Por padrão, `guix locate` primeiro tenta procurar um banco de dados de todo o sistema, geralmente em `/var/cache/guix/locate`; Se não existir ou for muito antigo, ele retornará ao banco de dados por usuário, por padrão em `~/.cache/guix/locate`. Em um sistema multiusuário, os administradores podem querer atualizar periodicamente o banco de dados de todo o sistema para que todos os usuários possam se beneficiar dele, por exemplo, configurando `package-database-service-type` (veja Seção 11.10.11 [File Search Services], Página 374).

A sintaxe geral é:

```
guix locate [opções...] arquivo...
```

... onde *arquivo* é o nome de um arquivo a ser pesquisado (especificamente, o "nome base" do arquivo: arquivos cujos diretórios pais são chamados *arquivo* não são correspondidos).

As opções disponíveis são as seguintes:

`--glob`

`-g` Interprete *arquivo...* como *padrões de globo*—padrões que podem incluir caracteres curinga, como '`*.scm`' para denotar todos os arquivos que terminam em '`.scm`'.

`--stats` Exibir estatísticas do banco de dados.

`--update`
`-u` Atualize o banco de dados dos arquivos.

Por padrão, o banco de dados é atualizado automaticamente quando é muito antigo.

`--clear` Limpe o banco de dados e preencha-o novamente.

Esta opção permite começar de novo, garantindo que os dados antigos sejam removidos do banco de dados, o que também evita ter um banco de dados em constante crescimento. Por padrão, `guix locate` faz isso automaticamente periodicamente, embora com pouca frequência.

`--database=`*arquivo*
Use *arquivo* como banco de dados, criando-o se necessário.

Por padrão, `guix locate` escolhe o banco de dados em `~/.cache/guix` ou `/var/cache/guix`, o que for mais recente.

`--method=`*método*
`-m` *método* Use *método* para selecionar o conjunto de pacotes a serem indexados. Os valores possíveis são:

`manifests`
Este é o método padrão: ele funciona percorrendo perfis na máquina e gravando os pacotes que encontra – pacotes instalados por você ou por outros usuários da máquina, direta ou indiretamente. É rápido mas você pode perder outros pacotes disponíveis no armazém mas não referenciados por nenhum perfil.

`store` Este é um método mais lento, porém mais exaustivo: verifica entre todos os pacotes existentes aqueles que estão disponíveis no armazém e os registra.

5.6 Invocando `guix gc`

Pacotes instalados mas não usados podem ser *garbage-collected*. O comando `guix gc` permite que os usuários executem explicitamente o coletor de lixo para recuperar espaço do diretório `/gnu/store`. É a maneira *única* de remover arquivos de `/gnu/store` — remover arquivos ou diretórios manualmente pode quebrá-los sem possibilidade de reparo!

O coletor de lixo possui um conjunto de *roots* conhecidos: qualquer arquivo em `/gnu/store` acessível a partir de uma raiz é considerado *live* e não pode ser excluído; Qualquer outro arquivo é considerado *dead* e pode ser excluído. O conjunto de raízes do coletor de lixo (abreviadamente "Raízes GC") inclui perfis de usuário padrão; por padrão, os links simbólicos em `/var/guix/gcroots` representam essas raízes do GC. Novas raízes de GC podem ser adicionadas com `guix build --root`, por exemplo (veja Seção 9.1 [Invocando guix build], Página 177). O comando `guix gc --list-roots` os lista.

Antes de executar `guix gc --collect-garbage` para liberar espaço, geralmente é útil remover gerações antigas dos perfis de usuário; dessa forma, compilações de pacotes antigos referenciadas por essas gerações podem ser recuperadas. Isso é conseguido executando `guix package --delete-generations` (veja Seção 5.2 [Invocando guix package], Página 37).

Nossa recomendação é executar uma coleta de lixo periodicamente ou quando houver pouco espaço em disco. Por exemplo, para garantir que pelo menos 5 GB estejam disponíveis no disco, basta executar:

```
guix gc -F 5G
```

É perfeitamente seguro executar como um trabalho periódico não interativo (veja Seção 11.10.2 [Execução de trabalho agendado], Página 289, para saber como configurar tal trabalho). Executar `guix gc` sem argumentos coletará o máximo de lixo possível, mas isso geralmente é inconveniente: você pode ter que reconstruir ou baixar novamente um software que está "morto" do ponto de vista do GC, mas que é necessário para construir outras peças de software - por exemplo, a cadeia de ferramentas do compilador.

O comando `guix gc` tem três modos de operação: pode ser usado para coletar o lixo de quaisquer arquivos mortos (o padrão), para excluir arquivos específicos (a opção `--delete`), para imprimir lixo- informações do coletor ou para consultas mais avançadas. As opções de coleta de lixo são as seguintes:

`--collect-garbage[=`*min*`]`
`-C [`*min*`]` Colete lixo, ou seja, arquivos e subdiretórios `/gnu/store` inacessíveis. Esta é a operação padrão quando nenhuma opção é especificada.

Quando *min* for fornecido, pare quando *min* bytes forem coletados. *min* pode ser um número de bytes ou pode incluir uma unidade como sufixo, como `MiB` para mebibytes e `GB` para gigabytes (veja Seção "Block size" em *GNU Coreutils*).

Quando *min* for omitido, colete todo o lixo.

`--free-space=`*free*
`-F` *free* Colete o lixo até que o espaço *free* esteja disponível em `/gnu/store`, se possível; *free* denota espaço de armazenamento, como `500MiB`, conforme descrito acima.

Quando *free* ou mais já estiver disponível em `/gnu/store`, não faça nada e saia imediatamente.

`--delete-generations[=`*duração*`]`
`-d [`*duração*`]`
Antes de iniciar o processo de coleta de lixo, exclua todas as gerações anteriores a *duração*, para todos os perfis de usuário e gerações do ambiente pessoal. Quando executado como root, isso se aplica a todos os perfis *de todos os usuários*.

Por exemplo, este comando exclui todas as gerações de todos os seus perfis com mais de 2 meses (exceto as gerações atuais) e depois libera espaço até que pelo menos 10 GiB estejam disponíveis:

```
guix gc -d 2m -F 10G
```

`--delete`
`-D` Tentativa de excluir todos os arquivos e diretórios de armazém especificados como argumentos. Isso falhará se alguns dos arquivos não estiverem no armazém ou se ainda estiverem ativos.

`--list-failures`
: Listar itens de armazém correspondentes a falhas de compilação em cache.

  Isso não imprime nada, a menos que o daemon tenha sido iniciado com `--cache-failures` (veja Seção 2.3 [Invocando guix-daemon], Página 13).

`--list-roots`
: Listar as raízes do GC de propriedade do usuário; quando executado como root, listar *todas* as raízes do GC.

`--list-busy`
: Listar itens de armazém em uso por processos em execução no momento. Esses itens de armazém são efetivamente considerados raízes GC: eles não podem ser excluídos.

`--clear-failures`
: Remova os itens de armazém especificados do cache de compilação com falha.

  Novamente, essa opção só faz sentido quando o daemon é iniciado com `--cache-failures`. Caso contrário, não faz nada.

`--list-dead`
: Exibe a lista de arquivos e diretórios mortos ainda presentes no armazém, ou seja, arquivos e diretórios que não podem mais ser acessados de nenhuma raiz.

`--list-live`
: Exibe a lista de arquivos e diretórios do armazém ativa.

Além disso, as referências entre arquivos de armazém existentes podem ser consultadas:

`--references`
`--referrers`
: Listar as referências (respectivamente, os referenciadores) dos arquivos de armazém fornecidos como argumentos.

`--requisites`
`-R`
: Liste os requisitos dos arquivos de armazém passados como argumentos. Os requisitos incluem os próprios arquivos de armazém, suas referências e as referências destes, recursivamente. Em outras palavras, a lista retornada é o *fechamento transitivo* dos arquivos de armazém.

  Veja Seção 9.9 [Invocando guix size], Página 214, para uma ferramenta para criar o perfil do tamanho do fechamento de um elemento. Veja Seção 9.10 [Invocando guix graph], Página 216, para uma ferramenta para visualizar o grafo de referências.

`--derivers`
: Retorna a(s) derivação(ões) que levam aos itens de armazém fornecidos (veja Seção 8.10 [Derivações], Página 156).

  Por exemplo, este comando:

  ```
  guix gc --derivers $(guix package -I ^emacs$ | cut -f4)
  ```

  retorna o(s) arquivo(s) `.drv` que levam ao pacote `emacs` instalado no seu perfil.

  Note que pode haver zero arquivos `.drv` correspondentes, por exemplo porque esses arquivos foram coletados como lixo. Também pode haver mais de um `.drv` correspondente devido a derivações de saída fixa.

Por fim, as seguintes opções permitem que você verifique a integridade do armazém e controle o uso do disco.

`--verify[=opções]`
: Verifique a integridade do armazém.

  Por padrão, certifique-se de que todos os itens de armazém marcados como válidos no banco de dados do daemon realmente existam em `/gnu/store`.

  Quando fornecido, *opções* deve ser uma lista separada por vírgulas contendo um ou mais de `contents` e `repair`.

  Ao passar `--verify=contents`, o daemon calcula o hash de conteúdo de cada item do armazém e o compara com seu hash no banco de dados. Incompatibilidades de hash são relatadas como corrupções de dados. Como ele percorre *todos os arquivos no armazém*, esse comando pode levar muito tempo, especialmente em sistemas com uma unidade de disco lenta.

  Usar `--verify=repair` ou `--verify=contents,repair` faz com que o daemon tente reparar itens corrompidos do armazém buscando substitutos para eles (veja Seção 5.3 [Substitutos], Página 47). Como o reparo não é atômico e, portanto, potencialmente perigoso, ele está disponível apenas para o administrador do sistema. Uma alternativa leve, quando você sabe exatamente quais itens no armazém estão corrompidos, é `guix build --repair` (veja Seção 9.1 [Invocando guix build], Página 177).

`--optimize`
: Otimize o armazém vinculando fisicamente arquivos idênticos — isso é *deduplication*.

  O daemon executa a desduplicação após cada importação bem-sucedida de build ou archive, a menos que tenha sido iniciado com `--disable-deduplication` (veja Seção 2.3 [Invocando guix-daemon], Página 13). Portanto, essa opção é útil principalmente quando o daemon estava em execução com `--disable-deduplication`.

`--vacuum-database`
: Guix uses an sqlite database to keep track of the items in (veja Seção 8.9 [O armazém], Página 154). Over time it is possible that the database may grow to a large size and become fragmented. As a result, one may wish to clear the freed space and join the partially used pages in the database left behind from removed packages or after running the garbage collector. Running `sudo guix gc --vacuum-database` will lock the database and `VACUUM` the store, defragmenting the database and purging freed pages, unlocking the database when it finishes.

5.7 Invocando `guix pull`

Packages are installed or upgraded to the latest version available in the distribution currently available on your local machine. To update that distribution, along with the Guix tools, you must run `guix pull`: the command downloads the latest Guix source code and package descriptions, and deploys it. Source code is downloaded from a Git (`https://git-scm.com/book/en/`) repository, by default the official GNU Guix repository, though this can be

customized. `guix pull` ensures that the code it downloads is *authentic* by verifying that commits are signed by Guix developers.

Specifically, `guix pull` downloads code from the *channels* (veja Capítulo 6 [Canais], Página 69) specified by one of the following, in this order:

1. the `--channels` option;
2. the user's `~/.config/guix/channels.scm` file, unless `-q` is passed;
3. the system-wide `/etc/guix/channels.scm` file, unless `-q` is passed (on Guix System, this file can be declared in the operating system configuration, veja [guix-configuration-channels], Página 278);
4. the built-in default channels specified in the `%default-channels` variable.

On completion, `guix package` will use packages and package versions from this just-retrieved copy of Guix. Not only that, but all the Guix commands and Scheme modules will also be taken from that latest version. New `guix` sub-commands added by the update also become available.

Any user can update their Guix copy using `guix pull`, and the effect is limited to the user who ran `guix pull`. For instance, when user `root` runs `guix pull`, this has no effect on the version of Guix that user `alice` sees, and vice versa.

The result of running `guix pull` is a *profile* available under `~/.config/guix/current` containing the latest Guix.

The `--list-generations` or `-l` option lists past generations produced by `guix pull`, along with details about their provenance:

```
$ guix pull -l
Generation 1 Jun 10 2018 00:18:18
  guix 65956ad
    repository URL: https://git.savannah.gnu.org/git/guix.git
    branch: origin/master
    commit: 65956ad3526ba09e1f7a40722c96c6ef7c0936fe

Generation 2 Jun 11 2018 11:02:49
  guix e0cc7f6
    repository URL: https://git.savannah.gnu.org/git/guix.git
    branch: origin/master
    commit: e0cc7f669bec22c37481dd03a7941c7d11a64f1d

Generation 3 Jun 13 2018 23:31:07 (current)
  guix 844cc1c
    repository URL: https://git.savannah.gnu.org/git/guix.git
    branch: origin/master
    commit: 844cc1c8f394f03b404c5bb3aee086922373490c
```

Veja Seção 5.10 [Invocando guix describe], Página 65, for other ways to describe the current status of Guix.

This `~/.config/guix/current` profile works exactly like the profiles created by `guix package` (veja Seção 5.2 [Invocando guix package], Página 37). That is, you can list generations, roll back to the previous generation—i.e., the previous Guix—and so on:

```
$ guix pull --roll-back
switched from generation 3 to 2
$ guix pull --delete-generations=1
deleting /var/guix/profiles/per-user/charlie/current-guix-1-link
```

You can also use `guix package` (veja Seção 5.2 [Invocando guix package], Página 37) to manage the profile by naming it explicitly:

```
$ guix package -p ~/.config/guix/current --roll-back
switched from generation 3 to 2
$ guix package -p ~/.config/guix/current --delete-generations=1
deleting /var/guix/profiles/per-user/charlie/current-guix-1-link
```

The `guix pull` command is usually invoked with no arguments, but it supports the following options:

`--url=`*url*
`--commit=`*commit*
`--branch=`*ramo*
: Download code for the `guix` channel from the specified *url*, at the given *commit* (a valid Git commit ID represented as a hexadecimal string or the name of a tag), or *branch*.

  These options are provided for convenience, but you can also specify your configuration in the `~/.config/guix/channels.scm` file or using the `--channels` option (see below).

`--channels=`*file*
`-C` *arquivo*
: Read the list of channels from *file* instead of `~/.config/guix/channels.scm` or `/etc/guix/channels.scm`. *file* must contain Scheme code that evaluates to a list of channel objects. Veja Capítulo 6 [Canais], Página 69, for more information.

`--no-channel-files`
`-q`
: Inhibit loading of the user and system channel files, `~/.config/guix/channels.scm` and `/etc/guix/channels.scm`.

`--news`
`-N`
: Display news written by channel authors for their users for changes made since the previous generation (veja Capítulo 6 [Canais], Página 69). When `--details` is passed, additionally display new and upgraded packages.

  You can view that information for previous generations with `guix pull -l`.

`--list-generations[=`*padrão*`]`
`-l [`*padrão*`]`
: List all the generations of `~/.config/guix/current` or, if *pattern* is provided, the subset of generations that match *pattern*. The syntax of *pattern* is the same as with `guix package --list-generations` (veja Seção 5.2 [Invocando guix package], Página 37).

  By default, this prints information about the channels used in each revision as well as the corresponding news entries. If you pass `--details`, it will also print

the list of packages added and upgraded in each generation compared to the previous one.

`--details`
: Instruct `--list-generations` or `--news` to display more information about the differences between subsequent generations—see above.

`--roll-back`
: Roll back to the previous *generation* of `~/.config/guix/current`—i.e., undo the last transaction.

`--switch-generation=`*padrão*
`-S` *padrão* Mude para uma geração específica definida por *padrão*.

padrão pode ser um número de geração ou um número prefixado com "+" ou "-". O último significa: mover para frente/para trás por um número especificado de gerações. Por exemplo, se você quiser retornar para a última geração após `--roll-back`, use `--switch-generation=+1`.

`--delete-generations[=`*padrão*`]`
`-d [`*padrão*`]`
: Quando *padrão* for omitido, exclua todas as gerações, exceto a atual.

Este comando aceita os mesmos padrões de `--list-Generations`. Quando *pattern* for especificado, exclua as gerações correspondentes. Quando *padrão* especifica uma duração, as gerações *mais antigas* que a duração especificada correspondem. Por exemplo, `--delete-generations=1m` exclui gerações com mais de um mês.

If the current generation matches, it is *not* deleted.

Observe que a exclusão de gerações impede a reversão para elas. Conseqüentemente, este comando deve ser usado com cuidado.

Veja Seção 5.10 [Invocando guix describe], Página 65, for a way to display information about the current generation only.

`--profile=`*perfil*
`-p` *perfil* Use *profile* instead of `~/.config/guix/current`.

`--dry-run`
`-n` Show which channel commit(s) would be used and what would be built or substituted but do not actually do it.

`--allow-downgrades`
: Allow pulling older or unrelated revisions of channels than those currently in use.

By default, `guix pull` protects against so-called "downgrade attacks" whereby the Git repository of a channel would be reset to an earlier or unrelated revision of itself, potentially leading you to install older, known-vulnerable versions of software packages.

> **Nota:** Make sure you understand its security implications before using `--allow-downgrades`.

`--disable-authentication`
: Allow pulling channel code without authenticating it.

  By default, `guix pull` authenticates code downloaded from channels by verifying that its commits are signed by authorized developers, and raises an error if this is not the case. This option instructs it to not perform any such verification.

  > **Nota:** Make sure you understand its security implications before using `--disable-authentication`.

`--system=`*system*
`-s` *sistema*
: Attempt to build for *system*—e.g., `i686-linux`—instead of the system type of the build host.

`--bootstrap`
: Use the bootstrap Guile to build the latest Guix. This option is only useful to Guix developers.

The *channel* mechanism allows you to instruct `guix pull` which repository and branch to pull from, as well as *additional* repositories containing package modules that should be deployed. Veja Capítulo 6 [Canais], Página 69, for more information.

In addition, `guix pull` supports all the common build options (veja Seção 9.1.1 [Opções de compilação comum], Página 177).

5.8 Invoking `guix time-machine`

The `guix time-machine` command provides access to other revisions of Guix, for example to install older versions of packages, or to reproduce a computation in an identical environment. The revision of Guix to be used is defined by a commit or by a channel description file created by `guix describe` (veja Seção 5.10 [Invocando guix describe], Página 65).

Let's assume that you want to travel to those days of November 2020 when version 1.2.0 of Guix was released and, once you're there, run the `guile` of that time:

```
guix time-machine --commit=v1.2.0 -- \
  environment -C --ad-hoc guile -- guile
```

The command above fetches Guix 1.2.0 (and possibly other channels specified by your `channels.scm` configuration files—see below) and runs its `guix environment` command to spawn an environment in a container running `guile` (`guix environment` has since been subsumed by `guix shell`; veja Seção 7.1 [Invocando guix shell], Página 79). It's like driving a DeLorean[1]! The first `guix time-machine` invocation can be expensive: it may have to download or even build a large number of packages; the result is cached though and subsequent commands targeting the same commit are almost instantaneous.

As for `guix pull`, in the absence of any options, `time-machine` fetches the latest commits of the channels specified in `~/.config/guix/channels.scm`, `/etc/guix/channels.scm`, or the default channels; the `-q` option lets you ignore these configuration files. The command:

```
guix time-machine -q -- build hello
```

[1] If you don't know what a DeLorean is, consider traveling back to the 1980's. (Back to the Future (1985) (`https://www.imdb.com/title/tt0088763/`))

will thus build the package `hello` as defined in the main branch of Guix, without any additional channel, which is in general a newer revision of Guix than you have installed. Time travel works in both directions!

> **Nota:** The history of Guix is immutable and `guix time-machine` provides the exact same software as they are in a specific Guix revision. Naturally, no security fixes are provided for old versions of Guix or its channels. A careless use of `guix time-machine` opens the door to security vulnerabilities. Veja Seção 5.7 [Invocando guix pull], Página 57.

`guix time-machine` raises an error when attempting to travel to commits older than "v0.16.0" (commit '`4a0b87f0`'), dated Dec. 2018. This is one of the oldest commits supporting the channel mechanism that makes "time travel" possible.

> **Nota:** Although it should technically be possible to travel to such an old commit, the ease to do so will largely depend on the availability of binary substitutes. When traveling to a distant past, some packages may not easily build from source anymore. One such example are old versions of OpenSSL whose tests would fail after a certain date. This particular problem can be worked around by running a *virtual build machine* with its clock set to the right time (veja [build-vm], Página 533).

A sintaxe geral é:

```
guix time-machine options... -- command  arg...
```

where *command* and *arg*... are passed unmodified to the `guix` command of the specified revision. The *options* that define this revision are the same as for `guix pull` (veja Seção 5.7 [Invocando guix pull], Página 57):

`--url=`*url*
`--commit=`*commit*
`--branch=`*ramo*
: Use the `guix` channel from the specified *url*, at the given *commit* (a valid Git commit ID represented as a hexadecimal string or the name of a tag), or *branch*.

`--channels=`*file*
`-C` *arquivo*
: Read the list of channels from *file*. *file* must contain Scheme code that evaluates to a list of channel objects. Veja Capítulo 6 [Canais], Página 69, for more information.

`--no-channel-files`
`-q`
: Inhibit loading of the user and system channel files, `~/.config/guix/channels.scm` and `/etc/guix/channels.scm`.

  Thus, `guix time-machine -q` is equivalent to the following Bash command, using the "process substitution" syntax (veja Seção "Process Substitution" em *The GNU Bash Reference Manual*):

  ```
  guix time-machine -C <(echo %default-channels) ...
  ```

Note that `guix time-machine` can trigger builds of channels and their dependencies, and these are controlled by the standard build options (veja Seção 9.1.1 [Opções de compilação comum], Página 177).

If `guix time-machine` is executed without any command, it prints the file name of the profile that would be used to execute the command. This is sometimes useful if you need to get store file name of the profile—e.g., when you want to `guix copy` it.

5.9 Inferiores

> **Nota:** The functionality described here is a "technology preview" as of version ba3a031. As such, the interface is subject to change.

Sometimes you might need to mix packages from the revision of Guix you're currently running with packages available in a different revision of Guix. Guix *inferiors* allow you to achieve that by composing different Guix revisions in arbitrary ways.

Technically, an "inferior" is essentially a separate Guix process connected to your main Guix process through a REPL (veja Seção 8.13 [Invocando guix repl], Página 172). The `(guix inferior)` module allows you to create inferiors and to communicate with them. It also provides a high-level interface to browse and manipulate the packages that an inferior provides—*inferior packages*.

When combined with channels (veja Capítulo 6 [Canais], Página 69), inferiors provide a simple way to interact with a separate revision of Guix. For example, let's assume you want to install in your profile the current `guile` package, along with the `guile-json` as it existed in an older revision of Guix—perhaps because the newer `guile-json` has an incompatible API and you want to run your code against the old API. To do that, you could write a manifest for use by `guix package --manifest` (veja Seção 8.4 [Escrevendo manifestos], Página 117); in that manifest, you would create an inferior for that old Guix revision you care about, and you would look up the `guile-json` package in the inferior:

```
(use-modules (guix inferior) (guix channels)
             (srfi srfi-1))   ;for 'first'

(define channels
  ;; This is the old revision from which we want to
  ;; extract guile-json.
  (list (channel
         (name 'guix)
         (url "https://git.savannah.gnu.org/git/guix.git")
         (commit
          "65956ad3526ba09e1f7a40722c96c6ef7c0936fe"))))

(define inferior
  ;; An inferior representing the above revision.
  (inferior-for-channels channels))

;; Now create a manifest with the current "guile" package
;; and the old "guile-json" package.
(packages->manifest
 (list (first (lookup-inferior-packages inferior "guile-json"))
       (specification->package "guile")))
```

On its first run, `guix package --manifest` might have to build the channel you specified before it can create the inferior; subsequent runs will be much faster because the Guix revision will be cached.

The `(guix inferior)` module provides the following procedures to open an inferior:

`inferior-for-channels` *channels* [*#:cache-directory*] [*#:ttl*] [Procedure]
Return an inferior for *channels*, a list of channels. Use the cache at *cache-directory*, where entries can be reclaimed after *ttl* seconds. This procedure opens a new connection to the build daemon.

As a side effect, this procedure may build or substitute binaries for *channels*, which can take time.

`open-inferior` *directory* [*#:command* `"bin/guix"`] [Procedure]
Open the inferior Guix in *directory*, running `directory/command repl` or equivalent. Return `#f` if the inferior could not be launched.

The procedures listed below allow you to obtain and manipulate inferior packages.

`inferior-packages` *inferior* [Procedure]
Return the list of packages known to *inferior*.

`lookup-inferior-packages` *inferior name* [*version*] [Procedure]
Return the sorted list of inferior packages matching *name* in *inferior*, with highest version numbers first. If *version* is true, return only packages with a version number prefixed by *version*.

`inferior-package?` *obj* [Procedure]
Return true if *obj* is an inferior package.

`inferior-package-name` *package* [Procedure]
`inferior-package-version` *package* [Procedure]
`inferior-package-synopsis` *package* [Procedure]
`inferior-package-description` *package* [Procedure]
`inferior-package-home-page` *package* [Procedure]
`inferior-package-location` *package* [Procedure]
`inferior-package-inputs` *package* [Procedure]
`inferior-package-native-inputs` *package* [Procedure]
`inferior-package-propagated-inputs` *package* [Procedure]
`inferior-package-transitive-propagated-inputs` *package* [Procedure]
`inferior-package-native-search-paths` *package* [Procedure]
`inferior-package-transitive-native-search-paths` *package* [Procedure]
`inferior-package-search-paths` *package* [Procedure]
These procedures are the counterpart of package record accessors (veja Seção 8.2.1 [Referência do package], Página 104). Most of them work by querying the inferior *package* comes from, so the inferior must still be live when you call these procedures.

Inferior packages can be used transparently like any other package or file-like object in G-expressions (veja Seção 8.12 [Expressões-G], Página 163). They are also transparently handled by the `packages->manifest` procedure, which is commonly used in manifests (veja

Seção 5.2 [Invocando guix package], Página 37). Thus you can insert an inferior package pretty much anywhere you would insert a regular package: in manifests, in the `packages` field of your `operating-system` declaration, and so on.

5.10 Invocando `guix describe`

Often you may want to answer questions like: "Which revision of Guix am I using?" or "Which channels am I using?" This is useful information in many situations: if you want to *replicate* an environment on a different machine or user account, if you want to report a bug or to determine what change in the channels you are using caused it, or if you want to record your system state for reproducibility purposes. The `guix describe` command answers these questions.

When run from a `guix pull`ed `guix`, `guix describe` displays the channel(s) that it was built from, including their repository URL and commit IDs (veja Capítulo 6 [Canais], Página 69):

```
$ guix describe
Generation 10 Sep 03 2018 17:32:44 (current)
  guix e0fa68c
    repository URL: https://git.savannah.gnu.org/git/guix.git
    branch: master
    commit: e0fa68c7718fffd33d81af415279d6ddb518f727
```

If you're familiar with the Git version control system, this is similar in spirit to `git describe`; the output is also similar to that of `guix pull --list-generations`, but limited to the current generation (veja Seção 5.7 [Invocando guix pull], Página 57). Because the Git commit ID shown above unambiguously refers to a snapshot of Guix, this information is all it takes to describe the revision of Guix you're using, and also to replicate it.

To make it easier to replicate Guix, `guix describe` can also be asked to return a list of channels instead of the human-readable description above:

```
$ guix describe -f channels
(list (channel
        (name 'guix)
        (url "https://git.savannah.gnu.org/git/guix.git")
        (commit
          "e0fa68c7718fffd33d81af415279d6ddb518f727")
        (introduction
          (make-channel-introduction
            "9edb3f66fd807b096b48283debdcddccfea34bad"
            (openpgp-fingerprint
              "BBB0 2DDF 2CEA F6A8 0D1D  E643 A2A0 6DF2 A33A 54FA")))))
```

You can save this to a file and feed it to `guix pull -C` on some other machine or at a later point in time, which will instantiate *this exact Guix revision* (veja Seção 5.7 [Invocando guix pull], Página 57). From there on, since you're able to deploy the same revision of Guix, you can just as well *replicate a complete software environment*. We humbly think that this is *awesome*, and we hope you'll like it too!

The details of the options supported by `guix describe` are as follows:

`--format=`*format*
`-f` *format* Produce output in the specified *format*, one of:

`human` produce human-readable output;

`channels` produce a list of channel specifications that can be passed to `guix pull -C` or installed as `~/.config/guix/channels.scm` (veja Seção 5.7 [Invocando guix pull], Página 57);

`channels-sans-intro`
like `channels`, but omit the `introduction` field; use it to produce a channel specification suitable for Guix version 1.1.0 or earlier—the `introduction` field has to do with channel authentication (veja Capítulo 6 [Canais], Página 69) and is not supported by these older versions;

`json` produce a list of channel specifications in JSON format;

`recutils` produce a list of channel specifications in Recutils format.

`--list-formats`
Display available formats for `--format` option.

`--profile=`*perfil*
`-p` *perfil* Display information about *profile*.

5.11 Invocando `guix archive`

The `guix archive` command allows users to *export* files from the store into a single archive, and to later *import* them on a machine that runs Guix. In particular, it allows store files to be transferred from one machine to the store on another machine.

> **Nota:** If you're looking for a way to produce archives in a format suitable for tools other than Guix, veja Seção 7.3 [Invocando guix pack], Página 92.

To export store files as an archive to standard output, run:

```
guix archive --export options specifications...
```

specifications may be either store file names or package specifications, as for `guix package` (veja Seção 5.2 [Invocando guix package], Página 37). For instance, the following command creates an archive containing the `gui` output of the `git` package and the main output of `emacs`:

```
guix archive --export git:gui /gnu/store/...-emacs-24.3 > great.nar
```

If the specified packages are not built yet, `guix archive` automatically builds them. The build process may be controlled with the common build options (veja Seção 9.1.1 [Opções de compilação comum], Página 177).

To transfer the `emacs` package to a machine connected over SSH, one would run:

```
guix archive --export -r emacs | ssh the-machine guix archive --import
```

Similarly, a complete user profile may be transferred from one machine to another like this:

```
guix archive --export -r $(readlink -f ~/.guix-profile) | \
  ssh the-machine guix archive --import
```

However, note that, in both examples, all of `emacs` and the profile as well as all of their dependencies are transferred (due to `-r`), regardless of what is already available in the store on the target machine. The `--missing` option can help figure out which items are missing from the target store. The `guix copy` command simplifies and optimizes this whole process, so this is probably what you should use in this case (veja Seção 9.13 [Invocando guix copy], Página 227).

Each store item is written in the *normalized archive* or *nar* format (described below), and the output of `guix archive --export` (and input of `guix archive --import`) is a *nar bundle*.

The nar format is comparable in spirit to 'tar', but with differences that make it more appropriate for our purposes. First, rather than recording all Unix metadata for each file, the nar format only mentions the file type (regular, directory, or symbolic link); Unix permissions and owner/group are dismissed. Second, the order in which directory entries are stored always follows the order of file names according to the C locale collation order. This makes archive production fully deterministic.

That nar bundle format is essentially the concatenation of zero or more nars along with metadata for each store item it contains: its file name, references, corresponding derivation, and a digital signature.

When exporting, the daemon digitally signs the contents of the archive, and that digital signature is appended. When importing, the daemon verifies the signature and rejects the import in case of an invalid signature or if the signing key is not authorized.

The main options are:

`--export` Export the specified store files or packages (see below). Write the resulting archive to the standard output.

Dependencies are *not* included in the output, unless `--recursive` is passed.

`-r`
`--recursive`
When combined with `--export`, this instructs `guix archive` to include dependencies of the given items in the archive. Thus, the resulting archive is self-contained: it contains the closure of the exported store items.

`--import` Read an archive from the standard input, and import the files listed therein into the store. Abort if the archive has an invalid digital signature, or if it is signed by a public key not among the authorized keys (see `--authorize` below).

`--missing`
Read a list of store file names from the standard input, one per line, and write on the standard output the subset of these files missing from the store.

`--generate-key[=`*parameters*`]`
Generate a new key pair for the daemon. This is a prerequisite before archives can be exported with `--export`. This operation is usually instantaneous but it can take time if the system's entropy pool needs to be refilled. On Guix System, `guix-service-type` takes care of generating this key pair the first boot.

The generated key pair is typically stored under `/etc/guix`, in `signing-key.pub` (public key) and `signing-key.sec` (private key, which must be kept

secret). When *parameters* is omitted, an ECDSA key using the Ed25519 curve is generated, or, for Libgcrypt versions before 1.6.0, it is a 4096-bit RSA key. Alternatively, *parameters* can specify `genkey` parameters suitable for Libgcrypt (veja Seção "General public-key related Functions" em *The Libgcrypt Reference Manual*).

`--authorize`
: Authorize imports signed by the public key passed on standard input. The public key must be in "s-expression advanced format"—i.e., the same format as the `signing-key.pub` file.

  The list of authorized keys is kept in the human-editable file `/etc/guix/acl`. The file contains "advanced-format s-expressions" (`https://people.csail.mit.edu/rivest/Sexp.txt`) and is structured as an access-control list in the Simple Public-Key Infrastructure (SPKI) (`https://theworld.com/~cme/spki.txt`).

`--extract=`*directory*
`-x` *directory*
: Read a single-item archive as served by substitute servers (veja Seção 5.3 [Substitutos], Página 47) and extract it to *directory*. This is a low-level operation needed in only very narrow use cases; see below.

  For example, the following command extracts the substitute for Emacs served by `bordeaux.guix.gnu.org` to `/tmp/emacs`:

  ```
  $ wget -O - \
    https://bordeaux.guix.gnu.org/nar/gzip/...-emacs-24.5 \
    | gunzip | guix archive -x /tmp/emacs
  ```

  Single-item archives are different from multiple-item archives produced by `guix archive --export`; they contain a single store item, and they do *not* embed a signature. Thus this operation does *no* signature verification and its output should be considered unsafe.

  The primary purpose of this operation is to facilitate inspection of archive contents coming from possibly untrusted substitute servers (veja Seção 9.12 [Invocando guix challenge], Página 225).

`--list`
`-t`
: Read a single-item archive as served by substitute servers (veja Seção 5.3 [Substitutos], Página 47) and print the list of files it contains, as in this example:

  ```
  $ wget -O - \
    https://bordeaux.guix.gnu.org/nar/lzip/...-emacs-26.3 \
    | lzip -d | guix archive -t
  ```

6 Canais

Guix and its package collection are updated by running `guix pull`. By default `guix pull` downloads and deploys Guix itself from the official GNU Guix repository. This can be customized by providing a file specifying the set of *channels* to pull from (veja Seção 5.7 [Invocando guix pull], Página 57). A channel specifies the URL and branch of a Git repository to be deployed, and `guix pull` can be instructed to pull from one or more channels. In other words, channels can be used to *customize* and to *extend* Guix, as we will see below. Guix is able to take into account security concerns and deal with authenticated updates.

6.1 Especificando canais adicionais

You can specify *additional channels* to pull from. To use a channel, write `~/.config/guix/channels.scm` to instruct `guix pull` to pull from it *in addition* to the default Guix channel(s):

```
;; Add variant packages to those Guix provides.
(cons (channel
        (name 'variant-packages)
        (url "https://example.org/variant-packages.git"))
      %default-channels)
```

Note that the snippet above is (as always!) Scheme code; we use `cons` to add a channel the list of channels that the variable `%default-channels` is bound to (veja Seção "Pairs" em *GNU Guile Reference Manual*). With this file in place, `guix pull` builds not only Guix but also the package modules from your own repository. The result in `~/.config/guix/current` is the union of Guix with your own package modules:

```
$ guix describe
Generation 19 Aug 27 2018 16:20:48
  guix d894ab8
    repository URL: https://git.savannah.gnu.org/git/guix.git
    branch: master
    commit: d894ab8e9bfabcefa6c49d9ba2e834dd5a73a300
  variant-packages dd3df5e
    repository URL: https://example.org/variant-packages.git
    branch: master
    commit: dd3df5e2c8818760a8fc0bd699e55d3b69fef2bb
```

The output of `guix describe` above shows that we're now running Generation 19 and that it includes both Guix and packages from the `variant-packages` channel (veja Seção 5.10 [Invocando guix describe], Página 65).

6.2 Usando um canal Guix personalizado

The channel called `guix` specifies where Guix itself—its command-line tools as well as its package collection—should be downloaded. For instance, suppose you want to update from another copy of the Guix repository at `example.org`, and specifically the `super-hacks` branch, you can write in `~/.config/guix/channels.scm` this specification:

```
;; Tell 'guix pull' to use another repo.
```

```
(list (channel
        (name 'guix)
        (url "https://example.org/another-guix.git")
        (branch "super-hacks")))
```

From there on, `guix pull` will fetch code from the `super-hacks` branch of the repository at `example.org`. The authentication concern is addressed below (veja Seção 6.5 [Autenticação de canal], Página 72).

Note that you can specify a local directory on the `url` field above if the channel that you intend to use resides on a local file system. However, in this case `guix` checks said directory for ownership before any further processing. This means that if the user is not the directory owner, but wants to use it as their default, they will then need to set it as a safe directory in their global git configuration file. Otherwise, `guix` will refuse to even read it. Supposing your system-wide local directory is at `/src/guix.git`, you would then create a git configuration file at `~/.gitconfig` with the following contents:

```
[safe]
        directory = /src/guix.git
```

This also applies to the root user unless when called with `sudo` by the directory owner.

6.3 Replicando Guix

The `guix describe` command shows precisely which commits were used to build the instance of Guix we're using (veja Seção 5.10 [Invocando guix describe], Página 65). We can replicate this instance on another machine or at a different point in time by providing a channel specification "pinned" to these commits that looks like this:

```
;; Deploy specific commits of my channels of interest.
(list (channel
       (name 'guix)
       (url "https://git.savannah.gnu.org/git/guix.git")
       (commit "6298c3ffd9654d3231a6f25390b056483e8f407c"))
      (channel
       (name 'variant-packages)
       (url "https://example.org/variant-packages.git")
       (commit "dd3df5e2c8818760a8fc0bd699e55d3b69fef2bb")))
```

To obtain this pinned channel specification, the easiest way is to run `guix describe` and to save its output in the `channels` format in a file, like so:

```
guix describe -f channels > channels.scm
```

The resulting `channels.scm` file can be passed to the `-C` option of `guix pull` (veja Seção 5.7 [Invocando guix pull], Página 57) or `guix time-machine` (veja Seção 5.8 [Invocando guix time-machine], Página 61), as in this example:

```
guix time-machine -C channels.scm -- shell python -- python3
```

Given the `channels.scm` file, the command above will always fetch the *exact same Guix instance*, then use that instance to run the exact same Python (veja Seção 7.1 [Invocando guix shell], Página 79). On any machine, at any time, it ends up running the exact same binaries, bit for bit.

Pinned channels address a problem similar to “lock files” as implemented by some deployment tools—they let you pin and reproduce a set of packages. In the case of Guix though, you are effectively pinning the entire package set as defined at the given channel commits; in fact, you are pinning all of Guix, including its core modules and command-line tools. You’re also getting strong guarantees that you are, indeed, obtaining the exact same software.

This gives you super powers, allowing you to track the provenance of binary artifacts with very fine grain, and to reproduce software environments at will—some sort of “meta reproducibility” capabilities, if you will. Veja Seção 5.9 [Inferiores], Página 63, for another way to take advantage of these super powers.

6.4 Customizing the System-Wide Guix

If you’re running Guix System or building system images with it, maybe you will want to customize the system-wide `guix` it provides—specifically, `/run/current-system/profile/bin/guix`. For example, you might want to provide additional channels or to pin its revision.

This can be done using the `guix-for-channels` procedure, which returns a package for the given channels, and using it as part of your operating system configuration, as in this example:

```
(use-modules (gnu packages package-management)
             (guix channels))

(define my-channels
  ;; Channels that should be available to
  ;; /run/current-system/profile/bin/guix.
  (append
   (list (channel
          (name 'guix-science)
          (url "https://github.com/guix-science/guix-science")
          (branch "master")))
   %default-channels))

(operating-system
  ;; ...
  (services
    ;; Change the package used by 'guix-service-type'.
    (modify-services %base-services
      (guix-service-type
       config => (guix-configuration
                  (inherit config)
                  (channels my-channels)
                  (guix (guix-for-channels my-channels)))))))
```

The resulting operating system will have both the `guix` and the `guix-science` channels visible by default. The `channels` field of `guix-configuration` above further ensures that

`/etc/guix/channels.scm`, which is used by `guix pull`, specifies the same set of channels (veja [guix-configuration-channels], Página 278).

The `(gnu packages package-management)` module exports the `guix-for-channels` procedure, described below.

`guix-for-channels` *channels* [Procedure]

Return a package corresponding to *channels*.

The result is a "regular" package, which can be used in `guix-configuration` as shown above or in any other place that expects a package.

6.5 Autenticação de canal

The `guix pull` and `guix time-machine` commands *authenticate* the code retrieved from channels: they make sure each commit that is fetched is signed by an authorized developer. The goal is to protect from unauthorized modifications to the channel that would lead users to run malicious code.

As a user, you must provide a *channel introduction* in your channels file so that Guix knows how to authenticate its first commit. A channel specification, including its introduction, looks something along these lines:

```
(channel
  (name 'some-channel)
  (url "https://example.org/some-channel.git")
  (introduction
   (make-channel-introduction
    "6f0d8cc0d88abb59c324b2990bfee2876016bb86"
    (openpgp-fingerprint
     "CABB A931 C0FF EEC6 900D  0CFB 090B 1199 3D9A EBB5"))))
```

The specification above shows the name and URL of the channel. The call to `make-channel-introduction` above specifies that authentication of this channel starts at commit `6f0d8cc...`, which is signed by the OpenPGP key with fingerprint `CABB A931...`.

For the main channel, called `guix`, you automatically get that information from your Guix installation. For other channels, include the channel introduction provided by the channel authors in your `channels.scm` file. Make sure you retrieve the channel introduction from a trusted source since that is the root of your trust.

If you're curious about the authentication mechanics, read on!

6.6 Canais com substitutos

When running `guix pull`, Guix will first compile the definitions of every available package. This is an expensive operation for which substitutes (veja Seção 5.3 [Substitutos], Página 47) may be available. The following snippet in `channels.scm` will ensure that `guix pull` uses the latest commit with available substitutes for the package definitions: this is done by querying the continuous integration server at `https://ci.guix.gnu.org`.

```
(use-modules (guix ci))

(list (channel-with-substitutes-available
```

```
%default-guix-channel
"https://ci.guix.gnu.org"))
```

Note that this does not mean that all the packages that you will install after running `guix pull` will have available substitutes. It only ensures that `guix pull` will not try to compile package definitions. This is particularly useful when using machines with limited resources.

6.7 Criando um canal

Let's say you have a bunch of custom package variants or personal packages that you think would make little sense to contribute to the Guix project, but would like to have these packages transparently available to you at the command line. By creating a *channel*, you can use and publish such a package collection. This involves the following steps:

1. A channel lives in a Git repository so the first step, when creating a channel, is to create its repository:

   ```
   mkdir my-channel
   cd my-channel
   git init
   ```

2. The next step is to create files containing package modules (veja Seção 8.1 [Módulos de pacote], Página 100), each of which will contain one or more package definitions (veja Seção 8.2 [Definindo pacotes], Página 101). A channel can provide things other than packages, such as build systems or services; we're using packages as it's the most common use case.

   For example, Alice might want to provide a module called `(alice packages greetings)` that will provide her favorite "hello world" implementations. To do that Alice will create a directory corresponding to that module name.

   ```
   mkdir -p alice/packages
   $EDITOR alice/packages/greetings.scm
   git add alice/packages/greetings.scm
   ```

   You can name your package modules however you like; the main constraint to keep in mind is to avoid name clashes with other package collections, which is why our hypothetical Alice wisely chose the `(alice packages ...)` name space.

   Note that you can also place modules in a sub-directory of the repository; veja Seção 6.8 [Módulos de pacote em um subdiretório], Página 74, for more info on that.

3. With this first module in place, the next step is to test the packages it provides. This can be done with `guix build`, which needs to be told to look for modules in the Git checkout. For example, assuming `(alice packages greetings)` provides a package called `hi-from-alice`, Alice will run this command from the Git checkout:

   ```
   guix build -L. hi-from-alice
   ```

   ... where `-L.` adds the current directory to Guile's load path (veja Seção "Load Paths" em *GNU Guile Reference Manual*).

4. It might take Alice a few iterations to obtain satisfying package definitions. Eventually Alice will commit this file:

   ```
   git commit
   ```

As a channel author, consider bundling authentication material with your channel so that users can authenticate it. Veja Seção 6.5 [Autenticação de canal], Página 72, and Seção 6.10 [Especificando autorizações de canal], Página 75, for info on how to do it.

5. To use Alice's channel, anyone can now add it to their channel file (veja Seção 6.1 [Especificando canais adicionais], Página 69) and run `guix pull` (veja Seção 5.7 [Invocando guix pull], Página 57):

   ```
   $EDITOR ~/.config/guix/channels.scm
   guix pull
   ```

   Guix will now behave as if the root directory of that channel's Git repository had been permanently added to the Guile load path. In this example, `(alice packages greetings)` will automatically be found by the `guix` command.

Voilà!

Aviso: Before you publish your channel, we would like to share a few words of caution:

- Before publishing a channel, please consider contributing your package definitions to Guix proper (veja Capítulo 22 [Contribuindo], Página 720). Guix as a project is open to free software of all sorts, and packages in Guix proper are readily available to all Guix users and benefit from the project's quality assurance process.
- Package modules and package definitions are Scheme code that uses various programming interfaces (APIs). We, Guix developers, never change APIs gratuitously, but we do *not* commit to freezing APIs either. When you maintain package definitions outside Guix, we consider that *the compatibility burden is on you*.
- Corollary: if you're using an external channel and that channel breaks, please *report the issue to the channel authors*, not to the Guix project.

You've been warned! Having said this, we believe external channels are a practical way to exert your freedom to augment Guix' package collection and to share your improvements, which are basic tenets of free software (`https://www.gnu.org/philosophy/free-sw.html`). Please email us at `guix-devel@gnu.org` if you'd like to discuss this.

6.8 Módulos de pacote em um subdiretório

As a channel author, you may want to keep your channel modules in a sub-directory. If your modules are in the sub-directory `guix`, you must add a meta-data file `.guix-channel` that contains:

```
(channel
  (version 0)
  (directory "guix"))
```

The modules must be **underneath** the specified directory, as the `directory` changes Guile's `load-path`. For example, if `.guix-channel` has `(directory "base")`, then a module defined as `(define-module (gnu packages fun))` must be located at `base/gnu/packages/fun.scm`.

Doing this allows for only parts of a repository to be used as a channel, as Guix expects valid Guile modules when pulling. For instance, `guix deploy` machine configuration files are not valid Guile modules, and treating them as such would make `guix pull` fail.

6.9 Declarando dependências de canal

Channel authors may decide to augment a package collection provided by other channels. They can declare their channel to be dependent on other channels in a meta-data file `.guix-channel`, which is to be placed in the root of the channel repository.

The meta-data file should contain a simple S-expression like this:

```
(channel
 (version 0)
 (dependencies
  (channel
   (name some-collection)
   (url "https://example.org/first-collection.git")

   ;; The 'introduction' bit below is optional: you would
   ;; provide it for dependencies that can be authenticated.
   (introduction
    (channel-introduction
      (version 0)
      (commit "a8883b58dc82e167c96506cf05095f37c2c2c6cd")
      (signer "CABB A931 C0FF EEC6 900D  0CFB 090B 1199 3D9A EBB5"))))
  (channel
   (name some-other-collection)
   (url "https://example.org/second-collection.git")
   (branch "testing"))))
```

In the above example this channel is declared to depend on two other channels, which will both be fetched automatically. The modules provided by the channel will be compiled in an environment where the modules of all these declared channels are available.

For the sake of reliability and maintainability, you should avoid dependencies on channels that you don't control, and you should aim to keep the number of dependencies to a minimum.

6.10 Especificando autorizações de canal

As we saw above, Guix ensures the source code it pulls from channels comes from authorized developers. As a channel author, you need to specify the list of authorized developers in the `.guix-authorizations` file in the channel's Git repository. The authentication rule is simple: each commit must be signed by a key listed in the `.guix-authorizations` file of its parent commit(s)[1] The `.guix-authorizations` file looks like this:

```
;; Example '.guix-authorizations' file.
```

[1] Git commits form a *directed acyclic graph* (DAG). Each commit can have zero or more parents; "regular" commits have one parent and merge commits have two parent commits. Read *Git for Computer Scientists* (`https://eagain.net/articles/git-for-computer-scientists/`) for a great overview.

```
(authorizations
 (version 0)               ;current file format version

 (("AD17 A21E F8AE D8F1 CC02  DBD9 F8AE D8F1 765C 61E3"
   (name "alice"))
  ("2A39 3FFF 68F4 EF7A 3D29  12AF 68F4 EF7A 22FB B2D5"
   (name "bob"))
  ("CABB A931 C0FF EEC6 900D  0CFB 090B 1199 3D9A EBB5"
   (name "charlie"))))
```

Each fingerprint is followed by optional key/value pairs, as in the example above. Currently these key/value pairs are ignored.

This authentication rule creates a chicken-and-egg issue: how do we authenticate the first commit? Related to that: how do we deal with channels whose repository history contains unsigned commits and lack `.guix-authorizations`? And how do we fork existing channels?

Channel introductions answer these questions by describing the first commit of a channel that should be authenticated. The first time a channel is fetched with `guix pull` or `guix time-machine`, the command looks up the introductory commit and verifies that it is signed by the specified OpenPGP key. From then on, it authenticates commits according to the rule above. Authentication fails if the target commit is neither a descendant nor an ancestor of the introductory commit.

Additionally, your channel must provide all the OpenPGP keys that were ever mentioned in `.guix-authorizations`, stored as `.key` files, which can be either binary or "ASCII-armored". By default, those `.key` files are searched for in the branch named `keyring` but you can specify a different branch name in `.guix-channel` like so:

```
(channel
  (version 0)
  (keyring-reference "my-keyring-branch"))
```

To summarize, as the author of a channel, there are three things you have to do to allow users to authenticate your code:

1. Export the OpenPGP keys of past and present committers with `gpg --export` and store them in `.key` files, by default in a branch named `keyring` (we recommend making it an *orphan branch*).
2. Introduce an initial `.guix-authorizations` in the channel's repository. Do that in a signed commit (veja Seção 22.14 [Confirmar acesso], Página 757, for information on how to sign Git commits.)
3. Advertise the channel introduction, for instance on your channel's web page. The channel introduction, as we saw above, is the commit/key pair—i.e., the commit that introduced `.guix-authorizations`, and the fingerprint of the OpenPGP used to sign it.

Before pushing to your public Git repository, you can run `guix git authenticate` to verify that you did sign all the commits you are about to push with an authorized key:

```
guix git authenticate commit signer
```

where *commit* and *signer* are your channel introduction. Veja Seção 7.5 [Invocando guix git authenticate], Página 98, for details.

Publishing a signed channel requires discipline: any mistake, such as an unsigned commit or a commit signed by an unauthorized key, will prevent users from pulling from your channel—well, that's the whole point of authentication! Pay attention to merges in particular: merge commits are considered authentic if and only if they are signed by a key present in the `.guix-authorizations` file of *both* branches.

6.11 URL principal

Channel authors can indicate the primary URL of their channel's Git repository in the `.guix-channel` file, like so:

```
(channel
  (version 0)
  (url "https://example.org/guix.git"))
```

This allows `guix pull` to determine whether it is pulling code from a mirror of the channel; when that is the case, it warns the user that the mirror might be stale and displays the primary URL. That way, users cannot be tricked into fetching code from a stale mirror that does not receive security updates.

This feature only makes sense for authenticated repositories, such as the official `guix` channel, for which `guix pull` ensures the code it fetches is authentic.

6.12 Escrevendo notícias do canal

Channel authors may occasionally want to communicate to their users information about important changes in the channel. You'd send them all an email, but that's not convenient.

Instead, channels can provide a *news file*; when the channel users run `guix pull`, that news file is automatically read and `guix pull --news` can display the announcements that correspond to the new commits that have been pulled, if any.

To do that, channel authors must first declare the name of the news file in their `.guix-channel` file:

```
(channel
  (version 0)
  (news-file "etc/news.txt"))
```

The news file itself, `etc/news.txt` in this example, must look something like this:

```
(channel-news
  (version 0)
  (entry (tag "the-bug-fix")
         (title (en "Fixed terrible bug")
                (fr "Oh la la"))
         (body (en "@emph{Good news}!  It's fixed!")
               (eo "Certe ĝi pli bone funkcias nun!")))
  (entry (commit "bdcabe815cd28144a2d2b4bc3c5057b051fa9906")
         (title (en "Added a great package")
                (ca "Què vol dir guix?"))
         (body (en "Don't miss the @code{hello} package!"))))
```

While the news file is using the Scheme syntax, avoid naming it with a `.scm` extension or else it will get picked up when building the channel and yield an error since it is not a valid module. Alternatively, you can move the channel module to a subdirectory and store the news file in another directory.

The file consists of a list of *news entries*. Each entry is associated with a commit or tag: it describes changes made in this commit, possibly in preceding commits as well. Users see entries only the first time they obtain the commit the entry refers to.

The `title` field should be a one-line summary while `body` can be arbitrarily long, and both can contain Texinfo markup (veja Seção "Overview" em *GNU Texinfo*). Both the title and body are a list of language tag/message tuples, which allows `guix pull` to display news in the language that corresponds to the user's locale.

If you want to translate news using a gettext-based workflow, you can extract translatable strings with `xgettext` (veja Seção "xgettext Invocation" em *GNU Gettext Utilities*). For example, assuming you write news entries in English first, the command below creates a PO file containing the strings to translate:

```
xgettext -o news.po -l scheme -ken etc/news.txt
```

To sum up, yes, you could use your channel as a blog. But beware, this is *not quite* what your users might expect.

7 Desenvolvimento

If you are a software developer, Guix provides tools that you should find helpful—independently of the language you're developing in. This is what this chapter is about.

The `guix shell` command provides a convenient way to set up one-off software environments, be it for development purposes or to run a command without installing it in your profile. The `guix pack` command allows you to create *application bundles* that can be easily distributed to users who do not run Guix.

7.1 Invoking `guix shell`

The purpose of `guix shell` is to make it easy to create one-off software environments, without changing one's profile. It is typically used to create development environments; it is also a convenient way to run applications without "polluting" your profile.

> **Nota:** The `guix shell` command was recently introduced to supersede `guix environment` (veja Seção 7.2 [Invocando guix environment], Página 86). If you are familiar with `guix environment`, you will notice that it is similar but also—we hope!—more convenient.

A sintaxe geral é:

```
guix shell [options] [package...]
```

Sometimes an interactive shell session is not desired. An arbitrary command may be invoked by placing the `--` token to separate the command from the rest of the arguments.

The following example creates an environment containing Python and NumPy, building or downloading any missing package, and runs the `python3` command in that environment:

```
guix shell python python-numpy -- python3
```

Note that it is necessary to include the main `python` package in this command even if it is already installed into your environment. This is so that the shell environment knows to set `PYTHONPATH` and other related variables. The shell environment cannot check the previously installed environment, because then it would be non-deterministic. This is true for most libraries: their corresponding language package should be included in the shell invocation.

> **Nota:** `guix shell` can be also be used as a script interpreter, also known as *shebang*. Here is an example self-contained Python script making use of this feature:
>
> ```
> #!/usr/bin/env -S guix shell python python-numpy -- python3
> import numpy
> print("This is numpy", numpy.version.version)
> ```
>
> You may pass any `guix shell` option, but there's one caveat: the Linux kernel has a limit of 127 bytes on shebang length.

Development environments can be created as in the example below, which spawns an interactive shell containing all the dependencies and environment variables needed to work on Inkscape:

```
guix shell --development inkscape
```

Exiting the shell places the user back in the original environment before `guix shell` was invoked. The next garbage collection (veja Seção 5.6 [Invocando guix gc], Página 54) may clean up packages that were installed in the environment and that are no longer used outside of it.

As an added convenience, `guix shell` will try to do what you mean when it is invoked interactively without any other arguments as in:

```
guix shell
```

If it finds a `manifest.scm` in the current working directory or any of its parents, it uses this manifest as though it was given via `--manifest`. Likewise, if it finds a `guix.scm` in the same directories, it uses it to build a development profile as though both `--development` and `--file` were present. In either case, the file will only be loaded if the directory it resides in is listed in `~/.config/guix/shell-authorized-directories`. This provides an easy way to define, share, and enter development environments.

By default, the shell session or command runs in an *augmented* environment, where the new packages are added to search path environment variables such as `PATH`. You can, instead, choose to create an *isolated* environment containing nothing but the packages you asked for. Passing the `--pure` option clears environment variable definitions found in the parent environment[1]; passing `--container` goes one step further by spawning a *container* isolated from the rest of the system:

```
guix shell --container emacs gcc-toolchain
```

The command above spawns an interactive shell in a container where nothing but `emacs`, `gcc-toolchain`, and their dependencies is available. The container lacks network access and shares no files other than the current working directory with the surrounding environment. This is useful to prevent access to system-wide resources such as `/usr/bin` on foreign distros.

This `--container` option can also prove useful if you wish to run a security-sensitive application, such as a web browser, in an isolated environment. For example, the command below launches Ungoogled-Chromium in an isolated environment, which:

- shares network access with the host
- inherits host's environment variables `DISPLAY` and `XAUTHORITY`
- has access to host's authentication records from the `XAUTHORITY` file
- has no information about host's current directory

```
guix shell --container --network --no-cwd ungoogled-chromium \
  --preserve='^XAUTHORITY$' --expose="${XAUTHORITY}" \
  --preserve='^DISPLAY$' -- chromium
```

`guix shell` defines the `GUIX_ENVIRONMENT` variable in the shell it spawns; its value is the file name of the profile of this environment. This allows users to, say, define a specific prompt for development environments in their `.bashrc` (veja Seção "Bash Startup Files" em *The GNU Bash Reference Manual*):

```
if [ -n "$GUIX_ENVIRONMENT" ]
then
    export PS1="\u@\h \w [dev]\$ "
```

[1] Be sure to use the `--check` option the first time you use `guix shell` interactively to make sure the shell does not undo the effect of `--pure`.

```
fi
```

... or to browse the profile:

```
$ ls "$GUIX_ENVIRONMENT/bin"
```

The available options are summarized below.

`--check` Set up the environment and check whether the shell would clobber environment variables. It's a good idea to use this option the first time you run `guix shell` for an interactive session to make sure your setup is correct.

For example, if the shell modifies the `PATH` environment variable, report it since you would get a different environment than what you asked for.

Such problems usually indicate that the shell startup files are unexpectedly modifying those environment variables. For example, if you are using Bash, make sure that environment variables are set or modified in `~/.bash_profile` and *not* in `~/.bashrc`—the former is sourced only by log-in shells. Veja Seção "Bash Startup Files" em *The GNU Bash Reference Manual*, for details on Bash start-up files.

`--development`
`-D` Cause `guix shell` to include in the environment the dependencies of the following package rather than the package itself. This can be combined with other packages. For instance, the command below starts an interactive shell containing the build-time dependencies of GNU Guile, plus Autoconf, Automake, and Libtool:

```
guix shell -D guile autoconf automake libtool
```

`--expression=`*expr*
`-e` *expr* Create an environment for the package or list of packages that *expr* evaluates to.

For example, running:

```
guix shell -D -e '(@ (gnu packages maths) petsc-openmpi)'
```

starts a shell with the environment for this specific variant of the PETSc package.

Running:

```
guix shell -e '(@ (gnu) %base-packages)'
```

starts a shell with all the base system packages available.

The above commands only use the default output of the given packages. To select other outputs, two element tuples can be specified:

```
guix shell -e '(list (@ (gnu packages bash) bash) "include")'
```

Veja [package-development-manifest], Página 120, for information on how to write a manifest for the development environment of a package.

`--file=`*file*
`-f` *arquivo*
Create an environment containing the package or list of packages that the code within *file* evaluates to.

Por exemplo, *arquivo* pode conter uma definição como esta (veja Seção 8.2 [Definindo pacotes], Página 101):

```
(use-modules (guix)
             (gnu packages gdb)
             (gnu packages autotools)
             (gnu packages texinfo))

;; Augment the package definition of GDB with the build tools
;; needed when developing GDB (and which are not needed when
;; simply installing it.)
(package
  (inherit gdb)
  (native-inputs (modify-inputs (package-native-inputs gdb)
                   (prepend autoconf-2.69 automake texinfo))))
```

With the file above, you can enter a development environment for GDB by running:

```
guix shell -D -f gdb-devel.scm
```

`--manifest=`*arquivo*
`-m` *arquivo*

Create an environment for the packages contained in the manifest object returned by the Scheme code in *file*. This option can be repeated several times, in which case the manifests are concatenated.

This is similar to the same-named option in `guix package` (veja [profile-manifest], Página 41) and uses the same manifest files.

Veja Seção 8.4 [Escrevendo manifestos], Página 117, for information on how to write a manifest. See `--export-manifest` below on how to obtain a first manifest.

`--export-manifest`

Write to standard output a manifest suitable for `--manifest` corresponding to given command-line options.

This is a way to "convert" command-line arguments into a manifest. For example, imagine you are tired of typing long lines and would like to get a manifest equivalent to this command line:

```
guix shell -D guile git emacs emacs-geiser emacs-geiser-guile
```

Just add `--export-manifest` to the command line above:

```
guix shell --export-manifest \
  -D guile git emacs emacs-geiser emacs-geiser-guile
```

... and you get a manifest along these lines:

```
(concatenate-manifests
  (list (specifications->manifest
          (list "git"
                "emacs"
                "emacs-geiser"
                "emacs-geiser-guile"))
```

```
                (package->development-manifest
                  (specification->package "guile"))))
```

You can store it into a file, say `manifest.scm`, and from there pass it to `guix shell` or indeed pretty much any `guix` command:

```
guix shell -m manifest.scm
```

Voilà, you've converted a long command line into a manifest! That conversion process honors package transformation options (veja Seção 9.1.2 [Opções de transformação de pacote], Página 180) so it should be lossless.

`--profile=`*perfil*
`-p` *perfil* Create an environment containing the packages installed in *profile*. Use `guix package` (veja Seção 5.2 [Invocando guix package], Página 37) to create and manage profiles.

`--pure` Unset existing environment variables when building the new environment, except those specified with `--preserve` (see below). This has the effect of creating an environment in which search paths only contain package inputs.

`--preserve=`*regexp*
`-E` *regexp* When used alongside `--pure`, preserve the environment variables matching *regexp*—in other words, put them on a "white list" of environment variables that must be preserved. This option can be repeated several times.

```
guix shell --pure --preserve=^SLURM openmpi ... \
  -- mpirun ...
```

This example runs `mpirun` in a context where the only environment variables defined are `PATH`, environment variables whose name starts with '`SLURM`', as well as the usual "precious" variables (`HOME`, `USER`, etc.).

`--search-paths`
Display the environment variable definitions that make up the environment.

`--system=`*system*
`-s` *sistema*
Attempt to build for *system*—e.g., `i686-linux`.

`--container`
`-C` Run *command* within an isolated container. The current working directory outside the container is mapped inside the container. Additionally, unless overridden with `--user`, a dummy home directory is created that matches the current user's home directory, and `/etc/passwd` is configured accordingly.

The spawned process runs as the current user outside the container. Inside the container, it has the same UID and GID as the current user, unless `--user` is passed (see below).

`--network`
`-N` For containers, share the network namespace with the host system. Containers created without this flag only have access to the loopback device.

`--link-profile`
`-P` For containers, link the environment profile to `~/.guix-profile` within the container and set `GUIX_ENVIRONMENT` to that. This is equivalent to making

`~/.guix-profile` a symlink to the actual profile within the container. Linking will fail and abort the environment if the directory already exists, which will certainly be the case if `guix shell` was invoked in the user's home directory.

Certain packages are configured to look in `~/.guix-profile` for configuration files and data;[2] `--link-profile` allows these programs to behave as expected within the environment.

`--user=`*user*
`-u` *usuário*

For containers, use the username *user* in place of the current user. The generated `/etc/passwd` entry within the container will contain the name *user*, the home directory will be `/home/`*user*, and no user GECOS data will be copied. Furthermore, the UID and GID inside the container are 1000. *user* need not exist on the system.

Additionally, any shared or exposed path (see `--share` and `--expose` respectively) whose target is within the current user's home directory will be remapped relative to `/home/USER`; this includes the automatic mapping of the current working directory.

```
# will expose paths as /home/foo/wd, /home/foo/test, and /home/foo/target
cd $HOME/wd
guix shell --container --user=foo \
     --expose=$HOME/test \
     --expose=/tmp/target=$HOME/target
```

While this will limit the leaking of user identity through home paths and each of the user fields, this is only one useful component of a broader privacy/anonymity solution—not one in and of itself.

`--no-cwd` For containers, the default behavior is to share the current working directory with the isolated container and immediately change to that directory within the container. If this is undesirable, `--no-cwd` will cause the current working directory to *not* be automatically shared and will change to the user's home directory within the container instead. See also `--user`.

`--expose=`*fonte*`[=`*alvo*`]`
`--share=`*fonte*`[=`*alvo*`]`

For containers, `--expose` (resp. `--share`) exposes the file system *source* from the host system as the read-only (resp. writable) file system *target* within the container. If *target* is not specified, *source* is used as the target mount point in the container.

The example below spawns a Guile REPL in a container in which the user's home directory is accessible read-only via the `/exchange` directory:

```
guix shell --container --expose=$HOME=/exchange guile -- guile
```

`--symlink=`*spec*
`-S` *spec* For containers, create the symbolic links specified by *spec*, as documented in [pack-symlink-option], Página 97.

[2] For example, the `fontconfig` package inspects `~/.guix-profile/share/fonts` for additional fonts.

`--emulate-fhs`
`-F` When used with `--container`, emulate a Filesystem Hierarchy Standard (FHS) (`https://refspecs.linuxfoundation.org/fhs.shtml`) configuration within the container, providing `/bin`, `/lib`, and other directories and files specified by the FHS.

As Guix deviates from the FHS specification, this option sets up the container to more closely mimic that of other GNU/Linux distributions. This is useful for reproducing other development environments, testing, and using programs which expect the FHS specification to be followed. With this option, the container will include a version of glibc that will read `/etc/ld.so.cache` within the container for the shared library cache (contrary to glibc in regular Guix usage) and set up the expected FHS directories: `/bin`, `/etc`, `/lib`, and `/usr` from the container's profile.

`--nesting`
`-W` When used with `--container`, provide Guix *inside* the container and arrange so that it can interact with the build daemon that runs outside the container. This is useful if you want, within your isolated container, to create other containers, as in this sample session:

```
$ guix shell -CW coreutils
[env]$ guix shell -C guile -- guile -c '(display "hello!\n")'
hello!
[env]$ exit
```

The session above starts a container with `coreutils` programs available in `PATH`. From there, we spawn `guix shell` to create a *nested* container that provides nothing but Guile.

Another example is evaluating a `guix.scm` file that is untrusted, as shown here:

```
guix shell -CW -- guix build -f guix.scm
```

The `guix build` command as executed above can only access the current directory.

Under the hood, the `-W` option does several things:

- mapeie o socket do daemon (por padrão, `/var/guix/daemon-socket/socket`) dentro do contêiner;
- map the whole store (by default `/gnu/store`) inside the container such that store items made available by nested `guix` invocations are visible;
- add the currently-used `guix` command to the profile in the container, such that `guix describe` returns the same state inside and outside the container;
- share the cache (by default `~/.cache/guix`) with the host, to speed up operations such as `guix time-machine` and `guix shell`.

`--rebuild-cache`
In most cases, `guix shell` caches the environment so that subsequent uses are instantaneous. Least-recently used cache entries are periodically removed. The cache is also invalidated, when using `--file` or `--manifest`, anytime the corresponding file is modified.

The `--rebuild-cache` forces the cached environment to be refreshed. This is useful when using `--file` or `--manifest` and the `guix.scm` or `manifest.scm` file has external dependencies, or if its behavior depends, say, on environment variables.

`--root=`*arquivo*
`-r` *arquivo*

Make *file* a symlink to the profile for this environment, and register it as a garbage collector root.

This is useful if you want to protect your environment from garbage collection, to make it "persistent".

When this option is omitted, `guix shell` caches profiles so that subsequent uses of the same environment are instantaneous—this is comparable to using `--root` except that `guix shell` takes care of periodically removing the least-recently used garbage collector roots.

In some cases, `guix shell` does not cache profiles—e.g., if transformation options such as `--with-latest` are used. In those cases, the environment is protected from garbage collection only for the duration of the `guix shell` session. This means that next time you recreate the same environment, you could have to rebuild or re-download packages.

Veja Seção 5.6 [Invocando guix gc], Página 54, for more on GC roots.

`guix shell` also supports all of the common build options that `guix build` supports (veja Seção 9.1.1 [Opções de compilação comum], Página 177) as well as package transformation options (veja Seção 9.1.2 [Opções de transformação de pacote], Página 180).

7.2 Invocando `guix environment`

The purpose of `guix environment` is to assist in creating development environments.

Deprecation warning: The `guix environment` command is deprecated in favor of `guix shell`, which performs similar functions but is more convenient to use. Veja Seção 7.1 [Invocando guix shell], Página 79.

Being deprecated, `guix environment` is slated for eventual removal, but the Guix project is committed to keeping it until May 1st, 2023. Please get in touch with us at `guix-devel@gnu.org` if you would like to discuss it.

A sintaxe geral é:

```
guix environment options package...
```

The following example spawns a new shell set up for the development of GNU Guile:

```
guix environment guile
```

If the needed dependencies are not built yet, `guix environment` automatically builds them. The environment of the new shell is an augmented version of the environment that `guix environment` was run in. It contains the necessary search paths for building the given package added to the existing environment variables. To create a "pure" environment, in which the original environment variables have been unset, use the `--pure` option[3].

[3] Users sometimes wrongfully augment environment variables such as `PATH` in their `~/.bashrc` file. As a consequence, when `guix environment` launches it, Bash may read `~/.bashrc`, thereby introducing

Exiting from a Guix environment is the same as exiting from the shell, and will place the user back in the old environment before `guix environment` was invoked. The next garbage collection (veja Seção 5.6 [Invocando guix gc], Página 54) will clean up packages that were installed from within the environment and are no longer used outside of it.

`guix environment` defines the `GUIX_ENVIRONMENT` variable in the shell it spawns; its value is the file name of the profile of this environment. This allows users to, say, define a specific prompt for development environments in their `.bashrc` (veja Seção "Bash Startup Files" em *The GNU Bash Reference Manual*):

```
if [ -n "$GUIX_ENVIRONMENT" ]
then
    export PS1="\u@\h \w [dev]\$ "
fi
```

... or to browse the profile:

```
$ ls "$GUIX_ENVIRONMENT/bin"
```

Additionally, more than one package may be specified, in which case the union of the inputs for the given packages are used. For example, the command below spawns a shell where all of the dependencies of both Guile and Emacs are available:

```
guix environment guile emacs
```

Sometimes an interactive shell session is not desired. An arbitrary command may be invoked by placing the `--` token to separate the command from the rest of the arguments:

```
guix environment guile -- make -j4
```

In other situations, it is more convenient to specify the list of packages needed in the environment. For example, the following command runs `python` from an environment containing Python 3 and NumPy:

```
guix environment --ad-hoc python-numpy python -- python3
```

Furthermore, one might want the dependencies of a package and also some additional packages that are not build-time or runtime dependencies, but are useful when developing nonetheless. Because of this, the `--ad-hoc` flag is positional. Packages appearing before `--ad-hoc` are interpreted as packages whose dependencies will be added to the environment. Packages appearing after are interpreted as packages that will be added to the environment directly. For example, the following command creates a Guix development environment that additionally includes Git and strace:

```
guix environment --pure guix --ad-hoc git strace
```

Sometimes it is desirable to isolate the environment as much as possible, for maximal purity and reproducibility. In particular, when using Guix on a host distro that is not Guix System, it is desirable to prevent access to `/usr/bin` and other system-wide resources from the development environment. For example, the following command spawns a Guile REPL in a "container" where only the store and the current working directory are mounted:

```
guix environment --ad-hoc --container guile -- guile
```

Nota: The `--container` option requires Linux-libre 3.19 or newer.

"impurities" in these environment variables. It is an error to define such environment variables in `.bashrc`; instead, they should be defined in `.bash_profile`, which is sourced only by log-in shells. Veja Seção "Bash Startup Files" em *The GNU Bash Reference Manual*, for details on Bash start-up files.

Another typical use case for containers is to run security-sensitive applications such as a web browser. To run Eolie, we must expose and share some files and directories; we include `nss-certs` and expose `/etc/ssl/certs/` for HTTPS authentication; finally we preserve the `DISPLAY` environment variable since containerized graphical applications won't display without it.

```
guix environment --preserve='^DISPLAY$' --container --network \
  --expose=/etc/machine-id \
  --expose=/etc/ssl/certs/ \
  --share=$HOME/.local/share/eolie/=$HOME/.local/share/eolie/ \
  --ad-hoc eolie nss-certs dbus --  eolie
```

The available options are summarized below.

`--check` Set up the environment and check whether the shell would clobber environment variables. Veja Seção 7.1 [Invocando guix shell], Página 79, for more info.

`--root=`*arquivo*
`-r` *arquivo*

Make *file* a symlink to the profile for this environment, and register it as a garbage collector root.

This is useful if you want to protect your environment from garbage collection, to make it "persistent".

When this option is omitted, the environment is protected from garbage collection only for the duration of the `guix environment` session. This means that next time you recreate the same environment, you could have to rebuild or redownload packages. Veja Seção 5.6 [Invocando guix gc], Página 54, for more on GC roots.

`--expression=`*expr*
`-e` *expr* Create an environment for the package or list of packages that *expr* evaluates to.

For example, running:

```
guix environment -e '(@ (gnu packages maths) petsc-openmpi)'
```

starts a shell with the environment for this specific variant of the PETSc package.

Running:

```
guix environment --ad-hoc -e '(@ (gnu) %base-packages)'
```

starts a shell with all the base system packages available.

The above commands only use the default output of the given packages. To select other outputs, two element tuples can be specified:

```
guix environment --ad-hoc -e '(list (@ (gnu packages bash) bash) "include")'
```

`--load=`*arquivo*
`-l` *arquivo*

Create an environment for the package or list of packages that the code within *file* evaluates to.

Por exemplo, *arquivo* pode conter uma definição como esta (veja Seção 8.2 [Definindo pacotes], Página 101):

```
(use-modules (guix)
             (gnu packages gdb)
             (gnu packages autotools)
             (gnu packages texinfo))

;; Augment the package definition of GDB with the build tools
;; needed when developing GDB (and which are not needed when
;; simply installing it.)
(package
  (inherit gdb)
  (native-inputs (modify-inputs (package-native-inputs gdb)
                   (prepend autoconf-2.69 automake texinfo))))
```

`--manifest=`*arquivo*
`-m` *arquivo*

Create an environment for the packages contained in the manifest object returned by the Scheme code in *file*. This option can be repeated several times, in which case the manifests are concatenated.

This is similar to the same-named option in `guix package` (veja [profile-manifest], Página 41) and uses the same manifest files.

Veja [shell-export-manifest], Página 82, for information on how to "convert" command-line options into a manifest.

`--ad-hoc` Include all specified packages in the resulting environment, as if an *ad hoc* package were defined with them as inputs. This option is useful for quickly creating an environment without having to write a package expression to contain the desired inputs.

For instance, the command:

```
guix environment --ad-hoc guile guile-sdl -- guile
```

runs `guile` in an environment where Guile and Guile-SDL are available.

Note that this example implicitly asks for the default output of `guile` and `guile-sdl`, but it is possible to ask for a specific output—e.g., `glib:bin` asks for the `bin` output of `glib` (veja Seção 5.4 [Pacotes com múltiplas saídas], Página 52).

This option may be composed with the default behavior of `guix environment`. Packages appearing before `--ad-hoc` are interpreted as packages whose dependencies will be added to the environment, the default behavior. Packages appearing after are interpreted as packages that will be added to the environment directly.

`--profile=`*perfil*
`-p` *perfil* Create an environment containing the packages installed in *profile*. Use `guix package` (veja Seção 5.2 [Invocando guix package], Página 37) to create and manage profiles.

`--pure` Unset existing environment variables when building the new environment, except those specified with `--preserve` (see below). This has the effect of creating an environment in which search paths only contain package inputs.

`--preserve=`*regexp*
`-E` *regexp* When used alongside `--pure`, preserve the environment variables matching *regexp*—in other words, put them on a "white list" of environment variables that must be preserved. This option can be repeated several times.

```
guix environment --pure --preserve=^SLURM --ad-hoc openmpi ... \
  -- mpirun ...
```

This example runs `mpirun` in a context where the only environment variables defined are `PATH`, environment variables whose name starts with '`SLURM`', as well as the usual "precious" variables (`HOME`, `USER`, etc.).

`--search-paths`
Display the environment variable definitions that make up the environment.

`--system=`*system*
`-s` *sistema*
Attempt to build for *system*—e.g., `i686-linux`.

`--container`
`-C` Run *command* within an isolated container. The current working directory outside the container is mapped inside the container. Additionally, unless overridden with `--user`, a dummy home directory is created that matches the current user's home directory, and `/etc/passwd` is configured accordingly.

The spawned process runs as the current user outside the container. Inside the container, it has the same UID and GID as the current user, unless `--user` is passed (see below).

`--network`
`-N` For containers, share the network namespace with the host system. Containers created without this flag only have access to the loopback device.

`--link-profile`
`-P` For containers, link the environment profile to `~/.guix-profile` within the container and set `GUIX_ENVIRONMENT` to that. This is equivalent to making `~/.guix-profile` a symlink to the actual profile within the container. Linking will fail and abort the environment if the directory already exists, which will certainly be the case if `guix environment` was invoked in the user's home directory.

Certain packages are configured to look in `~/.guix-profile` for configuration files and data;[4] `--link-profile` allows these programs to behave as expected within the environment.

`--user=`*user*
`-u` *usuário*
For containers, use the username *user* in place of the current user. The generated `/etc/passwd` entry within the container will contain the name *user*, the

[4] For example, the `fontconfig` package inspects `~/.guix-profile/share/fonts` for additional fonts.

home directory will be `/home/user`, and no user GECOS data will be copied. Furthermore, the UID and GID inside the container are 1000. *user* need not exist on the system.

Additionally, any shared or exposed path (see `--share` and `--expose` respectively) whose target is within the current user's home directory will be remapped relative to `/home/USER`; this includes the automatic mapping of the current working directory.

```
# will expose paths as /home/foo/wd, /home/foo/test, and /home/foo/target
cd $HOME/wd
guix environment --container --user=foo \
     --expose=$HOME/test \
     --expose=/tmp/target=$HOME/target
```

While this will limit the leaking of user identity through home paths and each of the user fields, this is only one useful component of a broader privacy/anonymity solution—not one in and of itself.

`--no-cwd` For containers, the default behavior is to share the current working directory with the isolated container and immediately change to that directory within the container. If this is undesirable, `--no-cwd` will cause the current working directory to *not* be automatically shared and will change to the user's home directory within the container instead. See also `--user`.

`--expose=`*fonte*`[=`*alvo*`]`
`--share=`*fonte*`[=`*alvo*`]`
For containers, `--expose` (resp. `--share`) exposes the file system *source* from the host system as the read-only (resp. writable) file system *target* within the container. If *target* is not specified, *source* is used as the target mount point in the container.

The example below spawns a Guile REPL in a container in which the user's home directory is accessible read-only via the `/exchange` directory:

```
guix environment --container --expose=$HOME=/exchange --ad-hoc guile -- guil
```

`--emulate-fhs`
`-F` For containers, emulate a Filesystem Hierarchy Standard (FHS) configuration within the container, see the official specification (`https://refspecs.linuxfoundation.org/fhs.shtml`). As Guix deviates from the FHS specification, this option sets up the container to more closely mimic that of other GNU/Linux distributions. This is useful for reproducing other development environments, testing, and using programs which expect the FHS specification to be followed. With this option, the container will include a version of `glibc` which will read `/etc/ld.so.cache` within the container for the shared library cache (contrary to `glibc` in regular Guix usage) and set up the expected FHS directories: `/bin`, `/etc`, `/lib`, and `/usr` from the container's profile.

`guix environment` also supports all of the common build options that `guix build` supports (veja Seção 9.1.1 [Opções de compilação comum], Página 177) as well as package transformation options (veja Seção 9.1.2 [Opções de transformação de pacote], Página 180).

7.3 Invocando `guix pack`

Occasionally you want to pass software to people who are not (yet!) lucky enough to be using Guix. You'd tell them to run `guix package -i *something*`, but that's not possible in this case. This is where `guix pack` comes in.

> **Nota:** If you are looking for ways to exchange binaries among machines that already run Guix, veja Seção 9.13 [Invocando guix copy], Página 227, Seção 9.11 [Invocando guix publish], Página 221, and Seção 5.11 [Invocando guix archive], Página 66.

The `guix pack` command creates a shrink-wrapped *pack* or *software bundle*: it creates a tarball or some other archive containing the binaries of the software you're interested in, and all its dependencies. The resulting archive can be used on any machine that does not have Guix, and people can run the exact same binaries as those you have with Guix. The pack itself is created in a bit-reproducible fashion, so anyone can verify that it really contains the build results that you pretend to be shipping.

For example, to create a bundle containing Guile, Emacs, Geiser, and all their dependencies, you can run:

```
$ guix pack guile emacs emacs-geiser
...
/gnu/store/...-pack.tar.gz
```

The result here is a tarball containing a `/gnu/store` directory with all the relevant packages. The resulting tarball contains a *profile* with the three packages of interest; the profile is the same as would be created by `guix package -i`. It is this mechanism that is used to create Guix's own standalone binary tarball (veja Seção 2.1 [Instalação de binários], Página 4).

Users of this pack would have to run `/gnu/store/...-profile/bin/guile` to run Guile, which you may find inconvenient. To work around it, you can create, say, a `/opt/gnu/bin` symlink to the profile:

```
guix pack -S /opt/gnu/bin=bin guile emacs emacs-geiser
```

That way, users can happily type `/opt/gnu/bin/guile` and enjoy.

What if the recipient of your pack does not have root privileges on their machine, and thus cannot unpack it in the root file system? In that case, you will want to use the `--relocatable` option (see below). This option produces *relocatable binaries*, meaning they can be placed anywhere in the file system hierarchy: in the example above, users can unpack your tarball in their home directory and directly run `./opt/gnu/bin/guile`.

Alternatively, you can produce a pack in the Docker image format using the following command:

```
guix pack -f docker -S /bin=bin guile guile-readline
```

The result is a tarball that can be passed to the `docker load` command, followed by `docker run`:

```
docker load < file
docker run -ti guile-guile-readline /bin/guile
```

where *file* is the image returned by `guix pack`, and `guile-guile-readline` is its "image tag". See the Docker documentation (`https://docs.docker.com/engine/reference/commandline/load/`) for more information.

Yet another option is to produce a SquashFS image with the following command:

```
guix pack -f squashfs bash guile emacs emacs-geiser
```

The result is a SquashFS file system image that can either be mounted or directly be used as a file system container image with the Singularity container execution environment (`https://www.sylabs.io/docs/`), using commands like `singularity shell` or `singularity exec`.

Several command-line options allow you to customize your pack:

`--format=`*format*

`-f` *format* Produce a pack in the given *format*.

The available formats are:

`tarball` This is the default format. It produces a tarball containing all the specified binaries and symlinks.

`docker` This produces a tarball that follows the Docker Image Specification (`https://github.com/docker/docker/blob/master/image/spec/v1.2.md`). By default, the "repository name" as it appears in the output of the `docker images` command is computed from package names passed on the command line or in the manifest file. Alternatively, the "repository name" can also be configured via the `--image-tag` option. Refer to `--help-docker-format` for more information on such advanced options.

`squashfs` This produces a SquashFS image containing all the specified binaries and symlinks, as well as empty mount points for virtual file systems like procfs.

> **Nota:** Singularity *requires* you to provide `/bin/sh` in the image. For that reason, `guix pack -f squashfs` always implies `-S /bin=bin`. Thus, your `guix pack` invocation must always start with something like:
>
> ```
> guix pack -f squashfs bash ...
> ```
>
> If you forget the `bash` (or similar) package, `singularity run` and `singularity exec` will fail with an unhelpful "no such file or directory" message.

`deb` This produces a Debian archive (a package with the '`.deb`' file extension) containing all the specified binaries and symbolic links, that can be installed on top of any dpkg-based GNU(/Linux) distribution. Advanced options can be revealed via the `--help-deb-format` option. They allow embedding control files for more fine-grained control, such as activating specific triggers or providing a maintainer configure script to run arbitrary setup code upon installation.

```
guix pack -f deb -C xz -S /usr/bin/hello=bin/hello hello
```

> **Nota:** Because archives produced with `guix pack` contain a collection of store items and because each `dpkg` package must not have conflicting files, in practice that

means you likely won't be able to install more than one such archive on a given system. You can nonetheless pack as many Guix packages as you want in one such archive.

Aviso: `dpkg` will assume ownership of any files contained in the pack that it does *not* know about. It is unwise to install Guix-produced '`.deb`' files on a system where `/gnu/store` is shared by other software, such as a Guix installation or other, non-deb packs.

`rpm` This produces an RPM archive (a package with the '`.rpm`' file extension) containing all the specified binaries and symbolic links, that can be installed on top of any RPM-based GNU/Linux distribution. The RPM format embeds checksums for every file it contains, which the `rpm` command uses to validate the integrity of the archive.

Advanced RPM-related options are revealed via the `--help-rpm-format` option. These options allow embedding maintainer scripts that can run before or after the installation of the RPM archive, for example.

The RPM format supports relocatable packages via the `--prefix` option of the `rpm` command, which can be handy to install an RPM package to a specific prefix.

```
guix pack -f rpm -R -C xz -S /usr/bin/hello=bin/hello hello
sudo rpm --install --prefix=/opt /gnu/store/...-hello.rpm
```

Nota: Contrary to Debian packages, conflicting but *identical* files in RPM packages can be installed simultaneously, which means multiple `guix pack`-produced RPM packages can usually be installed side by side without any problem.

Aviso: `rpm` assumes ownership of any files contained in the pack, which means it will remove `/gnu/store` upon uninstalling a Guix-generated RPM package, unless the RPM package was installed with the `--prefix` option of the `rpm` command. It is unwise to install Guix-produced '`.rpm`' packages on a system where `/gnu/store` is shared by other software, such as a Guix installation or other, non-rpm packs.

`--relocatable`
`-R` Produce *relocatable binaries*—i.e., binaries that can be placed anywhere in the file system hierarchy and run from there.

When this option is passed once, the resulting binaries require support for *user namespaces* in the kernel Linux; when passed *twice*[5], relocatable binaries fall

[5] Here's a trick to memorize it: `-RR`, which adds PRoot support, can be thought of as the abbreviation of "Really Relocatable". Neat, isn't it?

to back to other techniques if user namespaces are unavailable, and essentially work anywhere—see below for the implications.

For example, if you create a pack containing Bash with:

```
guix pack -RR -S /mybin=bin bash
```

... you can copy that pack to a machine that lacks Guix, and from your home directory as a normal user, run:

```
tar xf pack.tar.gz
./mybin/sh
```

In that shell, if you type `ls /gnu/store`, you'll notice that `/gnu/store` shows up and contains all the dependencies of `bash`, even though the machine actually lacks `/gnu/store` altogether! That is probably the simplest way to deploy Guix-built software on a non-Guix machine.

> **Nota:** By default, relocatable binaries rely on the *user namespace* feature of the kernel Linux, which allows unprivileged users to mount or change root. Old versions of Linux did not support it, and some GNU/Linux distributions turn it off.
>
> To produce relocatable binaries that work even in the absence of user namespaces, pass `--relocatable` or `-R` *twice*. In that case, binaries will try user namespace support and fall back to another *execution engine* if user namespaces are not supported. The following execution engines are supported:
>
> `default` Try user namespaces and fall back to PRoot if user namespaces are not supported (see below).
>
> `performance` Try user namespaces and fall back to Fakechroot if user namespaces are not supported (see below).
>
> `userns` Run the program through user namespaces and abort if they are not supported.
>
> `proot` Run through PRoot. The PRoot (`https://proot-me.github.io/`) program provides the necessary support for file system virtualization. It achieves that by using the `ptrace` system call on the running program. This approach has the advantage to work without requiring special kernel support, but it incurs run-time overhead every time a system call is made.
>
> `fakechroot` Run through Fakechroot. Fakechroot (`https://github.com/dex4er/fakechroot/`) virtualizes file system accesses by intercepting calls to C library functions such as `open`, `stat`, `exec`, and so on. Unlike PRoot, it incurs very little overhead. However, it does not always work: for example, some file system accesses made from within the C library are not intercepted, and file system

accesses made *via* direct syscalls are not intercepted either, leading to erratic behavior.

When running a wrapped program, you can explicitly request one of the execution engines listed above by setting the `GUIX_EXECUTION_ENGINE` environment variable accordingly.

`--entry-point=`*command*

Use *command* as the *entry point* of the resulting pack, if the pack format supports it—currently `docker` and `squashfs` (Singularity) support it. *command* must be relative to the profile contained in the pack.

The entry point specifies the command that tools like `docker run` or `singularity run` automatically start by default. For example, you can do:

```
guix pack -f docker --entry-point=bin/guile guile
```

The resulting pack can easily be loaded and `docker run` with no extra arguments will spawn `bin/guile`:

```
docker load -i pack.tar.gz
docker run image-id
```

`--entry-point-argument=`*command*

`-A` *command*

Use *command* as an argument to *entry point* of the resulting pack. This option is only valid in conjunction with `--entry-point` and can appear multiple times on the command line.

```
guix pack -f docker --entry-point=bin/guile --entry-point-argument="--help"
```

`--max-layers=n`

Specifies the maximum number of Docker image layers allowed when building an image.

```
guix pack -f docker --max-layers=100 guile
```

This option allows you to limit the number of layers in a Docker image. Docker images are comprised of multiple layers, and each layer adds to the overall size and complexity of the image. By setting a maximum number of layers, you can control the following effects:

- Disk Usage: Increasing the number of layers can help optimize the disk space required to store multiple images built with a similar package graph.
- Pulling: When transferring images between different nodes or systems, having more layers can reduce the time required to pull the image.

`--expression=`*expr*

`-e` *expr* Consider the package *expr* evaluates to.

This has the same purpose as the same-named option in `guix build` (veja Seção 9.1.3 [Opções de compilação adicional], Página 185).

`--manifest=`*arquivo*

`-m` *arquivo*

Use the packages contained in the manifest object returned by the Scheme code in *file*. This option can be repeated several times, in which case the manifests are concatenated.

This has a similar purpose as the same-named option in `guix package` (veja [profile-manifest], Página 41) and uses the same manifest files. It allows you to define a collection of packages once and use it both for creating profiles and for creating archives for use on machines that do not have Guix installed. Note that you can specify *either* a manifest file *or* a list of packages, but not both.

Veja Seção 8.4 [Escrevendo manifestos], Página 117, for information on how to write a manifest. Veja [shell-export-manifest], Página 82, for information on how to "convert" command-line options into a manifest.

`--system=`*system*
`-s` *sistema*
: Attempt to build for *system*—e.g., `i686-linux`—instead of the system type of the build host.

`--target=`*triplet*
: Cross-build for *triplet*, which must be a valid GNU triplet, such as `"aarch64-linux-gnu"` (veja Seção "Specifying target triplets" em *Autoconf*).

`--compression=`*tool*
`-C` *tool*
: Compress the resulting tarball using *tool*—one of `gzip`, `zstd`, `bzip2`, `xz`, `lzip`, or `none` for no compression.

`--symlink=`*spec*
`-S` *spec*
: Add the symlinks specified by *spec* to the pack. This option can appear several times.

  spec has the form *source*`=`*target*, where *source* is the symlink that will be created and *target* is the symlink target.

  For instance, `-S /opt/gnu/bin=bin` creates a `/opt/gnu/bin` symlink pointing to the `bin` sub-directory of the profile.

`--save-provenance`
: Save provenance information for the packages passed on the command line. Provenance information includes the URL and commit of the channels in use (veja Capítulo 6 [Canais], Página 69).

  Provenance information is saved in the `/gnu/store/...-profile/manifest` file in the pack, along with the usual package metadata—the name and version of each package, their propagated inputs, and so on. It is useful information to the recipient of the pack, who then knows how the pack was (supposedly) obtained.

  This option is not enabled by default because, like timestamps, provenance information contributes nothing to the build process. In other words, there is an infinity of channel URLs and commit IDs that can lead to the same pack. Recording such "silent" metadata in the output thus potentially breaks the source-to-binary bitwise reproducibility property.

`--root=`*arquivo*
`-r` *arquivo*
: Make *file* a symlink to the resulting pack, and register it as a garbage collector root.

`--localstatedir`
`--profile-name=`*name*
: Include the "local state directory", `/var/guix`, in the resulting pack, and notably the `/var/guix/profiles/per-user/root/`*name* profile—by default *name* is `guix-profile`, which corresponds to `~root/.guix-profile`.

  `/var/guix` contains the store database (veja Seção 8.9 [O armazém], Página 154) as well as garbage-collector roots (veja Seção 5.6 [Invocando guix gc], Página 54). Providing it in the pack means that the store is "complete" and manageable by Guix; not providing it pack means that the store is "dead": items cannot be added to it or removed from it after extraction of the pack.

  One use case for this is the Guix self-contained binary tarball (veja Seção 2.1 [Instalação de binários], Página 4).

`--derivation`
`-d`
: Print the name of the derivation that builds the pack.

`--bootstrap`
: Use the bootstrap binaries to build the pack. This option is only useful to Guix developers.

In addition, `guix pack` supports all the common build options (veja Seção 9.1.1 [Opções de compilação comum], Página 177) and all the package transformation options (veja Seção 9.1.2 [Opções de transformação de pacote], Página 180).

7.4 A cadeia de ferramentas do GCC

If you need a complete toolchain for compiling and linking C or C++ source code, use the `gcc-toolchain` package. This package provides a complete GCC toolchain for C/C++ development, including GCC itself, the GNU C Library (headers and binaries, plus debugging symbols in the `debug` output), Binutils, and a linker wrapper.

The wrapper's purpose is to inspect the `-L` and `-l` switches passed to the linker, add corresponding `-rpath` arguments, and invoke the actual linker with this new set of arguments. You can instruct the wrapper to refuse to link against libraries not in the store by setting the `GUIX_LD_WRAPPER_ALLOW_IMPURITIES` environment variable to `no`.

The package `gfortran-toolchain` provides a complete GCC toolchain for Fortran development. For other languages, please use '`guix search gcc toolchain`' (veja [Invoking guix package], Página 43).

7.5 Invoking `guix git authenticate`

The `guix git authenticate` command authenticates a Git checkout following the same rule as for channels (veja [channel-authentication], Página 72). That is, starting from a given commit, it ensures that all subsequent commits are signed by an OpenPGP key whose fingerprint appears in the `.guix-authorizations` file of its parent commit(s).

You will find this command useful if you maintain a channel. But in fact, this authentication mechanism is useful in a broader context, so you might want to use it for Git repositories that have nothing to do with Guix.

A sintaxe geral é:

```
guix git authenticate commit signer [options...]
```

By default, this command authenticates the Git checkout in the current directory; it outputs nothing and exits with exit code zero on success and non-zero on failure. *commit* above denotes the first commit where authentication takes place, and *signer* is the OpenPGP fingerprint of public key used to sign *commit*. Together, they form a *channel introduction* (veja [channel-authentication], Página 72). On your first successful run, the introduction is recorded in the `.git/config` file of your checkout, allowing you to omit them from subsequent invocations:

```
guix git authenticate [options...]
```

Should you have branches that require different introductions, you can specify them directly in `.git/config`. For example, if the branch called `personal-fork` has a different introduction than other branches, you can extend `.git/config` along these lines:

```
[guix "authentication-personal-fork"]
introduction-commit = cabba936fd807b096b48283debdcddccfea3900d
introduction-signer = C0FF EECA BBA9 E6A8 0D1D  E643 A2A0 6DF2 A33A 54FA
keyring = keyring
```

The first run also attempts to install pre-push and post-merge hooks, such that `guix git authenticate` is invoked as soon as you run `git push`, `git pull`, and related commands; it does not overwrite preexisting hooks though.

The command-line options described below allow you to fine-tune the process.

`--repository=`*directory*
`-r` *directory*
: Open the Git repository in *directory* instead of the current directory.

`--keyring=`*reference*
`-k` *reference*
: Load OpenPGP keyring from *reference*, the reference of a branch such as `origin/keyring` or `my-keyring`. The branch must contain OpenPGP public keys in `.key` files, either in binary form or "ASCII-armored". By default the keyring is loaded from the branch named `keyring`.

`--end=`*commit*
: Authenticate revisions up to *commit*.

`--stats`
: Display commit signing statistics upon completion.

`--cache-key=`*key*
: Previously-authenticated commits are cached in a file under `~/.cache/guix/authentication`. This option forces the cache to be stored in file *key* in that directory.

`--historical-authorizations=`*file*
: By default, any commit whose parent commit(s) lack the `.guix-authorizations` file is considered inauthentic. In contrast, this option considers the authorizations in *file* for any commit that lacks `.guix-authorizations`. The format of *file* is the same as that of `.guix-authorizations` (veja [channel-authorizations], Página 75).

8 Interface de programação

GNU Guix provides several Scheme programming interfaces (APIs) to define, build, and query packages. The first interface allows users to write high-level package definitions. These definitions refer to familiar packaging concepts, such as the name and version of a package, its build system, and its dependencies. These definitions can then be turned into concrete build actions.

Build actions are performed by the Guix daemon, on behalf of users. In a standard setup, the daemon has write access to the store—the `/gnu/store` directory—whereas users do not. The recommended setup also has the daemon perform builds in chroots, under specific build users, to minimize interference with the rest of the system.

Lower-level APIs are available to interact with the daemon and the store. To instruct the daemon to perform a build action, users actually provide it with a *derivation*. A derivation is a low-level representation of the build actions to be taken, and the environment in which they should occur—derivations are to package definitions what assembly is to C programs. The term "derivation" comes from the fact that build results *derive* from them.

This chapter describes all these APIs in turn, starting from high-level package definitions. Veja Seção 22.7 [Estrutura da árvore de origem], Página 730, for a more general overview of the source code.

8.1 Módulos de pacote

From a programming viewpoint, the package definitions of the GNU distribution are provided by Guile modules in the `(gnu packages ...)` name space[1] (veja Seção "Modules" em *GNU Guile Reference Manual*). For instance, the `(gnu packages emacs)` module exports a variable named `emacs`, which is bound to a `<package>` object (veja Seção 8.2 [Definindo pacotes], Página 101).

The `(gnu packages ...)` module name space is automatically scanned for packages by the command-line tools. For instance, when running `guix install emacs`, all the `(gnu packages ...)` modules are scanned until one that exports a package object whose name is `emacs` is found. This package search facility is implemented in the `(gnu packages)` module.

Users can store package definitions in modules with different names—e.g., `(my-packages emacs)`[2]. There are two ways to make these package definitions visible to the user interfaces:

1. By adding the directory containing your package modules to the search path with the `-L` flag of `guix package` and other commands (veja Seção 9.1.1 [Opções de compilação comum], Página 177), or by setting the `GUIX_PACKAGE_PATH` environment variable described below.

[1] Note that packages under the `(gnu packages ...)` module name space are not necessarily "GNU packages". This module naming scheme follows the usual Guile module naming convention: `gnu` means that these modules are distributed as part of the GNU system, and `packages` identifies modules that define packages.

[2] Note that the file name and module name must match. For instance, the `(my-packages emacs)` module must be stored in a `my-packages/emacs.scm` file relative to the load path specified with `--load-path` or `GUIX_PACKAGE_PATH`. Veja Seção "Modules and the File System" em *GNU Guile Reference Manual*, for details.

2. By defining a *channel* and configuring `guix pull` so that it pulls from it. A channel is essentially a Git repository containing package modules. Veja Capítulo 6 [Canais], Página 69, for more information on how to define and use channels.

`GUIX_PACKAGE_PATH` works similarly to other search path variables:

`GUIX_PACKAGE_PATH` [Environment Variable]
: This is a colon-separated list of directories to search for additional package modules. Directories listed in this variable take precedence over the own modules of the distribution.

The distribution is fully *bootstrapped* and *self-contained*: each package is built based solely on other packages in the distribution. The root of this dependency graph is a small set of *bootstrap binaries*, provided by the `(gnu packages bootstrap)` module. For more information on bootstrapping, veja Capítulo 20 [Inicializando], Página 712.

8.2 Definindo pacotes

The high-level interface to package definitions is implemented in the `(guix packages)` and `(guix build-system)` modules. As an example, the package definition, or *recipe*, for the GNU Hello package looks like this:

```
(define-module (gnu packages hello)
  #:use-module (guix packages)
  #:use-module (guix download)
  #:use-module (guix build-system gnu)
  #:use-module (guix licenses)
  #:use-module (gnu packages gawk))

(define-public hello
  (package
    (name "hello")
    (version "2.10")
    (source (origin
              (method url-fetch)
              (uri (string-append "mirror://gnu/hello/hello-" version
                                  ".tar.gz"))
              (sha256
               (base32
                "0ssi1wpaf7plaswqqjwigppsg5fyh99vdlb9kzl7c9lng89ndq1i"))))
    (build-system gnu-build-system)
    (arguments '(#:configure-flags '("--enable-silent-rules")))
    (inputs (list gawk))
    (synopsis "Hello, GNU world: An example GNU package")
    (description "Guess what GNU Hello prints!")
    (home-page "https://www.gnu.org/software/hello/")
    (license gpl3+)))
```

Without being a Scheme expert, the reader may have guessed the meaning of the various fields here. This expression binds the variable `hello` to a `<package>` object, which is essenti-

ally a record (veja Seção "SRFI-9" em *GNU Guile Reference Manual*). This package object can be inspected using procedures found in the `(guix packages)` module; for instance, `(package-name hello)` returns—surprise!—`"hello"`.

With luck, you may be able to import part or all of the definition of the package you are interested in from another repository, using the `guix import` command (veja Seção 9.5 [Invocando guix import], Página 194).

In the example above, `hello` is defined in a module of its own, `(gnu packages hello)`. Technically, this is not strictly necessary, but it is convenient to do so: all the packages defined in modules under `(gnu packages ...)` are automatically known to the command-line tools (veja Seção 8.1 [Módulos de pacote], Página 100).

There are a few points worth noting in the above package definition:

- The `source` field of the package is an `<origin>` object (veja Seção 8.2.2 [Referência do origin], Página 108, for the complete reference). Here, the `url-fetch` method from `(guix download)` is used, meaning that the source is a file to be downloaded over FTP or HTTP.

  The `mirror://gnu` prefix instructs `url-fetch` to use one of the GNU mirrors defined in `(guix download)`.

  The `sha256` field specifies the expected SHA256 hash of the file being downloaded. It is mandatory, and allows Guix to check the integrity of the file. The `(base32 ...)` form introduces the base32 representation of the hash. You can obtain this information with `guix download` (veja Seção 9.3 [Invocando guix download], Página 191) and `guix hash` (veja Seção 9.4 [Invocando guix hash], Página 192).

  When needed, the `origin` form can also have a `patches` field listing patches to be applied, and a `snippet` field giving a Scheme expression to modify the source code.

- The `build-system` field specifies the procedure to build the package (veja Seção 8.5 [Sistemas de compilação], Página 121). Here, `gnu-build-system` represents the familiar GNU Build System, where packages may be configured, built, and installed with the usual `./configure && make && make check && make install` command sequence.

  When you start packaging non-trivial software, you may need tools to manipulate those build phases, manipulate files, and so on. Veja Seção 8.7 [Construir utilitários], Página 144, for more on this.

- The `arguments` field specifies options for the build system (veja Seção 8.5 [Sistemas de compilação], Página 121). Here it is interpreted by `gnu-build-system` as a request run `configure` with the `--enable-silent-rules` flag.

  What about these quote (`'`) characters? They are Scheme syntax to introduce a literal list; `'` is synonymous with `quote`. Sometimes you'll also see `` ` `` (a backquote, synonymous with `quasiquote`) and `,` (a comma, synonymous with `unquote`). Veja Seção "Expression Syntax" em *GNU Guile Reference Manual*, for details. Here the value of the `arguments` field is a list of arguments passed to the build system down the road, as with `apply` (veja Seção "Fly Evaluation" em *GNU Guile Reference Manual*).

  The hash-colon (`#:`) sequence defines a Scheme *keyword* (veja Seção "Keywords" em *GNU Guile Reference Manual*), and `#:configure-flags` is a keyword used to pass a keyword argument to the build system (veja Seção "Coding With Keywords" em *GNU Guile Reference Manual*).

- The `inputs` field specifies inputs to the build process—i.e., build-time or run-time dependencies of the package. Here, we add an input, a reference to the `gawk` variable; `gawk` is itself bound to a `<package>` object.

  Note that GCC, Coreutils, Bash, and other essential tools do not need to be specified as inputs here. Instead, `gnu-build-system` takes care of ensuring that they are present (veja Seção 8.5 [Sistemas de compilação], Página 121).

  However, any other dependencies need to be specified in the `inputs` field. Any dependency not specified here will simply be unavailable to the build process, possibly leading to a build failure.

Veja Seção 8.2.1 [Referência do package], Página 104, for a full description of possible fields.

> **Indo além:** Intimidated by the Scheme language or curious about it? The Cookbook has a short section to get started that recaps some of the things shown above and explains the fundamentals. Veja Seção "A Scheme Crash Course" em *GNU Guix Cookbook*, for more information.

Once a package definition is in place, the package may actually be built using the `guix build` command-line tool (veja Seção 9.1 [Invocando guix build], Página 177), troubleshooting any build failures you encounter (veja Seção 9.1.4 [Depurando falhas de compilação], Página 190). You can easily jump back to the package definition using the `guix edit` command (veja Seção 9.2 [Invocando guix edit], Página 191). Veja Seção 22.8 [Diretrizes de empacotamento], Página 735, for more information on how to test package definitions, and Seção 9.8 [Invocando guix lint], Página 211, for information on how to check a definition for style conformance. Lastly, veja Capítulo 6 [Canais], Página 69, for information on how to extend the distribution by adding your own package definitions in a "channel".

Finally, updating the package definition to a new upstream version can be partly automated by the `guix refresh` command (veja Seção 9.6 [Invocando guix refresh], Página 202).

Behind the scenes, a derivation corresponding to the `<package>` object is first computed by the `package-derivation` procedure. That derivation is stored in a `.drv` file under `/gnu/store`. The build actions it prescribes may then be realized by using the `build-derivations` procedure (veja Seção 8.9 [O armazém], Página 154).

`package-derivation` *store package* [*system*] [Procedure]
: Return the `<derivation>` object of *package* for *system* (veja Seção 8.10 [Derivações], Página 156).

  package must be a valid `<package>` object, and *system* must be a string denoting the target system type—e.g., `"x86_64-linux"` for an x86_64 Linux-based GNU system. *store* must be a connection to the daemon, which operates on the store (veja Seção 8.9 [O armazém], Página 154).

Similarly, it is possible to compute a derivation that cross-builds a package for some other system:

`package-cross-derivation` *store package target* [*system*] [Procedure]
: Return the `<derivation>` object of *package* cross-built from *system* to *target*.

  target must be a valid GNU triplet denoting the target hardware and operating system, such as `"aarch64-linux-gnu"` (veja Seção "Specifying Target Triplets" em *Autoconf*).

Once you have package definitions, you can easily define *variants* of those packages. Veja Seção 8.3 [Definindo variantes de pacote], Página 113, for more on that.

8.2.1 `package` Reference

This section summarizes all the options available in `package` declarations (veja Seção 8.2 [Definindo pacotes], Página 101).

`package` [Data Type]

This is the data type representing a package recipe.

`name` The name of the package, as a string.

`version` The version of the package, as a string. Veja Seção 22.8.3 [Números de versão], Página 736, for guidelines.

`source` An object telling how the source code for the package should be acquired. Most of the time, this is an `origin` object, which denotes a file fetched from the Internet (veja Seção 8.2.2 [Referência do origin], Página 108). It can also be any other "file-like" object such as a `local-file`, which denotes a file from the local file system (veja Seção 8.12 [Expressões-G], Página 163).

`build-system`
The build system that should be used to build the package (veja Seção 8.5 [Sistemas de compilação], Página 121).

`arguments` (default: `'()`)
The arguments that should be passed to the build system (veja Seção 8.5 [Sistemas de compilação], Página 121). This is a list, typically containing sequential keyword-value pairs, as in this example:

```
(package
  (name "example")
  ;; several fields omitted
  (arguments
    (list #:tests? #f                     ;skip tests
          #:make-flags #~'("VERBOSE=1")   ;pass flags to 'make'
          #:configure-flags #~'("--enable-frobbing"))))
```

The exact set of supported keywords depends on the build system (veja Seção 8.5 [Sistemas de compilação], Página 121), but you will find that almost all of them honor `#:configure-flags`, `#:make-flags`, `#:tests?`, and `#:phases`. The `#:phases` keyword in particular lets you modify the set of build phases for your package (veja Seção 8.6 [Fases de construção], Página 141).

The REPL has dedicated commands to interactively inspect values of some of these arguments, as a convenient debugging aid (veja Seção 8.14 [Using Guix Interactively], Página 174).

Compatibility Note: Until version 1.3.0, the `arguments` field would typically use `quote` (`'`) or `quasiquote` (`` ` ``) and no G-expressions, like so:

```
(package
```

```
;; several fields omitted
(arguments   ;old-style quoted arguments
 '(#:tests? #f
   #:configure-flags '("--enable-frobbing"))))
```

To convert from that style to the one shown above, you can run `guix style -S arguments` *package* (veja Seção 9.7 [Invocando guix style], Página 208).

`inputs` (default: `'()`)
`native-inputs` (default: `'()`)
`propagated-inputs` (default: `'()`)

These fields list dependencies of the package. Each element of these lists is either a package, origin, or other "file-like object" (veja Seção 8.12 [Expressões-G], Página 163); to specify the output of that file-like object that should be used, pass a two-element list where the second element is the output (veja Seção 5.4 [Pacotes com múltiplas saídas], Página 52, for more on package outputs). For example, the list below specifies three inputs:

```
(list libffi libunistring
      `(,glib "bin"))      ;the "bin" output of GLib
```

In the example above, the `"out"` output of `libffi` and `libunistring` is used.

Compatibility Note: Until version 1.3.0, input lists were a list of tuples, where each tuple has a label for the input (a string) as its first element, a package, origin, or derivation as its second element, and optionally the name of the output thereof that should be used, which defaults to `"out"`. For example, the list below is equivalent to the one above, but using the *old input style*:

```
;; Old input style (deprecated).
`(("libffi" ,libffi)
  ("libunistring" ,libunistring)
  ("glib:bin" ,glib "bin"))  ;the "bin" output of GLib
```

This style is now deprecated; it is still supported but support will be removed in a future version. It should not be used for new package definitions. Veja Seção 9.7 [Invocando guix style], Página 208, on how to migrate to the new style.

The distinction between `native-inputs` and `inputs` is necessary when considering cross-compilation. When cross-compiling, dependencies listed in `inputs` are built for the *target* architecture; conversely, dependencies listed in `native-inputs` are built for the architecture of the *build* machine.

`native-inputs` is typically used to list tools needed at build time, but not at run time, such as Autoconf, Automake, pkg-config, Gettext, or Bison. `guix lint` can report likely mistakes in this area (veja Seção 9.8 [Invocando guix lint], Página 211).

Lastly, `propagated-inputs` is similar to `inputs`, but the specified packages will be automatically installed to profiles (veja Seção 5.1 [Recursos], Página 36) alongside the package they belong to (veja [package-cmd-propagated-inputs], Página 39, for information on how `guix package` deals with propagated inputs).

For example this is necessary when packaging a C/C++ library that needs headers of another library to compile, or when a pkg-config file refers to another one *via* its `Requires` field.

Another example where `propagated-inputs` is useful is for languages that lack a facility to record the run-time search path akin to the `RUNPATH` of ELF files; this includes Guile, Python, Perl, and more. When packaging libraries written in those languages, ensure they can find library code they depend on at run time by listing run-time dependencies in `propagated-inputs` rather than `inputs`.

`outputs` (default: `'("out")`)
: The list of output names of the package. Veja Seção 5.4 [Pacotes com múltiplas saídas], Página 52, for typical uses of additional outputs.

`native-search-paths` (default: `'()`)
`search-paths` (default: `'()`)
: A list of `search-path-specification` objects describing search-path environment variables honored by the package. Veja Seção 8.8 [Caminhos de pesquisa], Página 151, for more on search path specifications.

  As for inputs, the distinction between `native-search-paths` and `search-paths` only matters when cross-compiling. In a cross-compilation context, `native-search-paths` applies exclusively to native inputs whereas `search-paths` applies only to host inputs.

  Packages such as cross-compilers care about target inputs—for instance, our (modified) GCC cross-compiler has `CROSS_C_INCLUDE_PATH` in `search-paths`, which allows it to pick `.h` files for the target system and *not* those of native inputs. For the majority of packages though, only `native-search-paths` makes sense.

`replacement` (default: `#f`)
: This must be either `#f` or a package object that will be used as a *replacement* for this package. Veja Capítulo 19 [Atualizações de segurança], Página 710, for details.

`synopsis` A one-line description of the package.

`description`
: A more elaborate description of the package, as a string in Texinfo syntax.

`license` The license of the package; a value from `(guix licenses)`, or a list of such values.

`página inicial`
: The URL to the home-page of the package, as a string.

`supported-systems` (default: `%supported-systems`)
: The list of systems supported by the package, as strings of the form `architecture-kernel`, for example `"x86_64-linux"`.

`location` (default: source location of the `package` form)
: The source location of the package. It is useful to override this when inheriting from another package, in which case this field is not automatically corrected.

`this-package` [Macro]
: When used in the *lexical scope* of a package field definition, this identifier resolves to the package being defined.

  The example below shows how to add a package as a native input of itself when cross-compiling:

```
(package
  (name "guile")
  ;; ...

  ;; When cross-compiled, Guile, for example, depends on
  ;; a native version of itself.  Add it here.
  (native-inputs (if (%current-target-system)
                     (list this-package)
                     '())))
```

  It is an error to refer to `this-package` outside a package definition.

The following helper procedures are provided to help deal with package inputs.

`lookup-package-input` *package name* [Procedure]
`lookup-package-native-input` *package name* [Procedure]
`lookup-package-propagated-input` *package name* [Procedure]
`lookup-package-direct-input` *package name* [Procedure]
: Look up *name* among *package*'s inputs (or native, propagated, or direct inputs). Return it if found, `#f` otherwise.

  name is the name of a package depended on. Here's how you might use it:

```
(use-modules (guix packages) (gnu packages base))

(lookup-package-direct-input coreutils "gmp")
⇒ #<package gmp@6.2.1 ...>
```

  In this example we obtain the `gmp` package that is among the direct inputs of `coreutils`.

Sometimes you will want to obtain the list of inputs needed to *develop* a package—all the inputs that are visible when the package is compiled. This is what the `package-development-inputs` procedure returns.

`package-development-inputs` *package* [*system*] [*#:target #f*] [Procedure]
: Return the list of inputs required by *package* for development purposes on *system*. When *target* is true, return the inputs needed to cross-compile *package* from *system* to *target*, where *target* is a triplet such as `"aarch64-linux-gnu"`.

Note that the result includes both explicit inputs and implicit inputs—inputs automatically added by the build system (veja Seção 8.5 [Sistemas de compilação], Página 121). Let us take the `hello` package to illustrate that:

```
(use-modules (gnu packages base) (guix packages))

hello
⇒ #<package hello@2.10 gnu/packages/base.scm:79 7f585d4f6790>

(package-direct-inputs hello)
⇒ ()

(package-development-inputs hello)
⇒ (("source" ...) ("tar" #<package tar@1.32 ...>) ...)
```

In this example, `package-direct-inputs` returns the empty list, because `hello` has zero explicit dependencies. Conversely, `package-development-inputs` includes inputs implicitly added by `gnu-build-system` that are required to build `hello`: tar, gzip, GCC, libc, Bash, and more. To visualize it, `guix graph hello` would show you explicit inputs, whereas `guix graph -t bag hello` would include implicit inputs (veja Seção 9.10 [Invocando guix graph], Página 216).

Because packages are regular Scheme objects that capture a complete dependency graph and associated build procedures, it is often useful to write procedures that take a package and return a modified version thereof according to some parameters. Below are a few examples.

`package-with-c-toolchain` *package toolchain* [Procedure]

Return a variant of *package* that uses *toolchain* instead of the default GNU C/C++ toolchain. *toolchain* must be a list of inputs (label/package tuples) providing equivalent functionality, such as the `gcc-toolchain` package.

The example below returns a variant of the `hello` package built with GCC 10.x and the rest of the GNU tool chain (Binutils and the GNU C Library) instead of the default tool chain:

```
(let ((toolchain (specification->package "gcc-toolchain@10")))
  (package-with-c-toolchain hello `(("toolchain" ,toolchain))))
```

The build tool chain is part of the *implicit inputs* of packages—it's usually not listed as part of the various "inputs" fields and is instead pulled in by the build system. Consequently, this procedure works by changing the build system of *package* so that it pulls in *toolchain* instead of the defaults. Seção 8.5 [Sistemas de compilação], Página 121, for more on build systems.

8.2.2 `origin` Reference

This section documents *origins*. An `origin` declaration specifies data that must be "produced"—downloaded, usually—and whose content hash is known in advance. Origins are primarily used to represent the source code of packages (veja Seção 8.2 [Definindo pacotes], Página 101). For that reason, the `origin` form allows you to declare patches to apply to the original source code as well as code snippets to modify it.

`origin` [Data Type]

This is the data type representing a source code origin.

`uri` An object containing the URI of the source. The object type depends on the `method` (see below). For example, when using the *url-fetch* method of `(guix download)`, the valid `uri` values are: a URL represented as a string, or a list thereof.

`method` A monadic procedure that handles the given URI. The procedure must accept at least three arguments: the value of the `uri` field and the hash algorithm and hash value specified by the `hash` field. It must return a store item or a derivation in the store monad (veja Seção 8.11 [A mônada do armazém], Página 158); most methods return a fixed-output derivation (veja Seção 8.10 [Derivações], Página 156).

Commonly used methods include `url-fetch`, which fetches data from a URL, and `git-fetch`, which fetches data from a Git repository (see below).

`sha256` A bytevector containing the SHA-256 hash of the source. This is equivalent to providing a `content-hash` SHA256 object in the `hash` field described below.

`hash (masc.)`
The `content-hash` object of the source—see below for how to use `content-hash`.

You can obtain this information using `guix download` (veja Seção 9.3 [Invocando guix download], Página 191) or `guix hash` (veja Seção 9.4 [Invocando guix hash], Página 192).

`file-name` (default: `#f`)
The file name under which the source code should be saved. When this is `#f`, a sensible default value will be used in most cases. In case the source is fetched from a URL, the file name from the URL will be used. For version control checkouts, it is recommended to provide the file name explicitly because the default is not very descriptive.

`patches` (default: `'()`)
A list of file names, origins, or file-like objects (veja Seção 8.12 [Expressões-G], Página 163) pointing to patches to be applied to the source.

This list of patches must be unconditional. In particular, it cannot depend on the value of `%current-system` or `%current-target-system`.

`snippet` (default: `#f`)
A G-expression (veja Seção 8.12 [Expressões-G], Página 163) or S-expression that will be run in the source directory. This is a convenient way to modify the source, sometimes more convenient than a patch.

`patch-flags` (default: `'("-p1")`)
A list of command-line flags that should be passed to the `patch` command.

`patch-inputs` (default: `#f`)
: Input packages or derivations to the patching process. When this is `#f`, the usual set of inputs necessary for patching are provided, such as GNU Patch.

`modules` (default: `'()`)
: A list of Guile modules that should be loaded during the patching process and while running the code in the `snippet` field.

`patch-guile` (default: `#f`)
: The Guile package that should be used in the patching process. When this is `#f`, a sensible default is used.

`content-hash` *value* [*algorithm*] [Data Type]
: Construct a content hash object for the given *algorithm*, and with *value* as its hash value. When *algorithm* is omitted, assume it is `sha256`.

  value can be a literal string, in which case it is base32-decoded, or it can be a bytevector.

  The following forms are all equivalent:

```
(content-hash "05zxkyz9bv3j9h0xyid1rhvh3klhsmrpkf3bcs6frvlgyr2gwilj")
(content-hash "05zxkyz9bv3j9h0xyid1rhvh3klhsmrpkf3bcs6frvlgyr2gwilj"
              sha256)
(content-hash (base32
               "05zxkyz9bv3j9h0xyid1rhvh3klhsmrpkf3bcs6frvlgyr2gwilj"))
(content-hash (base64 "kkb+RPaP7uyMZmu4eXPVkM4BN8yhRd8BTHLslb6f/Rc=")
              sha256)
```

  Technically, `content-hash` is currently implemented as a macro. It performs sanity checks at macro-expansion time, when possible, such as ensuring that *value* has the right size for *algorithm*.

As we have seen above, how exactly the data an origin refers to is retrieved is determined by its `method` field. The `(guix download)` module provides the most common method, `url-fetch`, described below.

`url-fetch` *url hash-algo hash* [*name*] [*#:executable? #f*] [Procedure]
: Return a fixed-output derivation that fetches data from *url* (a string, or a list of strings denoting alternate URLs), which is expected to have hash *hash* of type *hash-algo* (a symbol). By default, the file name is the base name of URL; optionally, *name* can specify a different file name. When *executable?* is true, make the downloaded file executable.

  When one of the URL starts with `mirror://`, then its host part is interpreted as the name of a mirror scheme, taken from `%mirror-file`.

  Alternatively, when URL starts with `file://`, return the corresponding file name in the store.

Likewise, the `(guix git-download)` module defines the `git-fetch` origin method, which fetches data from a Git version control repository, and the `git-reference` data type to describe the repository and revision to fetch.

`git-fetch` *ref hash-algo hash* [Procedure]
Return a fixed-output derivation that fetches *ref*, a `<git-reference>` object. The output is expected to have recursive hash *hash* of type *hash-algo* (a symbol). Use *name* as the file name, or a generic name if `#f`.

`git-fetch/lfs` *ref hash-algo hash* [Procedure]
This is a variant of the `git-fetch` procedure that supports the Git LFS (Large File Storage) extension. This may be useful to pull some binary test data to run the test suite of a package, for example.

`git-reference` [Data Type]
This data type represents a Git reference for `git-fetch` to retrieve.

`url` The URL of the Git repository to clone.

`commit` This string denotes either the commit to fetch (a hexadecimal string), or the tag to fetch. You can also use a "short" commit ID or a `git describe` style identifier such as `v1.0.1-10-g58d7909c97`.

`recursive?` (default: `#f`)
This Boolean indicates whether to recursively fetch Git sub-modules.

The example below denotes the `v2.10` tag of the GNU Hello repository:

```
(git-reference
  (url "https://git.savannah.gnu.org/git/hello.git")
  (commit "v2.10"))
```

This is equivalent to the reference below, which explicitly names the commit:

```
(git-reference
  (url "https://git.savannah.gnu.org/git/hello.git")
  (commit "dc7dc56a00e48fe6f231a58f6537139fe2908fb9"))
```

For Mercurial repositories, the module `(guix hg-download)` defines the `hg-fetch` origin method and `hg-reference` data type for support of the Mercurial version control system.

`hg-fetch` *ref hash-algo hash* [*name*] [Procedure]
Return a fixed-output derivation that fetches *ref*, a `<hg-reference>` object. The output is expected to have recursive hash *hash* of type *hash-algo* (a symbol). Use *name* as the file name, or a generic name if `#f`.

`hg-reference` [Data Type]
This data type represents a Mercurial reference for `hg-fetch` to retrieve.

`url` The URL of the Mercurial repository to clone.

`changeset`
This string denotes changeset to fetch.

For Subversion repositories, the module `(guix svn-download)` defines the `svn-fetch` origin method and `svn-reference` data type for support of the Subversion version control system.

`svn-fetch` *ref hash-algo hash* [*name*] [Procedure]
Return a fixed-output derivation that fetches *ref*, a `<svn-reference>` object. The output is expected to have recursive hash *hash* of type *hash-algo* (a symbol). Use *name* as the file name, or a generic name if `#f`.

`svn-reference` [Data Type]
This data type represents a Subversion reference for `svn-fetch` to retrieve.

`url` The URL of the Subversion repository to clone.

`revision` This string denotes revision to fetch specified as a number.

`recursive?` (default: `#f`)
This Boolean indicates whether to recursively fetch Subversion "externals".

`user-name` (default: `#f`)
The name of an account that has read-access to the repository, if the repository isn't public.

`password` (default: `#f`)
Password to access the Subversion repository, if required.

For Bazaar repositories, the module `(guix bzr-download)` defines the `bzr-fetch` origin method and `bzr-reference` data type for support of the Bazaar version control system.

`bzr-fetch` *ref hash-algo hash* [*name*] [Procedure]
Return a fixed-output derivation that fetches *ref*, a `<bzr-reference>` object. The output is expected to have recursive hash *hash* of type *hash-algo* (a symbol). Use *name* as the file name, or a generic name if `#f`.

`bzr-reference` [Data Type]
This data type represents a Bazaar reference for `bzr-fetch` to retrieve.

`url` The URL of the Bazaar repository to clone.

`revision` This string denotes revision to fetch specified as a number.

For CVS repositories, the module `(guix cvs-download)` defines the `cvs-fetch` origin method and `cvs-reference` data type for support of the Concurrent Versions System (CVS).

`cvs-fetch` *ref hash-algo hash* [*name*] [Procedure]
Return a fixed-output derivation that fetches *ref*, a `<cvs-reference>` object. The output is expected to have recursive hash *hash* of type *hash-algo* (a symbol). Use *name* as the file name, or a generic name if `#f`.

`cvs-reference` [Data Type]
This data type represents a CVS reference for `cvs-fetch` to retrieve.

`root-directory`
The CVS root directory.

`modulo` Module to fetch.

`revision` Revision to fetch.

The example below denotes a version of gnu-standards to fetch:

```
(cvs-reference
  (root-directory ":pserver:anonymous@cvs.savannah.gnu.org:/sources/gnustandards"
  (module "gnustandards")
  (revision "2020-11-25"))
```

8.3 Definindo variantes de pacote

One of the nice things with Guix is that, given a package definition, you can easily *derive* variants of that package—for a different upstream version, with different dependencies, different compilation options, and so on. Some of these custom packages can be defined straight from the command line (veja Seção 9.1.2 [Opções de transformação de pacote], Página 180). This section describes how to define package variants in code. This can be useful in "manifests" (veja Seção 8.4 [Escrevendo manifestos], Página 117) and in your own package collection (veja Seção 6.7 [Criando um canal], Página 73), among others!

As discussed earlier, packages are first-class objects in the Scheme language. The `(guix packages)` module provides the `package` construct to define new package objects (veja Seção 8.2.1 [Referência do package], Página 104). The easiest way to define a package variant is using the `inherit` keyword together with `package`. This allows you to inherit from a package definition while overriding the fields you want.

For example, given the `hello` variable, which contains a definition for the current version of GNU Hello, here's how you would define a variant for version 2.2 (released in 2006, it's vintage!):

```
(use-modules (gnu packages base))    ;for 'hello'

(define hello-2.2
  (package
    (inherit hello)
    (version "2.2")
    (source (origin
              (method url-fetch)
              (uri (string-append "mirror://gnu/hello/hello-" version
                                  ".tar.gz"))
              (sha256
               (base32
                "0lappv4slgb5spyqbh6yl5r013zv72yqg2pcl30mginf3wdqd8k9"))))))
```

The example above corresponds to what the `--with-version` or `--with-source` package transformations option do. Essentially `hello-2.2` preserves all the fields of `hello`, except `version` and `source`, which it overrides. Note that the original `hello` variable is still there, in the `(gnu packages base)` module, unchanged. When you define a custom package like this, you are really *adding* a new package definition; the original one remains available.

You can just as well define variants with a different set of dependencies than the original package. For example, the default `gdb` package depends on `guile`, but since that is an optional dependency, you can define a variant that removes that dependency like so:

```
(use-modules (gnu packages gdb))   ;for 'gdb'
```

```
(define gdb-sans-guile
  (package
    (inherit gdb)
    (inputs (modify-inputs (package-inputs gdb)
              (delete "guile")))))
```

The `modify-inputs` form above removes the `"guile"` package from the `inputs` field of `gdb`. The `modify-inputs` macro is a helper that can prove useful anytime you want to remove, add, or replace package inputs.

`modify-inputs` *inputs clauses* [Macro]

Modify the given package inputs, as returned by `package-inputs` & co., according to the given clauses. Each clause must have one of the following forms:

`(delete` *name*`...)`
: Delete from the inputs packages with the given *name*s (strings).

`(prepend` *package*`...)`
: Add *package*s to the front of the input list.

`(append` *package*`...)`
: Add *package*s to the end of the input list.

`(replace` *name replacement*`)`
: Replace the package called *name* with *replacement*.

The example below removes the GMP and ACL inputs of Coreutils and adds libcap to the front of the input list:

```
(modify-inputs (package-inputs coreutils)
  (delete "gmp" "acl")
  (prepend libcap))
```

The example below replaces the `guile` package from the inputs of `guile-redis` with `guile-2.2`:

```
(modify-inputs (package-inputs guile-redis)
  (replace "guile" guile-2.2))
```

The last type of clause is `append`, to add inputs at the back of the list.

In some cases, you may find it useful to write functions (“procedures”, in Scheme parlance) that return a package based on some parameters. For example, consider the `luasocket` library for the Lua programming language. We want to create `luasocket` packages for major versions of Lua. One way to do that is to define a procedure that takes a Lua package and returns a `luasocket` package that depends on it:

```
(define (make-lua-socket name lua)
  ;; Return a luasocket package built with LUA.
  (package
    (name name)
    (version "3.0")
    ;; several fields omitted
    (inputs (list lua))
```

```
    (synopsis "Socket library for Lua")))

(define-public lua5.1-socket
  (make-lua-socket "lua5.1-socket" lua-5.1))

(define-public lua5.2-socket
  (make-lua-socket "lua5.2-socket" lua-5.2))
```

Here we have defined packages `lua5.1-socket` and `lua5.2-socket` by calling `make-lua-socket` with different arguments. Veja Seção "Procedures" em *GNU Guile Reference Manual*, for more info on procedures. Having top-level public definitions for these two packages means that they can be referred to from the command line (veja Seção 8.1 [Módulos de pacote], Página 100).

These are pretty simple package variants. As a convenience, the `(guix transformations)` module provides a high-level interface that directly maps to the more sophisticated package transformation options (veja Seção 9.1.2 [Opções de transformação de pacote], Página 180):

`options->transformation` *opts* [Procedure]

Return a procedure that, when passed an object to build (package, derivation, etc.), applies the transformations specified by *opts* and returns the resulting objects. *opts* must be a list of symbol/string pairs such as:

```
((with-branch . "guile-gcrypt=master")
 (without-tests . "libgcrypt"))
```

Each symbol names a transformation and the corresponding string is an argument to that transformation.

For instance, a manifest equivalent to this command:

```
guix build guix \
  --with-branch=guile-gcrypt=master \
  --with-debug-info=zlib
```

... would look like this:

```
(use-modules (guix transformations))

(define transform
  ;; The package transformation procedure.
  (options->transformation
   '((with-branch . "guile-gcrypt=master")
     (with-debug-info . "zlib"))))

(packages->manifest
 (list (transform (specification->package "guix"))))
```

The `options->transformation` procedure is convenient, but it's perhaps also not as flexible as you may like. How is it implemented? The astute reader probably noticed that most package transformation options go beyond the superficial changes shown in the first examples of this section: they involve *input rewriting*, whereby the dependency graph of a package is rewritten by replacing specific inputs by others.

Dependency graph rewriting, for the purposes of swapping packages in the graph, is what the `package-input-rewriting` procedure in `(guix packages)` implements.

`package-input-rewriting` *replacements* [*rewrite-name*] [*#:deep? #t*] [Procedure]

Return a procedure that, when passed a package, replaces its direct and indirect dependencies, including implicit inputs when *deep?* is true, according to *replacements*. *replacements* is a list of package pairs; the first element of each pair is the package to replace, and the second one is the replacement.

Optionally, *rewrite-name* is a one-argument procedure that takes the name of a package and returns its new name after rewrite.

Consider this example:

```
(define libressl-instead-of-openssl
  ;; This is a procedure to replace OPENSSL by LIBRESSL,
  ;; recursively.
  (package-input-rewriting `((,openssl . ,libressl))))

(define git-with-libressl
  (libressl-instead-of-openssl git))
```

Here we first define a rewriting procedure that replaces *openssl* with *libressl*. Then we use it to define a *variant* of the *git* package that uses *libressl* instead of *openssl*. This is exactly what the `--with-input` command-line option does (veja Seção 9.1.2 [Opções de transformação de pacote], Página 180).

The following variant of `package-input-rewriting` can match packages to be replaced by name rather than by identity.

`package-input-rewriting/spec` *replacements* [*#:deep? #t*] [Procedure]

Return a procedure that, given a package, applies the given *replacements* to all the package graph, including implicit inputs unless *deep?* is false.

replacements is a list of spec/procedures pair; each spec is a package specification such as `"gcc"` or `"guile@2"`, and each procedure takes a matching package and returns a replacement for that package. Matching packages that have the `hidden?` property set are not replaced.

The example above could be rewritten this way:

```
(define libressl-instead-of-openssl
  ;; Replace all the packages called "openssl" with LibreSSL.
  (package-input-rewriting/spec `(("openssl" . ,(const libressl)))))
```

The key difference here is that, this time, packages are matched by spec and not by identity. In other words, any package in the graph that is called `openssl` will be replaced.

A more generic procedure to rewrite a package dependency graph is `package-mapping`: it supports arbitrary changes to nodes in the graph.

`package-mapping` *proc* [*cut?*] [*#:deep? #f*] [Procedure]

Return a procedure that, given a package, applies *proc* to all the packages depended on and returns the resulting package. The procedure stops recursion when *cut?* returns

true for a given package. When *deep?* is true, *proc* is applied to implicit inputs as well.

Tips: Understanding what a variant really looks like can be difficult as one starts combining the tools shown above. There are several ways to inspect a package before attempting to build it that can prove handy:

- You can inspect the package interactively at the REPL, for instance to view its inputs, the code of its build phases, or its configure flags (veja Seção 8.14 [Using Guix Interactively], Página 174).
- When rewriting dependencies, `guix graph` can often help visualize the changes that are made (veja Seção 9.10 [Invocando guix graph], Página 216).

8.4 Escrevendo manifestos

`guix` commands let you specify package lists on the command line. This is convenient, but as the command line becomes longer and less trivial, it quickly becomes more convenient to have that package list in what we call a *manifest*. A manifest is some sort of a "bill of materials" that defines a package set. You would typically come up with a code snippet that builds the manifest, store it in a file, say `manifest.scm`, and then pass that file to the `-m` (or `--manifest`) option that many `guix` commands support. For example, here's what a manifest for a simple package set might look like:

```
;; Manifest for three packages.
(specifications->manifest '("gcc-toolchain" "make" "git"))
```

Once you have that manifest, you can pass it, for example, to `guix package` to install just those three packages to your profile (veja [profile-manifest], Página 41):

```
guix package -m manifest.scm
```

... or you can pass it to `guix shell` (veja [shell-manifest], Página 82) to spawn an ephemeral environment:

```
guix shell -m manifest.scm
```

... or you can pass it to `guix pack` in pretty much the same way (veja [pack-manifest], Página 96). You can store the manifest under version control, share it with others so they can easily get set up, etc.

But how do you write your first manifest? To get started, maybe you'll want to write a manifest that mirrors what you already have in a profile. Rather than start from a blank page, `guix package` can generate a manifest for you (veja [export-manifest], Página 46):

```
# Write to 'manifest.scm' a manifest corresponding to the
# default profile, ~/.guix-profile.
guix package --export-manifest > manifest.scm
```

Or maybe you'll want to "translate" command-line arguments into a manifest. In that case, `guix shell` can help (veja [shell-export-manifest], Página 82):

```
# Write a manifest for the packages specified on the command line.
guix shell --export-manifest gcc-toolchain make git > manifest.scm
```

In both cases, the `--export-manifest` option tries hard to generate a faithful manifest; in particular, it takes package transformation options into account (veja Seção 9.1.2 [Opções de transformação de pacote], Página 180).

> **Nota:** Manifests are *symbolic*: they refer to packages of the channels *currently in use* (veja Capítulo 6 [Canais], Página 69). In the example above, `gcc-toolchain` might refer to version 11 today, but it might refer to version 13 two years from now.
>
> If you want to "pin" your software environment to specific package versions and variants, you need an additional piece of information: the list of channel revisions in use, as returned by `guix describe`. Veja Seção 6.3 [Replicando Guix], Página 70, for more information.

Once you've obtained your first manifest, perhaps you'll want to customize it. Since your manifest is code, you now have access to all the Guix programming interfaces!

Let's assume you want a manifest to deploy a custom variant of GDB, the GNU Debugger, that does not depend on Guile, together with another package. Building on the example seen in the previous section (veja Seção 8.3 [Definindo variantes de pacote], Página 113), you can write a manifest along these lines:

```
(use-modules (guix packages)
             (gnu packages gdb)               ;for 'gdb'
             (gnu packages version-control))  ;for 'git'

;; Define a variant of GDB without a dependency on Guile.
(define gdb-sans-guile
  (package
    (inherit gdb)
    (inputs (modify-inputs (package-inputs gdb)
              (delete "guile")))))

;; Return a manifest containing that one package plus Git.
(packages->manifest (list gdb-sans-guile git))
```

Note that in this example, the manifest directly refers to the `gdb` and `git` variables, which are bound to a `package` object (veja Seção 8.2.1 [Referência do package], Página 104), instead of calling `specifications->manifest` to look up packages by name as we did before. The `use-modules` form at the top lets us access the core package interface (veja Seção 8.2 [Definindo pacotes], Página 101) and the modules that define `gdb` and `git` (veja Seção 8.1 [Módulos de pacote], Página 100). Seamlessly, we're weaving all this together—the possibilities are endless, unleash your creativity!

The data type for manifests as well as supporting procedures are defined in the `(guix profiles)` module, which is automatically available to code passed to `-m`. The reference follows.

`manifest` [Data Type]

Data type representing a manifest.

It currently has one field:

`entries` This must be a list of `manifest-entry` records—see below.

`manifest-entry` [Data Type]

Data type representing a manifest entry. A manifest entry contains essential metadata: a name and version string, the object (usually a package) for that entry, the desired output (veja Seção 5.4 [Pacotes com múltiplas saídas], Página 52), and a number of optional pieces of information detailed below.

Most of the time, you won't build a manifest entry directly; instead, you will pass a package to `package->manifest-entry`, described below. In some unusual cases though, you might want to create manifest entries for things that are *not* packages, as in this example:

```
;; Manually build a single manifest entry for a non-package object.
(let ((hello (program-file "hello" #~(display "Hi!"))))
  (manifest-entry
    (name "foo")
    (version "42")
    (item
     (computed-file "hello-directory"
                    #~(let ((bin (string-append #$output "/bin")))
                        (mkdir #$output) (mkdir bin)
                        (symlink #$hello
                                 (string-append bin "/hello")))))))
```

The available fields are the following:

`name`
`version` Name and version string for this entry.

`item` A package or other file-like object (veja Seção 8.12 [Expressões-G], Página 163).

`output` (default: `"out"`)
Output of `item` to use, in case `item` has multiple outputs (veja Seção 5.4 [Pacotes com múltiplas saídas], Página 52).

`dependencies` (default: `'()`)
List of manifest entries this entry depends on. When building a profile, dependencies are added to the profile.

Typically, the propagated inputs of a package (veja Seção 8.2.1 [Referência do package], Página 104) end up having a corresponding manifest entry in among the dependencies of the package's own manifest entry.

`search-paths` (default: `'()`)
The list of search path specifications honored by this entry (veja Seção 8.8 [Caminhos de pesquisa], Página 151).

`properties` (default: `'()`)
List of symbol/value pairs. When building a profile, those properties get serialized.

This can be used to piggyback additional metadata—e.g., the transformations applied to a package (veja Seção 9.1.2 [Opções de transformação de pacote], Página 180).

`parent` (default: `(delay #f)`)
: A promise pointing to the "parent" manifest entry.

  This is used as a hint to provide context when reporting an error related to a manifest entry coming from a `dependencies` field.

`concatenate-manifests` *lst* [Procedure]
: Concatenate the manifests listed in *lst* and return the resulting manifest.

`package->manifest-entry` *package* [*output*] [*#:properties*] [Procedure]
: Return a manifest entry for the *output* of package *package*, where *output* defaults to `"out"`, and with the given *properties*. By default *properties* is the empty list or, if one or more package transformations were applied to *package*, it is an association list representing those transformations, suitable as an argument to `options->transformation` (veja Seção 8.3 [Definindo variantes de pacote], Página 113).

  The code snippet below builds a manifest with an entry for the default output and the `send-email` output of the `git` package:

```
(use-modules (gnu packages version-control))

(manifest (list (package->manifest-entry git)
                (package->manifest-entry git "send-email")))
```

`packages->manifest` *packages* [Procedure]
: Return a list of manifest entries, one for each item listed in *packages*. Elements of *packages* can be either package objects or package/string tuples denoting a specific output of a package.

  Using this procedure, the manifest above may be rewritten more concisely:

```
(use-modules (gnu packages version-control))

(packages->manifest (list git `(,git "send-email")))
```

`package->development-manifest` *package* [*system*] [*#:target*] [Procedure]
: Return a manifest for the *development inputs* of *package* for *system*, optionally when cross-compiling to *target*. Development inputs include both explicit and implicit inputs of *package*.

  Like the `-D` option of `guix shell` (veja [shell-development-option], Página 81), the resulting manifest describes the environment in which one can develop *package*. For example, suppose you're willing to set up a development environment for Inkscape, with the addition of Git for version control; you can describe that "bill of materials" with the following manifest:

```
(use-modules (gnu packages inkscape)          ;for 'inkscape'
             (gnu packages version-control))  ;for 'git'

(concatenate-manifests
 (list (package->development-manifest inkscape)
       (packages->manifest (list git))))
```

  In this example, the development manifest that `package->development-manifest` returns includes the compiler (GCC), the many supporting libraries (Boost, GLib,

GTK, etc.), and a couple of additional development tools—these are the dependencies `guix show inkscape` lists.

Last, the `(gnu packages)` module provides higher-level facilities to build manifests. In particular, it lets you look up packages by name—see below.

`specifications->manifest` *specs* [Procedure]

Given *specs*, a list of specifications such as `"emacs@25.2"` or `"guile:debug"`, return a manifest. Specs have the format that command-line tools such as `guix install` and `guix package` understand (veja Seção 5.2 [Invocando guix package], Página 37).

As an example, it lets you rewrite the Git manifest that we saw earlier like this:

```
(specifications->manifest '("git" "git:send-email"))
```

Notice that we do not need to worry about `use-modules`, importing the right set of modules, and referring to the right variables. Instead, we directly refer to packages in the same way as on the command line, which can often be more convenient.

8.5 Sistemas de compilação

Each package definition specifies a *build system* and arguments for that build system (veja Seção 8.2 [Definindo pacotes], Página 101). This `build-system` field represents the build procedure of the package, as well as implicit dependencies of that build procedure.

Build systems are `<build-system>` objects. The interface to create and manipulate them is provided by the `(guix build-system)` module, and actual build systems are exported by specific modules.

Under the hood, build systems first compile package objects to *bags*. A *bag* is like a package, but with less ornamentation—in other words, a bag is a lower-level representation of a package, which includes all the inputs of that package, including some that were implicitly added by the build system. This intermediate representation is then compiled to a derivation (veja Seção 8.10 [Derivações], Página 156). The `package-with-c-toolchain` is an example of a way to change the implicit inputs that a package's build system pulls in (veja Seção 8.2.1 [Referência do package], Página 104).

Build systems accept an optional list of *arguments*. In package definitions, these are passed *via* the `arguments` field (veja Seção 8.2 [Definindo pacotes], Página 101). They are typically keyword arguments (veja Seção "Optional Arguments" em *GNU Guile Reference Manual*). The value of these arguments is usually evaluated in the *build stratum*—i.e., by a Guile process launched by the daemon (veja Seção 8.10 [Derivações], Página 156).

The main build system is `gnu-build-system`, which implements the standard build procedure for GNU and many other packages. It is provided by the `(guix build-system gnu)` module.

`gnu-build-system` [Variável]

`gnu-build-system` represents the GNU Build System, and variants thereof (veja Seção "Configuration" em *GNU Coding Standards*).

In a nutshell, packages using it are configured, built, and installed with the usual `./configure && make && make check && make install` command sequence. In practice, a few additional steps are often needed. All these steps are split up in separate

phases. Veja Seção 8.6 [Fases de construção], Página 141, for more info on build phases and ways to customize them.

In addition, this build system ensures that the "standard" environment for GNU packages is available. This includes tools such as GCC, libc, Coreutils, Bash, Make, Diffutils, grep, and sed (see the `(guix build-system gnu)` module for a complete list). We call these the *implicit inputs* of a package, because package definitions do not have to mention them.

This build system supports a number of keyword arguments, which can be passed *via* the `arguments` field of a package. Here are some of the main parameters:

`#:phases` This argument specifies build-side code that evaluates to an alist of build phases. Veja Seção 8.6 [Fases de construção], Página 141, for more information.

`#:configure-flags`
: This is a list of flags (strings) passed to the `configure` script. Veja Seção 8.2 [Definindo pacotes], Página 101, for an example.

`#:make-flags`
: This list of strings contains flags passed as arguments to `make` invocations in the `build`, `check`, and `install` phases.

`#:out-of-source?`
: This Boolean, `#f` by default, indicates whether to run builds in a build directory separate from the source tree.

  When it is true, the `configure` phase creates a separate build directory, changes to that directory, and runs the `configure` script from there. This is useful for packages that require it, such as `glibc`.

`#:tests?` This Boolean, `#t` by default, indicates whether the `check` phase should run the package's test suite.

`#:test-target`
: This string, `"check"` by default, gives the name of the makefile target used by the `check` phase.

`#:parallel-build?`
`#:parallel-tests?`
: These Boolean values specify whether to build, respectively run the test suite, in parallel, with the `-j` flag of `make`. When they are true, `make` is passed `-jn`, where *n* is the number specified as the `--cores` option of `guix-daemon` or that of the `guix` client command (veja Seção 9.1.1 [Opções de compilação comum], Página 177).

`#:validate-runpath?`
: This Boolean, `#t` by default, determines whether to "validate" the `RUNPATH` of ELF binaries (`.so` shared libraries as well as executables) previously installed by the `install` phase. Veja [phase-validate-runpath], Página 141, for details.

`#:substituível?`
: This Boolean, `#t` by default, tells whether the package outputs should be substitutable—i.e., whether users should be able to obtain substitutes for them instead of building locally (veja Seção 5.3 [Substitutos], Página 47).

`#:allowed-references`
`#:disallowed-references`
: When true, these arguments must be a list of dependencies that must not appear among the references of the build results. If, upon build completion, some of these references are retained, the build process fails.

  This is useful to ensure that a package does not erroneously keep a reference to some of it build-time inputs, in cases where doing so would, for example, unnecessarily increase its size (veja Seção 9.9 [Invocando guix size], Página 214).

Most other build systems support these keyword arguments.

Other `<build-system>` objects are defined to support other conventions and tools used by free software packages. They inherit most of `gnu-build-system`, and differ mainly in the set of inputs implicitly added to the build process, and in the list of phases executed. Some of these build systems are listed below.

`agda-build-system` [Variável]
: This variable is exported by `(guix build-system agda)`. It implements a build procedure for Agda libraries.

  It adds `agda` to the set of inputs. A different Agda can be specified with the `#:agda` key.

  The `#:plan` key is a list of cons cells `(`*`regexp`*` . `*`parameters`*`)`, where *regexp* is a regexp that should match the `.agda` files to build, and *parameters* is an optional list of parameters that will be passed to `agda` when type-checking it.

  When the library uses Haskell to generate a file containing all imports, the convenience `#:gnu-and-haskell?` can be set to `#t` to add `ghc` and the standard inputs of `gnu-build-system` to the input list. You will still need to manually add a phase or tweak the `'build` phase, as in the definition of `agda-stdlib`.

`ant-build-system` [Variável]
: This variable is exported by `(guix build-system ant)`. It implements the build procedure for Java packages that can be built with Ant build tool (`https://ant.apache.org/`).

  It adds both `ant` and the *Java Development Kit* (JDK) as provided by the `icedtea` package to the set of inputs. Different packages can be specified with the `#:ant` and `#:jdk` parameters, respectively.

  When the original package does not provide a suitable Ant build file, the parameter `#:jar-name` can be used to generate a minimal Ant build file `build.xml` with tasks to build the specified jar archive. In this case the parameter `#:source-dir` can be used to specify the source sub-directory, defaulting to "src".

The `#:main-class` parameter can be used with the minimal ant buildfile to specify the main class of the resulting jar. This makes the jar file executable. The `#:test-include` parameter can be used to specify the list of junit tests to run. It defaults to `(list "**/*Test.java")`. The `#:test-exclude` can be used to disable some tests. It defaults to `(list "**/Abstract*.java")`, because abstract classes cannot be run as tests.

The parameter `#:build-target` can be used to specify the Ant task that should be run during the `build` phase. By default the "jar" task will be run.

`android-ndk-build-system` [Variável]

This variable is exported by `(guix build-system android-ndk)`. It implements a build procedure for Android NDK (native development kit) packages using a Guix-specific build process.

The build system assumes that packages install their public interface (header) files to the subdirectory `include` of the `out` output and their libraries to the subdirectory `lib` the `out` output.

It's also assumed that the union of all the dependencies of a package has no conflicting files.

For the time being, cross-compilation is not supported - so right now the libraries and header files are assumed to be host tools.

`asdf-build-system/source` [Variável]
`asdf-build-system/sbcl` [Variável]
`asdf-build-system/ecl` [Variável]

These variables, exported by `(guix build-system asdf)`, implement build procedures for Common Lisp packages using "ASDF" (`https://common-lisp.net/project/asdf/`). ASDF is a system definition facility for Common Lisp programs and libraries.

The `asdf-build-system/source` system installs the packages in source form, and can be loaded using any common lisp implementation, via ASDF. The others, such as `asdf-build-system/sbcl`, install binary systems in the format which a particular implementation understands. These build systems can also be used to produce executable programs, or lisp images which contain a set of packages pre-loaded.

The build system uses naming conventions. For binary packages, the package name should be prefixed with the lisp implementation, such as `sbcl-` for `asdf-build-system/sbcl`.

Additionally, the corresponding source package should be labeled using the same convention as Python packages (veja Seção 22.8.8 [Módulos Python], Página 741), using the `cl-` prefix.

In order to create executable programs and images, the build-side procedures `build-program` and `build-image` can be used. They should be called in a build phase after the `create-asdf-configuration` phase, so that the system which was just built can be used within the resulting image. `build-program` requires a list of Common Lisp expressions to be passed as the `#:entry-program` argument.

By default, all the `.asd` files present in the sources are read to find system definitions. The `#:asd-files` parameter can be used to specify the list of `.asd` files to read.

Furthermore, if the package defines a system for its tests in a separate file, it will be loaded before the tests are run if it is specified by the `#:test-asd-file` parameter. If it is not set, the files `<system>-tests.asd`, `<system>-test.asd`, `tests.asd`, and `test.asd` will be tried if they exist.

If for some reason the package must be named in a different way than the naming conventions suggest, or if several systems must be compiled, the `#:asd-systems` parameter can be used to specify the list of system names.

`cargo-build-system` [Variável]

This variable is exported by `(guix build-system cargo)`. It supports builds of packages using Cargo, the build tool of the Rust programming language (`https://www.rust-lang.org`).

It adds `rustc` and `cargo` to the set of inputs. A different Rust package can be specified with the `#:rust` parameter.

Regular cargo dependencies should be added to the package definition similarly to other packages; those needed only at build time to native-inputs, others to inputs. If you need to add source-only crates then you should add them to via the `#:cargo-inputs` parameter as a list of name and spec pairs, where the spec can be a package or a source definition. Note that the spec must evaluate to a path to a gzipped tarball which includes a `Cargo.toml` file at its root, or it will be ignored. Similarly, cargo dev-dependencies should be added to the package definition via the `#:cargo-development-inputs` parameter.

In its `configure` phase, this build system will make any source inputs specified in the `#:cargo-inputs` and `#:cargo-development-inputs` parameters available to cargo. It will also remove an included `Cargo.lock` file to be recreated by `cargo` during the `build` phase. The `package` phase will run `cargo package` to create a source crate for future use. The `install` phase installs the binaries defined by the crate. Unless `install-source? #f` is defined it will also install a source crate repository of itself and unpacked sources, to ease in future hacking on rust packages.

`chicken-build-system` [Variável]

This variable is exported by `(guix build-system chicken)`. It builds CHICKEN Scheme (`https://call-cc.org/`) modules, also called “eggs” or “extensions”. CHICKEN generates C source code, which then gets compiled by a C compiler, in this case GCC.

This build system adds `chicken` to the package inputs, as well as the packages of `gnu-build-system`.

The build system can't (yet) deduce the egg's name automatically, so just like with `go-build-system` and its `#:import-path`, you should define `#:egg-name` in the package's `arguments` field.

For example, if you are packaging the `srfi-1` egg:

```
(arguments '(#:egg-name "srfi-1"))
```

Egg dependencies must be defined in `propagated-inputs`, not `inputs` because CHICKEN doesn't embed absolute references in compiled eggs. Test dependencies should go to `native-inputs`, as usual.

`copy-build-system` [Variável]

This variable is exported by `(guix build-system copy)`. It supports builds of simple packages that don't require much compiling, mostly just moving files around.

It adds much of the `gnu-build-system` packages to the set of inputs. Because of this, the `copy-build-system` does not require all the boilerplate code often needed for the `trivial-build-system`.

To further simplify the file installation process, an `#:install-plan` argument is exposed to let the packager specify which files go where. The install plan is a list of `(`*`source target`* `[`*`filters`*`])`. *filters* are optional.

- When *source* matches a file or directory without trailing slash, install it to *target*.
  - If *target* has a trailing slash, install *source* basename beneath *target*.
  - Otherwise install *source* as *target*.
- When *source* is a directory with a trailing slash, or when *filters* are used, the trailing slash of *target* is implied with the same meaning as above.
  - Without *filters*, install the full *source content* to *target*.
  - With *filters* among `#:include`, `#:include-regexp`, `#:exclude`, `#:exclude-regexp`, only select files are installed depending on the filters. Each filters is specified by a list of strings.
    - With `#:include`, install all the files which the path suffix matches at least one of the elements in the given list.
    - With `#:include-regexp`, install all the files which the subpaths match at least one of the regular expressions in the given list.
    - The `#:exclude` and `#:exclude-regexp` filters are the complement of their inclusion counterpart. Without `#:include` flags, install all files but those matching the exclusion filters. If both inclusions and exclusions are specified, the exclusions are done on top of the inclusions.
  - When a package has multiple outputs, the `#:output` argument can be used to specify which output label the files should be installed to.

  In all cases, the paths relative to *source* are preserved within *target*.

Examples:

- `("foo/bar" "share/my-app/")`: Install `bar` to `share/my-app/bar`.
- `("foo/bar" "share/my-app/baz")`: Install `bar` to `share/my-app/baz`.
- `("foo/" "share/my-app")`: Install the content of `foo` inside `share/my-app`, e.g., install `foo/sub/file` to `share/my-app/sub/file`.
- `("foo/" "share/my-app" #:include ("sub/file"))`: Install only `foo/sub/file` to `share/my-app/sub/file`.
- `("foo/sub" "share/my-app" #:include ("file"))`: Install `foo/sub/file` to `share/my-app/file`.
- `("foo/doc" "share/my-app/doc" #:output "doc")`: Install `"foo/doc"` to `"share/my-app/doc"` within the `"doc"` output.

`vim-build-system` [Variável]

This variable is exported by `(guix build-system vim)`. It is an extension of the `copy-build-system`, installing Vim and Neovim plugins into locations where these two text editors know to find their plugins, using their packpaths.

Packages which are prefixed with `vim-` will be installed in Vim's packpath, while those prefixed with `neovim-` will be installed in Neovim's packpath. If there is a `doc` directory with the plugin then helptags will be generated automatically.

There are a couple of keywords added with the `vim-build-system`:

- With `plugin-name` it is possible to set the name of the plugin. While by default this is set to the name and version of the package, it is often more helpful to set this to name which the upstream author calls their plugin. This is the name used for `:packadd` from inside Vim.
- With `install-plan` it is possible to augment the built-in install-plan of the `vim-build-system`. This is particularly helpful if you have files which should be installed in other locations. For more information about using the `install-plan`, see the `copy-build-system` (veja Seção 8.5 [Sistemas de compilação], Página 121).
- With `#:vim` it is possible to add this package to Vim's packpath, in addition to if it is added automatically because of the `vim-` prefix in the package's name.
- With `#:neovim` it is possible to add this package to Neovim's packpath, in addition to if it is added automatically because of the `neovim-` prefix in the package's name.
- With `#:mode` it is possible to adjust the path which the plugin is installed into. By default the plugin is installed into `start` and other options are available, including `opt`. Adding a plugin into `opt` will mean you will need to run, for example, `:packadd foo` to load the `foo` plugin from inside of Vim.

`clojure-build-system` [Variável]

This variable is exported by `(guix build-system clojure)`. It implements a simple build procedure for Clojure (`https://clojure.org/`) packages using plain old `compile` in Clojure. Cross-compilation is not supported yet.

It adds `clojure`, `icedtea` and `zip` to the set of inputs. Different packages can be specified with the `#:clojure`, `#:jdk` and `#:zip` parameters, respectively.

A list of source directories, test directories and jar names can be specified with the `#:source-dirs`, `#:test-dirs` and `#:jar-names` parameters, respectively. Compile directory and main class can be specified with the `#:compile-dir` and `#:main-class` parameters, respectively. Other parameters are documented below.

This build system is an extension of `ant-build-system`, but with the following phases changed:

`build` This phase calls `compile` in Clojure to compile source files and runs `jar` to create jars from both source files and compiled files according to the include list and exclude list specified in `#:aot-include` and `#:aot-exclude`, respectively. The exclude list has priority over the include list. These lists consist of symbols representing Clojure libraries or the special keyword `#:all` representing all Clojure libraries found under the source

directories. The parameter `#:omit-source?` decides if source should be included into the jars.

`marcar` This phase runs tests according to the include list and exclude list specified in `#:test-include` and `#:test-exclude`, respectively. Their meanings are analogous to that of `#:aot-include` and `#:aot-exclude`, except that the special keyword `#:all` now stands for all Clojure libraries found under the test directories. The parameter `#:tests?` decides if tests should be run.

`instalar` This phase installs all jars built previously.

Apart from the above, this build system also contains an additional phase:

`install-doc`
This phase installs all top-level files with base name matching `%doc-regex`. A different regex can be specified with the `#:doc-regex` parameter. All files (recursively) inside the documentation directories specified in `#:doc-dirs` are installed as well.

`cmake-build-system` [Variável]
This variable is exported by `(guix build-system cmake)`. It implements the build procedure for packages using the CMake build tool (`https://www.cmake.org`).

It automatically adds the `cmake` package to the set of inputs. Which package is used can be specified with the `#:cmake` parameter.

The `#:configure-flags` parameter is taken as a list of flags passed to the `cmake` command. The `#:build-type` parameter specifies in abstract terms the flags passed to the compiler; it defaults to `"RelWithDebInfo"` (short for "release mode with debugging information"), which roughly means that code is compiled with `-O2 -g`, as is the case for Autoconf-based packages by default.

`composer-build-system` [Variável]
This variable is exported by `(guix build-system composer)`. It implements the build procedure for packages using Composer (`https://getcomposer.org/`), the PHP package manager.

It automatically adds the `php` package to the set of inputs. Which package is used can be specified with the `#:php` parameter.

The `#:test-target` parameter is used to control which script is run for the tests. By default, the `test` script is run if it exists. If the script does not exist, the build system will run `phpunit` from the source directory, assuming there is a `phpunit.xml` file.

`dune-build-system` [Variável]
This variable is exported by `(guix build-system dune)`. It supports builds of packages using Dune (`https://dune.build/`), a build tool for the OCaml programming language. It is implemented as an extension of the `ocaml-build-system` which is described below. As such, the `#:ocaml` and `#:findlib` parameters can be passed to this build system.

It automatically adds the `dune` package to the set of inputs. Which package is used can be specified with the `#:dune` parameter.

There is no `configure` phase because dune packages typically don't need to be configured. The `#:build-flags` parameter is taken as a list of flags passed to the `dune` command during the build.

The `#:jbuild?` parameter can be passed to use the `jbuild` command instead of the more recent `dune` command while building a package. Its default value is `#f`.

The `#:package` parameter can be passed to specify a package name, which is useful when a package contains multiple packages and you want to build only one of them. This is equivalent to passing the `-p` argument to `dune`.

`elm-build-system` [Variável]

This variable is exported by `(guix build-system elm)`. It implements a build procedure for Elm (`https://elm-lang.org`) packages similar to '`elm install`'.

The build system adds an Elm compiler package to the set of inputs. The default compiler package (currently `elm-sans-reactor`) can be overridden using the `#:elm` argument. Additionally, Elm packages needed by the build system itself are added as implicit inputs if they are not already present: to suppress this behavior, use the `#:implicit-elm-package-inputs?` argument, which is primarily useful for bootstrapping.

The `"dependencies"` and `"test-dependencies"` in an Elm package's `elm.json` file correspond to `propagated-inputs` and `inputs`, respectively.

Elm requires a particular structure for package names: veja Seção 22.8.12 [Pacotes Elm], Página 743, for more details, including utilities provided by `(guix build-system elm)`.

There are currently a few noteworthy limitations to `elm-build-system`:

- The build system is focused on *packages* in the Elm sense of the word: Elm *projects* which declare `{ "type": "package" }` in their `elm.json` files. Using `elm-build-system` to build Elm *applications* (which declare `{ "type": "application" }`) is possible, but requires ad-hoc modifications to the build phases. For examples, see the definitions of the `elm-todomvc` example application and the `elm` package itself (because the front-end for the '`elm reactor`' command is an Elm application).
- Elm supports multiple versions of a package coexisting simultaneously under `ELM_HOME`, but this does not yet work well with `elm-build-system`. This limitation primarily affects Elm applications, because they specify exact versions for their dependencies, whereas Elm packages specify supported version ranges. As a workaround, the example applications mentioned above use the `patch-application-dependencies` procedure provided by `(guix build elm-build-system)` to rewrite their `elm.json` files to refer to the package versions actually present in the build environment. Alternatively, Guix package transformations (veja Seção 8.3 [Definindo variantes de pacote], Página 113) could be used to rewrite an application's entire dependency graph.
- We are not yet able to run tests for Elm projects because neither `elm-test-rs` (`https://github.com/mpizenberg/elm-test-rs`) nor the Node.js-based `elm-test` (`https://github.com/rtfeldman/node-test-runner`) runner has been packaged for Guix yet.

`go-build-system` [Variável]

This variable is exported by `(guix build-system go)`. It implements a build procedure for Go packages using the standard Go build mechanisms (`https://golang.org/cmd/go/#hdr-Compile_packages_and_dependencies`).

The user is expected to provide a value for the key `#:import-path` and, in some cases, `#:unpack-path`. The import path (`https://golang.org/doc/code.html#ImportPaths`) corresponds to the file system path expected by the package's build scripts and any referring packages, and provides a unique way to refer to a Go package. It is typically based on a combination of the package source code's remote URI and file system hierarchy structure. In some cases, you will need to unpack the package's source code to a different directory structure than the one indicated by the import path, and `#:unpack-path` should be used in such cases.

Packages that provide Go libraries should install their source code into the built output. The key `#:install-source?`, which defaults to `#t`, controls whether or not the source code is installed. It can be set to `#f` for packages that only provide executable files.

Packages can be cross-built, and if a specific architecture or operating system is desired then the keywords `#:goarch` and `#:goos` can be used to force the package to be built for that architecture and operating system. The combinations known to Go can be found in their documentation (`https://golang.org/doc/install/source#environment`).

The key `#:go` can be used to specify the Go compiler package with which to build the package.

The phase `check` provides a wrapper for `go test` which builds a test binary (or multiple binaries), vets the code and then runs the test binary. Build, test and test binary flags can be provided as `#:test-flags` parameter, default is `'()`. See `go help test` and `go help testflag` for more details.

The key `#:embed-files`, default is `'()`, provides a list of future embedded files or regexps matching files. They will be copied to build directory after `unpack` phase. See `https://pkg.go.dev/embed` for more details.

`glib-or-gtk-build-system` [Variável]

This variable is exported by `(guix build-system glib-or-gtk)`. It is intended for use with packages making use of GLib or GTK+.

This build system adds the following two phases to the ones defined by `gnu-build-system`:

`glib-or-gtk-wrap`

The phase `glib-or-gtk-wrap` ensures that programs in `bin/` are able to find GLib "schemas" and GTK+ modules (`https://developer.gnome.org/gtk3/stable/gtk-running.html`). This is achieved by wrapping the programs in launch scripts that appropriately set the `XDG_DATA_DIRS` and `GTK_PATH` environment variables.

It is possible to exclude specific package outputs from that wrapping process by listing their names in the `#:glib-or-gtk-wrap-excluded-outputs` parameter. This is useful when an output is known not to contain

any GLib or GTK+ binaries, and where wrapping would gratuitously add a dependency of that output on GLib and GTK+.

`glib-or-gtk-compile-schemas`
: The phase `glib-or-gtk-compile-schemas` makes sure that all GSettings schemas (`https://developer.gnome.org/gio/stable/glib-compile-schemas.html`) of GLib are compiled. Compilation is performed by the `glib-compile-schemas` program. It is provided by the package `glib:bin` which is automatically imported by the build system. The `glib` package providing `glib-compile-schemas` can be specified with the `#:glib` parameter.

Both phases are executed after the `install` phase.

`guile-build-system` [Variável]
: This build system is for Guile packages that consist exclusively of Scheme code and that are so lean that they don't even have a makefile, let alone a `configure` script. It compiles Scheme code using `guild compile` (veja Seção "Compilation" em *GNU Guile Reference Manual*) and installs the `.scm` and `.go` files in the right place. It also installs documentation.

  This build system supports cross-compilation by using the `--target` option of '`guild compile`'.

  Packages built with `guile-build-system` must provide a Guile package in their `native-inputs` field.

`julia-build-system` [Variável]
: This variable is exported by `(guix build-system julia)`. It implements the build procedure used by julia (`https://julialang.org/`) packages, which essentially is similar to running '`julia -e 'using Pkg; Pkg.add(package)'`' in an environment where `JULIA_LOAD_PATH` contains the paths to all Julia package inputs. Tests are run by calling `/test/runtests.jl`.

  The Julia package name and uuid is read from the file `Project.toml`. These values can be overridden by passing the argument `#:julia-package-name` (which must be correctly capitalized) or `#:julia-package-uuid`.

  Julia packages usually manage their binary dependencies via `JLLWrappers.jl`, a Julia package that creates a module (named after the wrapped library followed by `_jll.jl`.

  To add the binary path `_jll.jl` packages, you need to patch the files under `src/wrappers/`, replacing the call to the macro `JLLWrappers.@generate_wrapper_header`, adding as a second argument containing the store path the binary.

  As an example, in the MbedTLS Julia package, we add a build phase (veja Seção 8.6 [Fases de construção], Página 141) to insert the absolute file name of the wrapped MbedTLS package:

```
(add-after 'unpack 'override-binary-path
  (lambda* (#:key inputs #:allow-other-keys)
    (for-each (lambda (wrapper)
                (substitute* wrapper
```

```
                (("generate_wrapper_header.*")
                 (string-append
                  "generate_wrapper_header(\"MbedTLS\", \""
                  (assoc-ref inputs "mbedtls") "\")\n"))))
            ;; There's a Julia file for each platform, override them all.
            (find-files "src/wrappers/" "\\.jl$"))))
```

Some older packages that aren't using `Project.toml` yet, will require this file to be created, too. It is internally done if the arguments `#:julia-package-name` and `#:julia-package-uuid` are provided.

`maven-build-system` [Variável]

This variable is exported by `(guix build-system maven)`. It implements a build procedure for Maven (`https://maven.apache.org`) packages. Maven is a dependency and lifecycle management tool for Java. A user of Maven specifies dependencies and plugins in a `pom.xml` file that Maven reads. When Maven does not have one of the dependencies or plugins in its repository, it will download them and use them to build the package.

The maven build system ensures that maven will not try to download any dependency by running in offline mode. Maven will fail if a dependency is missing. Before running Maven, the `pom.xml` (and subprojects) are modified to specify the version of dependencies and plugins that match the versions available in the guix build environment. Dependencies and plugins must be installed in the fake maven repository at `lib/m2`, and are symlinked into a proper repository before maven is run. Maven is instructed to use that repository for the build and installs built artifacts there. Changed files are copied to the `lib/m2` directory of the package output.

You can specify a `pom.xml` file with the `#:pom-file` argument, or let the build system use the default `pom.xml` file in the sources.

In case you need to specify a dependency's version manually, you can use the `#:local-packages` argument. It takes an association list where the key is the groupId of the package and its value is an association list where the key is the artifactId of the package and its value is the version you want to override in the `pom.xml`.

Some packages use dependencies or plugins that are not useful at runtime nor at build time in Guix. You can alter the `pom.xml` file to remove them using the `#:exclude` argument. Its value is an association list where the key is the groupId of the plugin or dependency you want to remove, and the value is a list of artifactId you want to remove.

You can override the default `jdk` and `maven` packages with the corresponding argument, `#:jdk` and `#:maven`.

The `#:maven-plugins` argument is a list of maven plugins used during the build, with the same format as the `inputs` fields of the package declaration. Its default value is `(default-maven-plugins)` which is also exported.

`minetest-mod-build-system` [Variável]

This variable is exported by `(guix build-system minetest)`. It implements a build procedure for Minetest (`https://www.minetest.net`) mods, which consists of copying Lua code, images and other resources to the location Minetest searches for

mods. The build system also minimises PNG images and verifies that Minetest can load the mod without errors.

`minify-build-system` [Variável]
This variable is exported by `(guix build-system minify)`. It implements a minification procedure for simple JavaScript packages.

It adds `uglify-js` to the set of inputs and uses it to compress all JavaScript files in the `src` directory. A different minifier package can be specified with the `#:uglify-js` parameter, but it is expected that the package writes the minified code to the standard output.

When the input JavaScript files are not all located in the `src` directory, the parameter `#:javascript-files` can be used to specify a list of file names to feed to the minifier.

`mozilla-build-system` [Variável]
This variable is exported by `(guix build-system mozilla)`. It sets the `--target` and `--host` configuration flags to what software developed by Mozilla expects – due to historical reasons, Mozilla software expects `--host` to be the system that is cross-compiled from and `--target` to be the system that is cross-compiled to, contrary to the standard Autotools conventions.

`ocaml-build-system` [Variável]
This variable is exported by `(guix build-system ocaml)`. It implements a build procedure for OCaml (`https://ocaml.org`) packages, which consists of choosing the correct set of commands to run for each package. OCaml packages can expect many different commands to be run. This build system will try some of them.

When the package has a `setup.ml` file present at the top-level, it will run `ocaml setup.ml -configure`, `ocaml setup.ml -build` and `ocaml setup.ml -install`. The build system will assume that this file was generated by OASIS (`http://oasis.forge.ocamlcore.org/`) and will take care of setting the prefix and enabling tests if they are not disabled. You can pass configure and build flags with the `#:configure-flags` and `#:build-flags`. The `#:test-flags` key can be passed to change the set of flags used to enable tests. The `#:use-make?` key can be used to bypass this system in the build and install phases.

When the package has a `configure` file, it is assumed that it is a hand-made configure script that requires a different argument format than in the `gnu-build-system`. You can add more flags with the `#:configure-flags` key.

When the package has a `Makefile` file (or `#:use-make?` is `#t`), it will be used and more flags can be passed to the build and install phases with the `#:make-flags` key.

Finally, some packages do not have these files and use a somewhat standard location for its build system. In that case, the build system will run `ocaml pkg/pkg.ml` or `ocaml pkg/build.ml` and take care of providing the path to the required findlib module. Additional flags can be passed via the `#:build-flags` key. Install is taken care of by `opam-installer`. In this case, the `opam` package must be added to the `native-inputs` field of the package definition.

Note that most OCaml packages assume they will be installed in the same directory as OCaml, which is not what we want in guix. In particular, they will install `.so`

files in their module's directory, which is usually fine because it is in the OCaml compiler directory. In guix though, these libraries cannot be found and we use `CAML_LD_LIBRARY_PATH`. This variable points to `lib/ocaml/site-lib/stubslibs` and this is where `.so` libraries should be installed.

`python-build-system` [Variável]

This variable is exported by `(guix build-system python)`. It implements the more or less standard build procedure used by Python packages, which consists in running `python setup.py build` and then `python setup.py install --prefix=/gnu/store/...`.

For packages that install stand-alone Python programs under `bin/`, it takes care of wrapping these programs so that their `GUIX_PYTHONPATH` environment variable points to all the Python libraries they depend on.

Which Python package is used to perform the build can be specified with the `#:python` parameter. This is a useful way to force a package to be built for a specific version of the Python interpreter, which might be necessary if the package is only compatible with a single interpreter version.

By default guix calls `setup.py` under control of `setuptools`, much like `pip` does. Some packages are not compatible with setuptools (and pip), thus you can disable this by setting the `#:use-setuptools?` parameter to `#f`.

If a `"python"` output is available, the package is installed into it instead of the default `"out"` output. This is useful for packages that include a Python package as only a part of the software, and thus want to combine the phases of `python-build-system` with another build system. Python bindings are a common usecase.

`pyproject-build-system` [Variável]

This is a variable exported by `guix build-system pyproject`. It is based on *python-build-system*, and adds support for `pyproject.toml` and PEP 517 (`https://peps.python.org/pep-0517/`). It also supports a variety of build backends and test frameworks.

The API is slightly different from *python-build-system*:

- `#:use-setuptools?` and `#:test-target` is removed.
- `#:build-backend` is added. It defaults to `#false` and will try to guess the appropriate backend based on `pyproject.toml`.
- `#:test-backend` is added. It defaults to `#false` and will guess an appropriate test backend based on what is available in package inputs.
- `#:test-flags` is added. The default is `'()`. These flags are passed as arguments to the test command. Note that flags for verbose output is always enabled on supported backends.

It is considered "experimental" in that the implementation details are not set in stone yet, however users are encouraged to try it for new Python projects (even those using `setup.py`). The API is subject to change, but any breaking changes in the Guix channel will be dealt with.

Eventually this build system will be deprecated and merged back into *python-build-system*, probably some time in 2024.

`perl-build-system` [Variável]

This variable is exported by `(guix build-system perl)`. It implements the standard build procedure for Perl packages, which either consists in running `perl Build.PL --prefix=/gnu/store/...`, followed by `Build` and `Build install`; or in running `perl Makefile.PL PREFIX=/gnu/store/...`, followed by `make` and `make install`, depending on which of `Build.PL` or `Makefile.PL` is present in the package distribution. Preference is given to the former if both `Build.PL` and `Makefile.PL` exist in the package distribution. This preference can be reversed by specifying `#t` for the `#:make-maker?` parameter.

The initial `perl Makefile.PL` or `perl Build.PL` invocation passes flags specified by the `#:make-maker-flags` or `#:module-build-flags` parameter, respectively.

Which Perl package is used can be specified with `#:perl`.

`renpy-build-system` [Variável]

This variable is exported by `(guix build-system renpy)`. It implements the more or less standard build procedure used by Ren'py games, which consists of loading `#:game` once, thereby creating bytecode for it.

It further creates a wrapper script in `bin/` and a desktop entry in `share/applications`, both of which can be used to launch the game.

Which Ren'py package is used can be specified with `#:renpy`. Games can also be installed in outputs other than "out" by using `#:output`.

`qt-build-system` [Variável]

This variable is exported by `(guix build-system qt)`. It is intended for use with applications using Qt or KDE.

This build system adds the following two phases to the ones defined by `cmake-build-system`:

`check-setup`

The phase `check-setup` prepares the environment for running the checks as commonly used by Qt test programs. For now this only sets some environment variables: `QT_QPA_PLATFORM=offscreen`, `DBUS_FATAL_WARNINGS=0` and `CTEST_OUTPUT_ON_FAILURE=1`.

This phase is added before the `check` phase. It's a separate phase to ease adjusting if necessary.

`qt-wrap` The phase `qt-wrap` searches for Qt5 plugin paths, QML paths and some XDG in the inputs and output. In case some path is found, all programs in the output's `bin/`, `sbin/`, `libexec/` and `lib/libexec/` directories are wrapped in scripts defining the necessary environment variables.

It is possible to exclude specific package outputs from that wrapping process by listing their names in the `#:qt-wrap-excluded-outputs` parameter. This is useful when an output is known not to contain any Qt binaries, and where wrapping would gratuitously add a dependency of that output on Qt, KDE, or such.

This phase is added after the `install` phase.

`r-build-system` [Variável]
This variable is exported by `(guix build-system r)`. It implements the build procedure used by R (`https://r-project.org`) packages, which essentially is little more than running '`R CMD INSTALL --library=/gnu/store/...`' in an environment where `R_LIBS_SITE` contains the paths to all R package inputs. Tests are run after installation using the R function `tools::testInstalledPackage`.

`rakudo-build-system` [Variável]
This variable is exported by `(guix build-system rakudo)`. It implements the build procedure used by Rakudo (`https://rakudo.org/`) for Perl6 (`https://perl6.org/`) packages. It installs the package to `/gnu/store/.../NAME-VERSION/share/perl6` and installs the binaries, library files and the resources, as well as wrap the files under the `bin/` directory. Tests can be skipped by passing `#f` to the `tests?` parameter.

Which rakudo package is used can be specified with `rakudo`. Which perl6-tap-harness package used for the tests can be specified with `#:prove6` or removed by passing `#f` to the `with-prove6?` parameter. Which perl6-zef package used for tests and installing can be specified with `#:zef` or removed by passing `#f` to the `with-zef?` parameter.

`rebar-build-system` [Variável]
This variable is exported by `(guix build-system rebar)`. It implements a build procedure around rebar3 (`https://rebar3.org`), a build system for programs written in the Erlang language.

It adds both `rebar3` and the `erlang` to the set of inputs. Different packages can be specified with the `#:rebar` and `#:erlang` parameters, respectively.

This build system is based on `gnu-build-system`, but with the following phases changed:

`unpack` This phase, after unpacking the source like the `gnu-build-system` does, checks for a file `contents.tar.gz` at the top-level of the source. If this file exists, it will be unpacked, too. This eases handling of package hosted at `https://hex.pm/`, the Erlang and Elixir package repository.

`bootstrap`
`configure`
There are no `bootstrap` and `configure` phase because erlang packages typically don't need to be configured.

`build` This phase runs `rebar3 compile` with the flags listed in `#:rebar-flags`.

`marcar` Unless `#:tests? #f` is passed, this phase runs `rebar3 eunit`, or some other target specified with `#:test-target`, with the flags listed in `#:rebar-flags`,

`instalar` This installs the files created in the *default* profile, or some other profile specified with `#:install-profile`.

`texlive-build-system` [Variável]
This variable is exported by `(guix build-system texlive)`. It is used to build TeX packages in batch mode with a specified engine. The build system sets the `TEXINPUTS` variable to find all TeX source files in the inputs.

By default it tries to run `luatex` on all `.ins` files, and if it fails to find any, on all `.dtx` files. A different engine and format can be specified with, respectively, the `#:tex-engine` and `#:tex-format` arguments. Different build targets can be specified with the `#:build-targets` argument, which expects a list of file names.

It also generates font metrics (i.e., `.tfm` files) out of Metafont files whenever possible. Likewise, it can also create TeX formats (i.e., `.fmt` files) listed in the `#:create-formats` argument, and generate a symbolic link from `bin/` directory to any script located in `texmf-dist/scripts/`, provided its file name is listed in `#:link-scripts` argument.

The build system adds `texlive-bin` from `(gnu packages tex)` to the native inputs. It can be overridden with the `#:texlive-bin` argument.

The package `texlive-latex-bin`, from the same module, contains most of the tools for building TeX Live packages; for convenience, it is also added by default to the native inputs. However, this can be troublesome when building a dependency of `texlive-latex-bin` itself. In this particular situation, the `#:texlive-latex-bin?` argument should be set to `#f`.

`ruby-build-system` [Variável]

This variable is exported by `(guix build-system ruby)`. It implements the RubyGems build procedure used by Ruby packages, which involves running `gem build` followed by `gem install`.

The `source` field of a package that uses this build system typically references a gem archive, since this is the format that Ruby developers use when releasing their software. The build system unpacks the gem archive, potentially patches the source, runs the test suite, repackages the gem, and installs it. Additionally, directories and tarballs may be referenced to allow building unreleased gems from Git or a traditional source release tarball.

Which Ruby package is used can be specified with the `#:ruby` parameter. A list of additional flags to be passed to the `gem` command can be specified with the `#:gem-flags` parameter.

`waf-build-system` [Variável]

This variable is exported by `(guix build-system waf)`. It implements a build procedure around the `waf` script. The common phases—`configure`, `build`, and `install`—are implemented by passing their names as arguments to the `waf` script.

The `waf` script is executed by the Python interpreter. Which Python package is used to run the script can be specified with the `#:python` parameter.

`zig-build-system` [Variável]

This variable is exported by `(guix build-system zig)`. It implements the build procedures for the Zig (`https://ziglang.org/`) build system (`zig build` command).

Selecting this build system adds `zig` to the package inputs, in addition to the packages of `gnu-build-system`.

There is no `configure` phase because Zig packages typically do not need to be configured. The `#:zig-build-flags` parameter is a list of flags that are passed to the `zig` command during the build. The `#:zig-test-flags` parameter is a list of flags that

are passed to the `zig test` command during the `check` phase. The default compiler package can be overridden with the `#:zig` argument.

The optional `zig-release-type` parameter declares the type of release. Possible values are: `safe`, `fast`, or `small`. The default value is `#f`, which causes the release flag to be omitted from the `zig` command. That results in a `debug` build.

`scons-build-system` [Variável]

This variable is exported by `(guix build-system scons)`. It implements the build procedure used by the SCons software construction tool. This build system runs `scons` to build the package, `scons test` to run tests, and then `scons install` to install the package.

Additional flags to be passed to `scons` can be specified with the `#:scons-flags` parameter. The default build and install targets can be overridden with `#:build-targets` and `#:install-targets` respectively. The version of Python used to run SCons can be specified by selecting the appropriate SCons package with the `#:scons` parameter.

`haskell-build-system` [Variável]

This variable is exported by `(guix build-system haskell)`. It implements the Cabal build procedure used by Haskell packages, which involves running `runhaskell Setup.hs configure --prefix=/gnu/store/...` and `runhaskell Setup.hs build`. Instead of installing the package by running `runhaskell Setup.hs install`, to avoid trying to register libraries in the read-only compiler store directory, the build system uses `runhaskell Setup.hs copy`, followed by `runhaskell Setup.hs register`. In addition, the build system generates the package documentation by running `runhaskell Setup.hs haddock`, unless `#:haddock? #f` is passed. Optional Haddock parameters can be passed with the help of the `#:haddock-flags` parameter. If the file `Setup.hs` is not found, the build system looks for `Setup.lhs` instead.

Which Haskell compiler is used can be specified with the `#:haskell` parameter which defaults to `ghc`.

`dub-build-system` [Variável]

This variable is exported by `(guix build-system dub)`. It implements the Dub build procedure used by D packages, which involves running `dub build` and `dub run`. Installation is done by copying the files manually.

Which D compiler is used can be specified with the `#:ldc` parameter which defaults to `ldc`.

`emacs-build-system` [Variável]

This variable is exported by `(guix build-system emacs)`. It implements an installation procedure similar to the packaging system of Emacs itself (veja Seção “Packages” em *The GNU Emacs Manual*).

It first creates the `package-autoloads.el` file, then it byte compiles all Emacs Lisp files. Differently from the Emacs packaging system, the Info documentation files are moved to the standard documentation directory and the `dir` file is deleted. The Elisp package files are installed directly under `share/emacs/site-lisp`.

`font-build-system` [Variável]

This variable is exported by `(guix build-system font)`. It implements an installation procedure for font packages where upstream provides pre-compiled TrueType, OpenType, etc. font files that merely need to be copied into place. It copies font files to standard locations in the output directory.

`meson-build-system` [Variável]

This variable is exported by `(guix build-system meson)`. It implements the build procedure for packages that use Meson (`https://mesonbuild.com`) as their build system.

It adds both Meson and Ninja (`https://ninja-build.org/`) to the set of inputs, and they can be changed with the parameters `#:meson` and `#:ninja` if needed.

This build system is an extension of `gnu-build-system`, but with the following phases changed to some specific for Meson:

`configure`
: The phase runs `meson` with the flags specified in `#:configure-flags`. The flag `--buildtype` is always set to `debugoptimized` unless something else is specified in `#:build-type`.

`build`
: The phase runs `ninja` to build the package in parallel by default, but this can be changed with `#:parallel-build?`.

`marcar`
: The phase runs '`meson test`' with a base set of options that cannot be overridden. This base set of options can be extended via the `#:test-options` argument, for example to select or skip a specific test suite.

`instalar`
: The phase runs `ninja install` and can not be changed.

Apart from that, the build system also adds the following phases:

`fix-runpath`
: This phase ensures that all binaries can find the libraries they need. It searches for required libraries in subdirectories of the package being built, and adds those to `RUNPATH` where needed. It also removes references to libraries left over from the build phase by `meson`, such as test dependencies, that aren't actually required for the program to run.

`glib-or-gtk-wrap`
: This phase is the phase provided by `glib-or-gtk-build-system`, and it is not enabled by default. It can be enabled with `#:glib-or-gtk?`.

`glib-or-gtk-compile-schemas`
: This phase is the phase provided by `glib-or-gtk-build-system`, and it is not enabled by default. It can be enabled with `#:glib-or-gtk?`.

`linux-module-build-system` [Variável]

`linux-module-build-system` allows building Linux kernel modules.

This build system is an extension of `gnu-build-system`, but with the following phases changed:

`configure`
: This phase configures the environment so that the Linux kernel's Makefile can be used to build the external kernel module.

`build`
: This phase uses the Linux kernel's Makefile in order to build the external kernel module.

`instalar`
: This phase uses the Linux kernel's Makefile in order to install the external kernel module.

It is possible and useful to specify the Linux kernel to use for building the module (in the `arguments` form of a package using the `linux-module-build-system`, use the key `#:linux` to specify it).

`node-build-system` [Variável]
: This variable is exported by `(guix build-system node)`. It implements the build procedure used by Node.js (`https://nodejs.org`), which implements an approximation of the `npm install` command, followed by an `npm test` command.

  Which Node.js package is used to interpret the `npm` commands can be specified with the `#:node` parameter which defaults to `node`.

`tree-sitter-build-system` [Variável]
: This variable is exported by `(guix build-system tree-sitter)`. It implements procedures to compile grammars for the Tree-sitter (`https://tree-sitter.github.io/tree-sitter/`) parsing library. It essentially runs `tree-sitter generate` to translate `grammar.js` grammars to JSON and then to C. Which it then compiles to native code.

  Tree-sitter packages may support multiple grammars, so this build system supports a `#:grammar-directories` keyword to specify a list of locations where a `grammar.js` file may be found.

  Grammars sometimes depend on each other, such as C++ depending on C and TypeScript depending on JavaScript. You may use inputs to declare such dependencies.

Lastly, for packages that do not need anything as sophisticated, a "trivial" build system is provided. It is trivial in the sense that it provides basically no support: it does not pull any implicit inputs, and does not have a notion of build phases.

`trivial-build-system` [Variável]
: This variable is exported by `(guix build-system trivial)`.

  This build system requires a `#:builder` argument. This argument must be a Scheme expression that builds the package output(s)—as with `build-expression->derivation` (veja Seção 8.10 [Derivações], Página 156).

`channel-build-system` [Variável]
: This variable is exported by `(guix build-system channel)`.

  This build system is meant primarily for internal use. A package using this build system must have a channel specification as its `source` field (veja Capítulo 6 [Canais], Página 69); alternatively, its source can be a directory name, in which case an

additional `#:commit` argument must be supplied to specify the commit being built (a hexadecimal string).

Optionally, a `#:channels` argument specifying additional channels can be provided.

The resulting package is a Guix instance of the given channel(s), similar to how `guix time-machine` would build it.

8.6 Fases de construção

Almost all package build systems implement a notion *build phases*: a sequence of actions that the build system executes, when you build the package, leading to the installed byproducts in the store. A notable exception is the "bare-bones" `trivial-build-system` (veja Seção 8.5 [Sistemas de compilação], Página 121).

As discussed in the previous section, those build systems provide a standard list of phases. For `gnu-build-system`, the main build phases are the following:

`set-paths`
: Define search path environment variables for all the input packages, including `PATH` (veja Seção 8.8 [Caminhos de pesquisa], Página 151).

`unpack`
: Unpack the source tarball, and change the current directory to the extracted source tree. If the source is actually a directory, copy it to the build tree, and enter that directory.

`patch-source-shebangs`
: Patch shebangs encountered in source files so they refer to the right store file names. For instance, this changes `#!/bin/sh` to `#!/gnu/store/...-bash-4.3/bin/sh`.

`configure`
: Run the `configure` script with a number of default options, such as `--prefix=/gnu/store/...`, as well as the options specified by the `#:configure-flags` argument.

`build`
: Run `make` with the list of flags specified with `#:make-flags`. If the `#:parallel-build?` argument is true (the default), build with `make -j`.

`marcar`
: Run `make check`, or some other target specified with `#:test-target`, unless `#:tests? #f` is passed. If the `#:parallel-tests?` argument is true (the default), run `make check -j`.

`instalar`
: Run `make install` with the flags listed in `#:make-flags`.

`patch-shebangs`
: Patch shebangs on the installed executable files.

`strip`
: Strip debugging symbols from ELF files (unless `#:strip-binaries?` is false), copying them to the `debug` output when available (veja Capítulo 17 [Instalando arquivos de depuração], Página 705).

`validate-runpath`
: Validate the `RUNPATH` of ELF binaries, unless `#:validate-runpath?` is false (veja Seção 8.5 [Sistemas de compilação], Página 121).

This validation step consists in making sure that all the shared libraries needed by an ELF binary, which are listed as `DT_NEEDED` entries in its `PT_DYNAMIC` segment, appear in the `DT_RUNPATH` entry of that binary. In other words, it ensures that running or using those binaries will not result in a "file not found" error at run time. Veja Seção "Options" em *The GNU Linker*, for more information on `RUNPATH`.

Other build systems have similar phases, with some variations. For example, `cmake-build-system` has same-named phases but its `configure` phases runs `cmake` instead of `./configure`. Others, such as `python-build-system`, have a wholly different list of standard phases. All this code runs on the *build side*: it is evaluated when you actually build the package, in a dedicated build process spawned by the build daemon (veja Seção 2.3 [Invocando guix-daemon], Página 13).

Build phases are represented as association lists or "alists" (veja Seção "Association Lists" em *GNU Guile Reference Manual*) where each key is a symbol for the name of the phase and the associated value is a procedure that accepts an arbitrary number of arguments. By convention, those procedures receive information about the build in the form of *keyword parameters*, which they can use or ignore.

For example, here is how `(guix build gnu-build-system)` defines `%standard-phases`, the variable holding its alist of build phases[3]:

```
;; The build phases of 'gnu-build-system'.

(define* (unpack #:key source #:allow-other-keys)
  ;; Extract the source tarball.
  (invoke "tar" "xvf" source))

(define* (configure #:key outputs #:allow-other-keys)
  ;; Run the 'configure' script.  Install to output "out".
  (let ((out (assoc-ref outputs "out")))
    (invoke "./configure"
            (string-append "--prefix=" out))))

(define* (build #:allow-other-keys)
  ;; Compile.
  (invoke "make"))

(define* (check #:key (test-target "check") (tests? #true)
                #:allow-other-keys)
  ;; Run the test suite.
  (if tests?
      (invoke "make" test-target)
      (display "test suite not run\n")))

(define* (install #:allow-other-keys)
```

[3] We present a simplified view of those build phases, but do take a look at `(guix build gnu-build-system)` to see all the details!

```
  ;; Install files to the prefix 'configure' specified.
  (invoke "make" "install"))

(define %standard-phases
  ;; The list of standard phases (quite a few are omitted
  ;; for brevity).  Each element is a symbol/procedure pair.
  (list (cons 'unpack unpack)
        (cons 'configure configure)
        (cons 'build build)
        (cons 'check check)
        (cons 'install install)))
```

This shows how `%standard-phases` is defined as a list of symbol/procedure pairs (veja Seção "Pairs" em *GNU Guile Reference Manual*). The first pair associates the `unpack` procedure with the `unpack` symbol—a name; the second pair defines the `configure` phase similarly, and so on. When building a package that uses `gnu-build-system` with its default list of phases, those phases are executed sequentially. You can see the name of each phase started and completed in the build log of packages that you build.

Let's now look at the procedures themselves. Each one is defined with `define*`: `#:key` lists keyword parameters the procedure accepts, possibly with a default value, and `#:allow-other-keys` specifies that other keyword parameters are ignored (veja Seção "Optional Arguments" em *GNU Guile Reference Manual*).

The `unpack` procedure honors the `source` parameter, which the build system uses to pass the file name of the source tarball (or version control checkout), and it ignores other parameters. The `configure` phase only cares about the `outputs` parameter, an alist mapping package output names to their store file name (veja Seção 5.4 [Pacotes com múltiplas saídas], Página 52). It extracts the file name of for `out`, the default output, and passes it to `./configure` as the installation prefix, meaning that `make install` will eventually copy all the files in that directory (veja Seção "Configuration" em *GNU Coding Standards*). `build` and `install` ignore all their arguments. `check` honors the `test-target` argument, which specifies the name of the Makefile target to run tests; it prints a message and skips tests when `tests?` is false.

The list of phases used for a particular package can be changed with the `#:phases` parameter of the build system. Changing the set of build phases boils down to building a new alist of phases based on the `%standard-phases` alist described above. This can be done with standard alist procedures such as `alist-delete` (veja Seção "SRFI-1 Association Lists" em *GNU Guile Reference Manual*); however, it is more convenient to do so with `modify-phases` (veja Seção 8.7 [Construir utilitários], Página 144).

Here is an example of a package definition that removes the `configure` phase of `%standard-phases` and inserts a new phase before the `build` phase, called `set-prefix-in-makefile`:

```
(define-public example
  (package
    (name "example")
    ;; other fields omitted
    (build-system gnu-build-system)
```

```
(arguments
 (list
  #:phases
  #~(modify-phases %standard-phases
      (delete 'configure)
      (add-before 'build 'set-prefix-in-makefile
        (lambda* (#:key inputs #:allow-other-keys)
          ;; Modify the makefile so that its
          ;; 'PREFIX' variable points to #$output and
          ;; 'XMLLINT' points to the correct path.
          (substitute* "Makefile"
            (("PREFIX =.*")
             (string-append "PREFIX = " #$output "\n"))
            (("XMLLINT =.*")
             (string-append "XMLLINT = "
                            (search-input-file inputs "/bin/xmllint")
                            "\n")))))))))
```

The new phase that is inserted is written as an anonymous procedure, introduced with `lambda*`; it looks for the `xmllint` executable under a `/bin` directory among the package's inputs (veja Seção 8.2.1 [Referência do package], Página 104). It also honors the `outputs` parameter we have seen before. Veja Seção 8.7 [Construir utilitários], Página 144, for more about the helpers used by this phase, and for more examples of `modify-phases`.

> **Tip:** You can inspect the code associated with a package's `#:phases` argument interactively, at the REPL (veja Seção 8.14 [Using Guix Interactively], Página 174).

Keep in mind that build phases are code evaluated at the time the package is actually built. This explains why the whole `modify-phases` expression above is quoted (it comes after the `#~` or hash-tilde): it is *staged* for later execution. Veja Seção 8.12 [Expressões-G], Página 163, for an explanation of code staging and the *code strata* involved.

8.7 Construir utilitários

As soon as you start writing non-trivial package definitions (veja Seção 8.2 [Definindo pacotes], Página 101) or other build actions (veja Seção 8.12 [Expressões-G], Página 163), you will likely start looking for helpers for "shell-like" actions—creating directories, copying and deleting files recursively, manipulating build phases, and so on. The `(guix build utils)` module provides such utility procedures.

Most build systems load `(guix build utils)` (veja Seção 8.5 [Sistemas de compilação], Página 121). Thus, when writing custom build phases for your package definitions, you can usually assume those procedures are in scope.

When writing G-expressions, you can import `(guix build utils)` on the "build side" using `with-imported-modules` and then put it in scope with the `use-modules` form (veja Seção "Using Guile Modules" em *GNU Guile Reference Manual*):

```
(with-imported-modules '((guix build utils))  ;import it
  (computed-file "empty-tree"
                 #~(begin
```

```
;; Put it in scope.
(use-modules (guix build utils))

;; Happily use its 'mkdir-p' procedure.
(mkdir-p (string-append #$output "/a/b/c")))))
```

The remainder of this section is the reference for most of the utility procedures provided by `(guix build utils)`.

8.7.1 Dealing with Store File Names

This section documents procedures that deal with store file names.

`%store-directory` [Procedure]
Return the directory name of the store.

`store-file-name?` *file* [Procedure]
Return true if *file* is in the store.

`strip-store-file-name` *file* [Procedure]
Strip the `/gnu/store` and hash from *file*, a store file name. The result is typically a "*package-version*" string.

`package-name->name+version` *name* [Procedure]
Given *name*, a package name like `"foo-0.9.1b"`, return two values: `"foo"` and `"0.9.1b"`. When the version part is unavailable, *name* and `#f` are returned. The first hyphen followed by a digit is considered to introduce the version part.

8.7.2 File Types

The procedures below deal with files and file types.

`directory-exists?` *dir* [Procedure]
Return `#t` if *dir* exists and is a directory.

`executable-file?` *file* [Procedure]
Return `#t` if *file* exists and is executable.

`symbolic-link?` *file* [Procedure]
Return `#t` if *file* is a symbolic link (aka. a "symlink").

`elf-file?` *file* [Procedure]
`ar-file?` *file* [Procedure]
`gzip-file?` *file* [Procedure]
Return `#t` if *file* is, respectively, an ELF file, an `ar` archive (such as a `.a` static library), or a gzip file.

`reset-gzip-timestamp` *file* [*#:keep-mtime? #t*] [Procedure]
If *file* is a gzip file, reset its embedded timestamp (as with `gzip --no-name`) and return true. Otherwise return `#f`. When *keep-mtime?* is true, preserve *file*'s modification time.

8.7.3 File Manipulation

The following procedures and macros help create, modify, and delete files. They provide functionality comparable to common shell utilities such as `mkdir -p`, `cp -r`, `rm -r`, and `sed`. They complement Guile's extensive, but low-level, file system interface (veja Seção "POSIX" em *GNU Guile Reference Manual*).

`with-directory-excursion` *directory body ...* [Macro]

Run *body* with *directory* as the process's current directory.

Essentially, this macro changes the current directory to *directory* before evaluating *body*, using `chdir` (veja Seção "Processes" em *GNU Guile Reference Manual*). It changes back to the initial directory when the dynamic extent of *body* is left, be it *via* normal procedure return or *via* a non-local exit such as an exception.

`mkdir-p` *dir* [Procedure]

Create directory *dir* and all its ancestors.

`install-file` *file directory* [Procedure]

Create *directory* if it does not exist and copy *file* in there under the same name.

`make-file-writable` *file* [Procedure]

Make *file* writable for its owner.

`copy-recursively` *source destination* [*#:log* (*current-output-port*)] [Procedure]
[*#:follow-symlinks? #f*] [*#:copy-file*

copy-file] [#:keep-mtime? #f] [#:keep-permissions? #t] [#:select? (const #t)] Copy *source* directory to *destination*. Follow symlinks if *follow-symlinks?* is true; otherwise, just preserve them. Call *copy-file* to copy regular files. Call *select?*, taking two arguments, *file* and *stat*, for each entry in *source*, where *file* is the entry's absolute file name and *stat* is the result of `lstat` (or `stat` if *follow-symlinks?* is true); exclude entries for which *select?* does not return true. When *keep-mtime?* is true, keep the modification time of the files in *source* on those of *destination*. When *keep-permissions?* is true, preserve file permissions. Write verbose output to the *log* port.

`delete-file-recursively` *dir* [*#:follow-mounts? #f*] [Procedure]

Delete *dir* recursively, like `rm -rf`, without following symlinks. Don't follow mount points either, unless *follow-mounts?* is true. Report but ignore errors.

`substitute*` *file* ((*regexp match-var...*) *body...*) ... *Substitute* [Macro]
`regexp` *in*

file by the string returned by *body*. *body* is evaluated with each *match-var* bound to the corresponding positional regexp sub-expression. For example:

```
(substitute* file
  (("hello")
   "good morning\n")
  (("foo([a-z]+)bar(.*)$" all letters end)
   (string-append "baz" letters end)))
```

Here, anytime a line of *file* contains `hello`, it is replaced by `good morning`. Anytime a line of *file* matches the second regexp, `all` is bound to the complete match, `letters` is bound to the first sub-expression, and `end` is bound to the last one.

When one of the *match-var* is `_`, no variable is bound to the corresponding match substring.

Alternatively, *file* may be a list of file names, in which case they are all subject to the substitutions.

Be careful about using `$` to match the end of a line; by itself it won't match the terminating newline of a line. For example, to match a whole line ending with a backslash, one needs a regex like `"(.*)\\\\\n$"`.

8.7.4 File Search

This section documents procedures to search and filter files.

`file-name-predicate` *regexp* [Procedure]

Return a predicate that returns true when passed a file name whose base name matches *regexp*.

`find-files` *dir* [*pred*] [*#:stat lstat*] [*#:directories? #f*] [*#:fail-on-error? #f*] *Return the* [Procedure]

lexicographically sorted list of files under *dir* for which *pred* returns true. *pred* is passed two arguments: the absolute file name, and its stat buffer; the default predicate always returns true. *pred* can also be a regular expression, in which case it is equivalent to `(file-name-predicate pred)`. *stat* is used to obtain file information; using `lstat` means that symlinks are not followed. If *directories?* is true, then directories will also be included. If *fail-on-error?* is true, raise an exception upon error.

Here are a few examples where we assume that the current directory is the root of the Guix source tree:

```
;; List all the regular files in the current directory.
(find-files ".")
⇒ ("./.dir-locals.el" "./.gitignore" ...)

;; List all the .scm files under gnu/services.
(find-files "gnu/services" "\\.scm$")
⇒ ("gnu/services/admin.scm" "gnu/services/audio.scm" ...)

;; List ar files in the current directory.
(find-files "." (lambda (file stat) (ar-file? file)))
⇒ ("./libformat.a" "./libstore.a" ...)
```

`which` *program* [Procedure]

Return the complete file name for *program* as found in `$PATH`, or `#f` if *program* could not be found.

`search-input-file` *inputs name* [Procedure]

`search-input-directory` *inputs name* [Procedure]

Return the complete file name for *name* as found in *inputs*; `search-input-file` searches for a regular file and `search-input-directory` searches for a directory. If *name* could not be found, an exception is raised.

Here, *inputs* must be an association list like `inputs` and `native-inputs` as available to build phases (veja Seção 8.6 [Fases de construção], Página 141).

Here is a (simplified) example of how `search-input-file` is used in a build phase of the `wireguard-tools` package:

```
(add-after 'install 'wrap-wg-quick
  (lambda* (#:key inputs outputs #:allow-other-keys)
    (let ((coreutils (string-append (assoc-ref inputs "coreutils")
                                    "/bin")))
      (wrap-program (search-input-file outputs "bin/wg-quick")
        #:sh (search-input-file inputs "bin/bash")
        `("PATH" ":" prefix ,(list coreutils))))))
```

8.7.5 Program Invocation

You'll find handy procedures to spawn processes in this module, essentially convenient wrappers around Guile's `system*` (veja Seção "Processes" em *GNU Guile Reference Manual*).

`invoke` *program args...* [Procedure]

Invoke *program* with the given *args*. Raise an `&invoke-error` exception if the exit code is non-zero; otherwise return `#t`.

The advantage compared to `system*` is that you do not need to check the return value. This reduces boilerplate in shell-script-like snippets for instance in package build phases.

`invoke-error?` *c* [Procedure]

Return true if *c* is an `&invoke-error` condition.

`invoke-error-program` *c* [Procedure]
`invoke-error-arguments` *c* [Procedure]
`invoke-error-exit-status` *c* [Procedure]
`invoke-error-term-signal` *c* [Procedure]
`invoke-error-stop-signal` *c* [Procedure]

Access specific fields of *c*, an `&invoke-error` condition.

`report-invoke-error` *c* [*port*] [Procedure]

Report to *port* (by default the current error port) about *c*, an `&invoke-error` condition, in a human-friendly way.

Typical usage would look like this:

```
(use-modules (srfi srfi-34) ;for 'guard'
             (guix build utils))

(guard (c ((invoke-error? c)
           (report-invoke-error c)))
  (invoke "date" "--imaginary-option"))

⊣ command "date" "--imaginary-option" failed with status 1
```

`invoke/quiet` *program args...* [Procedure]

Invoke *program* with *args* and capture *program*'s standard output and standard error. If *program* succeeds, print nothing and return the unspecified value; otherwise, raise a `&message` error condition that includes the status code and the output of *program*.

Here's an example:

```
(use-modules (srfi srfi-34) ;for 'guard'
             (srfi srfi-35) ;for 'message-condition?'
             (guix build utils))

(guard (c ((message-condition? c)
           (display (condition-message c))))
  (invoke/quiet "date")  ;all is fine
  (invoke/quiet "date" "--imaginary-option"))

⊣ 'date --imaginary-option' exited with status 1; output follows:

    date: unrecognized option '--imaginary-option'
    Try 'date --help' for more information.
```

8.7.6 Fases de construção

The `(guix build utils)` also contains tools to manipulate build phases as used by build systems (veja Seção 8.5 [Sistemas de compilação], Página 121). Build phases are represented as association lists or "alists" (veja Seção "Association Lists" em *GNU Guile Reference Manual*) where each key is a symbol naming the phase and the associated value is a procedure (veja Seção 8.6 [Fases de construção], Página 141).

Guile core and the `(srfi srfi-1)` module both provide tools to manipulate alists. The `(guix build utils)` module complements those with tools written with build phases in mind.

`modify-phases` *phases clause...* [Macro]

Modify *phases* sequentially as per each *clause*, which may have one of the following forms:

```
(delete old-phase-name)
(replace old-phase-name new-phase)
(add-before old-phase-name new-phase-name new-phase)
(add-after old-phase-name new-phase-name new-phase)
```

Where every *phase-name* above is an expression evaluating to a symbol, and *new-phase* an expression evaluating to a procedure.

The example below is taken from the definition of the `grep` package. It adds a phase to run after the `install` phase, called `fix-egrep-and-fgrep`. That phase is a procedure (`lambda*` is for anonymous procedures) that takes a `#:outputs` keyword argument and ignores extra keyword arguments (veja Seção "Optional Arguments" em *GNU Guile Reference Manual*, for more on `lambda*` and optional and keyword arguments.) The phase uses `substitute*` to modify the installed `egrep` and `fgrep` scripts so that they refer to `grep` by its absolute file name:

```
(modify-phases %standard-phases
  (add-after 'install 'fix-egrep-and-fgrep
    ;; Patch 'egrep' and 'fgrep' to execute 'grep' via its
    ;; absolute file name instead of searching for it in $PATH.
```

```
(lambda* (#:key outputs #:allow-other-keys)
  (let* ((out (assoc-ref outputs "out"))
         (bin (string-append out "/bin")))
    (substitute* (list (string-append bin "/egrep")
                       (string-append bin "/fgrep"))
      (("^exec grep")
       (string-append "exec " bin "/grep")))))))
```

In the example below, phases are modified in two ways: the standard `configure` phase is deleted, presumably because the package does not have a `configure` script or anything similar, and the default `install` phase is replaced by one that manually copies the executable files to be installed:

```
(modify-phases %standard-phases
  (delete 'configure)      ;no 'configure' script
  (replace 'install
    (lambda* (#:key outputs #:allow-other-keys)
      ;; The package's Makefile doesn't provide an "install"
      ;; rule so do it by ourselves.
      (let ((bin (string-append (assoc-ref outputs "out")
                                "/bin")))
        (install-file "footswitch" bin)
        (install-file "scythe" bin)))))
```

8.7.7 Wrappers

It is not unusual for a command to require certain environment variables to be set for proper functioning, typically search paths (veja Seção 8.8 [Caminhos de pesquisa], Página 151). Failing to do that, the command might fail to find files or other commands it relies on, or it might pick the "wrong" ones—depending on the environment in which it runs. Examples include:

- a shell script that assumes all the commands it uses are in `PATH`;
- a Guile program that assumes all its modules are in `GUILE_LOAD_PATH` and `GUILE_LOAD_COMPILED_PATH`;
- a Qt application that expects to find certain plugins in `QT_PLUGIN_PATH`.

For a package writer, the goal is to make sure commands always work the same rather than depend on some external settings. One way to achieve that is to *wrap* commands in a thin script that sets those environment variables, thereby ensuring that those run-time dependencies are always found. The wrapper would be used to set `PATH`, `GUILE_LOAD_PATH`, or `QT_PLUGIN_PATH` in the examples above.

To ease that task, the `(guix build utils)` module provides a couple of helpers to wrap commands.

`wrap-program` *program* [*#:sh sh*] [*#:rest variables*] [Procedure]

Make a wrapper for *program*. *variables* should look like this:

```
'(variable delimiter position list-of-directories)
```

where *delimiter* is optional. `:` will be used if *delimiter* is not given.

For example, this call:

```
(wrap-program "foo"
              '("PATH" ":" = ("/gnu/.../bar/bin"))
              '("CERT_PATH" suffix ("/gnu/.../baz/certs"
                                    "/qux/certs")))
```

will copy `foo` to `.foo-real` and create the file `foo` with the following contents:

```
#!location/of/bin/bash
export PATH="/gnu/.../bar/bin"
export CERT_PATH="$CERT_PATH${CERT_PATH:+:}/gnu/.../baz/certs:/qux/certs"
exec -a $0 location/of/.foo-real "$@"
```

If *program* has previously been wrapped by `wrap-program`, the wrapper is extended with definitions for *variables*. If it is not, *sh* will be used as the interpreter.

`wrap-script` *program* [*#:guile guile*] [*#:rest variables*] [Procedure]

Wrap the script *program* such that *variables* are set first. The format of *variables* is the same as in the `wrap-program` procedure. This procedure differs from `wrap-program` in that it does not create a separate shell script. Instead, *program* is modified directly by prepending a Guile script, which is interpreted as a comment in the script's language.

Special encoding comments as supported by Python are recreated on the second line.

Note that this procedure can only be used once per file as Guile scripts are not supported.

8.8 Caminhos de pesquisa

Many programs and libraries look for input data in a *search path*, a list of directories: shells like Bash look for executables in the command search path, a C compiler looks for `.h` files in its header search path, the Python interpreter looks for `.py` files in its search path, the spell checker has a search path for dictionaries, and so on.

Search paths can usually be defined or overridden *via* environment variables (veja Seção "Environment Variables" em *The GNU C Library Reference Manual*). For example, the search paths mentioned above can be changed by defining the `PATH`, `C_INCLUDE_PATH`, `PYTHONPATH` (or `GUIX_PYTHONPATH`), and `DICPATH` environment variables—you know, all these something-PATH variables that you need to get right or things "won't be found".

You may have noticed from the command line that Guix "knows" which search path environment variables should be defined, and how. When you install packages in your default profile, the file `~/.guix-profile/etc/profile` is created, which you can "source" from the shell to set those variables. Likewise, if you ask `guix shell` to create an environment containing Python and NumPy, a Python library, and if you pass it the `--search-paths` option, it will tell you about `PATH` and `GUIX_PYTHONPATH` (veja Seção 7.1 [Invocando guix shell], Página 79):

```
$ guix shell python python-numpy --pure --search-paths
export PATH="/gnu/store/...-profile/bin"
export GUIX_PYTHONPATH="/gnu/store/...-profile/lib/python3.9/site-packages"
```

When you omit `--search-paths`, it defines these environment variables right away, such that Python can readily find NumPy:

```
$ guix shell python python-numpy -- python3
```

```
Python 3.9.6 (default, Jan  1 1970, 00:00:01)
[GCC 10.3.0] on linux
Type "help", "copyright", "credits" or "license" for more information.
>>> import numpy
>>> numpy.version.version
'1.20.3'
```

For this to work, the definition of the `python` package *declares* the search path it cares about and its associated environment variable, `GUIX_PYTHONPATH`. It looks like this:

```
(package
  (name "python")
  (version "3.9.9")
  ;; some fields omitted...
  (native-search-paths
   (list (search-path-specification
          (variable "GUIX_PYTHONPATH")
          (files (list "lib/python/3.9/site-packages"))))))
```

What this `native-search-paths` field says is that, when the `python` package is used, the `GUIX_PYTHONPATH` environment variable must be defined to include all the `lib/python/3.9/site-packages` sub-directories encountered in its environment. (The `native-` bit means that, if we are in a cross-compilation environment, only native inputs may be added to the search path; veja Seção 8.2.1 [Referência do package], Página 104.) In the NumPy example above, the profile where `python` appears contains exactly one such sub-directory, and `GUIX_PYTHONPATH` is set to that. When there are several `lib/python/3.9/site-packages`—this is the case in package build environments—they are all added to `GUIX_PYTHONPATH`, separated by colons (`:`).

> **Nota:** Notice that `GUIX_PYTHONPATH` is specified as part of the definition of the `python` package, and *not* as part of that of `python-numpy`. This is because this environment variable "belongs" to Python, not NumPy: Python actually reads the value of that variable and honors it.
>
> Corollary: if you create a profile that does not contain `python`, `GUIX_PYTHONPATH` will *not* be defined, even if it contains packages that provide `.py` files:
>
> ```
> $ guix shell python-numpy --search-paths --pure
> export PATH="/gnu/store/...-profile/bin"
> ```
>
> This makes a lot of sense if we look at this profile in isolation: no software in this profile would read `GUIX_PYTHONPATH`.

Of course, there are many variations on that theme: some packages honor more than one search path, some use separators other than colon, some accumulate several directories in their search path, and so on. A more complex example is the search path of libxml2: the value of the `XML_CATALOG_FILES` environment variable is space-separated, it must contain a list of `catalog.xml` files (not directories), which are to be found in `xml` sub-directories—nothing less. The search path specification looks like this:

```
(search-path-specification
 (variable "XML_CATALOG_FILES")
 (separator " ")
```

```
(files '("xml"))
(file-pattern "^catalog\\.xml$")
(file-type 'regular))
```

Worry not, search path specifications are usually not this tricky.

The `(guix search-paths)` module defines the data type of search path specifications and a number of helper procedures. Below is the reference of search path specifications.

`search-path-specification` [Data Type]

The data type for search path specifications.

`variable` The name of the environment variable for this search path (a string).

`files` The list of sub-directories (strings) that should be added to the search path.

`separator` (default: `":"`)
The string used to separate search path components.

As a special case, a `separator` value of `#f` specifies a "single-component search path"—in other words, a search path that cannot contain more than one element. This is useful in some cases, such as the `SSL_CERT_DIR` variable (honored by OpenSSL, cURL, and a few other packages) or the `ASPELL_DICT_DIR` variable (honored by the GNU Aspell spell checker), both of which must point to a single directory.

`file-type` (default: `'directory`)
The type of file being matched—`'directory` or `'regular`, though it can be any symbol returned by `stat:type` (veja Seção "File System" em *GNU Guile Reference Manual*).

In the `XML_CATALOG_FILES` example above, we would match regular files; in the Python example, we would match directories.

`file-pattern` (default: `#f`)
This must be either `#f` or a regular expression specifying files to be matched *within* the sub-directories specified by the `files` field.

Again, the `XML_CATALOG_FILES` example shows a situation where this is needed.

Some search paths are not tied by a single package but to many packages. To reduce duplications, some of them are pre-defined in `(guix search-paths)`.

`$SGML_CATALOG_FILES` [Variável]
`$XML_CATALOG_FILES` [Variável]

These two search paths indicate where the TR9401 catalog (`https://www.oasis-open.org/specs/a401.htm`)[4] or XML catalog (`https://www.oasis-open.org/committees/download.php/14809/xml-catalogs.html`) files can be found.

`$SSL_CERT_DIR` [Variável]
`$SSL_CERT_FILE` [Variável]

These two search paths indicate where X.509 certificates can be found (veja Seção 11.12 [Certificados X.509], Página 604).

[4] Alternatively known as SGML catalog.

These pre-defined search paths can be used as in the following example:

```
(package
  (name "curl")
  ;; some fields omitted ...
  (native-search-paths (list $SSL_CERT_DIR $SSL_CERT_FILE)))
```

How do you turn search path specifications on one hand and a bunch of directories on the other hand in a set of environment variable definitions? That's the job of `evaluate-search-paths`.

`evaluate-search-paths` *search-paths directories* [*getenv*] [Procedure]
Evaluate *search-paths*, a list of search-path specifications, for *directories*, a list of directory names, and return a list of specification/value pairs. Use *getenv* to determine the current settings and report only settings not already effective.

The `(guix profiles)` provides a higher-level helper procedure, `load-profile`, that sets the environment variables of a profile.

8.9 O armazém

Conceptually, the *store* is the place where derivations that have been built successfully are stored—by default, `/gnu/store`. Sub-directories in the store are referred to as *store items* or sometimes *store paths*. The store has an associated database that contains information such as the store paths referred to by each store path, and the list of *valid* store items—results of successful builds. This database resides in *`localstatedir`*`/guix/db`, where *localstatedir* is the state directory specified *via* `--localstatedir` at configure time, usually `/var`.

The store is *always* accessed by the daemon on behalf of its clients (veja Seção 2.3 [Invocando guix-daemon], Página 13). To manipulate the store, clients connect to the daemon over a Unix-domain socket, send requests to it, and read the result—these are remote procedure calls, or RPCs.

> **Nota:** Users must *never* modify files under `/gnu/store` directly. This would lead to inconsistencies and break the immutability assumptions of Guix's functional model (veja Capítulo 1 [Introdução], Página 1).
>
> Veja Seção 5.6 [Invocando guix gc], Página 54, for information on how to check the integrity of the store and attempt recovery from accidental modifications.

The `(guix store)` module provides procedures to connect to the daemon, and to perform RPCs. These are described below. By default, `open-connection`, and thus all the `guix` commands, connect to the local daemon or to the URI specified by the `GUIX_DAEMON_SOCKET` environment variable.

`GUIX_DAEMON_SOCKET` [Environment Variable]
When set, the value of this variable should be a file name or a URI designating the daemon endpoint. When it is a file name, it denotes a Unix-domain socket to connect to. In addition to file names, the supported URI schemes are:

`file`
`unix` These are for Unix-domain sockets. `file:///var/guix/daemon-socket/socket` is equivalent to `/var/guix/daemon-socket/socket`.

`guix` These URIs denote connections over TCP/IP, without encryption nor authentication of the remote host. The URI must specify the host name and optionally a port number (by default port 44146 is used):

```
guix://master.guix.example.org:1234
```

This setup is suitable on local networks, such as clusters, where only trusted nodes may connect to the build daemon at `master.guix.example.org`.

The `--listen` option of `guix-daemon` can be used to instruct it to listen for TCP connections (veja Seção 2.3 [Invocando guix-daemon], Página 13).

`ssh` These URIs allow you to connect to a remote daemon over SSH. This feature requires Guile-SSH (veja Seção 22.1 [Requisitos], Página 720) and a working `guile` binary in `PATH` on the destination machine. It supports public key and GSSAPI authentication. A typical URL might look like this:

```
ssh://charlie@guix.example.org:22
```

As for `guix copy`, the usual OpenSSH client configuration files are honored (veja Seção 9.13 [Invocando guix copy], Página 227).

Additional URI schemes may be supported in the future.

> **Nota:** The ability to connect to remote build daemons is considered experimental as of ba3a031. Please get in touch with us to share any problems or suggestions you may have (veja Capítulo 22 [Contribuindo], Página 720).

`open-connection` [*uri*] [*#:reserve-space? #t*] [Procedure]
Connect to the daemon over the Unix-domain socket at *uri* (a string). When *reserve-space?* is true, instruct it to reserve a little bit of extra space on the file system so that the garbage collector can still operate should the disk become full. Return a server object.

file defaults to `%default-socket-path`, which is the normal location given the options that were passed to `configure`.

`close-connection` *server* [Procedure]
Close the connection to *server*.

`current-build-output-port` [Variável]
This variable is bound to a SRFI-39 parameter, which refers to the port where build and error logs sent by the daemon should be written.

Procedures that make RPCs all take a server object as their first argument.

`valid-path?` *server path* [Procedure]
Return `#t` when *path* designates a valid store item and `#f` otherwise (an invalid item may exist on disk but still be invalid, for instance because it is the result of an aborted or failed build).

A `&store-protocol-error` condition is raised if *path* is not prefixed by the store directory (`/gnu/store`).

`add-text-to-store` *server name text* [*references*] [Procedure]
Add *text* under file *name* in the store, and return its store path. *references* is the list of store paths referred to by the resulting store path.

`build-derivations` *store derivations* [*mode*] [Procedure]
Build *derivations*, a list of `<derivation>` objects, `.drv` file names, or derivation/output pairs, using the specified *mode*—`(build-mode normal)` by default.

Note that the `(guix monads)` module provides a monad as well as monadic versions of the above procedures, with the goal of making it more convenient to work with code that accesses the store (veja Seção 8.11 [A mônada do armazém], Página 158).

This section is currently incomplete.

8.10 Derivações

Low-level build actions and the environment in which they are performed are represented by *derivations*. A derivation contains the following pieces of information:

- The outputs of the derivation—derivations produce at least one file or directory in the store, but may produce more.
- The inputs of the derivation—i.e., its build-time dependencies—which may be other derivations or plain files in the store (patches, build scripts, etc.).
- The system type targeted by the derivation—e.g., `x86_64-linux`.
- The file name of a build script in the store, along with the arguments to be passed.
- A list of environment variables to be defined.

Derivations allow clients of the daemon to communicate build actions to the store. They exist in two forms: as an in-memory representation, both on the client- and daemon-side, and as files in the store whose name end in `.drv`—these files are referred to as *derivation paths*. Derivations paths can be passed to the `build-derivations` procedure to perform the build actions they prescribe (veja Seção 8.9 [O armazém], Página 154).

Operations such as file downloads and version-control checkouts for which the expected content hash is known in advance are modeled as *fixed-output derivations*. Unlike regular derivations, the outputs of a fixed-output derivation are independent of its inputs—e.g., a source code download produces the same result regardless of the download method and tools being used.

The outputs of derivations—i.e., the build results—have a set of *references*, as reported by the `references` RPC or the `guix gc --references` command (veja Seção 5.6 [Invocando guix gc], Página 54). References are the set of run-time dependencies of the build results. References are a subset of the inputs of the derivation; this subset is automatically computed by the build daemon by scanning all the files in the outputs.

The `(guix derivations)` module provides a representation of derivations as Scheme objects, along with procedures to create and otherwise manipulate derivations. The lowest-level primitive to create a derivation is the `derivation` procedure:

`derivation` *store name builder args* [*#:outputs '("out")*] [*#:hash #f*] [*#:hash-algo #f*] [*#:recursive? #f*] [#:inputs '()] [#:env-vars '()] [#:system (%current-system)] [#:references-graphs #f] [#:allowed-references #f] [#:disallowed-references #f] [#:leaked-env-vars #f] [#:local-build? #f] [#:substitutable? #t] [#:properties '()] [Procedure]

Build a derivation with the given arguments, and return the resulting `<derivation>` object.

When *hash* and *hash-algo* are given, a *fixed-output derivation* is created—i.e., one whose result is known in advance, such as a file download. If, in addition, *recursive?* is true, then that fixed output may be an executable file or a directory and *hash* must be the hash of an archive containing this output.

When *references-graphs* is true, it must be a list of file name/store path pairs. In that case, the reference graph of each store path is exported in the build environment in the corresponding file, in a simple text format.

When *allowed-references* is true, it must be a list of store items or outputs that the derivation's output may refer to. Likewise, *disallowed-references*, if true, must be a list of things the outputs may *not* refer to.

When *leaked-env-vars* is true, it must be a list of strings denoting environment variables that are allowed to "leak" from the daemon's environment to the build environment. This is only applicable to fixed-output derivations—i.e., when *hash* is true. The main use is to allow variables such as `http_proxy` to be passed to derivations that download files.

When *local-build?* is true, declare that the derivation is not a good candidate for offloading and should rather be built locally (veja Seção 2.2.2 [Configuração de descarregamento de daemon], Página 8). This is the case for small derivations where the costs of data transfers would outweigh the benefits.

When *substitutable?* is false, declare that substitutes of the derivation's output should not be used (veja Seção 5.3 [Substitutos], Página 47). This is useful, for instance, when building packages that capture details of the host CPU instruction set.

properties must be an association list describing "properties" of the derivation. It is kept as-is, uninterpreted, in the derivation.

Here's an example with a shell script as its builder, assuming *store* is an open connection to the daemon, and *bash* points to a Bash executable in the store:

```
(use-modules (guix utils)
             (guix store)
             (guix derivations))

(let ((builder   ; add the Bash script to the store
        (add-text-to-store store "my-builder.sh"
                           "echo hello world > $out\n" '())))
  (derivation store "foo"
              bash `("-e" ,builder)
              #:inputs `((,bash) (,builder))
              #:env-vars '(("HOME" . "/homeless"))))
⇒ #<derivation /gnu/store/...-foo.drv => /gnu/store/...-foo>
```

As can be guessed, this primitive is cumbersome to use directly. A better approach is to write build scripts in Scheme, of course! The best course of action for that is to write the build code as a "G-expression", and to pass it to `gexp->derivation`. For more information, veja Seção 8.12 [Expressões-G], Página 163.

Once upon a time, `gexp->derivation` did not exist and constructing derivations with build code written in Scheme was achieved with `build-expression->derivation`, documented below. This procedure is now deprecated in favor of the much nicer `gexp->derivation`.

`build-expression->derivation` *store name exp* [*#:system* (*%current-system*)] [*#:inputs* '()] [*#:outputs* '("out")] [*#:hash* #f] [#:hash-algo #f] [#:recursive? #f] [#:env-vars '()] [#:modules '()] [#:references-graphs #f] [#:allowed-references #f] [#:disallowed-references #f] [#:local-build? #f] [#:substitutable? #t] [#:guile-for-build #f] [Procedure]

Return a derivation that executes Scheme expression *exp* as a builder for derivation *name*. *inputs* must be a list of `(name drv-path sub-drv)` tuples; when *sub-drv* is omitted, `"out"` is assumed. *modules* is a list of names of Guile modules from the current search path to be copied in the store, compiled, and made available in the load path during the execution of *exp*—e.g., `((guix build utils) (guix build gnu-build-system))`.

exp is evaluated in an environment where `%outputs` is bound to a list of output/path pairs, and where `%build-inputs` is bound to a list of string/output-path pairs made from *inputs*. Optionally, *env-vars* is a list of string pairs specifying the name and value of environment variables visible to the builder. The builder terminates by passing the result of *exp* to `exit`; thus, when *exp* returns `#f`, the build is considered to have failed.

exp is built using *guile-for-build* (a derivation). When *guile-for-build* is omitted or is `#f`, the value of the `%guile-for-build` fluid is used instead.

See the `derivation` procedure for the meaning of *references-graphs*, *allowed-references*, *disallowed-references*, *local-build?*, and *substitutable?*.

Here's an example of a single-output derivation that creates a directory containing one file:

```
(let ((builder '(let ((out (assoc-ref %outputs "out")))
                  (mkdir out)    ; create /gnu/store/...-goo
                  (call-with-output-file (string-append out "/test")
                    (lambda (p)
                      (display '(hello guix) p))))))
  (build-expression->derivation store "goo" builder))

⇒ #<derivation /gnu/store/...-goo.drv => ...>
```

8.11 A mônada do armazém

The procedures that operate on the store described in the previous sections all take an open connection to the build daemon as their first argument. Although the underlying model is functional, they either have side effects or depend on the current state of the store.

The former is inconvenient: the connection to the build daemon has to be carried around in all those functions, making it impossible to compose functions that do not take that

parameter with functions that do. The latter can be problematic: since store operations have side effects and/or depend on external state, they have to be properly sequenced.

This is where the `(guix monads)` module comes in. This module provides a framework for working with *monads*, and a particularly useful monad for our uses, the *store monad*. Monads are a construct that allows two things: associating "context" with values (in our case, the context is the store), and building sequences of computations (here computations include accesses to the store). Values in a monad—values that carry this additional context—are called *monadic values*; procedures that return such values are called *monadic procedures*.

Consider this "normal" procedure:

```
(define (sh-symlink store)
  ;; Return a derivation that symlinks the 'bash' executable.
  (let* ((drv (package-derivation store bash))
         (out (derivation->output-path drv))
         (sh  (string-append out "/bin/bash")))
    (build-expression->derivation store "sh"
                                  `(symlink ,sh %output))))
```

Using `(guix monads)` and `(guix gexp)`, it may be rewritten as a monadic function:

```
(define (sh-symlink)
  ;; Same, but return a monadic value.
  (mlet %store-monad ((drv (package->derivation bash)))
    (gexp->derivation "sh"
                      #~(symlink (string-append #$drv "/bin/bash")
                                 #$output))))
```

There are several things to note in the second version: the `store` parameter is now implicit and is "threaded" in the calls to the `package->derivation` and `gexp->derivation` monadic procedures, and the monadic value returned by `package->derivation` is *bound* using `mlet` instead of plain `let`.

As it turns out, the call to `package->derivation` can even be omitted since it will take place implicitly, as we will see later (veja Seção 8.12 [Expressões-G], Página 163):

```
(define (sh-symlink)
  (gexp->derivation "sh"
                    #~(symlink (string-append #$bash "/bin/bash")
                               #$output)))
```

Calling the monadic `sh-symlink` has no effect. As someone once said, "you exit a monad like you exit a building on fire: by running". So, to exit the monad and get the desired effect, one must use `run-with-store`:

```
(run-with-store (open-connection) (sh-symlink))
⇒ /gnu/store/...-sh-symlink
```

Note that the `(guix monad-repl)` module extends the Guile REPL with new "commands" to make it easier to deal with monadic procedures: `run-in-store`, and `enter-store-monad` (veja Seção 8.14 [Using Guix Interactively], Página 174). The former is used to "run" a single monadic value through the store:

```
scheme@(guile-user)> ,run-in-store (package->derivation hello)
```

```
$1 = #<derivation /gnu/store/...-hello-2.9.drv => ...>
```

The latter enters a recursive REPL, where all the return values are automatically run through the store:

```
scheme@(guile-user)> ,enter-store-monad
store-monad@(guile-user) [1]> (package->derivation hello)
$2 = #<derivation /gnu/store/...-hello-2.9.drv => ...>
store-monad@(guile-user) [1]> (text-file "foo" "Hello!")
$3 = "/gnu/store/...-foo"
store-monad@(guile-user) [1]> ,q
scheme@(guile-user)>
```

Note that non-monadic values cannot be returned in the `store-monad` REPL.

Other meta-commands are available at the REPL, such as `,build` to build a file-like object (veja Seção 8.14 [Using Guix Interactively], Página 174).

The main syntactic forms to deal with monads in general are provided by the `(guix monads)` module and are described below.

`with-monad` *monad body ...* [Macro]
: Evaluate any `>>=` or `return` forms in *body* as being in *monad*.

`return` *val* [Macro]
: Return a monadic value that encapsulates *val*.

`>>=` *mval mproc ...* [Macro]
: *Bind* monadic value *mval*, passing its "contents" to monadic procedures *mproc*...[5]. There can be one *mproc* or several of them, as in this example:

```
(run-with-state
    (with-monad %state-monad
      (>>= (return 1)
           (lambda (x) (return (+ 1 x)))
           (lambda (x) (return (* 2 x)))))
  'some-state)

⇒ 4
⇒ some-state
```

`mlet` *monad* ((*var mval*) ...) *body ...* [Macro]
`mlet*` *monad* ((*var mval*) ...) *body ...* [Macro]
: Bind the variables *var* to the monadic values *mval* in *body*, which is a sequence of expressions. As with the bind operator, this can be thought of as "unpacking" the raw, non-monadic value "contained" in *mval* and making *var* refer to that raw, non-monadic value within the scope of the *body*. The form (*var* `->` *val*) binds *var* to the "normal" value *val*, as per `let`. The binding operations occur in sequence from left to right. The last expression of *body* must be a monadic expression, and its result will become the result of the `mlet` or `mlet*` when run in the *monad*.

[5] This operation is commonly referred to as "bind", but that name denotes an unrelated procedure in Guile. Thus we use this somewhat cryptic symbol inherited from the Haskell language.

`mlet*` is to `mlet` what `let*` is to `let` (veja Seção "Local Bindings" em *GNU Guile Reference Manual*).

`mbegin` *monad mexp ...* [Macro]
Bind *mexp* and the following monadic expressions in sequence, returning the result of the last expression. Every expression in the sequence must be a monadic expression.

This is akin to `mlet`, except that the return values of the monadic expressions are ignored. In that sense, it is analogous to `begin`, but applied to monadic expressions.

`mwhen` *condition mexp0 mexp* ...* [Macro]
When *condition* is true, evaluate the sequence of monadic expressions *mexp0..mexp** as in an `mbegin`. When *condition* is false, return `*unspecified*` in the current monad. Every expression in the sequence must be a monadic expression.

`munless` *condition mexp0 mexp* ...* [Macro]
When *condition* is false, evaluate the sequence of monadic expressions *mexp0..mexp** as in an `mbegin`. When *condition* is true, return `*unspecified*` in the current monad. Every expression in the sequence must be a monadic expression.

The `(guix monads)` module provides the *state monad*, which allows an additional value—the state—to be *threaded* through monadic procedure calls.

`%state-monad` [Variável]
The state monad. Procedures in the state monad can access and change the state that is threaded.

Consider the example below. The `square` procedure returns a value in the state monad. It returns the square of its argument, but also increments the current state value:

```
(define (square x)
  (mlet %state-monad ((count (current-state)))
    (mbegin %state-monad
      (set-current-state (+ 1 count))
      (return (* x x)))))

(run-with-state (sequence %state-monad (map square (iota 3))) 0)
⇒ (0 1 4)
⇒ 3
```

When "run" through `%state-monad`, we obtain that additional state value, which is the number of `square` calls.

`current-state` [Monadic Procedure]
Return the current state as a monadic value.

`set-current-state` *value* [Monadic Procedure]
Set the current state to *value* and return the previous state as a monadic value.

`state-push` *value* [Monadic Procedure]
Push *value* to the current state, which is assumed to be a list, and return the previous state as a monadic value.

`state-pop` [Monadic Procedure]
Pop a value from the current state and return it as a monadic value. The state is assumed to be a list.

`run-with-state` *mval* [*state*] [Procedure]
Run monadic value *mval* starting with *state* as the initial state. Return two values: the resulting value, and the resulting state.

The main interface to the store monad, provided by the `(guix store)` module, is as follows.

`%store-monad` [Variável]
The store monad—an alias for `%state-monad`.

Values in the store monad encapsulate accesses to the store. When its effect is needed, a value of the store monad must be "evaluated" by passing it to the `run-with-store` procedure (see below).

`run-with-store` *store mval* [*#:guile-for-build*] [*#:system* (*%current-system*)] [Procedure]
Run `mval`, a monadic value in the store monad, in *store*, an open store connection.

`text-file` *`name text`* [*`references`*] [Monadic Procedure]
Return as a monadic value the absolute file name in the store of the file containing *text*, a string. *references* is a list of store items that the resulting text file refers to; it defaults to the empty list.

`binary-file` *`name data`* [*`references`*] [Monadic Procedure]
Return as a monadic value the absolute file name in the store of the file containing *data*, a bytevector. *references* is a list of store items that the resulting binary file refers to; it defaults to the empty list.

`interned-file` *`file`* [*`name`*] [*#:recursive? #t*] [*#:select?* (*const #t*)] [Monadic Procedure]
Return the name of `file` once interned in the store. Use *name* as its store name, or the basename of *file* if *name* is omitted.

When *recursive?* is true, the contents of *file* are added recursively; if *file* designates a flat file and *recursive?* is true, its contents are added, and its permission bits are kept.

When *recursive?* is true, call *`(select? file stat)`* for each directory entry, where *file* is the entry's absolute file name and *stat* is the result of `lstat`; exclude entries for which *select?* does not return true.

The example below adds a file to the store, under two different names:

```
(run-with-store (open-connection)
  (mlet %store-monad ((a (interned-file "README"))
                      (b (interned-file "README" "LEGU-MIN")))
    (return (list a b))))

⇒ ("/gnu/store/rwm...-README" "/gnu/store/44i...-LEGU-MIN")
```

The `(guix packages)` module exports the following package-related monadic procedures:

`package-file` *package* [*file*] [*#:system* (*%current-system*)] [*#:target #f*] [*#:output "out"*] [Monadic Procedure]
Return as a monadic value in the absolute file name of *file* within the *output* directory of *package*. When *file* is omitted, return the name of the *output* directory of *package*. When *target* is true, use it as a cross-compilation target triplet.

Note that this procedure does *not* build *package*. Thus, the result might or might not designate an existing file. We recommend not using this procedure unless you know what you are doing.

`package->derivation` *package* [*system*] [Monadic Procedure]
`package->cross-derivation` *package target* [*system*] [Monadic Procedure]
Monadic version of `package-derivation` *and* `package-cross-derivation` (veja Seção 8.2 [Definindo pacotes], Página 101).

8.12 Expressões-G

So we have "derivations", which represent a sequence of build actions to be performed to produce an item in the store (veja Seção 8.10 [Derivações], Página 156). These build actions are performed when asking the daemon to actually build the derivations; they are run by the daemon in a container (veja Seção 2.3 [Invocando guix-daemon], Página 13).

It should come as no surprise that we like to write these build actions in Scheme. When we do that, we end up with two *strata* of Scheme code[6]: the "host code"—code that defines packages, talks to the daemon, etc.—and the "build code"—code that actually performs build actions, such as making directories, invoking `make`, and so on (veja Seção 8.6 [Fases de construção], Página 141).

To describe a derivation and its build actions, one typically needs to embed build code inside host code. It boils down to manipulating build code as data, and the homoiconicity of Scheme—code has a direct representation as data—comes in handy for that. But we need more than the normal `quasiquote` mechanism in Scheme to construct build expressions.

The `(guix gexp)` module implements *G-expressions*, a form of S-expressions adapted to build expressions. G-expressions, or *gexps*, consist essentially of three syntactic forms: `gexp`, `ungexp`, and `ungexp-splicing` (or simply: `#~`, `#$`, and `#$@`), which are comparable to `quasiquote`, `unquote`, and `unquote-splicing`, respectively (veja Seção "Expression Syntax" em *GNU Guile Reference Manual*). However, there are major differences:

- Gexps are meant to be written to a file and run or manipulated by other processes.
- When a high-level object such as a package or derivation is unquoted inside a gexp, the result is as if its output file name had been introduced.
- Gexps carry information about the packages or derivations they refer to, and these dependencies are automatically added as inputs to the build processes that use them.

[6] The term *stratum* in this context was coined by Manuel Serrano et al. in the context of their work on Hop. Oleg Kiselyov, who has written insightful essays and code on this topic (`http://okmij.org/ftp/meta-programming/#meta-scheme`), refers to this kind of code generation as *staging*.

This mechanism is not limited to package and derivation objects: *compilers* able to "lower" other high-level objects to derivations or files in the store can be defined, such that these objects can also be inserted into gexps. For example, a useful type of high-level objects that can be inserted in a gexp is "file-like objects", which make it easy to add files to the store and to refer to them in derivations and such (see `local-file` and `plain-file` below).

To illustrate the idea, here is an example of a gexp:

```
(define build-exp
  #~(begin
      (mkdir #$output)
      (chdir #$output)
      (symlink (string-append #$coreutils "/bin/ls")
               "list-files")))
```

This gexp can be passed to `gexp->derivation`; we obtain a derivation that builds a directory containing exactly one symlink to `/gnu/store/...-coreutils-8.22/bin/ls`:

```
(gexp->derivation "the-thing" build-exp)
```

As one would expect, the `"/gnu/store/...-coreutils-8.22"` string is substituted to the reference to the *coreutils* package in the actual build code, and *coreutils* is automatically made an input to the derivation. Likewise, `#$output` (equivalent to `(ungexp output)`) is replaced by a string containing the directory name of the output of the derivation.

In a cross-compilation context, it is useful to distinguish between references to the *native* build of a package—that can run on the host—versus references to cross builds of a package. To that end, the `#+` plays the same role as `#$`, but is a reference to a native package build:

```
(gexp->derivation "vi"
   #~(begin
       (mkdir #$output)
       (mkdir (string-append #$output "/bin"))
       (system* (string-append #+coreutils "/bin/ln")
                "-s"
                (string-append #$emacs "/bin/emacs")
                (string-append #$output "/bin/vi")))
   #:target "aarch64-linux-gnu")
```

In the example above, the native build of *coreutils* is used, so that `ln` can actually run on the host; but then the cross-compiled build of *emacs* is referenced.

Another gexp feature is *imported modules*: sometimes you want to be able to use certain Guile modules from the "host environment" in the gexp, so those modules should be imported in the "build environment". The `with-imported-modules` form allows you to express that:

```
(let ((build (with-imported-modules '((guix build utils))
               #~(begin
                   (use-modules (guix build utils))
                   (mkdir-p (string-append #$output "/bin"))))))
  (gexp->derivation "empty-dir"
                    #~(begin
                        #$build
                        (display "success!\n")
```

```
                                #t)))
```

In this example, the `(guix build utils)` module is automatically pulled into the isolated build environment of our gexp, such that `(use-modules (guix build utils))` works as expected.

Usually you want the *closure* of the module to be imported—i.e., the module itself and all the modules it depends on—rather than just the module; failing to do that, attempts to use the module will fail because of missing dependent modules. The `source-module-closure` procedure computes the closure of a module by looking at its source file headers, which comes in handy in this case:

```
(use-modules (guix modules))   ;for 'source-module-closure'

(with-imported-modules (source-module-closure
                         '((guix build utils)
                           (gnu build image)))
  (gexp->derivation "something-with-vms"
                    #~(begin
                        (use-modules (guix build utils)
                                     (gnu build image))
                        ...)))
```

In the same vein, sometimes you want to import not just pure-Scheme modules, but also "extensions" such as Guile bindings to C libraries or other "full-blown" packages. Say you need the `guile-json` package available on the build side, here's how you would do it:

```
(use-modules (gnu packages guile))  ;for 'guile-json'

(with-extensions (list guile-json)
  (gexp->derivation "something-with-json"
                    #~(begin
                        (use-modules (json))
                        ...)))
```

The syntactic form to construct gexps is summarized below.

`#~`*exp* [Macro]
`(gexp` *exp*`)` [Macro]

Return a G-expression containing *exp*. *exp* may contain one or more of the following forms:

`#$`*obj*
`(ungexp` *obj*`)`

Introduce a reference to *obj*. *obj* may have one of the supported types, for example a package or a derivation, in which case the `ungexp` form is replaced by its output file name—e.g., `"/gnu/store/...-coreutils-8.22`.

If *obj* is a list, it is traversed and references to supported objects are substituted similarly.

If *obj* is another gexp, its contents are inserted and its dependencies are added to those of the containing gexp.

If *obj* is another kind of object, it is inserted as is.

`#$`*obj*`:`*saída*
`(ungexp` *obj saída*`)`
: This is like the form above, but referring explicitly to the *output* of *obj*—this is useful when *obj* produces multiple outputs (veja Seção 5.4 [Pacotes com múltiplas saídas], Página 52).

  Sometimes a gexp unconditionally refers to the `"out"` output, but the user of that gexp would still like to insert a reference to another output. The `gexp-input` procedure aims to address that. Veja [gexp-input], Página 171.

`#+`*obj*
`#+`*obj*`:output`
`(ungexp-native` *obj*`)`
`(ungexp-native` *obj output*`)`
: Same as `ungexp`, but produces a reference to the *native* build of *obj* when used in a cross compilation context.

`#$output[:`*saída*`]`
`(ungexp output [`*saída*`])`
: Insert a reference to derivation output *output*, or to the main output when *output* is omitted.

  This only makes sense for gexps passed to `gexp->derivation`.

`#$@`*lst*
`(ungexp-splicing` *lst*`)`
: Like the above, but splices the contents of *lst* inside the containing list.

`#+@`*lst*
`(ungexp-native-splicing` *lst*`)`
: Like the above, but refers to native builds of the objects listed in *lst*.

G-expressions created by `gexp` or `#~` are run-time objects of the `gexp?` type (see below).

`with-imported-modules` *modules body...* [Macro]
: Mark the gexps defined in *body*... as requiring *modules* in their execution environment.

  Each item in *modules* can be the name of a module, such as `(guix build utils)`, or it can be a module name, followed by an arrow, followed by a file-like object:

```
`((guix build utils)
  (guix gcrypt)
  ((guix config) => ,(scheme-file "config.scm"
                                  #~(define-module ...))))
```

  In the example above, the first two modules are taken from the search path, and the last one is created from the given file-like object.

  This form has *lexical* scope: it has an effect on the gexps directly defined in *body*..., but not on those defined, say, in procedures called from *body*....

`with-extensions` *extensions body...* [Macro]
Mark the gexps defined in *body...* as requiring *extensions* in their build and execution environment. *extensions* is typically a list of package objects such as those defined in the `(gnu packages guile)` module.

Concretely, the packages listed in *extensions* are added to the load path while compiling imported modules in *body...*; they are also added to the load path of the gexp returned by *body...*.

`gexp?` *obj* [Procedure]
Return `#t` if *obj* is a G-expression.

G-expressions are meant to be written to disk, either as code building some derivation, or as plain files in the store. The monadic procedures below allow you to do that (veja Seção 8.11 [A mônada do armazém], Página 158, for more information about monads).

`gexp->derivation` *name exp* [*#:system* (*%current-system*)] [*#:target #f*] [*#:graft? #t*] [*#:hash #f*] [#:hash-algo #f] [#:recursive? #f] [#:env-vars '()] [#:modules '()] [#:module-path `%load-path`] [#:effective-version `"2.2"`] [#:references-graphs #f] [#:allowed-references #f] [#:disallowed-references #f] [#:leaked-env-vars #f] [#:script-name (string-append *name* `"-builder"`)] [#:deprecation-warnings #f] [#:local-build? #f] [#:substitutable? #t] [#:properties '()] [#:guile-for-build #f] [Monadic Procedure]
Return a derivation *name* that runs *exp* (a gexp) with *guile-for-build* (a derivation) on *system*; *exp* is stored in a file called *script-name*. When *target* is true, it is used as the cross-compilation target triplet for packages referred to by *exp*.

modules is deprecated in favor of `with-imported-modules`. Its meaning is to make *modules* available in the evaluation context of *exp*; *modules* is a list of names of Guile modules searched in *module-path* to be copied in the store, compiled, and made available in the load path during the execution of *exp*—e.g., `((guix build utils) (guix build gnu-build-system))`.

effective-version determines the string to use when adding extensions of *exp* (see `with-extensions`) to the search path—e.g., `"2.2"`.

graft? determines whether packages referred to by *exp* should be grafted when applicable.

When *references-graphs* is true, it must be a list of tuples of one of the following forms:

```
(file-name obj)
(file-name obj output)
(file-name gexp-input)
(file-name store-item)
```

The right-hand-side of each element of *references-graphs* is automatically made an input of the build process of *exp*. In the build environment, each *file-name* contains the reference graph of the corresponding item, in a simple text format.

allowed-references must be either `#f` or a list of output names and packages. In the latter case, the list denotes store items that the result is allowed to refer to. Any

reference to another store item will lead to a build error. Similarly for *disallowed-references*, which can list items that must not be referenced by the outputs.

deprecation-warnings determines whether to show deprecation warnings while compiling modules. It can be `#f`, `#t`, or `'detailed`.

The other arguments are as for `derivation` (veja Seção 8.10 [Derivações], Página 156).

The `local-file`, `plain-file`, `computed-file`, `program-file`, and `scheme-file` procedures below return *file-like objects*. That is, when unquoted in a G-expression, these objects lead to a file in the store. Consider this G-expression:

```
#~(system* #$(file-append glibc "/sbin/nscd") "-f"
           #$(local-file "/tmp/my-nscd.conf"))
```

The effect here is to "intern" `/tmp/my-nscd.conf` by copying it to the store. Once expanded, for instance *via* `gexp->derivation`, the G-expression refers to that copy under `/gnu/store`; thus, modifying or removing the file in `/tmp` does not have any effect on what the G-expression does. `plain-file` can be used similarly; it differs in that the file content is directly passed as a string.

`local-file` *file* [*name*] [*#:recursive? #f*] [*#:select? (const #t)*] [Procedure]

Return an object representing local file *file* to add to the store; this object can be used in a gexp. If *file* is a literal string denoting a relative file name, it is looked up relative to the source file where it appears; if *file* is not a literal string, it is looked up relative to the current working directory at run time. *file* will be added to the store under *name*–by default the base name of *file*.

When *recursive?* is true, the contents of *file* are added recursively; if *file* designates a flat file and *recursive?* is true, its contents are added, and its permission bits are kept.

When *recursive?* is true, call `(select? file stat)` for each directory entry, where *file* is the entry's absolute file name and *stat* is the result of `lstat`; exclude entries for which *select?* does not return true.

file can be wrapped in the `assume-valid-file-name` syntactic keyword. When this is done, there will not be a warning when `local-file` is used with a non-literal path. The path is still looked up relative to the current working directory at run time. Wrapping is done like this:

```
(define alice-key-file-path "alice.pub")
;; ...
(local-file (assume-valid-file-name alice-key-file-path))
```

file can be wrapped in the `assume-source-relative-file-name` syntactic keyword. When this is done, the file name will be looked up relative to the source file where it appears even when it is not a string literal.

This is the declarative counterpart of the `interned-file` monadic procedure (veja Seção 8.11 [A mônada do armazém], Página 158).

`plain-file` *name content* [Procedure]

Return an object representing a text file called *name* with the given *content* (a string or a bytevector) to be added to the store.

This is the declarative counterpart of `text-file`.

`computed-file` *name gexp* [*#:local-build? #t*] [*#:options '()*] [Procedure]
Return an object representing the store item *name*, a file or directory computed by *gexp*. When *local-build?* is true (the default), the derivation is built locally. *options* is a list of additional arguments to pass to `gexp->derivation`.

This is the declarative counterpart of `gexp->derivation`.

`gexp->script` *name exp* [*#:guile (default-guile)*] [Monadic Procedure]
[*#:module-path %load-path*] [*#:system* (%current-system)] [#:target #f] Return an executable script *name* that runs *exp* using *guile*, with *exp*'s imported modules in its search path. Look up *exp*'s modules in *module-path*.

The example below builds a script that simply invokes the `ls` command:

```
(use-modules (guix gexp) (gnu packages base))

(gexp->script "list-files"
              #~(execl #$(file-append coreutils "/bin/ls")
                       "ls"))
```

When "running" it through the store (veja Seção 8.11 [A mônada do armazém], Página 158), we obtain a derivation that produces an executable file `/gnu/store/...-list-files` along these lines:

```
#!/gnu/store/...-guile-2.0.11/bin/guile -ds
!#
(execl "/gnu/store/...-coreutils-8.22"/bin/ls" "ls")
```

`program-file` *name exp* [*#:guile #f*] [*#:module-path %load-path*] [Procedure]
Return an object representing the executable store item *name* that runs *gexp*. *guile* is the Guile package used to execute that script. Imported modules of *gexp* are looked up in *module-path*.

This is the declarative counterpart of `gexp->script`.

`gexp->file` *name exp* [*#:set-load-path? #t*] [Monadic Procedure]
[*#:module-path %load-path*] [*#:splice? #f*] [*#:guile* (default-guile)] Return a derivation that builds a file *name* containing *exp*. When *splice?* is true, *exp* is considered to be a list of expressions that will be spliced in the resulting file.

When *set-load-path?* is true, emit code in the resulting file to set `%load-path` and `%load-compiled-path` to honor *exp*'s imported modules. Look up *exp*'s modules in *module-path*.

The resulting file holds references to all the dependencies of *exp* or a subset thereof.

`scheme-file` *name exp* [*#:splice? #f*] [*#:guile #f*] [Procedure]
[*#:set-load-path? #t*] *Return an object representing the Scheme* file *name* that contains *exp*. *guile* is the Guile package used to produce that file.

This is the declarative counterpart of `gexp->file`.

`text-file*` *name text ...* [Monadic Procedure]

Return as a monadic value a derivation that builds a text file containing all of *text*. *text* may list, in addition to strings, objects of any type that can be used in a gexp: packages, derivations, local file objects, etc. The resulting store file holds references to all these.

This variant should be preferred over `text-file` anytime the file to create will reference items from the store. This is typically the case when building a configuration file that embeds store file names, like this:

```
(define (profile.sh)
  ;; Return the name of a shell script in the store that
  ;; initializes the 'PATH' environment variable.
  (text-file* "profile.sh"
              "export PATH=" coreutils "/bin:"
              grep "/bin:" sed "/bin\n"))
```

In this example, the resulting `/gnu/store/...-profile.sh` file will reference *coreutils*, *grep*, and *sed*, thereby preventing them from being garbage-collected during its lifetime.

`mixed-text-file` *name text ...* [Procedure]

Return an object representing store file *name* containing *text*. *text* is a sequence of strings and file-like objects, as in:

```
(mixed-text-file "profile"
                 "export PATH=" coreutils "/bin:" grep "/bin")
```

This is the declarative counterpart of `text-file*`.

`file-union` *name files* [Procedure]

Return a `<computed-file>` that builds a directory containing all of *files*. Each item in *files* must be a two-element list where the first element is the file name to use in the new directory, and the second element is a gexp denoting the target file. Here's an example:

```
(file-union "etc"
            `(("hosts" ,(plain-file "hosts"
                                    "127.0.0.1 localhost"))
              ("bashrc" ,(plain-file "bashrc"
                                     "alias ls='ls --color=auto'"))))
```

This yields an `etc` directory containing these two files.

`directory-union` *name things* [Procedure]

Return a directory that is the union of *things*, where *things* is a list of file-like objects denoting directories. For example:

```
(directory-union "guile+emacs" (list guile emacs))
```

yields a directory that is the union of the `guile` and `emacs` packages.

`file-append` *obj suffix ...* [Procedure]

Return a file-like object that expands to the concatenation of *obj* and *suffix*, where *obj* is a lowerable object and each *suffix* is a string.

As an example, consider this gexp:

```
(gexp->script "run-uname"
              #~(system* #$(file-append coreutils
                                        "/bin/uname")))
```

The same effect could be achieved with:

```
(gexp->script "run-uname"
              #~(system* (string-append #$coreutils
                                        "/bin/uname")))
```

There is one difference though: in the `file-append` case, the resulting script contains the absolute file name as a string, whereas in the second case, the resulting script contains a `(string-append ...)` expression to construct the file name *at run time*.

`let-system` *system body...* [Macro]
`let-system` (*system target*) *body...* [Macro]

Bind *system* to the currently targeted system—e.g., `"x86_64-linux"`—within *body*.

In the second case, additionally bind *target* to the current cross-compilation target—a GNU triplet such as `"arm-linux-gnueabihf"`—or `#f` if we are not cross-compiling.

`let-system` is useful in the occasional case where the object spliced into the gexp depends on the target system, as in this example:

```
#~(system*
   #+(let-system system
       (cond ((string-prefix? "armhf-" system)
              (file-append qemu "/bin/qemu-system-arm"))
             ((string-prefix? "x86_64-" system)
              (file-append qemu "/bin/qemu-system-x86_64"))
             (else
              (error "dunno!"))))
   "-net" "user" #$image)
```

`with-parameters` ((*parameter value*) ...) *exp* [Macro]

This macro is similar to the `parameterize` form for dynamically-bound *parameters* (veja Seção "Parameters" em *GNU Guile Reference Manual*). The key difference is that it takes effect when the file-like object returned by *exp* is lowered to a derivation or store item.

A typical use of `with-parameters` is to force the system in effect for a given object:

```
(with-parameters ((%current-system "i686-linux"))
  coreutils)
```

The example above returns an object that corresponds to the i686 build of Coreutils, regardless of the current value of `%current-system`.

`gexp-input` *obj* [*output*] [*#:native? #f*] [Procedure]

Return a *gexp input* record for the given *output* of file-like object *obj*, with `#:native?` determining whether this is a native reference (as with `ungexp-native`) or not.

This procedure is helpful when you want to pass a reference to a specific output of an object to some procedure that may not know about that output. For example, assume you have this procedure, which takes one file-like object:

```
(define (make-symlink target)
  (computed-file "the-symlink"
                 #~(symlink #$target #$output)))
```

Here `make-symlink` can only ever refer to the default output of *target*—the `"out"` output (veja Seção 5.4 [Pacotes com múltiplas saídas], Página 52). To have it refer to, say, the `"lib"` output of the `hwloc` package, you can call it like so:

```
(make-symlink (gexp-input hwloc "lib"))
```

You can also compose it like any other file-like object:

```
(make-symlink
  (file-append (gexp-input hwloc "lib") "/lib/libhwloc.so"))
```

Of course, in addition to gexps embedded in "host" code, there are also modules containing build tools. To make it clear that they are meant to be used in the build stratum, these modules are kept in the `(guix build ...)` name space.

Internally, high-level objects are *lowered*, using their compiler, to either derivations or store items. For instance, lowering a package yields a derivation, and lowering a `plain-file` yields a store item. This is achieved using the `lower-object` monadic procedure.

`lower-object` *obj* [*system*] [*#:target #f*] *Return as a value in* `%store-monad` *the derivation or* [Monadic Procedure]

store item corresponding to *obj* for *system*, cross-compiling for *target* if *target* is true. *obj* must be an object that has an associated gexp compiler, such as a `<package>`.

`gexp->approximate-sexp` *gexp* [Procedure]

Sometimes, it may be useful to convert a G-exp into a S-exp. For example, some linters (veja Seção 9.8 [Invocando guix lint], Página 211) peek into the build phases of a package to detect potential problems. This conversion can be achieved with this procedure. However, some information can be lost in the process. More specifically, lowerable objects will be silently replaced with some arbitrary object – currently the list `(*approximate*)`, but this may change.

8.13 Invocando `guix repl`

The `guix repl` command makes it easier to program Guix in Guile by launching a Guile *read-eval-print loop* (REPL) for interactive programming (veja Seção "Using Guile Interactively" em *GNU Guile Reference Manual*), or by running Guile scripts (veja Seção "Running Guile Scripts" em *GNU Guile Reference Manual*). Compared to just launching the `guile` command, `guix repl` guarantees that all the Guix modules and all its dependencies are available in the search path.

A sintaxe geral é:

```
guix repl options [file args]
```

When a *file* argument is provided, *file* is executed as a Guile scripts:

```
guix repl my-script.scm
```

To pass arguments to the script, use `--` to prevent them from being interpreted as arguments to `guix repl` itself:

```
guix repl -- my-script.scm --input=foo.txt
```

To make a script executable directly from the shell, using the guix executable that is on the user's search path, add the following two lines at the top of the script:

```
#!/usr/bin/env -S guix repl --
!#
```

To make a script that launches an interactive REPL directly from the shell, use the `--interactive` flag:

```
#!/usr/bin/env -S guix repl --interactive
!#
```

Without a file name argument, a Guile REPL is started, allowing for interactive use (veja Seção 8.14 [Using Guix Interactively], Página 174):

```
$ guix repl
scheme@(guile-user)> ,use (gnu packages base)
scheme@(guile-user)> coreutils
$1 = #<package coreutils@8.29 gnu/packages/base.scm:327 3e28300>
```

In addition, `guix repl` implements a simple machine-readable REPL protocol for use by `(guix inferior)`, a facility to interact with *inferiors*, separate processes running a potentially different revision of Guix.

As opções disponíveis são as seguintes:

`--list-types`
: Display the *TYPE* options for `guix repl --type=TYPE` and exit.

`--type=`*type*
`-t` *tipo*
: Start a REPL of the given *TYPE*, which can be one of the following:

  `guile`
  : This is default, and it spawns a standard full-featured Guile REPL.

  `machine`
  : Spawn a REPL that uses the machine-readable protocol. This is the protocol that the `(guix inferior)` module speaks.

`--listen=`*endpoint*
: By default, `guix repl` reads from standard input and writes to standard output. When this option is passed, it will instead listen for connections on *endpoint*. Here are examples of valid options:

  `--listen=tcp:37146`
  : Accept connections on localhost on port 37146.

  `--listen=unix:/tmp/socket`
  : Accept connections on the Unix-domain socket `/tmp/socket`.

`--interactive`
`-i`
: Launch the interactive REPL after *file* is executed.

`--load-path=`*directory*
`-L` *diretório*
: Add *directory* to the front of the package module search path (veja Seção 8.1 [Módulos de pacote], Página 100).

  This allows users to define their own packages and make them visible to the script or REPL.

`-q` Inhibit loading of the `~/.guile` file. By default, that configuration file is loaded when spawning a `guile` REPL.

8.14 Using Guix Interactively

The `guix repl` command gives you access to a warm and friendly *read-eval-print loop* (REPL) (veja Seção 8.13 [Invocando guix repl], Página 172). If you're getting into Guix programming—defining your own packages, writing manifests, defining services for Guix System or Guix Home, etc.—you will surely find it convenient to toy with ideas at the REPL.

If you use Emacs, the most convenient way to do that is with Geiser (veja Seção 22.5 [A configuração perfeita], Página 726), but you do not have to use Emacs to enjoy the REPL. When using `guix repl` or `guile` in the terminal, we recommend using Readline for completion and Colorized to get colorful output. To do that, you can run:

```
guix install guile guile-readline guile-colorized
```

... and then create a `.guile` file in your home directory containing this:

```
(use-modules (ice-9 readline) (ice-9 colorized))

(activate-readline)
(activate-colorized)
```

The REPL lets you evaluate Scheme code; you type a Scheme expression at the prompt, and the REPL prints what it evaluates to:

```
$ guix repl
scheme@(guix-user)> (+ 2 3)
$1 = 5
scheme@(guix-user)> (string-append "a" "b")
$2 = "ab"
```

It becomes interesting when you start fiddling with Guix at the REPL. The first thing you'll want to do is to "import" the `(guix)` module, which gives access to the main part of the programming interface, and perhaps a bunch of useful Guix modules. You could type `(use-modules (guix))`, which is valid Scheme code to import a module (veja Seção "Using Guile Modules" em *GNU Guile Reference Manual*), but the REPL provides the `use` *command* as a shorthand notation (veja Seção "REPL Commands" em *GNU Guile Reference Manual*):

```
scheme@(guix-user)> ,use (guix)
scheme@(guix-user)> ,use (gnu packages base)
```

Notice that REPL commands are introduced by a leading comma. A REPL command like `use` is not valid Scheme code; it's interpreted specially by the REPL.

Guix extends the Guile REPL with additional commands for convenience. Among those, the `build` command comes in handy: it ensures that the given file-like object is built, building it if needed, and returns its output file name(s). In the example below, we build the `coreutils` and `grep` packages, as well as a "computed file" (veja Seção 8.12 [Expressões-G], Página 163), and we use the `scandir` procedure to list the files in Grep's `/bin` directory:

```
scheme@(guix-user)> ,build coreutils
$1 = "/gnu/store/...-coreutils-8.32-debug"
```

```
$2 = "/gnu/store/...-coreutils-8.32"
scheme@(guix-user)> ,build grep
$3 = "/gnu/store/...-grep-3.6"
scheme@(guix-user)> ,build (computed-file "x" #~(mkdir #$output))
building /gnu/store/...-x.drv...
$4 = "/gnu/store/...-x"
scheme@(guix-user)> ,use(ice-9 ftw)
scheme@(guix-user)> (scandir (string-append $3 "/bin"))
$5 = ("." ".." "egrep" "fgrep" "grep")
```

As a packager, you may be willing to inspect the build phases or flags of a given package; this is particularly useful when relying a lot on inheritance to define package variants (veja Seção 8.3 [Definindo variantes de pacote], Página 113) or when package arguments are a result of some computation, both of which can make it harder to foresee what ends up in the package arguments. Additional commands let you inspect those package arguments:

```
scheme@(guix-user)> ,phases grep
$1 = (modify-phases %standard-phases
       (add-after 'install 'fix-egrep-and-fgrep
         (lambda* (#:key outputs #:allow-other-keys)
           (let* ((out (assoc-ref outputs "out"))
                  (bin (string-append out "/bin")))
             (substitute* (list (string-append bin "/egrep")
                                (string-append bin "/fgrep"))
               (("^exec grep")
                (string-append "exec " bin "/grep")))))))
scheme@(guix-user)> ,configure-flags findutils
$2 = (list "--localstatedir=/var")
scheme@(guix-user)> ,make-flags binutils
$3 = '("MAKEINFO=true")
```

At a lower-level, a useful command is `lower`: it takes a file-like object and "lowers" it into a derivation (veja Seção 8.10 [Derivações], Página 156) or a store file:

```
scheme@(guix-user)> ,lower grep
$6 = #<derivation /gnu/store/...-grep-3.6.drv => /gnu/store/...-grep-3.6 7f0e639115f0>
scheme@(guix-user)> ,lower (plain-file "x" "Hello!")
$7 = "/gnu/store/...-x"
```

The full list of REPL commands can be seen by typing `,help guix` and is given below for reference.

`build` *object* [REPL command]
: Lower *object* and build it if it's not already built, returning its output file name(s).

`lower` *object* [REPL command]
: Lower *object* into a derivation or store file name and return it.

`verbosity` *level* [REPL command]
: Change build verbosity to *level*.

This is similar to the `--verbosity` command-line option (veja Seção 9.1.1 [Opções de compilação comum], Página 177): level 0 means total silence, level 1 shows build events only, and higher levels print build logs.

`phases` *package* [REPL command]
`configure-flags` *package* [REPL command]
`make-flags` *package* [REPL command]
These REPL commands return the value of one element of the `arguments` field of *package* (veja Seção 8.2.1 [Referência do package], Página 104): the first one show the staged code associated with `#:phases` (veja Seção 8.6 [Fases de construção], Página 141), the second shows the code for `#:configure-flags`, and `,make-flags` returns the code for `#:make-flags`.

`run-in-store` *exp* [REPL command]
Run *exp*, a monadic expression, through the store monad. Veja Seção 8.11 [A mônada do armazém], Página 158, for more information.

`enter-store-monad` [REPL command]
Enter a new REPL to evaluate monadic expressions (veja Seção 8.11 [A mônada do armazém], Página 158). You can quit this "inner" REPL by typing `,q`.

9 Utilitários

This section describes Guix command-line utilities. Some of them are primarily targeted at developers and users who write new package definitions, while others are more generally useful. They complement the Scheme programming interface of Guix in a convenient way.

9.1 Invocando `guix build`

The `guix build` command builds packages or derivations and their dependencies, and prints the resulting store paths. Note that it does not modify the user's profile—this is the job of the `guix package` command (veja Seção 5.2 [Invocando guix package], Página 37). Thus, it is mainly useful for distribution developers.

A sintaxe geral é:

```
guix build options package-or-derivation...
```

As an example, the following command builds the latest versions of Emacs and of Guile, displays their build logs, and finally displays the resulting directories:

```
guix build emacs guile
```

Similarly, the following command builds all the available packages:

```
guix build --quiet --keep-going \
  $(guix package -A | awk '{ print $1 "@" $2 }')
```

package-or-derivation may be either the name of a package found in the software distribution such as `coreutils` or `coreutils@8.20`, or a derivation such as `/gnu/store/...-coreutils-8.19.drv`. In the former case, a package with the corresponding name (and optionally version) is searched for among the GNU distribution modules (veja Seção 8.1 [Módulos de pacote], Página 100).

Alternatively, the `--expression` option may be used to specify a Scheme expression that evaluates to a package; this is useful when disambiguating among several same-named packages or package variants is needed.

There may be zero or more *options*. The available options are described in the subsections below.

9.1.1 Opções de compilação comum

A number of options that control the build process are common to `guix build` and other commands that can spawn builds, such as `guix package` or `guix archive`. These are the following:

`--load-path=`*directory*
`-L` *diretório*
: Add *directory* to the front of the package module search path (veja Seção 8.1 [Módulos de pacote], Página 100).

  This allows users to define their own packages and make them visible to the command-line tools.

`--keep-failed`
`-K`
: Keep the build tree of failed builds. Thus, if a build fails, its build tree is kept under `/tmp`, in a directory whose name is shown at the end of the build log.

This is useful when debugging build issues. Veja Seção 9.1.4 [Depurando falhas de compilação], Página 190, for tips and tricks on how to debug build issues.

This option implies `--no-offload`, and it has no effect when connecting to a remote daemon with a `guix://` URI (veja Seção 8.9 [O armazém], Página 154).

`--keep-going`
`-k` Keep going when some of the derivations fail to build; return only once all the builds have either completed or failed.

The default behavior is to stop as soon as one of the specified derivations has failed.

`--dry-run`
`-n` Do not build the derivations.

`--fallback`
When substituting a pre-built binary fails, fall back to building packages locally (veja Seção 5.3.6 [Falha na substituição], Página 51).

`--substitute-urls=`*urls*
Consider *urls* the whitespace-separated list of substitute source URLs, overriding the default list of URLs of `guix-daemon` (veja [`guix-daemon` URLs], Página 13).

This means that substitutes may be downloaded from *urls*, provided they are signed by a key authorized by the system administrator (veja Seção 5.3 [Substitutos], Página 47).

When *urls* is the empty string, substitutes are effectively disabled.

`--no-substitutes`
Não use substitutos para compilar produtos. Ou seja, sempre crie coisas localmente, em vez de permitir downloads de binários pré-compilados (veja Seção 5.3 [Substitutos], Página 47).

`--no-grafts`
Do not "graft" packages. In practice, this means that package updates available as grafts are not applied. Veja Capítulo 19 [Atualizações de segurança], Página 710, for more information on grafts.

`--rounds=`*n*
Build each derivation *n* times in a row, and raise an error if consecutive build results are not bit-for-bit identical.

This is a useful way to detect non-deterministic builds processes. Non-deterministic build processes are a problem because they make it practically impossible for users to *verify* whether third-party binaries are genuine. Veja Seção 9.12 [Invocando guix challenge], Página 225, for more.

Quando usado em conjunto com `--keep-failed`, uma saída de comparação é mantida no armazém, sob `/gnu/store/...-check`. Isso facilita procurar por diferenças entre os dois resultados.

`--no-offload`
: Não use compilações de offload para outras máquinas (veja Seção 2.2.2 [Configuração de descarregamento de daemon], Página 8). Ou seja, sempre compile as coisas localmente em vez de descarregar compilações para máquinas remotas.

`--max-silent-time=`*segundos*
: Quando o processo de compilação ou substituição permanecer em silêncio por mais de *segundos*, encerra-o e relata uma falha de compilação.

  By default, the daemon's setting is honored (veja Seção 2.3 [Invocando guix-daemon], Página 13).

`--timeout=`*segundos*
: Da mesma forma, quando o processo de compilação ou substituição durar mais que *segundos*, encerra-o e relata uma falha de compilação.

  By default, the daemon's setting is honored (veja Seção 2.3 [Invocando guix-daemon], Página 13).

`-v` *level*
`--verbosity=`*level*
: Use the given verbosity *level*, an integer. Choosing 0 means that no output is produced, 1 is for quiet output; 2 is similar to 1 but it additionally displays download URLs; 3 shows all the build log output on standard error.

`--cores=`*n*
`-c` *n*
: Allow the use of up to *n* CPU cores for the build. The special value `0` means to use as many CPU cores as available.

`--max-jobs=`*n*
`-M` *n*
: Allow at most *n* build jobs in parallel. Veja Seção 2.3 [Invocando guix-daemon], Página 13, for details about this option and the equivalent `guix-daemon` option.

`--debug=`*level*
: Produce debugging output coming from the build daemon. *level* must be an integer between 0 and 5; higher means more verbose output. Setting a level of 4 or more may be helpful when debugging setup issues with the build daemon.

Behind the scenes, `guix build` is essentially an interface to the `package-derivation` procedure of the `(guix packages)` module, and to the `build-derivations` procedure of the `(guix derivations)` module.

In addition to options explicitly passed on the command line, `guix build` and other `guix` commands that support building honor the `GUIX_BUILD_OPTIONS` environment variable.

`GUIX_BUILD_OPTIONS` [Environment Variable]
: Users can define this variable to a list of command line options that will automatically be used by `guix build` and other `guix` commands that can perform builds, as in the example below:

  ```
  $ export GUIX_BUILD_OPTIONS="--no-substitutes -c 2 -L /foo/bar"
  ```

  These options are parsed independently, and the result is appended to the parsed command-line options.

9.1.2 Opções de transformação de pacote

Another set of command-line options supported by `guix build` and also `guix package` are *package transformation options*. These are options that make it possible to define *package variants*—for instance, packages built from different source code. This is a convenient way to create customized packages on the fly without having to type in the definitions of package variants (veja Seção 8.2 [Definindo pacotes], Página 101).

Package transformation options are preserved across upgrades: `guix upgrade` attempts to apply transformation options initially used when creating the profile to the upgraded packages.

The available options are listed below. Most commands support them and also support a `--help-transform` option that lists all the available options and a synopsis (these options are not shown in the `--help` output for brevity).

`--tune[=`*cpu*`]`

Use versions of the packages marked as "tunable" optimized for *cpu*. When *cpu* is `native`, or when it is omitted, tune for the CPU on which the `guix` command is running.

Valid *cpu* names are those recognized by the underlying compiler, by default the GNU Compiler Collection. On x86_64 processors, this includes CPU names such as `nehalem`, `haswell`, and `skylake` (veja Seção "x86 Options" em *Using the GNU Compiler Collection (GCC)*).

As new generations of CPUs come out, they augment the standard instruction set architecture (ISA) with additional instructions, in particular instructions for single-instruction/multiple-data (SIMD) parallel processing. For example, while Core2 and Skylake CPUs both implement the x86_64 ISA, only the latter supports AVX2 SIMD instructions.

The primary gain one can expect from `--tune` is for programs that can make use of those SIMD capabilities *and* that do not already have a mechanism to select the right optimized code at run time. Packages that have the `tunable?` property set are considered *tunable packages* by the `--tune` option; a package definition with the property set looks like this:

```
(package
  (name "hello-simd")
  ;; ...

  ;; This package may benefit from SIMD extensions so
  ;; mark it as "tunable".
  (properties '((tunable? . #t))))
```

Other packages are not considered tunable. This allows Guix to use generic binaries in the cases where tuning for a specific CPU is unlikely to provide any gain.

Tuned packages are built with `-march=`*CPU*; under the hood, the `-march` option is passed to the actual wrapper by a compiler wrapper. Since the build machine may not be able to run code for the target CPU micro-architecture, the test suite is not run when building a tuned package.

To reduce rebuilds to the minimum, tuned packages are *grafted* onto packages that depend on them (veja Capítulo 19 [Atualizações de segurança], Página 710). Thus, using `--no-grafts` cancels the effect of `--tune`.

We call this technique *package multi-versioning*: several variants of tunable packages may be built, one for each CPU variant. It is the coarse-grain counterpart of *function multi-versioning* as implemented by the GNU tool chain (veja Seção "Function Multiversioning" em *Using the GNU Compiler Collection (GCC)*).

`--with-source=`*fonte*

`--with-source=`*pacote*`=`*fonte*

`--with-source=`*package*`@`*version*`=`*source*

Use *source* as the source of *package*, and *version* as its version number. *source* must be a file name or a URL, as for `guix download` (veja Seção 9.3 [Invocando guix download], Página 191).

When *package* is omitted, it is taken to be the package name specified on the command line that matches the base of *source*—e.g., if *source* is `/src/guile-2.0.10.tar.gz`, the corresponding package is `guile`.

Likewise, when *version* is omitted, the version string is inferred from *source*; in the previous example, it is `2.0.10`.

This option allows users to try out versions of packages other than the one provided by the distribution. The example below downloads `ed-1.7.tar.gz` from a GNU mirror and uses that as the source for the `ed` package:

```
guix build ed --with-source=mirror://gnu/ed/ed-1.4.tar.gz
```

As a developer, `--with-source` makes it easy to test release candidates, and even to test their impact on packages that depend on them:

```
guix build elogind --with-source=.../shepherd-0.9.0rc1.tar.gz
```

... or to build from a checkout in a pristine environment:

```
$ git clone git://git.sv.gnu.org/guix.git
$ guix build guix --with-source=guix@1.0=./guix
```

`--with-input=`*pacote*`=`*substituto*

Replace dependency on *package* by a dependency on *replacement*. *package* must be a package name, and *replacement* must be a package specification such as `guile` or `guile@1.8`.

For instance, the following command builds Guix, but replaces its dependency on the current stable version of Guile with a dependency on the legacy version of Guile, `guile@2.2`:

```
guix build --with-input=guile=guile@2.2 guix
```

This is a recursive, deep replacement. So in this example, both `guix` and its dependency `guile-json` (which also depends on `guile`) get rebuilt against `guile@2.2`.

This is implemented using the `package-input-rewriting/spec` Scheme procedure (veja Seção 8.2 [Definindo pacotes], Página 101).

`--with-graft=`*package*`=`*replacement*

This is similar to `--with-input` but with an important difference: instead of rebuilding the whole dependency chain, *replacement* is built and then *grafted*

onto the binaries that were initially referring to *package*. Veja Capítulo 19 [Atualizações de segurança], Página 710, for more information on grafts.

For example, the command below grafts version 3.5.4 of GnuTLS onto Wget and all its dependencies, replacing references to the version of GnuTLS they currently refer to:

```
guix build --with-graft=gnutls=gnutls@3.5.4 wget
```

This has the advantage of being much faster than rebuilding everything. But there is a caveat: it works if and only if *package* and *replacement* are strictly compatible—for example, if they provide a library, the application binary interface (ABI) of those libraries must be compatible. If *replacement* is somehow incompatible with *package*, then the resulting package may be unusable. Use with care!

`--with-debug-info=`*package*

Build *package* in a way that preserves its debugging info and graft it onto packages that depend on it. This is useful if *package* does not already provide debugging info as a `debug` output (veja Capítulo 17 [Instalando arquivos de depuração], Página 705).

For example, suppose you're experiencing a crash in Inkscape and would like to see what's up in GLib, a library deep down in Inkscape's dependency graph. GLib lacks a `debug` output, so debugging is tough. Fortunately, you rebuild GLib with debugging info and tack it on Inkscape:

```
guix install inkscape --with-debug-info=glib
```

Only GLib needs to be recompiled so this takes a reasonable amount of time. Veja Capítulo 17 [Instalando arquivos de depuração], Página 705, for more info.

> **Nota:** Under the hood, this option works by passing the '`#:strip-binaries? #f`' to the build system of the package of interest (veja Seção 8.5 [Sistemas de compilação], Página 121). Most build systems support that option but some do not. In that case, an error is raised.
>
> Likewise, if a C/C++ package is built without `-g` (which is rarely the case), debugging info will remain unavailable even when `#:strip-binaries?` is false.

`--with-c-toolchain=`*package*`=`*toolchain*

This option changes the compilation of *package* and everything that depends on it so that they get built with *toolchain* instead of the default GNU tool chain for C/C++.

Consider this example:

```
guix build octave-cli \
  --with-c-toolchain=fftw=gcc-toolchain@10 \
  --with-c-toolchain=fftwf=gcc-toolchain@10
```

The command above builds a variant of the `fftw` and `fftwf` packages using version 10 of `gcc-toolchain` instead of the default tool chain, and then builds a variant of the GNU Octave command-line interface using them. GNU Octave itself is also built with `gcc-toolchain@10`.

This other example builds the Hardware Locality (`hwloc`) library and its dependents up to `intel-mpi-benchmarks` with the Clang C compiler:

```
guix build --with-c-toolchain=hwloc=clang-toolchain \
           intel-mpi-benchmarks
```

Nota: There can be application binary interface (ABI) incompatibilities among tool chains. This is particularly true of the C++ standard library and run-time support libraries such as that of OpenMP. By rebuilding all dependents with the same tool chain, `--with-c-toolchain` minimizes the risks of incompatibility but cannot entirely eliminate them. Choose *package* wisely.

`--with-git-url=`*pacote*`=`*url*

Build *package* from the latest commit of the `master` branch of the Git repository at *url*. Git sub-modules of the repository are fetched, recursively.

For example, the following command builds the NumPy Python library against the latest commit of the master branch of Python itself:

```
guix build python-numpy \
  --with-git-url=python=https://github.com/python/cpython
```

This option can also be combined with `--with-branch` or `--with-commit` (see below).

Obviously, since it uses the latest commit of the given branch, the result of such a command varies over time. Nevertheless it is a convenient way to rebuild entire software stacks against the latest commit of one or more packages. This is particularly useful in the context of continuous integration (CI).

Checkouts are kept in a cache under `~/.cache/guix/checkouts` to speed up consecutive accesses to the same repository. You may want to clean it up once in a while to save disk space.

`--with-branch=`*pacote*`=`*ramo*

Build *package* from the latest commit of *branch*. If the `source` field of *package* is an origin with the `git-fetch` method (veja Seção 8.2.2 [Referência do origin], Página 108) or a `git-checkout` object, the repository URL is taken from that `source`. Otherwise you have to use `--with-git-url` to specify the URL of the Git repository.

For instance, the following command builds `guile-sqlite3` from the latest commit of its `master` branch, and then builds `guix` (which depends on it) and `cuirass` (which depends on `guix`) against this specific `guile-sqlite3` build:

```
guix build --with-branch=guile-sqlite3=master cuirass
```

`--with-commit=`*pacote*`=`*commit*

This is similar to `--with-branch`, except that it builds from *commit* rather than the tip of a branch. *commit* must be a valid Git commit SHA1 identifier, a tag, or a `git describe` style identifier such as `1.0-3-gabc123`.

`--with-patch=`*package*`=`*file*

Add *file* to the list of patches applied to *package*, where *package* is a spec such as `python@3.8` or `glibc`. *file* must contain a patch; it is applied with the

flags specified in the `origin` of *package* (veja Seção 8.2.2 [Referência do origin], Página 108), which by default includes `-p1` (veja Seção "patch Directories" em *Comparing and Merging Files*).

As an example, the command below rebuilds Coreutils with the GNU C Library (glibc) patched with the given patch:

```
guix build coreutils --with-patch=glibc=./glibc-frob.patch
```

In this example, glibc itself as well as everything that leads to Coreutils in the dependency graph is rebuilt.

`--with-configure-flag=`*package*`=`*flag*

Append *flag* to the configure flags of *package*, where *package* is a spec such as `guile@3.0` or `glibc`. The build system of *package* must support the `#:configure-flags` argument.

For example, the command below builds GNU Hello with the configure flag `--disable-nls`:

```
guix build hello --with-configure-flag=hello=--disable-nls
```

The following command passes an extra flag to `cmake` as it builds `lapack`:

```
guix build lapack \
  --with-configure-flag=lapack=-DBUILD_SHARED_LIBS=OFF
```

Nota: Under the hood, this option works by passing the '`#:configure-flags`' argument to the build system of the package of interest (veja Seção 8.5 [Sistemas de compilação], Página 121). Most build systems support that option but some do not. In that case, an error is raised.

`--with-latest=`*package*

`--with-version=`*package*`=`*version*

So you like living on the bleeding edge? The `--with-latest` option is for you! It replaces occurrences of *package* in the dependency graph with its latest upstream version, as reported by `guix refresh` (veja Seção 9.6 [Invocando guix refresh], Página 202).

It does so by determining the latest upstream release of *package* (if possible), downloading it, and authenticating it *if* it comes with an OpenPGP signature.

As an example, the command below builds Guix against the latest version of Guile-JSON:

```
guix build guix --with-latest=guile-json
```

The `--with-version` works similarly except that it lets you specify that you want precisely *version*, assuming that version exists upstream. For example, to spawn a development environment with SciPy built against version 1.22.4 of NumPy (skipping its test suite because hey, we're not gonna wait this long), you would run:

```
guix shell python python-scipy --with-version=python-numpy=1.22.4
```

Aviso: Because they depend on source code published at a given point in time on upstream servers, deployments made with

`--with-latest` and `--with-version` may be non-reproducible: source might disappear or be modified in place on the servers.

To deploy old software versions without compromising on reproducibility, veja Seção 5.8 [Invocando guix time-machine], Página 61.

There are limitations. First, in cases where the tool cannot or does not know how to authenticate source code, you are at risk of running malicious code; a warning is emitted in this case. Second, this option simply changes the source used in the existing package definitions, which is not always sufficient: there might be additional dependencies that need to be added, patches to apply, and more generally the quality assurance work that Guix developers normally do will be missing.

You've been warned! When those limitations are acceptable, it's a snappy way to stay on top. We encourage you to submit patches updating the actual package definitions once you have successfully tested an upgrade with `--with-latest` (veja Capítulo 22 [Contribuindo], Página 720).

`--without-tests=`*package*

Build *package* without running its tests. This can be useful in situations where you want to skip the lengthy test suite of a intermediate package, or if a package's test suite fails in a non-deterministic fashion. It should be used with care because running the test suite is a good way to ensure a package is working as intended.

Turning off tests leads to a different store item. Consequently, when using this option, anything that depends on *package* must be rebuilt, as in this example:

```
guix install --without-tests=python python-notebook
```

The command above installs `python-notebook` on top of `python` built without running its test suite. To do so, it also rebuilds everything that depends on `python`, including `python-notebook` itself.

Internally, `--without-tests` relies on changing the `#:tests?` option of a package's `check` phase (veja Seção 8.5 [Sistemas de compilação], Página 121). Note that some packages use a customized `check` phase that does not respect a `#:tests? #f` setting. Therefore, `--without-tests` has no effect on these packages.

Wondering how to achieve the same effect using Scheme code, for example in your manifest, or how to write your own package transformation? Veja Seção 8.3 [Definindo variantes de pacote], Página 113, for an overview of the programming interfaces available.

9.1.3 Opções de compilação adicional

The command-line options presented below are specific to `guix build`.

`--quiet`
`-q`

Build quietly, without displaying the build log; this is equivalent to `--verbosity=0`. Upon completion, the build log is kept in `/var` (or similar) and can always be retrieved using the `--log-file` option.

`--file=`*file*
`-f` *arquivo*

Build the package, derivation, or other file-like object that the code within *file* evaluates to (veja Seção 8.12 [Expressões-G], Página 163).

As an example, *file* might contain a package definition like this (veja Seção 8.2 [Definindo pacotes], Página 101):

```
(use-modules (guix)
             (guix build-system gnu)
             (guix licenses))

(package
  (name "hello")
  (version "2.10")
  (source (origin
            (method url-fetch)
            (uri (string-append "mirror://gnu/hello/hello-" version
                                ".tar.gz"))
            (sha256
             (base32
              "0ssi1wpaf7plaswqqjwigppsg5fyh99vdlb9kzl7c9lng89ndq1i"))))
  (build-system gnu-build-system)
  (synopsis "Hello, GNU world: An example GNU package")
  (description "Guess what GNU Hello prints!")
  (home-page "http://www.gnu.org/software/hello/")
  (license gpl3+))
```

The *file* may also contain a JSON representation of one or more package definitions. Running `guix build -f` on `hello.json` with the following contents would result in building the packages `myhello` and `greeter`:

```
[
  {
    "name": "myhello",
    "version": "2.10",
    "source": "mirror://gnu/hello/hello-2.10.tar.gz",
    "build-system": "gnu",
    "arguments": {
      "tests?": false
    },
    "home-page": "https://www.gnu.org/software/hello/",
    "synopsis": "Hello, GNU world: An example GNU package",
    "description": "GNU Hello prints a greeting.",
    "license": "GPL-3.0+",
    "native-inputs": ["gettext"]
  },
  {
    "name": "greeter",
    "version": "1.0",
```

```
                  "source": "mirror://gnu/hello/hello-2.10.tar.gz",
                  "build-system": "gnu",
                  "arguments": {
                    "test-target": "foo",
                    "parallel-build?": false
                  },
                  "home-page": "https://example.com/",
                  "synopsis": "Greeter using GNU Hello",
                  "description": "This is a wrapper around GNU Hello.",
                  "license": "GPL-3.0+",
                  "inputs": ["myhello", "hello"]
                }
              ]
```

`--manifest=`*manifest*
`-m` *manifest*
: Build all packages listed in the given *manifest* (veja [profile-manifest], Página 41).

`--expression=`*expr*
`-e` *expr*
: Build the package or derivation *expr* evaluates to.

  For example, *expr* may be `(@ (gnu packages guile) guile-1.8)`, which unambiguously designates this specific variant of version 1.8 of Guile.

  Alternatively, *expr* may be a G-expression, in which case it is used as a build program passed to `gexp->derivation` (veja Seção 8.12 [Expressões-G], Página 163).

  Lastly, *expr* may refer to a zero-argument monadic procedure (veja Seção 8.11 [A mônada do armazém], Página 158). The procedure must return a derivation as a monadic value, which is then passed through `run-with-store`.

`--source`
`-S`
: Build the source derivations of the packages, rather than the packages themselves.

  For instance, `guix build -S gcc` returns something like `/gnu/store/...-gcc-4.7.2.tar.bz2`, which is the GCC source tarball.

  The returned source tarball is the result of applying any patches and code snippets specified in the package `origin` (veja Seção 8.2 [Definindo pacotes], Página 101).

  As with other derivations, the result of building a source derivation can be verified using the `--check` option (veja [build-check], Página 189). This is useful to validate that a (potentially already built or substituted, thus cached) package source matches against its declared hash.

  Note that `guix build -S` compiles the sources only of the specified packages. They do not include the sources of statically linked dependencies and by themselves are insufficient for reproducing the packages.

`--sources`

Fetch and return the source of *package-or-derivation* and all their dependencies, recursively. This is a handy way to obtain a local copy of all the source code needed to build *packages*, allowing you to eventually build them even without network access. It is an extension of the `--source` option and can accept one of the following optional argument values:

`pacote` This value causes the `--sources` option to behave in the same way as the `--source` option.

`all` Build the source derivations of all packages, including any source that might be listed as `inputs`. This is the default value.

```
$ guix build --sources tzdata
The following derivations will be built:
   /gnu/store/...-tzdata2015b.tar.gz.drv
   /gnu/store/...-tzcode2015b.tar.gz.drv
```

`transitive`

Build the source derivations of all packages, as well of all transitive inputs to the packages. This can be used e.g. to prefetch package source for later offline building.

```
$ guix build --sources=transitive tzdata
The following derivations will be built:
   /gnu/store/...-tzcode2015b.tar.gz.drv
   /gnu/store/...-findutils-4.4.2.tar.xz.drv
   /gnu/store/...-grep-2.21.tar.xz.drv
   /gnu/store/...-coreutils-8.23.tar.xz.drv
   /gnu/store/...-make-4.1.tar.xz.drv
   /gnu/store/...-bash-4.3.tar.xz.drv
...
```

`--system=`*system*
`-s` *sistema*

Attempt to build for *system*—e.g., `i686-linux`—instead of the system type of the build host. The `guix build` command allows you to repeat this option several times, in which case it builds for all the specified systems; other commands ignore extraneous `-s` options.

> **Nota:** The `--system` flag is for *native* compilation and must not be confused with cross-compilation. See `--target` below for information on cross-compilation.

An example use of this is on Linux-based systems, which can emulate different personalities. For instance, passing `--system=i686-linux` on an `x86_64-linux` system or `--system=armhf-linux` on an `aarch64-linux` system allows you to build packages in a complete 32-bit environment.

> **Nota:** Building for an `armhf-linux` system is unconditionally enabled on `aarch64-linux` machines, although certain aarch64 chipsets do not allow for this functionality, notably the ThunderX.

Similarly, when transparent emulation with QEMU and `binfmt_misc` is enabled (veja Seção 11.10.30 [Serviços de virtualização], Página 523), you can build for any system for which a QEMU `binfmt_misc` handler is installed.

Builds for a system other than that of the machine you are using can also be offloaded to a remote machine of the right architecture. Veja Seção 2.2.2 [Configuração de descarregamento de daemon], Página 8, for more information on offloading.

`--target=`*triplet*
: Cross-build for *triplet*, which must be a valid GNU triplet, such as `"aarch64-linux-gnu"` (veja Seção "Specifying Target Triplets" em *Autoconf*).

`--list-systems`
: List all the supported systems, that can be passed as an argument to `--system`.

`--list-targets`
: List all the supported targets, that can be passed as an argument to `--target`.

`--check` Rebuild *package-or-derivation*, which are already available in the store, and raise an error if the build results are not bit-for-bit identical.

This mechanism allows you to check whether previously installed substitutes are genuine (veja Seção 5.3 [Substitutos], Página 47), or whether the build result of a package is deterministic. Veja Seção 9.12 [Invocando guix challenge], Página 225, for more background information and tools.

Quando usado em conjunto com `--keep-failed`, uma saída de comparação é mantida no armazém, sob `/gnu/store/...-check`. Isso facilita procurar por diferenças entre os dois resultados.

`--repair` Attempt to repair the specified store items, if they are corrupt, by re-downloading or rebuilding them.

This operation is not atomic and thus restricted to `root`.

`--derivations`
`-d`
: Return the derivation paths, not the output paths, of the given packages.

`--root=`*arquivo*
`-r` *arquivo*
: Make *file* a symlink to the result, and register it as a garbage collector root.

Consequently, the results of this `guix build` invocation are protected from garbage collection until *file* is removed. When that option is omitted, build results are eligible for garbage collection as soon as the build completes. Veja Seção 5.6 [Invocando guix gc], Página 54, for more on GC roots.

`--log-file`
: Return the build log file names or URLs for the given *package-or-derivation*, or raise an error if build logs are missing.

This works regardless of how packages or derivations are specified. For instance, the following invocations are equivalent:

```
guix build --log-file $(guix build -d guile)
guix build --log-file $(guix build guile)
```

```
guix build --log-file guile
guix build --log-file -e '(@ (gnu packages guile) guile-2.0)'
```

If a log is unavailable locally, and unless `--no-substitutes` is passed, the command looks for a corresponding log on one of the substitute servers.

So for instance, imagine you want to see the build log of GDB on `aarch64`, but you are actually on an `x86_64` machine:

```
$ guix build --log-file gdb -s aarch64-linux
https://bordeaux.guix.gnu.org/log/...-gdb-7.10
```

You can freely access a huge library of build logs!

9.1.4 Depurando falhas de compilação

When defining a new package (veja Seção 8.2 [Definindo pacotes], Página 101), you will probably find yourself spending some time debugging and tweaking the build until it succeeds. To do that, you need to operate the build commands yourself in an environment as close as possible to the one the build daemon uses.

To that end, the first thing to do is to use the `--keep-failed` or `-K` option of `guix build`, which will keep the failed build tree in `/tmp` or whatever directory you specified as `TMPDIR` (veja Seção 9.1.1 [Opções de compilação comum], Página 177).

From there on, you can `cd` to the failed build tree and source the `environment-variables` file, which contains all the environment variable definitions that were in place when the build failed. So let's say you're debugging a build failure in package `foo`; a typical session would look like this:

```
$ guix build foo -K
... build fails
$ cd /tmp/guix-build-foo.drv-0
$ source ./environment-variables
$ cd foo-1.2
```

Now, you can invoke commands as if you were the daemon (almost) and troubleshoot your build process.

Sometimes it happens that, for example, a package's tests pass when you run them manually but they fail when the daemon runs them. This can happen because the daemon runs builds in containers where, unlike in our environment above, network access is missing, `/bin/sh` does not exist, etc. (veja Seção 2.2.1 [Configuração do ambiente de compilação], Página 6).

In such cases, you may need to inspect the build process from within a container similar to the one the build daemon creates:

```
$ guix build -K foo
...
$ cd /tmp/guix-build-foo.drv-0
$ guix shell --no-grafts -C -D foo strace gdb
[env]# source ./environment-variables
[env]# cd foo-1.2
```

Here, `guix shell -C` creates a container and spawns a new shell in it (veja Seção 7.1 [Invocando guix shell], Página 79). The `strace gdb` part adds the `strace` and `gdb` commands

to the container, which you may find handy while debugging. The `--no-grafts` option makes sure we get the exact same environment, with ungrafted packages (veja Capítulo 19 [Atualizações de segurança], Página 710, for more info on grafts).

To get closer to a container like that used by the build daemon, we can remove `/bin/sh`:

```
[env]# rm /bin/sh
```

(Don't worry, this is harmless: this is all happening in the throw-away container created by `guix shell`.)

The `strace` command is probably not in the search path, but we can run:

```
[env]# $GUIX_ENVIRONMENT/bin/strace -f -o log make check
```

In this way, not only you will have reproduced the environment variables the daemon uses, you will also be running the build process in a container similar to the one the daemon uses.

9.2 Invocando `guix edit`

So many packages, so many source files! The `guix edit` command facilitates the life of users and packagers by pointing their editor at the source file containing the definition of the specified packages. For instance:

```
guix edit gcc@4.9 vim
```

launches the program specified in the `VISUAL` or in the `EDITOR` environment variable to view the recipe of GCC 4.9.3 and that of Vim.

If you are using a Guix Git checkout (veja Seção 22.2 [Compilando do git], Página 721), or have created your own packages on `GUIX_PACKAGE_PATH` (veja Seção 8.1 [Módulos de pacote], Página 100), you will be able to edit the package recipes. In other cases, you will be able to examine the read-only recipes for packages currently in the store.

Instead of `GUIX_PACKAGE_PATH`, the command-line option `--load-path=`*`directory`* (or in short `-L` *`directory`*) allows you to add *directory* to the front of the package module search path and so make your own packages visible.

9.3 Invocando `guix download`

When writing a package definition, developers typically need to download a source tarball, compute its SHA256 hash, and write that hash in the package definition (veja Seção 8.2 [Definindo pacotes], Página 101). The `guix download` tool helps with this task: it downloads a file from the given URI, adds it to the store, and prints both its file name in the store and its SHA256 hash.

The fact that the downloaded file is added to the store saves bandwidth: when the developer eventually tries to build the newly defined package with `guix build`, the source tarball will not have to be downloaded again because it is already in the store. It is also a convenient way to temporarily stash files, which may be deleted eventually (veja Seção 5.6 [Invocando guix gc], Página 54).

The `guix download` command supports the same URIs as used in package definitions. In particular, it supports `mirror://` URIs. `https` URIs (HTTP over TLS) are supported *provided* the Guile bindings for GnuTLS are available in the user's environment; when they

are not available, an error is raised. Veja Seção "Guile Preparations" em *GnuTLS-Guile*, for more information.

`guix download` verifies HTTPS server certificates by loading the certificates of X.509 authorities from the directory pointed to by the `SSL_CERT_DIR` environment variable (veja Seção 11.12 [Certificados X.509], Página 604), unless `--no-check-certificate` is used.

Alternatively, `guix download` can also retrieve a Git repository, possibly a specific commit, tag, or branch.

The following options are available:

`--hash=`*algorithm*
`-H` *algorithm*
: Compute a hash using the specified *algorithm*. Veja Seção 9.4 [Invocando guix hash], Página 192, for more information.

`--format=`*fmt*
`-f` *fmt*
: Write the hash in the format specified by *fmt*. For more information on the valid values for *fmt*, veja Seção 9.4 [Invocando guix hash], Página 192.

`--no-check-certificate`
: Do not validate the X.509 certificates of HTTPS servers.

  When using this option, you have *absolutely no guarantee* that you are communicating with the authentic server responsible for the given URL, which makes you vulnerable to "man-in-the-middle" attacks.

`--output=`*arquivo*
`-o` *arquivo*
: Save the downloaded file to *file* instead of adding it to the store.

`--git`
`-g`
: Checkout the Git repository at the latest commit on the default branch.

`--commit=`*commit-or-tag*
: Checkout the Git repository at *commit-or-tag*.

  commit-or-tag can be either a tag or a commit defined in the Git repository.

`--branch=`*ramo*
: Checkout the Git repository at *branch*.

  The repository will be checked out at the latest commit of *branch*, which must be a valid branch of the Git repository.

`--recursive`
`-r`
: Recursively clone the Git repository.

9.4 Invocando `guix hash`

The `guix hash` command computes the hash of a file. It is primarily a convenience tool for anyone contributing to the distribution: it computes the cryptographic hash of one or more files, which can be used in the definition of a package (veja Seção 8.2 [Definindo pacotes], Página 101).

A sintaxe geral é:

```
guix hash option file ...
```

When *file* is `-` (a hyphen), `guix hash` computes the hash of data read from standard input. `guix hash` has the following options:

`--hash=`*algorithm*
`-H` *algorithm*
: Compute a hash using the specified *algorithm*, `sha256` by default.

  algorithm must be the name of a cryptographic hash algorithm supported by Libgcrypt *via* Guile-Gcrypt—e.g., `sha512` or `sha3-256` (veja Seção "Hash Functions" em *Guile-Gcrypt Reference Manual*).

`--format=`*fmt*
`-f` *fmt*
: Write the hash in the format specified by *fmt*.

  Supported formats: `base64`, `nix-base32`, `base32`, `base16` (`hex` and `hexadecimal` can be used as well).

  If the `--format` option is not specified, `guix hash` will output the hash in `nix-base32`. This representation is used in the definitions of packages.

`--recursive`
`-r`
: The `--recursive` option is deprecated in favor of `--serializer=nar` (see below); `-r` remains accepted as a convenient shorthand.

`--serializer=`*type*
`-S` *type*
: Compute the hash on *file* using *type* serialization.

  type may be one of the following:

  `nenhuma`
  : This is the default: it computes the hash of a file's contents.

  `nar`
  : Compute the hash of a "normalized archive" (or "nar") containing *file*, including its children if it is a directory. Some of the metadata of *file* is part of the archive; for instance, when *file* is a regular file, the hash is different depending on whether *file* is executable or not. Metadata such as time stamps have no impact on the hash (veja Seção 5.11 [Invocando guix archive], Página 66, for more info on the nar format).

  `git`
  : Compute the hash of the file or directory as a Git "tree", following the same method as the Git version control system.

`--exclude-vcs`
`-x`
: When combined with `--recursive`, exclude version control system directories (`.bzr`, `.git`, `.hg`, etc.).

  As an example, here is how you would compute the hash of a Git checkout, which is useful when using the `git-fetch` method (veja Seção 8.2.2 [Referência do origin], Página 108):

```
$ git clone http://example.org/foo.git
$ cd foo
$ guix hash -x --serializer=nar .
```

9.5 Invoking `guix import`

The `guix import` command is useful for people who would like to add a package to the distribution with as little work as possible—a legitimate demand. The command knows of a few repositories from which it can "import" package metadata. The result is a package definition, or a template thereof, in the format we know (veja Seção 8.2 [Definindo pacotes], Página 101).

A sintaxe geral é:

```
guix import [global-options...] importer package [options...]
```

importer specifies the source from which to import package metadata, and *options* specifies a package identifier and other options specific to *importer*. `guix import` itself has the following *global-options*:

`--insert=file`
`-i file` Insert the package definition(s) that the *importer* generated into the specified *file*, either in alphabetical order among existing package definitions, or at the end of the file otherwise.

Some of the importers rely on the ability to run the `gpgv` command. For these, GnuPG must be installed and in `$PATH`; run `guix install gnupg` if needed.

Currently, the available "importers" are:

`gnu` Import metadata for the given GNU package. This provides a template for the latest version of that GNU package, including the hash of its source tarball, and its canonical synopsis and description.

Additional information such as the package dependencies and its license needs to be figured out manually.

For example, the following command returns a package definition for GNU Hello:

```
guix import gnu hello
```

Specific command-line options are:

`--key-download=policy`
As for `guix refresh`, specify the policy to handle missing OpenPGP keys when verifying the package signature. Veja Seção 9.6 [Invocando guix refresh], Página 202.

`pypi` Import metadata from the Python Package Index (`https://pypi.python.org/`). Information is taken from the JSON-formatted description available at `pypi.python.org` and usually includes all the relevant information, including package dependencies. For maximum efficiency, it is recommended to install the `unzip` utility, so that the importer can unzip Python wheels and gather data from them.

The command below imports metadata for the latest version of the `itsdangerous` Python package:

```
guix import pypi itsdangerous
```

You can also ask for a specific version:

```
guix import pypi itsdangerous@1.1.0
```

`--recursive`
`-r`
: Traverse the dependency graph of the given upstream package recursively and generate package expressions for all those packages that are not yet in Guix.

`gem`
: Import metadata from RubyGems (`https://rubygems.org/`). Information is taken from the JSON-formatted description available at `rubygems.org` and includes most relevant information, including runtime dependencies. There are some caveats, however. The metadata doesn't distinguish between synopses and descriptions, so the same string is used for both fields. Additionally, the details of non-Ruby dependencies required to build native extensions is unavailable and left as an exercise to the packager.

  The command below imports metadata for the `rails` Ruby package:

  ```
  guix import gem rails
  ```

  You can also ask for a specific version:

  ```
  guix import gem rails@7.0.4
  ```

  `--recursive`
  `-r`
  : Traverse the dependency graph of the given upstream package recursively and generate package expressions for all those packages that are not yet in Guix.

`minetest`
: Import metadata from ContentDB (`https://content.minetest.net`). Information is taken from the JSON-formatted metadata provided through ContentDB's API (`https://content.minetest.net/help/api/`) and includes most relevant information, including dependencies. There are some caveats, however. The license information is often incomplete. The commit hash is sometimes missing. The descriptions are in the Markdown format, but Guix uses Texinfo instead. Texture packs and subgames are unsupported.

  The command below imports metadata for the Mesecons mod by Jeija:

  ```
  guix import minetest Jeija/mesecons
  ```

  The author name can also be left out:

  ```
  guix import minetest mesecons
  ```

  `--recursive`
  `-r`
  : Traverse the dependency graph of the given upstream package recursively and generate package expressions for all those packages that are not yet in Guix.

`cpan`
: Import metadata from MetaCPAN (`https://www.metacpan.org/`). Information is taken from the JSON-formatted metadata provided through MetaCPAN's API (`https://fastapi.metacpan.org/`) and includes most relevant information, such as module dependencies. License information should be checked closely. If Perl is available in the store, then the `corelist` utility will be used to filter core modules out of the list of dependencies.

The command below imports metadata for the Acme::Boolean Perl module:

```
guix import cpan Acme::Boolean
```

`cran` Import metadata from CRAN (`https://cran.r-project.org/`), the central repository for the GNU R statistical and graphical environment (`https://r-project.org`).

Information is extracted from the `DESCRIPTION` file of the package.

The command below imports metadata for the Cairo R package:

```
guix import cran Cairo
```

You can also ask for a specific version:

```
guix import cran rasterVis@0.50.3
```

When `--recursive` is added, the importer will traverse the dependency graph of the given upstream package recursively and generate package expressions for all those packages that are not yet in Guix.

When `--style=specification` is added, the importer will generate package definitions whose inputs are package specifications instead of references to package variables. This is useful when generated package definitions are to be appended to existing user modules, as the list of used package modules need not be changed. The default is `--style=variable`.

When `--prefix=license:` is added, the importer will prefix license atoms with `license:`, allowing a prefixed import of `(guix licenses)`.

When `--archive=bioconductor` is added, metadata is imported from Bioconductor (`https://www.bioconductor.org/`), a repository of R packages for the analysis and comprehension of high-throughput genomic data in bioinformatics.

Information is extracted from the `DESCRIPTION` file contained in the package archive.

The command below imports metadata for the GenomicRanges R package:

```
guix import cran --archive=bioconductor GenomicRanges
```

Finally, you can also import R packages that have not yet been published on CRAN or Bioconductor as long as they are in a git repository. Use `--archive=git` followed by the URL of the git repository:

```
guix import cran --archive=git https://github.com/immunogenomics/harmony
```

`texlive` Import TeX package information from the TeX Live package database for TeX packages that are part of the TeX Live distribution (`https://www.tug.org/texlive/`).

Information about the package is obtained from the TeX Live package database, a plain text file that is included in the `texlive-scripts` package. The source code is downloaded from possibly multiple locations in the SVN repository of the Tex Live project. Note that therefore SVN must be installed and in `$PATH`; run `guix install subversion` if needed.

The command below imports metadata for the `fontspec` TeX package:

```
guix import texlive fontspec
```

Additional options include:

`--recursive`
`-r` Traverse the dependency graph of the given upstream package recursively and generate package expressions for all those packages that are not yet in Guix.

`json` Import package metadata from a local JSON file. Consider the following example package definition in JSON format:

```
{
  "name": "hello",
  "version": "2.10",
  "source": "mirror://gnu/hello/hello-2.10.tar.gz",
  "build-system": "gnu",
  "home-page": "https://www.gnu.org/software/hello/",
  "synopsis": "Hello, GNU world: An example GNU package",
  "description": "GNU Hello prints a greeting.",
  "license": "GPL-3.0+",
  "native-inputs": ["gettext"]
}
```

The field names are the same as for the `<package>` record (Veja Seção 8.2 [Definindo pacotes], Página 101). References to other packages are provided as JSON lists of quoted package specification strings such as `guile` or `guile@2.0`.

The importer also supports a more explicit source definition using the common fields for `<origin>` records:

```
{
  ...
  "source": {
    "method": "url-fetch",
    "uri": "mirror://gnu/hello/hello-2.10.tar.gz",
    "sha256": {
      "base32": "0ssi1wpaf7plaswqqjwigppsg5fyh99vdlb9kzl7c9lng89ndq1i"
    }
  }
  ...
}
```

The command below reads metadata from the JSON file `hello.json` and outputs a package expression:

```
guix import json hello.json
```

`hackage` Import metadata from the Haskell community's central package archive Hackage (`https://hackage.haskell.org/`). Information is taken from Cabal files and includes all the relevant information, including package dependencies.

Specific command-line options are:

`--stdin`
`-s` Read a Cabal file from standard input.

`--no-test-dependencies`
`-t` Do not include dependencies required only by the test suites.

`--cabal-environment=`*alist*
`-e` *alist* *alist* is a Scheme alist defining the environment in which the Cabal conditionals are evaluated. The accepted keys are: `os`, `arch`, `impl` and a string representing the name of a flag. The value associated with a flag has to be either the symbol `true` or `false`. The value associated with other keys has to conform to the Cabal file format definition. The default value associated with the keys `os`, `arch` and `impl` is '`linux`', '`x86_64`' and '`ghc`', respectively.

`--recursive`
`-r` Traverse the dependency graph of the given upstream package recursively and generate package expressions for all those packages that are not yet in Guix.

The command below imports metadata for the latest version of the HTTP Haskell package without including test dependencies and specifying the value of the flag '`network-uri`' as `false`:

```
guix import hackage -t -e "'((\"network-uri\" . false))" HTTP
```

A specific package version may optionally be specified by following the package name by an at-sign and a version number as in the following example:

```
guix import hackage mtl@2.1.3.1
```

`stackage` The `stackage` importer is a wrapper around the `hackage` one. It takes a package name, looks up the package version included in a long-term support (LTS) Stackage (`https://www.stackage.org`) release and uses the `hackage` importer to retrieve its metadata. Note that it is up to you to select an LTS release compatible with the GHC compiler used by Guix.

Specific command-line options are:

`--no-test-dependencies`
`-t` Do not include dependencies required only by the test suites.

`--lts-version=`*versão*
`-l` *versão* *version* is the desired LTS release version. If omitted the latest release is used.

`--recursive`
`-r` Traverse the dependency graph of the given upstream package recursively and generate package expressions for all those packages that are not yet in Guix.

The command below imports metadata for the HTTP Haskell package included in the LTS Stackage release version 7.18:

```
guix import stackage --lts-version=7.18 HTTP
```

`elpa` Import metadata from an Emacs Lisp Package Archive (ELPA) package repository (veja Seção "Packages" em *The GNU Emacs Manual*).

Specific command-line options are:

`--archive=`*repo*

`-a` *repo* *repo* identifies the archive repository from which to retrieve the information. Currently the supported repositories and their identifiers are:

- GNU (`https://elpa.gnu.org/packages`), selected by the `gnu` identifier. This is the default.

  Packages from `elpa.gnu.org` are signed with one of the keys contained in the GnuPG keyring at `share/emacs/25.1/etc/package-keyring.gpg` (or similar) in the `emacs` package (veja Seção "Package Installation" em *The GNU Emacs Manual*).
- NonGNU (`https://elpa.nongnu.org/nongnu/`), selected by the `nongnu` identifier.
- MELPA-Stable (`https://stable.melpa.org/packages`), selected by the `melpa-stable` identifier.
- MELPA (`https://melpa.org/packages`), selected by the `melpa` identifier.

`--recursive`

`-r` Traverse the dependency graph of the given upstream package recursively and generate package expressions for all those packages that are not yet in Guix.

`crate` Import metadata from the crates.io Rust package repository crates.io (`https://crates.io`), as in this example:

```
guix import crate blake2-rfc
```

The crate importer also allows you to specify a version string:

```
guix import crate constant-time-eq@0.1.0
```

Additional options include:

`--recursive`

`-r` Traverse the dependency graph of the given upstream package recursively and generate package expressions for all those packages that are not yet in Guix.

`--recursive-dev-dependencies`

If `--recursive-dev-dependencies` is specified, also the recursively imported packages contain their development dependencies, which are recursively imported as well.

`--allow-yanked`

If no non-yanked version of a crate is available, use the latest yanked version instead instead of aborting.

`elm` Import metadata from the Elm package repository package.elm-lang.org (`https://package.elm-lang.org`), as in this example:

```
guix import elm elm-explorations/webgl
```

The Elm importer also allows you to specify a version string:

```
guix import elm elm-explorations/webgl@1.1.3
```

Additional options include:

`--recursive`
`-r` Traverse the dependency graph of the given upstream package recursively and generate package expressions for all those packages that are not yet in Guix.

`npm-binary`

Import metadata from the npm Registry (`https://registry.npmjs.org`), as in this example:

```
guix import npm-binary buffer-crc32
```

The npm-binary importer also allows you to specify a version string:

```
guix import npm-binary buffer-crc32@1.0.0
```

Nota: Generated package expressions skip the build step of the `node-build-system`. As such, generated package expressions often refer to transpiled or generated files, instead of being built from source.

Additional options include:

`--recursive`
`-r` Traverse the dependency graph of the given upstream package recursively and generate package expressions for all those packages that are not yet in Guix.

`opam` Import metadata from the OPAM (`https://opam.ocaml.org/`) package repository used by the OCaml community.

Additional options include:

`--recursive`
`-r` Traverse the dependency graph of the given upstream package recursively and generate package expressions for all those packages that are not yet in Guix.

`composer` Import metadata from the Composer (`https://getcomposer.org/`) package archive used by the PHP community, as in this example:

```
guix import composer phpunit/phpunit
```

Additional options include:

`--recursive`
`-r` Traverse the dependency graph of the given upstream package recursively and generate package expressions for all those packages that are not yet in Guix.

`--repo` By default, packages are searched in the official OPAM repository. This option, which can be used more than once, lets you add other repositories which will be searched for packages. It accepts as valid arguments:

- the name of a known repository - can be one of `opam`, `coq` (equivalent to `coq-released`), `coq-core-dev`, `coq-extra-dev` or `grew`.
- the URL of a repository as expected by the `opam repository add` command (for instance, the URL equivalent of the above `opam` name would be `https://opam.ocaml.org`).
- the path to a local copy of a repository (a directory containing a `packages/` sub-directory).

Repositories are assumed to be passed to this option by order of preference. The additional repositories will not replace the default `opam` repository, which is always kept as a fallback.

Also, please note that versions are not compared across repositories. The first repository (from left to right) that has at least one version of a given package will prevail over any others, and the version imported will be the latest one found *in this repository only*.

`go` Import metadata for a Go module using proxy.golang.org (`https://proxy.golang.org`).

```
guix import go gopkg.in/yaml.v2
```

It is possible to use a package specification with a `@VERSION` suffix to import a specific version.

Additional options include:

`--recursive`
`-r` Traverse the dependency graph of the given upstream package recursively and generate package expressions for all those packages that are not yet in Guix.

`--pin-versions`
When using this option, the importer preserves the exact versions of the Go modules dependencies instead of using their latest available versions. This can be useful when attempting to import packages that recursively depend on former versions of themselves to build. When using this mode, the symbol of the package is made by appending the version to its name, so that multiple versions of the same package can coexist.

`egg` Import metadata for CHICKEN eggs (`https://wiki.call-cc.org/eggs`). The information is taken from `PACKAGE.egg` files found in the eggs-5-all (`git://code.call-cc.org/eggs-5-all`) Git repository. However, it does not provide all the information that we need, there is no "description" field, and the licenses used are not always precise (BSD is often used instead of BSD-N).

```
guix import egg sourcehut
```

You can also ask for a specific version:

```
guix import egg arrays@1.0
```

Additional options include:

`--recursive`
`-r` Traverse the dependency graph of the given upstream package recursively and generate package expressions for all those packages that are not yet in Guix.

`hexpm` Import metadata from the hex.pm Erlang and Elixir package repository hex.pm (`https://hex.pm`), as in this example:

```
guix import hexpm stun
```

The importer tries to determine the build system used by the package.

The hexpm importer also allows you to specify a version string:

```
guix import hexpm cf@0.3.0
```

Additional options include:

`--recursive`
`-r` Traverse the dependency graph of the given upstream package recursively and generate package expressions for all those packages that are not yet in Guix.

The structure of the `guix import` code is modular. It would be useful to have more importers for other package formats, and your help is welcome here (veja Capítulo 22 [Contribuindo], Página 720).

9.6 Invocando `guix refresh`

The primary audience of the `guix refresh` command is packagers. As a user, you may be interested in the `--with-latest` option, which can bring you package update superpowers built upon `guix refresh` (veja Seção 9.1.2 [Opções de transformação de pacote], Página 180). By default, `guix refresh` reports any packages provided by the distribution that are outdated compared to the latest upstream version, like this:

```
$ guix refresh
gnu/packages/gettext.scm:29:13: gettext would be upgraded from 0.18.1.1 to 0.18.2.1
gnu/packages/glib.scm:77:12: glib would be upgraded from 2.34.3 to 2.37.0
```

Alternatively, one can specify packages to consider, in which case a warning is emitted for packages that lack an updater:

```
$ guix refresh coreutils guile guile-ssh
gnu/packages/ssh.scm:205:2: warning: no updater for guile-ssh
gnu/packages/guile.scm:136:12: guile would be upgraded from 2.0.12 to 2.0.13
```

`guix refresh` browses the upstream repository of each package and determines the highest version number of the releases therein. The command knows how to update specific types of packages: GNU packages, ELPA packages, etc.—see the documentation for `--type` below. There are many packages, though, for which it lacks a method to determine whether a new upstream release is available. However, the mechanism is extensible, so feel free to get in touch with us to add a new method!

`--recursive`
Consider the packages specified, and all the packages upon which they depend.

```
$ guix refresh --recursive coreutils
```

```
gnu/packages/acl.scm:40:13: acl would be upgraded from 2.2.53 to 2.3.1
gnu/packages/m4.scm:30:12: 1.4.18 is already the latest version of m4
gnu/packages/xml.scm:68:2: warning: no updater for expat
gnu/packages/multiprecision.scm:40:12: 6.1.2 is already the latest version o
...
```

If for some reason you don't want to update to the latest version, you can update to a specific version by appending an equal sign and the desired version number to the package specification. Note that not all updaters support this; an error is reported when an updater cannot refresh to the specified version.

```
$ guix refresh trytond-party
gnu/packages/guile.scm:392:2: guile would be upgraded from 3.0.3 to 3.0.5
$ guix refresh -u guile=3.0.4
...
gnu/packages/guile.scm:392:2: guile: updating from version 3.0.3 to version 3.0.4...
...
$ guix refresh -u guile@2.0=2.0.12
...
gnu/packages/guile.scm:147:2: guile: updating from version 2.0.10 to version 2.0.12...
...
```

In some specific cases, you may have many packages specified via a manifest or a module selection which should all be updated together; for these cases, the `--target-version` option can be provided to have them all refreshed to the same version, as shown in the examples below:

```
$ guix refresh qtbase qtdeclarative --target-version=6.5.2
gnu/packages/qt.scm:1248:13: qtdeclarative would be upgraded from 6.3.2 to 6.5.2
gnu/packages/qt.scm:584:2: qtbase would be upgraded from 6.3.2 to 6.5.2
```

```
$ guix refresh --manifest=qt5-manifest.scm --target-version=5.15.10
gnu/packages/qt.scm:1173:13: qtxmlpatterns would be upgraded from 5.15.8 to 5.15.10
gnu/packages/qt.scm:1202:13: qtdeclarative would be upgraded from 5.15.8 to 5.15.10
gnu/packages/qt.scm:1762:13: qtserialbus would be upgraded from 5.15.8 to 5.15.10
gnu/packages/qt.scm:2070:13: qtquickcontrols2 would be upgraded from 5.15.8 to 5.15.10
...
```

Sometimes the upstream name differs from the package name used in Guix, and `guix refresh` needs a little help. Most updaters honor the `upstream-name` property in package definitions, which can be used to that effect:

```
(define-public network-manager
  (package
    (name "network-manager")
    ;; ...
    (properties '((upstream-name . "NetworkManager")))))
```

When passed `--update`, it modifies distribution source files to update the version numbers and source code hashes of those package definitions, as well as possibly their inputs (veja Seção 8.2 [Definindo pacotes], Página 101). This is achieved by downloading each package's latest source tarball and its associated OpenPGP signature, authenticating the

downloaded tarball against its signature using `gpgv`, and finally computing its hash—note that GnuPG must be installed and in `$PATH`; run `guix install gnupg` if needed.

When the public key used to sign the tarball is missing from the user's keyring, an attempt is made to automatically retrieve it from a public key server; when this is successful, the key is added to the user's keyring; otherwise, `guix refresh` reports an error.

The following options are supported:

`--expression=`*expr*
`-e` *expr* Consider the package *expr* evaluates to.

This is useful to precisely refer to a package, as in this example:

```
guix refresh -l -e '(@@ (gnu packages commencement) glibc-final)'
```

This command lists the dependents of the "final" libc (essentially all the packages).

`--update`
`-u` Update distribution source files (package definitions) in place. This is usually run from a checkout of the Guix source tree (veja Seção 22.4 [Executando guix antes dele ser instalado], Página 725):

```
./pre-inst-env guix refresh -s non-core -u
```

Veja Seção 8.2 [Definindo pacotes], Página 101, for more information on package definitions. You can also run it on packages from a third-party channel:

```
guix refresh -L /path/to/channel -u package
```

Veja Seção 6.7 [Criando um canal], Página 73, on how to create a channel.

This command updates the version and source code hash of the package. Depending on the updater being used, it can also update the various '`inputs`' fields of the package. In some cases, the updater might get inputs wrong—it might not know about an extra input that's necessary, or it might add an input that should be avoided.

To address that, packagers can add properties stating inputs that should be added to those found by the updater or inputs that should be ignored: the `updater-extra-inputs` and `updater-ignored-inputs` properties pertain to "regular" inputs, and there are equivalent properties for '`native`' and '`propagated`' inputs. In the example below, we tell the updater that we need '`openmpi`' as an additional input:

```
(define-public python-mpi4py
  (package
    (name "python-mpi4py")
    ;; ...
    (inputs (list openmpi))
    (properties
     '((updater-extra-inputs . ("openmpi"))))))
```

That way, `guix refresh -u python-mpi4py` will leave the '`openmpi`' input, even if it is not among the inputs it would normally add.

`--select=[`*subset*`]`
`-s` *subset* Select all the packages in *subset*, one of `core`, `non-core` or `module:`*name*.

The `core` subset refers to all the packages at the core of the distribution—i.e., packages that are used to build "everything else". This includes GCC, libc, Binutils, Bash, etc. Usually, changing one of these packages in the distribution entails a rebuild of all the others. Thus, such updates are an inconvenience to users in terms of build time or bandwidth used to achieve the upgrade.

The `non-core` subset refers to the remaining packages. It is typically useful in cases where an update of the core packages would be inconvenient.

The `module:`*`name`* subset refers to all the packages in a specified guile module. The module can be specified as `module:guile` or `module:(gnu packages guile)`, the former is a shorthand for the later.

`--manifest=`*arquivo*
`-m` *arquivo*

Select all the packages from the manifest in *file*. This is useful to check if any packages of the user manifest can be updated.

`--type=`*updater*
`-t` *updater*

Select only packages handled by *updater* (may be a comma-separated list of updaters). Currently, *updater* may be one of:

`gnu` the updater for GNU packages;

`savannah` the updater for packages hosted at Savannah (`https://savannah.gnu.org`);

`sourceforge` the updater for packages hosted at SourceForge (`https://sourceforge.net`);

`gnome` the updater for GNOME packages;

`kde` the updater for KDE packages;

`xorg` the updater for X.org packages;

`kernel.org` the updater for packages hosted on kernel.org;

`egg` the updater for Egg (`https://wiki.call-cc.org/eggs/`) packages;

`elpa` the updater for ELPA (`https://elpa.gnu.org/`) packages;

`cran` the updater for CRAN (`https://cran.r-project.org/`) packages;

`bioconductor` the updater for Bioconductor (`https://www.bioconductor.org/`) R packages;

`cpan` the updater for CPAN (`https://www.cpan.org/`) packages;

`pypi` the updater for PyPI (`https://pypi.python.org`) packages.

`gem` the updater for RubyGems (`https://rubygems.org`) packages.

`github` the updater for GitHub (`https://github.com`) packages.

`hackage` the updater for Hackage (`https://hackage.haskell.org`) packages.

`stackage` the updater for Stackage (`https://www.stackage.org`) packages.

`crate` the updater for Crates (`https://crates.io`) packages.

`launchpad`
the updater for Launchpad (`https://launchpad.net`) packages.

`generic-html`
a generic updater that crawls the HTML page where the source tarball of the package is hosted, when applicable, or the HTML page specified by the `release-monitoring-url` property of the package.

`generic-git`
a generic updater for packages hosted on Git repositories. It tries to be smart about parsing Git tag names, but if it is not able to parse the tag name and compare tags correctly, users can define the following properties for a package.

- `release-tag-prefix`: a regular expression for matching a prefix of the tag name.
- `release-tag-suffix`: a regular expression for matching a suffix of the tag name.
- `release-tag-version-delimiter`: a string used as the delimiter in the tag name for separating the numbers of the version.
- `accept-pre-releases`: by default, the updater will ignore pre-releases; to make it also look for pre-releases, set the this property to `#t`.

```
(package
  (name "foo")
  ;; ...
  (properties
    '((release-tag-prefix . "^release0-")
      (release-tag-suffix . "[a-z]?$")
      (release-tag-version-delimiter . ":"))))
```

For instance, the following command only checks for updates of Emacs packages hosted at `elpa.gnu.org` and for updates of CRAN packages:

```
$ guix refresh --type=elpa,cran
gnu/packages/statistics.scm:819:13: r-testthat would be upgraded from 0.10.0
gnu/packages/emacs.scm:856:13: emacs-auctex would be upgraded from 11.88.6 t
```

`--list-updaters`
List available updaters and exit (see `--type` above).

For each updater, display the fraction of packages it covers; at the end, display the fraction of packages covered by all these updaters.

In addition, `guix refresh` can be passed one or more package names, as in this example:

```
$ ./pre-inst-env guix refresh -u emacs idutils gcc@4.8
```

The command above specifically updates the `emacs` and `idutils` packages. The `--select` option would have no effect in this case. You might also want to update definitions that correspond to the packages installed in your profile:

```
$ ./pre-inst-env guix refresh -u \
       $(guix package --list-installed | cut -f1)
```

When considering whether to upgrade a package, it is sometimes convenient to know which packages would be affected by the upgrade and should be checked for compatibility. For this the following option may be used when passing `guix refresh` one or more package names:

`--list-dependent`
`-l`
: List top-level dependent packages that would need to be rebuilt as a result of upgrading one or more packages.

  Veja Seção 9.10 [Invocando guix graph], Página 216, for information on how to visualize the list of dependents of a package.

Be aware that the `--list-dependent` option only *approximates* the rebuilds that would be required as a result of an upgrade. More rebuilds might be required under some circumstances.

```
$ guix refresh --list-dependent flex
Building the following 120 packages would ensure 213 dependent packages are rebuilt:
hop@2.4.0 emacs-geiser@0.13 notmuch@0.18 mu@0.9.9.5 cflow@1.4 idutils@4.6 ...
```

The command above lists a set of packages that could be built to check for compatibility with an upgraded `flex` package.

`--list-transitive`
`-T`
: List all the packages which one or more packages depend upon.

```
$ guix refresh --list-transitive flex
flex@2.6.4 depends on the following 25 packages: perl@5.28.0 help2man@1.47.6
bison@3.0.5 indent@2.2.10 tar@1.30 gzip@1.9 bzip2@1.0.6 xz@5.2.4 file@5.33 .
```

The command above lists a set of packages which, when changed, would cause `flex` to be rebuilt.

The following options can be used to customize GnuPG operation:

`--gpg=`*command*
: Use *command* as the GnuPG 2.x command. *command* is searched for in `$PATH`.

`--keyring=`*file*
: Use *file* as the keyring for upstream keys. *file* must be in the *keybox format*. Keybox files usually have a name ending in `.kbx` and the GNU Privacy Guard (GPG) can manipulate these files (veja Seção "kbxutil" em *Using the GNU Privacy Guard*, for information on a tool to manipulate keybox files).

  When this option is omitted, `guix refresh` uses `~/.config/guix/upstream/trustedkeys.kbx` as the keyring for upstream signing keys. OpenPGP signatures are checked

against keys from this keyring; missing keys are downloaded to this keyring as well (see `--key-download` below).

You can export keys from your default GPG keyring into a keybox file using commands like this one:

```
gpg --export rms@gnu.org | kbxutil --import-openpgp >> mykeyring.kbx
```

Likewise, you can fetch keys to a specific keybox file like this:

```
gpg --no-default-keyring --keyring mykeyring.kbx \
  --recv-keys 3CE464558A84FDC69DB40CFB090B11993D9AEBB5
```

Veja Seção "GPG Configuration Options" em *Using the GNU Privacy Guard*, for more information on GPG's `--keyring` option.

`--key-download=`*policy*

Handle missing OpenPGP keys according to *policy*, which may be one of:

`always` Always download missing OpenPGP keys from the key server, and add them to the user's GnuPG keyring.

`never` Never try to download missing OpenPGP keys. Instead just bail out.

`interactive`
When a package signed with an unknown OpenPGP key is encountered, ask the user whether to download it or not. This is the default behavior.

`--key-server=`*host*

Use *host* as the OpenPGP key server when importing a public key.

`--load-path=`*directory*
`-L` *diretório*

Add *directory* to the front of the package module search path (veja Seção 8.1 [Módulos de pacote], Página 100).

This allows users to define their own packages and make them visible to the command-line tools.

The `github` updater uses the GitHub API (`https://developer.github.com/v3/`) to query for new releases. When used repeatedly e.g. when refreshing all packages, GitHub will eventually refuse to answer any further API requests. By default 60 API requests per hour are allowed, and a full refresh on all GitHub packages in Guix requires more than this. Authentication with GitHub through the use of an API token alleviates these limits. To use an API token, set the environment variable `GUIX_GITHUB_TOKEN` to a token procured from `https://github.com/settings/tokens` or otherwise.

9.7 Invoking `guix style`

The `guix style` command helps users and packagers alike style their package definitions and configuration files according to the latest fashionable trends. It can either reformat whole files, with the `--whole-file` option, or apply specific *styling rules* to individual package definitions. The command currently provides the following styling rules:

- formatting package definitions according to the project's conventions (veja Seção 22.9.4 [Formatação de código], Página 746);

- rewriting package inputs to the "new style", as explained below.

The way package inputs are written is going through a transition (veja Seção 8.2.1 [Referência do package], Página 104, for more on package inputs). Until version 1.3.0, package inputs were written using the "old style", where each input was given an explicit label, most of the time the package name:

```
(package
  ;; ...
  ;; The "old style" (deprecated).
  (inputs `(("libunistring" ,libunistring)
            ("libffi" ,libffi))))
```

Today, the old style is deprecated and the preferred style looks like this:

```
(package
  ;; ...
  ;; The "new style".
  (inputs (list libunistring libffi)))
```

Likewise, uses of `alist-delete` and friends to manipulate inputs is now deprecated in favor of `modify-inputs` (veja Seção 8.3 [Definindo variantes de pacote], Página 113, for more info on `modify-inputs`).

In the vast majority of cases, this is a purely mechanical change on the surface syntax that does not even incur a package rebuild. Running `guix style -S inputs` can do that for you, whether you're working on packages in Guix proper or in an external channel.

A sintaxe geral é:

```
guix style [options] package...
```

This causes `guix style` to analyze and rewrite the definition of *package*... or, when *package* is omitted, of *all* the packages. The `--styling` or `-S` option allows you to select the style rule, the default rule being `format`—see below.

To reformat entire source files, the syntax is:

```
guix style --whole-file file...
```

The available options are listed below.

`--dry-run`
`-n` Show source file locations that would be edited but do not modify them.

`--whole-file`
`-f` Reformat the given files in their entirety. In that case, subsequent arguments are interpreted as file names (rather than package names), and the `--styling` option has no effect.

As an example, here is how you might reformat your operating system configuration (you need write permissions for the file):

```
guix style -f /etc/config.scm
```

`--alphabetical-sort`
`-A` Place the top-level package definitions in the given files in alphabetical order. Package definitions with matching names are placed with versions in descending order. This option only has an effect in combination with `--whole-file`.

`--styling=`*rule*
`-S` *rule* Apply *rule*, one of the following styling rules:

`format` Format the given package definition(s)—this is the default styling rule. For example, a packager running Guix on a checkout (veja Seção 22.4 [Executando guix antes dele ser instalado], Página 725) might want to reformat the definition of the Coreutils package like so:

```
./pre-inst-env guix style coreutils
```

`inputs` Rewrite package inputs to the "new style", as described above. This is how you would rewrite inputs of package `whatnot` in your own channel:

```
guix style -L ~/my/channel -S inputs whatnot
```

Rewriting is done in a conservative way: preserving comments and bailing out if it cannot make sense of the code that appears in an inputs field. The `--input-simplification` option described below provides fine-grain control over when inputs should be simplified.

`arguments`
Rewrite package arguments to use G-expressions (veja Seção 8.12 [Expressões-G], Página 163). For example, consider this package definition:

```
(define-public my-package
  (package
    ;; ...
    (arguments      ;old-style quoted arguments
     '(#:make-flags '("V=1")
       #:phases (modify-phases %standard-phases
                  (delete 'build))))))
```

Running `guix style -S arguments` on this package would rewrite its `arguments` field like to:

```
(define-public my-package
  (package
    ;; ...
    (arguments
      (list #:make-flags #~'("V=1")
            #:phases #~(modify-phases %standard-phases
                         (delete 'build))))))
```

Note that changes made by the `arguments` rule do not entail a rebuild of the affected packages. Furthermore, if a package definition happens to be using G-expressions already, `guix style` leaves it unchanged.

`--list-stylings`
`-l` List and describe the available styling rules and exit.

`--load-path=`*directory*
`-L` *diretório*
: Add *directory* to the front of the package module search path (veja Seção 8.1 [Módulos de pacote], Página 100).

`--expression=`*expr*
`-e` *expr*
: Style the package *expr* evaluates to.

  For example, running:

```
guix style -e '(@ (gnu packages gcc) gcc-5)'
```

  styles the `gcc-5` package definition.

`--input-simplification=`*policy*
: When using the `inputs` styling rule, with '`-S inputs`', this option specifies the package input simplification policy for cases where an input label does not match the corresponding package name. *policy* may be one of the following:

  `silent`
  : Simplify inputs only when the change is "silent", meaning that the package does not need to be rebuilt (its derivation is unchanged).

  `safe`
  : Simplify inputs only when that is "safe" to do: the package might need to be rebuilt, but the change is known to have no observable effect.

  `always`
  : Simplify inputs even when input labels do not match package names, and even if that might have an observable effect.

  The default is `silent`, meaning that input simplifications do not trigger any package rebuild.

9.8 Invocando `guix lint`

The `guix lint` command is meant to help package developers avoid common errors and use a consistent style. It runs a number of checks on a given set of packages in order to find common mistakes in their definitions. Available *checkers* include (see `--list-checkers` for a complete list):

`synopsis`
`description`
: Validate certain typographical and stylistic rules about package descriptions and synopses.

`inputs-should-be-native`
: Identify inputs that should most likely be native inputs.

`source`
`página inicial`
`mirror-url`
`github-url`
`source-file-name`
: Probe `home-page` and `source` URLs and report those that are invalid. Suggest a `mirror://` URL when applicable. If the `source` URL redirects to a GitHub URL, recommend usage of the GitHub URL. Check that the source file name

is meaningful, e.g. is not just a version number or "git-checkout", without a declared `file-name` (veja Seção 8.2.2 [Referência do origin], Página 108).

`source-unstable-tarball`
: Parse the `source` URL to determine if a tarball from GitHub is autogenerated or if it is a release tarball. Unfortunately GitHub's autogenerated tarballs are sometimes regenerated.

`derivação`
: Check that the derivation of the given packages can be successfully computed for all the supported systems (veja Seção 8.10 [Derivações], Página 156).

`profile-collisions`
: Check whether installing the given packages in a profile would lead to collisions. Collisions occur when several packages with the same name but a different version or a different store file name are propagated. Veja Seção 8.2.1 [Referência do package], Página 104, for more information on propagated inputs.

`archival` Checks whether the package's source code is archived at Software Heritage (`https://www.softwareheritage.org`).

When the source code that is not archived comes from a version-control system (VCS)—e.g., it's obtained with `git-fetch`, send Software Heritage a "save" request so that it eventually archives it. This ensures that the source will remain available in the long term, and that Guix can fall back to Software Heritage should the source code disappear from its original host. The status of recent "save" requests can be viewed on-line (`https://archive.softwareheritage.org/save/#requests`).

When source code is a tarball obtained with `url-fetch`, simply print a message when it is not archived. As of this writing, Software Heritage does not allow requests to save arbitrary tarballs; we are working on ways to ensure that non-VCS source code is also archived.

Software Heritage limits the request rate per IP address (`https://archive.softwareheritage.org/api/#rate-limiting`). When the limit is reached, `guix lint` prints a message and the `archival` checker stops doing anything until that limit has been reset.

`cve` Report known vulnerabilities found in the Common Vulnerabilities and Exposures (CVE) databases of the current and past year published by the US NIST (`https://nvd.nist.gov/vuln/data-feeds`).

To view information about a particular vulnerability, visit pages such as:

- '`https://web.nvd.nist.gov/view/vuln/detail?vulnId=CVE-YYYY-ABCD`'
- '`https://cve.mitre.org/cgi-bin/cvename.cgi?name=CVE-YYYY-ABCD`'

where `CVE-YYYY-ABCD` is the CVE identifier—e.g., `CVE-2015-7554`.

Package developers can specify in package recipes the Common Platform Enumeration (CPE) (`https://nvd.nist.gov/products/cpe`) name and version of the package when they differ from the name or version that Guix uses, as in this example:

```
(package
```

```
(name "grub")
;; ...
;; CPE calls this package "grub2".
(properties '((cpe-name . "grub2")
              (cpe-version . "2.3"))))
```

Some entries in the CVE database do not specify which version of a package they apply to, and would thus "stick around" forever. Package developers who found CVE alerts and verified they can be ignored can declare them as in this example:

```
(package
  (name "t1lib")
  ;; ...
  ;; These CVEs no longer apply and can be safely ignored.
  (properties `((lint-hidden-cve . ("CVE-2011-0433"
                                    "CVE-2011-1553"
                                    "CVE-2011-1554"
                                    "CVE-2011-5244")))))
```

`formatting`
: Warn about obvious source code formatting issues: trailing white space, use of tabulations, etc.

`input-labels`
: Report old-style input labels that do not match the name of the corresponding package. This aims to help migrate from the "old input style". Veja Seção 8.2.1 [Referência do package], Página 104, for more information on package inputs and input styles. Veja Seção 9.7 [Invocando guix style], Página 208, on how to migrate to the new style.

A sintaxe geral é:

```
guix lint options package...
```

If no package is given on the command line, then all packages are checked. The *options* may be zero or more of the following:

`--list-checkers`
`-l`
: List and describe all the available checkers that will be run on packages and exit.

`--checkers`
`-c`
: Only enable the checkers specified in a comma-separated list using the names returned by `--list-checkers`.

`--exclude`
`-x`
: Only disable the checkers specified in a comma-separated list using the names returned by `--list-checkers`.

`--expression=`*expr*
`-e` *expr*
: Consider the package *expr* evaluates to.

  This is useful to unambiguously designate packages, as in this example:

```
guix lint -c archival -e '(@ (gnu packages guile) guile-3.0)'
```

`--no-network`
`-n` Only enable the checkers that do not depend on Internet access.

`--load-path=`*directory*
`-L` *diretório*
Add *directory* to the front of the package module search path (veja Seção 8.1 [Módulos de pacote], Página 100).

This allows users to define their own packages and make them visible to the command-line tools.

9.9 Invocando `guix size`

The `guix size` command helps package developers profile the disk usage of packages. It is easy to overlook the impact of an additional dependency added to a package, or the impact of using a single output for a package that could easily be split (veja Seção 5.4 [Pacotes com múltiplas saídas], Página 52). Such are the typical issues that `guix size` can highlight.

The command can be passed one or more package specifications such as `gcc@4.8` or `guile:debug`, or a file name in the store. Consider this example:

```
$ guix size coreutils
store item                                 total    self
/gnu/store/...-gcc-5.5.0-lib              60.4    30.1  38.1%
/gnu/store/...-glibc-2.27                 30.3    28.8  36.6%
/gnu/store/...-coreutils-8.28             78.9    15.0  19.0%
/gnu/store/...-gmp-6.1.2                  63.1     2.7   3.4%
/gnu/store/...-bash-static-4.4.12          1.5     1.5   1.9%
/gnu/store/...-acl-2.2.52                 61.1     0.4   0.5%
/gnu/store/...-attr-2.4.47                60.6     0.2   0.3%
/gnu/store/...-libcap-2.25                60.5     0.2   0.2%
total: 78.9 MiB
```

The store items listed here constitute the *transitive closure* of Coreutils—i.e., Coreutils and all its dependencies, recursively—as would be returned by:

```
$ guix gc -R /gnu/store/...-coreutils-8.23
```

Here the output shows three columns next to store items. The first column, labeled "total", shows the size in mebibytes (MiB) of the closure of the store item—that is, its own size plus the size of all its dependencies. The next column, labeled "self", shows the size of the item itself. The last column shows the ratio of the size of the item itself to the space occupied by all the items listed here.

In this example, we see that the closure of Coreutils weighs in at 79 MiB, most of which is taken by libc and GCC's run-time support libraries. (That libc and GCC's libraries represent a large fraction of the closure is not a problem *per se* because they are always available on the system anyway.)

Since the command also accepts store file names, assessing the size of a build result is straightforward:

```
guix size $(guix system build config.scm)
```

When the package(s) passed to `guix size` are available in the store[1], `guix size` queries the daemon to determine its dependencies, and measures its size in the store, similar to `du -ms --apparent-size` (veja Seção "du invocation" em *GNU Coreutils*).

When the given packages are *not* in the store, `guix size` reports information based on the available substitutes (veja Seção 5.3 [Substitutos], Página 47). This makes it possible to profile the disk usage of store items that are not even on disk, only available remotely.

You can also specify several package names:

```
$ guix size coreutils grep sed bash
store item                                total    self
/gnu/store/...-coreutils-8.24          77.8    13.8  13.4%
/gnu/store/...-grep-2.22               73.1     0.8   0.8%
/gnu/store/...-bash-4.3.42             72.3     4.7   4.6%
/gnu/store/...-readline-6.3            67.6     1.2   1.2%
...
total: 102.3 MiB
```

In this example we see that the combination of the four packages takes 102.3 MiB in total, which is much less than the sum of each closure since they have a lot of dependencies in common.

When looking at the profile returned by `guix size`, you may find yourself wondering why a given package shows up in the profile at all. To understand it, you can use `guix graph --path -t references` to display the shortest path between the two packages (veja Seção 9.10 [Invocando guix graph], Página 216).

The available options are:

`--substitute-urls=`*urls*
: Use substitute information from *urls*. Veja [client-substitute-urls], Página 178.

`--sort=`*key*
: Sort lines according to *key*, one of the following options:

  `próprio` the size of each item (the default);

  `fechamento`
  : the total size of the item's closure.

`--map-file=`*arquivo*
: Write a graphical map of disk usage in PNG format to *file*.

  For the example above, the map looks like this:

[1] More precisely, `guix size` looks for the *ungrafted* variant of the given package(s), as returned by `guix build` *package* `--no-grafts`. Veja Capítulo 19 [Atualizações de segurança], Página 710, for information on grafts.

This option requires that Guile-Charting (`https://wingolog.org/software/guile-charting/`) be installed and visible in Guile's module search path. When that is not the case, `guix size` fails as it tries to load it.

`--system=`*system*
`-s` *sistema*
: Consider packages for *system*—e.g., `x86_64-linux`.

`--load-path=`*directory*
`-L` *diretório*
: Add *directory* to the front of the package module search path (veja Seção 8.1 [Módulos de pacote], Página 100).

  This allows users to define their own packages and make them visible to the command-line tools.

9.10 Invocando `guix graph`

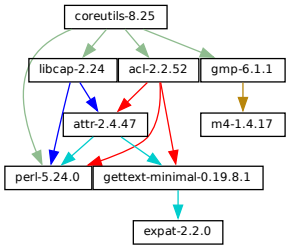
Packages and their dependencies form a *graph*, specifically a directed acyclic graph (DAG). It can quickly become difficult to have a mental model of the package DAG, so the `guix graph` command provides a visual representation of the DAG. By default, `guix graph` emits a DAG representation in the input format of Graphviz (`https://www.graphviz.org/`), so its output can be passed directly to the `dot` command of Graphviz. It can also emit an HTML page with embedded JavaScript code to display a "chord diagram" in a Web browser, using the d3.js (`https://d3js.org/`) library, or emit Cypher queries to construct a graph in a graph database supporting the openCypher (`https://www.opencypher.org/`) query language. With `--path`, it simply displays the shortest path between two packages. The general syntax is:

```
guix graph options package...
```

For example, the following command generates a PDF file representing the package DAG for the GNU Core Utilities, showing its build-time dependencies:

```
guix graph coreutils | dot -Tpdf > dag.pdf
```

The output looks like this:



Nice little graph, no?

You may find it more pleasant to navigate the graph interactively with `xdot` (from the `xdot` package):

```
guix graph coreutils | xdot -
```

But there is more than one graph! The one above is concise: it is the graph of package objects, omitting implicit inputs such as GCC, libc, grep, etc. It is often useful to have such a concise graph, but sometimes one may want to see more details. `guix graph` supports several types of graphs, allowing you to choose the level of detail:

`pacote`
: This is the default type used in the example above. It shows the DAG of package objects, excluding implicit dependencies. It is concise, but filters out many details.

`reverse-package`
: This shows the *reverse* DAG of packages. For example:

```
guix graph --type=reverse-package ocaml
```

... yields the graph of packages that *explicitly* depend on OCaml (if you are also interested in cases where OCaml is an implicit dependency, see `reverse-bag` below).

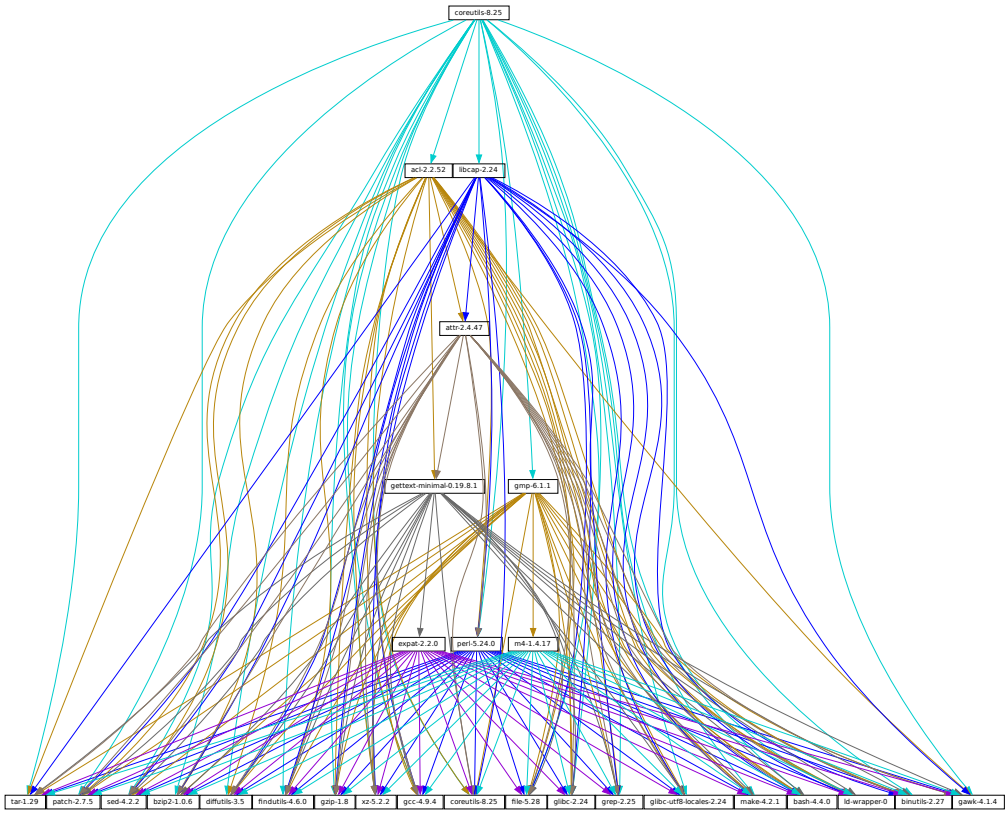
Note that for core packages this can yield huge graphs. If all you want is to know the number of packages that depend on a given package, use `guix refresh --list-dependent` (veja Seção 9.6 [Invocando guix refresh], Página 202).

`bag-emerged`
: This is the package DAG, *including* implicit inputs.

For instance, the following command:

```
guix graph --type=bag-emerged coreutils
```

... yields this bigger graph:



At the bottom of the graph, we see all the implicit inputs of *gnu-build-system* (veja Seção 8.5 [Sistemas de compilação], Página 121).

Now, note that the dependencies of these implicit inputs—that is, the *bootstrap dependencies* (veja Capítulo 20 [Inicializando], Página 712)—are not shown here, for conciseness.

`bag` Similar to `bag-emerged`, but this time including all the bootstrap dependencies.

`bag-with-origins`
Similar to `bag`, but also showing origins and their dependencies.

`reverse-bag`
This shows the *reverse* DAG of packages. Unlike `reverse-package`, it also takes implicit dependencies into account. For example:

```
guix graph -t reverse-bag dune
```

... yields the graph of all packages that depend on Dune, directly or indirectly. Since Dune is an *implicit* dependency of many packages *via* `dune-build-system`, this shows a large number of packages, whereas `reverse-package` would show very few if any.

`derivação`
: This is the most detailed representation: It shows the DAG of derivations (veja Seção 8.10 [Derivações], Página 156) and plain store items. Compared to the above representation, many additional nodes are visible, including build scripts, patches, Guile modules, etc.

  For this type of graph, it is also possible to pass a `.drv` file name instead of a package name, as in:

  ```
  guix graph -t derivation $(guix system build -d my-config.scm)
  ```

`modulo`
: This is the graph of *package modules* (veja Seção 8.1 [Módulos de pacote], Página 100). For example, the following command shows the graph for the package module that defines the `guile` package:

  ```
  guix graph -t module guile | xdot -
  ```

All the types above correspond to *build-time dependencies*. The following graph type represents the *run-time dependencies*:

`references`
: This is the graph of *references* of a package output, as returned by `guix gc --references` (veja Seção 5.6 [Invocando guix gc], Página 54).

  If the given package output is not available in the store, `guix graph` attempts to obtain dependency information from substitutes.

  Here you can also pass a store file name instead of a package name. For example, the command below produces the reference graph of your profile (which can be big!):

  ```
  guix graph -t references $(readlink -f ~/.guix-profile)
  ```

`referrers`
: This is the graph of the *referrers* of a store item, as returned by `guix gc --referrers` (veja Seção 5.6 [Invocando guix gc], Página 54).

  This relies exclusively on local information from your store. For instance, let us suppose that the current Inkscape is available in 10 profiles on your machine; `guix graph -t referrers inkscape` will show a graph rooted at Inkscape and with those 10 profiles linked to it.

  It can help determine what is preventing a store item from being garbage collected.

Often, the graph of the package you are interested in does not fit on your screen, and anyway all you want to know is *why* that package actually depends on some seemingly unrelated package. The `--path` option instructs `guix graph` to display the shortest path between two packages (or derivations, or store items, etc.):

```
$ guix graph --path emacs libunistring
emacs@26.3
mailutils@3.9
libunistring@0.9.10
$ guix graph --path -t derivation emacs libunistring
/gnu/store/...-emacs-26.3.drv
/gnu/store/...-mailutils-3.9.drv
```

```
/gnu/store/...-libunistring-0.9.10.drv
$ guix graph --path -t references emacs libunistring
/gnu/store/...-emacs-26.3
/gnu/store/...-libidn2-2.2.0
/gnu/store/...-libunistring-0.9.10
```

Sometimes you still want to visualize the graph but would like to trim it so it can actually be displayed. One way to do it is via the `--max-depth` (or `-M`) option, which lets you specify the maximum depth of the graph. In the example below, we visualize only `libreoffice` and the nodes whose distance to `libreoffice` is at most 2:

```
guix graph -M 2 libreoffice | xdot -f fdp -
```

Mind you, that's still a big ball of spaghetti, but at least `dot` can render it quickly and it can be browsed somewhat.

The available options are the following:

`--type=`*type*
`-t` *tipo* Produce a graph output of *type*, where *type* must be one of the values listed above.

`--list-types`
Lista os tipos de grafos disponíveis.

`--backend=`*backend*
`-b` *backend*
Produce a graph using the selected *backend*.

`--list-backends`
Lista os backends de grafos disponíveis.

Currently, the available backends are Graphviz and d3.js.

`--path` Display the shortest path between two nodes of the type specified by `--type`. The example below shows the shortest path between `libreoffice` and `llvm` according to the references of `libreoffice`:

```
$ guix graph --path -t references libreoffice llvm
/gnu/store/...-libreoffice-6.4.2.2
/gnu/store/...-libepoxy-1.5.4
/gnu/store/...-mesa-19.3.4
/gnu/store/...-llvm-9.0.1
```

`--expression=`*expr*
`-e` *expr* Consider the package *expr* evaluates to.

This is useful to precisely refer to a package, as in this example:

```
guix graph -e '(@@ (gnu packages commencement) gnu-make-final)'
```

`--system=`*system*
`-s` *sistema*
Display the graph for *system*—e.g., `i686-linux`.

The package dependency graph is largely architecture-independent, but there are some architecture-dependent bits that this option allows you to visualize.

`--load-path=`*directory*
`-L` *diretório*

Add *directory* to the front of the package module search path (veja Seção 8.1 [Módulos de pacote], Página 100).

This allows users to define their own packages and make them visible to the command-line tools.

On top of that, `guix graph` supports all the usual package transformation options (veja Seção 9.1.2 [Opções de transformação de pacote], Página 180). This makes it easy to view the effect of a graph-rewriting transformation such as `--with-input`. For example, the command below outputs the graph of `git` once `openssl` has been replaced by `libressl` everywhere in the graph:

```
guix graph git --with-input=openssl=libressl
```

So many possibilities, so much fun!

9.11 Invocando `guix publish`

The purpose of `guix publish` is to enable users to easily share their store with others, who can then use it as a substitute server (veja Seção 5.3 [Substitutos], Página 47).

When `guix publish` runs, it spawns an HTTP server which allows anyone with network access to obtain substitutes from it. This means that any machine running Guix can also act as if it were a build farm, since the HTTP interface is compatible with Cuirass, the software behind the `bordeaux.guix.gnu.org` build farm.

For security, each substitute is signed, allowing recipients to check their authenticity and integrity (veja Seção 5.3 [Substitutos], Página 47). Because `guix publish` uses the signing key of the system, which is only readable by the system administrator, it must be started as root; the `--user` option makes it drop root privileges early on.

The signing key pair must be generated before `guix publish` is launched, using `guix archive --generate-key` (veja Seção 5.11 [Invocando guix archive], Página 66).

When the `--advertise` option is passed, the server advertises its availability on the local network using multicast DNS (mDNS) and DNS service discovery (DNS-SD), currently *via* Guile-Avahi (veja *Using Avahi in Guile Scheme Programs*).

A sintaxe geral é:

```
guix publish options...
```

Running `guix publish` without any additional arguments will spawn an HTTP server on port 8080:

```
guix publish
```

`guix publish` can also be started following the systemd "socket activation" protocol (veja Seção "Service De- and Constructors" em *The GNU Shepherd Manual*).

Once a publishing server has been authorized, the daemon may download substitutes from it. Veja Seção 5.3.3 [Obtendo substitutos de outros servidores], Página 48.

By default, `guix publish` compresses archives on the fly as it serves them. This "on-the-fly" mode is convenient in that it requires no setup and is immediately available. However, when serving lots of clients, we recommend using the `--cache` option, which enables caching of the archives before they are sent to clients—see below for details. The `guix weather`

command provides a handy way to check what a server provides (veja Seção 9.15 [Invocando guix weather], Página 229).

As a bonus, `guix publish` also serves as a content-addressed mirror for source files referenced in `origin` records (veja Seção 8.2.2 [Referência do origin], Página 108). For instance, assuming `guix publish` is running on `example.org`, the following URL returns the raw `hello-2.10.tar.gz` file with the given SHA256 hash (represented in `nix-base32` format, veja Seção 9.4 [Invocando guix hash], Página 192):

```
http://example.org/file/hello-2.10.tar.gz/sha256/0ssi1...ndq1i
```

Obviously, these URLs only work for files that are in the store; in other cases, they return 404 ("Not Found").

Build logs are available from `/log` URLs like:

```
http://example.org/log/gwspk...-guile-2.2.3
```

When `guix-daemon` is configured to save compressed build logs, as is the case by default (veja Seção 2.3 [Invocando guix-daemon], Página 13), `/log` URLs return the compressed log as-is, with an appropriate `Content-Type` and/or `Content-Encoding` header. We recommend running `guix-daemon` with `--log-compression=gzip` since Web browsers can automatically decompress it, which is not the case with Bzip2 compression.

The following options are available:

`--port=`*porta*
`-p` *porta* Ouve requisições HTTP na *porta*.

`--listen=`*host*
: Listen on the network interface for *host*. The default is to accept connections from any interface.

`--user=`*user*
`-u` *usuário*
: Change privileges to *user* as soon as possible—i.e., once the server socket is open and the signing key has been read.

`--compression[=`*method*`[:`*level*`]]`
`-C [`*method*`[:`*level*`]]`
: Compress data using the given *method* and *level*. *method* is one of `lzip`, `zstd`, and `gzip`; when *method* is omitted, `gzip` is used.

  When *level* is zero, disable compression. The range 1 to 9 corresponds to different compression levels: 1 is the fastest, and 9 is the best (CPU-intensive). The default is 3.

  Usually, `lzip` compresses noticeably better than `gzip` for a small increase in CPU usage; see benchmarks on the lzip Web page (`https://nongnu.org/lzip/lzip_benchmark.html`). However, `lzip` achieves low decompression throughput (on the order of 50 MiB/s on modern hardware), which can be a bottleneck for someone who downloads over a fast network connection.

  The compression ratio of `zstd` is between that of `lzip` and that of `gzip`; its main advantage is a high decompression speed (`https://facebook.github.io/zstd/`).

Unless `--cache` is used, compression occurs on the fly and the compressed streams are not cached. Thus, to reduce load on the machine that runs `guix publish`, it may be a good idea to choose a low compression level, to run `guix publish` behind a caching proxy, or to use `--cache`. Using `--cache` has the advantage that it allows `guix publish` to add `Content-Length` HTTP header to its responses.

This option can be repeated, in which case every substitute gets compressed using all the selected methods, and all of them are advertised. This is useful when users may not support all the compression methods: they can select the one they support.

`--cache=`*directory*
`-c` *directory*

Cache archives and meta-data (`.narinfo` URLs) to *directory* and only serve archives that are in cache.

When this option is omitted, archives and meta-data are created on-the-fly. This can reduce the available bandwidth, especially when compression is enabled, since this may become CPU-bound. Another drawback of the default mode is that the length of archives is not known in advance, so `guix publish` does not add a `Content-Length` HTTP header to its responses, which in turn prevents clients from knowing the amount of data being downloaded.

Conversely, when `--cache` is used, the first request for a store item (*via* a `.narinfo` URL) triggers a background process to *bake* the archive—computing its `.narinfo` and compressing the archive, if needed. Once the archive is cached in *directory*, subsequent requests succeed and are served directly from the cache, which guarantees that clients get the best possible bandwidth.

That first `.narinfo` request nonetheless returns 200, provided the requested store item is "small enough", below the cache bypass threshold—see `--cache-bypass-threshold` below. That way, clients do not have to wait until the archive is baked. For larger store items, the first `.narinfo` request returns 404, meaning that clients have to wait until the archive is baked.

The "baking" process is performed by worker threads. By default, one thread per CPU core is created, but this can be customized. See `--workers` below.

When `--ttl` is used, cached entries are automatically deleted when they have expired.

`--workers=`*N*

When `--cache` is used, request the allocation of *N* worker threads to "bake" archives.

`--ttl=`*ttl*

Produce `Cache-Control` HTTP headers that advertise a time-to-live (TTL) of *ttl*. *ttl* must denote a duration: `5d` means 5 days, `1m` means 1 month, and so on.

This allows the user's Guix to keep substitute information in cache for *ttl*. However, note that `guix publish` does not itself guarantee that the store items it provides will indeed remain available for as long as *ttl*.

Additionally, when `--cache` is used, cached entries that have not been accessed for *ttl* and that no longer have a corresponding item in the store, may be deleted.

`--negative-ttl=`*ttl*
: Similarly produce `Cache-Control` HTTP headers to advertise the time-to-live (TTL) of *negative* lookups—missing store items, for which the HTTP 404 code is returned. By default, no negative TTL is advertised.

  This parameter can help adjust server load and substitute latency by instructing cooperating clients to be more or less patient when a store item is missing.

`--cache-bypass-threshold=`*size*
: When used in conjunction with `--cache`, store items smaller than *size* are immediately available, even when they are not yet in cache. *size* is a size in bytes, or it can be suffixed by `M` for megabytes and so on. The default is `10M`.

  "Cache bypass" allows you to reduce the publication delay for clients at the expense of possibly additional I/O and CPU use on the server side: depending on the client access patterns, those store items can end up being baked several times until a copy is available in cache.

  Increasing the threshold may be useful for sites that have few users, or to guarantee that users get substitutes even for store items that are not popular.

`--nar-path=`*path*
: Use *path* as the prefix for the URLs of "nar" files (veja Seção 5.11 [Invocando guix archive], Página 66).

  By default, nars are served at a URL such as `/nar/gzip/...-coreutils-8.25`. This option allows you to change the `/nar` part to *path*.

`--public-key=`*file*
`--private-key=`*file*
: Use the specific *file*s as the public/private key pair used to sign the store items being published.

  The files must correspond to the same key pair (the private key is used for signing and the public key is merely advertised in the signature metadata). They must contain keys in the canonical s-expression format as produced by `guix archive --generate-key` (veja Seção 5.11 [Invocando guix archive], Página 66). By default, `/etc/guix/signing-key.pub` and `/etc/guix/signing-key.sec` are used.

`--repl[=`*port*`]`
`-r [`*porta*`]`
: Spawn a Guile REPL server (veja Seção "REPL Servers" em *GNU Guile Reference Manual*) on *port* (37146 by default). This is used primarily for debugging a running `guix publish` server.

Enabling `guix publish` on Guix System is a one-liner: just instantiate a `guix-publish-service-type` service in the `services` field of the `operating-system` declaration (veja [guix-publish-service-type], Página 283).

If you are instead running Guix on a "foreign distro", follow these instructions:

- If your host distro uses the systemd init system:

```
# ln -s ~root/.guix-profile/lib/systemd/system/guix-publish.service \
       /etc/systemd/system/
# systemctl start guix-publish && systemctl enable guix-publish
```

- Se sua distro hospedeira usa o sistema init Upstart:

```
# ln -s ~root/.guix-profile/lib/upstart/system/guix-publish.conf /etc/init/
# start guix-publish
```

- Otherwise, proceed similarly with your distro's init system.

9.12 Invocando `guix challenge`

Do the binaries provided by this server really correspond to the source code it claims to build? Is a package build process deterministic? These are the questions the `guix challenge` command attempts to answer.

The former is obviously an important question: Before using a substitute server (veja Seção 5.3 [Substitutos], Página 47), one had better *verify* that it provides the right binaries, and thus *challenge* it. The latter is what enables the former: If package builds are deterministic, then independent builds of the package should yield the exact same result, bit for bit; if a server provides a binary different from the one obtained locally, it may be either corrupt or malicious.

We know that the hash that shows up in `/gnu/store` file names is the hash of all the inputs of the process that built the file or directory—compilers, libraries, build scripts, etc. (veja Capítulo 1 [Introdução], Página 1). Assuming deterministic build processes, one store file name should map to exactly one build output. `guix challenge` checks whether there is, indeed, a single mapping by comparing the build outputs of several independent builds of any given store item.

The command output looks like this:

```
$ guix challenge \
  --substitute-urls="https://bordeaux.guix.gnu.org https://guix.example.org" \
  openssl git pius coreutils grep
updating substitutes from 'https://bordeaux.guix.gnu.org'... 100.0%
updating substitutes from 'https://guix.example.org'... 100.0%
/gnu/store/...-openssl-1.0.2d contents differ:
  local hash: 0725l22r5jnzazaacncwsvp9kgf42266ayyp814v7djxs7nk963q
  https://bordeaux.guix.gnu.org/nar/...-openssl-1.0.2d: 0725l22r5jnzazaacncwsvp9kgf42266ayyp814v7djxs7nk9
  https://guix.example.org/nar/...-openssl-1.0.2d: 1zy4fmaaqcnjrzzajkdn3f5gmjk754b43qkq47llbyak9z0qjyim
  differing files:
    /lib/libcrypto.so.1.1
    /lib/libssl.so.1.1

/gnu/store/...-git-2.5.0 contents differ:
  local hash: 00p3bmryhjxrhpn2gxs2fy0a15lnip05l97205pgbk5ra395hyha
  https://bordeaux.guix.gnu.org/nar/...-git-2.5.0: 069nb85bv4d4a6slrwjdy8v1cn4cwspm3kdbmyb81d6zckj3nq9f
  https://guix.example.org/nar/...-git-2.5.0: 0mdqa9w1p6cmli6976v4wi0sw9r4p5prkj7lzfd1877wk11c9c73
  differing file:
    /libexec/git-core/git-fsck

/gnu/store/...-pius-2.1.1 contents differ:
  local hash: 0k4v3m9z1zp8xzzizb7d8kjj72f9172xv078sq4wl73vnq9ig3ax
  https://bordeaux.guix.gnu.org/nar/...-pius-2.1.1: 0k4v3m9z1zp8xzzizb7d8kjj72f9172xv078sq4wl73vnq9ig3ax
  https://guix.example.org/nar/...-pius-2.1.1: 1cy25x1a4fzq5rk0pmvc8xhwyffnqz95h2bpvqsz2mpvlbccy0gs
  differing file:
```

```
    /share/man/man1/pius.1.gz

...

5 store items were analyzed:
  - 2 (40.0%) were identical
  - 3 (60.0%) differed
  - 0 (0.0%) were inconclusive
```

In this example, `guix challenge` queries all the substitute servers for each of the fives packages specified on the command line. It then reports those store items for which the servers obtained a result different from the local build (if it exists) and/or different from one another; here, the '`local hash`' lines indicate that a local build result was available for each of these packages and shows its hash.

As an example, `guix.example.org` always gets a different answer. Conversely, `bordeaux.guix.gnu.org` agrees with local builds, except in the case of Git. This might indicate that the build process of Git is non-deterministic, meaning that its output varies as a function of various things that Guix does not fully control, in spite of building packages in isolated environments (veja Seção 5.1 [Recursos], Página 36). Most common sources of non-determinism include the addition of timestamps in build results, the inclusion of random numbers, and directory listings sorted by inode number. See `https://reproducible-builds.org/docs/`, for more information.

To find out what is wrong with this Git binary, the easiest approach is to run:

```
guix challenge git \
  --diff=diffoscope \
  --substitute-urls="https://bordeaux.guix.gnu.org https://guix.example.org"
```

This automatically invokes `diffoscope`, which displays detailed information about files that differ.

Alternatively, we can do something along these lines (veja Seção 5.11 [Invocando guix archive], Página 66):

```
$ wget -q -O - https://bordeaux.guix.gnu.org/nar/lzip/...-git-2.5.0 \
   | lzip -d | guix archive -x /tmp/git
$ diff -ur --no-dereference /gnu/store/...-git.2.5.0 /tmp/git
```

This command shows the difference between the files resulting from the local build, and the files resulting from the build on `bordeaux.guix.gnu.org` (veja Seção "Overview" em *Comparing and Merging Files*). The `diff` command works great for text files. When binary files differ, a better option is Diffoscope (`https://diffoscope.org/`), a tool that helps visualize differences for all kinds of files.

Once you have done that work, you can tell whether the differences are due to a non-deterministic build process or to a malicious server. We try hard to remove sources of non-determinism in packages to make it easier to verify substitutes, but of course, this is a process that involves not just Guix, but a large part of the free software community. In the meantime, `guix challenge` is one tool to help address the problem.

If you are writing packages for Guix, you are encouraged to check whether `bordeaux.guix.gnu.org` and other substitute servers obtain the same build result as you did with:

```
guix challenge package
```

A sintaxe geral é:

```
guix challenge options argument...
```

where *argument* is a package specification such as `guile@2.0` or `glibc:debug` or, alternatively, a store file name as returned, for example, by `guix build` or `guix gc --list-live`.

When a difference is found between the hash of a locally-built item and that of a server-provided substitute, or among substitutes provided by different servers, the command displays it as in the example above and its exit code is 2 (other non-zero exit codes denote other kinds of errors).

The one option that matters is:

`--substitute-urls=urls`
: Consider *urls* the whitespace-separated list of substitute source URLs to compare to.

`--diff=mode`
: Upon mismatches, show differences according to *mode*, one of:

  `simple` (the default)
  : Show the list of files that differ.

  `diffoscope`
  command
  : Invoke Diffoscope (`https://diffoscope.org/`), passing it two directories whose contents do not match.

    When *command* is an absolute file name, run *command* instead of Diffoscope.

  `nenhuma`
  : Do not show further details about the differences.

  Thus, unless `--diff=none` is passed, `guix challenge` downloads the store items from the given substitute servers so that it can compare them.

`--verbose`
`-v`
: Show details about matches (identical contents) in addition to information about mismatches.

9.13 Invocando `guix copy`

The `guix copy` command copies items from the store of one machine to that of another machine over a secure shell (SSH) connection[2]. For example, the following command copies the `coreutils` package, the user's profile, and all their dependencies over to *host*, logged in as *user*:

```
guix copy --to=user@host \
          coreutils $(readlink -f ~/.guix-profile)
```

If some of the items to be copied are already present on *host*, they are not actually sent.

The command below retrieves `libreoffice` and `gimp` from *host*, assuming they are available there:

```
guix copy --from=host libreoffice gimp
```

[2] This command is available only when Guile-SSH was found. Veja Seção 22.1 [Requisitos], Página 720, for details.

The SSH connection is established using the Guile-SSH client, which is compatible with OpenSSH: it honors `~/.ssh/known_hosts` and `~/.ssh/config`, and uses the SSH agent for authentication.

The key used to sign items that are sent must be accepted by the remote machine. Likewise, the key used by the remote machine to sign items you are retrieving must be in `/etc/guix/acl` so it is accepted by your own daemon. Veja Seção 5.11 [Invocando guix archive], Página 66, for more information about store item authentication.

A sintaxe geral é:

```
guix copy [--to=spec|--from=spec] items...
```

You must always specify one of the following options:

`--to=`*spec*
`--from=`*spec*
: Specify the host to send to or receive from. *spec* must be an SSH spec such as `example.org`, `charlie@example.org`, or `charlie@example.org:2222`.

The *items* can be either package names, such as `gimp`, or store items, such as `/gnu/store/...-idutils-4.6`.

When specifying the name of a package to send, it is first built if needed, unless `--dry-run` was specified. Common build options are supported (veja Seção 9.1.1 [Opções de compilação comum], Página 177).

9.14 Invocando `guix container`

> **Nota:** As of version ba3a031, this tool is experimental. The interface is subject to radical change in the future.

The purpose of `guix container` is to manipulate processes running within an isolated environment, commonly known as a "container", typically created by the `guix shell` (veja Seção 7.1 [Invocando guix shell], Página 79) and `guix system container` (veja Seção 11.16 [Invocando guix system], Página 616) commands.

A sintaxe geral é:

```
guix container action options...
```

action specifies the operation to perform with a container, and *options* specifies the context-specific arguments for the action.

The following actions are available:

`exec`
: Execute a command within the context of a running container.

  The syntax is:

  ```
  guix container exec pid program arguments...
  ```

  pid specifies the process ID of the running container. *program* specifies an executable file name within the root file system of the container. *arguments* are the additional options that will be passed to *program*.

  The following command launches an interactive login shell inside a Guix system container, started by `guix system container`, and whose process ID is 9001:

  ```
  guix container exec 9001 /run/current-system/profile/bin/bash --login
  ```

  Note that the *pid* cannot be the parent process of a container. It must be PID 1 of the container or one of its child processes.

9.15 Invocando `guix weather`

Occasionally you're grumpy because substitutes are lacking and you end up building packages by yourself (veja Seção 5.3 [Substitutos], Página 47). The `guix weather` command reports on substitute availability on the specified servers so you can have an idea of whether you'll be grumpy today. It can sometimes be useful info as a user, but it is primarily useful to people running `guix publish` (veja Seção 9.11 [Invocando guix publish], Página 221). Sometimes substitutes *are* available but they are not authorized on your system; `guix weather` reports it so you can authorize them if you want (veja Seção 5.3.3 [Obtendo substitutos de outros servidores], Página 48).

Here's a sample run:

```
$ guix weather --substitute-urls=https://guix.example.org
computing 5,872 package derivations for x86_64-linux...
looking for 6,128 store items on https://guix.example.org..
updating substitutes from 'https://guix.example.org'... 100.0%
https://guix.example.org
  43.4% substitutes available (2,658 out of 6,128)
  7,032.5 MiB of nars (compressed)
  19,824.2 MiB on disk (uncompressed)
  0.030 seconds per request (182.9 seconds in total)
  33.5 requests per second

  9.8% (342 out of 3,470) of the missing items are queued
  867 queued builds
      x86_64-linux: 518 (59.7%)
      i686-linux: 221 (25.5%)
      aarch64-linux: 128 (14.8%)
  build rate: 23.41 builds per hour
      x86_64-linux: 11.16 builds per hour
      i686-linux: 6.03 builds per hour
      aarch64-linux: 6.41 builds per hour
```

As you can see, it reports the fraction of all the packages for which substitutes are available on the server—regardless of whether substitutes are enabled, and regardless of whether this server's signing key is authorized. It also reports the size of the compressed archives ("nars") provided by the server, the size the corresponding store items occupy in the store (assuming deduplication is turned off), and the server's throughput. The second part gives continuous integration (CI) statistics, if the server supports it. In addition, using the `--coverage` option, `guix weather` can list "important" package substitutes missing on the server (see below).

To achieve that, `guix weather` queries over HTTP(S) meta-data (*narinfos*) for all the relevant store items. Like `guix challenge`, it ignores signatures on those substitutes, which is innocuous since the command only gathers statistics and cannot install those substitutes.

A sintaxe geral é:

```
guix weather options... [packages...]
```

When *packages* is omitted, `guix weather` checks the availability of substitutes for *all* the packages, or for those specified with `--manifest`; otherwise it only considers the specified

packages. It is also possible to query specific system types with `--system`. `guix weather` exits with a non-zero code when the fraction of available substitutes is below 100%.

The available options are listed below.

`--substitute-urls=`*urls*
: *urls* is the space-separated list of substitute server URLs to query. When this option is omitted, the URLs specified with the `--substitute-urls` option of `guix-daemon` are used or, as a last resort, the default set of substitute URLs.

`--system=`*system*
`-s` *sistema*
: Query substitutes for *system*—e.g., `aarch64-linux`. This option can be repeated, in which case `guix weather` will query substitutes for several system types.

`--manifest=`*arquivo*
: Instead of querying substitutes for all the packages, only ask for those specified in *file*. *file* must contain a *manifest*, as with the `-m` option of `guix package` (veja Seção 5.2 [Invocando guix package], Página 37).

  This option can be repeated several times, in which case the manifests are concatenated.

`--expression=`*expr*
`-e` *expr*
: Consider the package *expr* evaluates to.

  A typical use case for this option is specifying a package that is hidden and thus cannot be referred to in the usual way, as in this example:

```
guix weather -e '(@@ (gnu packages rust) rust-bootstrap)'
```

  This option can be repeated.

`--coverage[=`*contagem*`]`
`-c [`*contagem*`]`
: Report on substitute coverage for packages: list packages with at least *count* dependents (zero by default) for which substitutes are unavailable. Dependent packages themselves are not listed: if *b* depends on *a* and *a* has no substitutes, only *a* is listed, even though *b* usually lacks substitutes as well. The result looks like this:

```
$ guix weather --substitute-urls=https://bordeaux.guix.gnu.org
https://ci.guix.gnu.org -c 10
computing 8,983 package derivations for x86_64-linux...
looking for 9,343 store items on https://bordeaux.guix.gnu.org
https://ci.guix.gnu.org...
updating substitutes from 'https://bordeaux.guix.gnu.org https://ci.guix.gnu
https://bordeaux.guix.gnu.org https://ci.guix.gnu.org
  64.7% substitutes available (6,047 out of 9,343)
...
2502 packages are missing from 'https://bordeaux.guix.gnu.org
https://ci.guix.gnu.org' for 'x86_64-linux', among which:
    58  kcoreaddons@5.49.0      /gnu/store/...-kcoreaddons-5.49.0
    46  qgpgme@1.11.1           /gnu/store/...-qgpgme-1.11.1
```

```
37  perl-http-cookiejar@0.008  /gnu/store/...-perl-http-cookiejar-0.008
...
```

What this example shows is that `kcoreaddons` and presumably the 58 packages that depend on it have no substitutes at `bordeaux.guix.gnu.org`; likewise for `qgpgme` and the 46 packages that depend on it.

If you are a Guix developer, or if you are taking care of this build farm, you'll probably want to have a closer look at these packages: they may simply fail to build.

`--display-missing`
: Display the list of store items for which substitutes are missing.

9.16 Invocando `guix processes`

The `guix processes` command can be useful to developers and system administrators, especially on multi-user machines and on build farms: it lists the current sessions (connections to the daemon), as well as information about the processes involved[3]. Here's an example of the information it returns:

```
$ sudo guix processes
SessionPID: 19002
ClientPID: 19090
ClientCommand: guix shell python

SessionPID: 19402
ClientPID: 19367
ClientCommand: guix publish -u guix-publish -p 3000 -C 9 ...

SessionPID: 19444
ClientPID: 19419
ClientCommand: cuirass --cache-directory /var/cache/cuirass ...
LockHeld: /gnu/store/...-perl-ipc-cmd-0.96.lock
LockHeld: /gnu/store/...-python-six-bootstrap-1.11.0.lock
LockHeld: /gnu/store/...-libjpeg-turbo-2.0.0.lock
ChildPID: 20495
ChildCommand: guix offload x86_64-linux 7200 1 28800
ChildPID: 27733
ChildCommand: guix offload x86_64-linux 7200 1 28800
ChildPID: 27793
ChildCommand: guix offload x86_64-linux 7200 1 28800
```

In this example we see that `guix-daemon` has three clients: `guix shell`, `guix publish`, and the Cuirass continuous integration tool; their process identifier (PID) is given by the `ClientPID` field. The `SessionPID` field gives the PID of the `guix-daemon` sub-process of this particular session.

The `LockHeld` fields show which store items are currently locked by this session, which corresponds to store items being built or substituted (the `LockHeld` field is not displayed

[3] Remote sessions, when `guix-daemon` is started with `--listen` specifying a TCP endpoint, are *not* listed.

when `guix processes` is not running as root). Last, by looking at the `ChildPID` and `ChildCommand` fields, we understand that these three builds are being offloaded (veja Seção 2.2.2 [Configuração de descarregamento de daemon], Página 8).

The output is in Recutils format so we can use the handy `recsel` command to select sessions of interest (veja Seção "Selection Expressions" em *GNU recutils manual*). As an example, the command shows the command line and PID of the client that triggered the build of a Perl package:

```
$ sudo guix processes | \
    recsel -p ClientPID,ClientCommand -e 'LockHeld ~ "perl"'
ClientPID: 19419
ClientCommand: cuirass --cache-directory /var/cache/cuirass ...
```

Additional options are listed below.

`--format=`*format*
`-f` *format* Produce output in the specified *format*, one of:

`recutils` The default option. It outputs a set of Session recutils records that include each `ChildProcess` as a field.

`normalized`
Normalize the output records into record sets (veja Seção "Record Sets" em *GNU recutils manual*). Normalizing into record sets allows joins across record types. The example below lists the PID of each `ChildProcess` and the associated PID for `Session` that spawned the `ChildProcess` where the `Session` was started using `guix build`.

```
$ guix processes --format=normalized | \
    recsel \
    -j Session \
    -t ChildProcess \
    -p Session.PID,PID \
    -e 'Session.ClientCommand ~ "guix build"'
PID: 4435
Session_PID: 4278

PID: 4554
Session_PID: 4278

PID: 4646
Session_PID: 4278
```

10 Arquiteturas Estrangeiras

You can target computers of different CPU architectures when producing packages (veja Seção 5.2 [Invocando guix package], Página 37), packs (veja Seção 7.3 [Invocando guix pack], Página 92) or full systems (veja Seção 11.16 [Invocando guix system], Página 616).

GNU Guix supports two distinct mechanisms to target foreign architectures:

1. The traditional cross-compilation (`https://en.wikipedia.org/wiki/Cross_compiler`) mechanism.
2. The native building mechanism which consists in building using the CPU instruction set of the foreign system you are targeting. It often requires emulation, using the QEMU program for instance.

10.1 Cross-Compilation

The commands supporting cross-compilation are proposing the `--list-targets` and `--target` options.

The `--list-targets` option lists all the supported targets that can be passed as an argument to `--target`.

```
$ guix build --list-targets
The available targets are:

   - aarch64-linux-gnu
   - arm-linux-gnueabihf
   - avr
   - i586-pc-gnu
   - i686-linux-gnu
   - i686-w64-mingw32
   - mips64el-linux-gnu
   - or1k-elf
   - powerpc-linux-gnu
   - powerpc64le-linux-gnu
   - riscv64-linux-gnu
   - x86_64-linux-gnu
   - x86_64-linux-gnux32
   - x86_64-w64-mingw32
   - xtensa-ath9k-elf
```

Targets are specified as GNU triplets (veja Seção "Specifying Target Triplets" em *Autoconf*).

Those triplets are passed to GCC and the other underlying compilers possibly involved when building a package, a system image or any other GNU Guix output.

```
$ guix build --target=aarch64-linux-gnu hello
/gnu/store/9926by9qrxa91ijkhw9ndgwp4bn24g9h-hello-2.12

$ file /gnu/store/9926by9qrxa91ijkhw9ndgwp4bn24g9h-hello-2.12/bin/hello
/gnu/store/9926by9qrxa91ijkhw9ndgwp4bn24g9h-hello-2.12/bin/hello: ELF
```

```
64-bit LSB executable, ARM aarch64 ...
```

The major benefit of cross-compilation is that there are no performance penalty compared to emulation using QEMU. There are however higher risks that some packages fail to cross-compile because fewer users are using this mechanism extensively.

10.2 Construções nativas

The commands that support impersonating a specific system have the `--list-systems` and `--system` options.

The `--list-systems` option lists all the supported systems that can be passed as an argument to `--system`.

```
$ guix build --list-systems
The available systems are:

   - x86_64-linux [current]
   - aarch64-linux
   - armhf-linux
   - i586-gnu
   - i686-linux
   - mips64el-linux
   - powerpc-linux
   - powerpc64le-linux
   - riscv64-linux

$ guix build --system=i686-linux hello
/gnu/store/cc0km35s8x2z4pmwkrqqjx46i8b1i3gm-hello-2.12

$ file /gnu/store/cc0km35s8x2z4pmwkrqqjx46i8b1i3gm-hello-2.12/bin/hello
/gnu/store/cc0km35s8x2z4pmwkrqqjx46i8b1i3gm-hello-2.12/bin/hello: ELF
32-bit LSB executable, Intel 80386 ...
```

In the above example, the current system is *x86_64-linux*. The *hello* package is however built for the *i686-linux* system.

This is possible because the *i686* CPU instruction set is a subset of the *x86_64*, hence *i686* targeting binaries can be run on *x86_64*.

Still in the context of the previous example, if picking the *aarch64-linux* system and the `guix build --system=aarch64-linux hello` has to build some derivations, an extra step might be needed.

The *aarch64-linux* targeting binaries cannot directly be run on a *x86_64-linux* system. An emulation layer is requested. The GNU Guix daemon can take advantage of the Linux kernel binfmt_misc (`https://en.wikipedia.org/wiki/Binfmt_misc`) mechanism for that. In short, the Linux kernel can defer the execution of a binary targeting a foreign platform, here *aarch64-linux*, to a userspace program, usually an emulator.

There is a service that registers QEMU as a backend for the `binfmt_misc` mechanism (veja Seção 11.10.30 [Serviços de virtualização], Página 523). On Debian based foreign distributions, the alternative would be the `qemu-user-static` package.

If the `binfmt_misc` mechanism is not setup correctly, the building will fail this way:

```
$ guix build --system=armhf-linux hello --check
...
 unsupported-platform /gnu/store/jjn969pijv7hff62025yxpfmc8zy0aq0-hello-2.12.drv aarch
while setting up the build environment: a `aarch64-linux' is required to
build `/gnu/store/jjn969pijv7hff62025yxpfmc8zy0aq0-hello-2.12.drv', but
I am a `x86_64-linux'...
```

whereas, with the `binfmt_misc` mechanism correctly linked with QEMU, one can expect to see:

```
$ guix build --system=armhf-linux hello --check
/gnu/store/13xz4nghg39wpymivlwghy08yzj97hlj-hello-2.12
```

The main advantage of native building compared to cross-compiling, is that more packages are likely to build correctly. However it comes at a price: compilation backed by QEMU is *way slower* than cross-compilation, because every instruction needs to be emulated.

The availability of substitutes for the architecture targeted by the `--system` option can mitigate this problem. An other way to work around it is to install GNU Guix on a machine whose CPU supports the targeted instruction set, and set it up as an offload machine (veja Seção 2.2.2 [Configuração de descarregamento de daemon], Página 8).

11 Configuração do sistema

Guix System supports a consistent whole-system configuration mechanism. By that we mean that all aspects of the global system configuration—such as the available system services, timezone and locale settings, user accounts—are declared in a single place. Such a *system configuration* can be *instantiated*—i.e., effected.

One of the advantages of putting all the system configuration under the control of Guix is that it supports transactional system upgrades, and makes it possible to roll back to a previous system instantiation, should something go wrong with the new one (veja Seção 5.1 [Recursos], Página 36). Another advantage is that it makes it easy to replicate the exact same configuration across different machines, or at different points in time, without having to resort to additional administration tools layered on top of the own tools of the system.

This section describes this mechanism. First we focus on the system administrator's viewpoint—explaining how the system is configured and instantiated. Then we show how this mechanism can be extended, for instance to support new system services.

11.1 Começando

You're reading this section probably because you have just installed Guix System (veja Capítulo 3 [Instalação do sistema], Página 22) and would like to know where to go from here. If you're already familiar with GNU/Linux system administration, the way Guix System is configured is very different from what you're used to: you won't install a system service by running `guix install`, you won't configure services by modifying files under `/etc`, and you won't create user accounts by invoking `useradd`; instead, all these aspects are spelled out in a *system configuration file*.

The first step with Guix System is thus to write the *system configuration file*; luckily, system installation already generated one for you and stored it under `/etc/config.scm`.

> **Nota:** You can store your system configuration file anywhere you like—it doesn't have to be at `/etc/config.scm`. It's a good idea to keep it under version control, for instance in a Git repository (`https://git-scm.com/book/en/`).

The *entire* configuration of the system—user accounts, system services, timezone, locale settings—is declared in this file, which follows this template:

```
(use-modules (gnu))
(use-package-modules ...)
(use-service-modules ...)

(operating-system
  (host-name ...)
  (timezone ...)
  (locale ...)
  (bootloader ...)
  (file-systems ...)
  (users ...)
  (packages ...)
  (services ...))
```

This configuration file is in fact a Scheme program; the first lines pull in modules providing variables you might need in the rest of the file—e.g., packages, services, etc. The `operating-system` form declares the system configuration as a *record* with a number of *fields*. Veja Seção 11.2 [Usando o sistema de configuração], Página 238, to view complete examples and learn what to put in there.

The second step, once you have this configuration file, is to test it. Of course, you can skip this step if you're feeling lucky—you choose! To do that, pass your configuration file to `guix system vm` (no need to be root, you can do that as a regular user):

```
guix system vm /etc/config.scm
```

This command returns the name of a shell script that starts a virtual machine (VM) running the system *as described in the configuration file*:

```
/gnu/store/...-run-vm.sh
```

In this VM, you can log in as `root` with no password. That's a good way to check that your configuration file is correct and that it gives the expected result, without touching your system. Veja Seção 11.16 [Invocando guix system], Página 616, for more information.

> **Nota:** When using `guix system vm`, aspects tied to your hardware such as file systems and mapped devices are overridden because they cannot be meaningfully tested in the VM. Other aspects such as static network configuration (veja Seção 11.10.4 [Networking Setup], Página 295) are *not* overridden but they may not work inside the VM.

The third step, once you're happy with your configuration, is to *instantiate* it—make this configuration effective on your system. To do that, run:

```
sudo guix system reconfigure /etc/config.scm
```

This operation is *transactional*: either it succeeds and you end up with an upgraded system, or it fails and nothing has changed. Note that it does *not* restart system services that were already running. Thus, to upgrade those services, you have to reboot or to explicitly restart them; for example, to restart the secure shell (SSH) daemon, you would run:

```
sudo herd restart sshd
```

> **Nota:** System services are managed by the Shepherd (veja Seção "Jump Start" em *The GNU Shepherd Manual*). The `herd` command lets you inspect, start, and stop services. To view the status of services, run:
>
> ```
> sudo herd status
> ```
>
> To view detailed information about a given service, add its name to the command:
>
> ```
> sudo herd status sshd
> ```
>
> Veja Seção 11.10 [Serviços], Página 268, for more information.

The system records its *provenance*—the configuration file and channels that were used to deploy it. You can view it like so:

```
guix system describe
```

Additionally, `guix system reconfigure` preserves previous system generations, which you can list:

```
guix system list-generations
```

Crucially, that means that you can always *roll back* to an earlier generation should something go wrong! When you eventually reboot, you'll notice a sub-menu in the bootloader that reads "Old system generations": it's what allows you to boot *an older generation of your system*, should the latest generation be "broken" or otherwise unsatisfying. You can also "permanently" roll back, like so:

```
sudo guix system roll-back
```

Alternatively, you can use `guix system switch-generation` to switch to a specific generation.

Once in a while, you'll want to delete old generations that you do not need anymore to allow *garbage collection* to free space (veja Seção 5.6 [Invocando guix gc], Página 54). For example, to remove generations older than 4 months, run:

```
sudo guix system delete-generations 4m
```

From there on, anytime you want to change something in the system configuration, be it adding a user account or changing parameters of a service, you will first update your configuration file and then run `guix system reconfigure` as shown above. Likewise, to *upgrade* system software, you first fetch an up-to-date Guix and then reconfigure your system with that new Guix:

```
guix pull
sudo guix system reconfigure /etc/config.scm
```

We recommend doing that regularly so that your system includes the latest security updates (veja Capítulo 19 [Atualizações de segurança], Página 710).

> **Nota:** `sudo guix` runs your user's `guix` command and *not* root's, because `sudo` leaves `PATH` unchanged.
>
> The difference matters here, because `guix pull` updates the `guix` command and package definitions only for the user it is run as. This means that if you choose to use `guix system reconfigure` in root's login shell, you'll need to `guix pull` separately.

That's it! If you're getting started with Guix entirely, veja Capítulo 4 [Começando], Página 33. The next sections dive in more detail into the crux of the matter: system configuration.

11.2 Usando o sistema de configuração

The previous section showed the overall workflow you would follow when administering a Guix System machine (veja Seção 11.1 [Começando com o Sistema], Página 236). Let's now see in more detail what goes into the system configuration file.

The operating system is configured by providing an `operating-system` declaration in a file that can then be passed to the `guix system` command (veja Seção 11.16 [Invocando guix system], Página 616), as we've seen before. A simple setup, with the default Linux-Libre kernel, initial RAM disk, and a couple of system services added to those provided by default looks like this:

```
;; -*- mode: scheme; -*-
;; This is an operating system configuration template
;; for a "bare bones" setup, with no X11 display server.
```

```
(use-modules (gnu))
(use-service-modules networking ssh)
(use-package-modules screen ssh)

(operating-system
  (host-name "komputilo")
  (timezone "Europe/Berlin")
  (locale "en_US.utf8")

  ;; Boot in "legacy" BIOS mode, assuming /dev/sdX is the
  ;; target hard disk, and "my-root" is the label of the target
  ;; root file system.
  (bootloader (bootloader-configuration
               (bootloader grub-bootloader)
               (targets '("/dev/sdX"))))
  ;; It's fitting to support the equally bare bones ‘-nographic’
  ;; QEMU option, which also nicely sidesteps forcing QWERTY.
  (kernel-arguments (list "console=ttyS0,115200"))
  (file-systems (cons (file-system
                        (device (file-system-label "my-root"))
                        (mount-point "/")
                        (type "ext4"))
                      %base-file-systems))

  ;; This is where user accounts are specified.  The "root"
  ;; account is implicit, and is initially created with the
  ;; empty password.
  (users (cons (user-account
                (name "alice")
                (comment "Bob's sister")
                (group "users")

                ;; Adding the account to the "wheel" group
                ;; makes it a sudoer.  Adding it to "audio"
                ;; and "video" allows the user to play sound
                ;; and access the webcam.
                (supplementary-groups '("wheel"
                                        "audio" "video")))
               %base-user-accounts))

  ;; Globally-installed packages.
  (packages (cons screen %base-packages))

  ;; Add services to the baseline: a DHCP client and an SSH
  ;; server.  You may wish to add an NTP service here.
  (services (append (list (service dhcp-client-service-type)
```

```
                    (service openssh-service-type
                             (openssh-configuration
                              (openssh openssh-sans-x)
                              (port-number 2222))))
                  %base-services)))
```

The configuration is declarative. It is code in the Scheme programming language; the whole `(operating-system ...)` expression produces a *record* with a number of *fields*. Some of the fields defined above, such as `host-name` and `bootloader`, are mandatory. Others, such as `packages` and `services`, can be omitted, in which case they get a default value. Veja Seção 11.3 [Referência do operating-system], Página 247, for details about all the available fields.

Below we discuss the meaning of some of the most important fields.

> **Troubleshooting:** The configuration file is a Scheme program and you might get the syntax or semantics wrong as you get started. Syntactic issues such as misplaced parentheses can often be identified by reformatting your file:
>
> ```
> guix style -f config.scm
> ```
>
> The Cookbook has a short section to get started with the Scheme programming language that explains the fundamentals, which you will find helpful when hacking your configuration. Veja Seção "A Scheme Crash Course" em *GNU Guix Cookbook*.

Bootloader

The `bootloader` field describes the method that will be used to boot your system. Machines based on Intel processors can boot in "legacy" BIOS mode, as in the example above. However, more recent machines rely instead on the *Unified Extensible Firmware Interface* (UEFI) to boot. In that case, the `bootloader` field should contain something along these lines:

```
(bootloader-configuration
  (bootloader grub-efi-bootloader)
  (targets '("/boot/efi")))
```

Veja Seção 11.15 [Configuração do carregador de inicialização], Página 610, for more information on the available configuration options.

Globally-Visible Packages

The `packages` field lists packages that will be globally visible on the system, for all user accounts—i.e., in every user's `PATH` environment variable—in addition to the per-user profiles (veja Seção 5.2 [Invocando guix package], Página 37). The `%base-packages` variable provides all the tools one would expect for basic user and administrator tasks—including the GNU Core Utilities, the GNU Networking Utilities, the `mg` lightweight text editor, `find`, `grep`, etc. The example above adds GNU Screen to those, taken from the `(gnu packages screen)` module (veja Seção 8.1 [Módulos de pacote], Página 100). The `(list package output)` syntax can be used to add a specific output of a package:

```
(use-modules (gnu packages))
(use-modules (gnu packages dns))
```

```
(operating-system
  ;; ...
  (packages (cons (list isc-bind "utils")
                  %base-packages)))
```

Referring to packages by variable name, like `isc-bind` above, has the advantage of being unambiguous; it also allows typos and such to be diagnosed right away as "unbound variables". The downside is that one needs to know which module defines which package, and to augment the `use-package-modules` line accordingly. To avoid that, one can use the `specification->package` procedure of the `(gnu packages)` module, which returns the best package for a given name or name and version:

```
(use-modules (gnu packages))

(operating-system
  ;; ...
  (packages (append (map specification->package
                         '("tcpdump" "htop" "gnupg@2.0"))
                    %base-packages)))
```

When a package has more than one output it can be a challenge to refer to a specific output instead of just to the standard `out` output. For these situations one can use the `specifications->packages` procedure from the `(gnu packages)` module. For example:

```
(use-modules (gnu packages))

(operating-system
  ;; ...
  (packages (append (specifications->packages
                      '("git" "git:send-email"))
                    %base-packages)))
```

System Services

The `services` field lists *system services* to be made available when the system starts (veja Seção 11.10 [Serviços], Página 268). The `operating-system` declaration above specifies that, in addition to the basic services, we want the OpenSSH secure shell daemon listening on port 2222 (veja Seção 11.10.5 [Serviços de Rede], Página 306). Under the hood, `openssh-service-type` arranges so that `sshd` is started with the right command-line options, possibly with supporting configuration files generated as needed (veja Seção 11.19 [Definindo serviços], Página 631).

Occasionally, instead of using the base services as is, you will want to customize them. To do this, use `modify-services` (veja Seção 11.19.3 [Referência de Service], Página 634) to modify the list.

For example, suppose you want to modify `guix-daemon` and Mingetty (the console log-in) in the `%base-services` list (veja Seção 11.10.1 [Serviços básicos], Página 268). To do that, you can write the following in your operating system declaration:

```
(define %my-services
  ;; My very own list of services.
```

```
  (modify-services %base-services
    (guix-service-type config =>
                       (guix-configuration
                        (inherit config)
                        ;; Fetch substitutes from example.org.
                        (substitute-urls
                          (list "https://example.org/guix"
                                "https://ci.guix.gnu.org"))))
    (mingetty-service-type config =>
                           (mingetty-configuration
                            (inherit config)
                            ;; Automatically log in as "guest".
                            (auto-login "guest")))))

(operating-system
  ;; ...
  (services %my-services))
```

This changes the configuration—i.e., the service parameters—of the `guix-service-type` instance, and that of all the `mingetty-service-type` instances in the `%base-services` list (veja Seção "Auto-Login to a Specific TTY" em *GNU Guix Cookbook*). Observe how this is accomplished: first, we arrange for the original configuration to be bound to the identifier `config` in the *body*, and then we write the *body* so that it evaluates to the desired configuration. In particular, notice how we use `inherit` to create a new configuration which has the same values as the old configuration, but with a few modifications.

The configuration for a typical "desktop" usage, with an encrypted root partition, a swap file on the root partition, the X11 display server, GNOME and Xfce (users can choose which of these desktop environments to use at the log-in screen by pressing *F1*), network management, power management, and more, would look like this:

```
;; -*- mode: scheme; -*-
;; This is an operating system configuration template
;; for a "desktop" setup with GNOME and Xfce where the
;; root partition is encrypted with LUKS, and a swap file.

(use-modules (gnu) (gnu system nss) (guix utils))
(use-service-modules desktop sddm xorg)
(use-package-modules gnome)

(operating-system
  (host-name "antelope")
  (timezone "Europe/Paris")
  (locale "en_US.utf8")

  ;; Choose US English keyboard layout.  The "altgr-intl"
  ;; variant provides dead keys for accented characters.
  (keyboard-layout (keyboard-layout "us" "altgr-intl"))
```

```
;; Use the UEFI variant of GRUB with the EFI System
;; Partition mounted on /boot/efi.
(bootloader (bootloader-configuration
              (bootloader grub-efi-bootloader)
              (targets '("/boot/efi"))
              (keyboard-layout keyboard-layout)))

;; Specify a mapped device for the encrypted root partition.
;; The UUID is that returned by 'cryptsetup luksUUID'.
(mapped-devices
 (list (mapped-device
        (source (uuid "12345678-1234-1234-1234-123456789abc"))
        (target "my-root")
        (type luks-device-mapping))))

(file-systems (append
               (list (file-system
                       (device (file-system-label "my-root"))
                       (mount-point "/")
                       (type "ext4")
                       (dependencies mapped-devices))
                     (file-system
                       (device (uuid "1234-ABCD" 'fat))
                       (mount-point "/boot/efi")
                       (type "vfat")))
               %base-file-systems))

;; Specify a swap file for the system, which resides on the
;; root file system.
(swap-devices (list (swap-space
                     (target "/swapfile"))))

;; Create user `bob' with `alice' as its initial password.
(users (cons (user-account
              (name "bob")
              (comment "Alice's brother")
              (password (crypt "alice" "$6$abc"))
              (group "students")
              (supplementary-groups '("wheel" "netdev"
                                      "audio" "video")))
             %base-user-accounts))

;; Add the `students' group
(groups (cons* (user-group
                (name "students"))
               %base-groups))
```

```
;; This is where we specify system-wide packages.
(packages (append (list
                   ;; for user mounts
                   gvfs)
                  %base-packages))

;; Add GNOME and Xfce---we can choose at the log-in screen
;; by clicking the gear.  Use the "desktop" services, which
;; include the X11 log-in service, networking with
;; NetworkManager, and more.
(services (if (target-x86-64?)
              (append (list (service gnome-desktop-service-type)
                            (service xfce-desktop-service-type)
                            (set-xorg-configuration
                             (xorg-configuration
                              (keyboard-layout keyboard-layout))))
                      %desktop-services)

              ;; FIXME: Since GDM depends on Rust (gdm -> gnome-shell -> gjs
              ;; -> mozjs -> rust) and Rust is currently unavailable on
              ;; non-x86_64 platforms, we use SDDM and Mate here instead of
              ;; GNOME and GDM.
              (append (list (service mate-desktop-service-type)
                            (service xfce-desktop-service-type)
                            (set-xorg-configuration
                             (xorg-configuration
                              (keyboard-layout keyboard-layout))
                             sddm-service-type))
                      %desktop-services)))

;; Allow resolution of '.local' host names with mDNS.
(name-service-switch %mdns-host-lookup-nss))
```

Um sistema gráfico com uma escolha de gerenciadores de janelas leves em vez de ambientes de desktop completos teria a seguinte aparência:

```
;; -*- mode: scheme; -*-
;; This is an operating system configuration template
;; for a "desktop" setup without full-blown desktop
;; environments.

(use-modules (gnu) (gnu system nss))
(use-service-modules desktop)
(use-package-modules bootloaders emacs emacs-xyz ratpoison suckless wm
                     xorg)

(operating-system
  (host-name "antelope")
```

```
(timezone "Europe/Paris")
(locale "en_US.utf8")

;; Use the UEFI variant of GRUB with the EFI System
;; Partition mounted on /boot/efi.
(bootloader (bootloader-configuration
              (bootloader grub-efi-bootloader)
              (targets '("/boot/efi"))))

;; Assume the target root file system is labelled "my-root",
;; and the EFI System Partition has UUID 1234-ABCD.
(file-systems (append
               (list (file-system
                       (device (file-system-label "my-root"))
                       (mount-point "/")
                       (type "ext4"))
                     (file-system
                       (device (uuid "1234-ABCD" 'fat))
                       (mount-point "/boot/efi")
                       (type "vfat")))
               %base-file-systems))

(users (cons (user-account
              (name "alice")
              (comment "Bob's sister")
              (group "users")
              (supplementary-groups '("wheel" "netdev"
                                      "audio" "video")))
             %base-user-accounts))

;; Add a bunch of window managers; we can choose one at
;; the log-in screen with F1.
(packages (append (list
                   ;; window managers
                   ratpoison i3-wm i3status dmenu
                   emacs emacs-exwm emacs-desktop-environment
                   ;; terminal emulator
                   xterm)
                  %base-packages))

;; Use the "desktop" services, which include the X11
;; log-in service, networking with NetworkManager, and more.
(services %desktop-services)

;; Allow resolution of '.local' host names with mDNS.
(name-service-switch %mdns-host-lookup-nss))
```

Este exemplo faz referência ao sistema de arquivos `/boot/efi` por seu UUID, `1234-ABCD`. Substitua esse UUID pelo UUID correto no seu sistema, conforme retornado pelo comando `blkid`.

Veja Seção 11.10.9 [Serviços de desktop], Página 354, for the exact list of services provided by `%desktop-services`.

Again, `%desktop-services` is just a list of service objects. If you want to remove services from there, you can do so using the procedures for list filtering (veja Seção "SRFI-1 Filtering and Partitioning" em *GNU Guile Reference Manual*). For instance, the following expression returns a list that contains all the services in `%desktop-services` minus the Avahi service:

```
(remove (lambda (service)
          (eq? (service-kind service) avahi-service-type))
        %desktop-services)
```

Alternatively, the `modify-services` macro can be used:

```
(modify-services %desktop-services
  (delete avahi-service-type))
```

Inspecting Services

As you work on your system configuration, you might wonder why some system service doesn't show up or why the system is not as you expected. There are several ways to inspect and troubleshoot problems.

First, you can inspect the dependency graph of Shepherd services like so:

```
guix system shepherd-graph /etc/config.scm | \
  guix shell xdot -- xdot -
```

This lets you visualize the Shepherd services as defined in `/etc/config.scm`. Each box is a service as would be shown by `sudo herd status` on the running system, and each arrow denotes a dependency (in the sense that if service A depends on B, then B must be started before A).

Not all "services" are Shepherd services though, since Guix System uses a broader definition of the term (veja Seção 11.10 [Serviços], Página 268). To visualize system services and their relations at a higher level, run:

```
guix system extension-graph /etc/config.scm | \
  guix shell xdot -- xdot -
```

This lets you view the *service extension graph*: how services "extend" each other, for instance by contributing to their configuration. Veja Seção 11.19.1 [Composição de serviço], Página 631, to understand the meaning of this graph.

Last, you may also find it useful to inspect your system configuration at the REPL (veja Seção 8.14 [Using Guix Interactively], Página 174). Here is an example session:

```
$ guix repl
scheme@(guix-user)> ,use (gnu)
scheme@(guix-user)> (define os (load "config.scm"))
scheme@(guix-user)> ,pp (map service-kind (operating-system-services os))
$1 = (#<service-type localed cabba93>
      ...)
```

Veja Seção 11.19.3 [Referência de Service], Página 634, to learn about the Scheme interface to manipulate and inspect services.

Instantiating the System

Assuming the `operating-system` declaration is stored in the `config.scm` file, the `sudo guix system reconfigure config.scm` command instantiates that configuration, and makes it the default boot entry. Veja Seção 11.1 [Começando com o Sistema], Página 236, for an overview.

The normal way to change the system configuration is by updating this file and rerunning `guix system reconfigure`. One should never have to touch files in `/etc` or to run commands that modify the system state such as `useradd` or `grub-install`. In fact, you must avoid that since that would not only void your warranty but also prevent you from rolling back to previous versions of your system, should you ever need to.

The Programming Interface

At the Scheme level, the bulk of an `operating-system` declaration is instantiated with the following monadic procedure (veja Seção 8.11 [A mônada do armazém], Página 158):

`operating-system-derivation` *os* [Monadic Procedure]

Return a derivation that builds *os*, an `operating-system` object (veja Seção 8.10 [Derivações], Página 156).

The output of the derivation is a single directory that refers to all the packages, configuration files, and other supporting files needed to instantiate *os*.

This procedure is provided by the `(gnu system)` module. Along with `(gnu services)` (veja Seção 11.10 [Serviços], Página 268), this module contains the guts of Guix System. Make sure to visit it!

11.3 `operating-system` Reference

This section summarizes all the options available in `operating-system` declarations (veja Seção 11.2 [Usando o sistema de configuração], Página 238).

`operating-system` [Data Type]

This is the data type representing an operating system configuration. By that, we mean all the global system configuration, not per-user configuration (veja Seção 11.2 [Usando o sistema de configuração], Página 238).

`kernel` (default: `linux-libre`)

The package object of the operating system kernel to use[1].

`hurd` (default: `#f`)

The package object of the Hurd to be started by the kernel. When this field is set, produce a GNU/Hurd operating system. In that case, `kernel` must also be set to the `gnumach` package—the microkernel the Hurd runs on.

[1] Currently only the Linux-libre kernel is fully supported. Using GNU mach with the GNU Hurd is experimental and only available when building a virtual machine disk image.

> **Aviso:** This feature is experimental and only supported for disk images.

`kernel-loadable-modules` (default: '())
: A list of objects (usually packages) to collect loadable kernel modules from–e.g. `(list ddcci-driver-linux)`.

`kernel-arguments` (default: `%default-kernel-arguments`)
: List of strings or gexps representing additional arguments to pass on the command-line of the kernel—e.g., `("console=ttyS0")`.

`bootloader`
: The system bootloader configuration object. Veja Seção 11.15 [Configuração do carregador de inicialização], Página 610.

`rótulo` This is the label (a string) as it appears in the bootloader's menu entry. The default label includes the kernel name and version.

`keyboard-layout` (default: `#f`)
: This field specifies the keyboard layout to use in the console. It can be either `#f`, in which case the default keyboard layout is used (usually US English), or a `<keyboard-layout>` record. Veja Seção 11.8 [Disposição do teclado], Página 264, for more information.

  This keyboard layout is in effect as soon as the kernel has booted. For instance, it is the keyboard layout in effect when you type a passphrase if your root file system is on a `luks-device-mapping` mapped device (veja Seção 11.5 [Dispositivos mapeados], Página 256).

  > **Nota:** This does *not* specify the keyboard layout used by the bootloader, nor that used by the graphical display server. Veja Seção 11.15 [Configuração do carregador de inicialização], Página 610, for information on how to specify the bootloader's keyboard layout. Veja Seção 11.10.7 [X Window], Página 332, for information on how to specify the keyboard layout used by the X Window System.

`initrd-modules` (default: `%base-initrd-modules`)
: The list of Linux kernel modules that need to be available in the initial RAM disk. Veja Seção 11.14 [Disco de RAM inicial], Página 607.

`initrd` (default: `base-initrd`)
: A procedure that returns an initial RAM disk for the Linux kernel. This field is provided to support low-level customization and should rarely be needed for casual use. Veja Seção 11.14 [Disco de RAM inicial], Página 607.

`firmware` (default: `%base-firmware`)
: List of firmware packages loadable by the operating system kernel.

  The default includes firmware needed for Atheros- and Broadcom-based WiFi devices (Linux-libre modules `ath9k` and `b43-open`, respectively). Veja Seção 3.2 [Considerações de Hardware], Página 22, for more info on supported hardware.

`host-name`
: The host name.

`mapped-devices` (default: `'()`)
: A list of mapped devices. Veja Seção 11.5 [Dispositivos mapeados], Página 256.

`file-systems`
: A list of file systems. Veja Seção 11.4 [Sistemas de arquivos], Página 251.

`swap-devices` (default: `'()`)
: A list of swap spaces. Veja Seção 11.6 [Espaço de troca (swap)], Página 259.

`users` (default: `%base-user-accounts`)
`groups` (default: `%base-groups`)
: List of user accounts and groups. Veja Seção 11.7 [Contas de usuário], Página 261.

  If the `users` list lacks a user account with UID 0, a "root" account with UID 0 is automatically added.

`skeletons` (default: `(default-skeletons)`)
: A list of target file name/file-like object tuples (veja Seção 8.12 [Expressões-G], Página 163). These are the skeleton files that will be added to the home directory of newly-created user accounts.

  For instance, a valid value may look like this:

```
`((".bashrc" ,(plain-file "bashrc" "echo Hello\n"))
  (".guile" ,(plain-file "guile"
                         "(use-modules (ice-9 readline))
                          (activate-readline)")))
```

`issue` (default: `%default-issue`)
: A string denoting the contents of the `/etc/issue` file, which is displayed when users log in on a text console.

`packages` (default: `%base-packages`)
: A list of packages to be installed in the global profile, which is accessible at `/run/current-system/profile`. Each element is either a package variable or a package/output tuple. Here's a simple example of both:

```
(cons* git                       ; the default "out" output
       (list git "send-email") ; another output of git
       %base-packages)         ; the default set
```

  The default set includes core utilities and it is good practice to install non-core utilities in user profiles (veja Seção 5.2 [Invocando guix package], Página 37).

`timezone` (default: `"Etc/UTC"`)
: A timezone identifying string—e.g., `"Europe/Paris"`.

  You can run the `tzselect` command to find out which timezone string corresponds to your region. Choosing an invalid timezone name causes `guix system` to fail.

`locale` (default: `"en_US.utf8"`)
: The name of the default locale (veja Seção "Locale Names" em *The GNU C Library Reference Manual*). Veja Seção 11.9 [Locales], Página 266, for more information.

`locale-definitions` (default: `%default-locale-definitions`)
: The list of locale definitions to be compiled and that may be used at run time. Veja Seção 11.9 [Locales], Página 266.

`locale-libcs` (default: `(list *glibc*)`)
: The list of GNU libc packages whose locale data and tools are used to build the locale definitions. Veja Seção 11.9 [Locales], Página 266, for compatibility considerations that justify this option.

`name-service-switch` (default: `%default-nss`)
: Configuration of the libc name service switch (NSS)—a `<name-service-switch>` object. Veja Seção 11.13 [Name Service Switch], Página 605, for details.

`services` (default: `%base-services`)
: A list of service objects denoting system services. Veja Seção 11.10 [Serviços], Página 268.

`essential-services` (default: ...)
: The list of "essential services"—i.e., things like instances of `system-service-type` (veja Seção 11.19.3 [Referência de Service], Página 634) and `host-name-service-type`, which are derived from the operating system definition itself. As a user you should *never* need to touch this field.

`pam-services` (default: `(base-pam-services)`)
: Linux *pluggable authentication module* (PAM) services.

`privileged-programs` (default: `%default-privileged-programs`)
: List of `<privileged-program>`. Veja Seção 11.11 [Privileged Programs], Página 603, for more information.

`sudoers-file` (default: `%sudoers-specification`)
: The contents of the `/etc/sudoers` file as a file-like object (veja Seção 8.12 [Expressões-G], Página 163).

  This file specifies which users can use the `sudo` command, what they are allowed to do, and what privileges they may gain. The default is that only `root` and members of the `wheel` group may use `sudo`.

`this-operating-system` [Macro]
: When used in the *lexical scope* of an operating system field definition, this identifier resolves to the operating system being defined.

  The example below shows how to refer to the operating system being defined in the definition of the `label` field:

```
(use-modules (gnu) (guix))

(operating-system
```

```
;; ...
(label (package-full-name
        (operating-system-kernel this-operating-system))))
```

It is an error to refer to `this-operating-system` outside an operating system definition.

11.4 Sistemas de arquivos

The list of file systems to be mounted is specified in the `file-systems` field of the operating system declaration (veja Seção 11.2 [Usando o sistema de configuração], Página 238). Each file system is declared using the `file-system` form, like this:

```
(file-system
  (mount-point "/home")
  (device "/dev/sda3")
  (type "ext4"))
```

As usual, some of the fields are mandatory—those shown in the example above—while others can be omitted. These are described below.

`file-system` [Data Type]

Objects of this type represent file systems to be mounted. They contain the following members:

`tipo` This is a string specifying the type of the file system—e.g., `"ext4"`.

`mount-point`
This designates the place where the file system is to be mounted.

`device` This names the "source" of the file system. It can be one of three things: a file system label, a file system UUID, or the name of a `/dev` node. Labels and UUIDs offer a way to refer to file systems without having to hard-code their actual device name[2].

File system labels are created using the `file-system-label` procedure, UUIDs are created using `uuid`, and `/dev` nodes are plain strings. Here's an example of a file system referred to by its label, as shown by the `e2label` command:

```
(file-system
  (mount-point "/home")
  (type "ext4")
  (device (file-system-label "my-home")))
```

UUIDs are converted from their string representation (as shown by the `tune2fs -l` command) using the `uuid` form[3], like this:

```
(file-system
```

[2] Note that, while it is tempting to use `/dev/disk/by-uuid` and similar device names to achieve the same result, this is not recommended: These special device nodes are created by the udev daemon and may be unavailable at the time the device is mounted.

[3] The `uuid` form expects 16-byte UUIDs as defined in RFC 4122 (`https://tools.ietf.org/html/rfc4122`). This is the form of UUID used by the ext2 family of file systems and others, but it is different from "UUIDs" found in FAT file systems, for instance.

```
(mount-point "/home")
(type "ext4")
(device (uuid "4dab5feb-d176-45de-b287-9b0a6e4c01cb")))
```

When the source of a file system is a mapped device (veja Seção 11.5 [Dispositivos mapeados], Página 256), its `device` field *must* refer to the mapped device name—e.g., `"/dev/mapper/root-partition"`. This is required so that the system knows that mounting the file system depends on having the corresponding device mapping established.

`flags` (default: `'()`)

This is a list of symbols denoting mount flags. Recognized flags include `read-only`, `bind-mount`, `no-dev` (disallow access to special files), `no-suid` (ignore setuid and setgid bits), `no-atime` (do not update file access times), `no-diratime` (likewise for directories only), `strict-atime` (update file access time), `lazy-time` (only update time on the in-memory version of the file inode), `no-exec` (disallow program execution), and `shared` (make the mount shared). Veja Seção "Mount-Unmount-Remount" em *The GNU C Library Reference Manual*, for more information on these flags.

`options` (default: `#f`)

This is either `#f`, or a string denoting mount options passed to the file system driver. Veja Seção "Mount-Unmount-Remount" em *The GNU C Library Reference Manual*, for details.

Run `man 8 mount` for options for various file systems, but beware that what it lists as file-system-independent "mount options" are in fact flags, and belong in the `flags` field described above.

The `file-system-options->alist` and `alist->file-system-options` procedures from `(gnu system file-systems)` can be used to convert file system options given as an association list to the string representation, and vice-versa.

`mount?` (default: `#t`)

This value indicates whether to automatically mount the file system when the system is brought up. When set to `#f`, the file system gets an entry in `/etc/fstab` (read by the `mount` command) but is not automatically mounted.

`needed-for-boot?` (default: `#f`)

This Boolean value indicates whether the file system is needed when booting. If that is true, then the file system is mounted when the initial RAM disk (initrd) is loaded. This is always the case, for instance, for the root file system.

`check?` (padrão: `#t`)

This Boolean indicates whether the file system should be checked for errors before being mounted. How and when this happens can be further adjusted with the following options.

`skip-check-if-clean?` (default: `#t`)
: When true, this Boolean indicates that a file system check triggered by `check?` may exit early if the file system is marked as "clean", meaning that it was previously correctly unmounted and should not contain errors.

  Setting this to false will always force a full consistency check when `check?` is true. This may take a very long time and is not recommended on healthy systems—in fact, it may reduce reliability!

  Conversely, some primitive file systems like `fat` do not keep track of clean shutdowns and will perform a full scan regardless of the value of this option.

`repair` (default: `'preen`)
: When `check?` finds errors, it can (try to) repair them and continue booting. This option controls when and how to do so.

  If false, try not to modify the file system at all. Checking certain file systems like `jfs` may still write to the device to replay the journal. No repairs will be attempted.

  If `#t`, try to repair any errors found and assume "yes" to all questions. This will fix the most errors, but may be risky.

  If `'preen`, repair only errors that are safe to fix without human interaction. What that means is left up to the developers of each file system and may be equivalent to "none" or "all".

`create-mount-point?` (default: `#f`)
: When true, the mount point is created if it does not exist yet.

`mount-may-fail?` (default: `#f`)
: When true, this indicates that mounting this file system can fail but that should not be considered an error. This is useful in unusual cases; an example of this is `efivarfs`, a file system that can only be mounted on EFI/UEFI systems.

`dependencies` (default: `'()`)
: This is a list of `<file-system>` or `<mapped-device>` objects representing file systems that must be mounted or mapped devices that must be opened before (and unmounted or closed after) this one.

  As an example, consider a hierarchy of mounts: `/sys/fs/cgroup` is a dependency of `/sys/fs/cgroup/cpu` and `/sys/fs/cgroup/memory`.

  Another example is a file system that depends on a mapped device, for example for an encrypted partition (veja Seção 11.5 [Dispositivos mapeados], Página 256).

`shepherd-requirements` (default: `'()`)
: This is a list of symbols denoting Shepherd requirements that must be met before mounting the file system.

  As an example, an NFS file system would typically have a requirement for `networking`.

Typically, file systems are mounted before most other Shepherd services are started. However, file systems with a non-empty shepherd-requirements field are mounted after Shepherd services have begun. Any Shepherd service that depends on a file system with a non-empty shepherd-requirements field must depend on it directly and not on the generic symbol `file-systems`.

`file-system-label` *str* [Procedure]

This procedure returns an opaque file system label from *str*, a string:

```
(file-system-label "home")
⇒ #<file-system-label "home">
```

File system labels are used to refer to file systems by label rather than by device name. See above for examples.

The `(gnu system file-systems)` exports the following useful variables.

`%base-file-systems` [Variável]

These are essential file systems that are required on normal systems, such as `%pseudo-terminal-file-system` and `%immutable-store` (see below). Operating system declarations should always contain at least these.

`%pseudo-terminal-file-system` [Variável]

This is the file system to be mounted as `/dev/pts`. It supports *pseudo-terminals* created *via* `openpty` and similar functions (veja Seção "Pseudo-Terminals" em *The GNU C Library Reference Manual*). Pseudo-terminals are used by terminal emulators such as `xterm`.

`%shared-memory-file-system` [Variável]

This file system is mounted as `/dev/shm` and is used to support memory sharing across processes (veja Seção "Memory-mapped I/O" em *The GNU C Library Reference Manual*).

`%immutable-store` [Variável]

This file system performs a read-only "bind mount" of `/gnu/store`, making it read-only for all the users including `root`. This prevents against accidental modification by software running as `root` or by system administrators.

The daemon itself is still able to write to the store: it remounts it read-write in its own "name space."

`%binary-format-file-system` [Variável]

The `binfmt_misc` file system, which allows handling of arbitrary executable file types to be delegated to user space. This requires the `binfmt.ko` kernel module to be loaded.

`%fuse-control-file-system` [Variável]

The `fusectl` file system, which allows unprivileged users to mount and unmount user-space FUSE file systems. This requires the `fuse.ko` kernel module to be loaded.

The `(gnu system uuid)` module provides tools to deal with file system "unique identifiers" (UUIDs).

`uuid` *str* [*type*] [Procedure]

Return an opaque UUID (unique identifier) object of the given *type* (a symbol) by parsing *str* (a string):

```
(uuid "4dab5feb-d176-45de-b287-9b0a6e4c01cb")
⇒ #<<uuid> type: dce bv: ...>

(uuid "1234-ABCD" 'fat)
⇒ #<<uuid> type: fat bv: ...>
```

type may be one of `dce`, `iso9660`, `fat`, `ntfs`, or one of the commonly found synonyms for these.

UUIDs are another way to unambiguously refer to file systems in operating system configuration. See the examples above.

11.4.1 Sistema de arquivos Btrfs

The Btrfs has special features, such as subvolumes, that merit being explained in more details. The following section attempts to cover basic as well as complex uses of a Btrfs file system with the Guix System.

In its simplest usage, a Btrfs file system can be described, for example, by:

```
(file-system
  (mount-point "/home")
  (type "btrfs")
  (device (file-system-label "my-home")))
```

The example below is more complex, as it makes use of a Btrfs subvolume, named `rootfs`. The parent Btrfs file system is labeled `my-btrfs-pool`, and is located on an encrypted device (hence the dependency on `mapped-devices`):

```
(file-system
  (device (file-system-label "my-btrfs-pool"))
  (mount-point "/")
  (type "btrfs")
  (options "subvol=rootfs")
  (dependencies mapped-devices))
```

Some bootloaders, for example GRUB, only mount a Btrfs partition at its top level during the early boot, and rely on their configuration to refer to the correct subvolume path within that top level. The bootloaders operating in this way typically produce their configuration on a running system where the Btrfs partitions are already mounted and where the subvolume information is readily available. As an example, `grub-mkconfig`, the configuration generator command shipped with GRUB, reads `/proc/self/mountinfo` to determine the top-level path of a subvolume.

The Guix System produces a bootloader configuration using the operating system configuration as its sole input; it is therefore necessary to extract the subvolume name on which `/gnu/store` lives (if any) from that operating system configuration. To better illustrate, consider a subvolume named 'rootfs' which contains the root file system data. In such situation, the GRUB bootloader would only see the top level of the root Btrfs partition, e.g.:

```
/                   (top level)
```

```
 rootfs          (subvolume directory)
     gnu         (normal directory)
         store   (normal directory)
[...]
```

Thus, the subvolume name must be prepended to the `/gnu/store` path of the kernel, initrd binaries and any other files referred to in the GRUB configuration that must be found during the early boot.

The next example shows a nested hierarchy of subvolumes and directories:

```
/                   (top level)
 rootfs          (subvolume)
     gnu         (normal directory)
         store   (subvolume)
[...]
```

This scenario would work without mounting the 'store' subvolume. Mounting 'rootfs' is sufficient, since the subvolume name matches its intended mount point in the file system hierarchy. Alternatively, the 'store' subvolume could be referred to by setting the `subvol` option to either `/rootfs/gnu/store` or `rootfs/gnu/store`.

Finally, a more contrived example of nested subvolumes:

```
/                          (top level)
 root-snapshots          (subvolume)
     root-current        (subvolume)
         guix-store      (subvolume)
[...]
```

Here, the 'guix-store' subvolume doesn't match its intended mount point, so it is necessary to mount it. The subvolume must be fully specified, by passing its file name to the `subvol` option. To illustrate, the 'guix-store' subvolume could be mounted on `/gnu/store` by using a file system declaration such as:

```
(file-system
  (device (file-system-label "btrfs-pool-1"))
  (mount-point "/gnu/store")
  (type "btrfs")
  (options "subvol=root-snapshots/root-current/guix-store,\
compress-force=zstd,space_cache=v2"))
```

11.5 Dispositivos mapeados

The Linux kernel has a notion of *device mapping*: a block device, such as a hard disk partition, can be *mapped* into another device, usually in `/dev/mapper/`, with additional processing over the data that flows through it[4]. A typical example is encryption device mapping: all writes to the mapped device are encrypted, and all reads are deciphered, transparently. Guix extends this notion by considering any device or set of devices that are

[4] Note that the GNU Hurd makes no difference between the concept of a "mapped device" and that of a file system: both boil down to *translating* input/output operations made on a file to operations on its backing store. Thus, the Hurd implements mapped devices, like file systems, using the generic *translator* mechanism (veja Seção "Translators" em *The GNU Hurd Reference Manual*).

transformed in some way to create a new device; for instance, RAID devices are obtained by *assembling* several other devices, such as hard disks or partitions, into a new one that behaves as one partition.

Mapped devices are declared using the `mapped-device` form, defined as follows; for examples, see below.

`mapped-device` [Data Type]

Objects of this type represent device mappings that will be made when the system boots up.

`source` This is either a string specifying the name of the block device to be mapped, such as `"/dev/sda3"`, or a list of such strings when several devices need to be assembled for creating a new one. In case of LVM this is a string specifying name of the volume group to be mapped.

`target` This string specifies the name of the resulting mapped device. For kernel mappers such as encrypted devices of type `luks-device-mapping`, specifying `"my-partition"` leads to the creation of the `"/dev/mapper/my-partition"` device. For RAID devices of type `raid-device-mapping`, the full device name such as `"/dev/md0"` needs to be given. LVM logical volumes of type `lvm-device-mapping` need to be specified as `"VGNAME-LVNAME"`.

`targets` This list of strings specifies names of the resulting mapped devices in case there are several. The format is identical to *target*.

`tipo` This must be a `mapped-device-kind` object, which specifies how *source* is mapped to *target*.

`luks-device-mapping` [Variável]

This defines LUKS block device encryption using the `cryptsetup` command from the package with the same name. It relies on the `dm-crypt` Linux kernel module.

`luks-device-mapping-with-options` [*#:key-file*] [Procedure]

Return a `luks-device-mapping` object, which defines LUKS block device encryption using the `cryptsetup` command from the package with the same name. It relies on the `dm-crypt` Linux kernel module.

If `key-file` is provided, unlocking is first attempted using that key file. This has an advantage of not requiring a password entry, so it can be used (for example) to unlock RAID arrays automatically on boot. If key file unlock fails, password unlock is attempted as well. Key file is not stored in the store and needs to be available at the given location at the time of the unlock attempt.

```
;; Following definition would be equivalent to running:
;;   cryptsetup open --key-file /crypto.key /dev/sdb1 data
(mapped-device
 (source "/dev/sdb1)
 (target "data)
 (type (luks-device-mapping-with-options
        #:key-file "/crypto.key")))
```

`raid-device-mapping` [Variável]
: This defines a RAID device, which is assembled using the `mdadm` command from the package with the same name. It requires a Linux kernel module for the appropriate RAID level to be loaded, such as `raid456` for RAID-4, RAID-5 or RAID-6, or `raid10` for RAID-10.

`lvm-device-mapping` [Variável]
: This defines one or more logical volumes for the Linux Logical Volume Manager (LVM) (`https://www.sourceware.org/lvm2/`). The volume group is activated by the `vgchange` command from the `lvm2` package.

The following example specifies a mapping from `/dev/sda3` to `/dev/mapper/home` using LUKS—the Linux Unified Key Setup (`https://gitlab.com/cryptsetup/cryptsetup`), a standard mechanism for disk encryption. The `/dev/mapper/home` device can then be used as the `device` of a `file-system` declaration (veja Seção 11.4 [Sistemas de arquivos], Página 251).

```
(mapped-device
  (source "/dev/sda3")
  (target "home")
  (type luks-device-mapping))
```

Alternatively, to become independent of device numbering, one may obtain the LUKS UUID (*unique identifier*) of the source device by a command like:

```
cryptsetup luksUUID /dev/sda3
```

and use it as follows:

```
(mapped-device
  (source (uuid "cb67fc72-0d54-4c88-9d4b-b225f30b0f44"))
  (target "home")
  (type luks-device-mapping))
```

It is also desirable to encrypt swap space, since swap space may contain sensitive data. One way to accomplish that is to use a swap file in a file system on a device mapped via LUKS encryption. In this way, the swap file is encrypted because the entire device is encrypted. Veja Seção 11.6 [Espaço de troca (swap)], Página 259, or Veja Seção 3.4 [Disk Partitioning], Página 24, for an example.

A RAID device formed of the partitions `/dev/sda1` and `/dev/sdb1` may be declared as follows:

```
(mapped-device
  (source (list "/dev/sda1" "/dev/sdb1"))
  (target "/dev/md0")
  (type raid-device-mapping))
```

The `/dev/md0` device can then be used as the `device` of a `file-system` declaration (veja Seção 11.4 [Sistemas de arquivos], Página 251). Note that the RAID level need not be given; it is chosen during the initial creation and formatting of the RAID device and is determined automatically later.

LVM logical volumes “alpha” and “beta” from volume group “vg0” can be declared as follows:

```
(mapped-device
```

```
(source "vg0")
(targets (list "vg0-alpha" "vg0-beta"))
(type lvm-device-mapping))
```

Devices `/dev/mapper/vg0-alpha` and `/dev/mapper/vg0-beta` can then be used as the `device` of a `file-system` declaration (veja Seção 11.4 [Sistemas de arquivos], Página 251).

11.6 Espaço de troca (swap)

Swap space, as it is commonly called, is a disk area specifically designated for paging: the process in charge of memory management (the Linux kernel or Hurd's default pager) can decide that some memory pages stored in RAM which belong to a running program but are unused should be stored on disk instead. It unloads those from the RAM, freeing up precious fast memory, and writes them to the swap space. If the program tries to access that very page, the memory management process loads it back into memory for the program to use.

A common misconception about swap is that it is only useful when small amounts of RAM are available to the system. However, it should be noted that kernels often use all available RAM for disk access caching to make I/O faster, and thus paging out unused portions of program memory will expand the RAM available for such caching.

For a more detailed description of how memory is managed from the viewpoint of a monolithic kernel, veja Seção "Memory Concepts" em *The GNU C Library Reference Manual*.

The Linux kernel has support for swap partitions and swap files: the former uses a whole disk partition for paging, whereas the second uses a file on a file system for that (the file system driver needs to support it). On a comparable setup, both have the same performance, so one should consider ease of use when deciding between them. Partitions are "simpler" and do not need file system support, but need to be allocated at disk formatting time (logical volumes notwithstanding), whereas files can be allocated and deallocated at any time.

Swap space is also required to put the system into *hibernation* (also called *suspend to disk*), whereby memory is dumped to swap before shutdown so it can be restored when the machine is eventually restarted. Hibernation uses at most half the size of the RAM in the configured swap space. The Linux kernel needs to know about the swap space to be used to resume from hibernation on boot (*via* a kernel argument). When using a swap file, its offset in the device holding it also needs to be given to the kernel; that value has to be updated if the file is initialized again as swap—e.g., because its size was changed.

Note that swap space is not zeroed on shutdown, so sensitive data (such as passwords) may linger on it if it was paged out. As such, you should consider having your swap reside on an encrypted device (veja Seção 11.5 [Dispositivos mapeados], Página 256).

`swap-space` [Data Type]

Objects of this type represent swap spaces. They contain the following members:

`target` The device or file to use, either a UUID, a `file-system-label` or a string, as in the definition of a `file-system` (veja Seção 11.4 [Sistemas de arquivos], Página 251).

`dependencies` (default: `'()`)
A list of `file-system` or `mapped-device` objects, upon which the availability of the space depends. Note that just like for `file-system` objects,

dependencies which are needed for boot and mounted in early userspace are not managed by the Shepherd, and so automatically filtered out for you.

`priority` (default: `#f`)
: Only supported by the Linux kernel. Either `#f` to disable swap priority, or an integer between 0 and 32767. The kernel will first use swap spaces of higher priority when paging, and use same priority spaces on a round-robin basis. The kernel will use swap spaces without a set priority after prioritized spaces, and in the order that they appeared in (not round-robin).

`discard?` (default: `#f`)
: Only supported by the Linux kernel. When true, the kernel will notify the disk controller of discarded pages, for example with the TRIM operation on Solid State Drives.

Here are some examples:

```
(swap-space (target (uuid "4dab5feb-d176-45de-b287-9b0a6e4c01cb")))
```

Use the swap partition with the given UUID. You can learn the UUID of a Linux swap partition by running `swaplabel` *`device`*, where *device* is the `/dev` file name of that partition.

```
(swap-space
  (target (file-system-label "swap"))
  (dependencies mapped-devices))
```

Use the partition with label `swap`, which can be found after all the *mapped-devices* mapped devices have been opened. Again, the `swaplabel` command allows you to view and change the label of a Linux swap partition.

Here's a more involved example with the corresponding `file-systems` part of an `operating-system` declaration.

```
(file-systems
  (list (file-system
          (device (file-system-label "root"))
          (mount-point "/")
          (type "ext4"))
        (file-system
          (device (file-system-label "btrfs"))
          (mount-point "/btrfs")
          (type "btrfs"))))

(swap-devices
  (list
    (swap-space
      (target "/btrfs/swapfile")
      (dependencies (filter (file-system-mount-point-predicate "/btrfs")
                            file-systems)))))
```

Use the file `/btrfs/swapfile` as swap space, which depends on the file system mounted at `/btrfs`. Note how we use Guile's filter to select the file system in an elegant fashion!

```
(swap-devices
  (list
    (swap-space
      (target "/dev/mapper/my-swap")
      (dependencies mapped-devices))))

(kernel-arguments
  (cons* "resume=/dev/mapper/my-swap"
         %default-kernel-arguments))
```

The above snippet of an `operating-system` declaration enables the mapped device `/dev/mapper/my-swap` (which may be part of an encrypted device) as swap space, and tells the kernel to use it for hibernation via the `resume` kernel argument (veja Seção 11.3 [Referência do operating-system], Página 247, `kernel-arguments`).

```
(swap-devices
  (list
    (swap-space
      (target "/swapfile")
      (dependencies (filter (file-system-mount-point-predicate "/")
                            file-systems)))))

(kernel-arguments
  (cons* "resume=/dev/sda3"        ;device that holds /swapfile
         "resume_offset=92514304"  ;offset of /swapfile on device
         %default-kernel-arguments))
```

This other snippet of `operating-system` enables the swap file `/swapfile` for hibernation by telling the kernel about the partition containing it (`resume` argument) and its offset on that partition (`resume_offset` argument). The latter value can be found in the output of the command `filefrag -e` as the first number right under the `physical_offset` column header (the second command extracts its value directly):

```
$ sudo filefrag -e /swapfile
Filesystem type is: ef53
File size of /swapfile is 2463842304 (601524 blocks of 4096 bytes)
 ext:     logical_offset:        physical_offset: length:   expected: flags:
   0:        0..    2047:   92514304..  92516351:   2048:
...
$ sudo filefrag -e /swapfile | grep '^ *0:' | cut -d: -f3 | cut -d. -f1
   92514304
```

11.7 Contas de usuário

User accounts and groups are entirely managed through the `operating-system` declaration. They are specified with the `user-account` and `user-group` forms:

```
(user-account
  (name "alice")
  (group "users")
  (supplementary-groups '("wheel"   ;allow use of sudo, etc.
                          "audio"   ;sound card
                          "video"   ;video devices such as webcams
```

```
                          "cdrom")) ;the good ol' CD-ROM
  (comment "Bob's sister"))
```

Here's a user account that uses a different shell and a custom home directory (the default would be `"/home/bob"`):

```
(user-account
  (name "bob")
  (group "users")
  (comment "Alice's bro")
  (shell (file-append zsh "/bin/zsh"))
  (home-directory "/home/robert"))
```

When booting or upon completion of `guix system reconfigure`, the system ensures that only the user accounts and groups specified in the `operating-system` declaration exist, and with the specified properties. Thus, account or group creations or modifications made by directly invoking commands such as `useradd` are lost upon reconfiguration or reboot. This ensures that the system remains exactly as declared.

`user-account` [Data Type]

Objects of this type represent user accounts. The following members may be specified:

`name` The name of the user account.

`grupo` This is the name (a string) or identifier (a number) of the user group this account belongs to.

`supplementary-groups` (default: `'()`)
Optionally, this can be defined as a list of group names that this account belongs to.

`uid` (default: `#f`)
This is the user ID for this account (a number), or `#f`. In the latter case, a number is automatically chosen by the system when the account is created.

`comment` (default: `""`)
A comment about the account, such as the account owner's full name.

Note that, for non-system accounts, users are free to change their real name as it appears in `/etc/passwd` using the `chfn` command. When they do, their choice prevails over the system administrator's choice; reconfiguring does *not* change their name.

`home-directory`
This is the name of the home directory for the account.

`create-home-directory?` (default: `#t`)
Indicates whether the home directory of this account should be created if it does not exist yet.

`shell` (default: Bash)
This is a G-expression denoting the file name of a program to be used as the shell (veja Seção 8.12 [Expressões-G], Página 163). For example, you would refer to the Bash executable like this:

```
(file-append bash "/bin/bash")
```

... and to the Zsh executable like that:

```
(file-append zsh "/bin/zsh")
```

`system?` (default: `#f`)
: This Boolean value indicates whether the account is a "system" account. System accounts are sometimes treated specially; for instance, graphical login managers do not list them.

`password` (default: `#f`)
: You would normally leave this field to `#f`, initialize user passwords as `root` with the `passwd` command, and then let users change it with `passwd`. Passwords set with `passwd` are of course preserved across reboot and reconfiguration.

  If you *do* want to set an initial password for an account, then this field must contain the encrypted password, as a string. You can use the `crypt` procedure for this purpose:

  ```
  (user-account
    (name "charlie")
    (group "users")

    ;; Specify a SHA-512-hashed initial password.
    (password (crypt "InitialPassword!" "$6$abc")))
  ```

  Nota: The hash of this initial password will be available in a file in `/gnu/store`, readable by all the users, so this method must be used with care.

  Veja Seção "Passphrase Storage" em *The GNU C Library Reference Manual*, for more information on password encryption, and Seção "Encryption" em *GNU Guile Reference Manual*, for information on Guile's `crypt` procedure.

User group declarations are even simpler:

```
(user-group (name "students"))
```

`user-group` [Data Type]
: This type is for, well, user groups. There are just a few fields:

  `name` The name of the group.

  `id` (default: `#f`)
  : The group identifier (a number). If `#f`, a new number is automatically allocated when the group is created.

  `system?` (default: `#f`)
  : This Boolean value indicates whether the group is a "system" group. System groups have low numerical IDs.

  `password` (default: `#f`)
  : What, user groups can have a password? Well, apparently yes. Unless `#f`, this field specifies the password of the group.

For convenience, a variable lists all the basic user groups one may expect:

`%base-groups` [Variável]
: This is the list of basic user groups that users and/or packages expect to be present on the system. This includes groups such as “root”, “wheel”, and “users”, as well as groups used to control access to specific devices such as “audio”, “disk”, and “cdrom”.

`%base-user-accounts` [Variável]
: This is the list of basic system accounts that programs may expect to find on a GNU/Linux system, such as the “nobody” account.

  Note that the “root” account is not included here. It is a special-case and is automatically added whether or not it is specified.

11.8 Disposição do teclado

To specify what each key of your keyboard does, you need to tell the operating system what *keyboard layout* you want to use. The default, when nothing is specified, is the US English QWERTY layout for 105-key PC keyboards. However, German speakers will usually prefer the German QWERTZ layout, French speakers will want the AZERTY layout, and so on; hackers might prefer Dvorak or bépo, and they might even want to further customize the effect of some of the keys. This section explains how to get that done.

There are three components that will want to know about your keyboard layout:

- The *bootloader* may want to know what keyboard layout you want to use (veja Seção 11.15 [Configuração do carregador de inicialização], Página 610). This is useful if you want, for instance, to make sure that you can type the passphrase of your encrypted root partition using the right layout.
- The *operating system kernel*, Linux, will need that so that the console is properly configured (veja Seção 11.3 [Referência do operating-system], Página 247).
- The *graphical display server*, usually Xorg, also has its own idea of the keyboard layout (veja Seção 11.10.7 [X Window], Página 332).

Guix allows you to configure all three separately but, fortunately, it allows you to share the same keyboard layout for all three components.

Keyboard layouts are represented by records created by the `keyboard-layout` procedure of `(gnu system keyboard)`. Following the X Keyboard extension (XKB), each layout has four attributes: a name (often a language code such as “fi” for Finnish or “jp” for Japanese), an optional variant name, an optional keyboard model name, and a possibly empty list of additional options. In most cases the layout name is all you care about.

`keyboard-layout` *name* [*variant*] [*#:model*] [*#:options '()*] [Procedure]
: Return a new keyboard layout with the given *name* and *variant*.

  name must be a string such as `"fr"`; *variant* must be a string such as `"bepo"` or `"nodeadkeys"`. See the `xkeyboard-config` package for valid options.

Here are a few examples:

```
;; The German QWERTZ layout.  Here we assume a standard
;; "pc105" keyboard model.
```

```
(keyboard-layout "de")

;; The bépo variant of the French layout.
(keyboard-layout "fr" "bepo")

;; The Catalan layout.
(keyboard-layout "es" "cat")

;; Arabic layout with "Alt-Shift" to switch to US layout.
(keyboard-layout "ar,us" #:options '("grp:alt_shift_toggle"))

;; The Latin American Spanish layout.  In addition, the
;; "Caps Lock" key is used as an additional "Ctrl" key,
;; and the "Menu" key is used as a "Compose" key to enter
;; accented letters.
(keyboard-layout "latam"
                 #:options '("ctrl:nocaps" "compose:menu"))

;; The Russian layout for a ThinkPad keyboard.
(keyboard-layout "ru" #:model "thinkpad")

;; The "US international" layout, which is the US layout plus
;; dead keys to enter accented characters.  This is for an
;; Apple MacBook keyboard.
(keyboard-layout "us" "intl" #:model "macbook78")
```

See the `share/X11/xkb` directory of the `xkeyboard-config` package for a complete list of supported layouts, variants, and models.

Let's say you want your system to use the Turkish keyboard layout throughout your system—bootloader, console, and Xorg. Here's what your system configuration would look like:

```
;; Using the Turkish layout for the bootloader, the console,
;; and for Xorg.

(operating-system
  ;; ...
  (keyboard-layout (keyboard-layout "tr"))  ;for the console
  (bootloader (bootloader-configuration
               (bootloader grub-efi-bootloader)
               (targets '("/boot/efi"))
               (keyboard-layout keyboard-layout))) ;for GRUB
  (services (cons (set-xorg-configuration
                   (xorg-configuration             ;for Xorg
                     (keyboard-layout keyboard-layout)))
                  %desktop-services)))
```

In the example above, for GRUB and for Xorg, we just refer to the `keyboard-layout` field defined above, but we could just as well refer to a different layout. The `set-xorg-`

`configuration` procedure communicates the desired Xorg configuration to the graphical log-in manager, by default GDM.

We've discussed how to specify the *default* keyboard layout of your system when it starts, but you can also adjust it at run time:

- If you're using GNOME, its settings panel has a "Region & Language" entry where you can select one or more keyboard layouts.
- Under Xorg, the `setxkbmap` command (from the same-named package) allows you to change the current layout. For example, this is how you would change the layout to US Dvorak:

  ```
  setxkbmap us dvorak
  ```

- The `loadkeys` command changes the keyboard layout in effect in the Linux console. However, note that `loadkeys` does *not* use the XKB keyboard layout categorization described above. The command below loads the French bépo layout:

  ```
  loadkeys fr-bepo
  ```

11.9 Locales

A *locale* defines cultural conventions for a particular language and region of the world (veja Seção "Locales" em *The GNU C Library Reference Manual*). Each locale has a name that typically has the form *`language_territory.codeset`*—e.g., `fr_LU.utf8` designates the locale for the French language, with cultural conventions from Luxembourg, and using the UTF-8 encoding.

Usually, you will want to specify the default locale for the machine using the `locale` field of the `operating-system` declaration (veja Seção 11.3 [Referência do operating-system], Página 247).

The selected locale is automatically added to the *locale definitions* known to the system if needed, with its codeset inferred from its name—e.g., `bo_CN.utf8` will be assumed to use the `UTF-8` codeset. Additional locale definitions can be specified in the `locale-definitions` slot of `operating-system`—this is useful, for instance, if the codeset could not be inferred from the locale name. The default set of locale definitions includes some widely used locales, but not all the available locales, in order to save space.

For instance, to add the North Frisian locale for Germany, the value of that field may be:

```
(cons (locale-definition
        (name "fy_DE.utf8") (source "fy_DE"))
      %default-locale-definitions)
```

Likewise, to save space, one might want `locale-definitions` to list only the locales that are actually used, as in:

```
(list (locale-definition
        (name "ja_JP.eucjp") (source "ja_JP")
        (charset "EUC-JP")))
```

The compiled locale definitions are available at `/run/current-system/locale/X.Y`, where `X.Y` is the libc version, which is the default location where the GNU libc provided by Guix looks for locale data. This can be overridden using the `LOCPATH` environment variable (veja [locales-and-locpath], Página 17).

The `locale-definition` form is provided by the `(gnu system locale)` module. Details are given below.

`locale-definition` [Data Type]

This is the data type of a locale definition.

`name` The name of the locale. Veja Seção "Locale Names" em *The GNU C Library Reference Manual*, for more information on locale names.

`source` The name of the source for that locale. This is typically the *`language_territory`* part of the locale name.

`charset` (default: `"UTF-8"`)
The "character set" or "code set" for that locale, as defined by IANA (`https://www.iana.org/assignments/character-sets`).

`%default-locale-definitions` [Variável]

A list of commonly used UTF-8 locales, used as the default value of the `locale-definitions` field of `operating-system` declarations.

These locale definitions use the *normalized codeset* for the part that follows the dot in the name (veja Seção "Using gettextized software" em *The GNU C Library Reference Manual*). So for instance it has `uk_UA.utf8` but *not*, say, `uk_UA.UTF-8`.

11.9.1 Locale Data Compatibility Considerations

`operating-system` declarations provide a `locale-libcs` field to specify the GNU libc packages that are used to compile locale declarations (veja Seção 11.3 [Referência do operating-system], Página 247). "Why would I care?", you may ask. Well, it turns out that the binary format of locale data is occasionally incompatible from one libc version to another.

For instance, a program linked against libc version 2.21 is unable to read locale data produced with libc 2.22; worse, that program *aborts* instead of simply ignoring the incompatible locale data[5]. Similarly, a program linked against libc 2.22 can read most, but not all, of the locale data from libc 2.21 (specifically, `LC_COLLATE` data is incompatible); thus calls to `setlocale` may fail, but programs will not abort.

The "problem" with Guix is that users have a lot of freedom: They can choose whether and when to upgrade software in their profiles, and might be using a libc version different from the one the system administrator used to build the system-wide locale data.

Fortunately, unprivileged users can also install their own locale data and define `GUIX_LOCPATH` accordingly (veja [locales-and-locpath], Página 17).

Still, it is best if the system-wide locale data at `/run/current-system/locale` is built for all the libc versions actually in use on the system, so that all the programs can access it—this is especially crucial on a multi-user system. To do that, the administrator can specify several libc packages in the `locale-libcs` field of `operating-system`:

```
(use-package-modules base)

(operating-system
```

[5] Versions 2.23 and later of GNU libc will simply skip the incompatible locale data, which is already an improvement.

```
;; ...
(locale-libcs (list glibc-2.21 (canonical-package glibc))))
```

This example would lead to a system containing locale definitions for both libc 2.21 and the current version of libc in `/run/current-system/locale`.

11.10 Serviços

An important part of preparing an `operating-system` declaration is listing *system services* and their configuration (veja Seção 11.2 [Usando o sistema de configuração], Página 238). System services are typically daemons launched when the system boots, or other actions needed at that time—e.g., configuring network access.

Guix has a broad definition of "service" (veja Seção 11.19.1 [Composição de serviço], Página 631), but many services are managed by the GNU Shepherd (veja Seção 11.19.4 [Serviços de Shepherd], Página 638). On a running system, the `herd` command allows you to list the available services, show their status, start and stop them, or do other specific operations (veja Seção "Jump Start" em *The GNU Shepherd Manual*). For example:

```
# herd status
```

The above command, run as `root`, lists the currently defined services. The `herd doc` command shows a synopsis of the given service and its associated actions:

```
# herd doc nscd
Run libc's name service cache daemon (nscd).

# herd doc nscd action invalidate
invalidate: Invalidate the given cache--e.g., 'hosts' for host name lookups.
```

The `start`, `stop`, and `restart` sub-commands have the effect you would expect. For instance, the commands below stop the nscd service and restart the Xorg display server:

```
# herd stop nscd
Service nscd has been stopped.
# herd restart xorg-server
Service xorg-server has been stopped.
Service xorg-server has been started.
```

For some services, `herd configuration` returns the name of the service's configuration file, which can be handy to inspect its configuration:

```
# herd configuration sshd
/gnu/store/...-sshd_config
```

The following sections document the available services, starting with the core services, that may be used in an `operating-system` declaration.

11.10.1 Serviços básicos

The `(gnu services base)` module provides definitions for the basic services that one expects from the system. The services exported by this module are listed below.

`%base-services` [Variável]

This variable contains a list of basic services (veja Seção 11.19.2 [Tipos de Service e Serviços], Página 632, for more information on service objects) one would expect

from the system: a login service (mingetty) on each tty, syslogd, the libc name service cache daemon (nscd), the udev device manager, and more.

This is the default value of the `services` field of `operating-system` declarations. Usually, when customizing a system, you will want to append services to `%base-services`, like this:

```
(append (list (service avahi-service-type)
              (service openssh-service-type))
        %base-services)
```

`special-files-service-type` [Variável]

This is the service that sets up "special files" such as `/bin/sh`; an instance of it is part of `%base-services`.

The value associated with `special-files-service-type` services must be a list of two-element lists where the first element is the "special file" and the second element is its target. By default it is:

```
`(("/bin/sh" ,(file-append bash "/bin/sh"))
  ("/usr/bin/env" ,(file-append coreutils "/bin/env")))
```

If you want to add, say, `/bin/bash` to your system, you can change it to:

```
`(("/bin/sh" ,(file-append bash "/bin/sh"))
  ("/usr/bin/env" ,(file-append coreutils "/bin/env"))
  ("/bin/bash" ,(file-append bash "/bin/bash")))
```

Since this is part of `%base-services`, you can use `modify-services` to customize the set of special files (veja Seção 11.19.3 [Referência de Service], Página 634). But the simple way to add a special file is *via* the `extra-special-file` procedure (see below).

`extra-special-file` *file target* [Procedure]

Use *target* as the "special file" *file*.

For example, adding the following lines to the `services` field of your operating system declaration leads to a `/usr/bin/env` symlink:

```
(extra-special-file "/usr/bin/env"
                    (file-append coreutils "/bin/env"))
```

This procedure is meant for `/bin/sh`, `/usr/bin/env` and similar targets. In particular, use for targets under `/etc` might not work as expected if the target is managed by Guix in other ways.

`host-name-service-type` [Variável]

Type of the service that sets the system host name, whose value is a string. This service is included in `operating-system` by default (veja [operating-system-essential-services], Página 250).

`console-font-service-type` [Variável]

Install the given fonts on the specified ttys (fonts are per virtual console on the kernel Linux). The value of this service is a list of tty/font pairs. The font can be the name of a font provided by the `kbd` package or any valid argument to `setfont`, as in this example:

```
`(("tty1" . "LatGrkCyr-8x16")
```

```
("tty2" . ,(file-append
              font-tamzen
              "/share/kbd/consolefonts/TamzenForPowerline10x20.psf"))
("tty3" . ,(file-append
              font-terminus
              "/share/consolefonts/ter-132n"))) ; for HDPI
```

`hosts-service-type` [Variável]

Type of the service that populates the entries for (`/etc/hosts`). This service type can be *extended* by passing it a list of `host` records.

The example below shows how to add two entries to `/etc/hosts`:

```
(simple-service 'add-extra-hosts
                hosts-service-type
                (list (host "192.0.2.1" "example.com"
                            '("example.net" "example.org"))
                      (host "2001:db8::1" "example.com"
                            '("example.net" "example.org"))))
```

Nota: By default `/etc/hosts` comes with the following entries:

```
127.0.0.1 localhost host-name
::1       localhost host-name
```

For most setups this is what you want though if you find yourself in the situation where you want to change the default entries, you can do so in `operating-system` via `modify-services` (veja Seção 11.19.3 [Referência de Service], Página 634).

The following example shows how to unset *host-name* from being an alias of `localhost`.

```
(operating-system
  ;; ...

  (essential-services
   (modify-services
     (operating-system-default-essential-services this-operating-system)
     (hosts-service-type config => (list
                                    (host "127.0.0.1" "localhost")
                                    (host "::1"       "localhost"))))))
```

`host` *address canonical-name* [*aliases*] [Procedure]

Return a new record for the host at *address* with the given *canonical-name* and possibly *aliases*.

address must be a string denoting a valid IPv4 or IPv6 address, and *canonical-name* and the strings listed in *aliases* must be valid host names.

`login-service-type` [Variável]

Type of the service that provides a console login service, whose value is a `<login-configuration>` object.

`login-configuration` [Data Type]
Data type representing the configuration of login, which specifies the MOTD (message of the day), among other things.

`motd` A file-like object containing the "message of the day".

`allow-empty-passwords?` (default: `#t`)
Allow empty passwords by default so that first-time users can log in when the 'root' account has just been created.

`mingetty-service-type` [Variável]
Type of the service that runs Mingetty, an implementation of the virtual console log-in. The value for this service is a `<mingetty-configuration>` object.

`mingetty-configuration` [Data Type]
Data type representing the configuration of Mingetty, which specifies the tty to run, among other things.

`tty` The name of the console this Mingetty runs on—e.g., `"tty1"`.

`auto-login` (default: `#f`)
When true, this field must be a string denoting the user name under which the system automatically logs in. When it is `#f`, a user name and password must be entered to log in.

`login-program` (default: `#f`)
This must be either `#f`, in which case the default log-in program is used (`login` from the Shadow tool suite), or a gexp denoting the name of the log-in program.

`login-pause?` (default: `#f`)
When set to `#t` in conjunction with *auto-login*, the user will have to press a key before the log-in shell is launched.

`clear-on-logout?` (default: `#t`)
When set to `#t`, the screen will be cleared after logout.

`mingetty` (default: *mingetty*)
The Mingetty package to use.

`agetty-service-type` [Variável]
Type of the service that runs agetty, which implements virtual and serial console log-in. The value for this service is a `<agetty-configuration>` object.

`agetty-configuration` [Data Type]
Data type representing the configuration of agetty, which specifies the tty to run, among other things[6].

`tty` The name of the console this agetty runs on, as a string—e.g., `"ttyS0"`. This argument is optional, it will default to a reasonable default serial port used by the kernel Linux.

[6] See the `agetty(8)` man page for more information.

For this, if there is a value for an option `agetty.tty` in the kernel command line, agetty will extract the device name of the serial port from it and use that.

If not and if there is a value for an option `console` with a tty in the Linux command line, agetty will extract the device name of the serial port from it and use that.

In both cases, agetty will leave the other serial device settings (baud rate etc.) alone—in the hope that Linux pinned them to the correct values.

`baud-rate` (default: `#f`)
A string containing a comma-separated list of one or more baud rates, in descending order.

`term` (default: `#f`)
A string containing the value used for the `TERM` environment variable.

`eight-bits?` (default: `#f`)
When `#t`, the tty is assumed to be 8-bit clean, and parity detection is disabled.

`auto-login` (default: `#f`)
When passed a login name, as a string, the specified user will be logged in automatically without prompting for their login name or password.

`no-reset?` (default: `#f`)
When `#t`, don't reset terminal cflags (control modes).

`host` (default: `#f`)
This accepts a string containing the "login_host", which will be written into the `/var/run/utmpx` file.

`remote?` (padrão: `#f`)
When set to `#t` in conjunction with *host*, this will add an `-r` fakehost option to the command line of the login program specified in *login-program*.

`flow-control?` (default: `#f`)
When set to `#t`, enable hardware (RTS/CTS) flow control.

`no-issue?` (padrão: `#f`)
When set to `#t`, the contents of the `/etc/issue` file will not be displayed before presenting the login prompt.

`init-string` (default: `#f`)
This accepts a string that will be sent to the tty or modem before sending anything else. It can be used to initialize a modem.

`no-clear?` (padrão: `#f`)
When set to `#t`, agetty will not clear the screen before showing the login prompt.

`login-program` (default: (file-append shadow "/bin/login"))
This must be either a gexp denoting the name of a log-in program, or unset, in which case the default value is the `login` from the Shadow tool suite.

`local-line` (default: `#f`)
: Control the CLOCAL line flag. This accepts one of three symbols as arguments, `'auto`, `'always`, or `'never`. If `#f`, the default value chosen by agetty is `'auto`.

`extract-baud?` (default: `#f`)
: When set to `#t`, instruct agetty to try to extract the baud rate from the status messages produced by certain types of modems.

`skip-login?` (default: `#f`)
: When set to `#t`, do not prompt the user for a login name. This can be used with *login-program* field to use non-standard login systems.

`no-newline?` (padrão: `#f`)
: When set to `#t`, do not print a newline before printing the `/etc/issue` file.

`login-options` (default: `#f`)
: This option accepts a string containing options that are passed to the login program. When used with the *login-program*, be aware that a malicious user could try to enter a login name containing embedded options that could be parsed by the login program.

`login-pause` (default: `#f`)
: When set to `#t`, wait for any key before showing the login prompt. This can be used in conjunction with *auto-login* to save memory by lazily spawning shells.

`chroot` (default: `#f`)
: Change root to the specified directory. This option accepts a directory path as a string.

`hangup?` (padrão: `#f`)
: Use the Linux system call `vhangup` to do a virtual hangup of the specified terminal.

`keep-baud?` (default: `#f`)
: When set to `#t`, try to keep the existing baud rate. The baud rates from *baud-rate* are used when agetty receives a `BREAK` character.

`timeout` (default: `#f`)
: When set to an integer value, terminate if no user name could be read within *timeout* seconds.

`detect-case?` (default: `#f`)
: When set to `#t`, turn on support for detecting an uppercase-only terminal. This setting will detect a login name containing only uppercase letters as indicating an uppercase-only terminal and turn on some upper-to-lower case conversions. Note that this will not support Unicode characters.

`wait-cr?` (default: `#f`)
: When set to `#t`, wait for the user or modem to send a carriage-return or linefeed character before displaying `/etc/issue` or login prompt. This is typically used with the *init-string* option.

`no-hints?` (padrão: `#f`)
: When set to `#t`, do not print hints about Num, Caps, and Scroll locks.

`no-hostname?` (default: `#f`)
: By default, the hostname is printed. When this option is set to `#t`, no hostname will be shown at all.

`long-hostname?` (default: `#f`)
: By default, the hostname is only printed until the first dot. When this option is set to `#t`, the fully qualified hostname by `gethostname` or `getaddrinfo` is shown.

`erase-characters` (default: `#f`)
: This option accepts a string of additional characters that should be interpreted as backspace when the user types their login name.

`kill-characters` (default: `#f`)
: This option accepts a string that should be interpreted to mean "ignore all previous characters" (also called a "kill" character) when the user types their login name.

`chdir` (default: `#f`)
: This option accepts, as a string, a directory path that will be changed to before login.

`delay` (default: `#f`)
: This options accepts, as an integer, the number of seconds to sleep before opening the tty and displaying the login prompt.

`nice` (default: `#f`)
: This option accepts, as an integer, the nice value with which to run the `login` program.

`extra-options` (default: `'()`)
: This option provides an "escape hatch" for the user to provide arbitrary command-line arguments to `agetty` as a list of strings.

`shepherd-requirement` (default: `'()`)
: The option can be used to provides extra shepherd requirements (for example `'syslogd`) to the respective `'term-`* shepherd service.

`kmscon-service-type` [Variável]
: Type of the service that runs kmscon (`https://www.freedesktop.org/wiki/Software/kmscon`), which implements virtual console log-in. The value for this service is a `<kmscon-configuration>` object.

`kmscon-configuration` [Data Type]
: Data type representing the configuration of Kmscon, which specifies the tty to run, among other things.

`virtual-terminal`
: The name of the console this Kmscon runs on—e.g., `"tty1"`.

`login-program` (default: `#~(string-append #$shadow "/bin/login")`)
: A gexp denoting the name of the log-in program. The default log-in program is `login` from the Shadow tool suite.

`login-arguments` (default: `'("-p")`)
: A list of arguments to pass to `login`.

`auto-login` (default: `#f`)
: When passed a login name, as a string, the specified user will be logged in automatically without prompting for their login name or password.

`hardware-acceleration?` (default: #f)
: Whether to use hardware acceleration.

`font-engine` (default: `"pango"`)
: Font engine used in Kmscon.

`font-size` (default: `12`)
: Font size used in Kmscon.

`keyboard-layout` (default: `#f`)
: If this is `#f`, Kmscon uses the default keyboard layout—usually US English ("qwerty") for a 105-key PC keyboard.

  Otherwise this must be a `keyboard-layout` object specifying the keyboard layout. Veja Seção 11.8 [Disposição do teclado], Página 264, for more information on how to specify the keyboard layout.

`kmscon` (default: *kmscon*)
: The Kmscon package to use.

`nscd-service-type` [Variável]

Type of the service that runs the libc nscd (name service cache daemon), whose value is an `<nscd-configuration>` object.

For convenience, the Shepherd service for nscd provides the following actions:

`invalidate`
: This invalidate the given cache. For instance, running:

```
herd invalidate nscd hosts
```

  invalidates the host name lookup cache of nscd.

`statistics`
: Running `herd statistics nscd` displays information about nscd usage and caches.

`nscd-configuration` [Data Type]

Data type representing the nscd (name service cache daemon) configuration.

`name-services` (default: `'()`)
: List of packages denoting *name services* that must be visible to the nscd—e.g., `(list nss-mdns)`.

`glibc` (default: *glibc*)
: Package object denoting the GNU C Library providing the `nscd` command.

`log-file` (default: `#f`)
: Name of the nscd log file. Debugging output goes to that file when `debug-level` is strictly positive, or to standard error if it is `#f`. Regular messages are written to syslog when `debug-level` is zero, regardless of the value of `log-file`.

`debug-level` (default: `0`)
: Integer denoting the debugging levels. Higher numbers mean that more debugging output is logged.

`caches` (default: `%nscd-default-caches`)
: List of `<nscd-cache>` objects denoting things to be cached; see below.

`nscd-cache` [Data Type]

Data type representing a cache database of nscd and its parameters.

`database` This is a symbol representing the name of the database to be cached. Valid values are `passwd`, `group`, `hosts`, and `services`, which designate the corresponding NSS database (veja Seção "NSS Basics" em *The GNU C Library Reference Manual*).

`positive-time-to-live`
`negative-time-to-live` (default: `20`)
: A number representing the number of seconds during which a positive or negative lookup result remains in cache.

`check-files?` (default: `#t`)
: Whether to check for updates of the files corresponding to *database*.

  For instance, when *database* is `hosts`, setting this flag instructs nscd to check for updates in `/etc/hosts` and to take them into account.

`persistent?` (padrão: `#t`)
: Whether the cache should be stored persistently on disk.

`shared?` (padrão: `#t`)
: Whether the cache should be shared among users.

`max-database-size` (default: 32 MiB)
: Maximum size in bytes of the database cache.

`%nscd-default-caches` [Variável]

List of `<nscd-cache>` objects used by default by `nscd-configuration` (see above).

It enables persistent and aggressive caching of service and host name lookups. The latter provides better host name lookup performance, resilience in the face of unreliable name servers, and also better privacy—often the result of host name lookups is in local cache, so external name servers do not even need to be queried.

`syslog-service-type` [Variável]

Type of the service that runs the syslog daemon, whose value is a `<syslog-configuration>` object.

To have a modified `syslog-configuration` come into effect after reconfiguring your system, the '`reload`' action should be preferred to restarting the service, as many services such as the login manager depend on it and would be restarted as well:

```
# herd reload syslog
```

which will cause the running `syslogd` process to reload its configuration.

`syslog-configuration` [Data Type]

Data type representing the configuration of the syslog daemon.

`syslogd` (default: `#~(string-append #$inetutils "/libexec/syslogd")`)
The syslog daemon to use.

`config-file` (default: `%default-syslog.conf`)
The syslog configuration file to use. Veja Seção "syslogd invocation" em *GNU Inetutils*, for more information on the configuration file syntax.

`guix-service-type` [Variável]

This is the type of the service that runs the build daemon, `guix-daemon` (veja Seção 2.3 [Invocando guix-daemon], Página 13). Its value must be a `guix-configuration` record as described below.

`guix-configuration` [Data Type]

This data type represents the configuration of the Guix build daemon. Veja Seção 2.3 [Invocando guix-daemon], Página 13, for more information.

`guix` (default: *guix*)
The Guix package to use. Veja Seção 6.4 [Customizing the System-Wide Guix], Página 71, to learn how to provide a package with a pre-configured set of channels.

`build-group` (default: `"guixbuild"`)
Name of the group for build user accounts.

`build-accounts` (default: `10`)
Number of build user accounts to create.

`authorize-key?` (default: `#t`)
Whether to authorize the substitute keys listed in `authorized-keys`—by default that of `bordeaux.guix.gnu.org` and `ci.guix.gnu.org` (veja Seção 5.3 [Substitutos], Página 47).

When `authorize-key?` is true, `/etc/guix/acl` cannot be changed by invoking `guix archive --authorize`. You must instead adjust `guix-configuration` as you wish and reconfigure the system. This ensures that your operating system configuration file is self-contained.

> **Nota:** When booting or reconfiguring to a system where `authorize-key?` is true, the existing `/etc/guix/acl` file is backed up as `/etc/guix/acl.bak` if it was determined to be a manually modified file. This is to facilitate migration from earlier versions, which allowed for in-place modifications to `/etc/guix/acl`.

`authorized-keys` (default: `%default-authorized-guix-keys`)
: The list of authorized key files for archive imports, as a list of string-valued gexps (veja Seção 5.11 [Invocando guix archive], Página 66). By default, it contains that of `bordeaux.guix.gnu.org` and `ci.guix.gnu.org` (veja Seção 5.3 [Substitutos], Página 47). See `substitute-urls` below for an example on how to change it.

`use-substitutes?` (default: `#t`)
: Whether to use substitutes.

`substitute-urls` (default: `%default-substitute-urls`)
: The list of URLs where to look for substitutes by default.

  Suppose you would like to fetch substitutes from `guix.example.org` in addition to `bordeaux.guix.gnu.org`. You will need to do two things: (1) add `guix.example.org` to `substitute-urls`, and (2) authorize its signing key, having done appropriate checks (veja Seção 5.3.2 [Autorização de servidor substituto], Página 48). The configuration below does exactly that:

```
(guix-configuration
  (substitute-urls
   (append (list "https://guix.example.org")
           %default-substitute-urls))
  (authorized-keys
   (append (list (local-file "./guix.example.org-key.pub"))
           %default-authorized-guix-keys)))
```

  This example assumes that the file `./guix.example.org-key.pub` contains the public key that `guix.example.org` uses to sign substitutes.

`generate-substitute-key?` (default: `#t`)
: Whether to generate a *substitute key pair* under `/etc/guix/signing-key.pub` and `/etc/guix/signing-key.sec` if there is not already one.

  This key pair is used when exporting store items, for instance with `guix publish` (veja Seção 9.11 [Invocando guix publish], Página 221) or `guix archive` (veja Seção 5.11 [Invocando guix archive], Página 66). Generating a key pair takes a few seconds when enough entropy is available and is only done once; you might want to turn it off for instance in a virtual machine that does not need it and where the extra boot time is a problem.

`channels` (default: `#f`)
: List of channels to be specified in `/etc/guix/channels.scm`, which is what `guix pull` uses by default (veja Seção 5.7 [Invocando guix pull], Página 57).

  > **Nota:** When reconfiguring a system, the existing `/etc/guix/channels.scm` file is backed up as `/etc/guix/channels.scm.bak` if it was determined to be a manually modified file. This is to facilitate migration from earlier versions, which allowed for in-place modifications to `/etc/guix/channels.scm`.

`max-silent-time` (default: `3600`)
`timeout` (default: `(* 3600 24)`)
: The number of seconds of silence and the number of seconds of activity, respectively, after which a build process times out. A value of zero disables the timeout.

`log-compression` (default: `'gzip`)
: The type of compression used for build logs—one of `gzip`, `bzip2`, or `none`.

`discover?` (default: `#f`)
: Se deve descobrir servidores substitutos na rede local usando mDNS e DNS-SD.

`build-machines` (default: `#f`)
: This field must be either `#f` or a list of gexps evaluating to a `build-machine` record or to a list of `build-machine` records (veja Seção 2.2.2 [Configuração de descarregamento de daemon], Página 8).

  When it is `#f`, the `/etc/guix/machines.scm` file is left untouched. Otherwise, the list of of gexps is written to `/etc/guix/machines.scm`; if a previously-existing file is found, it is backed up as `/etc/guix/machines.scm.bak`. This allows you to declare build machines for offloading directly in the operating system declaration, like so:

```
(guix-configuration
  (build-machines
    (list #~(build-machine (name "foo.example.org") ...)
          #~(build-machine (name "bar.example.org") ...))))
```

  Additional build machines may be added *via* the `guix-extension` mechanism (see below).

`extra-options` (default: `'()`)
: List of extra command-line options for `guix-daemon`.

`log-file` (default: `"/var/log/guix-daemon.log"`)
: File where `guix-daemon`'s standard output and standard error are written.

`http-proxy` (default: `#f`)
: The URL of the HTTP and HTTPS proxy used for downloading fixed-output derivations and substitutes.

  It is also possible to change the daemon's proxy at run time through the `set-http-proxy` action, which restarts it:

```
herd set-http-proxy guix-daemon http://localhost:8118
```

  To clear the proxy settings, run:

```
herd set-http-proxy guix-daemon
```

`tmpdir` (default: `#f`)
: A directory path where the `guix-daemon` will perform builds.

`environment` (default: `'()`)
: Environment variables to be set before starting the daemon, as a list of `key=value` strings.

`socket-directory-permissions` (default: `#o755`)
: Permissions to set for the directory `/var/guix/daemon-socket`. This, together with `socket-directory-group` and `socket-directory-user`, determines who can connect to the build daemon via its Unix socket. TCP socket operation is unaffected by these.

`socket-directory-user` (default: `#f`)
`socket-directory-group` (default: `#f`)
: User and group owning the `/var/guix/daemon-socket` directory or `#f` to keep the user or group as root.

`guix-extension` [Data Type]
: This data type represents the parameters of the Guix build daemon that are extendable. This is the type of the object that must be used within a guix service extension. Veja Seção 11.19.1 [Composição de serviço], Página 631, for more information.

`authorized-keys` (default: `'()`)
: A list of file-like objects where each element contains a public key.

`substitute-urls` (default: `'()`)
: A list of strings where each element is a substitute URL.

`build-machines` (default: `'()`)
: A list of gexps that evaluate to `build-machine` records or to a list of `build-machine` records. (veja Seção 2.2.2 [Configuração de descarregamento de daemon], Página 8).

  Using this field, a service may add new build machines to receive builds offloaded by the daemon. This is useful for a service such as `hurd-vm-service-type`, which can make a GNU/Hurd virtual machine directly usable for offloading (veja [hurd-vm], Página 535).

`chroot-directories` (default: `'()`)
: A list of file-like objects or strings pointing to additional directories the build daemon can use.

`udev-service-type` [Variável]
: Type of the service that runs udev, a service which populates the `/dev` directory dynamically, whose value is a `<udev-configuration>` object.

  Since the file names for udev rules and hardware description files matter, the configuration items for rules and hardware cannot simply be plain file-like objects with the rules content, because the name would be ignored. Instead, they are directory file-like objects that contain optional rules in `lib/udev/rules.d` and optional hardware files in `lib/udev/hwdb.d`. This way, the service can be configured with whole packages from which to take rules and hwdb files.

  The `udev-service-type` can be *extended* with file-like directories that respect this hierarchy. For convenience, the `udev-rule` and `file->udev-rule` can be used to

construct udev rules, while `udev-hardware` and `file->udev-hardware` can be used to construct hardware description files.

In an `operating-system` declaration, this service type can be *extended* using procedures `udev-rules-service` and `udev-hardware-service`.

`udev-configuration` [Data Type]

Data type representing the configuration of udev.

`udev` (default: `eudev`) (type: file-like)
: Package object of the udev service. This package is used at run-time, when compiled for the target system. In order to generate the `hwdb.bin` hardware index, it is also used when generating the system definition, compiled for the current system.

`rules` (default: *'()*) (type: list-of-file-like)
: List of file-like objects denoting udev rule files under a sub-directory.

`hardware` (default: *'()*) (type: list-of-file-like)
: List of file-like objects denoting udev hardware description files under a sub-directory.

`udev-rule` *`file-name contents`* [Procedure]

Return a udev-rule file named *file-name* containing the rules defined by the *contents* literal.

In the following example, a rule for a USB device is defined to be stored in the file `90-usb-thing.rules`. The rule runs a script upon detecting a USB device with a given product identifier.

```
(define %example-udev-rule
  (udev-rule
    "90-usb-thing.rules"
    (string-append "ACTION==\"add\", SUBSYSTEM==\"usb\", "
                   "ATTR{product}==\"Example\", "
                   "RUN+=\"/path/to/script\"")))
```

`udev-hardware` *`file-name contents`* [Procedure]

Return a udev hardware description file named *file-name* containing the hardware information *contents*.

`udev-rules-service` *`name rules`* [*#:groups '*()] [Procedure]

Return a service that extends `udev-service-type` with *rules* and `account-service-type` with *groups* as system groups. This works by creating a singleton service type *`name`*`-udev-rules`, of which the returned service is an instance.

Here we show how it can be used to extend `udev-service-type` with the previously defined rule `%example-udev-rule`.

```
(operating-system
 ;; ...
 (services
   (cons (udev-rules-service 'usb-thing %example-udev-rule)
         %desktop-services)))
```

`udev-hardware-service` *name hardware* [Procedure]
Return a service that extends `udev-service-type` with *hardware*. The service name is *name*`-udev-hardware`.

`file->udev-rule` *file-name file* [Procedure]
Return a udev-rule file named *file-name* containing the rules defined within *file*, a file-like object.

The following example showcases how we can use an existing rule file.

```
(use-modules (guix download)     ;for url-fetch
             (guix packages)     ;for origin
             ...)

(define %android-udev-rules
  (file->udev-rule
    "51-android-udev.rules"
    (let ((version "20170910"))
      (origin
       (method url-fetch)
       (uri (string-append "https://raw.githubusercontent.com/M0Rf30/"
                           "android-udev-rules/" version "/51-android.rules"))
       (sha256
        (base32 "0lmmagpyb6xsq6zcr2w1cyx9qmjqmajkvrdbhjx32gqf1d9is003")))))))
```

Since guix package definitions can be included in *rules* in order to use all their rules under the `lib/udev/rules.d` sub-directory, then in lieu of the previous *file->udev-rule* example, we could have used the *android-udev-rules* package which exists in Guix in the `(gnu packages android)` module.

`file->udev-hardware` *file-name file* [Procedure]
Return a udev hardware description file named *file-name* containing the rules defined within *file*, a file-like object.

The following example shows how to use the *android-udev-rules* package so that the Android tool `adb` can detect devices without root privileges. It also details how to create the `adbusers` group, which is required for the proper functioning of the rules defined within the `android-udev-rules` package. To create such a group, we must define it both as part of the `supplementary-groups` of our `user-account` declaration, as well as in the *groups* of the `udev-rules-service` procedure.

```
(use-modules (gnu packages android)  ;for android-udev-rules
             (gnu system shadow)     ;for user-group
             ...)

(operating-system
  ;; ...
  (users (cons (user-account
                ;; ...
                (supplementary-groups
```

```
                    '("adbusers"   ;for adb
                      "wheel" "netdev" "audio" "video")))))
       ;; ...
       (services
         (cons (udev-rules-service 'android android-udev-rules
                                   #:groups '("adbusers"))
               %desktop-services)))
```

`urandom-seed-service-type` [Variável]

Save some entropy in `%random-seed-file` to seed `/dev/urandom` when rebooting. It also tries to seed `/dev/urandom` from `/dev/hwrng` while booting, if `/dev/hwrng` exists and is readable.

`%random-seed-file` [Variável]

This is the name of the file where some random bytes are saved by *urandom-seed-service* to seed `/dev/urandom` when rebooting. It defaults to `/var/lib/random-seed`.

`gpm-service-type` [Variável]

This is the type of the service that runs GPM, the *general-purpose mouse daemon*, which provides mouse support to the Linux console. GPM allows users to use the mouse in the console, notably to select, copy, and paste text.

The value for services of this type must be a `gpm-configuration` (see below). This service is not part of `%base-services`.

`gpm-configuration` [Data Type]

Data type representing the configuration of GPM.

`options` (default: `%default-gpm-options`)
: Command-line options passed to `gpm`. The default set of options instruct `gpm` to listen to mouse events on `/dev/input/mice`. Veja Seção "Command Line" em *gpm manual*, for more information.

`gpm` (default: `gpm`)
: O pacote GPM a ser usado.

`guix-publish-service-type` [Variável]

This is the service type for `guix publish` (veja Seção 9.11 [Invocando guix publish], Página 221). Its value must be a `guix-publish-configuration` object, as described below.

This assumes that `/etc/guix` already contains a signing key pair as created by `guix archive --generate-key` (veja Seção 5.11 [Invocando guix archive], Página 66). If that is not the case, the service will fail to start.

`guix-publish-configuration` [Data Type]

Data type representing the configuration of the `guix publish` service.

`guix` (default: `guix`)
: The Guix package to use.

`port` (default: `80`)
: The TCP port to listen for connections.

`host` (default: `"localhost"`)
: The host (and thus, network interface) to listen to. Use `"0.0.0.0"` to listen on all the network interfaces.

`advertise?` (default: `#f`)
: When true, advertise the service on the local network *via* the DNS-SD protocol, using Avahi.

  This allows neighboring Guix devices with discovery on (see `guix-configuration` above) to discover this `guix publish` instance and to automatically download substitutes from it.

`compression` (default: `'(("gzip" 3) ("zstd" 3))`)
: This is a list of compression method/level tuple used when compressing substitutes. For example, to compress all substitutes with *both* lzip at level 7 and gzip at level 9, write:

  ```
  '(("lzip" 7) ("gzip" 9))
  ```

  Level 9 achieves the best compression ratio at the expense of increased CPU usage, whereas level 1 achieves fast compression. Veja Seção 9.11 [Invocando guix publish], Página 221, for more information on the available compression methods and the tradeoffs involved.

  An empty list disables compression altogether.

`nar-path` (default: `"nar"`)
: The URL path at which "nars" can be fetched. Veja Seção 9.11 [Invocando guix publish], Página 221, for details.

`cache` (default: `#f`)
: When it is `#f`, disable caching and instead generate archives on demand. Otherwise, this should be the name of a directory—e.g., `"/var/cache/guix/publish"`—where `guix publish` caches archives and meta-data ready to be sent. Veja Seção 9.11 [Invocando guix publish], Página 221, for more information on the tradeoffs involved.

`workers` (default: `#f`)
: When it is an integer, this is the number of worker threads used for caching; when `#f`, the number of processors is used. Veja Seção 9.11 [Invocando guix publish], Página 221, for more information.

`cache-bypass-threshold` (default: 10 MiB)
: When `cache` is true, this is the maximum size in bytes of a store item for which `guix publish` may bypass its cache in case of a cache miss. Veja Seção 9.11 [Invocando guix publish], Página 221, for more information.

`ttl` (default: `#f`)
: When it is an integer, this denotes the *time-to-live* in seconds of the published archives. Veja Seção 9.11 [Invocando guix publish], Página 221, for more information.

`negative-ttl` (default: `#f`)
: When it is an integer, this denotes the *time-to-live* in seconds for the negative lookups. Veja Seção 9.11 [Invocando guix publish], Página 221, for more information.

`rngd-service-type` [Variável]
: Type of the service that runs rng-tools rngd, whose value is an `<rngd-configuration>` object.

`rngd-configuration` [Data Type]
: Data type representing the configuration of rngd.

  `rng-tools` (default: `rng-tools`) (type: file-like)
  : Package object of the rng-tools rngd.

  `device` (default: "*/dev/hwrng*") (type: string)
  : Path of the device to add to the kernel's entropy pool. The service will fail if *device* does not exist.

`pam-limits-service-type` [Variável]
: Type of the service that installs a configuration file for the `pam_limits` module (`http://linux-pam.org/Linux-PAM-html/sag-pam_limits.html`). The value for this service type is a list of `pam-limits-entry` values, which can be used to specify `ulimit` limits and `nice` priority limits to user sessions. By default, the value is the empty list.

  The following limits definition sets two hard and soft limits for all login sessions of users in the `realtime` group:

```
(service pam-limits-service-type
         (list
          (pam-limits-entry "@realtime" 'both 'rtprio 99)
          (pam-limits-entry "@realtime" 'both 'memlock 'unlimited)))
```

  The first entry increases the maximum realtime priority for non-privileged processes; the second entry lifts any restriction of the maximum address space that can be locked in memory. These settings are commonly used for real-time audio systems.

  Another useful example is raising the maximum number of open file descriptors that can be used:

```
(service pam-limits-service-type
         (list
          (pam-limits-entry "*" 'both 'nofile 100000)))
```

  In the above example, the asterisk means the limit should apply to any user. It is important to ensure the chosen value doesn't exceed the maximum system value visible in the `/proc/sys/fs/file-max` file, else the users would be prevented from login in. For more information about the Pluggable Authentication Module (PAM) limits, refer to the '`pam_limits`' man page from the `linux-pam` package.

`greetd-service-type` [Variável]
: `greetd` (`https://git.sr.ht/~kennylevinsen/greetd`) is a minimal and flexible login manager daemon, that makes no assumptions about what you want to launch.

If you can run it from your shell in a TTY, greetd can start it. If it can be taught to speak a simple JSON-based IPC protocol, then it can be a geeter.

`greetd-service-type` provides necessary infrastructure for logging in users, including:

- `greetd` PAM service
- Special variation of `pam-mount` to mount `XDG_RUNTIME_DIR`

Here is an example of switching from `mingetty-service-type` to `greetd-service-type`, and how different terminals could be:

```
(append
 (modify-services %base-services
   ;; greetd-service-type provides "greetd" PAM service
   (delete login-service-type)
   ;; and can be used in place of mingetty-service-type
   (delete mingetty-service-type))
 (list
  (service greetd-service-type
           (greetd-configuration
            (terminals
             (list
              ;; we can make any terminal active by default
              (greetd-terminal-configuration (terminal-vt "1") (terminal-switch
              ;; we can make environment without XDG_RUNTIME_DIR set
              ;; even provide our own environment variables
              (greetd-terminal-configuration
               (terminal-vt "2")
               (default-session-command
                 (greetd-agreety-session
                  (extra-env '(("MY_VAR" . "1")))
                  (xdg-env? #f))))
              ;; we can use different shell instead of default bash
              (greetd-terminal-configuration
               (terminal-vt "3")
               (default-session-command
                 (greetd-agreety-session (command (file-append zsh "/bin/zsh"))
              ;; we can use any other executable command as greeter
              (greetd-terminal-configuration
               (terminal-vt "4")
               (default-session-command (program-file "my-noop-greeter" #~(exit
              (greetd-terminal-configuration (terminal-vt "5"))
              (greetd-terminal-configuration (terminal-vt "6"))))))
  ;; mingetty-service-type can be used in parallel
  ;; if needed to do so, do not (delete login-service-type)
  ;; as illustrated above
  #| (service mingetty-service-type (mingetty-configuration (tty "tty8"))) |#))
```

`greetd-configuration` [Data Type]

Configuration record for the `greetd-service-type`.

`motd` A file-like object containing the “message of the day”.

`allow-empty-passwords?` (default: `#t`)
Allow empty passwords by default so that first-time users can log in when the 'root' account has just been created.

`terminals` (default: `'()`)
List of `greetd-terminal-configuration` per terminal for which `greetd` should be started.

`greeter-supplementary-groups` (default: `'()`)
List of groups which should be added to `greeter` user. For instance:

```
(greeter-supplementary-groups '("seat" "video"))
```

Note that this example will fail if `seat` group does not exist.

`greetd-terminal-configuration` [Data Type]

Configuration record for per terminal greetd daemon service.

`greetd` (default: `greetd`)
The greetd package to use.

`config-file-name`
Configuration file name to use for greetd daemon. Generally, autogenerated derivation based on `terminal-vt` value.

`log-file-name`
Log file name to use for greetd daemon. Generally, autogenerated name based on `terminal-vt` value.

`terminal-vt` (default: ‘`"7"`’)
The VT to run on. Use of a specific VT with appropriate conflict avoidance is recommended.

`terminal-switch` (default: `#f`)
Make this terminal active on start of `greetd`.

`source-profile?` (default: `#t`)
Whether to source `/etc/profile` and `~/.profile`, when they exist.

`default-session-user` (default: ‘`"greeter"`’)
The user to use for running the greeter.

`default-session-command` (default: `(greetd-agreety-session)`)
Can be either instance of `greetd-agreety-session` configuration or `gexp->script` like object to use as greeter.

`greetd-agreety-session` [Data Type]

Configuration record for the agreety greetd greeter.

`agreety` (default: `greetd`)
The package with `/bin/agreety` command.

`command` (default: `(file-append bash "/bin/bash")`)
Command to be started by `/bin/agreety` on successful login.

`command-args` (default: `'("-l")`)
Command arguments to pass to command.

`extra-env` (default: `'()`)
Extra environment variables to set on login.

`xdg-env?` (default: `#t`)
If true `XDG_RUNTIME_DIR` and `XDG_SESSION_TYPE` will be set before starting command. One should note that, `extra-env` variables are set right after mentioned variables, so that they can be overridden.

`greetd-wlgreet-session` [Data Type]
Generic configuration record for the wlgreet greetd greeter.

`wlgreet` (default: `wlgreet`)
The package with the `/bin/wlgreet` command.

`command` (default: `(file-append sway "/bin/sway")`)
Command to be started by `/bin/wlgreet` on successful login.

`command-args` (default: `'()`)
Command arguments to pass to command.

`output-mode` (default: `"all"`)
Option to use for `outputMode` in the TOML configuration file.

`scale` (default: `1`)
Option to use for `scale` in the TOML configuration file.

`background` (default: `'(0 0 0 0.9)`)
RGBA list to use as the background colour of the login prompt.

`headline` (default: `'(1 1 1 1)`)
RGBA list to use as the headline colour of the UI popup.

`prompt` (default: `'(1 1 1 1)`)
RGBA list to use as the prompt colour of the UI popup.

`prompt-error` (default: `'(1 1 1 1)`)
RGBA list to use as the error colour of the UI popup.

`border` (default: `'(1 1 1 1)`)
RGBA list to use as the border colour of the UI popup.

`extra-env` (default: `'()`)
Extra environment variables to set on login.

`greetd-wlgreet-sway-session` [Data Type]
Sway-specific configuration record for the wlgreet greetd greeter.

`wlgreet-session` (default: `(greetd-wlgreet-session)`)
A `greetd-wlgreet-session` record for generic wlgreet configuration, on top of the Sway-specific `greetd-wlgreet-sway-session`.

`sway` (default: `sway`)
: The package providing the `/bin/sway` command.

`sway-configuration` (default: #f)
: File-like object providing an additional Sway configuration file to be prepended to the mandatory part of the configuration.

Here is an example of a greetd configuration that uses wlgreet and Sway:

```
(greetd-configuration
 ;; We need to give the greeter user these permissions, otherwise
 ;; Sway will crash on launch.
 (greeter-supplementary-groups (list "video" "input" "seat"))
 (terminals
  (list (greetd-terminal-configuration
         (terminal-vt "1")
         (terminal-switch #t)
         (default-session-command
          (greetd-wlgreet-sway-session
           (sway-configuration
            (local-file "sway-greetd.conf")))))))))
```

11.10.2 Execução de trabalho agendado

The `(gnu services mcron)` module provides an interface to GNU mcron, a daemon to run jobs at scheduled times (veja *GNU mcron*). GNU mcron is similar to the traditional Unix `cron` daemon; the main difference is that it is implemented in Guile Scheme, which provides a lot of flexibility when specifying the scheduling of jobs and their actions.

The example below defines an operating system that runs the `updatedb` (veja Seção "Invoking updatedb" em *Finding Files*) and the `guix gc` commands (veja Seção 5.6 [Invocando guix gc], Página 54) daily, as well as the `mkid` command on behalf of an unprivileged user (veja Seção "mkid invocation" em *ID Database Utilities*). It uses gexps to introduce job definitions that are passed to mcron (veja Seção 8.12 [Expressões-G], Página 163).

```
(use-modules (guix) (gnu) (gnu services mcron))
(use-package-modules base idutils)

(define updatedb-job
  ;; Run 'updatedb' at 3AM every day.  Here we write the
  ;; job's action as a Scheme procedure.
  #~(job '(next-hour '(3))
         (lambda ()
           (system* (string-append #$findutils "/bin/updatedb")
                    "--prunepaths=/tmp /var/tmp /gnu/store"))
         "updatedb"))

(define garbage-collector-job
  ;; Collect garbage 5 minutes after midnight every day.
  ;; The job's action is a shell command.
  #~(job "5 0 * * *"            ;Vixie cron syntax
```

```
        "guix gc -F 1G"))

(define idutils-job
  ;; Update the index database as user "charlie" at 12:15PM
  ;; and 19:15PM.  This runs from the user's home directory.
  #~(job '(next-minute-from (next-hour '(12 19)) '(15))
         (string-append #$idutils "/bin/mkid src")
         #:user "charlie"))

(operating-system
  ;; ...

  ;; %BASE-SERVICES already includes an instance of
  ;; 'mcron-service-type', which we extend with additional
  ;; jobs using 'simple-service'.
  (services (cons (simple-service 'my-cron-jobs
                                  mcron-service-type
                                  (list garbage-collector-job
                                        updatedb-job
                                        idutils-job))
                  %base-services)))
```

Tip: When providing the action of a job specification as a procedure, you should provide an explicit name for the job via the optional 3rd argument as done in the `updatedb-job` example above. Otherwise, the job would appear as "Lambda function" in the output of `herd schedule mcron`, which is not nearly descriptive enough!

Tip: Avoid calling the Guile procedures `execl`, `execle` or `execlp` inside a job specification, else mcron won't be able to output the completion status of the job.

For more complex jobs defined in Scheme where you need control over the top level, for instance to introduce a `use-modules` form, you can move your code to a separate program using the `program-file` procedure of the `(guix gexp)` module (veja Seção 8.12 [Expressões-G], Página 163). The example below illustrates that.

```
(define %battery-alert-job
  ;; Beep when the battery percentage falls below %MIN-LEVEL.
  #~(job
     '(next-minute (range 0 60 1))
     #$(program-file
        "battery-alert.scm"
        (with-imported-modules (source-module-closure
                                '((guix build utils)))
          #~(begin
              (use-modules (guix build utils)
                           (ice-9 popen)
                           (ice-9 regex)
                           (ice-9 textual-ports)
```

```
                    (srfi srfi-2))

(define %min-level 20)

(setenv "LC_ALL" "C")     ;ensure English output
(and-let* ((input-pipe (open-pipe*
                        OPEN_READ
                        #$(file-append acpi "/bin/acpi")))
           (output (get-string-all input-pipe))
           (m (string-match "Discharging, ([0-9]+)%" output))
           (level (string->number (match:substring m 1)))
           ((< level %min-level)))
  (format #t "warning: Battery level is low (~a%)~%" level)
  (invoke #$(file-append beep "/bin/beep") "-r5")))))))
```

Veja Seção "Guile Syntax" em *GNU mcron*, for more information on mcron job specifications. Below is the reference of the mcron service.

On a running system, you can use the `schedule` action of the service to visualize the mcron jobs that will be executed next:

```
# herd schedule mcron
```

The example above lists the next five tasks that will be executed, but you can also specify the number of tasks to display:

```
# herd schedule mcron 10
```

`mcron-service-type` [Variável]

This is the type of the `mcron` service, whose value is an `mcron-configuration` object.

This service type can be the target of a service extension that provides additional job specifications (veja Seção 11.19.1 [Composição de serviço], Página 631). In other words, it is possible to define services that provide additional mcron jobs to run.

`mcron-configuration` [Data Type]

Available `mcron-configuration` fields are:

`mcron` (default: `mcron`) (type: file-like)
: The mcron package to use.

`jobs` (default: `'()`) (type: list-of-gexps)
: This is a list of gexps (veja Seção 8.12 [Expressões-G], Página 163), where each gexp corresponds to an mcron job specification (veja Seção "Syntax" em *GNU mcron*).

`log?` (default: `#t`) (type: boolean)
: Log messages to standard output.

`log-file` (default: `"/var/log/mcron.log"`) (type: string)
: Log file location.

`log-format` (default: `"~1@*~a ~a: ~a~%"`) (type: string)
: `(ice-9 format)` format string for log messages. The default value produces messages like '*`pid name: message`*' (veja Seção "Invoking mcron"

em *GNU mcron*). Each message is also prefixed by a timestamp by GNU Shepherd.

`date-format` (type: maybe-string)
: `(srfi srfi-19)` format string for date.

11.10.3 Rotação de log

Log files such as those found in `/var/log` tend to grow endlessly, so it's a good idea to *rotate* them once in a while—i.e., archive their contents in separate files, possibly compressed. The `(gnu services admin)` module provides an interface to GNU Rot[t]log, a log rotation tool (veja *GNU Rot[t]log Manual*).

This service is part of `%base-services`, and thus enabled by default, with the default settings, for commonly encountered log files. The example below shows how to extend it with an additional *rotation*, should you need to do that (usually, services that produce log files already take care of that):

```
(use-modules (guix) (gnu))
(use-service-modules admin)

(define my-log-files
  ;; Log files that I want to rotate.
  '("/var/log/something.log" "/var/log/another.log"))

(operating-system
  ;; ...
  (services (cons (simple-service 'rotate-my-stuff
                                  rottlog-service-type
                                  (list (log-rotation
                                         (frequency 'daily)
                                         (files my-log-files))))
                  %base-services)))
```

`rottlog-service-type` [Variável]
: This is the type of the Rottlog service, whose value is a `rottlog-configuration` object.

  Other services can extend this one with new `log-rotation` objects (see below), thereby augmenting the set of files to be rotated.

  This service type can define mcron jobs (veja Seção 11.10.2 [Execução de trabalho agendado], Página 289) to run the rottlog service.

`rottlog-configuration` [Data Type]
: Data type representing the configuration of rottlog.

  `rottlog` (default: `rottlog`)
  : The Rottlog package to use.

  `rc-file` (default: `(file-append rottlog "/etc/rc")`)
  : The Rottlog configuration file to use (veja Seção "Mandatory RC Variables" em *GNU Rot[t]log Manual*).

`rotations` (default: `%default-rotations`)
: A list of `log-rotation` objects as defined below.

`jobs`
: This is a list of gexps where each gexp corresponds to an mcron job specification (veja Seção 11.10.2 [Execução de trabalho agendado], Página 289).

`log-rotation` [Data Type]

Data type representing the rotation of a group of log files.

Taking an example from the Rottlog manual (veja Seção "Period Related File Examples" em *GNU Rot[t]log Manual*), a log rotation might be defined like this:

```
(log-rotation
  (frequency 'daily)
  (files '("/var/log/apache/*"))
  (options '("storedir apache-archives"
             "rotate 6"
             "notifempty"
             "nocompress")))
```

The list of fields is as follows:

`frequency` (default: `'weekly`)
: The log rotation frequency, a symbol.

`files`
: The list of files or file glob patterns to rotate.

`options` (default: `%default-log-rotation-options`)
: The list of rottlog options for this rotation (veja Seção "Configuration parameters" em *GNU Rot[t]log Manual*).

`post-rotate` (default: `#f`)
: Either `#f` or a gexp to execute once the rotation has completed.

`%default-rotations` [Variável]

Specifies weekly rotation of `%rotated-files` and of `/var/log/guix-daemon.log`.

`%rotated-files` [Variável]

The list of syslog-controlled files to be rotated. By default it is: `'("/var/log/messages" "/var/log/secure" "/var/log/debug" \ "/var/log/maillog")`.

Some log files just need to be deleted periodically once they are old, without any other criterion and without any archival step. This is the case of build logs stored by `guix-daemon` under `/var/log/guix/drvs` (veja Seção 2.3 [Invocando guix-daemon], Página 13). The `log-cleanup` service addresses this use case. For example, `%base-services` (veja Seção 11.10.1 [Serviços básicos], Página 268) includes the following:

```
;; Periodically delete old build logs.
(service log-cleanup-service-type
         (log-cleanup-configuration
          (directory "/var/log/guix/drvs")))
```

That ensures build logs do not accumulate endlessly.

`log-cleanup-service-type` [Variável]
This is the type of the service to delete old logs. Its value must be a `log-cleanup-configuration` record as described below.

`log-cleanup-configuration` [Data Type]
Data type representing the log cleanup configuration

`directory`
Name of the directory containing log files.

`expiry` (default: `(* 6 30 24 3600)`)
Age in seconds after which a file is subject to deletion (six months by default).

`schedule` (default: `"30 12 01,08,15,22 * *"`)
String or gexp denoting the corresponding mcron job schedule (veja Seção 11.10.2 [Execução de trabalho agendado], Página 289).

Anonip Service

Anonip is a privacy filter that removes IP address from web server logs. This service creates a FIFO and filters any written lines with anonip before writing the filtered log to a target file.

The following example sets up the FIFO `/var/run/anonip/https.access.log` and writes the filtered log file `/var/log/anonip/https.access.log`.

```
(service anonip-service-type
         (anonip-configuration
           (input  "/var/run/anonip/https.access.log")
           (output "/var/log/anonip/https.access.log")))
```

Configure your web server to write its logs to the FIFO at `/var/run/anonip/https.access.log` and collect the anonymized log file at `/var/web-logs/https.access.log`.

`anonip-configuration` [Data Type]
Este tipo de dado representa a configuração do anonip. Ele possui os seguintes parâmetros:

`anonip` (default: `anonip`)
The anonip package to use.

`input` The file name of the input log file to process. The service creates a FIFO of this name. The web server should write its logs to this FIFO.

`output` The file name of the processed log file.

The following optional settings may be provided:

`debug?` Print debug messages when `#true`.

`skip-private?`
When `#true` do not mask addresses in private ranges.

`column` A 1-based indexed column number. Assume IP address is in the specified column (default is 1).

`replacement`
: Replacement string in case address parsing fails, e.g. `"0.0.0.0"`.

`ipv4mask` Number of bits to mask in IPv4 addresses.

`ipv6mask` Number of bits to mask in IPv6 addresses.

`increment`
: Increment the IP address by the given number. By default this is zero.

`delimiter`
: Log delimiter string.

`regex` Regular expression for detecting IP addresses. Use this instead of `column`.

11.10.4 Networking Setup

The `(gnu services networking)` module provides services to configure network interfaces and set up networking on your machine. Those services provide different ways for you to set up your machine: by declaring a static network configuration, by running a Dynamic Host Configuration Protocol (DHCP) client, or by running daemons such as NetworkManager and Connman that automate the whole process, automatically adapt to connectivity changes, and provide a high-level user interface.

On a laptop, NetworkManager and Connman are by far the most convenient options, which is why the default desktop services include NetworkManager (veja Seção 11.10.9 [Serviços de desktop], Página 354). For a server, or for a virtual machine or a container, static network configuration or a simple DHCP client are often more appropriate.

This section describes the various network setup services available, starting with static network configuration.

`static-networking-service-type` [Variável]
: This is the type for statically-configured network interfaces. Its value must be a list of `static-networking` records. Each of them declares a set of *addresses*, *routes*, and *links*, as shown below.

  Here is the simplest configuration, with only one network interface controller (NIC) and only IPv4 connectivity:

```
;; Static networking for one NIC, IPv4-only.
(service static-networking-service-type
         (list (static-networking
                (addresses
                 (list (network-address
                        (device "eno1")
                        (value "10.0.2.15/24"))))
                (routes
                 (list (network-route
                        (destination "default")
                        (gateway "10.0.2.2"))))
                (name-servers '("10.0.2.3")))))
```

  The snippet above can be added to the `services` field of your operating system configuration (veja Seção 11.2 [Usando o sistema de configuração], Página 238). It

will configure your machine to have 10.0.2.15 as its IP address, with a 24-bit netmask for the local network—meaning that any 10.0.2.*x* address is on the local area network (LAN). Traffic to addresses outside the local network is routed *via* 10.0.2.2. Host names are resolved by sending domain name system (DNS) queries to 10.0.2.3.

`static-networking` [Data Type]

This is the data type representing a static network configuration.

As an example, here is how you would declare the configuration of a machine with a single network interface controller (NIC) available as `eno1`, and with one IPv4 and one IPv6 address:

```
;; Network configuration for one NIC, IPv4 + IPv6.
(static-networking
 (addresses (list (network-address
                   (device "eno1")
                   (value "10.0.2.15/24"))
                  (network-address
                   (device "eno1")
                   (value "2001:123:4567:101::1/64"))))
 (routes (list (network-route
                (destination "default")
                (gateway "10.0.2.2"))
               (network-route
                (destination "default")
                (gateway "2020:321:4567:42::1"))))
 (name-servers '("10.0.2.3")))
```

If you are familiar with the `ip` command of the `iproute2` package (`https://wiki.linuxfoundation.org/networking/iproute2`) found on Linux-based systems, the declaration above is equivalent to typing:

```
ip address add 10.0.2.15/24 dev eno1
ip address add 2001:123:4567:101::1/64 dev eno1
ip route add default via inet 10.0.2.2
ip route add default via inet6 2020:321:4567:42::1
```

Run `man 8 ip` for more info. Venerable GNU/Linux users will certainly know how to do it with `ifconfig` and `route`, but we'll spare you that.

The available fields of this data type are as follows:

`addresses`
`links` (default: `'()`)
`routes` (default: `'()`)
: The list of `network-address`, `network-link`, and `network-route` records for this network (see below).

`name-servers` (default: `'()`)
: The list of IP addresses (strings) of domain name servers. These IP addresses go to `/etc/resolv.conf`.

`provision` (default: `'(networking)`)
: If true, this should be a list of symbols for the Shepherd service corresponding to this network configuration.

`requirement` (default `'()`)
: The list of Shepherd services depended on.

`network-address` [Data Type]

This is the data type representing the IP address of a network interface.

`device` The name of the network interface for this address—e.g., `"eno1"`.

`value` The actual IP address and network mask, in CIDR (Classless Inter-Domain Routing) notation (`https://en.wikipedia.org/wiki/CIDR#CIDR_notation`), as a string.

For example, `"10.0.2.15/24"` denotes IPv4 address 10.0.2.15 on a 24-bit sub-network—all 10.0.2.*x* addresses are on the same local network.

`ipv6?` Whether `value` denotes an IPv6 address. By default this is automatically determined.

`network-route` [Data Type]

This is the data type representing a network route.

`destination`
: The route destination (a string), either an IP address and network mask or `"default"` to denote the default route.

`source` (default: `#f`)
: The route source.

`device` (default: `#f`)
: The device used for this route—e.g., `"eno2"`.

`ipv6?` (default: auto)
: Whether this is an IPv6 route. By default this is automatically determined based on `destination` or `gateway`.

`gateway` (default: `#f`)
: IP address (a string) through which traffic is routed.

`network-link` [Data Type]

Data type for a network link (veja Seção "Link" em *Guile-Netlink Manual*). During startup, network links are employed to construct or modify existing or virtual ethernet links. These ethernet links can be identified by their *name* or *mac-address*. If there is a need to create virtual interface, *name* and *type* fields are required.

`name` The name of the link—e.g., `"v0p0"` (default: `#f`).

`tipo` A symbol denoting the type of the link—e.g., `'veth` (default: `#f`).

`mac-address`
: The mac-address of the link—e.g., `"98:11:22:33:44:55"` (default: `#f`).

`arguments`
: List of arguments for this type of link.

Consider a scenario where a server equipped with a network interface which has multiple ports. These ports are connected to a switch, which supports link aggregation (`https://en.wikipedia.org/wiki/Link_aggregation`) (also known as bonding or NIC teaming). The switch uses port channels to consolidate multiple physical interfaces into one logical interface to provide higher bandwidth, load balancing, and link redundancy. When a port is added to a LAG (or link aggregation group), it inherits the properties of the port-channel. Some of these properties are VLAN membership, trunk status, and so on.

VLAN (`https://en.wikipedia.org/wiki/Virtual_LAN`) (or virtual local area network) is a logical network that is isolated from other VLANs on the same physical network. This can be used to segregate traffic, improve security, and simplify network management.

With all that in mind let's configure our static network for the server. We will bond two existing interfaces together using 802.3ad schema and on top of it, build a VLAN interface with id 1055. We assign a static ip to our new VLAN interface.

```
(static-networking
 (links (list (network-link
               (name "bond0")
               (type 'bond)
               (arguments '((mode . "802.3ad")
                            (miimon . 100)
                            (lacp-active . "on")
                            (lacp-rate . "fast"))))

              (network-link
               (mac-address "98:11:22:33:44:55")
               (arguments '((master . "bond0"))))

              (network-link
               (mac-address "98:11:22:33:44:56")
               (arguments '((master . "bond0"))))

              (network-link
               (name "bond0.1055")
               (type 'vlan)
               (arguments '((id . 1055)
                            (link . "bond0"))))))
 (addresses (list (network-address
                   (value "192.168.1.4/24")
                   (device "bond0.1055")))))
```

`%loopback-static-networking` [Variável]

This is the `static-networking` record representing the "loopback device", `lo`, for IP addresses 127.0.0.1 and ::1, and providing the `loopback` Shepherd service.

`%qemu-static-networking` [Variável]
This is the `static-networking` record representing network setup when using QEMU's user-mode network stack on `eth0` (veja Seção "Using the user mode network stack" em *QEMU Documentation*).

`dhcp-client-service-type` [Variável]
This is the type of services that run *dhclient*, the ISC Dynamic Host Configuration Protocol (DHCP) client.

`dhcp-client-configuration` [Data Type]
Data type representing the configuration of the ISC DHCP client service.

`package` (default: `isc-dhcp`)
The ISC DHCP client package to use.

`interfaces` (default: `'all`)
Either `'all` or the list of interface names that the ISC DHCP client should listen on—e.g., `'("eno1")`.

When set to `'all`, the ISC DHCP client listens on all the available non-loopback interfaces that can be activated. Otherwise the ISC DHCP client listens only on the specified interfaces.

`config-file` (default: `#f`)
The configuration file for the ISC DHCP client.

`version` (default: `"4"`)
The DHCP protocol version to use, as a string. Accepted values are `"4"` or `"6"` for DHCPv4 or DHCPv6, respectively, as well as `"4o6"`, for DHCPv4 over DHCPv6 (as specified by RFC 7341).

`shepherd-requirement` (default: `'()`)
`shepherd-provision` (default: `'(networking)`)
This option can be used to provide a list of symbols naming Shepherd services that this service will depend on, such as `'wpa-supplicant` or `'iwd` if you require authenticated access for encrypted WiFi or Ethernet networks.

Likewise, `shepherd-provision` is a list of Shepherd service names (symbols) provided by this service. You might want to change the default value if you intend to run several ISC DHCP clients, only one of which provides the `networking` Shepherd service.

`network-manager-service-type` [Variável]
This is the service type for the NetworkManager (`https://wiki.gnome.org/Projects/NetworkManager`) service. The value for this service type is a `network-manager-configuration` record.

This service is part of `%desktop-services` (veja Seção 11.10.9 [Serviços de desktop], Página 354).

`network-manager-configuration` [Data Type]
Data type representing the configuration of NetworkManager.

`network-manager` (default: `network-manager`)
: The NetworkManager package to use.

`shepherd-requirement` (default: `'(wpa-supplicant)`)
: This option can be used to provide a list of symbols naming Shepherd services that this service will depend on, such as `'wpa-supplicant` or `'iwd` if you require authenticated access for encrypted WiFi or Ethernet networks.

`dns` (default: `"default"`)
: Processing mode for DNS, which affects how NetworkManager uses the `resolv.conf` configuration file.

  ‘`default`’ NetworkManager will update `resolv.conf` to reflect the nameservers provided by currently active connections.

  ‘`dnsmasq`’ NetworkManager will run `dnsmasq` as a local caching nameserver, using a *conditional forwarding* configuration if you are connected to a VPN, and then update `resolv.conf` to point to the local nameserver.

  With this setting, you can share your network connection. For example when you want to share your network connection to another laptop *via* an Ethernet cable, you can open `nm-connection-editor` and configure the Wired connection's method for IPv4 and IPv6 to be “Shared to other computers” and reestablish the connection (or reboot).

  You can also set up a *host-to-guest connection* to QEMU VMs (veja Seção 3.8 [Instalando Guix em uma VM], Página 31). With a host-to-guest connection, you can e.g. access a Web server running on the VM (veja Seção 11.10.20 [Serviços Web], Página 457) from a Web browser on your host system, or connect to the VM *via* SSH (veja Seção 11.10.5 [Serviços de Rede], Página 306). To set up a host-to-guest connection, run this command once:

  ```
  nmcli connection add type tun \
    connection.interface-name tap0 \
    tun.mode tap tun.owner $(id -u) \
    ipv4.method shared \
    ipv4.addresses 172.28.112.1/24
  ```

  Then each time you launch your QEMU VM (veja Seção 11.18 [Executando Guix em uma VM], Página 629), pass `-nic tap,ifname=tap0,script=no,downscript=no` to `qemu-system-...`.

  ‘`nenhuma`’ NetworkManager will not modify `resolv.conf`.

`vpn-plugins` (default: `'()`)
: This is the list of available plugins for virtual private networks (VPNs). An example of this is the `network-manager-openvpn` package, which allows NetworkManager to manage VPNs *via* OpenVPN.

`connman-service-type` [Variável]

This is the service type to run Connman (`https://01.org/connman`), a network connection manager.

Its value must be a `connman-configuration` record as in this example:

```
(service connman-service-type
         (connman-configuration
           (disable-vpn? #t)))
```

See below for details about `connman-configuration`.

`connman-configuration` [Data Type]

Data Type representing the configuration of connman.

`connman` (default: *connman*)
The connman package to use.

`shepherd-requirement` (default: `'()`)
This option can be used to provide a list of symbols naming Shepherd services that this service will depend on, such as `'wpa-supplicant` or `'iwd` if you require authenticated access for encrypted WiFi or Ethernet networks.

`disable-vpn?` (default: `#f`)
When true, disable connman's vpn plugin.

`general-configuration` (default: `(connman-general-configuration)`)
Configuration serialized to `main.conf` and passed as `--config` to `connmand`.

`connman-general-configuration` [Data Type]

Available `connman-general-configuration` fields are:

`input-request-timeout` (type: maybe-number)
Set input request timeout. Default is 120 seconds. The request for inputs like passphrase will timeout after certain amount of time. Use this setting to increase the value in case of different user interface designs.

`browser-launch-timeout` (type: maybe-number)
Set browser launch timeout. Default is 300 seconds. The request for launching a browser for portal pages will timeout after certain amount of time. Use this setting to increase the value in case of different user interface designs.

`background-scanning?` (type: maybe-boolean)
Enable background scanning. Default is true. If wifi is disconnected, the background scanning will follow a simple back off mechanism from 3s up to 5 minutes. Then, it will stay in 5 minutes unless user specifically asks for scanning through a D-Bus call. If so, the mechanism will start again from 3s. This feature activates also the background scanning while being connected, which is required for roaming on wifi. When `background-scanning?` is false, ConnMan will not perform any scan regardless of wifi is connected or not, unless it is requested by the user through a D-Bus call.

`use-gateways-as-timeservers?` (type: maybe-boolean)
: Assume that service gateways also function as timeservers. Default is false.

`fallback-timeservers` (type: maybe-list)
: List of Fallback timeservers. These timeservers are used for NTP sync when there are no timeservers set by the user or by the service, and when `use-gateways-as-timeservers?` is `#f`. These can contain a mixed combination of fully qualified domain names, IPv4 and IPv6 addresses.

`fallback-nameservers` (type: maybe-list)
: List of fallback nameservers appended to the list of nameservers given by the service. The nameserver entries must be in numeric format, host names are ignored.

`default-auto-connect-technologies` (type: maybe-list)
: List of technologies that are marked autoconnectable by default. The default value for this entry when empty is `"ethernet"`, `"wifi"`, `"cellular"`. Services that are automatically connected must have been set up and saved to storage beforehand.

`default-favourite-technologies` (type: maybe-list)
: List of technologies that are marked favorite by default. The default value for this entry when empty is `"ethernet"`. Connects to services from this technology even if not setup and saved to storage.

`always-connected-technologies` (type: maybe-list)
: List of technologies which are always connected regardless of preferred-technologies setting (`auto-connect? #t`). The default value is empty and this feature is disabled unless explicitly enabled.

`preferred-technologies` (type: maybe-list)
: List of preferred technologies from the most preferred one to the least preferred one. Services of the listed technology type will be tried one by one in the order given, until one of them gets connected or they are all tried. A service of a preferred technology type in state 'ready' will get the default route when compared to another preferred type further down the list with state 'ready' or with a non-preferred type; a service of a preferred technology type in state 'online' will get the default route when compared to either a non-preferred type or a preferred type further down in the list.

`network-interface-blacklist` (type: maybe-list)
: List of blacklisted network interfaces. Found interfaces will be compared to the list and will not be handled by ConnMan, if their first characters match any of the list entries. Default value is `"vmnet"`, `"vboxnet"`, `"virbr"`, `"ifb"`.

`allow-hostname-updates?` (type: maybe-boolean)
: Allow ConnMan to change the system hostname. This can happen for example if we receive DHCP hostname option. Default value is `#t`.

`allow-domainname-updates?` (type: maybe-boolean)
Allow connman to change the system domainname. This can happen for example if we receive DHCP domainname option. Default value is `#t`.

`single-connected-technology?` (type: maybe-boolean)
Keep only a single connected technology at any time. When a new service is connected by the user or a better one is found according to preferred-technologies, the new service is kept connected and all the other previously connected services are disconnected. With this setting it does not matter whether the previously connected services are in 'online' or 'ready' states, the newly connected service is the only one that will be kept connected. A service connected by the user will be used until going out of network coverage. With this setting enabled applications will notice more network breaks than normal. Note this options can't be used with VPNs. Default value is `#f`.

`tethering-technologies` (type: maybe-list)
List of technologies that are allowed to enable tethering. The default value is `"wifi"`, `"bluetooth"`, `"gadget"`. Only those technologies listed here are used for tethering. If one wants to tether ethernet, then add `"ethernet"` in the list. Note that if ethernet tethering is enabled, then a DHCP server is started on all ethernet interfaces. Tethered ethernet should never be connected to corporate or home network as it will disrupt normal operation of these networks. Due to this ethernet is not tethered by default. Do not activate ethernet tethering unless you really know what you are doing.

`persistent-tethering-mode?` (type: maybe-boolean)
Restore earlier tethering status when returning from offline mode, re-enabling a technology, and after restarts and reboots. Default value is `#f`.

`enable-6to4?` (type: maybe-boolean)
Automatically enable anycast 6to4 if possible. This is not recommended, as the use of 6to4 will generally lead to a severe degradation of connection quality. See RFC6343. Default value is `#f` (as recommended by RFC6343 section 4.1).

`vendor-class-id` (type: maybe-string)
Set DHCP option 60 (Vendor Class ID) to the given string. This option can be used by DHCP servers to identify specific clients without having to rely on MAC address ranges, etc.

`enable-online-check?` (type: maybe-boolean)
Enable or disable use of HTTP GET as an online status check. When a service is in a READY state, and is selected as default, ConnMan will issue an HTTP GET request to verify that end-to-end connectivity is successful. Only then the service will be transitioned to ONLINE state. If this setting is false, the default service will remain in READY state. Default value is `#t`.

`online-check-ipv4-url` (type: maybe-string)
: IPv4 URL used during the online status check. Please refer to the README for more detailed information. Default value is `http://ipv4.connman.net/online/status.html`.

`online-check-ipv6-url` (type: maybe-string)
: IPv6 URL used during the online status check. Please refer to the README for more detailed information. Default value is `http://ipv6.connman.net/online/status.html`.

`online-check-initial-interval` (type: maybe-number)
: Range of intervals between two online check requests. Please refer to the README for more detailed information. Default value is '`1`'.

`online-check-max-interval` (type: maybe-number)
: Range of intervals between two online check requests. Please refer to the README for more detailed information. Default value is '`1`'.

`enable-online-to-ready-transition?` (type: maybe-boolean)
: WARNING: This is an experimental feature. In addition to `enable-online-check` setting, enable or disable use of HTTP GET to detect the loss of end-to-end connectivity. If this setting is `#f`, when the default service transitions to ONLINE state, the HTTP GET request is no more called until next cycle, initiated by a transition of the default service to DISCONNECT state. If this setting is `#t`, the HTTP GET request keeps being called to guarantee that end-to-end connectivity is still successful. If not, the default service will transition to READY state, enabling another service to become the default one, in replacement. Default value is `#f`.

`auto-connect-roaming-services?` (type: maybe-boolean)
: Automatically connect roaming services. This is not recommended unless you know you won't have any billing problem. Default value is `#f`.

`address-conflict-detection?` (type: maybe-boolean)
: Enable or disable the implementation of IPv4 address conflict detection according to RFC5227. ConnMan will send probe ARP packets to see if an IPv4 address is already in use before assigning the address to an interface. If an address conflict occurs for a statically configured address, an IPv4LL address will be chosen instead (according to RFC3927). If an address conflict occurs for an address offered via DHCP, ConnMan sends a DHCP DECLINE once and for the second conflict resorts to finding an IPv4LL address. Default value is `#f`.

`localtime` (type: maybe-string)
: Path to localtime file. Defaults to `/etc/localtime`.

`regulatory-domain-follows-timezone?` (type: maybe-boolean)
: Enable regulatory domain to be changed along timezone changes. With this option set to true each time the timezone changes the first present ISO3166 country code is read from `/usr/share/zoneinfo/zone1970.tab` and set as regulatory domain value. Default value is `#f`.

`resolv-conf` (type: maybe-string)
: Path to resolv.conf file. If the file does not exist, but intermediate directories exist, it will be created. If this option is not set, it tries to write into `/var/run/connman/resolv.conf` if it fails (`/var/run/connman` does not exist or is not writeable). If you do not want to update resolv.conf, you can set `/dev/null`.

`wpa-supplicant-service-type` [Variável]
: This is the service type to run WPA supplicant (`https://w1.fi/wpa_supplicant/`), an authentication daemon required to authenticate against encrypted WiFi or ethernet networks.

`wpa-supplicant-configuration` [Data Type]
: Data type representing the configuration of WPA Supplicant.

  It takes the following parameters:

  `wpa-supplicant` (default: `wpa-supplicant`)
  : The WPA Supplicant package to use.

  `requirement` (default: `'(user-processes loopback syslogd)`)
  : List of services that should be started before WPA Supplicant starts.

  `dbus?` (padrão: `#t`)
  : Whether to listen for requests on D-Bus.

  `pid-file` (default: `"/var/run/wpa_supplicant.pid"`)
  : Where to store the PID file.

  `interface` (default: `#f`)
  : If this is set, it must specify the name of a network interface that WPA supplicant will control.

  `config-file` (default: `#f`)
  : Optional configuration file to use.

  `extra-options` (default: `'()`)
  : List of additional command-line arguments to pass to the daemon.

Some networking devices such as modems require special care, and this is what the services below focus on.

`modem-manager-service-type` [Variável]
: This is the service type for the ModemManager (`https://wiki.gnome.org/Projects/ModemManager`) service. The value for this service type is a `modem-manager-configuration` record.

  This service is part of `%desktop-services` (veja Seção 11.10.9 [Serviços de desktop], Página 354).

`modem-manager-configuration` [Data Type]
: Data type representing the configuration of ModemManager.

  `modem-manager` (default: `modem-manager`)
  : The ModemManager package to use.

`usb-modeswitch-service-type` [Variável]

This is the service type for the USB_ModeSwitch (`https://www.draisberghof.de/usb_modeswitch/`) service. The value for this service type is a `usb-modeswitch-configuration` record.

When plugged in, some USB modems (and other USB devices) initially present themselves as a read-only storage medium and not as a modem. They need to be *modeswitched* before they are usable. The USB_ModeSwitch service type installs udev rules to automatically modeswitch these devices when they are plugged in.

This service is part of `%desktop-services` (veja Seção 11.10.9 [Serviços de desktop], Página 354).

`usb-modeswitch-configuration` [Data Type]

Data type representing the configuration of USB_ModeSwitch.

`usb-modeswitch` (default: `usb-modeswitch`)
: The USB_ModeSwitch package providing the binaries for modeswitching.

`usb-modeswitch-data` (default: `usb-modeswitch-data`)
: The package providing the device data and udev rules file used by USB_ModeSwitch.

`config-file` (default: `#~(string-append #$usb-modeswitch:dispatcher "/etc/usb_modeswitch.conf")`)
: Which config file to use for the USB_ModeSwitch dispatcher. By default the config file shipped with USB_ModeSwitch is used which disables logging to `/var/log` among other default settings. If set to `#f`, no config file is used.

11.10.5 Serviços de Rede

The `(gnu services networking)` module discussed in the previous section provides services for more advanced setups: providing a DHCP service for others to use, filtering packets with iptables or nftables, running a WiFi access point with `hostapd`, running the `inetd` "superdaemon", and more. This section describes those.

`dhcpd-service-type` [Variável]

This type defines a service that runs a DHCP daemon. To create a service of this type, you must supply a `<dhcpd-configuration>`. For example:

```
(service dhcpd-service-type
         (dhcpd-configuration
          (config-file (local-file "my-dhcpd.conf"))
          (interfaces '("enp0s25"))))
```

`dhcpd-configuration` [Data Type]

`package` (default: `isc-dhcp`)
: The package that provides the DHCP daemon. This package is expected to provide the daemon at `sbin/dhcpd` relative to its output directory. The default package is the ISC's DHCP server (`https://www.isc.org/dhcp/`).

`config-file` (default: `#f`)
: The configuration file to use. This is required. It will be passed to `dhcpd` via its `-cf` option. This may be any "file-like" object (veja Seção 8.12 [Expressões-G], Página 163). See `man dhcpd.conf` for details on the configuration file syntax.

`version` (default: `"4"`)
: The DHCP version to use. The ISC DHCP server supports the values "4", "6", and "4o6". These correspond to the `dhcpd` program options `-4`, `-6`, and `-4o6`. See `man dhcpd` for details.

`run-directory` (default: `"/run/dhcpd"`)
: The run directory to use. At service activation time, this directory will be created if it does not exist.

`pid-file` (default: `"/run/dhcpd/dhcpd.pid"`)
: The PID file to use. This corresponds to the `-pf` option of `dhcpd`. See `man dhcpd` for details.

`interfaces` (default: `'()`)
: The names of the network interfaces on which dhcpd should listen for broadcasts. If this list is not empty, then its elements (which must be strings) will be appended to the `dhcpd` invocation when starting the daemon. It may not be necessary to explicitly specify any interfaces here; see `man dhcpd` for details.

`hostapd-service-type` [Variável]
This is the service type to run the hostapd (`https://w1.fi/hostapd/`) daemon to set up WiFi (IEEE 802.11) access points and authentication servers. Its associated value must be a `hostapd-configuration` as shown below:

```
;; Use wlan1 to run the access point for "My Network".
(service hostapd-service-type
         (hostapd-configuration
          (interface "wlan1")
          (ssid "My Network")
          (channel 12)))
```

`hostapd-configuration` [Data Type]
This data type represents the configuration of the hostapd service, with the following fields:

`package` (default: `hostapd`)
: The hostapd package to use.

`interface` (default: `"wlan0"`)
: The network interface to run the WiFi access point.

`ssid` The SSID (*service set identifier*), a string that identifies this network.

`broadcast-ssid?` (default: `#t`)
: Whether to broadcast this SSID.

`channel` (default: `1`)
: The WiFi channel to use.

`driver` (default: `"nl80211"`)
: The driver interface type. `"nl80211"` is used with all Linux mac80211 drivers. Use `"none"` if building hostapd as a standalone RADIUS server that does not control any wireless/wired driver.

`extra-settings` (default: `""`)
: Extra settings to append as-is to the hostapd configuration file. See `https://w1.fi/cgit/hostap/plain/hostapd/hostapd.conf` for the configuration file reference.

`simulated-wifi-service-type` [Variável]
This is the type of a service to simulate WiFi networking, which can be useful in virtual machines for testing purposes. The service loads the Linux kernel `mac80211_hwsim` module (`https://www.kernel.org/doc/html/latest/networking/mac80211_hwsim/mac80211_hwsim.html`) and starts hostapd to create a pseudo WiFi network that can be seen on `wlan0`, by default.

The service's value is a `hostapd-configuration` record.

`iptables-service-type` [Variável]
This is the service type to set up an iptables configuration. iptables is a packet filtering framework supported by the Linux kernel. This service supports configuring iptables for both IPv4 and IPv6. A simple example configuration rejecting all incoming connections except those to the ssh port 22 is shown below.

```
(service iptables-service-type
         (iptables-configuration
          (ipv4-rules (plain-file "iptables.rules" "*filter
:INPUT ACCEPT
:FORWARD ACCEPT
:OUTPUT ACCEPT
-A INPUT -m conntrack --ctstate ESTABLISHED,RELATED -j ACCEPT
-A INPUT -p tcp --dport 22 -j ACCEPT
-A INPUT -j REJECT --reject-with icmp-port-unreachable
COMMIT
"))
          (ipv6-rules (plain-file "ip6tables.rules" "*filter
:INPUT ACCEPT
:FORWARD ACCEPT
:OUTPUT ACCEPT
-A INPUT -m conntrack --ctstate ESTABLISHED,RELATED -j ACCEPT
-A INPUT -p tcp --dport 22 -j ACCEPT
-A INPUT -j REJECT --reject-with icmp6-port-unreachable
COMMIT
"))))
```

`iptables-configuration` [Data Type]
The data type representing the configuration of iptables.

`iptables` (default: `iptables`)
: The iptables package that provides `iptables-restore` and `ip6tables-restore`.

`ipv4-rules` (default: `%iptables-accept-all-rules`)
: The iptables rules to use. It will be passed to `iptables-restore`. This may be any "file-like" object (veja Seção 8.12 [Expressões-G], Página 163).

`ipv6-rules` (default: `%iptables-accept-all-rules`)
: The ip6tables rules to use. It will be passed to `ip6tables-restore`. This may be any "file-like" object (veja Seção 8.12 [Expressões-G], Página 163).

`nftables-service-type` [Variável]
: This is the service type to set up a nftables configuration. nftables is a netfilter project that aims to replace the existing iptables, ip6tables, arptables and ebtables framework. It provides a new packet filtering framework, a new user-space utility `nft`, and a compatibility layer for iptables. This service comes with a default ruleset `%default-nftables-ruleset` that rejecting all incoming connections except those to the ssh port 22. To use it, simply write:

```
(service nftables-service-type)
```

`nftables-configuration` [Data Type]
: The data type representing the configuration of nftables.

`package` (default: `nftables`)
: The nftables package that provides `nft`.

`ruleset` (default: `%default-nftables-ruleset`)
: The nftables ruleset to use. This may be any "file-like" object (veja Seção 8.12 [Expressões-G], Página 163).

`ntp-service-type` [Variável]
: This is the type of the service running the Network Time Protocol (NTP) (`https://www.ntp.org`) daemon, `ntpd`. The daemon will keep the system clock synchronized with that of the specified NTP servers.

  The value of this service is an `ntpd-configuration` object, as described below.

`ntp-configuration` [Data Type]
: This is the data type for the NTP service configuration.

`servers` (default: `%ntp-servers`)
: This is the list of servers (`<ntp-server>` records) with which `ntpd` will be synchronized. See the `ntp-server` data type definition below.

`allow-large-adjustment?` (default: `#t`)
: This determines whether `ntpd` is allowed to make an initial adjustment of more than 1,000 seconds.

`ntp` (default: `ntp`)
: The NTP package to use.

`%ntp-servers` [Variável]

List of host names used as the default NTP servers. These are servers of the NTP Pool Project (`https://www.ntppool.org/en/`).

`ntp-server` [Data Type]

The data type representing the configuration of a NTP server.

`type` (default: `'server`)
: The type of the NTP server, given as a symbol. One of `'pool`, `'server`, `'peer`, `'broadcast` or `'manycastclient`.

`address`
: The address of the server, as a string.

`options`
: NTPD options to use with that specific server, given as a list of option names and/or of option names and values tuples. The following example define a server to use with the options `iburst` and `prefer`, as well as `version` 3 and a `maxpoll` time of 16 seconds.

```
(ntp-server
 (type 'server)
 (address "some.ntp.server.org")
 (options `(iburst (version 3) (maxpoll 16) prefer))))
```

`openntpd-service-type` [Variável]

Run the `ntpd`, the Network Time Protocol (NTP) daemon, as implemented by OpenNTPD (`http://www.openntpd.org`). The daemon will keep the system clock synchronized with that of the given servers.

```
(service
 openntpd-service-type
 (openntpd-configuration
  (listen-on '("127.0.0.1" "::1"))
  (sensor '("udcf0 correction 70000"))
  (constraint-from '("www.gnu.org"))
  (constraints-from '("https://www.google.com/"))))
```

`%openntpd-servers` [Variável]

This variable is a list of the server addresses defined in `%ntp-servers`.

`openntpd-configuration` [Data Type]

`openntpd` (default: `openntpd`)
: The openntpd package to use.

`listen-on` (default: `'("127.0.0.1" "::1")`)
: A list of local IP addresses or hostnames the ntpd daemon should listen on.

`query-from` (default: `'()`)
: A list of local IP address the ntpd daemon should use for outgoing queries.

`sensor` (default: `'()`)
: Specify a list of timedelta sensor devices ntpd should use. `ntpd` will listen to each sensor that actually exists and ignore non-existent ones.

See upstream documentation (`https://man.openbsd.org/ntpd.conf`) for more information.

`server` (default: `'()`)
: Specify a list of IP addresses or hostnames of NTP servers to synchronize to.

`servers` (default: `%openntp-servers`)
: Specify a list of IP addresses or hostnames of NTP pools to synchronize to.

`constraint-from` (default: `'()`)
: `ntpd` can be configured to query the 'Date' from trusted HTTPS servers via TLS. This time information is not used for precision but acts as an authenticated constraint, thereby reducing the impact of unauthenticated NTP man-in-the-middle attacks. Specify a list of URLs, IP addresses or hostnames of HTTPS servers to provide a constraint.

`constraints-from` (default: `'()`)
: As with constraint from, specify a list of URLs, IP addresses or hostnames of HTTPS servers to provide a constraint. Should the hostname resolve to multiple IP addresses, `ntpd` will calculate a median constraint from all of them.

`inetd-service-type` [Variável]

This service runs the `inetd` (veja Seção "inetd invocation" em *GNU Inetutils*) daemon. `inetd` listens for connections on internet sockets, and lazily starts the specified server program when a connection is made on one of these sockets.

The value of this service is an `inetd-configuration` object. The following example configures the `inetd` daemon to provide the built-in `echo` service, as well as an smtp service which forwards smtp traffic over ssh to a server `smtp-server` behind a gateway `hostname`:

```
(service
 inetd-service-type
 (inetd-configuration
  (entries (list
            (inetd-entry
             (name "echo")
             (socket-type 'stream)
             (protocol "tcp")
             (wait? #f)
             (user "root"))
            (inetd-entry
             (node "127.0.0.1")
             (name "smtp")
             (socket-type 'stream)
             (protocol "tcp")
             (wait? #f)
             (user "root")
```

```
                    (program (file-append openssh "/bin/ssh"))
                    (arguments
                     '("ssh" "-qT" "-i" "/path/to/ssh_key"
                       "-W" "smtp-server:25" "user@hostname")))))))
```

See below for more details about `inetd-configuration`.

`inetd-configuration` [Data Type]

Data type representing the configuration of `inetd`.

`program` (default: `(file-append inetutils "/libexec/inetd")`)
The `inetd` executable to use.

`entries` (default: `'()`)
A list of `inetd` service entries. Each entry should be created by the `inetd-entry` constructor.

`inetd-entry` [Data Type]

Data type representing an entry in the `inetd` configuration. Each entry corresponds to a socket where `inetd` will listen for requests.

`node` (default: `#f`)
Optional string, a comma-separated list of local addresses `inetd` should use when listening for this service. Veja Seção "Configuration file" em *GNU Inetutils* for a complete description of all options.

`name` A string, the name must correspond to an entry in `/etc/services`.

`socket-type`
One of `'stream`, `'dgram`, `'raw`, `'rdm` or `'seqpacket`.

`protocol` A string, must correspond to an entry in `/etc/protocols`.

`wait?` (padrão: `#t`)
Whether `inetd` should wait for the server to exit before listening to new service requests.

`user` A string containing the user (and, optionally, group) name of the user as whom the server should run. The group name can be specified in a suffix, separated by a colon or period, i.e. `"user"`, `"user:group"` or `"user.group"`.

`program` (default: `"internal"`)
The server program which will serve the requests, or `"internal"` if `inetd` should use a built-in service.

`arguments` (default: `'()`)
A list strings or file-like objects, which are the server program's arguments, starting with the zeroth argument, i.e. the name of the program itself. For `inetd`'s internal services, this entry must be `'()` or `'("internal")`.

Veja Seção "Configuration file" em *GNU Inetutils* for a more detailed discussion of each configuration field.

`opendht-service-type` [Variável]

This is the type of the service running a OpenDHT (`https://opendht.net`) node, `dhtnode`. The daemon can be used to host your own proxy service to the distributed hash table (DHT), for example to connect to with Jami, among other applications.

> **Importante:** When using the OpenDHT proxy server, the IP addresses it "sees" from the clients should be addresses reachable from other peers. In practice this means that a publicly reachable address is best suited for a proxy server, outside of your private network. For example, hosting the proxy server on a IPv4 private local network and exposing it via port forwarding could work for external peers, but peers local to the proxy would have their private addresses shared with the external peers, leading to connectivity problems.

The value of this service is a `opendht-configuration` object, as described below.

`opendht-configuration` [Data Type]

Available `opendht-configuration` fields are:

`opendht` (default: `opendht`) (type: file-like)
: The `opendht` package to use.

`peer-discovery?` (default: `#f`) (type: boolean)
: Whether to enable the multicast local peer discovery mechanism.

`enable-logging?` (default: `#f`) (type: boolean)
: Whether to enable logging messages to syslog. It is disabled by default as it is rather verbose.

`debug?` (default: `#f`) (type: boolean)
: Whether to enable debug-level logging messages. This has no effect if logging is disabled.

`bootstrap-host` (default: `"bootstrap.jami.net:4222"`) (type: maybe-string)
: The node host name that is used to make the first connection to the network. A specific port value can be provided by appending the `:PORT` suffix. By default, it uses the Jami bootstrap nodes, but any host can be specified here. It's also possible to disable bootstrapping by explicitly setting this field to the `%unset-value` value.

`port` (default: `4222`) (type: maybe-number)
: The UDP port to bind to. When left unspecified, an available port is automatically selected.

`proxy-server-port` (type: maybe-number)
: Spawn a proxy server listening on the specified port.

`proxy-server-port-tls` (type: maybe-number)
: Spawn a proxy server listening to TLS connections on the specified port.

`tor-service-type` [Variável]

Type for a service that runs the Tor (`https://torproject.org`) anonymous networking daemon. The service is configured using a `<tor-configuration>` record. By

default, the Tor daemon runs as the `tor` unprivileged user, which is a member of the `tor` group.

Services of this type can be extended by other services to specify *onion services* (in addition to those already specified in `tor-configuration`) as in this example:

```
(simple-service 'my-extra-onion-service tor-service-type
                (list (tor-onion-service-configuration
                        (name "extra-onion-service")
                        (mapping '((80 . "127.0.0.1:8080"))))))
```

`tor-configuration` [Data Type]

`tor` (default: `tor`)
: The package that provides the Tor daemon. This package is expected to provide the daemon at `bin/tor` relative to its output directory. The default package is the Tor Project's (`https://www.torproject.org`) implementation.

`config-file` (default: `(plain-file "empty" "")`)
: The configuration file to use. It will be appended to a default configuration file, and the final configuration file will be passed to `tor` via its `-f` option. This may be any "file-like" object (veja Seção 8.12 [Expressões-G], Página 163). See `man tor` for details on the configuration file syntax.

`hidden-services` (default: `'()`)
: The list of `<tor-onion-service-configuration>` records to use. For any onion service you include in this list, appropriate configuration to enable the onion service will be automatically added to the default configuration file.

`socks-socket-type` (default: `'tcp`)
: The default socket type that Tor should use for its SOCKS socket. This must be either `'tcp` or `'unix`. If it is `'tcp`, then by default Tor will listen on TCP port 9050 on the loopback interface (i.e., localhost). If it is `'unix`, then Tor will listen on the UNIX domain socket `/var/run/tor/socks-sock`, which will be made writable by members of the `tor` group.

  If you want to customize the SOCKS socket in more detail, leave `socks-socket-type` at its default value of `'tcp` and use `config-file` to override the default by providing your own `SocksPort` option.

`control-socket?` (default: `#f`)
: Whether or not to provide a "control socket" by which Tor can be controlled to, for instance, dynamically instantiate tor onion services. If `#t`, Tor will listen for control commands on the UNIX domain socket `/var/run/tor/control-sock`, which will be made writable by members of the `tor` group.

`transport-plugins` (default: `'()`)
: The list of `<tor-transport-plugin>` records to use. For any transport plugin you include in this list, appropriate configuration line to enable transport plugin will be automatically added to the default configuration file.

`tor-onion-service-configuration` [Data Type]

Data Type representing a Tor *Onion Service* configuration. See the Tor project's documentation (`https://community.torproject.org/onion-services/`) for more information. Available `tor-onion-service-configuration` fields are:

`name` (type: string)
: Name for this Onion Service. This creates a `/var/lib/tor/hidden-services/`*`name`* directory, where the `hostname` file contains the '`.onion`' host name for this Onion Service.

`mapping` (type: alist)
: Association list of port to address mappings. The following example:

```
'((22 . "127.0.0.1:22")
  (80 . "127.0.0.1:8080"))
```

maps ports 22 and 80 of the Onion Service to the local ports 22 and 8080.

`tor-transport-plugin` [Data Type]

Data type representing a Tor pluggable transport plugin in `tor-configuration`. Plugguble transports are programs that disguise Tor traffic, which can be useful in case Tor is censored. See the the Tor project's documentation (`https://tb-manual.torproject.org/circumvention/`) and specification (`https://spec.torproject.org/pt-spec/index.html`) for more information.

Each transport plugin corresponds either to `ClientTransportPlugin ...` or to `ServerTransportPlugin ...` line in the default configuration file, see `man tor`. Available `tor-transport-plugin` fields are:

`role` (default: `'client`)
: This must be either `'client` or `'server`. Otherwise, an error is raised. Set the `'server` value if you want to run a bridge to help censored users connect to the Tor network, see the Tor project's brige guide (`https://community.torproject.org/relay/setup/bridge/`). Set the `'client` value if you want to connect to somebody else's bridge, see the Tor project's "Get Bridges" page (`https://bridges.torproject.org/`). In both cases the required additional configuration should be provided via `#:config-file` option of `tor-configuration`.

`protocol` (default: `"obfs4"`)
: A string that specifies a pluggable transport protocol.

`program`
: This must be a "file-like" object or a string pointing to the pluggable transport plugin executable. This option allows the Tor daemon run inside the container to access the executable and all the references (e.g. package dependencies) attached to it.

Suppose you would like Tor daemon to use obfs4 type obfuscation and to connect to Tor network via obfs4 bridge (a nonpublic Tor relay with support for obfs4 type obfuscation). Then you may go to https://bridges.torproject.org/ (`https://bridges.torproject.org/`) and get there a couple of bridge lines (each starts with `obfs4 ...`) and use these lines in tor-service-type configuration as follows:

```
(service tor-service-type
```

```
 (tor-configuration
  (config-file (plain-file "torrc"
   "\
UseBridges 1
Bridge obfs4 ...
Bridge obfs4 ..."))
  (transport-plugins
   (list (tor-transport-plugin
  (program
   (file-append
    go-gitlab-torproject-org-tpo-anti-censorship-pluggable-transports-lyrebird
    "/bin/lyrebird")))))))
```

The `(gnu services rsync)` module provides the following services:

You might want an rsync daemon if you have files that you want available so anyone (or just yourself) can download existing files or upload new files.

`rsync-service-type` [Variável]

This is the service type for the rsync (`https://rsync.samba.org`) daemon, The value for this service type is a `rsync-configuration` record as in this example:

```
;; Export two directories over rsync.  By default rsync listens on
;; all the network interfaces.
(service rsync-service-type
         (rsync-configuration
           (modules (list (rsync-module
                           (name "music")
                           (file-name "/srv/zik")
                           (read-only? #f))
                          (rsync-module
                           (name "movies")
                           (file-name "/home/charlie/movies"))))))
```

See below for details about `rsync-configuration`.

`rsync-configuration` [Data Type]

Data type representing the configuration for `rsync-service`.

`package` (default: *rsync*)
: `rsync` package to use.

`address` (default: `#f`)
: IP address on which `rsync` listens for incoming connections. If unspecified, it defaults to listening on all available addresses.

`port-number` (default: `873`)
: TCP port on which `rsync` listens for incoming connections. If port is less than `1024` `rsync` needs to be started as the `root` user and group.

`pid-file` (default: `"/var/run/rsyncd/rsyncd.pid"`)
: Name of the file where `rsync` writes its PID.

`lock-file` (default: `"/var/run/rsyncd/rsyncd.lock"`)
: Name of the file where `rsync` writes its lock file.

`log-file` (default: `"/var/log/rsyncd.log"`)
: Name of the file where `rsync` writes its log file.

`user` (default: `"root"`)
: Owner of the `rsync` process.

`group` (default: `"root"`)
: Group of the `rsync` process.

`uid` (default: `"rsyncd"`)
: User name or user ID that file transfers to and from that module should take place as when the daemon was run as `root`.

`gid` (default: `"rsyncd"`)
: Group name or group ID that will be used when accessing the module.

`modules` (default: `%default-modules`)
: List of "modules"—i.e., directories exported over rsync. Each element must be a `rsync-module` record, as described below.

`rsync-module` [Data Type]

This is the data type for rsync "modules". A module is a directory exported over the rsync protocol. The available fields are as follows:

`name`
: The module name. This is the name that shows up in URLs. For example, if the module is called `music`, the corresponding URL will be `rsync://host.example.org/music`.

`file-name`
: Name of the directory being exported.

`comment` (default: `""`)
: Comment associated with the module. Client user interfaces may display it when they obtain the list of available modules.

`read-only?` (default: `#t`)
: Whether or not client will be able to upload files. If this is false, the uploads will be authorized if permissions on the daemon side permit it.

`chroot?` (default: `#t`)
: When this is true, the rsync daemon changes root to the module's directory before starting file transfers with the client. This improves security, but requires rsync to run as root.

`timeout` (default: `300`)
: Idle time in seconds after which the daemon closes a connection with the client.

The `(gnu services syncthing)` module provides the following services:

You might want a syncthing daemon if you have files between two or more computers and want to sync them in real time, safely protected from prying eyes.

`syncthing-service-type` [Variável]

This is the service type for the syncthing (`https://syncthing.net/`) daemon, The value for this service type is a `syncthing-configuration` record as in this example:

```
(service syncthing-service-type
         (syncthing-configuration (user "alice")))
```

Nota: This service is also available for Guix Home, where it runs directly with your user privileges (veja Seção 13.3.16 [Networking Home Services], Página 688).

See below for details about `syncthing-configuration`.

`syncthing-configuration` [Data Type]

Data type representing the configuration for `syncthing-service-type`.

`syncthing` (default: *syncthing*)
: `syncthing` package to use.

`arguments` (default: *'()*)
: List of command-line arguments passing to `syncthing` binary.

`logflags` (default: *0*)
: Sum of logging flags, see Syncthing documentation logflags (`https://docs.syncthing.net/users/syncthing.html#cmdoption-logflags`).

`user` (default: *#f*)
: The user as which the Syncthing service is to be run. This assumes that the specified user exists.

`group` (default: "*users*")
: The group as which the Syncthing service is to be run. This assumes that the specified group exists.

`home` (default: *#f*)
: Common configuration and data directory. The default configuration directory is `$HOME` of the specified Syncthing `user`.

Furthermore, `(gnu services ssh)` provides the following services.

`lsh-service-type` [Variável]

Type of the service that runs the GNU lsh secure shell (SSH) daemon, `lshd`. The value for this service is a `<lsh-configuration>` object.

`lsh-configuration` [Data Type]

Data type representing the configuration of `lshd`.

`lsh` (default: `lsh`) (type: file-like)
: The package object of the GNU lsh secure shell (SSH) daemon.

`daemonic?` (default: `#t`) (type: boolean)
: Whether to detach from the controlling terminal.

`host-key` (default: `"/etc/lsh/host-key"`) (type: string)
: File containing the *host key*. This file must be readable by root only.

`interfaces` (default: `'()`) (type: list)
: List of host names or addresses that `lshd` will listen on. If empty, `lshd` listens for connections on all the network interfaces.

`port-number` (default: `22`) (type: integer)
: Port to listen on.

`allow-empty-passwords?` (default: `#f`) (type: boolean)
: Whether to accept log-ins with empty passwords.

`root-login?` (default: `#f`) (type: boolean)
: Whether to accept log-ins as root.

`syslog-output?` (default: `#t`) (type: boolean)
: Whether to log `lshd` standard output to syslogd. This will make the service depend on the existence of a syslogd service.

`pid-file?` (default: `#f`) (type: boolean)
: When `#t`, `lshd` writes its PID to the file specified in *pid-file*.

`pid-file` (default: `"/var/run/lshd.pid"`) (type: string)
: File that `lshd` will write its PID to.

`x11-forwarding?` (default: `#t`) (type: boolean)
: Whether to enable X11 forwarding.

`tcp/ip-forwarding?` (default: `#t`) (type: boolean)
: Whether to enable TCP/IP forwarding.

`password-authentication?` (default: `#t`) (type: boolean)
: Whether to accept log-ins using password authentication.

`public-key-authentication?` (default: `#t`) (type: boolean)
: Whether to accept log-ins using public key authentication.

`initialize?` (default: `#t`) (type: boolean)
: When `#f`, it is up to the user to initialize the randomness generator (veja Seção "lsh-make-seed" em *LSH Manual*), and to create a key pair with the private key stored in file *host-key* (veja Seção "lshd basics" em *LSH Manual*).

`openssh-service-type` [Variável]

This is the type for the OpenSSH (`http://www.openssh.org`) secure shell daemon, `sshd`. Its value must be an `openssh-configuration` record as in this example:

```
(service openssh-service-type
         (openssh-configuration
           (x11-forwarding? #t)
           (permit-root-login 'prohibit-password)
           (authorized-keys
             `(("alice" ,(local-file "alice.pub"))
               ("bob" ,(local-file "bob.pub"))))))
```

See below for details about `openssh-configuration`.

This service can be extended with extra authorized keys, as in this example:

```
(service-extension openssh-service-type
                   (const `(("charlie"
                             ,(local-file "charlie.pub")))))
```

`openssh-configuration` [Data Type]

This is the configuration record for OpenSSH's `sshd`.

`openssh` (default *openssh*)
: The OpenSSH package to use.

`pid-file` (default: `"/var/run/sshd.pid"`)
: Name of the file where `sshd` writes its PID.

`port-number` (default: `22`)
: TCP port on which `sshd` listens for incoming connections.

`max-connections` (default: `200`)
: Hard limit on the maximum number of simultaneous client connections, enforced by the inetd-style Shepherd service (veja Seção "Service De- and Constructors" em *The GNU Shepherd Manual*).

`permit-root-login` (default: `#f`)
: This field determines whether and when to allow logins as root. If `#f`, root logins are disallowed; if `#t`, they are allowed. If it's the symbol `'prohibit-password`, then root logins are permitted but not with password-based authentication.

`allow-empty-passwords?` (default: `#f`)
: When true, users with empty passwords may log in. When false, they may not.

`password-authentication?` (default: `#t`)
: When true, users may log in with their password. When false, they have other authentication methods.

`public-key-authentication?` (default: `#t`)
: When true, users may log in using public key authentication. When false, users have to use other authentication method.

  Authorized public keys are stored in `~/.ssh/authorized_keys`. This is used only by protocol version 2.

`x11-forwarding?` (padrão: `#f`)
: When true, forwarding of X11 graphical client connections is enabled—in other words, `ssh` options `-X` and `-Y` will work.

`allow-agent-forwarding?` (padrão: `#t`)
: Whether to allow agent forwarding.

`allow-tcp-forwarding?` (padrão: `#t`)
: Whether to allow TCP forwarding.

`gateway-ports?` (padrão: `#f`)
: Whether to allow gateway ports.

`challenge-response-authentication?` (default: `#f`)
: Specifies whether challenge response authentication is allowed (e.g. via PAM).

`use-pam?` (default: `#t`)
: Enables the Pluggable Authentication Module interface. If set to `#t`, this will enable PAM authentication using `challenge-response-authentication?` and `password-authentication?`, in addition to PAM account and session module processing for all authentication types.

  Because PAM challenge response authentication usually serves an equivalent role to password authentication, you should disable either `challenge-response-authentication?` or `password-authentication?`.

`print-last-log?` (default: `#t`)
: Specifies whether `sshd` should print the date and time of the last user login when a user logs in interactively.

`subsystems` (default: `'(("sftp" "internal-sftp"))`)
: Configures external subsystems (e.g. file transfer daemon).

  This is a list of two-element lists, each of which containing the subsystem name and a command (with optional arguments) to execute upon subsystem request.

  The command `internal-sftp` implements an in-process SFTP server. Alternatively, one can specify the `sftp-server` command:

```
(service openssh-service-type
         (openssh-configuration
          (subsystems
           `(("sftp" ,(file-append openssh "/libexec/sftp-server"))))))
```

`accepted-environment` (default: `'()`)
: List of strings describing which environment variables may be exported.

  Each string gets on its own line. See the `AcceptEnv` option in `man sshd_config`.

  This example allows ssh-clients to export the `COLORTERM` variable. It is set by terminal emulators, which support colors. You can use it in your shell's resource file to enable colors for the prompt and commands if this variable is set.

```
(service openssh-service-type
         (openssh-configuration
           (accepted-environment '("COLORTERM"))))
```

`authorized-keys` (default: `'()`)
: This is the list of authorized keys. Each element of the list is a user name followed by one or more file-like objects that represent SSH public keys. For example:

```
(openssh-configuration
  (authorized-keys
```

```
`(("rekado" ,(local-file "rekado.pub"))
  ("chris" ,(local-file "chris.pub"))
  ("root" ,(local-file "rekado.pub") ,(local-file "chris.pub")))))
```

registers the specified public keys for user accounts `rekado`, `chris`, and `root`.

Additional authorized keys can be specified *via* `service-extension`.

Note that this does *not* interfere with the use of `~/.ssh/authorized_keys`.

`generate-host-keys?` (default: `#t`)
Whether to generate host key pairs with `ssh-keygen -A` under `/etc/ssh` if there are none.

Generating key pairs takes a few seconds when enough entropy is available and is only done once. You might want to turn it off for instance in a virtual machine that does not need it because host keys are provided in some other way, and where the extra boot time is a problem.

`log-level` (default: `'info`)
This is a symbol specifying the logging level: `quiet`, `fatal`, `error`, `info`, `verbose`, `debug`, etc. See the man page for `sshd_config` for the full list of level names.

`extra-content` (default: `""`)
This field can be used to append arbitrary text to the configuration file. It is especially useful for elaborate configurations that cannot be expressed otherwise. This configuration, for example, would generally disable root logins, but permit them from one specific IP address:

```
(openssh-configuration
  (extra-content "\
Match Address 192.168.0.1
  PermitRootLogin yes"))
```

`dropbear-service-type` [Variável]
Type of the service that runs the Dropbear SSH daemon (`https://matt.ucc.asn.au/dropbear/dropbear.html`), whose value is a `<dropbear-configuration>` object.

For example, to specify a Dropbear service listening on port 1234:

```
(service dropbear-service-type (dropbear-configuration
                                 (port-number 1234)))
```

`dropbear-configuration` [Data Type]
This data type represents the configuration of a Dropbear SSH daemon.

`dropbear` (default: *dropbear*)
The Dropbear package to use.

`port-number` (default: 22)
The TCP port where the daemon waits for incoming connections.

`syslog-output?` (padrão: `#t`)
Whether to enable syslog output.

`pid-file` (default: `"/var/run/dropbear.pid"`)
: File name of the daemon's PID file.

`root-login?` (default: `#f`)
: Whether to allow `root` logins.

`allow-empty-passwords?` (default: `#f`)
: Whether to allow empty passwords.

`password-authentication?` (default: `#t`)
: Whether to enable password-based authentication.

`autossh-service-type` [Variável]

This is the type for the AutoSSH (`https://www.harding.motd.ca/autossh`) program that runs a copy of `ssh` and monitors it, restarting it as necessary should it die or stop passing traffic. AutoSSH can be run manually from the command-line by passing arguments to the binary `autossh` from the package `autossh`, but it can also be run as a Guix service. This latter use case is documented here.

AutoSSH can be used to forward local traffic to a remote machine using an SSH tunnel, and it respects the `~/.ssh/config` of the user it is run as.

For example, to specify a service running autossh as the user `pino` and forwarding all local connections to port `8081` to `remote:8081` using an SSH tunnel, add this call to the operating system's `services` field:

```
(service autossh-service-type
         (autossh-configuration
          (user "pino")
          (ssh-options (list "-T" "-N" "-L" "8081:localhost:8081" "remote.net")))
```

`autossh-configuration` [Data Type]

This data type represents the configuration of an AutoSSH service.

`user` (default `"autossh"`)
: The user as which the AutoSSH service is to be run. This assumes that the specified user exists.

`poll` (default `600`)
: Specifies the connection poll time in seconds.

`first-poll` (default `#f`)
: Specifies how many seconds AutoSSH waits before the first connection test. After this first test, polling is resumed at the pace defined in `poll`. When set to `#f`, the first poll is not treated specially and will also use the connection poll specified in `poll`.

`gate-time` (default `30`)
: Specifies how many seconds an SSH connection must be active before it is considered successful.

`log-level` (default `1`)
: The log level, corresponding to the levels used by syslog—so `0` is the most silent while `7` is the chattiest.

`max-start` (default `#f`)
: The maximum number of times SSH may be (re)started before AutoSSH exits. When set to `#f`, no maximum is configured and AutoSSH may restart indefinitely.

`message` (default `""`)
: The message to append to the echo message sent when testing connections.

`port` (default `"0"`)
: The ports used for monitoring the connection. When set to `"0"`, monitoring is disabled. When set to `"n"` where *n* is a positive integer, ports *n* and *n*+1 are used for monitoring the connection, such that port *n* is the base monitoring port and `n+1` is the echo port. When set to `"n:m"` where *n* and *m* are positive integers, the ports *n* and *m* are used for monitoring the connection, such that port *n* is the base monitoring port and *m* is the echo port.

`ssh-options` (default `'()`)
: The list of command-line arguments to pass to `ssh` when it is run. Options `-f` and `-M` are reserved for AutoSSH and may cause undefined behaviour.

`webssh-service-type` [Variável]

This is the type for the WebSSH (`https://webssh.huashengdun.org/`) program that runs a web SSH client. WebSSH can be run manually from the command-line by passing arguments to the binary `wssh` from the package `webssh`, but it can also be run as a Guix service. This latter use case is documented here.

For example, to specify a service running WebSSH on loopback interface on port `8888` with reject policy with a list of allowed to connection hosts, and NGINX as a reverse-proxy to this service listening for HTTPS connection, add this call to the operating system's `services` field:

```
(service webssh-service-type
  (webssh-configuration (address "127.0.0.1")
                        (port 8888)
                        (policy 'reject)
                        (known-hosts '("localhost ecdsa-sha2-nistp256 AAAA..."
                                       "127.0.0.1 ecdsa-sha2-nistp256 AAAA..."))))

(service nginx-service-type
         (nginx-configuration
          (server-blocks
           (list
            (nginx-server-configuration
             (inherit %webssh-configuration-nginx)
             (server-name '("webssh.example.com"))
             (listen '("443 ssl"))
             (ssl-certificate (letsencrypt-certificate "webssh.example.com"))
             (ssl-certificate-key (letsencrypt-key "webssh.example.com"))
```

```
                    (locations
                     (cons (nginx-location-configuration
                            (uri "/.well-known")
                            (body '("root /var/www;")))
                           (nginx-server-configuration-locations %webssh-configuration-n
```

`webssh-configuration` [Data Type]

Data type representing the configuration for `webssh-service`.

`package` (default: *webssh*)
: `webssh` package to use.

`user-name` (default: "*webssh*")
: User name or user ID that file transfers to and from that module should take place.

`group-name` (default: "*webssh*")
: Group name or group ID that will be used when accessing the module.

`address` (default: *#f*)
: IP address on which `webssh` listens for incoming connections.

`port` (default: *8888*)
: TCP port on which `webssh` listens for incoming connections.

`policy` (default: *#f*)
: Connection policy. *reject* policy requires to specify *known-hosts*.

`known-hosts` (default: *'()*)
: List of hosts which allowed for SSH connection from `webssh`.

`log-file` (default: `"/var/log/webssh.log"`)
: Name of the file where `webssh` writes its log file.

`log-level` (default: *#f*)
: Logging level.

`block-facebook-hosts-service-type` [Variável]

This service type adds a list of known Facebook hosts to the `/etc/hosts` file. (veja Seção "Host Names" em *The GNU C Library Reference Manual*) Each line contains an entry that maps a known server name of the Facebook on-line service—e.g., `www.facebook.com`—to unroutable IPv4 and IPv6 addresses.

This mechanism can prevent programs running locally, such as Web browsers, from accessing Facebook.

The `(gnu services avahi)` provides the following definition.

`avahi-service-type` [Variável]

This is the service that runs `avahi-daemon`, a system-wide mDNS/DNS-SD responder that allows for service discovery and "zero-configuration" host name lookups (see `https://avahi.org/`). Its value must be an `avahi-configuration` record—see below.

This service extends the name service cache daemon (nscd) so that it can resolve `.local` host names using nss-mdns (`https://0pointer.de/lennart/projects/nss-mdns/`). Veja Seção 11.13 [Name Service Switch], Página 605, for information on host name resolution.

Additionally, add the *avahi* package to the system profile so that commands such as `avahi-browse` are directly usable.

`avahi-configuration` [Data Type]

Data type representation the configuration for Avahi.

`host-name` (default: `#f`)
: If different from `#f`, use that as the host name to publish for this machine; otherwise, use the machine's actual host name.

`publish?` (padrão: `#t`)
: When true, allow host names and services to be published (broadcast) over the network.

`publish-workstation?` (padrão: `#t`)
: When true, `avahi-daemon` publishes the machine's host name and IP address via mDNS on the local network. To view the host names published on your local network, you can run:

```
avahi-browse _workstation._tcp
```

`wide-area?` (padrão: `#f`)
: When true, DNS-SD over unicast DNS is enabled.

`ipv4?` (default: `#t`)
`ipv6?` (default: `#t`)
: These fields determine whether to use IPv4/IPv6 sockets.

`domains-to-browse` (default: `'()`)
: This is a list of domains to browse.

`openvswitch-service-type` [Variável]

This is the type of the Open vSwitch (`https://www.openvswitch.org`) service, whose value should be an `openvswitch-configuration` object.

`openvswitch-configuration` [Data Type]

Data type representing the configuration of Open vSwitch, a multilayer virtual switch which is designed to enable massive network automation through programmatic extension.

`package` (default: *openvswitch*)
: Package object of the Open vSwitch.

`pagekite-service-type` [Variável]

This is the service type for the PageKite (`https://pagekite.net`) service, a tunneling solution for making localhost servers publicly visible, even from behind restrictive firewalls or NAT without forwarded ports. The value for this service type is a `pagekite-configuration` record.

Here's an example exposing the local HTTP and SSH daemons:

```
(service pagekite-service-type
         (pagekite-configuration
           (kites '("http:@kitename:localhost:80:@kitesecret"
                    "raw/22:@kitename:localhost:22:@kitesecret"))
           (extra-file "/etc/pagekite.rc")))
```

`pagekite-configuration` [Data Type]

Data type representing the configuration of PageKite.

`package` (default: *pagekite*)
: Package object of PageKite.

`kitename` (default: `#f`)
: PageKite name for authenticating to the frontend server.

`kitesecret` (default: `#f`)
: Shared secret for authenticating to the frontend server. You should probably put this inside `extra-file` instead.

`frontend` (default: `#f`)
: Connect to the named PageKite frontend server instead of the pagekite.net service.

`kites` (default: `'("http:@kitename:localhost:80:@kitesecret")`)
: List of service kites to use. Exposes HTTP on port 80 by default. The format is `proto:kitename:host:port:secret`.

`extra-file` (default: `#f`)
: Extra configuration file to read, which you are expected to create manually. Use this to add additional options and manage shared secrets out-of-band.

`yggdrasil-service-type` [Variável]

The service type for connecting to the Yggdrasil network (`https://yggdrasil-network.github.io/`), an early-stage implementation of a fully end-to-end encrypted IPv6 network.

> Yggdrasil provides name-independent routing with cryptographically generated addresses. Static addressing means you can keep the same address as long as you want, even if you move to a new location, or generate a new address (by generating new keys) whenever you want. `https://yggdrasil-network.github.io/2018/07/28/addressing.html`

Pass it a value of `yggdrasil-configuration` to connect it to public peers and/or local peers.

Here is an example using public peers and a static address. The static signing and encryption keys are defined in `/etc/yggdrasil-private.conf` (the default value for `config-file`).

```
;; part of the operating-system declaration
(service yggdrasil-service-type
                (yggdrasil-configuration
```

```
                    (autoconf? #f) ;; use only the public peers
                    (json-config
                    ;; choose one from
                    ;; https://github.com/yggdrasil-network/public-peers
                     '((peers . #("tcp://1.2.3.4:1337"))))
                    ;; /etc/yggdrasil-private.conf is the default value for config-fil
                    ))
          # sample content for /etc/yggdrasil-private.conf
          {
            # Your private key. DO NOT share this with anyone!
            PrivateKey: 5c750...
          }
```

`yggdrasil-configuration` [Data Type]

Data type representing the configuration of Yggdrasil.

`package` (default: `yggdrasil`)
: Package object of Yggdrasil.

`json-config` (default: `'()`)
: Contents of `/etc/yggdrasil.conf`. Will be merged with `/etc/yggdrasil-private.conf`. Note that these settings are stored in the Guix store, which is readable to all users. **Do not store your private keys in it**. See the output of `yggdrasil -genconf` for a quick overview of valid keys and their default values.

`autoconf?` (default: `#f`)
: Whether to use automatic mode. Enabling it makes Yggdrasil use a dynamic IP and peer with IPv6 neighbors.

`log-level` (default: `'info`)
: How much detail to include in logs. Use `'debug` for more detail.

`log-to` (default: `'stdout`)
: Where to send logs. By default, the service logs standard output to `/var/log/yggdrasil.log`. The alternative is `'syslog`, which sends output to the running syslog service.

`config-file` (default: `"/etc/yggdrasil-private.conf"`)
: What HJSON file to load sensitive data from. This is where private keys should be stored, which are necessary to specify if you don't want a randomized address after each restart. Use `#f` to disable. Options defined in this file take precedence over `json-config`. Use the output of `yggdrasil -genconf` as a starting point. To configure a static address, delete everything except PrivateKey option.

`ipfs-service-type` [Variável]

The service type for connecting to the IPFS network (`https://ipfs.io`), a global, versioned, peer-to-peer file system. Pass it a `ipfs-configuration` to change the ports used for the gateway and API.

Here's an example configuration, using some non-standard ports:

```
(service ipfs-service-type
         (ipfs-configuration
          (gateway "/ip4/127.0.0.1/tcp/8880")
          (api "/ip4/127.0.0.1/tcp/8881")))
```

`ipfs-configuration` [Data Type]

Data type representing the configuration of IPFS.

`package` (default: `go-ipfs`)
: Package object of IPFS.

`gateway` (default: `"/ip4/127.0.0.1/tcp/8082"`)
: Address of the gateway, in 'multiaddress' format.

`api` (default: `"/ip4/127.0.0.1/tcp/5001"`)
: Address of the API endpoint, in 'multiaddress' format.

`keepalived-service-type` [Variável]

This is the type for the Keepalived (`https://www.keepalived.org/`) routing software, `keepalived`. Its value must be an `keepalived-configuration` record as in this example for master machine:

```
(service keepalived-service-type
         (keepalived-configuration
           (config-file (local-file "keepalived-master.conf"))))
```

where `keepalived-master.conf`:

```
vrrp_instance my-group {
  state MASTER
  interface enp9s0
  virtual_router_id 100
  priority 100
  unicast_peer { 10.0.0.2 }
  virtual_ipaddress {
    10.0.0.4/24
  }
}
```

and for backup machine:

```
(service keepalived-service-type
         (keepalived-configuration
          (config-file (local-file "keepalived-backup.conf"))))
```

where `keepalived-backup.conf`:

```
vrrp_instance my-group {
  state BACKUP
  interface enp9s0
  virtual_router_id 100
  priority 99
  unicast_peer { 10.0.0.3 }
```

```
    virtual_ipaddress {
      10.0.0.4/24
    }
}
```

11.10.6 Atualizações sem supervisão

Guix provides a service to perform *unattended upgrades*: periodically, the system automatically reconfigures itself from the latest Guix. Guix System has several properties that make unattended upgrades safe:

- upgrades are transactional (either the upgrade succeeds or it fails, but you cannot end up with an "in-between" system state);
- the upgrade log is kept—you can view it with `guix system list-generations`—and you can roll back to any previous generation, should the upgraded system fail to behave as intended;
- channel code is authenticated so you know you can only run genuine code (veja Capítulo 6 [Canais], Página 69);
- `guix system reconfigure` prevents downgrades, which makes it immune to *downgrade attacks*.

To set up unattended upgrades, add an instance of `unattended-upgrade-service-type` like the one below to the list of your operating system services:

```
(service unattended-upgrade-service-type)
```

The defaults above set up weekly upgrades: every Sunday at midnight. You do not need to provide the operating system configuration file: it uses `/run/current-system/configuration.scm`, which ensures it always uses your latest configuration—veja [provenance-service-type], Página 638, for more information about this file.

There are several things that can be configured, in particular the periodicity and services (daemons) to be restarted upon completion. When the upgrade is successful, the service takes care of deleting system generations older that some threshold, as per `guix system delete-generations`. See the reference below for details.

To ensure that upgrades are actually happening, you can run `guix system describe`. To investigate upgrade failures, visit the unattended upgrade log file (see below).

`unattended-upgrade-service-type` [Variável]

This is the service type for unattended upgrades. It sets up an mcron job (veja Seção 11.10.2 [Execução de trabalho agendado], Página 289) that runs `guix system reconfigure` from the latest version of the specified channels.

Its value must be a `unattended-upgrade-configuration` record (see below).

`unattended-upgrade-configuration` [Data Type]

This data type represents the configuration of the unattended upgrade service. The following fields are available:

`schedule` (default: `"30 01 * * 0"`)

This is the schedule of upgrades, expressed as a gexp containing an mcron job schedule (veja Seção "Guile Syntax" em *GNU mcron*).

`channels` (default: `#~%default-channels`)
: This gexp specifies the channels to use for the upgrade (veja Capítulo 6 [Canais], Página 69). By default, the tip of the official `guix` channel is used.

`operating-system-file` (default: `"/run/current-system/configuration.scm"`)
: This field specifies the operating system configuration file to use. The default is to reuse the config file of the current configuration.

  There are cases, though, where referring to `/run/current-system/configuration.scm` is not enough, for instance because that file refers to extra files (SSH public keys, extra configuration files, etc.) *via* `local-file` and similar constructs. For those cases, we recommend something along these lines:

```
(unattended-upgrade-configuration
  (operating-system-file
    (file-append (local-file "." "config-dir" #:recursive? #t)
                 "/config.scm")))
```

  The effect here is to import all of the current directory into the store, and to refer to `config.scm` within that directory. Therefore, uses of `local-file` within `config.scm` will work as expected. Veja Seção 8.12 [Expressões-G], Página 163, for information about `local-file` and `file-append`.

`operating-system-expression` (default: `#f`)
: This field specifies an expression that evaluates to the operating system to use for the upgrade. If no value is provided the `operating-system-file` field value is used.

```
(unattended-upgrade-configuration
  (operating-system-expression
    #~(@ (guix system install) installation-os)))
```

`reboot?` (default: `#f`)
: This field specifies whether the system should reboot after completing an unattended upgrade.

`services-to-restart` (default: `'(mcron)`)
: This field specifies the Shepherd services to restart when the upgrade completes.

  Those services are restarted right away upon completion, as with `herd restart`, which ensures that the latest version is running—remember that by default `guix system reconfigure` only restarts services that are not currently running, which is conservative: it minimizes disruption but leaves outdated services running.

  Use `herd status` to find out candidates for restarting. Veja Seção 11.10 [Serviços], Página 268, for general information about services. Common services to restart would include `ntpd` and `ssh-daemon`.

  By default, the `mcron` service is restarted. This ensures that the latest version of the unattended upgrade job will be used next time.

`system-expiration` (default: `(* 3 30 24 3600)`)
: This is the expiration time in seconds for system generations. System generations older that this amount of time are deleted with `guix system delete-generations` when an upgrade completes.

> **Nota:** The unattended upgrade service does not run the garbage collector. You will probably want to set up your own mcron job to run `guix gc` periodically.

`maximum-duration` (default: `3600`)
: Maximum duration in seconds for the upgrade; past that time, the upgrade aborts.

This is primarily useful to ensure the upgrade does not end up rebuilding or re-downloading "the world".

`log-file` (default: `"/var/log/unattended-upgrade.log"`)
: File where unattended upgrades are logged.

11.10.7 X Window

Support for the X Window graphical display system—specifically Xorg—is provided by the `(gnu services xorg)` module. Note that there is no `xorg-service` procedure. Instead, the X server is started by the *login manager*, by default the GNOME Display Manager (GDM).

GDM of course allows users to log in into window managers and desktop environments other than GNOME; for those using GNOME, GDM is required for features such as automatic screen locking.

To use X11, you must install at least one *window manager*—for example the `windowmaker` or `openbox` packages—preferably by adding it to the `packages` field of your operating system definition (veja Seção 11.3 [Referência do operating-system], Página 247).

GDM also supports Wayland: it can itself use Wayland instead of X11 for its user interface, and it can also start Wayland sessions. Wayland support is enabled by default. To disable it, set `wayland?` to `#f` in `gdm-configuration`.

`gdm-service-type` [Variável]
: This is the type for the GNOME Desktop Manager (`https://wiki.gnome.org/Projects/GDM/`) (GDM), a program that manages graphical display servers and handles graphical user logins. Its value must be a `gdm-configuration` (see below).

GDM looks for *session types* described by the `.desktop` files in `/run/current-system/profile/share/xsessions` (for X11 sessions) and `/run/current-system/profile/share/wayland-sessions` (for Wayland sessions) and allows users to choose a session from the log-in screen. Packages such as `gnome`, `xfce`, `i3` and `sway` provide `.desktop` files; adding them to the system-wide set of packages automatically makes them available at the log-in screen.

In addition, `~/.xsession` files are honored. When available, `~/.xsession` must be an executable that starts a window manager and/or other X clients.

`gdm-configuration` [Data Type]
: `auto-login?` (default: `#f`)
`default-user` (default: `#f`)
When `auto-login?` is false, GDM presents a log-in screen.

When `auto-login?` is true, GDM logs in directly as `default-user`.

`auto-suspend?` (default `#t`)
When true, GDM will automatically suspend to RAM when nobody is physically connected. When a machine is used via remote desktop or SSH, this should be set to false to avoid GDM interrupting remote sessions or rendering the machine unavailable.

`debug?` (default: `#f`)
When true, GDM writes debug messages to its log.

`gnome-shell-assets` (default: ...)
List of GNOME Shell assets needed by GDM: icon theme, fonts, etc.

`xorg-configuration` (default: `(xorg-configuration)`)
Configuration of the Xorg graphical server.

`x-session` (default: `(xinitrc)`)
Script to run before starting a X session.

`xdmcp?` (default: `#f`)
When true, enable the X Display Manager Control Protocol (XDMCP). This should only be enabled in trusted environments, as the protocol is not secure. When enabled, GDM listens for XDMCP queries on the UDP port 177.

`dbus-daemon` (default: `dbus-daemon-wrapper`)
File name of the `dbus-daemon` executable.

`gdm` (default: `gdm`)
The GDM package to use.

`wayland?` (default: `#t`)
When true, enables Wayland in GDM, necessary to use Wayland sessions.

`wayland-session` (default: `gdm-wayland-session-wrapper`)
The Wayland session wrapper to use, needed to setup the environment.

`slim-service-type` [Variável]
This is the type for the SLiM graphical login manager for X11.

Like GDM, SLiM looks for session types described by `.desktop` files and allows users to choose a session from the log-in screen using *F1*. It also honors `~/.xsession` files.

Unlike GDM, SLiM does not spawn the user session on a different VT after logging in, which means that you can only start one graphical session. If you want to be able to run multiple graphical sessions at the same time you have to add multiple SLiM services to your system services. The following example shows how to replace the default GDM service with two SLiM services on tty7 and tty8.

```
(use-modules (gnu services)
             (gnu services desktop)
             (gnu services xorg))

(operating-system
```

```
;; ...
(services (cons* (service slim-service-type (slim-configuration
                                             (display ":0")
                                             (vt "vt7")))
                 (service slim-service-type (slim-configuration
                                             (display ":1")
                                             (vt "vt8")))
                 (modify-services %desktop-services
                   (delete gdm-service-type)))))
```

`slim-configuration` [Data Type]

Data type representing the configuration of `slim-service-type`.

`allow-empty-passwords?` (default: `#t`)
: Whether to allow logins with empty passwords.

`gnupg?` (default: `#f`)
: If enabled, `pam-gnupg` will attempt to automatically unlock the user's GPG keys with the login password via `gpg-agent`. The keygrips of all keys to be unlocked should be written to `~/.pam-gnupg`, and can be queried with `gpg -K --with-keygrip`. Presetting passphrases must be enabled by adding `allow-preset-passphrase` in `~/.gnupg/gpg-agent.conf`.

`auto-login?` (default: `#f`)
`default-user` (default: `""`)
: When `auto-login?` is false, SLiM presents a log-in screen.

  When `auto-login?` is true, SLiM logs in directly as `default-user`.

`theme` (default: `%default-slim-theme`)
`theme-name` (default: `%default-slim-theme-name`)
: The graphical theme to use and its name.

`auto-login-session` (default: `#f`)
: If true, this must be the name of the executable to start as the default session—e.g., `(file-append windowmaker "/bin/windowmaker")`.

  If false, a session described by one of the available `.desktop` files in `/run/current-system/profile` and `~/.guix-profile` will be used.

  > **Nota:** You must install at least one window manager in the system profile or in your user profile. Failing to do that, if `auto-login-session` is false, you will be unable to log in.

`xorg-configuration` (default `(xorg-configuration)`)
: Configuration of the Xorg graphical server.

`display` (default `":0"`)
: The display on which to start the Xorg graphical server.

`vt` (default `"vt7"`)
: The VT on which to start the Xorg graphical server.

`xauth` (default: `xauth`)
: The XAuth package to use.

`shepherd` (default: `shepherd`)
: The Shepherd package used when invoking `halt` and `reboot`.

`sessreg` (default: `sessreg`)
: The sessreg package used in order to register the session.

`slim` (default: `slim`)
: The SLiM package to use.

`%default-theme` [Variável]
`%default-theme-name` [Variável]
: The default SLiM theme and its name.

`sddm-service-type` [Variável]
: This is the type of the service to run the SDDM display manager (`https://github.com/sddm/sddm`). Its value must be a `sddm-configuration` record (see below).

  Here's an example use:

```
(service sddm-service-type
         (sddm-configuration
           (auto-login-user "alice")
           (auto-login-session "xfce.desktop")))
```

`sddm-configuration` [Data Type]
: This data type represents the configuration of the SDDM login manager. The available fields are:

  `sddm` (default: `sddm`)
  : The SDDM package to use.

    Nota: sddm has Qt6 enabled by default. If you want to still use a Qt5 theme, you need to set it to `sddm-qt5`.

  `display-server` (default: `"x11"`)
  : Select display server to use for the greeter. Valid values are ‘`"x11"`’ or ‘`"wayland"`’.

  `numlock` (default: `"on"`)
  : Valid values are ‘`"on"`’, ‘`"off"`’ or ‘`"none"`’.

  `halt-command` (default `#~(string-append #$shepherd "/sbin/halt")`)
  : Command to run when halting.

  `reboot-command` (default `#~(string-append #$shepherd "/sbin/reboot")`)
  : Command to run when rebooting.

  `theme` (default `"maldives"`)
  : Theme to use. Default themes provided by SDDM are ‘`"elarun"`’, ‘`"maldives"`’ or ‘`"maya"`’.

  `themes-directory` (default `"/run/current-system/profile/share/sddm/themes"`)
  : Directory to look for themes.

  `faces-directory` (default `"/run/current-system/profile/share/sddm/faces"`)
  : Directory to look for faces.

`default-path` (default `"/run/current-system/profile/bin"`)
Default PATH to use.

`minimum-uid` (default: 1000)
Minimum UID displayed in SDDM and allowed for log-in.

`maximum-uid` (default: 2000)
Maximum UID to display in SDDM.

`remember-last-user?` (default #t)
Remember last user.

`remember-last-session?` (default #t)
Remember last session.

`hide-users` (default `""`)
Usernames to hide from SDDM greeter.

`hide-shells` (default `#~(string-append #$shadow "/sbin/nologin")`)
Users with shells listed will be hidden from the SDDM greeter.

`session-command` (default `#~(string-append #$sddm "/share/sddm/scripts/wayland-session")`)
Script to run before starting a wayland session.

`sessions-directory` (default `"/run/current-system/profile/share/wayland-sessions"`)
Directory to look for desktop files starting wayland sessions.

`xorg-configuration` (default `(xorg-configuration)`)
Configuration of the Xorg graphical server.

`xauth-path` (default `#~(string-append #$xauth "/bin/xauth")`)
Path to xauth.

`xephyr-path` (default `#~(string-append #$xorg-server "/bin/Xephyr")`)
Path to Xephyr.

`xdisplay-start` (default `#~(string-append #$sddm "/share/sddm/scripts/Xsetup")`)
Script to run after starting xorg-server.

`xdisplay-stop` (default `#~(string-append #$sddm "/share/sddm/scripts/Xstop")`)
Script to run before stopping xorg-server.

`xsession-command` (default: `xinitrc`)
Script to run before starting a X session.

`xsessions-directory` (default: `"/run/current-system/profile/share/xsessions"`)
Directory to look for desktop files starting X sessions.

`minimum-vt` (default: 7)
Minimum VT to use.

`auto-login-user` (default `""`)
User account that will be automatically logged in. Setting this to the empty string disables auto-login.

`auto-login-session` (default `""`)
: The `.desktop` file name to use as the auto-login session, or the empty string.

`relogin?` (default #f)
: Relogin after logout.

`lightdm-service-type` [Variável]

This is the type of the service to run the LightDM display manager (`https://github.com/canonical/lightdm`). Its value must be a `lightdm-configuration` record, which is documented below. Among its distinguishing features are TigerVNC integration for easily remoting your desktop as well as support for the XDMCP protocol, which can be used by remote clients to start a session from the login manager.

In its most basic form, it can be used simply as:

```
(service lightdm-service-type)
```

A more elaborate example making use of the VNC capabilities and enabling more features and verbose logs could look like:

```
(service lightdm-service-type
         (lightdm-configuration
          (allow-empty-passwords? #t)
          (xdmcp? #t)
          (vnc-server? #t)
          (vnc-server-command
           (file-append tigervnc-server "/bin/Xvnc"
                        "  -SecurityTypes None"))
          (seats
           (list (lightdm-seat-configuration
                  (name "*")
                  (user-session "ratpoison"))))))
```

`lightdm-configuration` [Data Type]

Available `lightdm-configuration` fields are:

`lightdm` (default: `lightdm`) (type: file-like)
: The lightdm package to use.

`allow-empty-passwords?` (default: `#f`) (type: boolean)
: Whether users not having a password set can login.

`debug?` (default: `#f`) (type: boolean)
: Enable verbose output.

`xorg-configuration` (type: xorg-configuration)
: The default Xorg server configuration to use to generate the Xorg server start script. It can be refined per seat via the `xserver-command` of the `<lightdm-seat-configuration>` record, if desired.

`greeters` (type: list-of-greeter-configurations)
: The LightDM greeter configurations specifying the greeters to use.

`seats` (type: list-of-seat-configurations)
: The seat configurations to use. A LightDM seat is akin to a user.

`xdmcp?` (default: `#f`) (type: boolean)
: Whether a XDMCP server should listen on port UDP 177.

`xdmcp-listen-address` (type: maybe-string)
: The host or IP address the XDMCP server listens for incoming connections. When unspecified, listen on for any hosts/IP addresses.

`vnc-server?` (default: `#f`) (type: boolean)
: Whether a VNC server is started.

`vnc-server-command` (type: file-like)
: The Xvnc command to use for the VNC server, it's possible to provide extra options not otherwise exposed along the command, for example to disable security:

```
(vnc-server-command (file-append tigervnc-server "/bin/Xvnc"
                                 " -SecurityTypes None" ))
```

Or to set a PasswordFile for the classic (unsecure) VncAuth mechanism:

```
(vnc-server-command (file-append tigervnc-server "/bin/Xvnc"
                                 " -PasswordFile /var/lib/lightdm/.vnc/
```

The password file should be manually created using the `vncpasswd` command. Note that LightDM will create new sessions for VNC users, which means they need to authenticate in the same way as local users would.

`vnc-server-listen-address` (type: maybe-string)
: The host or IP address the VNC server listens for incoming connections. When unspecified, listen for any hosts/IP addresses.

`vnc-server-port` (default: `5900`) (type: number)
: The TCP port the VNC server should listen to.

`extra-config` (default: `'()`) (type: list-of-strings)
: Extra configuration values to append to the LightDM configuration file.

`lightdm-gtk-greeter-configuration` [Data Type]

Available `lightdm-gtk-greeter-configuration` fields are:

`lightdm-gtk-greeter` (default: `lightdm-gtk-greeter`) (type: file-like)
: The lightdm-gtk-greeter package to use.

`assets` (default: `(adwaita-icon-theme gnome-themes-extra hicolor-icon-theme)`) (type: list-of-file-likes)
: The list of packages complementing the greeter, such as package providing icon themes.

`theme-name` (default: `"Adwaita"`) (type: string)
: The name of the theme to use.

`icon-theme-name` (default: `"Adwaita"`) (type: string)
: The name of the icon theme to use.

`cursor-theme-name` (default: `"Adwaita"`) (type: string)
The name of the cursor theme to use.

`cursor-theme-size` (default: `16`) (type: number)
The size to use for the cursor theme.

`allow-debugging?` (type: maybe-boolean)
Set to #t to enable debug log level.

`background` (type: file-like)
The background image to use.

`at-spi-enabled?` (default: `#f`) (type: boolean)
Enable accessibility support through the Assistive Technology Service Provider Interface (AT-SPI).

`a11y-states` (default: `(contrast font keyboard reader)`) (type: list-of-a11y-states)
The accessibility features to enable, given as list of symbols.

`reader` (type: maybe-file-like)
The command to use to launch a screen reader.

`extra-config` (default: `'()`) (type: list-of-strings)
Extra configuration values to append to the LightDM GTK Greeter configuration file.

`lightdm-seat-configuration` [Data Type]
Available `lightdm-seat-configuration` fields are:

`name` (type: seat-name)
The name of the seat. An asterisk (*) can be used in the name to apply the seat configuration to all the seat names it matches.

`user-session` (type: maybe-string)
The session to use by default. The session name must be provided as a lowercase string, such as `"gnome"`, `"ratpoison"`, etc.

`type` (default: `local`) (type: seat-type)
The type of the seat, either the `local` or `xremote` symbol.

`autologin-user` (type: maybe-string)
The username to automatically log in with by default.

`greeter-session` (default: `lightdm-gtk-greeter`) (type: greeter-session)
The greeter session to use, specified as a symbol. Currently, only `lightdm-gtk-greeter` is supported.

`xserver-command` (type: maybe-file-like)
The Xorg server command to run.

`session-wrapper` (type: file-like)
The xinitrc session wrapper to use.

`extra-config` (default: `'()`) (type: list-of-strings)
Extra configuration values to append to the seat configuration section.

`xorg-configuration` [Data Type]

This data type represents the configuration of the Xorg graphical display server. Note that there is no Xorg service; instead, the X server is started by a "display manager" such as GDM, SDDM, LightDM or SLiM. Thus, the configuration of these display managers aggregates an `xorg-configuration` record.

`modules` (default: `%default-xorg-modules`)
This is a list of *module packages* loaded by the Xorg server—e.g., `xf86-video-vesa`, `xf86-input-keyboard`, and so on.

`fonts` (default: `%default-xorg-fonts`)
This is a list of font directories to add to the server's *font path*.

`drivers` (default: `'()`)
This must be either the empty list, in which case Xorg chooses a graphics driver automatically, or a list of driver names that will be tried in this order—e.g., `'("modesetting" "vesa")`.

`resolutions` (default: `'()`)
When `resolutions` is the empty list, Xorg chooses an appropriate screen resolution. Otherwise, it must be a list of resolutions—e.g., `'((1024 768) (640 480))`.

`keyboard-layout` (default: `#f`)
If this is `#f`, Xorg uses the default keyboard layout—usually US English ("qwerty") for a 105-key PC keyboard.

Otherwise this must be a `keyboard-layout` object specifying the keyboard layout in use when Xorg is running. Veja Seção 11.8 [Disposição do teclado], Página 264, for more information on how to specify the keyboard layout.

`extra-config` (default: `'()`)
This is a list of strings or objects appended to the configuration file. It is used to pass extra text to be added verbatim to the configuration file.

`server` (default: `xorg-server`)
This is the package providing the Xorg server.

`server-arguments` (default: `%default-xorg-server-arguments`)
This is the list of command-line arguments to pass to the X server. The default is `-nolisten tcp`.

`set-xorg-configuration` *config* [*login-manager-service-type*] [Procedure]

Tell the log-in manager (of type *login-manager-service-type*) to use *config*, an `<xorg-configuration>` record.

Since the Xorg configuration is embedded in the log-in manager's configuration—e.g., `gdm-configuration`—this procedure provides a shorthand to set the Xorg configuration.

`xorg-start-command` [*config*] [Procedure]

Return a `startx` script in which the modules, fonts, etc. specified in *config*, are available. The result should be used in place of `startx`.

Usually the X server is started by a login manager.

`xorg-start-command-xinit` [*config*] [Procedure]
Return a `startx` script in which the modules, fonts, etc. specified in *config* are available. The result should be used in place of `startx` and should be invoked by the user from a tty after login. Unlike `xorg-start-command`, this script calls xinit. Therefore it works well when executed from a tty. This script can be set up as `startx` using `startx-command-service-type` or `home-startx-command-service-type`. If you are using a desktop environment, you are unlikely to need this procedure.

`screen-locker-service-type` [Variável]
Type for a service that adds a package for a screen locker or screen saver to the set of privileged programs and/or add a PAM entry for it. The value for this service is a `<screen-locker-configuration>` object.

While the default behavior is to setup both a privileged program and PAM entry, these two methods are redundant. Screen locker programs may not execute when PAM is configured and `setuid` is set on their executable. In this case, `using-setuid?` can be set to `#f`.

For example, to make XlockMore usable:

```
(service screen-locker-service-type
         (screen-locker-configuration
           (name "xlock")
           (program (file-append xlockmore "/bin/xlock"))))
```

makes the good ol' XlockMore usable.

For example, swaylock fails to execute when compiled with PAM support and setuid enabled. One can thus disable setuid:

```
(service screen-locker-service-type
         (screen-locker-configuration
           (name "swaylock")
           (program (file-append swaylock "/bin/swaylock"))
           (using-pam? #t)
           (using-setuid? #f)))
```

`screen-locker-configuration` [Data Type]
Available `screen-locker-configuration` fields are:

`name` (type: string)
Name of the screen locker.

`program` (type: file-like)
Path to the executable for the screen locker as a G-Expression.

`allow-empty-password?` (default: `#f`) (type: boolean)
Whether to allow empty passwords.

`using-pam?` (default: `#t`) (type: boolean)
Whether to setup PAM entry.

`using-setuid?` (default: `#t`) (type: boolean)
Whether to setup program as setuid binary.

`startx-command-service-type` [Variável]

Add `startx` to the system profile putting it onto `PATH`.

The value for this service is a `<xorg-configuration>` object which is passed to the `xorg-start-command-xinit` procedure producing the `startx` used. Default value is `(xorg-configuration)`.

11.10.8 Serviços de impressão

The `(gnu services cups)` module provides a Guix service definition for the CUPS printing service. To add printer support to a Guix system, add a `cups-service` to the operating system definition:

`cups-service-type` [Variável]

The service type for the CUPS print server. Its value should be a valid CUPS configuration (see below). To use the default settings, simply write:

```
(service cups-service-type)
```

The CUPS configuration controls the basic things about your CUPS installation: what interfaces it listens on, what to do if a print job fails, how much logging to do, and so on. To actually add a printer, you have to visit the `http://localhost:631` URL, or use a tool such as GNOME's printer configuration services. By default, configuring a CUPS service will generate a self-signed certificate if needed, for secure connections to the print server.

Suppose you want to enable the Web interface of CUPS and also add support for Epson printers *via* the `epson-inkjet-printer-escpr` package and for HP printers *via* the `hplip-minimal` package. You can do that directly, like this (you need to use the `(gnu packages cups)` module):

```
(service cups-service-type
         (cups-configuration
           (web-interface? #t)
           (extensions
             (list cups-filters epson-inkjet-printer-escpr hplip-minimal))))
```

Nota: If you wish to use the Qt5 based GUI which comes with the hplip package then it is suggested that you install the `hplip` package, either in your OS configuration file or as your user.

The available configuration parameters follow. Each parameter definition is preceded by its type; for example, '`string-list foo`' indicates that the `foo` parameter should be specified as a list of strings. There is also a way to specify the configuration as a string, if you have an old `cupsd.conf` file that you want to port over from some other system; see the end for more details.

Available `cups-configuration` fields are:

`package cups` [`cups-configuration` parameter]

The CUPS package.

`package-list extensions` (*default:* `(list brlaser cups-filters epson-inkjet-printer-escpr foomatic-filters hplip-minimal splix)`) [`cups-configuration` parameter]

Drivers and other extensions to the CUPS package.

`files-configuration files-configuration` [`cups-configuration` parameter]
Configuration of where to write logs, what directories to use for print spools, and related privileged configuration parameters.

Available `files-configuration` fields are:

`log-location access-log` [`files-configuration` parameter]
Defines the access log filename. Specifying a blank filename disables access log generation. The value `stderr` causes log entries to be sent to the standard error file when the scheduler is running in the foreground, or to the system log daemon when run in the background. The value `syslog` causes log entries to be sent to the system log daemon. The server name may be included in filenames using the string `%s`, as in `/var/log/cups/%s-access_log`.

Defaults to '`"/var/log/cups/access_log"`'.

`file-name cache-dir` [`files-configuration` parameter]
Where CUPS should cache data.

Defaults to '`"/var/cache/cups"`'.

`string config-file-perm` [`files-configuration` parameter]
Specifies the permissions for all configuration files that the scheduler writes.

Note that the permissions for the printers.conf file are currently masked to only allow access from the scheduler user (typically root). This is done because printer device URIs sometimes contain sensitive authentication information that should not be generally known on the system. There is no way to disable this security feature.

Defaults to '`"0640"`'.

`log-location error-log` [`files-configuration` parameter]
Defines the error log filename. Specifying a blank filename disables error log generation. The value `stderr` causes log entries to be sent to the standard error file when the scheduler is running in the foreground, or to the system log daemon when run in the background. The value `syslog` causes log entries to be sent to the system log daemon. The server name may be included in filenames using the string `%s`, as in `/var/log/cups/%s-error_log`.

Defaults to '`"/var/log/cups/error_log"`'.

`string fatal-errors` [`files-configuration` parameter]
Specifies which errors are fatal, causing the scheduler to exit. The kind strings are:

`nenhuma` No errors are fatal.

`all` All of the errors below are fatal.

`browse` Browsing initialization errors are fatal, for example failed connections to the DNS-SD daemon.

`config` Configuration file syntax errors are fatal.

`listen` Listen or Port errors are fatal, except for IPv6 failures on the loopback or `any` addresses.

`log` Log file creation or write errors are fatal.

`permissions`
Bad startup file permissions are fatal, for example shared TLS certificate and key files with world-read permissions.

Defaults to '`"all -browse"`'.

`boolean file-device?` [`files-configuration` parameter]
Specifies whether the file pseudo-device can be used for new printer queues. The URI `file:///dev/null` is always allowed.

Defaults to '`#f`'.

`string group` [`files-configuration` parameter]
Specifies the group name or ID that will be used when executing external programs.

Defaults to '`"lp"`'.

`string log-file-group` [`files-configuration` parameter]
Specifies the group name or ID that will be used for log files.

Defaults to '`"lpadmin"`'.

`string log-file-perm` [`files-configuration` parameter]
Specifies the permissions for all log files that the scheduler writes.

Defaults to '`"0644"`'.

`log-location page-log` [`files-configuration` parameter]
Defines the page log filename. Specifying a blank filename disables page log generation. The value `stderr` causes log entries to be sent to the standard error file when the scheduler is running in the foreground, or to the system log daemon when run in the background. The value `syslog` causes log entries to be sent to the system log daemon. The server name may be included in filenames using the string `%s`, as in `/var/log/cups/%s-page_log`.

Defaults to '`"/var/log/cups/page_log"`'.

`string remote-root` [`files-configuration` parameter]
Specifies the username that is associated with unauthenticated accesses by clients claiming to be the root user. The default is `remroot`.

Defaults to '`"remroot"`'.

`file-name request-root` [`files-configuration` parameter]
Specifies the directory that contains print jobs and other HTTP request data.

Defaults to '`"/var/spool/cups"`'.

`sandboxing sandboxing` [`files-configuration` parameter]
Specifies the level of security sandboxing that is applied to print filters, backends, and other child processes of the scheduler; either `relaxed` or `strict`. This directive is currently only used/supported on macOS.

Defaults to '`strict`'.

`file-name server-keychain` [`files-configuration` parameter]
Specifies the location of TLS certificates and private keys. CUPS will look for public and private keys in this directory: `.crt` files for PEM-encoded certificates and corresponding `.key` files for PEM-encoded private keys.

Defaults to '`"/etc/cups/ssl"`'.

`file-name server-root` [`files-configuration` parameter]
Specifies the directory containing the server configuration files.

Defaults to '`"/etc/cups"`'.

`boolean sync-on-close?` [`files-configuration` parameter]
Specifies whether the scheduler calls fsync(2) after writing configuration or state files.

Defaults to '`#f`'.

`space-separated-string-list system-group` [`files-configuration` parameter]
Specifies the group(s) to use for `@SYSTEM` group authentication.

`file-name temp-dir` [`files-configuration` parameter]
Specifies the directory where temporary files are stored.

Defaults to '`"/var/spool/cups/tmp"`'.

`string user` [`files-configuration` parameter]
Specifies the user name or ID that is used when running external programs.

Defaults to '`"lp"`'.

`string set-env` [`files-configuration` parameter]
Set the specified environment variable to be passed to child processes.

Defaults to '`"variable value"`'.

`access-log-level access-log-level` [`cups-configuration` parameter]
Specifies the logging level for the AccessLog file. The `config` level logs when printers and classes are added, deleted, or modified and when configuration files are accessed or updated. The `actions` level logs when print jobs are submitted, held, released, modified, or canceled, and any of the conditions for `config`. The `all` level logs all requests.

Defaults to '`actions`'.

`boolean auto-purge-jobs?` [`cups-configuration` parameter]
Specifies whether to purge job history data automatically when it is no longer required for quotas.

Defaults to '`#f`'.

`comma-separated-string-list browse-dns-sd-sub-types` [`cups-configuration` parameter]
Specifies a list of DNS-SD sub-types to advertise for each shared printer.

The default '`(list "_cups" "_print" "_universal")`' tells clients that CUPS sharing, IPP Everywhere, AirPrint, and Mopria are supported.

`browse-local-protocols` [`cups-configuration` parameter]
`browse-local-protocols`
Specifies which protocols to use for local printer sharing.

Defaults to '`dnssd`'.

`boolean browse-web-if?` [`cups-configuration` parameter]
Specifies whether the CUPS web interface is advertised.

Defaults to '`#f`'.

`boolean browsing?` [`cups-configuration` parameter]
Specifies whether shared printers are advertised.

Defaults to '`#f`'.

`default-auth-type default-auth-type` [`cups-configuration` parameter]
Specifies the default type of authentication to use.

Defaults to '`Basic`'.

`default-encryption default-encryption` [`cups-configuration` parameter]
Specifies whether encryption will be used for authenticated requests.

Defaults to '`Required`'.

`string default-language` [`cups-configuration` parameter]
Specifies the default language to use for text and web content.

Defaults to '`"en"`'.

`string default-paper-size` [`cups-configuration` parameter]
Specifies the default paper size for new print queues. '`"Auto"`' uses a locale-specific default, while '`"None"`' specifies there is no default paper size. Specific size names are typically '`"Letter"`' or '`"A4"`'.

Defaults to '`"Auto"`'.

`string default-policy` [`cups-configuration` parameter]
Specifies the default access policy to use.

Defaults to '`"default"`'.

`boolean default-shared?` [`cups-configuration` parameter]
Specifies whether local printers are shared by default.

Defaults to '`#t`'.

`non-negative-integer` [`cups-configuration` parameter]
`dirty-clean-interval`
Specifies the delay for updating of configuration and state files, in seconds. A value of 0 causes the update to happen as soon as possible, typically within a few milliseconds.

Defaults to '`30`'.

`error-policy error-policy` [`cups-configuration` parameter]
Specifies what to do when an error occurs. Possible values are `abort-job`, which will discard the failed print job; `retry-job`, which will retry the job at a later time; `retry-current-job`, which retries the failed job immediately; and `stop-printer`, which stops the printer.

Defaults to '`stop-printer`'.

`non-negative-integer filter-limit` [`cups-configuration` parameter]
Specifies the maximum cost of filters that are run concurrently, which can be used to minimize disk, memory, and CPU resource problems. A limit of 0 disables filter limiting. An average print to a non-PostScript printer needs a filter limit of about 200. A PostScript printer needs about half that (100). Setting the limit below these thresholds will effectively limit the scheduler to printing a single job at any time.

Defaults to '`0`'.

`non-negative-integer filter-nice` [`cups-configuration` parameter]
Specifies the scheduling priority of filters that are run to print a job. The nice value ranges from 0, the highest priority, to 19, the lowest priority.

Defaults to '`0`'.

`host-name-lookups host-name-lookups` [`cups-configuration` parameter]
Specifies whether to do reverse lookups on connecting clients. The `double` setting causes `cupsd` to verify that the hostname resolved from the address matches one of the addresses returned for that hostname. Double lookups also prevent clients with unregistered addresses from connecting to your server. Only set this option to `#t` or `double` if absolutely required.

Defaults to '`#f`'.

`non-negative-integer job-kill-delay` [`cups-configuration` parameter]
Specifies the number of seconds to wait before killing the filters and backend associated with a canceled or held job.

Defaults to '`30`'.

`non-negative-integer job-retry-interval` [`cups-configuration` parameter]
Specifies the interval between retries of jobs in seconds. This is typically used for fax queues but can also be used with normal print queues whose error policy is `retry-job` or `retry-current-job`.

Defaults to '`30`'.

`non-negative-integer job-retry-limit` [`cups-configuration` parameter]
Specifies the number of retries that are done for jobs. This is typically used for fax queues but can also be used with normal print queues whose error policy is `retry-job` or `retry-current-job`.

Defaults to '`5`'.

`boolean keep-alive?` [`cups-configuration` parameter]
Specifies whether to support HTTP keep-alive connections.

Defaults to '`#t`'.

`non-negative-integer limit-request-body` [`cups-configuration` parameter]
Specifies the maximum size of print files, IPP requests, and HTML form data. A limit of 0 disables the limit check.

Defaults to '`0`'.

`multiline-string-list listen` [`cups-configuration` parameter]
Listens on the specified interfaces for connections. Valid values are of the form *address*:*port*, where *address* is either an IPv6 address enclosed in brackets, an IPv4 address, or `*` to indicate all addresses. Values can also be file names of local UNIX domain sockets. The Listen directive is similar to the Port directive but allows you to restrict access to specific interfaces or networks.

`location-access-control-list location-access-controls` [`cups-configuration` parameter]
Specifies a set of additional access controls.

Available `location-access-controls` fields are:

`file-name path` [`location-access-controls` parameter]
Specifies the URI path to which the access control applies.

`access-control-list access-controls` [`location-access-controls` parameter]
Access controls for all access to this path, in the same format as the `access-controls` of `operation-access-control`.

Defaults to '`'()`'.

`method-access-control-list method-access-controls` [`location-access-controls` parameter]
Access controls for method-specific access to this path.

Defaults to '`'()`'.

Available `method-access-controls` fields are:

`boolean reverse?` [`method-access-controls` parameter]
If `#t`, apply access controls to all methods except the listed methods. Otherwise apply to only the listed methods.

Defaults to '`#f`'.

`method-list methods` [`method-access-controls` parameter]
Methods to which this access control applies.

Defaults to '`'()`'.

`access-control-list access-controls` [`method-access-controls` parameter]
Access control directives, as a list of strings. Each string should be one directive, such as '`"Order allow,deny"`'.

Defaults to '`'()`'.

`non-negative-integer log-debug-history` [`cups-configuration` parameter]
Specifies the number of debugging messages that are retained for logging if an error occurs in a print job. Debug messages are logged regardless of the LogLevel setting.

Defaults to '`100`'.

`log-level log-level` [`cups-configuration` parameter]
Specifies the level of logging for the ErrorLog file. The value `none` stops all logging while `debug2` logs everything.

Defaults to '`info`'.

`log-time-format log-time-format` [`cups-configuration` parameter]
Specifies the format of the date and time in the log files. The value `standard` logs whole seconds while `usecs` logs microseconds.

Defaults to '`standard`'.

`non-negative-integer max-clients` [`cups-configuration` parameter]
Specifies the maximum number of simultaneous clients that are allowed by the scheduler.

Defaults to '`100`'.

`non-negative-integer max-clients-per-host` [`cups-configuration` parameter]
Specifies the maximum number of simultaneous clients that are allowed from a single address.

Defaults to '`100`'.

`non-negative-integer max-copies` [`cups-configuration` parameter]
Specifies the maximum number of copies that a user can print of each job.

Defaults to '`9999`'.

`non-negative-integer max-hold-time` [`cups-configuration` parameter]
Specifies the maximum time a job may remain in the `indefinite` hold state before it is canceled. A value of 0 disables cancellation of held jobs.

Defaults to '`0`'.

`non-negative-integer max-jobs` [`cups-configuration` parameter]
Specifies the maximum number of simultaneous jobs that are allowed. Set to 0 to allow an unlimited number of jobs.

Defaults to '`500`'.

`non-negative-integer max-jobs-per-printer` [`cups-configuration` parameter]
Specifies the maximum number of simultaneous jobs that are allowed per printer. A value of 0 allows up to `max-jobs` per printer.

Defaults to '`0`'.

`non-negative-integer max-jobs-per-user` [`cups-configuration` parameter]
Specifies the maximum number of simultaneous jobs that are allowed per user. A value of 0 allows up to `max-jobs` per user.

Defaults to '`0`'.

`non-negative-integer max-job-time` [`cups-configuration` parameter]
Specifies the maximum time a job may take to print before it is canceled, in seconds. Set to 0 to disable cancellation of "stuck" jobs.

Defaults to '`10800`'.

`non-negative-integer max-log-size` [`cups-configuration` parameter]
Specifies the maximum size of the log files before they are rotated, in bytes. The value 0 disables log rotation.

Defaults to '`1048576`'.

`non-negative-integer max-subscriptions` [`cups-configuration` parameter]
Specifies the maximum number of simultaneous event subscriptions that are allowed. Set to '`0`' to allow an unlimited number of subscriptions.

Defaults to '`0`'.

`non-negative-integer max-subscriptions-per-job` [`cups-configuration` parameter]
Specifies the maximum number of simultaneous event subscriptions that are allowed per job. A value of '`0`' allows up to `max-subscriptions` per job.

Defaults to '`0`'.

`non-negative-integer max-subscriptions-per-printer` [`cups-configuration` parameter]
Specifies the maximum number of simultaneous event subscriptions that are allowed per printer. A value of '`0`' allows up to `max-subscriptions` per printer.

Defaults to '`0`'.

`non-negative-integer max-subscriptions-per-user` [`cups-configuration` parameter]
Specifies the maximum number of simultaneous event subscriptions that are allowed per user. A value of '`0`' allows up to `max-subscriptions` per user.

Defaults to '`0`'.

`non-negative-integer multiple-operation-timeout` [`cups-configuration` parameter]
Specifies the maximum amount of time to allow between files in a multiple file print job, in seconds.

Defaults to '`900`'.

`environment-variables environment-variables` [`cups-configuration` parameter]
Passes the specified environment variable(s) to child processes; a list of strings.

Defaults to '`'()`'.

`policy-configuration-list policies` [`cups-configuration` parameter]

Specifies named access control policies.

Available `policy-configuration` fields are:

`string name` [`policy-configuration` parameter]

Name of the policy.

`string job-private-access` [`policy-configuration` parameter]

Specifies an access list for a job's private values. `@ACL` maps to the printer's requesting-user-name-allowed or requesting-user-name-denied values. `@OWNER` maps to the job's owner. `@SYSTEM` maps to the groups listed for the `system-group` field of the `files-configuration`, which is reified into the `cups-files.conf(5)` file. Other possible elements of the access list include specific user names, and `@`*`group`* to indicate members of a specific group. The access list may also be simply `all` or `default`.

Defaults to '`"@OWNER @SYSTEM"`'.

`string job-private-values` [`policy-configuration` parameter]

Specifies the list of job values to make private, or `all`, `default`, or `none`.

Defaults to '`"job-name job-originating-host-name job-originating-user-name phone"`'.

`string subscription-private-access` [`policy-configuration` parameter]

Specifies an access list for a subscription's private values. `@ACL` maps to the printer's requesting-user-name-allowed or requesting-user-name-denied values. `@OWNER` maps to the job's owner. `@SYSTEM` maps to the groups listed for the `system-group` field of the `files-configuration`, which is reified into the `cups-files.conf(5)` file. Other possible elements of the access list include specific user names, and `@`*`group`* to indicate members of a specific group. The access list may also be simply `all` or `default`.

Defaults to '`"@OWNER @SYSTEM"`'.

`string subscription-private-values` [`policy-configuration` parameter]

Specifies the list of job values to make private, or `all`, `default`, or `none`.

Defaults to '`"notify-events notify-pull-method notify-recipient-uri notify-subscriber-user-name notify-user-data"`'.

`operation-access-control-list access-controls` [`policy-configuration` parameter]

Access control by IPP operation.

Defaults to '`'()`'.

`boolean-or-non-negative-integer preserve-job-files` [`cups-configuration` parameter]

Specifies whether job files (documents) are preserved after a job is printed. If a numeric value is specified, job files are preserved for the indicated number of seconds after printing. Otherwise a boolean value applies indefinitely.

Defaults to '86400'.

`boolean-or-non-negative-integer` [`cups-configuration` parameter]
`preserve-job-history`

Specifies whether the job history is preserved after a job is printed. If a numeric value is specified, the job history is preserved for the indicated number of seconds after printing. If `#t`, the job history is preserved until the MaxJobs limit is reached.

Defaults to '`#t`'.

`comma-separated-string-list-or-#f` [`cups-configuration` parameter]
`ready-paper-sizes`

Specifies a list of potential paper sizes that are reported as ready, that is: loaded. The actual list will contain only the sizes that each printer supports.

The default value of `#f` is a special case: CUPS will use '`(list \"Letter\" \"Legal\" \"Tabloid\" \"4x6\" \"Env10\")`' if the default paper size is \"Letter\", and '`(list \"A3\" \"A4\" \"A5\" \"A6\" \"EnvDL\")`' otherwise.

`non-negative-integer reload-timeout` [`cups-configuration` parameter]

Specifies the amount of time to wait for job completion before restarting the scheduler.

Defaults to '30'.

`string server-admin` [`cups-configuration` parameter]

Specifies the email address of the server administrator.

Defaults to '`"root@localhost.localdomain"`'.

`host-name-list-or-* server-alias` [`cups-configuration` parameter]

The ServerAlias directive is used for HTTP Host header validation when clients connect to the scheduler from external interfaces. Using the special name `*` can expose your system to known browser-based DNS rebinding attacks, even when accessing sites through a firewall. If the auto-discovery of alternate names does not work, we recommend listing each alternate name with a ServerAlias directive instead of using `*`.

Defaults to '`*`'.

`string server-name` [`cups-configuration` parameter]

Specifies the fully-qualified host name of the server.

Defaults to '`"localhost"`'.

`server-tokens server-tokens` [`cups-configuration` parameter]

Specifies what information is included in the Server header of HTTP responses. `None` disables the Server header. `ProductOnly` reports `CUPS`. `Major` reports `CUPS 2`. `Minor` reports `CUPS 2.0`. `Minimal` reports `CUPS 2.0.0`. `OS` reports `CUPS 2.0.0 (`*uname*`)` where *uname* is the output of the `uname` command. `Full` reports `CUPS 2.0.0 (`*uname*`) IPP/2.0`.

Defaults to '`Minimal`'.

`multiline-string-list ssl-listen` [`cups-configuration` parameter]
Listens on the specified interfaces for encrypted connections. Valid values are of the form *address*:*port*, where *address* is either an IPv6 address enclosed in brackets, an IPv4 address, or `*` to indicate all addresses.

Defaults to ‘`'()`’.

`ssl-options ssl-options` [`cups-configuration` parameter]
Sets encryption options. By default, CUPS only supports encryption using TLS v1.0 or higher using known secure cipher suites. Security is reduced when `Allow` options are used, and enhanced when `Deny` options are used. The `AllowRC4` option enables the 128-bit RC4 cipher suites, which are required for some older clients. The `AllowSSL3` option enables SSL v3.0, which is required for some older clients that do not support TLS v1.0. The `DenyCBC` option disables all CBC cipher suites. The `DenyTLS1.0` option disables TLS v1.0 support - this sets the minimum protocol version to TLS v1.1.

Defaults to ‘`'()`’.

`boolean strict-conformance?` [`cups-configuration` parameter]
Specifies whether the scheduler requires clients to strictly adhere to the IPP specifications.

Defaults to ‘`#f`’.

`non-negative-integer timeout` [`cups-configuration` parameter]
Specifies the HTTP request timeout, in seconds.

Defaults to ‘`900`’.

`boolean web-interface?` [`cups-configuration` parameter]
Specifies whether the web interface is enabled.

Defaults to ‘`#f`’.

At this point you’re probably thinking “oh dear, Guix manual, I like you but you can stop already with the configuration options”. Indeed. However, one more point: it could be that you have an existing `cupsd.conf` that you want to use. In that case, you can pass an `opaque-cups-configuration` as the configuration of a `cups-service-type`.

Available `opaque-cups-configuration` fields are:

`package cups` [`opaque-cups-configuration` parameter]
The CUPS package.

`string cupsd.conf` [`opaque-cups-configuration` parameter]
The contents of the `cupsd.conf`, as a string.

`string cups-files.conf` [`opaque-cups-configuration` parameter]
The contents of the `cups-files.conf` file, as a string.

For example, if your `cupsd.conf` and `cups-files.conf` are in strings of the same name, you could instantiate a CUPS service like this:

```
(service cups-service-type
         (opaque-cups-configuration
           (cupsd.conf cupsd.conf)
           (cups-files.conf cups-files.conf)))
```

11.10.9 Serviços de desktop

The `(gnu services desktop)` module provides services that are usually useful in the context of a "desktop" setup—that is, on a machine running a graphical display server, possibly with graphical user interfaces, etc. It also defines services that provide specific desktop environments like GNOME, Xfce or MATE.

To simplify things, the module defines a variable containing the set of services that users typically expect on a machine with a graphical environment and networking:

`%desktop-services` [Variável]

This is a list of services that builds upon `%base-services` and adds or adjusts services for a typical "desktop" setup.

In particular, it adds a graphical login manager (veja Seção 11.10.7 [X Window], Página 332), screen lockers, a network management tool (veja Seção 11.10.5 [Serviços de Rede], Página 306) with modem support (veja Seção 11.10.5 [Serviços de Rede], Página 306), energy and color management services, the `elogind` login and seat manager, the Polkit privilege service, the GeoClue location service, the AccountsService daemon that allows authorized users change system passwords, a NTP client (veja Seção 11.10.5 [Serviços de Rede], Página 306) and the Avahi daemon.

The `%desktop-services` variable can be used as the `services` field of an `operating-system` declaration (veja Seção 11.3 [Referência do operating-system], Página 247).

Additionally, the following procedures add one (or more!) desktop environments to a system.

- `gnome-desktop-service-type` adds GNOME,
- `plasma-desktop-service-type` adds KDE Plasma,
- `enlightenment-desktop-service-type` adds Enlightenment,
- `lxqt-desktop-service-type` adds LXQt,
- `mate-desktop-service-type` adds MATE, and
- `xfce-desktop-service` adds Xfce.

These service types add "metapackages" such as `gnome` or `plasma` to the system profile, but most of them also set up other useful services that mere packages can't do.

For example, they may elevate privileges on a limited number of special-purpose system interfaces and programs. This allows backlight adjustment helpers, power management utilities, screen lockers, and other integrated functionality to work as expected.

The desktop environments in Guix use the Xorg display server by default. If you'd like to use the newer display server protocol called Wayland, you need to enable Wayland support in GDM (veja [wayland-gdm], Página 332). Another solution is to use the `sddm-service` instead of GDM as the graphical login manager. You should then select the "GNOME (Wayland)" session in SDDM. Alternatively you can also try starting GNOME on Wayland manually from a TTY with the command "XDG_SESSION_TYPE=wayland exec dbus-run-session gnome-session". Currently only GNOME has support for Wayland.

`gnome-desktop-service-type` [Variável]

This is the type of the service that adds the GNOME (`https://www.gnome.org`) desktop environment. Its value is a `gnome-desktop-configuration` object (see below).

This service adds the `gnome` package to the system profile, and extends polkit with the actions from `gnome-settings-daemon`.

`gnome-desktop-configuration` [Data Type]
Configuration record for the GNOME desktop environment. Available `gnome-desktop-configuration` fields are:

`core-services` (type: list-of-packages)
A list of packages that the GNOME Shell and applications may rely on.

`shell` (type: list-of-packages)
A list of packages that constitute the GNOME Shell, without applications.

`utilities` (type: list-of-packages)
A list of packages that serve as applications to use on top of the GNOME Shell.

`gnome` (type: maybe-package)
This field used to be the only configuration point and specified a GNOME meta-package to install system-wide. Since the meta-package itself provides neither sources nor the actual packages and is only used to propagate them, this field is deprecated.

`extra-packages` (type: list-of-packages)
A list of GNOME-adjacent packages to also include. This field is intended for users to add their own packages to their GNOME experience. Note, that it already includes some packages that are considered essential by some (most?) GNOME users.

`udev-ignorelist` (default: `()`) (type: list-of-strings)
A list of regular expressions denoting udev rules or hardware file names provided by any package that should not be installed. By default, every udev rule and hardware file specified by any package referenced in the other fields are installed.

`polkit-ignorelist` (default: `()`) (type: list-of-strings)
A list of regular expressions denoting polkit rules provided by any package that should not be installed. By default, every polkit rule added by any package referenced in the other fields are installed.

`plasma-desktop-service-type` [Variável]
This is the type of the service that adds the Plasma (`https://kde.org/plasma-desktop/`) desktop environment. Its value is a `plasma-desktop-configuration` object (see below).

This service adds the `plasma` package to the system profile.

`plasma-desktop-configuration` [Data Type]
Configuration record for the Plasma desktop environment.

`plasma` (default: `plasma`)
The Plasma package to use.

`xfce-desktop-service-type` [Variável]
This is the type of a service to run the https://xfce.org/ (`Xfce`) desktop environment. Its value is an `xfce-desktop-configuration` object (see below).

This service adds the `xfce` package to the system profile, and extends polkit with the ability for `thunar` to manipulate the file system as root from within a user session, after the user has authenticated with the administrator's password.

Note that `xfce4-panel` and its plugin packages should be installed in the same profile to ensure compatibility. When using this service, you should add extra plugins (`xfce4-whiskermenu-plugin`, `xfce4-weather-plugin`, etc.) to the `packages` field of your `operating-system`.

`xfce-desktop-configuration` [Data Type]
Configuration record for the Xfce desktop environment.

`xfce` (default: `xfce`)
The Xfce package to use.

`mate-desktop-service-type` [Variável]
This is the type of the service that runs the MATE desktop environment (`https://mate-desktop.org/`). Its value is a `mate-desktop-configuration` object (see below).

This service adds the `mate` package to the system profile, and extends polkit with the actions from `mate-settings-daemon`.

`mate-desktop-configuration` [Data Type]
Configuration record for the MATE desktop environment.

`mate` (default: `mate`)
The MATE package to use.

`lxqt-desktop-service-type` [Variável]
This is the type of the service that runs the LXQt desktop environment (`https://lxqt-project.org`). Its value is a `lxqt-desktop-configuration` object (see below).

This service adds the `lxqt` package to the system profile.

`lxqt-desktop-configuration` [Data Type]
Configuration record for the LXQt desktop environment.

`lxqt` (default: `lxqt`)
The LXQT package to use.

`sugar-desktop-service-type` [Variável]
This is the type of the service that runs the Sugar desktop environment (`https://www.sugarlabs.org`). Its value is a `sugar-desktop-configuration` object (see below).

This service adds the `sugar` package to the system profile, as well as any selected Sugar activities. By default it only includes a minimal set of activities.

`sugar-desktop-configuration` [Data Type]

Configuration record for the Sugar desktop environment.

`sugar` (default: `sugar`)
The Sugar package to use.

`gobject-introspection` (default: `gobject-introspection`)
The `gobject-introspection` package to use. This package is used to access libraries installed as dependencies of Sugar activities.

`activities` (default: `(list sugar-help-activity)`)
A list of Sugar activities to install.

The following example configures the Sugar desktop environment with a number of useful activities:

```
(use-modules (gnu))
(use-package-modules sugar)
(use-service-modules desktop)
(operating-system
  ...
  (services (cons* (service sugar-desktop-service-type
                            (sugar-desktop-configuration
                              (activities (list sugar-browse-activity
                                                sugar-help-activity
                                                sugar-jukebox-activity
                                                sugar-typing-turtle-activity))))
                   %desktop-services))
  ...)
```

`enlightenment-desktop-service-type` [Variável]

Return a service that adds the `enlightenment` package to the system profile, and extends dbus with actions from `efl`.

`enlightenment-desktop-service-configuration` [Data Type]

`enlightenment` (default: `enlightenment`)
The enlightenment package to use.

Because the GNOME, Xfce and MATE desktop services pull in so many packages, the default `%desktop-services` variable doesn't include any of them by default. To add GNOME, Xfce or MATE, just `cons` them onto `%desktop-services` in the `services` field of your `operating-system`:

```
(use-modules (gnu))
(use-service-modules desktop)
(operating-system
  ...
  ;; cons* adds items to the list given as its last argument.
  (services (cons* (service gnome-desktop-service-type)
                   (service xfce-desktop-service)
                   %desktop-services))
```

```
...)
```

These desktop environments will then be available as options in the graphical login window.

The actual service definitions included in `%desktop-services` and provided by `(gnu services dbus)` and `(gnu services desktop)` are described below.

`dbus-root-service-type` [Variável]

Type for a service that runs the D-Bus "system bus".[7]

The value for this service type is a `<dbus-configuration>` record.

`dbus-configuration` [Data Type]

Data type representing the configuration for `dbus-root-service-type`.

`dbus` (default: `dbus`) (type: file-like)
Package object for dbus.

`services` (default: `'()`) (type: list)
List of packages that provide an `etc/dbus-1/system.d` directory containing additional D-Bus configuration and policy files. For example, to allow avahi-daemon to use the system bus, *services* must be equal to `(list avahi)`.

`verbose?` (default: `#f`) (type: boolean)
When `#t`, D-Bus is launched with environment variable '`DBUS_VERBOSE`' set to '`1`'. A verbose-enabled D-Bus package such as `dbus-verbose` should be provided to *dbus* in this scenario. The verbose output is logged to `/var/log/dbus-daemon.log`.

Elogind

Elogind (`https://github.com/elogind/elogind`) is a login and seat management daemon that also handles most system-level power events for a computer, for example suspending the system when a lid is closed, or shutting it down when the power button is pressed.

It also provides a D-Bus interface that can be used to know which users are logged in, know what kind of sessions they have open, suspend the system, inhibit system suspend, reboot the system, and other tasks.

`elogind-service-type` [Variável]

Type of the service that runs `elogind`, a login and seat management daemon. The value for this service is a `<elogind-configuration>` object.

`elogind-configuration` [Data Type]

Data type representing the configuration of `elogind`.

`elogind` (default: `elogind`) (type: file-like)
...

`kill-user-processes?` (default: `#f`) (type: boolean)
...

[7] D-Bus (`https://dbus.freedesktop.org/`) is an inter-process communication facility. Its system bus is used to allow system services to communicate and to be notified of system-wide events.

`kill-only-users` (default: `'()`) (type: list)
...

`kill-exclude-users` (default: `'("root")`) (type: list-of-string)
...

`inhibit-delay-max-seconds` (default: `5`) (type: integer)
...

`handle-power-key` (default: `'poweroff`) (type: symbol)
...

`handle-suspend-key` (default: `'suspend`) (type: symbol)
...

`handle-hibernate-key` (default: `'hibernate`) (type: symbol)
...

`handle-lid-switch` (default: `'suspend`) (type: symbol)
...

`handle-lid-switch-docked` (default: `'ignore`) (type: symbol)
...

`handle-lid-switch-external-power` (default: `*unspecified*`) (type: symbol)
...

`power-key-ignore-inhibited?` (default: `#f`) (type: boolean)
...

`suspend-key-ignore-inhibited?` (default: `#f`) (type: boolean)
...

`hibernate-key-ignore-inhibited?` (default: `#f`) (type: boolean)
...

`lid-switch-ignore-inhibited?` (default: `#t`) (type: boolean)
...

`holdoff-timeout-seconds` (default: `30`) (type: integer)
...

`idle-action` (default: `'ignore`) (type: symbol)
...

`idle-action-seconds` (default: `(* 30 60)`) (type: integer)
...

`runtime-directory-size-percent` (default: `10`) (type: integer)
...

`runtime-directory-size` (default: `#f`) (type: integer)
...

`remove-ipc?` (default: `#t`) (type: boolean)
...

`suspend-state` (default: `'("mem" "standby" "freeze")`) (type: list)
...

`suspend-mode` (default: `'()`) (type: list)
...

`hibernate-state` (default: `'("disk")`) (type: list)
...

`hibernate-mode` (default: `'("platform" "shutdown")`) (type: list)
...

`hybrid-sleep-state` (default: `'("disk")`) (type: list)
...

`hybrid-sleep-mode` (default: `'("suspend" "platform" "shutdown")`) (type: list)
...

`hibernate-delay-seconds` (default: `*unspecified*`) (type: integer)
...

`suspend-estimation-seconds` (default: `*unspecified*`) (type: integer)
...

`accountsservice-service-type` [Variável]

Type for the service that runs AccountsService, a system service that can list available accounts, change their passwords, and so on. AccountsService integrates with PolicyKit to enable unprivileged users to acquire the capability to modify their system configuration. See AccountsService (`https://www.freedesktop.org/wiki/Software/AccountsService/`) for more information.

The value for this service is a file-like object, by default it is set to `accountsservice` (the package object for AccountsService).

`polkit-service-type` [Variável]

Type for the service that runs the Polkit privilege management service (`https://www.freedesktop.org/wiki/Software/polkit/`), which allows system administrators to grant access to privileged operations in a structured way. By querying the Polkit service, a privileged system component can know when it should grant additional capabilities to ordinary users. For example, an ordinary user can be granted the capability to suspend the system if the user is logged in locally.

The value for this service is a `<polkit-configuration>` object.

`polkit-wheel-service` [Variável]

Service that adds the `wheel` group as admins to the Polkit service. This makes it so that users in the `wheel` group are queried for their own passwords when performing administrative actions instead of `root`'s, similar to the behaviour used by `sudo`.

`upower-service-type` [Variável]

Service that runs `upowerd` (`https://upower.freedesktop.org/`), a system-wide monitor for power consumption and battery levels, with the given configuration settings.

It implements the `org.freedesktop.UPower` D-Bus interface, and is notably used by GNOME.

`upower-configuration` [Data Type]

Data type representation the configuration for UPower.

`upower` (default: *upower*)
: Package to use for `upower`.

`watts-up-pro?` (padrão: `#f`)
: Enable the Watts Up Pro device.

`poll-batteries?` (padrão: `#t`)
: Enable polling the kernel for battery level changes.

`ignore-lid?` (padrão: `#f`)
: Ignore the lid state, this can be useful if it's incorrect on a device.

`use-percentage-for-policy?` (default: `#t`)
: Whether to use a policy based on battery percentage rather than on estimated time left. A policy based on battery percentage is usually more reliable.

`percentage-low` (default: `20`)
: When `use-percentage-for-policy?` is `#t`, this sets the percentage at which the battery is considered low.

`percentage-critical` (default: `5`)
: When `use-percentage-for-policy?` is `#t`, this sets the percentage at which the battery is considered critical.

`percentage-action` (default: `2`)
: When `use-percentage-for-policy?` is `#t`, this sets the percentage at which action will be taken.

`time-low` (default: `1200`)
: When `use-time-for-policy?` is `#f`, this sets the time remaining in seconds at which the battery is considered low.

`time-critical` (default: `300`)
: When `use-time-for-policy?` is `#f`, this sets the time remaining in seconds at which the battery is considered critical.

`time-action` (default: `120`)
: When `use-time-for-policy?` is `#f`, this sets the time remaining in seconds at which action will be taken.

`critical-power-action` (default: `'hybrid-sleep`)
: The action taken when `percentage-action` or `time-action` is reached (depending on the configuration of `use-percentage-for-policy?`).

  Possible values are:

  - `'power-off`
  - `'hibernate`
  - `'hybrid-sleep`.

`udisks-service-type` [Variável]

Type for the service that runs UDisks (`https://udisks.freedesktop.org/docs/latest/`), a *disk management* daemon that provides user interfaces with notifications and ways to mount/unmount disks. Programs that talk to UDisks include the `udisksctl` command, part of UDisks, and GNOME Disks. Note that Udisks relies on the `mount` command, so it will only be able to use the file-system utilities installed in the system profile. For example if you want to be able to mount NTFS file-systems in read and write fashion, you'll need to have `ntfs-3g` installed system-wide.

The value for this service is a `<udisks-configuration>` object.

`udisks-configuration` [Data Type]

Data type representing the configuration for `udisks-service-type`.

`udisks` (default: `udisks`) (type: file-like)
Package object for UDisks.

`gvfs-service-type` [Variável]

Type for the service that provides virtual file systems for GIO applications, which enables support for `trash://`, `ftp://`, `sftp://` and many other location schemas in file managers like Nautilus (GNOME Files) and Thunar.

The value for this service is a `<gvfs-configuration>` object.

`gvfs-configuration` [Data Type]

Data type representing the configuration for `gvfs-service-type`.

`gvfs` (default: `gvfs`) (type: file-like)
Package object for GVfs.

`colord-service-type` [Variável]

This is the type of the service that runs `colord`, a system service with a D-Bus interface to manage the color profiles of input and output devices such as screens and scanners. It is notably used by the GNOME Color Manager graphical tool. See the colord web site (`https://www.freedesktop.org/software/colord/`) for more information.

`sane-service-type` [Variável]

This service provides access to scanners *via* SANE (`http://www.sane-project.org`) by installing the necessary udev rules. It is included in `%desktop-services` (veja Seção 11.10.9 [Serviços de desktop], Página 354) and relies by default on `sane-backends-minimal` package (see below) for hardware support.

`sane-backends-minimal` [Variável]

The default package which the `sane-service-type` installs. It supports many recent scanners.

`sane-backends` [Variável]

This package includes support for all scanners that `sane-backends-minimal` supports, plus older Hewlett-Packard scanners supported by `hplip` package. In order to use this on a system which relies on `%desktop-services`, you may use `modify-services` (veja Seção 11.19.3 [Referência de Service], Página 634) as illustrated below:

```
(use-modules (gnu))
```

```
(use-service-modules
  ...
  desktop)
(use-package-modules
  ...
  scanner)

(define %my-desktop-services
  ;; List of desktop services that supports a broader range of scanners.
  (modify-services %desktop-services
    (sane-service-type _ => sane-backends)))

(operating-system
  ...
  (services %my-desktop-services))
```

`geoclue-application` *name* [*#:allowed? #t*] [*#:system? #f*] [*#:users '()*] [Procedure]

Return a configuration allowing an application to access GeoClue location data. *name* is the Desktop ID of the application, without the `.desktop` part. If *allowed?* is true, the application will have access to location information by default. The boolean *system?* value indicates whether an application is a system component or not. Finally *users* is a list of UIDs of all users for which this application is allowed location info access. An empty users list means that all users are allowed.

`%standard-geoclue-applications` [Variável]

The standard list of well-known GeoClue application configurations, granting authority to the GNOME date-and-time utility to ask for the current location in order to set the time zone, and allowing the IceCat and Epiphany web browsers to request location information. IceCat and Epiphany both query the user before allowing a web page to know the user's location.

`geoclue-service-type` [Variável]

Type for the service that runs the GeoClue (`https://wiki.freedesktop.org/www/Software/GeoClue/`) location service. This service provides a D-Bus interface to allow applications to request access to a user's physical location, and optionally to add information to online location databases.

The value for this service is a `<geoclue-configuration>` object.

`bluetooth-service-type` [Variável]

This is the type for the Linux Bluetooth Protocol Stack (`https://bluez.org/`) (BlueZ) system, which generates the `/etc/bluetooth/main.conf` configuration file. The value for this type is a `bluetooth-configuration` record as in this example:

```
(service bluetooth-service-type)
```

See below for details about `bluetooth-configuration`.

`bluetooth-configuration` [Data Type]

Data type representing the configuration for `bluetooth-service`.

`bluez` (default: `bluez`)
: `bluez` package to use.

`name` (default: `"BlueZ"`)
: Default adapter name.

`class` (default: `#x000000`)
: Default device class. Only the major and minor device class bits are considered.

`discoverable-timeout` (default: `180`)
: How long to stay in discoverable mode before going back to non-discoverable. The value is in seconds.

`always-pairable?` (default: `#f`)
: Always allow pairing even if there are no agents registered.

`pairable-timeout` (default: `0`)
: How long to stay in pairable mode before going back to non-discoverable. The value is in seconds.

`device-id` (default: `#f`)
: Use vendor id source (assigner), vendor, product and version information for DID profile support. The values are separated by `":"` and *assigner*, *VID*, *PID* and *version*.

  Possible values are:

  - `#f` to disable it,
  - `"assigner:1234:5678:abcd"`, where *assigner* is either `usb` (default) or `bluetooth`.

`reverse-service-discovery?` (default: `#t`)
: Do reverse service discovery for previously unknown devices that connect to us. For BR/EDR this option is really only needed for qualification since the BITE tester doesn't like us doing reverse SDP for some test cases, for LE this disables the GATT client functionally so it can be used in system which can only operate as peripheral.

`name-resolving?` (default: `#t`)
: Enable name resolving after inquiry. Set it to `#f` if you don't need remote devices name and want shorter discovery cycle.

`debug-keys?` (default: `#f`)
: Enable runtime persistency of debug link keys. Default is false which makes debug link keys valid only for the duration of the connection that they were created for.

`controller-mode` (default: `'dual`)
: Restricts all controllers to the specified transport. `'dual` means both BR/EDR and LE are enabled (if supported by the hardware).

  Possible values are:

  - `'dual`

- `'bredr`
- `'le`

`multi-profile` (default: `'off`)
: Enables Multi Profile Specification support. This allows to specify if system supports only Multiple Profiles Single Device (MPSD) configuration or both Multiple Profiles Single Device (MPSD) and Multiple Profiles Multiple Devices (MPMD) configurations.

  Possible values are:

  - `'off`
  - `'single`
  - `'multiple`

`fast-connectable?` (default: `#f`)
: Permanently enables the Fast Connectable setting for adapters that support it. When enabled other devices can connect faster to us, however the tradeoff is increased power consumptions. This feature will fully work only on kernel version 4.1 and newer.

`privacy` (default: `'off`)
: Default privacy settings.

  - `'off`: Disable local privacy
  - `'network/on`: A device will only accept advertising packets from peer devices that contain private addresses. It may not be compatible with some legacy devices since it requires the use of RPA(s) all the time
  - `'device`: A device in device privacy mode is only concerned about the privacy of the device and will accept advertising packets from peer devices that contain their Identity Address as well as ones that contain a private address, even if the peer device has distributed its IRK in the past

  and additionally, if *controller-mode* is set to `'dual`:

  - `'limited-network`: Apply Limited Discoverable Mode to advertising, which follows the same policy as to BR/EDR that publishes the identity address when discoverable, and Network Privacy Mode for scanning
  - `'limited-device`: Apply Limited Discoverable Mode to advertising, which follows the same policy as to BR/EDR that publishes the identity address when discoverable, and Device Privacy Mode for scanning.

`just-works-repairing` (default: `'never`)
: Specify the policy to the JUST-WORKS repairing initiated by peer.

  Possible values:

  - `'never`
  - `'confirm`
  - `'always`

`temporary-timeout` (default: `30`)
: How long to keep temporary devices around. The value is in seconds. `0` disables the timer completely.

`refresh-discovery?` (default: `#t`)
: Enables the device to issue an SDP request to update known services when profile is connected.

`experimental` (default: `#f`)
: Enables experimental features and interfaces, alternatively a list of UUIDs can be given.

  Possible values:

  - `#t`
  - `#f`
  - `(list (uuid <uuid-1>) (uuid <uuid-2>) ...)`.

  List of possible UUIDs:

  - `d4992530-b9ec-469f-ab01-6c481c47da1c`: BlueZ Experimental Debug,
  - `671b10b5-42c0-4696-9227-eb28d1b049d6`: BlueZ Experimental Simultaneous Central and Peripheral,
  - `15c0a148-c273-11ea-b3de-0242ac130004`: BlueZ Experimental LL privacy,
  - `330859bc-7506-492d-9370-9a6f0614037f`: BlueZ Experimental Bluetooth Quality Report,
  - `a6695ace-ee7f-4fb9-881a-5fac66c629af`: BlueZ Experimental Offload Codecs.

`remote-name-request-retry-delay` (default: `300`)
: The duration to avoid retrying to resolve a peer's name, if the previous try failed.

`page-scan-type` (default: `#f`)
: BR/EDR Page scan activity type.

`page-scan-interval` (default: `#f`)
: BR/EDR Page scan activity interval.

`page-scan-window` (default: `#f`)
: BR/EDR Page scan activity window.

`inquiry-scan-type` (default: `#f`)
: BR/EDR Inquiry scan activity type.

`inquiry-scan-interval` (default: `#f`)
: BR/EDR Inquiry scan activity interval.

`inquiry-scan-window` (default: `#f`)
: BR/EDR Inquiry scan activity window.

`link-supervision-timeout` (default: `#f`)
: BR/EDR Link supervision timeout.

`page-timeout` (default: `#f`)
: BR/EDR Page timeout.

`min-sniff-interval` (default: `#f`)
: BR/EDR minimum sniff interval.

`max-sniff-interval` (default: `#f`)
: BR/EDR maximum sniff interval.

`min-advertisement-interval` (default: `#f`)
: LE minimum advertisement interval (used for legacy advertisement only).

`max-advertisement-interval` (default: `#f`)
: LE maximum advertisement interval (used for legacy advertisement only).

`multi-advertisement-rotation-interval` (default: `#f`)
: LE multiple advertisement rotation interval.

`scan-interval-auto-connect` (default: `#f`)
: LE scanning interval used for passive scanning supporting auto connect.

`scan-window-auto-connect` (default: `#f`)
: LE scanning window used for passive scanning supporting auto connect.

`scan-interval-suspend` (default: `#f`)
: LE scanning interval used for active scanning supporting wake from suspend.

`scan-window-suspend` (default: `#f`)
: LE scanning window used for active scanning supporting wake from suspend.

`scan-interval-discovery` (default: `#f`)
: LE scanning interval used for active scanning supporting discovery.

`scan-window-discovery` (default: `#f`)
: LE scanning window used for active scanning supporting discovery.

`scan-interval-adv-monitor` (default: `#f`)
: LE scanning interval used for passive scanning supporting the advertisement monitor APIs.

`scan-window-adv-monitor` (default: `#f`)
: LE scanning window used for passive scanning supporting the advertisement monitor APIs.

`scan-interval-connect` (default: `#f`)
: LE scanning interval used for connection establishment.

`scan-window-connect` (default: `#f`)
: LE scanning window used for connection establishment.

`min-connection-interval` (default: `#f`)
: LE default minimum connection interval. This value is superseded by any specific value provided via the Load Connection Parameters interface.

`max-connection-interval` (default: `#f`)
: LE default maximum connection interval. This value is superseded by any specific value provided via the Load Connection Parameters interface.

`connection-latency` (default: `#f`)
: LE default connection latency. This value is superseded by any specific value provided via the Load Connection Parameters interface.

`connection-supervision-timeout` (default: `#f`)
: LE default connection supervision timeout. This value is superseded by any specific value provided via the Load Connection Parameters interface.

`autoconnect-timeout` (default: `#f`)
: LE default autoconnect timeout. This value is superseded by any specific value provided via the Load Connection Parameters interface.

`adv-mon-allowlist-scan-duration` (default: `300`)
: Allowlist scan duration during interleaving scan. Only used when scanning for ADV monitors. The units are msec.

`adv-mon-no-filter-scan-duration` (default: `500`)
: No filter scan duration during interleaving scan. Only used when scanning for ADV monitors. The units are msec.

`enable-adv-mon-interleave-scan?` (default: `#t`)
: Enable/Disable Advertisement Monitor interleave scan for power saving.

`cache` (default: `'always`)
: GATT attribute cache.

  Possible values are:

  - `'always`: Always cache attributes even for devices not paired, this is recommended as it is best for interoperability, with more consistent reconnection times and enables proper tracking of notifications for all devices
  - `'yes`: Only cache attributes of paired devices
  - `'no`: Never cache attributes.

`key-size` (default: `0`)
: Minimum required Encryption Key Size for accessing secured characteristics.

  Possible values are:

  - `0`: Don't care
  - `7 <= N <= 16`

`exchange-mtu` (default: `517`)
: Exchange MTU size. Possible values are:

  - `23 <= N <= 517`

`att-channels` (default: `3`)
: Number of ATT channels. Possible values are:

  - `1`: Disables EATT

- `2 <= N <= 5`

`session-mode` (default: `'basic`)
AVDTP L2CAP signalling channel mode.

Possible values are:

- `'basic`: Use L2CAP basic mode
- `'ertm`: Use L2CAP enhanced retransmission mode.

`stream-mode` (default: `'basic`)
AVDTP L2CAP transport channel mode.

Possible values are:

- `'basic`: Use L2CAP basic mode
- `'streaming`: Use L2CAP streaming mode.

`reconnect-uuids` (default: `'()`)
The ReconnectUUIDs defines the set of remote services that should try to be reconnected to in case of a link loss (link supervision timeout). The policy plugin should contain a sane set of values by default, but this list can be overridden here. By setting the list to empty the reconnection feature gets disabled.

Possible values:

- `'()`
- `(list (uuid <uuid-1>) (uuid <uuid-2>) ...)`.

`reconnect-attempts` (default: `7`)
Defines the number of attempts to reconnect after a link lost. Setting the value to 0 disables reconnecting feature.

`reconnect-intervals` (default: `'(1 2 4 8 16 32 64)`)
Defines a list of intervals in seconds to use in between attempts. If the number of attempts defined in *reconnect-attempts* is bigger than the list of intervals the last interval is repeated until the last attempt.

`auto-enable?` (default: `#f`)
Defines option to enable all controllers when they are found. This includes adapters present on start as well as adapters that are plugged in later on.

`resume-delay` (default: `2`)
Audio devices that were disconnected due to suspend will be reconnected on resume. *resume-delay* determines the delay between when the controller resumes from suspend and a connection attempt is made. A longer delay is better for better co-existence with Wi-Fi. The value is in seconds.

`rssi-sampling-period` (default: `#xFF`)
Default RSSI Sampling Period. This is used when a client registers an advertisement monitor and leaves the RSSISamplingPeriod unset.

Possible values are:

- `#x0`: Report all advertisements

- `N = #xXX`: Report advertisements every N x 100 msec (range: #x01 to #xFE)
- `#xFF`: Report only one advertisement per device during monitoring period.

`gnome-keyring-service-type` [Variável]

This is the type of the service that adds the GNOME Keyring (`https://wiki.gnome.org/Projects/GnomeKeyring`). Its value is a `gnome-keyring-configuration` object (see below).

This service adds the `gnome-keyring` package to the system profile and extends PAM with entries using `pam_gnome_keyring.so`, unlocking a user's login keyring when they log in or setting its password with passwd.

`gnome-keyring-configuration` [Data Type]

Configuration record for the GNOME Keyring service.

`keyring` (default: `gnome-keyring`)
: The GNOME keyring package to use.

`pam-services`
: A list of `(`*`service . kind`*`)` pairs denoting PAM services to extend, where *service* is the name of an existing service to extend and *kind* is one of `login` or `passwd`.

  If `login` is given, it adds an optional `pam_gnome_keyring.so` to the auth block without arguments and to the session block with `auto_start`. If `passwd` is given, it adds an optional `pam_gnome_keyring.so` to the password block without arguments.

  By default, this field contains "gdm-password" with the value `login` and "passwd" is with the value `passwd`.

`seatd-service-type` [Variável]

seatd (`https://sr.ht/~kennylevinsen/seatd/`) is a minimal seat management daemon.

Seat management takes care of mediating access to shared devices (graphics, input), without requiring the applications needing access to be root.

```
(append
  (list
   ;; make sure seatd is running
   (service seatd-service-type))

  ;; normally one would want %base-services
  %base-services)
```

`seatd` operates over a UNIX domain socket, with `libseat` providing the client side of the protocol. Applications that acquire access to the shared resources via `seatd` (e.g. `sway`) need to be able to talk to this socket. This can be achieved by adding the user they run under to the group owning `seatd`'s socket (usually "seat"), like so:

```
(user-account
```

```
          (name "alice")
          (group "users")
          (supplementary-groups '("wheel"   ; allow use of sudo, etc.
                                  "seat"    ; seat management
                                  "audio"   ; sound card
                                  "video"   ; video devices such as webcams
                                  "cdrom")) ; the good ol' CD-ROM
          (comment "Bob's sister"))
```

Depending on your setup, you will have to not only add regular users, but also system users to this group. For instance, some greetd greeters require graphics and therefore also need to negotiate with seatd.

`seatd-configuration` [Data Type]

Configuration record for the seatd daemon service.

`seatd` (default: `seatd`)
: The seatd package to use.

`group` (default: '`"seat"`')
: Group to own the seatd socket.

`socket` (default: '`"/run/seatd.sock"`')
: Where to create the seatd socket.

`logfile` (default: '`"/var/log/seatd.log"`')
: Log file to write to.

`loglevel` (default: '`"error"`')
: Log level to output logs. Possible values: '`"silent"`', '`"error"`', '`"info"`' and '`"debug"`'.

11.10.10 Serviços de som

The `(gnu services sound)` module provides a service to configure the Advanced Linux Sound Architecture (ALSA) system, which makes PulseAudio the preferred ALSA output driver.

`alsa-service-type` [Variável]

This is the type for the Advanced Linux Sound Architecture (`https://alsa-project.org/`) (ALSA) system, which generates the `/etc/asound.conf` configuration file. The value for this type is a `alsa-configuration` record as in this example:

```
(service alsa-service-type)
```

See below for details about `alsa-configuration`.

`alsa-configuration` [Data Type]

Data type representing the configuration for `alsa-service`.

`alsa-plugins` (default: *alsa-plugins*)
: `alsa-plugins` package to use.

`pulseaudio?` (default: *#t*)
: Whether ALSA applications should transparently be made to use the PulseAudio (`https://www.pulseaudio.org/`) sound server.

  Using PulseAudio allows you to run several sound-producing applications at the same time and to individual control them *via* `pavucontrol`, among other things.

`extra-options` (default: `""`)
: String to append to the `/etc/asound.conf` file.

Individual users who want to override the system configuration of ALSA can do it with the `~/.asoundrc` file:

```
# In guix, we have to specify the absolute path for plugins.
pcm_type.jack {
  lib "/home/alice/.guix-profile/lib/alsa-lib/libasound_module_pcm_jack.so"
}

# Routing ALSA to jack:
# <http://jackaudio.org/faq/routing_alsa.html>.
pcm.rawjack {
  type jack
  playback_ports {
    0 system:playback_1
    1 system:playback_2
  }

  capture_ports {
    0 system:capture_1
    1 system:capture_2
  }
}

pcm.!default {
  type plug
  slave {
    pcm "rawjack"
  }
}
```

See `https://www.alsa-project.org/main/index.php/Asoundrc` for the details.

`pulseaudio-service-type` [Variável]
: This is the type for the PulseAudio (`https://www.pulseaudio.org/`) sound server. It exists to allow system overrides of the default settings via `pulseaudio-configuration`, see below.

  Aviso: This service overrides per-user configuration files. If you want PulseAudio to honor configuration files in `~/.config/pulse`, you have to unset the environment variables `PULSE_CONFIG` and `PULSE_CLIENTCONFIG` in your `~/.bash_profile`.

> **Aviso:** This service on its own does not ensure, that the `pulseaudio` package exists on your machine. It merely adds configuration files for it, as detailed below. In the (admittedly unlikely) case, that you find yourself without a `pulseaudio` package, consider enabling it through the `alsa-service-type` above.

`pulseaudio-configuration` [Data Type]

Data type representing the configuration for `pulseaudio-service`.

`client-conf` (default: `'()`)
: List of settings to set in `client.conf`. Accepts a list of strings or symbol-value pairs. A string will be inserted as-is with a newline added. A pair will be formatted as "key = value", again with a newline added.

`daemon-conf` (default: `'((flat-volumes . no))`)
: List of settings to set in `daemon.conf`, formatted just like *client-conf*.

`script-file` (default: `(file-append pulseaudio "/etc/pulse/default.pa")`)
: Script file to use as `default.pa`. In case the `extra-script-files` field below is used, an `.include` directive pointing to `/etc/pulse/default.pa.d` is appended to the provided script.

`extra-script-files` (default: `'()`)
: A list of file-like objects defining extra PulseAudio scripts to run at the initialization of the `pulseaudio` daemon, after the main `script-file`. The scripts are deployed to the `/etc/pulse/default.pa.d` directory; they should have the '`.pa`' file name extension. For a reference of the available commands, refer to `man pulse-cli-syntax`.

`system-script-file` (default: `(file-append pulseaudio "/etc/pulse/system.pa")`)
: Script file to use as `system.pa`.

The example below sets the default PulseAudio card profile, the default sink and the default source to use for a old SoundBlaster Audigy sound card:

```
(pulseaudio-configuration
 (extra-script-files
  (list (plain-file "audigy.pa"
                    (string-append "\
set-card-profile alsa_card.pci-0000_01_01.0 \
  output:analog-surround-40+input:analog-mono
set-default-source alsa_input.pci-0000_01_01.0.analog-mono
set-default-sink alsa_output.pci-0000_01_01.0.analog-surround-40\n")))))
```

Note that `pulseaudio-service-type` is part of `%desktop-services`; if your operating system declaration was derived from one of the desktop templates, you'll want to adjust the above example to modify the existing `pulseaudio-service-type` via `modify-services` (veja Seção 11.19.3 [Referência de Service], Página 634), instead of defining a new one.

`ladspa-service-type` [Variável]

This service sets the *LADSPA_PATH* variable, so that programs, which respect it, e.g. PulseAudio, can load LADSPA plugins.

The following example will setup the service to enable modules from the `swh-plugins` package:

```
(service ladspa-service-type
         (ladspa-configuration (plugins (list swh-plugins))))
```

See `http://plugin.org.uk/ladspa-swh/docs/ladspa-swh.html` for the details.

11.10.11 File Search Services

The services in this section populate *file databases* that let you search for files on your machine. These services are provided by the `(gnu services admin)` module.

The first one, `file-database-service-type`, periodically runs the venerable `updatedb` command (veja Seção "Invoking updatedb" em *GNU Findutils*). That command populates a database of file names that you can then search with the `locate` command (veja Seção "Invoing locate" em *GNU Findutils*), as in this example:

```
locate important-notes.txt
```

You can enable this service with its default settings by adding this snippet to your operating system services:

```
(service file-database-service-type)
```

This updates the database once a week, excluding files from `/gnu/store`—these are more usefully handled by `guix locate` (veja Seção 5.5 [Invocando guix locate], Página 53). You can of course provide a custom configuration, as described below.

`file-database-service-type` [Variável]

This is the type of the file database service, which runs `updatedb` periodically. Its associated value must be a `file-database-configuration` record, as described below.

`file-database-configuration` [Data Type]

Record type for the `file-database-service-type` configuration, with the following fields:

`package` (default: `findutils`)
: The GNU Findutils package from which the `updatedb` command is taken.

`schedule` (default: `%default-file-database-update-schedule`)
: String or G-exp denoting an mcron schedule for the periodic `updatedb` job (veja Seção "Guile Syntax" em *GNU mcron*).

`excluded-directories` (default `%default-file-database-excluded-directories`)
: List of regular expressions of directories to ignore when building the file database. By default, this includes `/tmp` and `/gnu/store`; the latter should instead be indexed by `guix locate` (veja Seção 5.5 [Invocando guix locate], Página 53). This list is passed to the `--prunepaths` option of `updatedb` (veja Seção "Invoking updatedb" em *GNU Findutils*).

The second service, `package-database-service-type`, builds the database used by `guix locate`, which lets you search for packages that contain a given file (veja Seção 5.5 [Invocando guix locate], Página 53). The service periodically updates a system-wide database, which will be readily available to anyone running `guix locate` on the system. To use this service with its default settings, add this snippet to your service list:

```
(service package-database-service-type)
```

This will run `guix locate --update` once a week.

`package-database-service-type` [Variável]
This is the service type for periodic `guix locate` updates (veja Seção 5.5 [Invocando guix locate], Página 53). Its value must be a `package-database-configuration` record, as shown below.

`package-database-configuration` [Data Type]
Data type to configure periodic package database updates. It has the following fields:

`package` (default: `guix`)
The Guix package to use.

`schedule` (default: `%default-package-database-update-schedule`)
String or G-exp denoting an mcron schedule for the periodic `guix locate --update` job (veja Seção "Guile Syntax" em *GNU mcron*).

`method` (default: `'store`)
Indexing method for `guix locate`. The default value, `'store`, yields a more complete database but is relatively expensive in terms of CPU and input/output.

`channels` (default: `#~%default-channels`)
G-exp denoting the channels to use when updating the database (veja Capítulo 6 [Canais], Página 69).

11.10.12 Serviços de bancos de dados

The `(gnu services databases)` module provides the following services.

PostgreSQL

`postgresql-service-type` [Variável]
The service type for the PostgreSQL database server. Its value should be a valid `postgresql-configuration` object, documented below. The following example describes a PostgreSQL service with the default configuration.

```
(service postgresql-service-type
         (postgresql-configuration
          (postgresql postgresql)))
```

If the services fails to start, it may be due to an incompatible cluster already present in *data-directory*. Adjust it (or, if you don't need the cluster anymore, delete *data-directory*), then restart the service.

Peer authentication is used by default and the `postgres` user account has no shell, which prevents the direct execution of `psql` commands as this user. To use `psql`, you

can temporarily log in as `postgres` using a shell, create a PostgreSQL superuser with the same name as one of the system users and then create the associated database.

```
sudo -u postgres -s /bin/sh
createuser --interactive
createdb $MY_USER_LOGIN      # Replace appropriately.
```

`postgresql-configuration` [Data Type]

Data type representing the configuration for the `postgresql-service-type`.

`postgresql`
: PostgreSQL package to use for the service.

`port` (default: `5432`)
: Port on which PostgreSQL should listen.

`locale` (default: `"en_US.utf8"`)
: Locale to use as the default when creating the database cluster.

`config-file` (default: `(postgresql-config-file)`)
: The configuration file to use when running PostgreSQL. The default behaviour uses the postgresql-config-file record with the default values for the fields.

`log-directory` (default: `"/var/log/postgresql"`)
: The directory where `pg_ctl` output will be written in a file named `"pg_ctl.log"`. This file can be useful to debug PostgreSQL configuration errors for instance.

`data-directory` (default: `"/var/lib/postgresql/data"`)
: Directory in which to store the data.

`extension-packages` (default: `'()`)
: Additional extensions are loaded from packages listed in *extension-packages*. Extensions are available at runtime. For instance, to create a geographic database using the `postgis` extension, a user can configure the postgresql-service as in this example:

```
(use-package-modules databases geo)

(operating-system
  ...
  ;; postgresql is required to run `psql' but postgis is not required f
  ;; proper operation.
  (packages (cons* postgresql %base-packages))
  (services
    (cons*
      (service postgresql-service-type
               (postgresql-configuration
                (postgresql postgresql)
                (extension-packages (list postgis))))
      %base-services)))
```

Then the extension becomes visible and you can initialise an empty geographic database in this way:

```
psql -U postgres
> create database postgistest;
> \connect postgistest;
> create extension postgis;
> create extension postgis_topology;
```

There is no need to add this field for contrib extensions such as hstore or dblink as they are already loadable by postgresql. This field is only required to add extensions provided by other packages.

`create-account?` (default: `#t`)
Whether or not the `postgres` user and group should be created.

`uid` (default: `#f`)
Explicitly specify the UID of the `postgres` daemon account. You normally do not need to specify this, in which case a free UID will be automatically assigned.

One situation where this option might be useful is if the *data-directory* is located on a mounted network share.

`gid` (default: `#f`)
Explicitly specify the GID of the `postgres` group.

`postgresql-config-file` [Data Type]
Data type representing the PostgreSQL configuration file. As shown in the following example, this can be used to customize the configuration of PostgreSQL. Note that you can use any G-expression or filename in place of this record, if you already have a configuration file you'd like to use for example.

```
(service postgresql-service-type
         (postgresql-configuration
          (config-file
           (postgresql-config-file
            (log-destination "stderr")
            (hba-file
             (plain-file "pg_hba.conf"
                         "
local all all trust
host all all 127.0.0.1/32  md5
host all all ::1/128  md5"))
            (extra-config
             '(("session_preload_libraries"     "auto_explain")
               ("random_page_cost"              2)
               ("auto_explain.log_min_duration" "100 ms")
               ("work_mem"                      "500 MB")
               ("logging_collector"             #t)
               ("log_directory"                 "/var/log/postgresql")))))))
```

`log-destination` (default: `"syslog"`)
: The logging method to use for PostgreSQL. Multiple values are accepted, separated by commas.

`hba-file` (default: `%default-postgres-hba`)
: Filename or G-expression for the host-based authentication configuration.

`ident-file` (default: `%default-postgres-ident`)
: Filename or G-expression for the user name mapping configuration.

`socket-directory` (default: `"/var/run/postgresql"`)
: Specifies the directory of the Unix-domain socket(s) on which PostgreSQL is to listen for connections from client applications. If set to `""` PostgreSQL does not listen on any Unix-domain sockets, in which case only TCP/IP sockets can be used to connect to the server.

  By default, the `#false` value means the PostgreSQL default value will be used, which is currently '`/tmp`'.

`extra-config` (default: `'()`)
: List of additional keys and values to include in the PostgreSQL config file. Each entry in the list should be a list where the first element is the key, and the remaining elements are the values.

  The values can be numbers, booleans or strings and will be mapped to PostgreSQL parameters types `Boolean`, `String`, `Numeric`, `Numeric with Unit` and `Enumerated` described here (`https://www.postgresql.org/docs/current/config-setting.html`).

`postgresql-role-service-type` [Variável]

This service allows to create PostgreSQL roles and databases after PostgreSQL service start. Here is an example of its use.

```
(service postgresql-role-service-type
            (postgresql-role-configuration
             (roles
              (list (postgresql-role
                     (name "test")
                     (create-database? #t))))))
```

This service can be extended with extra roles, as in this example:

```
(service-extension postgresql-role-service-type
                   (const (postgresql-role
                           (name "alice")
                           (create-database? #t))))
```

`postgresql-role` [Data Type]

PostgreSQL manages database access permissions using the concept of roles. A role can be thought of as either a database user, or a group of database users, depending on how the role is set up. Roles can own database objects (for example, tables) and can assign privileges on those objects to other roles to control who has access to which objects.

`name` The role name.

`permissions` (default: `'(createdb login)`)
: The role permissions list. Supported permissions are `bypassrls`, `createdb`, `createrole`, `login`, `replication` and `superuser`.

`create-database?` (default: `#f`)
: whether to create a database with the same name as the role.

`encoding` (default: `"UTF8"`)
: The character set to use for storing text in the database.

`collation` (default: `"en_US.utf8"`)
: The string sort order locale setting.

`ctype` (default: `"en_US.utf8"`)
: The character classification locale setting.

`template` (default: `"template1"`)
: The default template to copy the new database from when creating it. Use `"template0"` for a pristine database with no system-local modifications.

`postgresql-role-configuration` [Data Type]
Data type representing the configuration of *postgresql-role-service-type*.

`host` (default: `"/var/run/postgresql"`)
: The PostgreSQL host to connect to.

`log` (default: `"/var/log/postgresql_roles.log"`)
: File name of the log file.

`roles` (default: `'()`)
: The initial PostgreSQL roles to create.

MariaDB/MySQL

`mysql-service-type` [Variável]
This is the service type for a MySQL or MariaDB database server. Its value is a `mysql-configuration` object that specifies which package to use, as well as various settings for the `mysqld` daemon.

`mysql-configuration` [Data Type]
Data type representing the configuration of *mysql-service-type*.

`mysql` (default: *mariadb*)
: Package object of the MySQL database server, can be either *mariadb* or *mysql*.

  For MySQL, a temporary root password will be displayed at activation time. For MariaDB, the root password is empty.

`bind-address` (default: `"127.0.0.1"`)
: The IP on which to listen for network connections. Use `"0.0.0.0"` to bind to all available network interfaces.

`porta` (default: `3306`)
: TCP port on which the database server listens for incoming connections.

`socket` (default: `"/run/mysqld/mysqld.sock"`)
: Socket file to use for local (non-network) connections.

`extra-content` (default: `""`)
: Additional settings for the `my.cnf` configuration file.

`extra-environment` (default: `#~'()`)
: List of environment variables passed to the `mysqld` process.

`auto-upgrade?` (default: `#t`)
: Whether to automatically run `mysql_upgrade` after starting the service. This is necessary to upgrade the *system schema* after "major" updates (such as switching from MariaDB 10.4 to 10.5), but can be disabled if you would rather do that manually.

Memcached

`memcached-service-type` [Variável]
This is the service type for the Memcached (`https://memcached.org/`) service, which provides a distributed in memory cache. The value for the service type is a `memcached-configuration` object.

```
(service memcached-service-type)
```

`memcached-configuration` [Data Type]
Data type representing the configuration of memcached.

`memcached` (default: `memcached`)
: The Memcached package to use.

`interfaces` (default: `'("0.0.0.0")`)
: Network interfaces on which to listen.

`tcp-port` (default: `11211`)
: Port on which to accept connections.

`udp-port` (default: `11211`)
: Port on which to accept UDP connections on, a value of 0 will disable listening on a UDP socket.

`additional-options` (default: `'()`)
: Additional command line options to pass to `memcached`.

Redis

`redis-service-type` [Variável]
This is the service type for the Redis (`https://redis.io/`) key/value store, whose value is a `redis-configuration` object.

`redis-configuration` [Data Type]
Data type representing the configuration of redis.

`redis` (default: `redis`)
: The Redis package to use.

`bind` (default: `"127.0.0.1"`)
: Network interface on which to listen.

`porta` (default: `6379`)
: Port on which to accept connections on, a value of 0 will disable listening on a TCP socket.

`working-directory` (default: `"/var/lib/redis"`)
: Directory in which to store the database and related files.

11.10.13 Serviços de correio

The `(gnu services mail)` module provides Guix service definitions for email services: IMAP, POP3, and LMTP servers, as well as mail transport agents (MTAs). Lots of acronyms! These services are detailed in the subsections below.

Dovecot Service

`dovecot-service-type` [Variável]
: Type for the service that runs the Dovecot IMAP/POP3/LMTP mail server, whose value is a `<dovecot-configuration>` object.

By default, Dovecot does not need much configuration; the default configuration object created by `(dovecot-configuration)` will suffice if your mail is delivered to `~/Maildir`. A self-signed certificate will be generated for TLS-protected connections, though Dovecot will also listen on cleartext ports by default. There are a number of options, though, which mail administrators might need to change, and as is the case with other services, Guix allows the system administrator to specify these parameters via a uniform Scheme interface.

For example, to specify that mail is located at `maildir~/.mail`, one would instantiate the Dovecot service like this:

```
(service dovecot-service-type
         (dovecot-configuration
           (mail-location "maildir:~/.mail")))
```

The available configuration parameters follow. Each parameter definition is preceded by its type; for example, '`string-list foo`' indicates that the `foo` parameter should be specified as a list of strings. There is also a way to specify the configuration as a string, if you have an old `dovecot.conf` file that you want to port over from some other system; see the end for more details.

Available `dovecot-configuration` fields are:

`package dovecot` [`dovecot-configuration` parameter]
: The dovecot package.

`comma-separated-string-list listen` [`dovecot-configuration` parameter]
: A list of IPs or hosts where to listen for connections. '`*`' listens on all IPv4 interfaces, '`::`' listens on all IPv6 interfaces. If you want to specify non-default ports or anything more complex, customize the address and port fields of the '`inet-listener`' of the specific services you are interested in.

`protocol-configuration-list protocols` [`dovecot-configuration` parameter]
List of protocols we want to serve. Available protocols include '`imap`', '`pop3`', and '`lmtp`'.

Available `protocol-configuration` fields are:

`string name` [`protocol-configuration` parameter]
The name of the protocol.

`string auth-socket-path` [`protocol-configuration` parameter]
UNIX socket path to the master authentication server to find users. This is used by imap (for shared users) and lda. It defaults to '`"/var/run/dovecot/auth-userdb"`'.

`boolean imap-metadata?` [`protocol-configuration` parameter]
Whether to enable the `IMAP METADATA` extension as defined in RFC 5464 (`https://tools.ietf.org/html/rfc5464`), which provides a means for clients to set and retrieve per-mailbox, per-user metadata and annotations over IMAP.

If this is '`#t`', you must also specify a dictionary *via* the `mail-attribute-dict` setting.

Defaults to '`#f`'.

`space-separated-string-list` [`protocol-configuration` parameter]
`managesieve-notify-capabilities`
Which NOTIFY capabilities to report to clients that first connect to the ManageSieve service, before authentication. These may differ from the capabilities offered to authenticated users. If this field is left empty, report what the Sieve interpreter supports by default.

Defaults to '`'()`'.

`space-separated-string-list` [`protocol-configuration` parameter]
`managesieve-sieve-capability`
Which SIEVE capabilities to report to clients that first connect to the ManageSieve service, before authentication. These may differ from the capabilities offered to authenticated users. If this field is left empty, report what the Sieve interpreter supports by default.

Defaults to '`'()`'.

`space-separated-string-list` [`protocol-configuration` parameter]
`mail-plugins`
Space separated list of plugins to load.

`non-negative-integer` [`protocol-configuration` parameter]
`mail-max-userip-connections`
Maximum number of IMAP connections allowed for a user from each IP address. NOTE: The username is compared case-sensitively. Defaults to '`10`'.

`service-configuration-list services` [`dovecot-configuration` parameter]
List of services to enable. Available services include ‘`imap`’, ‘`imap-login`’, ‘`pop3`’, ‘`pop3-login`’, ‘`auth`’, and ‘`lmtp`’.

Available `service-configuration` fields are:

`string kind` [`service-configuration` parameter]
The service kind. Valid values include `director`, `imap-login`, `pop3-login`, `lmtp`, `imap`, `pop3`, `auth`, `auth-worker`, `dict`, `tcpwrap`, `quota-warning`, or anything else.

`listener-configuration-list listeners` [`service-configuration` parameter]
Listeners for the service. A listener is either a `unix-listener-configuration`, a `fifo-listener-configuration`, or an `inet-listener-configuration`. Defaults to ‘`'()`’.

Available `unix-listener-configuration` fields are:

`string path` [`unix-listener-configuration` parameter]
Path to the file, relative to `base-dir` field. This is also used as the section name.

`string mode` [`unix-listener-configuration` parameter]
The access mode for the socket. Defaults to ‘`"0600"`’.

`string user` [`unix-listener-configuration` parameter]
The user to own the socket. Defaults to ‘`""`’.

`string group` [`unix-listener-configuration` parameter]
The group to own the socket. Defaults to ‘`""`’.

Available `fifo-listener-configuration` fields are:

`string path` [`fifo-listener-configuration` parameter]
Path to the file, relative to `base-dir` field. This is also used as the section name.

`string mode` [`fifo-listener-configuration` parameter]
The access mode for the socket. Defaults to ‘`"0600"`’.

`string user` [`fifo-listener-configuration` parameter]
The user to own the socket. Defaults to ‘`""`’.

`string group` [`fifo-listener-configuration` parameter]
The group to own the socket. Defaults to ‘`""`’.

Available `inet-listener-configuration` fields are:

`string protocol` [`inet-listener-configuration` parameter]
The protocol to listen for.

`string address` [`inet-listener-configuration` parameter]
The address on which to listen, or empty for all addresses. Defaults to '`""`'.

`non-negative-integer port` [`inet-listener-configuration` parameter]
The port on which to listen.

`boolean ssl?` [`inet-listener-configuration` parameter]
Whether to use SSL for this service; '`yes`', '`no`', or '`required`'. Defaults to '`#t`'.

`non-negative-integer client-limit` [`service-configuration` parameter]
Maximum number of simultaneous client connections per process. Once this number of connections is received, the next incoming connection will prompt Dovecot to spawn another process. If set to 0, `default-client-limit` is used instead.

Defaults to '`0`'.

`non-negative-integer service-count` [`service-configuration` parameter]
Number of connections to handle before starting a new process. Typically the only useful values are 0 (unlimited) or 1. 1 is more secure, but 0 is faster. <doc/wiki/LoginProcess.txt>. Defaults to '`1`'.

`non-negative-integer process-limit` [`service-configuration` parameter]
Maximum number of processes that can exist for this service. If set to 0, `default-process-limit` is used instead.

Defaults to '`0`'.

`non-negative-integer process-min-avail` [`service-configuration` parameter]
Number of processes to always keep waiting for more connections. Defaults to '`0`'.

`non-negative-integer vsz-limit` [`service-configuration` parameter]
If you set '`service-count 0`', you probably need to grow this. Defaults to '`256000000`'.

`dict-configuration dict` [`dovecot-configuration` parameter]
Dict configuration, as created by the `dict-configuration` constructor.

Available `dict-configuration` fields are:

`free-form-fields entries` [`dict-configuration` parameter]
A list of key-value pairs that this dict should hold. Defaults to '`'()`'.

`passdb-configuration-list passdbs` [`dovecot-configuration` parameter]
A list of passdb configurations, each one created by the `passdb-configuration` constructor.

Available `passdb-configuration` fields are:

`string driver` [`passdb-configuration` parameter]
The driver that the passdb should use. Valid values include '`pam`', '`passwd`', '`shadow`', '`bsdauth`', and '`static`'. Defaults to '`"pam"`'.

`space-separated-string-list args` [`passdb-configuration` parameter]
Space separated list of arguments to the passdb driver. Defaults to '`""`'.

`userdb-configuration-list userdbs` [`dovecot-configuration` parameter]
List of userdb configurations, each one created by the `userdb-configuration` constructor.

Available `userdb-configuration` fields are:

`string driver` [`userdb-configuration` parameter]
The driver that the userdb should use. Valid values include '`passwd`' and '`static`'. Defaults to '`"passwd"`'.

`space-separated-string-list args` [`userdb-configuration` parameter]
Space separated list of arguments to the userdb driver. Defaults to '`""`'.

`free-form-args override-fields` [`userdb-configuration` parameter]
Override fields from passwd. Defaults to '`'()`'.

`plugin-configuration` [`dovecot-configuration` parameter]
`plugin-configuration`
Plug-in configuration, created by the `plugin-configuration` constructor.

`list-of-namespace-configuration` [`dovecot-configuration` parameter]
`namespaces`
List of namespaces. Each item in the list is created by the `namespace-configuration` constructor.

Available `namespace-configuration` fields are:

`string name` [`namespace-configuration` parameter]
Name for this namespace.

`string type` [`namespace-configuration` parameter]
Namespace type: '`private`', '`shared`' or '`public`'. Defaults to '`"private"`'.

`string separator` [`namespace-configuration` parameter]
Hierarchy separator to use. You should use the same separator for all namespaces or some clients get confused. '`/`' is usually a good one. The default however depends on the underlying mail storage format. Defaults to '`""`'.

`string prefix` [`namespace-configuration` parameter]
Prefix required to access this namespace. This needs to be different for all namespaces. For example '`Public/`'. Defaults to '`""`'.

`string location` [`namespace-configuration` parameter]
Physical location of the mailbox. This is in the same format as mail_location, which is also the default for it. Defaults to '`""`'.

`boolean inbox?` [`namespace-configuration` parameter]
There can be only one INBOX, and this setting defines which namespace has it. Defaults to '`#f`'.

`boolean hidden?` [`namespace-configuration` parameter]
If namespace is hidden, it's not advertised to clients via NAMESPACE extension. You'll most likely also want to set '`list? #f`'. This is mostly useful when converting from another server with different namespaces which you want to deprecate but still keep working. For example you can create hidden namespaces with prefixes '`~/mail/`', '`~%u/mail/`' and '`mail/`'. Defaults to '`#f`'.

`boolean list?` [`namespace-configuration` parameter]
Show the mailboxes under this namespace with the LIST command. This makes the namespace visible for clients that do not support the NAMESPACE extension. The special `children` value lists child mailboxes, but hides the namespace prefix. Defaults to '`#t`'.

`boolean subscriptions?` [`namespace-configuration` parameter]
Namespace handles its own subscriptions. If set to `#f`, the parent namespace handles them. The empty prefix should always have this as `#t`). Defaults to '`#t`'.

`mailbox-configuration-list mailboxes` [`namespace-configuration` parameter]
List of predefined mailboxes in this namespace. Defaults to '`'()`'.

Available `mailbox-configuration` fields are:

`string name` [`mailbox-configuration` parameter]
Name for this mailbox.

`string auto` [`mailbox-configuration` parameter]
'`create`' will automatically create this mailbox. '`subscribe`' will both create and subscribe to the mailbox. Defaults to '`"no"`'.

`space-separated-string-list special-use` [`mailbox-configuration` parameter]
List of IMAP `SPECIAL-USE` attributes as specified by RFC 6154. Valid values are `\All`, `\Archive`, `\Drafts`, `\Flagged`, `\Junk`, `\Sent`, and `\Trash`. Defaults to '`'()`'.

`file-name base-dir` [`dovecot-configuration` parameter]
Base directory where to store runtime data. Defaults to '`"/var/run/dovecot/"`'.

`string login-greeting` [`dovecot-configuration` parameter]
Greeting message for clients. Defaults to '`"Dovecot ready."`'.

`space-separated-string-list` [`dovecot-configuration` parameter]
`login-trusted-networks`
List of trusted network ranges. Connections from these IPs are allowed to override their IP addresses and ports (for logging and for authentication checks). '`disable-plaintext-auth`' is also ignored for these networks. Typically you would specify your IMAP proxy servers here. Defaults to '`'()`'.

`space-separated-string-list` [`dovecot-configuration` parameter]
`login-access-sockets`
List of login access check sockets (e.g. tcpwrap). Defaults to '`'()`'.

`boolean verbose-proctitle?` [`dovecot-configuration` parameter]
Show more verbose process titles (in ps). Currently shows user name and IP address. Useful for seeing who is actually using the IMAP processes (e.g. shared mailboxes or if the same uid is used for multiple accounts). Defaults to '`#f`'.

`boolean shutdown-clients?` [`dovecot-configuration` parameter]
Should all processes be killed when Dovecot master process shuts down. Setting this to `#f` means that Dovecot can be upgraded without forcing existing client connections to close (although that could also be a problem if the upgrade is e.g. due to a security fix). Defaults to '`#t`'.

`non-negative-integer` [`dovecot-configuration` parameter]
`doveadm-worker-count`
If non-zero, run mail commands via this many connections to doveadm server, instead of running them directly in the same process. Defaults to '`0`'.

`string doveadm-socket-path` [`dovecot-configuration` parameter]
UNIX socket or host:port used for connecting to doveadm server. Defaults to '`"doveadm-server"`'.

`space-separated-string-list` [`dovecot-configuration` parameter]
`import-environment`
List of environment variables that are preserved on Dovecot startup and passed down to all of its child processes. You can also give key=value pairs to always set specific settings.

`boolean disable-plaintext-auth?` [`dovecot-configuration` parameter]
Disable LOGIN command and all other plaintext authentications unless SSL/TLS is used (LOGINDISABLED capability). Note that if the remote IP matches the local IP (i.e. you're connecting from the same computer), the connection is considered secure and plaintext authentication is allowed. See also the '`ssl=required`' setting. Defaults to '`#t`'.

`non-negative-integer auth-cache-size` [`dovecot-configuration` parameter]
Authentication cache size (e.g. '`#e10e6`'). 0 means it's disabled. Note that bsdauth, PAM and vpopmail require '`cache-key`' to be set for caching to be used. Defaults to '`0`'.

`string auth-cache-ttl` [`dovecot-configuration` parameter]
Time to live for cached data. After TTL expires the cached record is no longer used, *except* if the main database lookup returns internal failure. We also try to handle password changes automatically: If user's previous authentication was successful, but this one wasn't, the cache isn't used. For now this works only with plaintext authentication. Defaults to '`"1 hour"`'.

`string auth-cache-negative-ttl` [`dovecot-configuration` parameter]
TTL for negative hits (user not found, password mismatch). 0 disables caching them completely. Defaults to '`"1 hour"`'.

`space-separated-string-list auth-realms` [`dovecot-configuration` parameter]
List of realms for SASL authentication mechanisms that need them. You can leave it empty if you don't want to support multiple realms. Many clients simply use the first one listed here, so keep the default realm first. Defaults to '`'()`'.

`string auth-default-realm` [`dovecot-configuration` parameter]
Default realm/domain to use if none was specified. This is used for both SASL realms and appending @domain to username in plaintext logins. Defaults to '`""`'.

`string auth-username-chars` [`dovecot-configuration` parameter]
List of allowed characters in username. If the user-given username contains a character not listed in here, the login automatically fails. This is just an extra check to make sure user can't exploit any potential quote escaping vulnerabilities with SQL/LDAP databases. If you want to allow all characters, set this value to empty. Defaults to '`"abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ01234567890.-_@"`'.

`string auth-username-translation` [`dovecot-configuration` parameter]
Username character translations before it's looked up from databases. The value contains series of from `->` to characters. For example '`#@/@`' means that '`#`' and '`/`' characters are translated to '`@`'. Defaults to '`""`'.

`string auth-username-format` [`dovecot-configuration` parameter]
Username formatting before it's looked up from databases. You can use the standard variables here, e.g. %Lu would lowercase the username, %n would drop away the domain if it was given, or '`%n-AT-%d`' would change the '`@`' into '`-AT-`'. This translation is done after '`auth-username-translation`' changes. Defaults to '`"%Lu"`'.

`string auth-master-user-separator` [`dovecot-configuration` parameter]
If you want to allow master users to log in by specifying the master username within the normal username string (i.e. not using SASL mechanism's support for it), you can specify the separator character here. The format is then <username><separator><master username>. UW-IMAP uses '`*`' as the separator, so that could be a good choice. Defaults to '`""`'.

`string auth-anonymous-username` [`dovecot-configuration` parameter]
Username to use for users logging in with ANONYMOUS SASL mechanism. Defaults to '`"anonymous"`'.

`non-negative-integer` [`dovecot-configuration` parameter]
`auth-worker-max-count`
Maximum number of dovecot-auth worker processes. They're used to execute blocking passdb and userdb queries (e.g. MySQL and PAM). They're automatically created and destroyed as needed. Defaults to '`30`'.

`string auth-gssapi-hostname` [`dovecot-configuration` parameter]
Host name to use in GSSAPI principal names. The default is to use the name returned by gethostname(). Use '`$ALL`' (with quotes) to allow all keytab entries. Defaults to '`""`'.

`string auth-krb5-keytab` [`dovecot-configuration` parameter]
Kerberos keytab to use for the GSSAPI mechanism. Will use the system default (usually `/etc/krb5.keytab`) if not specified. You may need to change the auth service to run as root to be able to read this file. Defaults to '`""`'.

`boolean auth-use-winbind?` [`dovecot-configuration` parameter]
Do NTLM and GSS-SPNEGO authentication using Samba's winbind daemon and '`ntlm-auth`' helper. <doc/wiki/Authentication/Mechanisms/Winbind.txt>. Defaults to '`#f`'.

`file-name auth-winbind-helper-path` [`dovecot-configuration` parameter]
Path for Samba's '`ntlm-auth`' helper binary. Defaults to '`"/usr/bin/ntlm_auth"`'.

`string auth-failure-delay` [`dovecot-configuration` parameter]
Time to delay before replying to failed authentications. Defaults to '`"2 secs"`'.

`boolean auth-ssl-require-client-cert?` [`dovecot-configuration` parameter]
Require a valid SSL client certificate or the authentication fails. Defaults to '`#f`'.

`boolean auth-ssl-username-from-cert?` [`dovecot-configuration` parameter]
Take the username from client's SSL certificate, using `X509_NAME_get_text_by_NID()` which returns the subject's DN's CommonName. Defaults to '`#f`'.

`space-separated-string-list` [`dovecot-configuration` parameter]
`auth-mechanisms`
List of wanted authentication mechanisms. Supported mechanisms are: '`plain`', '`login`', '`digest-md5`', '`cram-md5`', '`ntlm`', '`rpa`', '`apop`', '`anonymous`', '`gssapi`', '`otp`', '`skey`', and '`gss-spnego`'. See also the '`disable-plaintext-auth`' setting.

`space-separated-string-list` [`dovecot-configuration` parameter]
`director-servers`
List of IPs or hostnames to all director servers, including ourself. Ports can be specified as ip:port. The default port is the same as what director service's '`inet-listener`' is using. Defaults to '`'()`'.

`space-separated-string-list` [`dovecot-configuration` parameter]
`director-mail-servers`
List of IPs or hostnames to all backend mail servers. Ranges are allowed too, like 10.0.0.10-10.0.0.30. Defaults to '`'()`'.

`string director-user-expire` [`dovecot-configuration` parameter]
How long to redirect users to a specific server after it no longer has any connections. Defaults to '`"15 min"`'.

`string director-username-hash` [`dovecot-configuration` parameter]
How the username is translated before being hashed. Useful values include %Ln if user can log in with or without @domain, %Ld if mailboxes are shared within domain. Defaults to '`"%Lu"`'.

`string log-path` [`dovecot-configuration` parameter]
Log file to use for error messages. '`syslog`' logs to syslog, '`/dev/stderr`' logs to stderr. Defaults to '`"syslog"`'.

`string info-log-path` [`dovecot-configuration` parameter]
Log file to use for informational messages. Defaults to '`log-path`'. Defaults to '`""`'.

`string debug-log-path` [`dovecot-configuration` parameter]
Log file to use for debug messages. Defaults to '`info-log-path`'. Defaults to '`""`'.

`string syslog-facility` [`dovecot-configuration` parameter]
Syslog facility to use if you're logging to syslog. Usually if you don't want to use '`mail`', you'll use local0..local7. Also other standard facilities are supported. Defaults to '`"mail"`'.

`boolean auth-verbose?` [`dovecot-configuration` parameter]
Log unsuccessful authentication attempts and the reasons why they failed. Defaults to '`#f`'.

`string auth-verbose-passwords` [`dovecot-configuration` parameter]
In case of password mismatches, log the attempted password. Valid values are no, plain and sha1. sha1 can be useful for detecting brute force password attempts vs. user simply trying the same password over and over again. You can also truncate the value to n chars by appending `":n"` (e.g. sha1:6). Defaults to '`"no"`'.

`boolean auth-debug?` [`dovecot-configuration` parameter]
Even more verbose logging for debugging purposes. Shows for example SQL queries. Defaults to '`#f`'.

`boolean auth-debug-passwords?` [`dovecot-configuration` parameter]
In case of password mismatches, log the passwords and used scheme so the problem can be debugged. Enabling this also enables '`auth-debug`'. Defaults to '`#f`'.

`boolean mail-debug?` [`dovecot-configuration` parameter]
Enable mail process debugging. This can help you figure out why Dovecot isn't finding your mails. Defaults to '`#f`'.

`boolean verbose-ssl?` [`dovecot-configuration` parameter]
Show protocol level SSL errors. Defaults to '`#f`'.

`string log-timestamp` [`dovecot-configuration` parameter]
Prefix for each line written to log file. % codes are in strftime(3) format. Defaults to '`"\"%b %d %H:%M:%S \""`'.

`space-separated-string-list` [`dovecot-configuration` parameter]
`login-log-format-elements`
List of elements we want to log. The elements which have a non-empty variable value are joined together to form a comma-separated string.

`string login-log-format` [`dovecot-configuration` parameter]
Login log format. %s contains '`login-log-format-elements`' string, %$ contains the data we want to log. Defaults to '`"%$: %s"`'.

`string mail-log-prefix` [`dovecot-configuration` parameter]
Log prefix for mail processes. See doc/wiki/Variables.txt for list of possible variables you can use. Defaults to '`"\"%s(%u)<%{pid}><%{session}>: \""`'.

`string deliver-log-format` [`dovecot-configuration` parameter]
Format to use for logging mail deliveries. You can use variables:

`%$`	Delivery status message (e.g. '`saved to INBOX`')
`%m`	Mensagem-ID
`%s`	Assunto
`%f`	From address
`%p`	Physical size
`%w`	Virtual size.

Defaults to '`"msgid=%m: %$"`'.

`string mail-location` [`dovecot-configuration` parameter]
Location for users' mailboxes. The default is empty, which means that Dovecot tries to find the mailboxes automatically. This won't work if the user doesn't yet have any mail, so you should explicitly tell Dovecot the full location.

If you're using mbox, giving a path to the INBOX file (e.g. `/var/mail/%u`) isn't enough. You'll also need to tell Dovecot where the other mailboxes are kept. This is called the *root mail directory*, and it must be the first path given in the '`mail-location`' setting.

There are a few special variables you can use, e.g.:

'`%u`'	nome de usuário
'`%n`'	user part in user@domain, same as %u if there's no domain
'`%d`'	domain part in user@domain, empty if there's no domain
'`%h`'	home director

See doc/wiki/Variables.txt for full list. Some examples:

'`maildir:~/Maildir`'
'`mbox:~/mail:INBOX=/var/mail/%u`'
'`mbox:/var/mail/%d/%1n/%n:INDEX=/var/indexes/%d/%1n/%`'

Defaults to '`""`'.

`string mail-uid` [`dovecot-configuration` parameter]
System user and group used to access mails. If you use multiple, userdb can override these by returning uid or gid fields. You can use either numbers or names. <doc/wiki/UserIds.txt>. Defaults to '`""`'.

`string mail-gid` [`dovecot-configuration` parameter]
Defaults to '`""`'.

`string mail-privileged-group` [`dovecot-configuration` parameter]
Group to enable temporarily for privileged operations. Currently this is used only with INBOX when either its initial creation or dotlocking fails. Typically this is set to '`"mail"`' to give access to `/var/mail`. Defaults to '`""`'.

`string mail-access-groups` [`dovecot-configuration` parameter]
Grant access to these supplementary groups for mail processes. Typically these are used to set up access to shared mailboxes. Note that it may be dangerous to set these if users can create symlinks (e.g. if '`mail`' group is set here, `ln -s /var/mail ~/mail/var` could allow a user to delete others' mailboxes, or `ln -s /secret/shared/box ~/mail/mybox` would allow reading it). Defaults to '`""`'.

`string mail-attribute-dict` [`dovecot-configuration` parameter]
The location of a dictionary used to store `IMAP METADATA` as defined by RFC 5464 (`https://tools.ietf.org/html/rfc5464`).

The IMAP METADATA commands are available only if the "imap" protocol configuration's `imap-metadata?` field is '`#t`'.

Defaults to '`""`'.

`boolean mail-full-filesystem-access?` [`dovecot-configuration` parameter]
Allow full file system access to clients. There's no access checks other than what the operating system does for the active UID/GID. It works with both maildir and mboxes, allowing you to prefix mailboxes names with e.g. `/path/` or `~user/`. Defaults to '`#f`'.

`boolean mmap-disable?` [`dovecot-configuration` parameter]
Don't use `mmap()` at all. This is required if you store indexes to shared file systems (NFS or clustered file system). Defaults to '`#f`'.

`boolean dotlock-use-excl?` [`dovecot-configuration` parameter]
Rely on '`O_EXCL`' to work when creating dotlock files. NFS supports '`O_EXCL`' since version 3, so this should be safe to use nowadays by default. Defaults to '`#t`'.

`string mail-fsync` [`dovecot-configuration` parameter]
When to use fsync() or fdatasync() calls:

`optimized`
: Whenever necessary to avoid losing important data

`always`
: Useful with e.g. NFS when `write()`s are delayed

`never`
: Never use it (best performance, but crashes can lose data).

Defaults to '`"optimized"`'.

`boolean mail-nfs-storage?` [`dovecot-configuration` parameter]
Mail storage exists in NFS. Set this to yes to make Dovecot flush NFS caches whenever needed. If you're using only a single mail server this isn't needed. Defaults to '`#f`'.

`boolean mail-nfs-index?` [`dovecot-configuration` parameter]
Mail index files also exist in NFS. Setting this to yes requires '`mmap-disable? #t`' and '`fsync-disable? #f`'. Defaults to '`#f`'.

`string lock-method` [`dovecot-configuration` parameter]
Locking method for index files. Alternatives are fcntl, flock and dotlock. Dotlocking uses some tricks which may create more disk I/O than other locking methods. NFS users: flock doesn't work, remember to change '`mmap-disable`'. Defaults to '`"fcntl"`'.

`file-name mail-temp-dir` [`dovecot-configuration` parameter]
Directory in which LDA/LMTP temporarily stores incoming mails >128 kB. Defaults to '`"/tmp"`'.

`non-negative-integer first-valid-uid` [`dovecot-configuration` parameter]
Valid UID range for users. This is mostly to make sure that users can't log in as daemons or other system users. Note that denying root logins is hardcoded to dovecot binary and can't be done even if '`first-valid-uid`' is set to 0. Defaults to '`500`'.

`non-negative-integer last-valid-uid` [`dovecot-configuration` parameter]
Defaults to '`0`'.

`non-negative-integer first-valid-gid` [`dovecot-configuration` parameter]
Valid GID range for users. Users having non-valid GID as primary group ID aren't allowed to log in. If user belongs to supplementary groups with non-valid GIDs, those groups are not set. Defaults to '`1`'.

`non-negative-integer last-valid-gid` [`dovecot-configuration` parameter]
Defaults to '`0`'.

`non-negative-integer mail-max-keyword-length` [`dovecot-configuration` parameter]
Maximum allowed length for mail keyword name. It's only forced when trying to create new keywords. Defaults to '`50`'.

`colon-separated-file-name-list valid-chroot-dirs` [`dovecot-configuration` parameter]
List of directories under which chrooting is allowed for mail processes (i.e. `/var/mail` will allow chrooting to `/var/mail/foo/bar` too). This setting doesn't affect '`login-chroot`' '`mail-chroot`' or auth chroot settings. If this setting is empty, '`/./`' in home dirs are ignored. WARNING: Never add directories here which local users can modify, that may lead to root exploit. Usually this should be done only if you don't allow shell access for users. <doc/wiki/Chrooting.txt>. Defaults to '`'()`'.

`string mail-chroot` [`dovecot-configuration` parameter]
Default chroot directory for mail processes. This can be overridden for specific users in user database by giving '`/./`' in user's home directory (e.g. '`/home/./user`' chroots into `/home`). Note that usually there is no real need to do chrooting, Dovecot doesn't allow users to access files outside their mail directory anyway. If your

home directories are prefixed with the chroot directory, append '`/.`' to '`mail-chroot`'. <doc/wiki/Chrooting.txt>. Defaults to '`""`'.

`file-name auth-socket-path` [`dovecot-configuration` parameter]
UNIX socket path to master authentication server to find users. This is used by imap (for shared users) and lda. Defaults to '`"/var/run/dovecot/auth-userdb"`'.

`file-name mail-plugin-dir` [`dovecot-configuration` parameter]
Directory where to look up mail plugins. Defaults to '`"/usr/lib/dovecot"`'.

`space-separated-string-list` [`dovecot-configuration` parameter]
`mail-plugins`
List of plugins to load for all services. Plugins specific to IMAP, LDA, etc. are added to this list in their own .conf files. Defaults to '`'()`'.

`non-negative-integer` [`dovecot-configuration` parameter]
`mail-cache-min-mail-count`
The minimum number of mails in a mailbox before updates are done to cache file. This allows optimizing Dovecot's behavior to do less disk writes at the cost of more disk reads. Defaults to '`0`'.

`string mailbox-idle-check-interval` [`dovecot-configuration` parameter]
When IDLE command is running, mailbox is checked once in a while to see if there are any new mails or other changes. This setting defines the minimum time to wait between those checks. Dovecot can also use dnotify, inotify and kqueue to find out immediately when changes occur. Defaults to '`"30 secs"`'.

`boolean mail-save-crlf?` [`dovecot-configuration` parameter]
Save mails with CR+LF instead of plain LF. This makes sending those mails take less CPU, especially with sendfile() syscall with Linux and FreeBSD. But it also creates a bit more disk I/O which may just make it slower. Also note that if other software reads the mboxes/maildirs, they may handle the extra CRs wrong and cause problems. Defaults to '`#f`'.

`boolean maildir-stat-dirs?` [`dovecot-configuration` parameter]
By default LIST command returns all entries in maildir beginning with a dot. Enabling this option makes Dovecot return only entries which are directories. This is done by stat()ing each entry, so it causes more disk I/O. (For systems setting struct '`dirent->d_type`' this check is free and it's done always regardless of this setting). Defaults to '`#f`'.

`boolean maildir-copy-with-hardlinks?` [`dovecot-configuration` parameter]
When copying a message, do it with hard links whenever possible. This makes the performance much better, and it's unlikely to have any side effects. Defaults to '`#t`'.

`boolean maildir-very-dirty-syncs?` [`dovecot-configuration` parameter]
Assume Dovecot is the only MUA accessing Maildir: Scan cur/ directory only when its mtime changes unexpectedly or when we can't find the mail otherwise. Defaults to '`#f`'.

`space-separated-string-list` [`dovecot-configuration` parameter]
`mbox-read-locks`

Which locking methods to use for locking mbox. There are four available:

`dotlock` Create <mailbox>.lock file. This is the oldest and most NFS-safe solution. If you want to use /var/mail/ like directory, the users will need write access to that directory.

`dotlock-try`
Same as dotlock, but if it fails because of permissions or because there isn't enough disk space, just skip it.

`fcntl` Use this if possible. Works with NFS too if lockd is used.

`flock` May not exist in all systems. Doesn't work with NFS.

`lockf` May not exist in all systems. Doesn't work with NFS.

You can use multiple locking methods; if you do the order they're declared in is important to avoid deadlocks if other MTAs/MUAs are using multiple locking methods as well. Some operating systems don't allow using some of them simultaneously.

`space-separated-string-list` [`dovecot-configuration` parameter]
`mbox-write-locks`

`string mbox-lock-timeout` [`dovecot-configuration` parameter]
Maximum time to wait for lock (all of them) before aborting. Defaults to '`"5 mins"`'.

`string mbox-dotlock-change-timeout` [`dovecot-configuration` parameter]
If dotlock exists but the mailbox isn't modified in any way, override the lock file after this much time. Defaults to '`"2 mins"`'.

`boolean mbox-dirty-syncs?` [`dovecot-configuration` parameter]
When mbox changes unexpectedly we have to fully read it to find out what changed. If the mbox is large this can take a long time. Since the change is usually just a newly appended mail, it'd be faster to simply read the new mails. If this setting is enabled, Dovecot does this but still safely fallbacks to re-reading the whole mbox file whenever something in mbox isn't how it's expected to be. The only real downside to this setting is that if some other MUA changes message flags, Dovecot doesn't notice it immediately. Note that a full sync is done with SELECT, EXAMINE, EXPUNGE and CHECK commands. Defaults to '`#t`'.

`boolean mbox-very-dirty-syncs?` [`dovecot-configuration` parameter]
Like '`mbox-dirty-syncs`', but don't do full syncs even with SELECT, EXAMINE, EXPUNGE or CHECK commands. If this is set, '`mbox-dirty-syncs`' is ignored. Defaults to '`#f`'.

`boolean mbox-lazy-writes?` [`dovecot-configuration` parameter]
Delay writing mbox headers until doing a full write sync (EXPUNGE and CHECK commands and when closing the mailbox). This is especially useful for POP3 where clients often delete all mails. The downside is that our changes aren't immediately visible to other MUAs. Defaults to '`#t`'.

`non-negative-integer` [`dovecot-configuration` parameter]
`mbox-min-index-size`
If mbox size is smaller than this (e.g. 100k), don't write index files. If an index file already exists it's still read, just not updated. Defaults to '`0`'.

`non-negative-integer` [`dovecot-configuration` parameter]
`mdbox-rotate-size`
Maximum dbox file size until it's rotated. Defaults to '`10000000`'.

`string mdbox-rotate-interval` [`dovecot-configuration` parameter]
Maximum dbox file age until it's rotated. Typically in days. Day begins from midnight, so 1d = today, 2d = yesterday, etc. 0 = check disabled. Defaults to '`"1d"`'.

`boolean mdbox-preallocate-space?` [`dovecot-configuration` parameter]
When creating new mdbox files, immediately preallocate their size to '`mdbox-rotate-size`'. This setting currently works only in Linux with some file systems (ext4, xfs). Defaults to '`#f`'.

`string mail-attachment-dir` [`dovecot-configuration` parameter]
sdbox and mdbox support saving mail attachments to external files, which also allows single instance storage for them. Other backends don't support this for now.

WARNING: This feature hasn't been tested much yet. Use at your own risk.

Directory root where to store mail attachments. Disabled, if empty. Defaults to '`""`'.

`non-negative-integer` [`dovecot-configuration` parameter]
`mail-attachment-min-size`
Attachments smaller than this aren't saved externally. It's also possible to write a plugin to disable saving specific attachments externally. Defaults to '`128000`'.

`string mail-attachment-fs` [`dovecot-configuration` parameter]
File system backend to use for saving attachments:

`posix` No SiS done by Dovecot (but this might help FS's own deduplication)

`sis posix` SiS with immediate byte-by-byte comparison during saving

`sis-queue posix`
SiS with delayed comparison and deduplication.

Defaults to '`"sis posix"`'.

`string mail-attachment-hash` [`dovecot-configuration` parameter]
Hash format to use in attachment filenames. You can add any text and variables: `%{md4}`, `%{md5}`, `%{sha1}`, `%{sha256}`, `%{sha512}`, `%{size}`. Variables can be truncated, e.g. `%{sha256:80}` returns only first 80 bits. Defaults to '`"%{sha1}"`'.

`non-negative-integer` [`dovecot-configuration` parameter]
`default-process-limit`
Defaults to '`100`'.

`non-negative-integer` [`dovecot-configuration` parameter]
`default-client-limit`
Defaults to '`1000`'.

`non-negative-integer` [`dovecot-configuration` parameter]
`default-vsz-limit`
Default VSZ (virtual memory size) limit for service processes. This is mainly intended to catch and kill processes that leak memory before they eat up everything. Defaults to '`256000000`'.

`string default-login-user` [`dovecot-configuration` parameter]
Login user is internally used by login processes. This is the most untrusted user in Dovecot system. It shouldn't have access to anything at all. Defaults to '`"dovenull"`'.

`string default-internal-user` [`dovecot-configuration` parameter]
Internal user is used by unprivileged processes. It should be separate from login user, so that login processes can't disturb other processes. Defaults to '`"dovecot"`'.

`string ssl?` [`dovecot-configuration` parameter]
SSL/TLS support: yes, no, required. <doc/wiki/SSL.txt>. Defaults to '`"required"`'.

`string ssl-cert` [`dovecot-configuration` parameter]
PEM encoded X.509 SSL/TLS certificate (public key). Defaults to '`"</etc/dovecot/default.pem"`'.

`string ssl-key` [`dovecot-configuration` parameter]
PEM encoded SSL/TLS private key. The key is opened before dropping root privileges, so keep the key file unreadable by anyone but root. Defaults to '`"</etc/dovecot/private/default.pem"`'.

`string ssl-key-password` [`dovecot-configuration` parameter]
If key file is password protected, give the password here. Alternatively give it when starting dovecot with -p parameter. Since this file is often world-readable, you may want to place this setting instead to a different. Defaults to '`""`'.

`string ssl-ca` [`dovecot-configuration` parameter]
PEM encoded trusted certificate authority. Set this only if you intend to use '`ssl-verify-client-cert? #t`'. The file should contain the CA certificate(s) followed by the matching CRL(s). (e.g. '`ssl-ca </etc/ssl/certs/ca.pem`'). Defaults to '`""`'.

`boolean ssl-require-crl?` [`dovecot-configuration` parameter]
Require that CRL check succeeds for client certificates. Defaults to '`#t`'.

`boolean ssl-verify-client-cert?` [`dovecot-configuration` parameter]
Request client to send a certificate. If you also want to require it, set '`auth-ssl-require-client-cert? #t`' in auth section. Defaults to '`#f`'.

`string ssl-cert-username-field` [`dovecot-configuration` parameter]
Which field from certificate to use for username. commonName and x500UniqueIdentifier are the usual choices. You'll also need to set '`auth-ssl-username-from-cert? #t`'. Defaults to '`"commonName"`'.

`string ssl-min-protocol` [`dovecot-configuration` parameter]
Minimum SSL protocol version to accept. Defaults to '`"TLSv1"`'.

`string ssl-cipher-list` [`dovecot-configuration` parameter]
SSL ciphers to use. Defaults to '`"ALL:!kRSA:!SRP:!kDHd:!DSS:!aNULL:!eNULL:!EXPORT:!DES:!3DES:`

`string ssl-crypto-device` [`dovecot-configuration` parameter]
SSL crypto device to use, for valid values run "openssl engine". Defaults to '`""`'.

`string postmaster-address` [`dovecot-configuration` parameter]
Address to use when sending rejection mails. %d expands to recipient domain. Defaults to '`"postmaster@%d"`'.

`string hostname` [`dovecot-configuration` parameter]
Hostname to use in various parts of sent mails (e.g. in Message-Id) and in LMTP replies. Default is the system's real hostname@domain. Defaults to '`""`'.

`boolean quota-full-tempfail?` [`dovecot-configuration` parameter]
If user is over quota, return with temporary failure instead of bouncing the mail. Defaults to '`#f`'.

`file-name sendmail-path` [`dovecot-configuration` parameter]
Binary to use for sending mails. Defaults to '`"/usr/sbin/sendmail"`'.

`string submission-host` [`dovecot-configuration` parameter]
If non-empty, send mails via this SMTP host[:port] instead of sendmail. Defaults to '`""`'.

`string rejection-subject` [`dovecot-configuration` parameter]
Subject: header to use for rejection mails. You can use the same variables as for '`rejection-reason`' below. Defaults to '`"Rejected: %s"`'.

`string rejection-reason` [`dovecot-configuration` parameter]
Human readable error message for rejection mails. You can use variables:

`%n`	CRLF
`%r`	reason
`%s`	original subject
`%t`	destinatário

Defaults to '`"Your message to <%t> was automatically rejected:%n%r"`'.

`string recipient-delimiter` [`dovecot-configuration` parameter]
Delimiter character between local-part and detail in email address. Defaults to '`"+"`'.

`string lda-original-recipient-header` [`dovecot-configuration` parameter]
Header where the original recipient address (SMTP's RCPT TO: address) is taken from if not available elsewhere. With dovecot-lda -a parameter overrides this. A commonly used header for this is X-Original-To. Defaults to '`""`'.

`boolean lda-mailbox-autocreate?` [`dovecot-configuration` parameter]
Should saving a mail to a nonexistent mailbox automatically create it?. Defaults to '`#f`'.

`boolean lda-mailbox-autosubscribe?` [`dovecot-configuration` parameter]
Should automatically created mailboxes be also automatically subscribed?. Defaults to '`#f`'.

`non-negative-integer imap-max-line-length` [`dovecot-configuration` parameter]
Maximum IMAP command line length. Some clients generate very long command lines with huge mailboxes, so you may need to raise this if you get "Too long argument" or "IMAP command line too large" errors often. Defaults to '`64000`'.

`string imap-logout-format` [`dovecot-configuration` parameter]
IMAP logout format string:

`%i` total number of bytes read from client

`%o` total number of bytes sent to client.

See `doc/wiki/Variables.txt` for a list of all the variables you can use. Defaults to '`"in=%i out=%o deleted=%{deleted} expunged=%{expunged} trashed=%{trashed} hdr_count=%{fetch_hdr_count} hdr_bytes=%{fetch_hdr_bytes} body_count=%{fetch_body_count} body_bytes=%{fetch_body_bytes}"`'.

`string imap-capability` [`dovecot-configuration` parameter]
Override the IMAP CAPABILITY response. If the value begins with '+', add the given capabilities on top of the defaults (e.g. +XFOO XBAR). Defaults to '`""`'.

`string imap-idle-notify-interval` [`dovecot-configuration` parameter]
How long to wait between "OK Still here" notifications when client is IDLEing. Defaults to '`"2 mins"`'.

`string imap-id-send` [`dovecot-configuration` parameter]
ID field names and values to send to clients. Using * as the value makes Dovecot use the default value. The following fields have default values currently: name, version, os, os-version, support-url, support-email. Defaults to '`""`'.

`string imap-id-log` [`dovecot-configuration` parameter]
ID fields sent by client to log. * means everything. Defaults to '`""`'.

`space-separated-string-list imap-client-workarounds` [`dovecot-configuration` parameter]
Workarounds for various client bugs:

`delay-newmail`
Send EXISTS/RECENT new mail notifications only when replying to NOOP and CHECK commands. Some clients ignore them otherwise, for example OSX Mail (<v2.1). Outlook Express breaks more badly though, without this it may show user "Message no longer in server" errors. Note that OE6 still breaks even with this workaround if synchronization is set to "Headers Only".

`tb-extra-mailbox-sep`
: Thunderbird gets somehow confused with LAYOUT=fs (mbox and dbox) and adds extra '`/`' suffixes to mailbox names. This option causes Dovecot to ignore the extra '`/`' instead of treating it as invalid mailbox name.

`tb-lsub-flags`
: Show \Noselect flags for LSUB replies with LAYOUT=fs (e.g. mbox). This makes Thunderbird realize they aren't selectable and show them greyed out, instead of only later giving "not selectable" popup error.

Defaults to '`'()`'.

`string imap-urlauth-host` [`dovecot-configuration` parameter]
: Host allowed in URLAUTH URLs sent by client. "*" allows all. Defaults to '`""`'.

Whew! Lots of configuration options. The nice thing about it though is that Guix has a complete interface to Dovecot's configuration language. This allows not only a nice way to declare configurations, but also offers reflective capabilities as well: users can write code to inspect and transform configurations from within Scheme.

However, it could be that you just want to get a `dovecot.conf` up and running. In that case, you can pass an `opaque-dovecot-configuration` as the `#:config` parameter to `dovecot-service`. As its name indicates, an opaque configuration does not have easy reflective capabilities.

Available `opaque-dovecot-configuration` fields are:

`package dovecot` [`opaque-dovecot-configuration` parameter]
: The dovecot package.

`string string` [`opaque-dovecot-configuration` parameter]
: The contents of the `dovecot.conf`, as a string.

For example, if your `dovecot.conf` is just the empty string, you could instantiate a dovecot service like this:

```
(dovecot-service #:config
                 (opaque-dovecot-configuration
                  (string "")))
```

OpenSMTPD Service

`opensmtpd-service-type` [Variável]
: This is the type of the OpenSMTPD (`https://www.opensmtpd.org`) service, whose value should be an `opensmtpd-configuration` object as in this example:

```
(service opensmtpd-service-type
         (opensmtpd-configuration
           (config-file (local-file "./my-smtpd.conf"))))
```

`opensmtpd-configuration` [Data Type]
: Data type representing the configuration of opensmtpd.

`package` (default: *opensmtpd*)
: Package object of the OpenSMTPD SMTP server.

`shepherd-requirement` (default: `'()`)
: This option can be used to provide a list of symbols naming Shepherd services that this service will depend on, such as `'networking` if you want to configure OpenSMTPD to listen on non-loopback interfaces.

`config-file` (default: `%default-opensmtpd-config-file`)
: File-like object of the OpenSMTPD configuration file to use. By default it listens on the loopback network interface, and allows for mail from users and daemons on the local machine, as well as permitting email to remote servers. Run `man smtpd.conf` for more information.

`setgid-commands?` (default: `#t`)
: Make the following commands setgid to `smtpq` so they can be executed: `smtpctl`, `sendmail`, `send-mail`, `makemap`, `mailq`, and `newaliases`. Veja Seção 11.11 [Privileged Programs], Página 603, for more information on setgid programs.

Exim Service

`exim-service-type` [Variável]
: This is the type of the Exim (`https://exim.org`) mail transfer agent (MTA), whose value should be an `exim-configuration` object as in this example:

```
(service exim-service-type
         (exim-configuration
           (config-file (local-file "./my-exim.conf"))))
```

In order to use an `exim-service-type` service you must also have a `mail-aliases-service-type` service present in your `operating-system` (even if it has no aliases).

`exim-configuration` [Data Type]
: Data type representing the configuration of exim.

`package` (default: *exim*)
: Package object of the Exim server.

`config-file` (default: `#f`)
: File-like object of the Exim configuration file to use. If its value is `#f` then use the default configuration file from the package provided in `package`. The resulting configuration file is loaded after setting the `exim_user` and `exim_group` configuration variables.

Getmail service

`getmail-service-type` [Variável]
: This is the type of the Getmail (`http://pyropus.ca/software/getmail/`) mail retriever, whose value should be a `getmail-configuration`.

Available `getmail-configuration` fields are:

`symbol name` [`getmail-configuration` parameter]
: A symbol to identify the getmail service.

Defaults to ‘`"unset"`’.

`package package` [`getmail-configuration` parameter]
The getmail package to use.

`string user` [`getmail-configuration` parameter]
The user to run getmail as.
Defaults to '`"getmail"`'.

`string group` [`getmail-configuration` parameter]
The group to run getmail as.
Defaults to '`"getmail"`'.

`string directory` [`getmail-configuration` parameter]
The getmail directory to use.
Defaults to '`"/var/lib/getmail/default"`'.

`getmail-configuration-file rcfile` [`getmail-configuration` parameter]
The getmail configuration file to use.
Available `getmail-configuration-file` fields are:

`getmail-retriever-configuration retriever` [`getmail-configuration-file` parameter]
What mail account to retrieve mail from, and how to access that account.
Available `getmail-retriever-configuration` fields are:

`string type` [`getmail-retriever-configuration` parameter]
The type of mail retriever to use. Valid values include '`passwd`' and '`static`'.
Defaults to '`"SimpleIMAPSSLRetriever"`'.

`string server` [`getmail-retriever-configuration` parameter]
Username to login to the mail server with.
Defaults to '`unset`'.

`string username` [`getmail-retriever-configuration` parameter]
Username to login to the mail server with.
Defaults to '`unset`'.

`non-negative-integer port` [`getmail-retriever-configuration` parameter]
Port number to connect to.
Defaults to '`#f`'.

`string password` [`getmail-retriever-configuration` parameter]
Override fields from passwd.
Defaults to '`""`'.

`list password-command` [`getmail-retriever-configuration` parameter]
Override fields from passwd.
Defaults to '`'()`'.

`string keyfile` [`getmail-retriever-configuration` parameter]
PEM-formatted key file to use for the TLS negotiation.

Defaults to ‘`""`’.

`string certfile` [`getmail-retriever-configuration` parameter]
PEM-formatted certificate file to use for the TLS negotiation.

Defaults to ‘`""`’.

`string ca-certs` [`getmail-retriever-configuration` parameter]
CA certificates to use.

Defaults to ‘`""`’.

`parameter-alist` [`getmail-retriever-configuration` parameter]
`extra-parameters`
Extra retriever parameters.

Defaults to ‘`'()`’.

`getmail-destination-configuration` [`getmail-configuration-file` parameter]
`destination`
What to do with retrieved messages.

Available `getmail-destination-configuration` fields are:

`string type` [`getmail-destination-configuration` parameter]
The type of mail destination. Valid values include ‘`Maildir`’, ‘`Mboxrd`’ and ‘`MDA_external`’.

Defaults to ‘`unset`’.

`string-or-filelike` [`getmail-destination-configuration` parameter]
`path`
The path option for the mail destination. The behaviour depends on the chosen type.

Defaults to ‘`""`’.

`parameter-alist` [`getmail-destination-configuration` parameter]
`extra-parameters`
Extra destination parameters

Defaults to ‘`'()`’.

`getmail-options-configuration` [`getmail-configuration-file` parameter]
`options`
Configure getmail.

Available `getmail-options-configuration` fields are:

`non-negative-integer` [`getmail-options-configuration` parameter]
`verbose`
If set to ‘`0`’, getmail will only print warnings and errors. A value of ‘`1`’ means that messages will be printed about retrieving and deleting messages. If set to ‘`2`’, getmail will print messages about each of its actions.

Defaults to ‘`1`’.

`boolean read-all` [`getmail-options-configuration` parameter]
If true, getmail will retrieve all available messages. Otherwise it will only retrieve messages it hasn't seen previously.

Defaults to '`#t`'.

`boolean delete` [`getmail-options-configuration` parameter]
If set to true, messages will be deleted from the server after retrieving and successfully delivering them. Otherwise, messages will be left on the server.

Defaults to '`#f`'.

`non-negative-integer` [`getmail-options-configuration` parameter]
`delete-after`
Getmail will delete messages this number of days after seeing them, if they have been delivered. This means messages will be left on the server this number of days after delivering them. A value of '`0`' disabled this feature.

Defaults to '`0`'.

`non-negative-integer` [`getmail-options-configuration` parameter]
`delete-bigger-than`
Delete messages larger than this of bytes after retrieving them, even if the delete and delete-after options are disabled. A value of '`0`' disables this feature.

Defaults to '`0`'.

`non-negative-integer` [`getmail-options-configuration` parameter]
`max-bytes-per-session`
Retrieve messages totalling up to this number of bytes before closing the session with the server. A value of '`0`' disables this feature.

Defaults to '`0`'.

`non-negative-integer` [`getmail-options-configuration` parameter]
`max-message-size`
Don't retrieve messages larger than this number of bytes. A value of '`0`' disables this feature.

Defaults to '`0`'.

`boolean delivered-to` [`getmail-options-configuration` parameter]
If true, getmail will add a Delivered-To header to messages.

Defaults to '`#t`'.

`boolean received` [`getmail-options-configuration` parameter]
If set, getmail adds a Received header to the messages.

Defaults to '`#t`'.

`string message-log` [`getmail-options-configuration` parameter]
Getmail will record a log of its actions to the named file. A value of '`""`' disables this feature.

Defaults to '`""`'.

`boolean message-log-syslog` [`getmail-options-configuration` parameter]
If true, getmail will record a log of its actions using the system logger.

Defaults to '`#f`'.

`boolean message-log-verbose` [`getmail-options-configuration` parameter]
If true, getmail will log information about messages not retrieved and the reason for not retrieving them, as well as starting and ending information lines.

Defaults to '`#f`'.

`parameter-alist extra-parameters` [`getmail-options-configuration` parameter]
Extra options to include.

Defaults to '`'()`'.

`list idle` [`getmail-configuration` parameter]
A list of mailboxes that getmail should wait on the server for new mail notifications. This depends on the server supporting the IDLE extension.

Defaults to '`'()`'.

`list environment-variables` [`getmail-configuration` parameter]
Environment variables to set for getmail.

Defaults to '`'()`'.

Mail Aliases Service

`mail-aliases-service-type` [Variável]
This is the type of the service which provides `/etc/aliases`, specifying how to deliver mail to users on this system.

```
(service mail-aliases-service-type
         '(("postmaster" "bob")
           ("bob" "bob@example.com" "bob@example2.com")))
```

The configuration for a `mail-aliases-service-type` service is an association list denoting how to deliver mail that comes to this system. Each entry is of the form `(alias addresses ...)`, with `alias` specifying the local alias and `addresses` specifying where to deliver this user's mail.

The aliases aren't required to exist as users on the local system. In the above example, there doesn't need to be a `postmaster` entry in the `operating-system`'s `user-accounts` in order to deliver the `postmaster` mail to `bob` (which subsequently would deliver mail to `bob@example.com` and `bob@example2.com`).

GNU Mailutils IMAP4 Daemon

`imap4d-service-type` [Variável]

This is the type of the GNU Mailutils IMAP4 Daemon (veja Seção "imap4d" em *GNU Mailutils Manual*), whose value should be an `imap4d-configuration` object as in this example:

```
(service imap4d-service-type
         (imap4d-configuration
           (config-file (local-file "imap4d.conf"))))
```

`imap4d-configuration` [Data Type]

Data type representing the configuration of `imap4d`.

`package` (default: `mailutils`)
: The package that provides `imap4d`.

`config-file` (default: `%default-imap4d-config-file`)
: File-like object of the configuration file to use, by default it will listen on TCP port 143 of `localhost`. Veja Seção "Conf-imap4d" em *GNU Mailutils Manual*, for details.

Radicale Service

`radicale-service-type` [Variável]

This is the type of the Radicale (`https://radicale.org`) CalDAV/CardDAV server whose value should be a `radicale-configuration`. The default configuration matches the upstream documentation (`https://radicale.org/v3.html#configuration`).

`radicale-configuration` [Data Type]

Data type representing the configuration of `radicale`. Available `radicale-configuration` fields are:

`package` (default: `radicale`) (type: package)
: Package that provides `radicale`.

`auth` (default: `'()`) (type: radicale-auth-configuration)
: Configuration for auth-related variables.

  `radicale-auth-configuration` [Data Type]
  : Data type representing the `auth` section of a `radicale` configuration file. Available `radicale-auth-configuration` fields are:

    `type` (default: `'none`) (type: symbol)
    : The method to verify usernames and passwords. Options are `none`, `htpasswd`, `remote-user`, and `http-x-remote-user`. This value is tied to `htpasswd-filename` and `htpasswd-encryption`.

    `htpasswd-filename` (default: `"/etc/radicale/users"`) (type: file-name)
    : Path to the htpasswd file. Use htpasswd or similar to generate this file.

`htpasswd-encryption` (default: `'md5`) (type: symbol)
Encryption method used in the htpasswd file. Options are `plain`, `bcrypt`, and `md5`.

`delay` (default: `1`) (type: non-negative-integer)
Average delay after failed login attempts in seconds.

`realm` (default: `"Radicale - Password Required"`) (type: string)
Message displayed in the client when a password is needed.

`encoding` (default: `'()`) (type: radicale-encoding-configuration)
Configuration for encoding-related variables.

`radicale-encoding-configuration` [Data Type]
Data type representing the `encoding` section of a `radicale` configuration file. Available `radicale-encoding-configuration` fields are:

`request` (default: `'utf-8`) (type: symbol)
Encoding for responding requests.

`stock` (default: `'utf-8`) (type: symbol)
Encoding for storing local collections.

`headers-file` (default: none) (type: file-like)
Custom HTTP headers.

`logging` (default: `'()`) (type: radicale-logging-configuration)
Configuration for logging-related variables.

`radicale-logging-configuration` [Data Type]
Data type representing the `logging` section of a `radicale` configuration file. Available `radicale-logging-configuration` fields are:

`level` (default: `'warning`) (type: symbol)
Set the logging level. One of `debug`, `info`, `warning`, `error`, or `critical`.

`mask-passwords?` (default: `#t`) (type: boolean)
Whether to include passwords in logs.

`rights` (default: `'()`) (type: radicale-rights-configuration)
Configuration for rights-related variables. This should be a `radicale-rights-configuration`.

`radicale-rights-configuration` [Data Type]
Data type representing the `rights` section of a `radicale` configuration file. Available `radicale-rights-configuration` fields are:

`type` (default: `'owner-only`) (type: symbol)
Backend used to check collection access rights. The recommended backend is `owner-only`. If access to calendars and address books outside the home directory

of users is granted, clients won't detect these collections and will not show them to the user. Choosing any other method is only useful if you access calendars and address books directly via URL. Options are `authenticate`, `owner-only`, `owner-write`, and `from-file`.

`file` (default: `""`) (type: file-name)
: File for the rights backend `from-file`.

`server` (default: `'()`) (type: radicale-server-configuration)
: Configuration for server-related variables. Ignored if WSGI is used.

`radicale-server-configuration` [Data Type]
: Data type representing the `server` section of a `radicale` configuration file. Available `radicale-server-configuration` fields are:

`hosts` (default: `(list "localhost:5232")`) (type: list-of-ip-addresses)
: List of IP addresses that the server will bind to.

`max-connections` (default: `8`) (type: non-negative-integer)
: Maximum number of parallel connections. Set to 0 to disable the limit.

`max-content-length` (default: `100000000`) (type: non-negative-integer)
: Maximum size of the request body in bytes.

`timeout` (default: `30`) (type: non-negative-integer)
: Socket timeout in seconds.

`ssl?` (default: `#f`) (type: boolean)
: Whether to enable transport layer encryption.

`certificate` (default: `"/etc/ssl/radicale.cert.pem"`) (type: file-name)
: Path of the SSL certificate.

`key` (default: `"/etc/ssl/radicale.key.pem"`) (type: file-name)
: Path to the private key for SSL. Only effective if `ssl?` is `#t`.

`certificate-authority` (default: `""`) (type: file-name)
: Path to CA certificate for validating client certificates. This can be used to secure TCP traffic between Radicale and a reverse proxy. If you want to authenticate users with client-side certificates, you also have to write an authentication plugin that extracts the username from the certificate.

`storage` (default: `'()`) (type: radicale-storage-configuration)
: Configuration for storage-related variables.

`radicale-storage-configuration` [Data Type]
Data type representing the `storage` section of a `radicale` configuration file. Available `radicale-storage-configuration` fields are:

`type` (default: `'multifilesystem`) (type: symbol)
Backend used to store data. Options are `multifilesystem` and `multifilesystem-nolock`.

`filesystem-folder` (default: `"/var/lib/radicale/collections"`) (type: file-name)
Folder for storing local collections. Created if not present.

`max-sync-token-age` (default: `2592000`) (type: non-negative-integer)
Delete sync-tokens that are older than the specified time in seconds.

`hook` (default: `""`) (type: string)
Command run after changes to storage.

`web-interface?` (default: `#t`) (type: boolean)
Whether to use Radicale's built-in web interface.

Rspamd Service

`rspamd-service-type` [Variável]
This is the type of the Rspamd (`https://rspamd.com/`) filtering system whose value should be a `rspamd-configuration`.

`rspamd-configuration` [Data Type]
Available `rspamd-configuration` fields are:

`package` (default: `rspamd`) (type: file-like)
The package that provides rspamd.

`config-file` (default: `%default-rspamd-config-file`) (type: file-like)
File-like object of the configuration file to use. By default all workers are enabled except fuzzy and they are binded to their usual ports, e.g localhost:11334, localhost:11333 and so on

`local.d-files` (default: `()`) (type: directory-tree)
Configuration files in local.d, provided as a list of two element lists where the first element is the filename and the second one is a file-like object. Settings in these files will be merged with the defaults.

`override.d-files` (default: `()`) (type: directory-tree)
Configuration files in override.d, provided as a list of two element lists where the first element is the filename and the second one is a file-like object. Settings in these files will override the defaults.

`user` (default: `%default-rspamd-account`) (type: user-account)
The user to run rspamd as.

`group` (default: `%default-rspamd-group`) (type: user-group)
The group to run rspamd as.

`debug?` (default: `#f`) (type: boolean)
Force debug output.

`insecure?` (default: `#f`) (type: boolean)
Ignore running workers as privileged users.

`skip-template?` (default: `#f`) (type: boolean)
Do not apply Jinja templates.

`shepherd-requirements` (default: `(loopback)`) (type: list-of-symbols)
This is a list of symbols naming Shepherd services that this service will depend on.

11.10.14 Serviços de mensageria

The `(gnu services messaging)` module provides Guix service definitions for messaging services. Currently it provides the following services:

Prosody Service

`prosody-service-type` [Variável]
This is the type for the Prosody XMPP communication server (`https://prosody.im`). Its value must be a `prosody-configuration` record as in this example:

```
(service prosody-service-type
         (prosody-configuration
          (modules-enabled (cons* "groups" "mam" %default-modules-enabled))
          (int-components
           (list
            (int-component-configuration
             (hostname "conference.example.net")
             (plugin "muc")
             (mod-muc (mod-muc-configuration)))))
          (virtualhosts
           (list
            (virtualhost-configuration
             (domain "example.net"))))))
```

See below for details about `prosody-configuration`.

By default, Prosody does not need much configuration. Only one `virtualhosts` field is needed: it specifies the domain you wish Prosody to serve.

You can perform various sanity checks on the generated configuration with the `prosodyctl check` command.

Prosodyctl will also help you to import certificates from the `letsencrypt` directory so that the `prosody` user can access them. See `https://prosody.im/doc/letsencrypt`.

```
prosodyctl --root cert import /etc/certs
```

The available configuration parameters follow. Each parameter definition is preceded by its type; for example, '`string-list foo`' indicates that the `foo` parameter should be

specified as a list of strings. Types starting with `maybe-` denote parameters that won't show up in `prosody.cfg.lua` when their value is left unspecified.

There is also a way to specify the configuration as a string, if you have an old `prosody.cfg.lua` file that you want to port over from some other system; see the end for more details.

The `file-object` type designates either a file-like object (veja Seção 8.12 [Expressões-G], Página 163) or a file name.

Available `prosody-configuration` fields are:

`package prosody` [`prosody-configuration` parameter]
The Prosody package.

`file-name data-path` [`prosody-configuration` parameter]
Location of the Prosody data storage directory. See `https://prosody.im/doc/configure`. Defaults to '`"/var/lib/prosody"`'.

`file-object-list plugin-paths` [`prosody-configuration` parameter]
Additional plugin directories. They are searched in all the specified paths in order. See `https://prosody.im/doc/plugins_directory`. Defaults to '`'()`'.

`file-name certificates` [`prosody-configuration` parameter]
Every virtual host and component needs a certificate so that clients and servers can securely verify its identity. Prosody will automatically load certificates/keys from the directory specified here. Defaults to '`"/etc/prosody/certs"`'.

`string-list admins` [`prosody-configuration` parameter]
This is a list of accounts that are admins for the server. Note that you must create the accounts separately. See `https://prosody.im/doc/admins` and `https://prosody.im/doc/creating_accounts`. Example: `(admins '("user1@example.com" "user2@example.net"))` Defaults to '`'()`'.

`boolean use-libevent?` [`prosody-configuration` parameter]
Enable use of libevent for better performance under high load. See `https://prosody.im/doc/libevent`. Defaults to '`#f`'.

`module-list modules-enabled` [`prosody-configuration` parameter]
This is the list of modules Prosody will load on startup. It looks for `mod_modulename.lua` in the plugins folder, so make sure that exists too. Documentation on modules can be found at: `https://prosody.im/doc/modules`. Defaults to '`'("roster" "saslauth" "tls" "dialback" "disco" "carbons" "private" "blocklist" "vcard" "version" "uptime" "time" "ping" "pep" "register" "admin_adhoc")`'.

`string-list modules-disabled` [`prosody-configuration` parameter]
'`"offline"`', '`"c2s"`' and '`"s2s"`' are auto-loaded, but should you want to disable them then add them to this list. Defaults to '`'()`'.

`file-object groups-file` [`prosody-configuration` parameter]
Path to a text file where the shared groups are defined. If this path is empty then '`mod_groups`' does nothing. See `https://prosody.im/doc/modules/mod_groups`. Defaults to '`"/var/lib/prosody/sharedgroups.txt"`'.

`boolean allow-registration?` [`prosody-configuration` parameter]
Disable account creation by default, for security. See `https://prosody.im/doc/creating_accounts`. Defaults to '`#f`'.

`maybe-ssl-configuration ssl` [`prosody-configuration` parameter]
These are the SSL/TLS-related settings. Most of them are disabled so to use Prosody's defaults. If you do not completely understand these options, do not add them to your config, it is easy to lower the security of your server using them. See `https://prosody.im/doc/advanced_ssl_config`.

Available `ssl-configuration` fields are:

`maybe-string protocol` [`ssl-configuration` parameter]
This determines what handshake to use.

`maybe-file-name key` [`ssl-configuration` parameter]
Path to your private key file.

`maybe-file-name certificate` [`ssl-configuration` parameter]
Path to your certificate file.

`file-object capath` [`ssl-configuration` parameter]
Path to directory containing root certificates that you wish Prosody to trust when verifying the certificates of remote servers. Defaults to '`"/etc/ssl/certs"`'.

`maybe-file-object cafile` [`ssl-configuration` parameter]
Path to a file containing root certificates that you wish Prosody to trust. Similar to `capath` but with all certificates concatenated together.

`maybe-string-list verify` [`ssl-configuration` parameter]
A list of verification options (these mostly map to OpenSSL's `set_verify()` flags).

`maybe-string-list options` [`ssl-configuration` parameter]
A list of general options relating to SSL/TLS. These map to OpenSSL's `set_options()`. For a full list of options available in LuaSec, see the LuaSec source.

`maybe-non-negative-integer depth` [`ssl-configuration` parameter]
How long a chain of certificate authorities to check when looking for a trusted root certificate.

`maybe-string ciphers` [`ssl-configuration` parameter]
An OpenSSL cipher string. This selects what ciphers Prosody will offer to clients, and in what order.

`maybe-file-name dhparam` [`ssl-configuration` parameter]
A path to a file containing parameters for Diffie-Hellman key exchange. You can create such a file with: `openssl dhparam -out /etc/prosody/certs/dh-2048.pem 2048`

`maybe-string curve` [`ssl-configuration` parameter]
Curve for Elliptic curve Diffie-Hellman. Prosody's default is '`"secp384r1"`'.

`maybe-string-list verifyext` [`ssl-configuration` parameter]
A list of "extra" verification options.

`maybe-string password` [`ssl-configuration` parameter]
Password for encrypted private keys.

`boolean c2s-require-encryption?` [`prosody-configuration` parameter]
Whether to force all client-to-server connections to be encrypted or not. See `https://prosody.im/doc/modules/mod_tls`. Defaults to '`#f`'.

`string-list disable-sasl-mechanisms` [`prosody-configuration` parameter]
Set of mechanisms that will never be offered. See `https://prosody.im/doc/modules/mod_saslauth`. Defaults to '`'("DIGEST-MD5")`'.

`string-list insecure-sasl-mechanisms` [`prosody-configuration` parameter]
Set of mechanisms that will not be offered on unencrypted connections. See `https://prosody.im/doc/modules/mod_saslauth`. Defaults to '`'("PLAIN" "LOGIN")`'.

`boolean s2s-require-encryption?` [`prosody-configuration` parameter]
Whether to force all server-to-server connections to be encrypted or not. See `https://prosody.im/doc/modules/mod_tls`. Defaults to '`#f`'.

`boolean s2s-secure-auth?` [`prosody-configuration` parameter]
Whether to require encryption and certificate authentication. This provides ideal security, but requires servers you communicate with to support encryption AND present valid, trusted certificates. See `https://prosody.im/doc/s2s#security`. Defaults to '`#f`'.

`string-list s2s-insecure-domains` [`prosody-configuration` parameter]
Many servers don't support encryption or have invalid or self-signed certificates. You can list domains here that will not be required to authenticate using certificates. They will be authenticated using DNS. See `https://prosody.im/doc/s2s#security`. Defaults to '`'()`'.

`string-list s2s-secure-domains` [`prosody-configuration` parameter]
Even if you leave `s2s-secure-auth?` disabled, you can still require valid certificates for some domains by specifying a list here. See `https://prosody.im/doc/s2s#security`. Defaults to '`'()`'.

`string authentication` [`prosody-configuration` parameter]
Select the authentication backend to use. The default provider stores passwords in plaintext and uses Prosody's configured data storage to store the authentication data. If you do not trust your server please see `https://prosody.im/doc/modules/mod_auth_internal_hashed` for information about using the hashed backend. See also `https://prosody.im/doc/authentication` Defaults to '`"internal_plain"`'.

`maybe-string log` [`prosody-configuration` parameter]
Set logging options. Advanced logging configuration is not yet supported by the Prosody service. See `https://prosody.im/doc/logging`. Defaults to '`"*syslog"`'.

`file-name pidfile` [`prosody-configuration` parameter]
: File to write pid in. See `https://prosody.im/doc/modules/mod_posix`. Defaults to '`"/var/run/prosody/prosody.pid"`'.

`maybe-non-negative-integer http-max-content-size` [`prosody-configuration` parameter]
: Maximum allowed size of the HTTP body (in bytes).

`maybe-string http-external-url` [`prosody-configuration` parameter]
: Some modules expose their own URL in various ways. This URL is built from the protocol, host and port used. If Prosody sits behind a proxy, the public URL will be `http-external-url` instead. See `https://prosody.im/doc/http#external_url`.

`virtualhost-configuration-list virtualhosts` [`prosody-configuration` parameter]
: A host in Prosody is a domain on which user accounts can be created. For example if you want your users to have addresses like '`"john.smith@example.com"`' then you need to add a host '`"example.com"`'. All options in this list will apply only to this host.

  > **Nota:** The name *virtual* host is used in configuration to avoid confusion with the actual physical host that Prosody is installed on. A single Prosody instance can serve many domains, each one defined as a VirtualHost entry in Prosody's configuration. Conversely a server that hosts a single domain would have just one VirtualHost entry.
  >
  > See `https://prosody.im/doc/configure#virtual_host_settings`.

  Available `virtualhost-configuration` fields are:

  all these `prosody-configuration` fields: `admins`, `use-libevent?`, `modules-enabled`, `modules-disabled`, `groups-file`, `allow-registration?`, `ssl`, `c2s-require-encryption?`, `disable-sasl-mechanisms`, `insecure-sasl-mechanisms`, `s2s-require-encryption?`, `s2s-secure-auth?`, `s2s-insecure-domains`, `s2s-secure-domains`, `authentication`, `log`, `http-max-content-size`, `http-external-url`, `raw-content`, plus:

  `string domain` [`virtualhost-configuration` parameter]
  : Domain you wish Prosody to serve.

`int-component-configuration-list int-components` [`prosody-configuration` parameter]
: Components are extra services on a server which are available to clients, usually on a subdomain of the main server (such as '`"mycomponent.example.com"`'). Example components might be chatroom servers, user directories, or gateways to other protocols.

  Internal components are implemented with Prosody-specific plugins. To add an internal component, you simply fill the hostname field, and the plugin you wish to use for the component.

  See `https://prosody.im/doc/components`. Defaults to '`'()`'.

  Available `int-component-configuration` fields are:

all these `prosody-configuration` fields: `admins`, `use-libevent?`, `modules-enabled`, `modules-disabled`, `groups-file`, `allow-registration?`, `ssl`, `c2s-require-encryption?`, `disable-sasl-mechanisms`, `insecure-sasl-mechanisms`, `s2s-require-encryption?`, `s2s-secure-auth?`, `s2s-insecure-domains`, `s2s-secure-domains`, `authentication`, `log`, `http-max-content-size`, `http-external-url`, `raw-content`, plus:

`string hostname` [`int-component-configuration` parameter]
Hostname of the component.

`string plugin` [`int-component-configuration` parameter]
Plugin you wish to use for the component.

`maybe-mod-muc-configuration` [`int-component-configuration` parameter]
`mod-muc`
Multi-user chat (MUC) is Prosody's module for allowing you to create hosted chatrooms/conferences for XMPP users.

General information on setting up and using multi-user chatrooms can be found in the "Chatrooms" documentation (`https://prosody.im/doc/chatrooms`), which you should read if you are new to XMPP chatrooms.

See also `https://prosody.im/doc/modules/mod_muc`.

Available `mod-muc-configuration` fields are:

`string name` [`mod-muc-configuration` parameter]
The name to return in service discovery responses. Defaults to '`"Prosody Chatrooms"`'.

`string-or-boolean` [`mod-muc-configuration` parameter]
`restrict-room-creation`
If '`#t`', this will only allow admins to create new chatrooms. Otherwise anyone can create a room. The value '`"local"`' restricts room creation to users on the service's parent domain. E.g. '`user@example.com`' can create rooms on '`rooms.example.com`'. The value '`"admin"`' restricts to service administrators only. Defaults to '`#f`'.

`non-negative-integer` [`mod-muc-configuration` parameter]
`max-history-messages`
Maximum number of history messages that will be sent to the member that has just joined the room. Defaults to '`20`'.

`ext-component-configuration-list` [`prosody-configuration` parameter]
`ext-components`
External components use XEP-0114, which most standalone components support. To add an external component, you simply fill the hostname field. See `https://prosody.im/doc/components`. Defaults to '`'()`'.

Available `ext-component-configuration` fields are:

all these `prosody-configuration` fields: `admins`, `use-libevent?`, `modules-enabled`, `modules-disabled`, `groups-file`, `allow-registration?`, `ssl`, `c2s-require-encryption?`, `disable-sasl-mechanisms`, `insecure-sasl-mechanisms`,

`s2s-require-encryption?`, `s2s-secure-auth?`, `s2s-insecure-domains`, `s2s-secure-domains`, `authentication`, `log`, `http-max-content-size`, `http-external-url`, `raw-content`, plus:

`string component-secret` [`ext-component-configuration` parameter]
Password which the component will use to log in.

`string hostname` [`ext-component-configuration` parameter]
Hostname of the component.

`non-negative-integer-list component-ports` [`prosody-configuration` parameter]
Port(s) Prosody listens on for component connections. Defaults to ‘`'(5347)`’.

`string component-interface` [`prosody-configuration` parameter]
Interface Prosody listens on for component connections. Defaults to ‘`"127.0.0.1"`’.

`maybe-raw-content raw-content` [`prosody-configuration` parameter]
Raw content that will be added to the configuration file.

It could be that you just want to get a `prosody.cfg.lua` up and running. In that case, you can pass an `opaque-prosody-configuration` record as the value of `prosody-service-type`. As its name indicates, an opaque configuration does not have easy reflective capabilities. Available `opaque-prosody-configuration` fields are:

`package prosody` [`opaque-prosody-configuration` parameter]
The prosody package.

`string prosody.cfg.lua` [`opaque-prosody-configuration` parameter]
The contents of the `prosody.cfg.lua` to use.

For example, if your `prosody.cfg.lua` is just the empty string, you could instantiate a prosody service like this:

```
(service prosody-service-type
         (opaque-prosody-configuration
          (prosody.cfg.lua "")))
```

BitlBee Service

BitlBee (`https://bitlbee.org`) is a gateway that provides an IRC interface to a variety of messaging protocols such as XMPP.

`bitlbee-service-type` [Variável]
This is the service type for the BitlBee (`https://bitlbee.org`) IRC gateway daemon. Its value is a `bitlbee-configuration` (see below).

To have BitlBee listen on port 6667 on localhost, add this line to your services:

```
(service bitlbee-service-type)
```

`bitlbee-configuration` [Data Type]

This is the configuration for BitlBee, with the following fields:

`interface` (default: `"127.0.0.1"`)
`porta` (default: `6667`)
: Listen on the network interface corresponding to the IP address specified in *interface*, on *port*.

  When *interface* is `127.0.0.1`, only local clients can connect; when it is `0.0.0.0`, connections can come from any networking interface.

`bitlbee` (default: `bitlbee`)
: The BitlBee package to use.

`plugins` (default: `'()`)
: List of plugin packages to use—e.g., `bitlbee-discord`.

`extra-settings` (default: `""`)
: Configuration snippet added as-is to the BitlBee configuration file.

Quassel Service

Quassel (`https://quassel-irc.org/`) is a distributed IRC client, meaning that one or more clients can attach to and detach from the central core.

`quassel-service-type` [Variável]

This is the service type for the Quassel (`https://quassel-irc.org/`) IRC backend daemon. Its value is a `quassel-configuration` (see below).

`quassel-configuration` [Data Type]

This is the configuration for Quassel, with the following fields:

`quassel` (default: `quassel`)
: The Quassel package to use.

`interface` (default: `"::,0.0.0.0"`)
`port` (default: `4242`)
: Listen on the network interface(s) corresponding to the IPv4 or IPv6 interfaces specified in the comma delimited *interface*, on *port*.

`loglevel` (default: `"Info"`)
: The level of logging desired. Accepted values are Debug, Info, Warning and Error.

11.10.15 Serviços de telefonia

The `(gnu services telephony)` module contains Guix service definitions for telephony services. Currently it provides the following services:

Jami

`jami-service-type` [Variável]

The service type for running Jami as a service. It takes a `jami-configuration` object as a value, documented below. This section describes how to configure a Jami

server that can be used to host video (or audio) conferences, among other uses. The following example demonstrates how to specify Jami account archives (backups) to be provisioned automatically:

```
(service jami-service-type
         (jami-configuration
          (accounts
           (list (jami-account
                  (archive "/etc/jami/unencrypted-account-1.gz"))
                 (jami-account
                  (archive "/etc/jami/unencrypted-account-2.gz"))))))
```

When the accounts field is specified, the Jami account files of the service found under `/var/lib/jami` are recreated every time the service starts.

Jami accounts and their corresponding backup archives can be generated using the `jami` or `jami-gnome` Jami clients. The accounts should not be password-protected, but it is wise to ensure their files are only readable by '`root`'.

The next example shows how to declare that only some contacts should be allowed to communicate with a given account:

```
(service jami-service-type
         (jami-configuration
          (accounts
           (list (jami-account
                  (archive "/etc/jami/unencrypted-account-1.gz")
                  (peer-discovery? #t)
                  (rendezvous-point? #t)
                  (allowed-contacts
                   '("1dbcb0f5f37324228235564b79f2b9737e9a008f"
                     "2dbcb0f5f37324228235564b79f2b9737e9a008f")))))))
```

In this mode, only the declared `allowed-contacts` can initiate communication with the Jami account. This can be used, for example, with rendezvous point accounts to create a private video conferencing space.

To put the system administrator in full control of the conferences hosted on their system, the Jami service supports the following actions:

```
# herd doc jami list-actions
(list-accounts
 list-account-details
 list-banned-contacts
 list-contacts
 list-moderators
 add-moderator
 ban-contact
 enable-account
 disable-account)
```

The above actions aim to provide the most valuable actions for moderation purposes, not to cover the whole Jami API. Users wanting to interact with the Jami daemon

from Guile may be interested in experimenting with the `(gnu build jami-service)` module, which powers the above Shepherd actions.

The `add-moderator` and `ban-contact` actions accept a contact *fingerprint* (40 characters long hash) as first argument and an account fingerprint or username as second argument:

```
# herd add-moderator jami 1dbcb0f5f37324228235564b79f2b9737e9a008f \
  f3345f2775ddfe07a4b0d95daea111d15fbc1199

# herd list-moderators jami
Moderators for account f3345f2775ddfe07a4b0d95daea111d15fbc1199:
  - 1dbcb0f5f37324228235564b79f2b9737e9a008f
```

In the case of `ban-contact`, the second username argument is optional; when omitted, the account is banned from all Jami accounts:

```
# herd ban-contact jami 1dbcb0f5f37324228235564b79f2b9737e9a008f

# herd list-banned-contacts jami
Banned contacts for account f3345f2775ddfe07a4b0d95daea111d15fbc1199:
  - 1dbcb0f5f37324228235564b79f2b9737e9a008f
```

Banned contacts are also stripped from their moderation privileges.

The `disable-account` action allows to completely disconnect an account from the network, making it unreachable, while `enable-account` does the inverse. They accept a single account username or fingerprint as first argument:

```
# herd disable-account jami f3345f2775ddfe07a4b0d95daea111d15fbc1199

# herd list-accounts jami
The following Jami accounts are available:
  - f3345f2775ddfe07a4b0d95daea111d15fbc1199 (dummy) [disabled]
```

The `list-account-details` action prints the detailed parameters of each accounts in the Recutils format, which means the `recsel` command can be used to select accounts of interest (veja Seção "Selection Expressions" em *GNU recutils manual*). Note that period characters (‘`.`’) found in the account parameter keys are mapped to underscores (‘`_`’) in the output, to meet the requirements of the Recutils format. The following example shows how to print the account fingerprints for all accounts operating in the rendezvous point mode:

```
# herd list-account-details jami | \
  recsel -p Account.username -e 'Account.rendezVous ~ "true"'
Account_username: f3345f2775ddfe07a4b0d95daea111d15fbc1199
```

The remaining actions should be self-explanatory.

The complete set of available configuration options is detailed below.

`jami-configuration` [Data Type]

Available `jami-configuration` fields are:

`libjami` (default: `libjami`) (type: package)
The Jami daemon package to use.

`dbus` (default: `dbus-for-jami`) (type: package)
The D-Bus package to use to start the required D-Bus session.

`nss-certs` (default: `nss-certs`) (type: package)
The nss-certs package to use to provide TLS certificates.

`enable-logging?` (default: `#t`) (type: boolean)
Whether to enable logging to syslog.

`debug?` (default: `#f`) (type: boolean)
Whether to enable debug level messages.

`auto-answer?` (default: `#f`) (type: boolean)
Whether to force automatic answer to incoming calls.

`accounts` (type: maybe-jami-account-list)
A list of Jami accounts to be (re-)provisioned every time the Jami daemon service starts. When providing this field, the account directories under `/var/lib/jami/` are recreated every time the service starts, ensuring a consistent state.

`jami-account` [Data Type]

Available `jami-account` fields are:

`archive` (type: string-or-computed-file)
The account archive (backup) file name of the account. This is used to provision the account when the service starts. The account archive should *not* be encrypted. It is highly recommended to make it readable only to the '`root`' user (i.e., not in the store), to guard against leaking the secret key material of the Jami account it contains.

`allowed-contacts` (type: maybe-account-fingerprint-list)
The list of allowed contacts for the account, entered as their 40 characters long fingerprint. Messages or calls from accounts not in that list will be rejected. When left specified, the configuration of the account archive is used as-is with respect to contacts and public inbound calls/messaging allowance, which typically defaults to allow any contact to communicate with the account.

`moderators` (type: maybe-account-fingerprint-list)
The list of contacts that should have moderation privileges (to ban, mute, etc. other users) in rendezvous conferences, entered as their 40 characters long fingerprint. When left unspecified, the configuration of the account archive is used as-is with respect to moderation, which typically defaults to allow anyone to moderate.

`rendezvous-point?` (type: maybe-boolean)
Whether the account should operate in the rendezvous mode. In this mode, all the incoming audio/video calls are mixed into a conference. When left unspecified, the value from the account archive prevails.

`peer-discovery?` (type: maybe-boolean)
: Whether peer discovery should be enabled. Peer discovery is used to discover other OpenDHT nodes on the local network, which can be useful to maintain communication between devices on such network even when the connection to the Internet has been lost. When left unspecified, the value from the account archive prevails.

`bootstrap-hostnames` (type: maybe-list-of-strings)
: A list of hostnames or IPs pointing to OpenDHT nodes, that should be used to initially join the OpenDHT network. When left unspecified, the value from the account archive prevails.

`name-server-uri` (type: maybe-string)
: The URI of the name server to use, that can be used to retrieve the account fingerprint for a registered username.

Mumble server

This section describes how to set up and run a Mumble (`https://mumble.info`) server (formerly known as Murmur).

`mumble-server-service-type` [Variável]
: This is the service to run a Mumble server. It takes a `mumble-server-configuration` object as its value, defined below.

`mumble-server-configuration` [Data Type]
: The service type for the Mumble server. An example configuration can look like this:

```
(service mumble-server-service-type
         (mumble-server-configuration
          (welcome-text
            "Welcome to this Mumble server running on Guix!")
          (cert-required? #t) ;disallow text password logins
          (ssl-cert "/etc/certs/mumble.example.com/fullchain.pem")
          (ssl-key "/etc/certs/mumble.example.com/privkey.pem")))
```

After reconfiguring your system, you can manually set the mumble-server `SuperUser` password with the command that is printed during the activation phase.

It is recommended to register a normal Mumble user account and grant it admin or moderator rights. You can use the `mumble` client to login as new normal user, register yourself, and log out. For the next step login with the name `SuperUser` use the `SuperUser` password that you set previously, and grant your newly registered mumble user administrator or moderator rights and create some channels.

Available `mumble-server-configuration` fields are:

`package` (default: `mumble`)
: Package that contains `bin/mumble-server`.

`user` (default: `"mumble-server"`)
: User who will run the Mumble-Server server.

`group` (default: `"mumble-server"`)
: Group of the user who will run the mumble-server server.

`porta` (default: `64738`)
: Port on which the server will listen.

`welcome-text` (default: `""`)
: Welcome text sent to clients when they connect.

`server-password` (default: `""`)
: Password the clients have to enter in order to connect.

`max-users` (default: `100`)
: Maximum of users that can be connected to the server at once.

`max-user-bandwidth` (default: `#f`)
: Maximum voice traffic a user can send per second.

`database-file` (default: `"/var/lib/mumble-server/db.sqlite"`)
: File name of the sqlite database. The service's user will become the owner of the directory.

`log-file` (default: `"/var/log/mumble-server/mumble-server.log"`)
: File name of the log file. The service's user will become the owner of the directory.

`autoban-attempts` (default: `10`)
: Maximum number of logins a user can make in `autoban-timeframe` without getting auto banned for `autoban-time`.

`autoban-timeframe` (default: `120`)
: Timeframe for autoban in seconds.

`autoban-time` (default: `300`)
: Amount of time in seconds for which a client gets banned when violating the autoban limits.

`opus-threshold` (default: `100`)
: Percentage of clients that need to support opus before switching over to opus audio codec.

`channel-nesting-limit` (default: `10`)
: How deep channels can be nested at maximum.

`channelname-regex` (default: `#f`)
: A string in form of a Qt regular expression that channel names must conform to.

`username-regex` (default: `#f`)
: A string in form of a Qt regular expression that user names must conform to.

`text-message-length` (default: `5000`)
: Maximum size in bytes that a user can send in one text chat message.

`image-message-length` (default: `(* 128 1024)`)
: Maximum size in bytes that a user can send in one image message.

`cert-required?` (default: `#f`)
: If it is set to `#t` clients that use weak password authentication will not be accepted. Users must have completed the certificate wizard to join.

`remember-channel?` (padrão: `#f`)
: Should mumble-server remember the last channel each user was in when they disconnected and put them into the remembered channel when they rejoin.

`allow-html?` (default: `#f`)
: Should html be allowed in text messages, user comments, and channel descriptions.

`allow-ping?` (default: `#f`)
: Setting to true exposes the current user count, the maximum user count, and the server's maximum bandwidth per client to unauthenticated users. In the Mumble client, this information is shown in the Connect dialog.

  Disabling this setting will prevent public listing of the server.

`bonjour?` (padrão: `#f`)
: Should the server advertise itself in the local network through the bonjour protocol.

`send-version?` (default: `#f`)
: Should the mumble-server server version be exposed in ping requests.

`log-days` (default: `31`)
: Mumble also stores logs in the database, which are accessible via RPC. The default is 31 days of months, but you can set this setting to 0 to keep logs forever, or -1 to disable logging to the database.

`obfuscate-ips?` (default: `#t`)
: Should logged ips be obfuscated to protect the privacy of users.

`ssl-cert` (default: `#f`)
: File name of the SSL/TLS certificate used for encrypted connections.

```
(ssl-cert "/etc/certs/example.com/fullchain.pem")
```

`ssl-key` (default: `#f`)
: Filepath to the ssl private key used for encrypted connections.

```
(ssl-key "/etc/certs/example.com/privkey.pem")
```

`ssl-dh-params` (default: `#f`)
: File name of a PEM-encoded file with Diffie-Hellman parameters for the SSL/TLS encryption. Alternatively you set it to `"@ffdhe2048"`, `"@ffdhe3072"`, `"@ffdhe4096"`, `"@ffdhe6144"` or `"@ffdhe8192"` to use bundled parameters from RFC 7919.

`ssl-ciphers` (default: `#f`)
: The `ssl-ciphers` option chooses the cipher suites to make available for use in SSL/TLS.

  This option is specified using OpenSSL cipher list notation (`https://www.openssl.org/docs/apps/ciphers.html#CIPHER-LIST-FORMAT`).

It is recommended that you try your cipher string using 'openssl ciphers <string>' before setting it here, to get a feel for which cipher suites you will get. After setting this option, it is recommend that you inspect your Mumble server log to ensure that Mumble is using the cipher suites that you expected it to.

> **Nota:** Changing this option may impact the backwards compatibility of your Mumble-Server server, and can remove the ability for older Mumble clients to be able to connect to it.

`public-registration` (default: `#f`)
: Must be a `<mumble-server-public-registration-configuration>` record or `#f`.

  You can optionally register your server in the public server list that the `mumble` client shows on startup. You cannot register your server if you have set a `server-password`, or set `allow-ping` to `#f`.

  It might take a few hours until it shows up in the public list.

`file` (default: `#f`)
: Optional alternative override for this configuration.

`mumble-server-public-registration-configuration` [Data Type]

Configuration for public registration of a mumble-server service.

`name` This is a display name for your server. Not to be confused with the hostname.

`senha` A password to identify your registration. Subsequent updates will need the same password. Don't lose your password.

`url` This should be a `http://` or `https://` link to your web site.

`hostname` (default: `#f`)
: By default your server will be listed by its IP address. If it is set your server will be linked by this host name instead.

Deprecation notice: Due to historical reasons, all of the above `mumble-server-` procedures are also exported with the `murmur-` prefix. It is recommended that you switch to using `mumble-server-` going forward.

11.10.16 Serviços de compartilhamento de arquivos

The `(gnu services file-sharing)` module provides services that assist with transferring files over peer-to-peer file-sharing networks.

Transmission Daemon Service

Transmission (`https://transmissionbt.com/`) is a flexible BitTorrent client that offers a variety of graphical and command-line interfaces. A `transmission-daemon-service-type` service provides Transmission's headless variant, `transmission-daemon`, as a system service, allowing users to share files via BitTorrent even when they are not logged in.

`transmission-daemon-service-type` [Variável]

The service type for the Transmission Daemon BitTorrent client. Its value must be a `transmission-daemon-configuration` object as in this example:

```
(service transmission-daemon-service-type
         (transmission-daemon-configuration
          ;; Restrict access to the RPC ("control") interface
          (rpc-authentication-required? #t)
          (rpc-username "transmission")
          (rpc-password
           (transmission-password-hash
            "transmission" ; desired password
            "uKd1uMs9"))   ; arbitrary salt value

          ;; Accept requests from this and other hosts on the
          ;; local network
          (rpc-whitelist-enabled? #t)
          (rpc-whitelist '("::1" "127.0.0.1" "192.168.0.*"))

          ;; Limit bandwidth use during work hours
          (alt-speed-down (* 1024 2)) ;   2 MB/s
          (alt-speed-up 512)          ; 512 kB/s

          (alt-speed-time-enabled? #t)
          (alt-speed-time-day 'weekdays)
          (alt-speed-time-begin
           (+ (* 60 8) 30))           ; 8:30 am
          (alt-speed-time-end
           (+ (* 60 (+ 12 5)) 30))))  ; 5:30 pm
```

Once the service is started, users can interact with the daemon through its Web interface (at `http://localhost:9091/`) or by using the `transmission-remote` command-line tool, available in the `transmission` package. (Emacs users may want to also consider the `emacs-transmission` package.) Both communicate with the daemon through its remote procedure call (RPC) interface, which by default is available to all users on the system; you may wish to change this by assigning values to the `rpc-authentication-required?`, `rpc-username` and `rpc-password` settings, as shown in the example above and documented further below.

The value for `rpc-password` must be a password hash of the type generated and used by Transmission clients. This can be copied verbatim from an existing `settings.json` file, if another Transmission client is already being used. Otherwise, the `transmission-password-hash` and `transmission-random-salt` procedures provided by this module can be used to obtain a suitable hash value.

`transmission-password-hash` *password salt* [Procedure]

Returns a string containing the result of hashing *password* together with *salt*, in the format recognized by Transmission clients for their `rpc-password` configuration setting.

salt must be an eight-character string. The `transmission-random-salt` procedure can be used to generate a suitable salt value at random.

`transmission-random-salt` [Procedure]
Returns a string containing a random, eight-character salt value of the type generated and used by Transmission clients, suitable for passing to the `transmission-password-hash` procedure.

These procedures are accessible from within a Guile REPL started with the `guix repl` command (veja Seção 8.13 [Invocando guix repl], Página 172). This is useful for obtaining a random salt value to provide as the second parameter to ‘transmission-password-hash‘, as in this example session:

```
$ guix repl
scheme@(guix-user)> ,use (gnu services file-sharing)
scheme@(guix-user)> (transmission-random-salt)
$1 = "uKd1uMs9"
```

Alternatively, a complete password hash can generated in a single step:

```
scheme@(guix-user)> (transmission-password-hash "transmission"
(transmission-random-salt))
$2 = "{c8bbc6d1740cd8dc819a6e25563b67812c1c19c9VtFPfdsX"
```

The resulting string can be used as-is for the value of `rpc-password`, allowing the password to be kept hidden even in the operating-system configuration.

Torrent files downloaded by the daemon are directly accessible only to users in the “transmission” user group, who receive read-only access to the directory specified by the `download-dir` configuration setting (and also the directory specified by `incomplete-dir`, if `incomplete-dir-enabled?` is `#t`). Downloaded files can be moved to another directory or deleted altogether using `transmission-remote` with its `--move` and `--remove-and-delete` options.

If the `watch-dir-enabled?` setting is set to `#t`, users in the “transmission” group are able also to place `.torrent` files in the directory specified by `watch-dir` to have the corresponding torrents added by the daemon. (The `trash-original-torrent-files?` setting controls whether the daemon deletes these files after processing them.)

Some of the daemon’s configuration settings can be changed temporarily by `transmission-remote` and similar tools. To undo these changes, use the service’s `reload` action to have the daemon reload its settings from disk:

```
# herd reload transmission-daemon
```

The full set of available configuration settings is defined by the `transmission-daemon-configuration` data type.

`transmission-daemon-configuration` [Data Type]
The data type representing configuration settings for Transmission Daemon. These correspond directly to the settings recognized by Transmission clients in their `settings.json` file.

Available `transmission-daemon-configuration` fields are:

`package transmission` [`transmission-daemon-configuration` parameter]
The Transmission package to use.

`non-negative-integer` [`transmission-daemon-configuration` parameter]
`stop-wait-period`
The period, in seconds, to wait when stopping the service for `transmission-daemon` to exit before killing its process. This allows the daemon time to complete its housekeeping and send a final update to trackers as it shuts down. On slow hosts, or hosts with a slow network connection, this value may need to be increased.
Defaults to '`10`'.

`string download-dir` [`transmission-daemon-configuration` parameter]
The directory to which torrent files are downloaded.
Defaults to '`"/var/lib/transmission-daemon/downloads"`'.

`boolean` [`transmission-daemon-configuration` parameter]
`incomplete-dir-enabled?`
If `#t`, files will be held in `incomplete-dir` while their torrent is being downloaded, then moved to `download-dir` once the torrent is complete. Otherwise, files for all torrents (including those still being downloaded) will be placed in `download-dir`.
Defaults to '`#f`'.

`maybe-string` [`transmission-daemon-configuration` parameter]
`incomplete-dir`
The directory in which files from incompletely downloaded torrents will be held when `incomplete-dir-enabled?` is `#t`.
Defaults to '`disabled`'.

`umask umask` [`transmission-daemon-configuration` parameter]
The file mode creation mask used for downloaded files. (See the `umask` man page for more information.)
Defaults to '`18`'.

`boolean` [`transmission-daemon-configuration` parameter]
`rename-partial-files?`
When `#t`, ".part" is appended to the name of partially downloaded files.
Defaults to '`#t`'.

`preallocation-mode` [`transmission-daemon-configuration` parameter]
`preallocation`
The mode by which space should be preallocated for downloaded files, one of `none`, `fast` (or `sparse`) and `full`. Specifying `full` will minimize disk fragmentation at a cost to file-creation speed.
Defaults to '`fast`'.

`boolean watch-dir-enabled?` [`transmission-daemon-configuration` parameter]
If `#t`, the directory specified by `watch-dir` will be watched for new `.torrent` files and the torrents they describe added automatically (and the original files removed, if `trash-original-torrent-files?` is `#t`).
Defaults to '`#f`'.

`maybe-string watch-dir` [`transmission-daemon-configuration` parameter]
The directory to be watched for `.torrent` files indicating new torrents to be added, when `watch-dir-enabled` is `#t`.

Defaults to '`disabled`'.

`boolean trash-original-torrent-files?` [`transmission-daemon-configuration` parameter]
When `#t`, `.torrent` files will be deleted from the watch directory once their torrent has been added (see `watch-directory-enabled?`).

Defaults to '`#f`'.

`boolean speed-limit-down-enabled?` [`transmission-daemon-configuration` parameter]
When `#t`, the daemon's download speed will be limited to the rate specified by `speed-limit-down`.

Defaults to '`#f`'.

`non-negative-integer speed-limit-down` [`transmission-daemon-configuration` parameter]
The default global-maximum download speed, in kilobytes per second.

Defaults to '`100`'.

`boolean speed-limit-up-enabled?` [`transmission-daemon-configuration` parameter]
When `#t`, the daemon's upload speed will be limited to the rate specified by `speed-limit-up`.

Defaults to '`#f`'.

`non-negative-integer speed-limit-up` [`transmission-daemon-configuration` parameter]
The default global-maximum upload speed, in kilobytes per second.

Defaults to '`100`'.

`boolean alt-speed-enabled?` [`transmission-daemon-configuration` parameter]
When `#t`, the alternate speed limits `alt-speed-down` and `alt-speed-up` are used (in place of `speed-limit-down` and `speed-limit-up`, if they are enabled) to constrain the daemon's bandwidth usage. This can be scheduled to occur automatically at certain times during the week; see `alt-speed-time-enabled?`.

Defaults to '`#f`'.

`non-negative-integer alt-speed-down` [`transmission-daemon-configuration` parameter]
The alternate global-maximum download speed, in kilobytes per second.

Defaults to '`50`'.

`non-negative-integer alt-speed-up` [`transmission-daemon-configuration` parameter]
The alternate global-maximum upload speed, in kilobytes per second.

Defaults to '`50`'.

`boolean` [`transmission-daemon-configuration` parameter]
`alt-speed-time-enabled?`

When `#t`, the alternate speed limits `alt-speed-down` and `alt-speed-up` will be enabled automatically during the periods specified by `alt-speed-time-day`, `alt-speed-time-begin` and `alt-time-speed-end`.

Defaults to '`#f`'.

`day-list` [`transmission-daemon-configuration` parameter]
`alt-speed-time-day`

The days of the week on which the alternate-speed schedule should be used, specified either as a list of days (`sunday`, `monday`, and so on) or using one of the symbols `weekdays`, `weekends` or `all`.

Defaults to '`all`'.

`non-negative-integer` [`transmission-daemon-configuration` parameter]
`alt-speed-time-begin`

The time of day at which to enable the alternate speed limits, expressed as a number of minutes since midnight.

Defaults to '`540`'.

`non-negative-integer` [`transmission-daemon-configuration` parameter]
`alt-speed-time-end`

The time of day at which to disable the alternate speed limits, expressed as a number of minutes since midnight.

Defaults to '`1020`'.

`string bind-address-ipv4` [`transmission-daemon-configuration` parameter]
The IP address at which to listen for peer connections, or "0.0.0.0" to listen at all available IP addresses.

Defaults to '`"0.0.0.0"`'.

`string bind-address-ipv6` [`transmission-daemon-configuration` parameter]
The IPv6 address at which to listen for peer connections, or "::" to listen at all available IPv6 addresses.

Defaults to '`"::"`'.

`boolean` [`transmission-daemon-configuration` parameter]
`peer-port-random-on-start?`

If `#t`, when the daemon starts it will select a port at random on which to listen for peer connections, from the range specified (inclusively) by `peer-port-random-low` and `peer-port-random-high`. Otherwise, it listens on the port specified by `peer-port`.

Defaults to '`#f`'.

`port-number` [`transmission-daemon-configuration` parameter]
`peer-port-random-low`

The lowest selectable port number when `peer-port-random-on-start?` is `#t`.

Defaults to '`49152`'.

`port-number` [`transmission-daemon-configuration` parameter]
`peer-port-random-high`

The highest selectable port number when `peer-port-random-on-start` is `#t`.

Defaults to '`65535`'.

`port-number peer-port` [`transmission-daemon-configuration` parameter]

The port on which to listen for peer connections when `peer-port-random-on-start?` is `#f`.

Defaults to '`51413`'.

`boolean` [`transmission-daemon-configuration` parameter]
`port-forwarding-enabled?`

If `#t`, the daemon will attempt to configure port-forwarding on an upstream gateway automatically using UPnP and NAT-PMP.

Defaults to '`#t`'.

`encryption-mode encryption` [`transmission-daemon-configuration` parameter]

The encryption preference for peer connections, one of `prefer-unencrypted-connections`, `prefer-encrypted-connections` or `require-encrypted-connections`.

Defaults to '`prefer-encrypted-connections`'.

`maybe-string` [`transmission-daemon-configuration` parameter]
`peer-congestion-algorithm`

The TCP congestion-control algorithm to use for peer connections, specified using a string recognized by the operating system in calls to `setsockopt`. When left unspecified, the operating-system default is used.

Note that on GNU/Linux systems, the kernel must be configured to allow processes to use a congestion-control algorithm not in the default set; otherwise, it will deny these requests with "Operation not permitted". To see which algorithms are available on your system and which are currently permitted for use, look at the contents of the files `tcp_available_congestion_control` and `tcp_allowed_congestion_control` in the `/proc/sys/net/ipv4` directory.

As an example, to have Transmission Daemon use the TCP Low Priority congestion-control algorithm (`http://www-ece.rice.edu/networks/TCP-LP/`), you'll need to modify your kernel configuration to build in support for the algorithm, then update your operating-system configuration to allow its use by adding a `sysctl-service-type` service (or updating the existing one's configuration) with lines like the following:

```
(service sysctl-service-type
         (sysctl-configuration
          (settings
           ("net.ipv4.tcp_allowed_congestion_control" .
            "reno cubic lp"))))
```

The Transmission Daemon configuration can then be updated with

```
(peer-congestion-algorithm "lp")
```

and the system reconfigured to have the changes take effect.

Defaults to '`disabled`'.

`tcp-type-of-service` [`transmission-daemon-configuration` parameter]
`peer-socket-tos`

The type of service to request in outgoing TCP packets, one of `default`, `low-cost`, `throughput`, `low-delay` and `reliability`.

Defaults to '`default`'.

`non-negative-integer` [`transmission-daemon-configuration` parameter]
`peer-limit-global`

The global limit on the number of connected peers.

Defaults to '`200`'.

`non-negative-integer` [`transmission-daemon-configuration` parameter]
`peer-limit-per-torrent`

The per-torrent limit on the number of connected peers.

Defaults to '`50`'.

`non-negative-integer` [`transmission-daemon-configuration` parameter]
`upload-slots-per-torrent`

The maximum number of peers to which the daemon will upload data simultaneously for each torrent.

Defaults to '`14`'.

`non-negative-integer` [`transmission-daemon-configuration` parameter]
`peer-id-ttl-hours`

The maximum lifespan, in hours, of the peer ID associated with each public torrent before it is regenerated.

Defaults to '`6`'.

`boolean blocklist-enabled?` [`transmission-daemon-configuration` parameter]

When `#t`, the daemon will ignore peers mentioned in the blocklist it has most recently downloaded from `blocklist-url`.

Defaults to '`#f`'.

`maybe-string blocklist-url` [`transmission-daemon-configuration` parameter]

The URL of a peer blocklist (in P2P-plaintext or eMule `.dat` format) to be periodically downloaded and applied when `blocklist-enabled?` is `#t`.

Defaults to '`disabled`'.

`boolean` [`transmission-daemon-configuration` parameter]
`download-queue-enabled?`

If `#t`, the daemon will be limited to downloading at most `download-queue-size` non-stalled torrents simultaneously.

Defaults to '`#t`'.

`non-negative-integer` [`transmission-daemon-configuration` parameter]
`download-queue-size`

The size of the daemon's download queue, which limits the number of non-stalled torrents it will download at any one time when `download-queue-enabled?` is `#t`.

Defaults to '`5`'.

`boolean` [`transmission-daemon-configuration` parameter]
`seed-queue-enabled?`

If `#t`, the daemon will be limited to seeding at most `seed-queue-size` non-stalled torrents simultaneously.

Defaults to '`#f`'.

`non-negative-integer` [`transmission-daemon-configuration` parameter]
`seed-queue-size`

The size of the daemon's seed queue, which limits the number of non-stalled torrents it will seed at any one time when `seed-queue-enabled?` is `#t`.

Defaults to '`10`'.

`boolean` [`transmission-daemon-configuration` parameter]
`queue-stalled-enabled?`

When `#t`, the daemon will consider torrents for which it has not shared data in the past `queue-stalled-minutes` minutes to be stalled and not count them against its `download-queue-size` and `seed-queue-size` limits.

Defaults to '`#t`'.

`non-negative-integer` [`transmission-daemon-configuration` parameter]
`queue-stalled-minutes`

The maximum period, in minutes, a torrent may be idle before it is considered to be stalled, when `queue-stalled-enabled?` is `#t`.

Defaults to '`30`'.

`boolean` [`transmission-daemon-configuration` parameter]
`ratio-limit-enabled?`

When `#t`, a torrent being seeded will automatically be paused once it reaches the ratio specified by `ratio-limit`.

Defaults to '`#f`'.

`non-negative-rational` [`transmission-daemon-configuration` parameter]
`ratio-limit`

The ratio at which a torrent being seeded will be paused, when `ratio-limit-enabled?` is `#t`.

Defaults to '`2.0`'.

`boolean` [`transmission-daemon-configuration` parameter]
`idle-seeding-limit-enabled?`

When `#t`, a torrent being seeded will automatically be paused once it has been idle for `idle-seeding-limit` minutes.

Defaults to '`#f`'.

`non-negative-integer` [`transmission-daemon-configuration` parameter]
`idle-seeding-limit`

The maximum period, in minutes, a torrent being seeded may be idle before it is paused, when `idle-seeding-limit-enabled?` is `#t`.

Defaults to '`30`'.

`boolean dht-enabled?` [`transmission-daemon-configuration` parameter]
Enable the distributed hash table (DHT) protocol (`http://bittorrent.org/beps/bep_0005.html`), which supports the use of trackerless torrents.

Defaults to '`#t`'.

`boolean lpd-enabled?` [`transmission-daemon-configuration` parameter]
Enable local peer discovery (`https://en.wikipedia.org/wiki/Local_Peer_Discovery`) (LPD), which allows the discovery of peers on the local network and may reduce the amount of data sent over the public Internet.

Defaults to '`#f`'.

`boolean pex-enabled?` [`transmission-daemon-configuration` parameter]
Enable peer exchange (`https://en.wikipedia.org/wiki/Peer_exchange`) (PEX), which reduces the daemon's reliance on external trackers and may improve its performance.

Defaults to '`#t`'.

`boolean utp-enabled?` [`transmission-daemon-configuration` parameter]
Enable the micro transport protocol (`http://bittorrent.org/beps/bep_0029.html`) (uTP), which aims to reduce the impact of BitTorrent traffic on other users of the local network while maintaining full utilization of the available bandwidth.

Defaults to '`#t`'.

`boolean rpc-enabled?` [`transmission-daemon-configuration` parameter]
If `#t`, enable the remote procedure call (RPC) interface, which allows remote control of the daemon via its Web interface, the `transmission-remote` command-line client, and similar tools.

Defaults to '`#t`'.

`string rpc-bind-address` [`transmission-daemon-configuration` parameter]
The IP address at which to listen for RPC connections, or "0.0.0.0" to listen at all available IP addresses.

Defaults to '`"0.0.0.0"`'.

`port-number rpc-port` [`transmission-daemon-configuration` parameter]
The port on which to listen for RPC connections.

Defaults to '`9091`'.

`string rpc-url` [`transmission-daemon-configuration` parameter]
The path prefix to use in the RPC-endpoint URL.

Defaults to '`"/transmission/"`'.

`boolean rpc-authentication-required?` [`transmission-daemon-configuration` parameter]
When `#t`, clients must authenticate (see `rpc-username` and `rpc-password`) when using the RPC interface. Note this has the side effect of disabling host-name whitelisting (see `rpc-host-whitelist-enabled?`.

Defaults to '`#f`'.

`maybe-string rpc-username` [`transmission-daemon-configuration` parameter]
The username required by clients to access the RPC interface when `rpc-authentication-required?` is `#t`.

Defaults to '`disabled`'.

`maybe-transmission-password-hash rpc-password` [`transmission-daemon-configuration` parameter]
The password required by clients to access the RPC interface when `rpc-authentication-required?` is `#t`. This must be specified using a password hash in the format recognized by Transmission clients, either copied from an existing `settings.json` file or generated using the `transmission-password-hash` procedure.

Defaults to '`disabled`'.

`boolean rpc-whitelist-enabled?` [`transmission-daemon-configuration` parameter]
When `#t`, RPC requests will be accepted only when they originate from an address specified in `rpc-whitelist`.

Defaults to '`#t`'.

`string-list rpc-whitelist` [`transmission-daemon-configuration` parameter]
The list of IP and IPv6 addresses from which RPC requests will be accepted when `rpc-whitelist-enabled?` is `#t`. Wildcards may be specified using '`*`'.

Defaults to '`'("127.0.0.1" "::1")`'.

`boolean rpc-host-whitelist-enabled?` [`transmission-daemon-configuration` parameter]
When `#t`, RPC requests will be accepted only when they are addressed to a host named in `rpc-host-whitelist`. Note that requests to "localhost" or "localhost.", or to a numeric address, are always accepted regardless of these settings.

Note also this functionality is disabled when `rpc-authentication-required?` is `#t`.

Defaults to '`#t`'.

`string-list rpc-host-whitelist` [`transmission-daemon-configuration` parameter]
The list of host names recognized by the RPC server when `rpc-host-whitelist-enabled?` is `#t`.

Defaults to '`'()`'.

`message-level message-level` [`transmission-daemon-configuration` parameter]
The minimum severity level of messages to be logged (to `/var/log/transmission.log`) by the daemon, one of `none` (no logging), `error`, `info` and `debug`.

Defaults to '`info`'.

`boolean` [`transmission-daemon-configuration` parameter]
`start-added-torrents?`

When `#t`, torrents are started as soon as they are added; otherwise, they are added in "paused" state.

Defaults to '`#t`'.

`boolean` [`transmission-daemon-configuration` parameter]
`script-torrent-done-enabled?`

When `#t`, the script specified by `script-torrent-done-filename` will be invoked each time a torrent completes.

Defaults to '`#f`'.

`maybe-file-object` [`transmission-daemon-configuration` parameter]
`script-torrent-done-filename`

A file name or file-like object specifying a script to run each time a torrent completes, when `script-torrent-done-enabled?` is `#t`.

Defaults to '`disabled`'.

`boolean` [`transmission-daemon-configuration` parameter]
`scrape-paused-torrents-enabled?`

When `#t`, the daemon will scrape trackers for a torrent even when the torrent is paused.

Defaults to '`#t`'.

`non-negative-integer` [`transmission-daemon-configuration` parameter]
`cache-size-mb`

The amount of memory, in megabytes, to allocate for the daemon's in-memory cache. A larger value may increase performance by reducing the frequency of disk I/O.

Defaults to '`4`'.

`boolean prefetch-enabled?` [`transmission-daemon-configuration` parameter]

When `#t`, the daemon will try to improve I/O performance by hinting to the operating system which data is likely to be read next from disk to satisfy requests from peers.

Defaults to '`#t`'.

11.10.17 Serviços de monitoramento

Tailon Service

Tailon (`https://tailon.readthedocs.io/`) is a web application for viewing and searching log files.

The following example will configure the service with default values. By default, Tailon can be accessed on port 8080 (`http://localhost:8080`).

```
(service tailon-service-type)
```

The following example customises more of the Tailon configuration, adding `sed` to the list of allowed commands.

```
(service tailon-service-type
```

```
(tailon-configuration
  (config-file
    (tailon-configuration-file
      (allowed-commands '("tail" "grep" "awk" "sed")))))
```

`tailon-configuration` [Data Type]

Data type representing the configuration of Tailon. This type has the following parameters:

`config-file` (default: `(tailon-configuration-file)`)
: The configuration file to use for Tailon. This can be set to a *tailon-configuration-file* record value, or any gexp (veja Seção 8.12 [Expressões-G], Página 163).

  For example, to instead use a local file, the `local-file` function can be used:

```
(service tailon-service-type
         (tailon-configuration
           (config-file (local-file "./my-tailon.conf"))))
```

`package` (default: `tailon`)
: The tailon package to use.

`tailon-configuration-file` [Data Type]

Data type representing the configuration options for Tailon. This type has the following parameters:

`files` (default: `(list "/var/log")`)
: List of files to display. The list can include strings for a single file or directory, or a list, where the first item is the name of a subsection, and the remaining items are the files or directories in that subsection.

`bind` (default: `"localhost:8080"`)
: Address and port to which Tailon should bind on.

`relative-root` (default: `#f`)
: URL path to use for Tailon, set to `#f` to not use a path.

`allow-transfers?` (default: `#t`)
: Allow downloading the log files in the web interface.

`follow-names?` (default: `#t`)
: Allow tailing of not-yet existent files.

`tail-lines` (default: `200`)
: Number of lines to read initially from each file.

`allowed-commands` (default: `(list "tail" "grep" "awk")`)
: Commands to allow running. By default, `sed` is disabled.

`debug?` (default: `#f`)
: Set `debug?` to `#t` to show debug messages.

`wrap-lines` (default: `#t`)
: Initial line wrapping state in the web interface. Set to `#t` to initially wrap lines (the default), or to `#f` to initially not wrap lines.

`http-auth` (default: `#f`)
: HTTP authentication type to use. Set to `#f` to disable authentication (the default). Supported values are `"digest"` or `"basic"`.

`users` (default: `#f`)
: If HTTP authentication is enabled (see `http-auth`), access will be restricted to the credentials provided here. To configure users, use a list of pairs, where the first element of the pair is the username, and the 2nd element of the pair is the password.

```
(tailon-configuration-file
  (http-auth "basic")
  (users     '(("user1" . "password1")
               ("user2" . "password2"))))
```

Darkstat Service

Darkstat is a packet sniffer that captures network traffic, calculates statistics about usage, and serves reports over HTTP.

`darkstat-service-type` [Variável]
: This is the service type for the darkstat (`https://unix4lyfe.org/darkstat/`) service, its value must be a `darkstat-configuration` record as in this example:

```
(service darkstat-service-type
         (darkstat-configuration
           (interface "eno1")))
```

`darkstat-configuration` [Data Type]
: Data type representing the configuration of `darkstat`.

`package` (default: `darkstat`)
: The darkstat package to use.

`interface`
: Capture traffic on the specified network interface.

`porta` (default: `"667"`)
: Bind the web interface to the specified port.

`bind-address` (default: `"127.0.0.1"`)
: Bind the web interface to the specified address.

`base` (default: `"/"`)
: Specify the path of the base URL. This can be useful if `darkstat` is accessed via a reverse proxy.

Prometheus Node Exporter Service

The Prometheus "node exporter" makes hardware and operating system statistics provided by the Linux kernel available for the Prometheus monitoring system. This service should

be deployed on all physical nodes and virtual machines, where monitoring these statistics is desirable.

`prometheus-node-exporter-service-type` [Variável]
This is the service type for the prometheus-node-exporter (`https://github.com/prometheus/node_exporter/`) service, its value must be a `prometheus-node-exporter-configuration`.

```
(service prometheus-node-exporter-service-type)
```

`prometheus-node-exporter-configuration` [Data Type]
Data type representing the configuration of `node_exporter`.

`package` (default: `go-github-com-prometheus-node-exporter`)
The prometheus-node-exporter package to use.

`web-listen-address` (default: `":9100"`)
Bind the web interface to the specified address.

`textfile-directory` (default: `"/var/lib/prometheus/node-exporter"`)
This directory can be used to export metrics specific to this machine. Files containing metrics in the text format, with the filename ending in `.prom` should be placed in this directory.

`extra-options` (default: `'()`)
Extra options to pass to the Prometheus node exporter.

vnStat Network Traffic Monitor

vnStat is a network traffic monitor that uses interface statistics provided by the kernel rather than traffic sniffing. This makes it a light resource monitor, regardless of network traffic rate.

`vnstat-service-type` [Variável]
This is the service type for the vnStat (`https://humdi.net/vnstat/`) daemon and accepts a `vnstat-configuration` value.

The following example will configure the service with default values:

```
(service vnstat-service-type)
```

`vnstat-configuration` [Data Type]
Available `vnstat-configuration` fields are:

`package` (default: `vnstat`) (type: file-like)
The vnstat package.

`database-directory` (default: `"/var/lib/vnstat"`) (type: string)
Specifies the directory where the database is to be stored. A full path must be given and a leading '/' isn't required.

`5-minute-hours` (default: `48`) (type: maybe-integer)
Data retention duration for the 5 minute resolution entries. The configuration defines for how many past hours entries will be stored. Set to `-1` for unlimited entries or to `0` to disable the data collection of this resolution.

`64bit-interface-counters` (default: `-2`) (type: maybe-integer)
Select interface counter handling. Set to `1` for defining that all interfaces use 64-bit counters on the kernel side and `0` for defining 32-bit counter. Set to `-1` for using the old style logic used in earlier versions where counter values within 32-bits are assumed to be 32-bit and anything larger is assumed to be a 64-bit counter. This may produce false results if a 64-bit counter is reset within the 32-bits. Set to `-2` for using automatic detection based on available kernel datastructures.

`always-add-new-interfaces?` (default: `#t`) (type: maybe-boolean)
Enable or disable automatic creation of new database entries for interfaces not currently in the database even if the database file already exists when the daemon is started. New database entries will also get created for new interfaces seen while the daemon is running. Pseudo interfaces '`lo`', '`lo0`' and '`sit0`' are always excluded from getting added.

`bandwidth-detection?` (default: `#t`) (type: maybe-boolean)
Try to automatically detect *max-bandwidth* value for each monitored interface. Mostly only ethernet interfaces support this feature. *max-bandwidth* will be used as fallback value if detection fails. Any interface specific *max-BW* configuration will disable the detection for the specified interface. In Linux, the detection is disabled for tun interfaces due to the Linux kernel always reporting 10 Mbit regardless of the used real interface.

`bandwidth-detection-interval` (default: `5`) (type: maybe-integer)
How often in minutes interface specific detection of *max-bandwidth* is done for detecting possible changes when *bandwidth-detection* is enabled. Can be disabled by setting to `0`. Value range: '`0`'..'`30`'

`boot-variation` (default: `15`) (type: maybe-integer)
Time in seconds how much the boot time reported by system kernel can variate between updates. Value range: '`0`'..'`300`'

`check-disk-space?` (default: `#t`) (type: maybe-boolean)
Enable or disable the availability check of at least some free disk space before a database write.

`create-directories?` (default: `#t`) (type: maybe-boolean)
Enable or disable the creation of directories when a configured path doesn't exist. This includes *database-directory*.

`daemon-group` (type: maybe-user-group)
Specify the group to which the daemon process should switch during startup. Set to `%unset-value` to disable group switching.

`daemon-user` (type: maybe-user-account)
Specify the user to which the daemon process should switch during startup. Set to `%unset-value` to disable user switching.

`daily-days` (default: `62`) (type: maybe-integer)
Data retention duration for the one day resolution entries. The configuration defines for how many past days entries will be stored. Set to `-1` for unlimited entries or to `0` to disable the data collection of this resolution.

`database-synchronous` (default: `-1`) (type: maybe-integer)
Change the setting of the SQLite "synchronous" flag which controls how much care is taken to ensure disk writes have fully completed when writing data to the database before continuing other actions. Higher values take extra steps to ensure data safety at the cost of slower performance. A value of `0` will result in all handling being left to the filesystem itself. Set to `-1` to select the default value according to database mode controlled by *database-write-ahead-logging* setting. See SQLite documentation for more details regarding values from `1` to `3`. Value range: '`-1`'..'`3`'

`database-write-ahead-logging?` (default: `#f`) (type: maybe-boolean)
Enable or disable SQLite Write-Ahead Logging mode for the database. See SQLite documentation for more details and note that support for read-only operations isn't available in older SQLite versions.

`hourly-days` (default: `4`) (type: maybe-integer)
Data retention duration for the one hour resolution entries. The configuration defines for how many past days entries will be stored. Set to `-1` for unlimited entries or to `0` to disable the data collection of this resolution.

`log-file` (type: maybe-string)
Specify log file path and name to be used if *use-logging* is set to `1`.

`max-bandwidth` (type: maybe-integer)
Maximum bandwidth for all interfaces. If the interface specific traffic exceeds the given value then the data is assumed to be invalid and rejected. Set to 0 in order to disable the feature. Value range: '`0`'..'`50000`'

`max-bw` (type: maybe-alist)
Same as *max-bandwidth* but can be used for setting individual limits for selected interfaces. This is an association list of interfaces as strings to integer values. For example,

```
(max-bw `(("eth0" .  15000)
          ("ppp0" .  10000)))
```

bandwidth-detection is disabled on an interface specific level for each *max-bw* configuration. Value range: '`0`'..'`50000`'

`monthly-months` (default: `25`) (type: maybe-integer)
Data retention duration for the one month resolution entries. The configuration defines for how many past months entries will be stored. Set to `-1` for unlimited entries or to `0` to disable the data collection of this resolution.

`month-rotate` (default: `1`) (type: maybe-integer)
Day of month that months are expected to change. Usually set to 1 but can be set to alternative values for example for tracking monthly billed

traffic where the billing period doesn't start on the first day. For example, if set to 7, days of February up to and including the 6th will count for January. Changing this option will not cause existing data to be recalculated. Value range: '1'..'28'

`month-rotate-affects-years?` (default: `#f`) (type: maybe-boolean)
: Enable or disable *month-rotate* also affecting yearly data. Applicable only when *month-rotate* has a value greater than one.

`offline-save-interval` (default: `30`) (type: maybe-integer)
: How often in minutes cached interface data is saved to file when all monitored interfaces are offline. Value range: *save-interval*..'60'

`pid-file` (default: `"/var/run/vnstatd.pid"`) (type: maybe-string)
: Specify pid file path and name to be used.

`poll-interval` (default: `5`) (type: maybe-integer)
: How often in seconds interfaces are checked for status changes. Value range: '2'..'60'

`rescan-database-on-save?` (type: maybe-boolean)
: Automatically discover added interfaces from the database and start monitoring. The rescan is done every *save-interval* or *offline-save-interval* minutes depending on the current activity state.

`save-interval` (default: `5`) (type: maybe-integer)
: How often in minutes cached interface data is saved to file. Value range: (*update-interval* / 60)..'60'

`save-on-status-change?` (default: `#t`) (type: maybe-boolean)
: Enable or disable the additional saving to file of cached interface data when the availability of an interface changes, i.e., when an interface goes offline or comes online.

`time-sync-wait` (default: `5`) (type: maybe-integer)
: How many minutes to wait during daemon startup for system clock to sync if most recent database update appears to be in the future. This may be needed in systems without a real-time clock (RTC) which require some time after boot to query and set the correct time. `0` = wait disabled. Value range: '0'..'60'

`top-day-entries` (default: `20`) (type: maybe-integer)
: Data retention duration for the top day entries. The configuration defines how many of the past top day entries will be stored. Set to `-1` for unlimited entries or to `0` to disable the data collection of this resolution.

`trafficless-entries?` (default: `#t`) (type: maybe-boolean)
: Create database entries even when there is no traffic during the entry's time period.

`update-file-owner?` (default: `#t`) (type: maybe-boolean)
: Enable or disable the update of file ownership during daemon process startup. During daemon startup, only database, log and pid files will be

modified if the user or group change feature (*daemon-user* or *daemon-group*) is enabled and the files don't match the requested user or group. During manual database creation, this option will cause file ownership to be inherited from the database directory if the directory already exists. This option only has effect when the process is started as root or via sudo.

`update-interval` (default: `20`) (type: maybe-integer)
How often in seconds the interface data is updated. Value range: *poll-interval*..'`300`'

`use-logging` (default: `2`) (type: maybe-integer)
Enable or disable logging. Accepted values are: `0` = disabled, `1` = logfile and `2` = syslog.

`use-utc?` (type: maybe-boolean)
Enable or disable using UTC as timezone in the database for all entries. When enabled, all entries added to the database will use UTC regardless of the configured system timezone. When disabled, the configured system timezone will be used. Changing this setting will not result in already existing data to be modified.

`yearly-years` (default: `-1`) (type: maybe-integer)
Data retention duration for the one year resolution entries. The configuration defines for how many past years entries will be stored. Set to `-1` for unlimited entries or to `0` to disable the data collection of this resolution.

Zabbix server

Zabbix is a high performance monitoring system that can collect data from a variety of sources and provide the results in a web-based interface. Alerting and reporting is built-in, as well as *templates* for common operating system metrics such as network utilization, CPU load, and disk space consumption.

This service provides the central Zabbix monitoring service; you also need [zabbix-frontend], Página 444, to configure Zabbix and display results, and optionally [zabbix-agent], Página 443, on machines that should be monitored (other data sources are supported, such as [prometheus-node-exporter], Página 437).

`zabbix-server-service-type` [Variável]
This is the service type for the Zabbix server service. Its value must be a `zabbix-server-configuration` record, shown below.

`zabbix-server-configuration` [Data Type]
Available `zabbix-server-configuration` fields are:

`zabbix-server` (default: `zabbix-server`) (type: file-like)
The zabbix-server package.

`user` (default: `"zabbix"`) (type: string)
User who will run the Zabbix server.

`group` (default: `"zabbix"`) (type: string)
Group who will run the Zabbix server.

`db-host` (default: `"127.0.0.1"`) (type: string)
Database host name.

`db-name` (default: `"zabbix"`) (type: string)
Database name.

`db-user` (default: `"zabbix"`) (type: string)
Database user.

`db-password` (default: `""`) (type: string)
Database password. Please, use `include-files` with `DBPassword=SECRET` inside a specified file instead.

`db-port` (default: `5432`) (type: number)
Database port.

`log-type` (default: `""`) (type: string)
Specifies where log messages are written to:

- `system` - syslog.
- `file` - file specified with `log-file` parameter.
- `console` - standard output.

`log-file` (default: `"/var/log/zabbix/server.log"`) (type: string)
Log file name for `log-type file` parameter.

`pid-file` (default: `"/var/run/zabbix/zabbix_server.pid"`) (type: string)
Name of PID file.

`ssl-ca-location` (default: `"/etc/ssl/certs/ca-certificates.crt"`) (type: string)
The location of certificate authority (CA) files for SSL server certificate verification.

`ssl-cert-location` (default: `"/etc/ssl/certs"`) (type: string)
Location of SSL client certificates.

`extra-options` (default: `""`) (type: extra-options)
Extra options will be appended to Zabbix server configuration file.

`include-files` (default: `'()`) (type: include-files)
You may include individual files or all files in a directory in the configuration file.

Zabbix agent

The Zabbix agent gathers information about the running system for the Zabbix monitoring server. It has a variety of built-in checks, and can be extended with custom *user parameters* (`https://www.zabbix.com/documentation/current/en/manual/config/items/userparameters`).

`zabbix-agent-service-type` [Variável]
This is the service type for the Zabbix agent service. Its value must be a `zabbix-agent-configuration` record, shown below.

`zabbix-agent-configuration` [Data Type]

Available `zabbix-agent-configuration` fields are:

`zabbix-agent` (default: `zabbix-agentd`) (type: file-like)
The zabbix-agent package.

`user` (default: `"zabbix"`) (type: string)
User who will run the Zabbix agent.

`group` (default: `"zabbix"`) (type: string)
Group who will run the Zabbix agent.

`hostname` (default: `""`) (type: string)
Unique, case sensitive hostname which is required for active checks and must match hostname as configured on the server.

`log-type` (default: `""`) (type: string)
Specifies where log messages are written to:

- `system` - syslog.
- `file` - file specified with `log-file` parameter.
- `console` - standard output.

`log-file` (default: `"/var/log/zabbix/agent.log"`) (type: string)
Log file name for `log-type file` parameter.

`pid-file` (default: `"/var/run/zabbix/zabbix_agent.pid"`) (type: string)
Name of PID file.

`server` (default: `'("127.0.0.1")`) (type: list)
List of IP addresses, optionally in CIDR notation, or hostnames of Zabbix servers and Zabbix proxies. Incoming connections will be accepted only from the hosts listed here.

`server-active` (default: `'("127.0.0.1")`) (type: list)
List of IP:port (or hostname:port) pairs of Zabbix servers and Zabbix proxies for active checks. If port is not specified, default port is used. If this parameter is not specified, active checks are disabled.

`extra-options` (default: `""`) (type: extra-options)
Extra options will be appended to Zabbix server configuration file.

`include-files` (default: `'()`) (type: include-files)
You may include individual files or all files in a directory in the configuration file.

Zabbix front-end

The Zabbix front-end provides a web interface to Zabbix. It does not need to run on the same machine as the Zabbix server. This service works by extending the [PHP-FPM], Página 470, and [NGINX], Página 459, services with the configuration necessary for loading the Zabbix user interface.

`zabbix-front-end-service-type` [Variável]

This is the service type for the Zabbix web frontend. Its value must be a `zabbix-front-end-configuration` record, shown below.

`zabbix-front-end-configuration` [Data Type]

Available `zabbix-front-end-configuration` fields are:

`zabbix-server` (default: `zabbix-server`) (type: file-like)
The Zabbix server package to use.

`nginx` (default: `'()`) (type: list)
List of [nginx-server-configuration], Página 462, blocks for the Zabbix front-end. When empty, a default that listens on port 80 is used.

`db-host` (default: `"localhost"`) (type: string)
Database host name.

`db-port` (default: `5432`) (type: number)
Database port.

`db-name` (default: `"zabbix"`) (type: string)
Database name.

`db-user` (default: `"zabbix"`) (type: string)
Database user.

`db-password` (default: `""`) (type: string)
Database password. Please, use `db-secret-file` instead.

`db-secret-file` (default: `""`) (type: string)
Secret file which will be appended to `zabbix.conf.php` file. This file contains credentials for use by Zabbix front-end. You are expected to create it manually.

`zabbix-host` (default: `"localhost"`) (type: string)
Zabbix server hostname.

`zabbix-port` (default: `10051`) (type: number)
Zabbix server port.

11.10.18 Serviços Kerberos

The `(gnu services kerberos)` module provides services relating to the authentication protocol *Kerberos*.

Krb5 Service

Programs using a Kerberos client library normally expect a configuration file in `/etc/krb5.conf`. This service generates such a file from a definition provided in the operating system declaration. It does not cause any daemon to be started.

No "keytab" files are provided by this service—you must explicitly create them. This service is known to work with the MIT client library, `mit-krb5`. Other implementations have not been tested.

`krb5-service-type` [Variável]

A service type for Kerberos 5 clients.

Here is an example of its use:

```
(service krb5-service-type
         (krb5-configuration
          (default-realm "EXAMPLE.COM")
          (allow-weak-crypto? #t)
          (realms (list
                   (krb5-realm
                    (name "EXAMPLE.COM")
                    (admin-server "groucho.example.com")
                    (kdc "karl.example.com"))
                   (krb5-realm
                    (name "ARGRX.EDU")
                    (admin-server "kerb-admin.argrx.edu")
                    (kdc "keys.argrx.edu"))))))
```

This example provides a Kerberos 5 client configuration which:

- Recognizes two realms, *viz:* "EXAMPLE.COM" and "ARGRX.EDU", both of which have distinct administration servers and key distribution centers;
- Will default to the realm "EXAMPLE.COM" if the realm is not explicitly specified by clients;
- Accepts services which only support encryption types known to be weak.

The `krb5-realm` and `krb5-configuration` types have many fields. Only the most commonly used ones are described here. For a full list, and more detailed explanation of each, see the MIT krb5.conf documentation.

`krb5-realm` [Data Type]

`name` This field is a string identifying the name of the realm. A common convention is to use the fully qualified DNS name of your organization, converted to upper case.

`admin-server`
This field is a string identifying the host where the administration server is running.

`kdc` This field is a string identifying the key distribution center for the realm.

`krb5-configuration` [Data Type]

`allow-weak-crypto?` (default: `#f`)
If this flag is `#t` then services which only offer encryption algorithms known to be weak will be accepted.

`default-realm` (default: `#f`)
This field should be a string identifying the default Kerberos realm for the client. You should set this field to the name of your Kerberos realm. If this value is `#f` then a realm must be specified with every Kerberos principal when invoking programs such as `kinit`.

`realms` This should be a non-empty list of `krb5-realm` objects, which clients may access. Normally, one of them will have a `name` field matching the `default-realm` field.

PAM krb5 Service

The `pam-krb5` service allows for login authentication and password management via Kerberos. You will need this service if you want PAM enabled applications to authenticate users using Kerberos.

`pam-krb5-service-type` [Variável]
A service type for the Kerberos 5 PAM module.

`pam-krb5-configuration` [Data Type]
Data type representing the configuration of the Kerberos 5 PAM module. This type has the following parameters:

`pam-krb5` (default: `pam-krb5`)
The pam-krb5 package to use.

`minimum-uid` (default: `1000`)
The smallest user ID for which Kerberos authentications should be attempted. Local accounts with lower values will silently fail to authenticate.

11.10.19 Serviços LDAP

Authentication against LDAP with nslcd

The `(gnu services authentication)` module provides the `nslcd-service-type`, which can be used to authenticate against an LDAP server. In addition to configuring the service itself, you may want to add `ldap` as a name service to the Name Service Switch. Veja Seção 11.13 [Name Service Switch], Página 605, for detailed information.

Here is a simple operating system declaration with a default configuration of the `nslcd-service-type` and a Name Service Switch configuration that consults the `ldap` name service last:

```
(use-service-modules authentication)
(use-modules (gnu system nss))
...
(operating-system
  ...
  (services
    (cons*
      (service nslcd-service-type)
      (service dhcp-client-service-type)
      %base-services))
  (name-service-switch
   (let ((services (list (name-service (name "db"))
                         (name-service (name "files"))
                         (name-service (name "ldap")))))
     (name-service-switch
      (inherit %mdns-host-lookup-nss)
      (password services)
      (shadow   services)
```

```
          (group    services)
          (netgroup services)
          (gshadow  services)))))
```

Available `nslcd-configuration` fields are:

`package nss-pam-ldapd` [`nslcd-configuration` parameter]
The `nss-pam-ldapd` package to use.

`maybe-number threads` [`nslcd-configuration` parameter]
The number of threads to start that can handle requests and perform LDAP queries. Each thread opens a separate connection to the LDAP server. The default is to start 5 threads.

Defaults to '`disabled`'.

`string uid` [`nslcd-configuration` parameter]
This specifies the user id with which the daemon should be run.

Defaults to '`"nslcd"`'.

`string gid` [`nslcd-configuration` parameter]
This specifies the group id with which the daemon should be run.

Defaults to '`"nslcd"`'.

`log-option log` [`nslcd-configuration` parameter]
This option controls the way logging is done via a list containing SCHEME and LEVEL. The SCHEME argument may either be the symbols '`none`' or '`syslog`', or an absolute file name. The LEVEL argument is optional and specifies the log level. The log level may be one of the following symbols: '`crit`', '`error`', '`warning`', '`notice`', '`info`' or '`debug`'. All messages with the specified log level or higher are logged.

Defaults to '`'("/var/log/nslcd" info)`'.

`list uri` [`nslcd-configuration` parameter]
The list of LDAP server URIs. Normally, only the first server will be used with the following servers as fall-back.

Defaults to '`'("ldap://localhost:389/")`'.

`maybe-string ldap-version` [`nslcd-configuration` parameter]
The version of the LDAP protocol to use. The default is to use the maximum version supported by the LDAP library.

Defaults to '`disabled`'.

`maybe-string binddn` [`nslcd-configuration` parameter]
Specifies the distinguished name with which to bind to the directory server for lookups. The default is to bind anonymously.

Defaults to '`disabled`'.

`maybe-string bindpw` [`nslcd-configuration` parameter]
Specifies the credentials with which to bind. This option is only applicable when used with binddn.

Defaults to '`disabled`'.

`maybe-string rootpwmoddn` [`nslcd-configuration` parameter]
Specifies the distinguished name to use when the root user tries to modify a user's password using the PAM module.

Defaults to '`disabled`'.

`maybe-string rootpwmodpw` [`nslcd-configuration` parameter]
Specifies the credentials with which to bind if the root user tries to change a user's password. This option is only applicable when used with rootpwmoddn

Defaults to '`disabled`'.

`maybe-string sasl-mech` [`nslcd-configuration` parameter]
Specifies the SASL mechanism to be used when performing SASL authentication.

Defaults to '`disabled`'.

`maybe-string sasl-realm` [`nslcd-configuration` parameter]
Specifies the SASL realm to be used when performing SASL authentication.

Defaults to '`disabled`'.

`maybe-string sasl-authcid` [`nslcd-configuration` parameter]
Specifies the authentication identity to be used when performing SASL authentication.

Defaults to '`disabled`'.

`maybe-string sasl-authzid` [`nslcd-configuration` parameter]
Specifies the authorization identity to be used when performing SASL authentication.

Defaults to '`disabled`'.

`maybe-boolean sasl-canonicalize?` [`nslcd-configuration` parameter]
Determines whether the LDAP server host name should be canonicalised. If this is enabled the LDAP library will do a reverse host name lookup. By default, it is left up to the LDAP library whether this check is performed or not.

Defaults to '`disabled`'.

`maybe-string krb5-ccname` [`nslcd-configuration` parameter]
Set the name for the GSS-API Kerberos credentials cache.

Defaults to '`disabled`'.

`string base` [`nslcd-configuration` parameter]
The directory search base.

Defaults to '`"dc=example,dc=com"`'.

`scope-option scope` [`nslcd-configuration` parameter]
Specifies the search scope (subtree, onelevel, base or children). The default scope is subtree; base scope is almost never useful for name service lookups; children scope is not supported on all servers.

Defaults to '`'(subtree)`'.

`maybe-deref-option deref` [`nslcd-configuration` parameter]
Specifies the policy for dereferencing aliases. The default policy is to never dereference aliases.

Defaults to '`disabled`'.

`maybe-boolean referrals` [`nslcd-configuration` parameter]
Specifies whether automatic referral chasing should be enabled. The default behaviour is to chase referrals.

Defaults to '`disabled`'.

`list-of-map-entries maps` [`nslcd-configuration` parameter]
This option allows for custom attributes to be looked up instead of the default RFC 2307 attributes. It is a list of maps, each consisting of the name of a map, the RFC 2307 attribute to match and the query expression for the attribute as it is available in the directory.

Defaults to '`'()`'.

`list-of-filter-entries filters` [`nslcd-configuration` parameter]
A list of filters consisting of the name of a map to which the filter applies and an LDAP search filter expression.

Defaults to '`'()`'.

`maybe-number bind-timelimit` [`nslcd-configuration` parameter]
Specifies the time limit in seconds to use when connecting to the directory server. The default value is 10 seconds.

Defaults to '`disabled`'.

`maybe-number timelimit` [`nslcd-configuration` parameter]
Specifies the time limit (in seconds) to wait for a response from the LDAP server. A value of zero, which is the default, is to wait indefinitely for searches to be completed.

Defaults to '`disabled`'.

`maybe-number idle-timelimit` [`nslcd-configuration` parameter]
Specifies the period if inactivity (in seconds) after which the con nection to the LDAP server will be closed. The default is not to time out connections.

Defaults to '`disabled`'.

`maybe-number reconnect-sleeptime` [`nslcd-configuration` parameter]
Specifies the number of seconds to sleep when connecting to all LDAP servers fails. By default one second is waited between the first failure and the first retry.

Defaults to '`disabled`'.

`maybe-number reconnect-retrytime` [`nslcd-configuration` parameter]
Specifies the time after which the LDAP server is considered to be permanently unavailable. Once this time is reached retries will be done only once per this time period. The default value is 10 seconds.

Defaults to '`disabled`'.

`maybe-ssl-option ssl` [`nslcd-configuration` parameter]
Specifies whether to use SSL/TLS or not (the default is not to). If 'start-tls is specified then StartTLS is used rather than raw LDAP over SSL.

Defaults to '`disabled`'.

`maybe-tls-reqcert-option tls-reqcert` [`nslcd-configuration` parameter]
Specifies what checks to perform on a server-supplied certificate. The meaning of the values is described in the ldap.conf(5) manual page.

Defaults to '`disabled`'.

`maybe-string tls-cacertdir` [`nslcd-configuration` parameter]
Specifies the directory containing X.509 certificates for peer authen tication. This parameter is ignored when using GnuTLS.

Defaults to '`disabled`'.

`maybe-string tls-cacertfile` [`nslcd-configuration` parameter]
Specifies the path to the X.509 certificate for peer authentication.

Defaults to '`disabled`'.

`maybe-string tls-randfile` [`nslcd-configuration` parameter]
Specifies the path to an entropy source. This parameter is ignored when using GnuTLS.

Defaults to '`disabled`'.

`maybe-string tls-ciphers` [`nslcd-configuration` parameter]
Specifies the ciphers to use for TLS as a string.

Defaults to '`disabled`'.

`maybe-string tls-cert` [`nslcd-configuration` parameter]
Specifies the path to the file containing the local certificate for client TLS authentication.

Defaults to '`disabled`'.

`maybe-string tls-key` [`nslcd-configuration` parameter]
Specifies the path to the file containing the private key for client TLS authentication.

Defaults to '`disabled`'.

`maybe-number pagesize` [`nslcd-configuration` parameter]
Set this to a number greater than 0 to request paged results from the LDAP server in accordance with RFC2696. The default (0) is to not request paged results.

Defaults to '`disabled`'.

`maybe-ignore-users-option` [`nslcd-configuration` parameter]
`nss-initgroups-ignoreusers`
This option prevents group membership lookups through LDAP for the specified users. Alternatively, the value 'all-local may be used. With that value nslcd builds a full list of non-LDAP users on startup.

Defaults to '`disabled`'.

`maybe-number nss-min-uid` [`nslcd-configuration` parameter]
This option ensures that LDAP users with a numeric user id lower than the specified value are ignored.

Defaults to '`disabled`'.

`maybe-number nss-uid-offset` [`nslcd-configuration` parameter]
This option specifies an offset that is added to all LDAP numeric user ids. This can be used to avoid user id collisions with local users.

Defaults to '`disabled`'.

`maybe-number nss-gid-offset` [`nslcd-configuration` parameter]
This option specifies an offset that is added to all LDAP numeric group ids. This can be used to avoid user id collisions with local groups.

Defaults to '`disabled`'.

`maybe-boolean nss-nested-groups` [`nslcd-configuration` parameter]
If this option is set, the member attribute of a group may point to another group. Members of nested groups are also returned in the higher level group and parent groups are returned when finding groups for a specific user. The default is not to perform extra searches for nested groups.

Defaults to '`disabled`'.

`maybe-boolean nss-getgrent-skipmembers` [`nslcd-configuration` parameter]
If this option is set, the group member list is not retrieved when looking up groups. Lookups for finding which groups a user belongs to will remain functional so the user will likely still get the correct groups assigned on login.

Defaults to '`disabled`'.

`maybe-boolean nss-disable-enumeration` [`nslcd-configuration` parameter]
If this option is set, functions which cause all user/group entries to be loaded from the directory will not succeed in doing so. This can dramatically reduce LDAP server load in situations where there are a great number of users and/or groups. This option is not recommended for most configurations.

Defaults to '`disabled`'.

`maybe-string validnames` [`nslcd-configuration` parameter]
This option can be used to specify how user and group names are verified within the system. This pattern is used to check all user and group names that are requested and returned from LDAP.

Defaults to '`disabled`'.

`maybe-boolean ignorecase` [`nslcd-configuration` parameter]
This specifies whether or not to perform searches using case-insensitive matching. Enabling this could open up the system to authorization bypass vulnerabilities and introduce nscd cache poisoning vulnerabilities which allow denial of service.

Defaults to '`disabled`'.

`maybe-boolean pam-authc-ppolicy` [`nslcd-configuration` parameter]
: This option specifies whether password policy controls are requested and handled from the LDAP server when performing user authentication.

  Defaults to '`disabled`'.

`maybe-string pam-authc-search` [`nslcd-configuration` parameter]
: By default nslcd performs an LDAP search with the user's credentials after BIND (authentication) to ensure that the BIND operation was successful. The default search is a simple check to see if the user's DN exists. A search filter can be specified that will be used instead. It should return at least one entry.

  Defaults to '`disabled`'.

`maybe-string pam-authz-search` [`nslcd-configuration` parameter]
: This option allows flexible fine tuning of the authorisation check that should be performed. The search filter specified is executed and if any entries match, access is granted, otherwise access is denied.

  Defaults to '`disabled`'.

`maybe-string pam-password-prohibit-message` [`nslcd-configuration` parameter]
: If this option is set password modification using pam_ldap will be denied and the specified message will be presented to the user instead. The message can be used to direct the user to an alternative means of changing their password.

  Defaults to '`disabled`'.

`list pam-services` [`nslcd-configuration` parameter]
: List of pam service names for which LDAP authentication should suffice.

  Defaults to '`'()`'.

LDAP Directory Server

The `(gnu services ldap)` module provides the `directory-server-service-type`, which can be used to create and launch an LDAP server instance.

Here is an example configuration of the `directory-server-service-type`:

```
(use-service-modules ldap)

...
(operating-system
  ...
  (services
    (cons
      (service directory-server-service-type
               (directory-server-instance-configuration
                (slapd
                 (slapd-configuration
                  (root-password "{PBKDF2_SHA256}AAAgAG...ABSOLUTELYSECRET")))))
      %base-services)))
```

The root password should be generated with the `pwdhash` utility that is provided by the `389-ds-base` package.

Note that changes to the directory server configuration will not be applied to existing instances. You will need to back up and restore server data manually. Only new directory server instances will be created upon system reconfiguration.

`directory-server-instance-configuration` [Data Type]

Available `directory-server-instance-configuration` fields are:

`package` (default: `389-ds-base`) (type: file-like)
The `389-ds-base` package.

`config-version` (default: `2`) (type: number)
Sets the format version of the configuration file. To use the INF file with `dscreate`, this parameter must be 2.

`full-machine-name` (default: `"localhost"`) (type: string)
Sets the fully qualified hostname (FQDN) of this system.

`selinux` (default: `#false`) (type: boolean)
Enables SELinux detection and integration during the installation of this instance. If set to `#true`, `dscreate` auto-detects whether SELinux is enabled.

`strict-host-checking` (default: `#true`) (type: boolean)
Sets whether the server verifies the forward and reverse record set in the `full-machine-name` parameter. When installing this instance with GSSAPI authentication behind a load balancer, set this parameter to `#false`.

`systemd` (default: `#false`) (type: boolean)
Enables systemd platform features. If set to `#true`, `dscreate` auto-detects whether systemd is installed.

`slapd` (type: slapd-configuration)
Configuration of slapd.

`slapd-configuration` [Data Type]

Available `slapd-configuration` fields are:

`instance-name` (default: `"localhost"`) (type: string)
Sets the name of the instance. You can refer to this value in other parameters of this INF file using the `{instance_name}` variable. Note that this name cannot be changed after the installation!

`user` (default: `"dirsrv"`) (type: string)
Sets the user name the ns-slapd process will use after the service started.

`group` (default: `"dirsrv"`) (type: string)
Sets the group name the ns-slapd process will use after the service started.

`port` (default: `389`) (type: number)
: Sets the TCP port the instance uses for LDAP connections.

`secure-port` (default: `636`) (type: number)
: Sets the TCP port the instance uses for TLS-secured LDAP connections (LDAPS).

`root-dn` (default: `"cn=Directory Manager"`) (type: string)
: Sets the *Distinquished Name* (DN) of the administrator account for this instance.

`root-password` (default: `"{invalid}YOU-SHOULD-CHANGE-THIS"`) (type: string)
: Sets the password of the account specified in the `root-dn` parameter. You can either set this parameter to a plain text password `dscreate` hashes during the installation or to a "{algorithm}hash" string generated by the `pwdhash` utility. Note that setting a plain text password can be a security risk if unprivileged users can read this INF file!

`self-sign-cert` (default: `#true`) (type: boolean)
: Sets whether the setup creates a self-signed certificate and enables TLS encryption during the installation. This is not suitable for production, but it enables administrators to use TLS right after the installation. You can replace the self-signed certificate with a certificate issued by a certificate authority.

`self-sign-cert-valid-months` (default: `24`) (type: number)
: Set the number of months the issued self-signed certificate will be valid.

`backup-dir` (default: `"/var/lib/dirsrv/slapd-{instance_name}/bak"`) (type: string)
: Set the backup directory of the instance.

`cert-dir` (default: `"/etc/dirsrv/slapd-{instance_name}"`) (type: string)
: Sets the directory of the instance's Network Security Services (NSS) database.

`config-dir` (default: `"/etc/dirsrv/slapd-{instance_name}"`) (type: string)
: Sets the configuration directory of the instance.

`db-dir` (default: `"/var/lib/dirsrv/slapd-{instance_name}/db"`) (type: string)
: Sets the database directory of the instance.

`initconfig-dir` (default: `"/etc/dirsrv/registry"`) (type: string)
Sets the directory of the operating system's rc configuration directory.

`ldif-dir` (default: `"/var/lib/dirsrv/slapd-{instance_name}/ldif"`) (type: string)
Sets the LDIF export and import directory of the instance.

`lock-dir` (default: `"/var/lock/dirsrv/slapd-{instance_name}"`) (type: string)
Sets the lock directory of the instance.

`log-dir` (default: `"/var/log/dirsrv/slapd-{instance_name}"`) (type: string)
Sets the log directory of the instance.

`run-dir` (default: `"/run/dirsrv"`) (type: string)
Sets PID directory of the instance.

`schema-dir` (default: `"/etc/dirsrv/slapd-{instance_name}/schema"`) (type: string)
Sets schema directory of the instance.

`tmp-dir` (default: `"/tmp"`) (type: string)
Sets the temporary directory of the instance.

`backend-userroot` (type: backend-userroot-configuration)
Configuration of the userroot backend.

`backend-userroot-configuration` [Data Type]
Available `backend-userroot-configuration` fields are:

`create-suffix-entry?` (default: `#false`) (type: boolean)
Set this parameter to `#true` to create a generic root node entry for the suffix in the database.

`require-index?` (default: `#false`) (type: boolean)
Set this parameter to `#true` to refuse unindexed searches in this database.

`sample-entries` (default: `"no"`) (type: string)
Set this parameter to `"yes"` to add latest version of sample entries to this database. Or, use `"001003006"` to use the 1.3.6 version sample entries. Use this option, for example, to create a database for testing purposes.

`suffix` (type: maybe-string)
Sets the root suffix stored in this database. If you do not set the suffix attribute the install process will not create the backend/suffix. You can also create multiple backends/suffixes by duplicating this section.

11.10.20 Serviços Web

The `(gnu services web)` module provides the Apache HTTP Server, the nginx web server, and also a fastcgi wrapper daemon.

Apache HTTP Server

`httpd-service-type` [Variável]

Service type for the Apache HTTP (`https://httpd.apache.org/`) server (*httpd*). The value for this service type is a `httpd-configuration` record.

A simple example configuration is given below.

```
(service httpd-service-type
         (httpd-configuration
           (config
             (httpd-config-file
               (server-name "www.example.com")
               (document-root "/srv/http/www.example.com")))))
```

Other services can also extend the `httpd-service-type` to add to the configuration.

```
(simple-service 'www.example.com-server httpd-service-type
                (list
                  (httpd-virtualhost
                    "*:80"
                    (list (string-join '("ServerName www.example.com"
                                         "DocumentRoot /srv/http/www.example.com"
                                        "\n")))))
```

The details for the `httpd-configuration`, `httpd-module`, `httpd-config-file` and `httpd-virtualhost` record types are given below.

`httpd-configuration` [Data Type]

This data type represents the configuration for the httpd service.

`package` (default: `httpd`)
: The httpd package to use.

`pid-file` (default: `"/var/run/httpd"`)
: The pid file used by the shepherd-service.

`config` (default: `(httpd-config-file)`)
: The configuration file to use with the httpd service. The default value is a `httpd-config-file` record, but this can also be a different G-expression that generates a file, for example a `plain-file`. A file outside of the store can also be specified through a string.

`httpd-module` [Data Type]

This data type represents a module for the httpd service.

`name` The name of the module.

`file` The file for the module. This can be relative to the httpd package being used, the absolute location of a file, or a G-expression for a file within the store, for example `(file-append mod-wsgi "/modules/mod_wsgi.so")`.

`%default-httpd-modules` [Variável]

A default list of `httpd-module` objects.

`httpd-config-file` [Data Type]

This data type represents a configuration file for the httpd service.

`modules` (default: `%default-httpd-modules`)

The modules to load. Additional modules can be added here, or loaded by additional configuration.

For example, in order to handle requests for PHP files, you can use Apache's `mod_proxy_fcgi` module along with `php-fpm-service-type`:

```
(service httpd-service-type
         (httpd-configuration
          (config
           (httpd-config-file
            (modules (cons*
                      (httpd-module
                       (name "proxy_module")
                       (file "modules/mod_proxy.so"))
                      (httpd-module
                       (name "proxy_fcgi_module")
                       (file "modules/mod_proxy_fcgi.so"))
                      %default-httpd-modules))
            (extra-config (list "\
<FilesMatch \\.php$>
    SetHandler \"proxy:unix:/var/run/php-fpm.sock|fcgi://localhost/\"
</FilesMatch>"))))))
(service php-fpm-service-type
         (php-fpm-configuration
          (socket "/var/run/php-fpm.sock")
          (socket-group "httpd")))
```

`server-root` (default: `httpd`)

The `ServerRoot` in the configuration file, defaults to the httpd package. Directives including `Include` and `LoadModule` are taken as relative to the server root.

`server-name` (default: `#f`)

The `ServerName` in the configuration file, used to specify the request scheme, hostname and port that the server uses to identify itself.

This doesn't need to be set in the server config, and can be specified in virtual hosts. The default is `#f` to not specify a `ServerName`.

`document-root` (default: `"/srv/http"`)

The `DocumentRoot` from which files will be served.

`listen` (default: `'("80")`)

The list of values for the `Listen` directives in the config file. The value should be a list of strings, when each string can specify the port number to listen on, and optionally the IP address and protocol to use.

`pid-file` (default: `"/var/run/httpd"`)
: The `PidFile` to use. This should match the `pid-file` set in the `httpd-configuration` so that the Shepherd service is configured correctly.

`error-log` (default: `"/var/log/httpd/error_log"`)
: The `ErrorLog` to which the server will log errors.

`user` (default: `"httpd"`)
: The `User` which the server will answer requests as.

`group` (default: `"httpd"`)
: The `Group` which the server will answer requests as.

`extra-config` (default: `(list "TypesConfig etc/httpd/mime.types")`)
: A flat list of strings and G-expressions which will be added to the end of the configuration file.

  Any values which the service is extended with will be appended to this list.

`httpd-virtualhost` [Data Type]

This data type represents a virtualhost configuration block for the httpd service.

These should be added to the extra-config for the httpd-service.

```
(simple-service 'www.example.com-server httpd-service-type
                (list
                  (httpd-virtualhost
                    "*:80"
                    (list (string-join '("ServerName www.example.com"
                                         "DocumentRoot /srv/http/www.example.com
                                       "\n")))))
```

`addresses-and-ports`
: The addresses and ports for the `VirtualHost` directive.

`conteúdo` The contents of the `VirtualHost` directive, this should be a list of strings and G-expressions.

NGINX

`nginx-service-type` [Variável]

Service type for the NGinx (`https://nginx.org/`) web server. The value for this service type is a `<nginx-configuration>` record.

A simple example configuration is given below.

```
(service nginx-service-type
         (nginx-configuration
           (server-blocks
             (list (nginx-server-configuration
                     (server-name '("www.example.com"))
                     (root "/srv/http/www.example.com"))))))
```

In addition to adding server blocks to the service configuration directly, this service can be extended by other services to add server blocks, as in this example:

```
(simple-service 'my-extra-server nginx-service-type
                (list (nginx-server-configuration
                        (root "/srv/http/extra-website")
                        (try-files (list "$uri" "$uri/index.html")))))
```

At startup, `nginx` has not yet read its configuration file, so it uses a default file to log error messages. If it fails to load its configuration file, that is where error messages are logged. After the configuration file is loaded, the default error log file changes as per configuration. In our case, startup error messages can be found in `/var/run/nginx/logs/error.log`, and after configuration in `/var/log/nginx/error.log`. The second location can be changed with the *log-directory* configuration option.

`nginx-configuration` [Data Type]

This data type represents the configuration for NGinx. Some configuration can be done through this and the other provided record types, or alternatively, a config file can be provided.

`nginx` (default: `nginx`)
: The nginx package to use.

`shepherd-requirement` (default: `'()`)
: This is a list of symbols naming Shepherd services the nginx service will depend on.

  This is useful if you would like `nginx` to be started after a back-end web server or a logging service such as Anonip has been started.

`log-directory` (default: `"/var/log/nginx"`)
: The directory to which NGinx will write log files.

`log-level` (default: `'error`) (type: symbol)
: Logging level, which can be any of the following values: `'debug`, `'info`, `'notice`, `'warn`, `'error`, `'crit`, `'alert`, or `'emerg`.

`run-directory` (default: `"/var/run/nginx"`)
: The directory in which NGinx will create a pid file, and write temporary files.

`server-blocks` (default: `'()`)
: A list of *server blocks* to create in the generated configuration file, the elements should be of type `<nginx-server-configuration>`.

  The following example would setup NGinx to serve `www.example.com` from the `/srv/http/www.example.com` directory, without using HTTPS.

```
(service nginx-service-type
         (nginx-configuration
           (server-blocks
             (list (nginx-server-configuration
                     (server-name '("www.example.com"))
                     (root "/srv/http/www.example.com"))))))
```

`upstream-blocks` (default: `'()`)
: A list of *upstream blocks* to create in the generated configuration file, the elements should be of type `<nginx-upstream-configuration>`.

  Configuring upstreams through the `upstream-blocks` can be useful when combined with `locations` in the `<nginx-server-configuration>` records. The following example creates a server configuration with one location configuration, that will proxy requests to a upstream configuration, which will handle requests with two servers.

```
(service
  nginx-service-type
  (nginx-configuration
    (server-blocks
      (list (nginx-server-configuration
              (server-name '("www.example.com"))
              (root "/srv/http/www.example.com")
              (locations
                (list
                  (nginx-location-configuration
                  (uri "/path1")
                  (body '("proxy_pass http://server-proxy;")))))))
    (upstream-blocks
      (list (nginx-upstream-configuration
              (name "server-proxy")
              (servers (list "server1.example.com"
                             "server2.example.com")))))))
```

`file` (default: `#f`)
: If a configuration *file* is provided, this will be used, rather than generating a configuration file from the provided `log-directory`, `run-directory`, `server-blocks` and `upstream-blocks`. For proper operation, these arguments should match what is in *file* to ensure that the directories are created when the service is activated.

  This can be useful if you have an existing configuration file, or it's not possible to do what is required through the other parts of the nginx-configuration record.

`server-names-hash-bucket-size` (default: `#f`)
: Bucket size for the server names hash tables, defaults to `#f` to use the size of the processors cache line.

`server-names-hash-bucket-max-size` (default: `#f`)
: Maximum bucket size for the server names hash tables.

`modules` (default: `'()`)
: List of nginx dynamic modules to load. This should be a list of file names of loadable modules, as in this example:

```
(modules
 (list
```

```
  (file-append nginx-accept-language-module "\
/etc/nginx/modules/ngx_http_accept_language_module.so")
  (file-append nginx-lua-module "\
/etc/nginx/modules/ngx_http_lua_module.so")))
```

`lua-package-path` (default: `'()`)
: List of nginx lua packages to load. This should be a list of package names of loadable lua modules, as in this example:

```
(lua-package-path (list lua-resty-core
                        lua-resty-lrucache
                        lua-resty-signal
                        lua-tablepool
                        lua-resty-shell))
```

`lua-package-cpath` (default: `'()`)
: List of nginx lua C packages to load. This should be a list of package names of loadable lua C modules, as in this example:

```
(lua-package-cpath (list lua-resty-signal))
```

`global-directives` (default: `'((events . ()))`)
: Association list of global directives for the top level of the nginx configuration. Values may themselves be association lists.

```
(global-directives
 `((worker_processes . 16)
   (pcre_jit . on)
   (events . ((worker_connections . 1024)))))
```

`extra-content` (default: `""`)
: Additional content to be appended to the `http` block. Can either be a value that can be lowered into a string or a list of such values. In the former case, it is inserted directly. In the latter, it is prefixed with indentation and suffixed with a newline. Nested lists are flattened into one line.

```
(extra-content "include /etc/nginx/custom-config.conf;")
(extra-content `("include /etc/nginx/custom-config.conf;"
                 ("include " ,%custom-config.conf ";")))
```

`nginx-server-configuration` [Data Type]
: Data type representing the configuration of an nginx server block. This type has the following parameters:

`listen` (default: `'("80" "443 ssl")`)
: Each `listen` directive sets the address and port for IP, or the path for a UNIX-domain socket on which the server will accept requests. Both address and port, or only address or only port can be specified. An address may also be a hostname, for example:

```
'("127.0.0.1:8000" "127.0.0.1" "8000" "*:8000" "localhost:8000")
```

`server-name` (default: `(list 'default)`)
: A list of server names this server represents. `'default` represents the default server for connections matching no other server.

`root` (default: `"/srv/http"`)
: Root of the website nginx will serve.

`locations` (default: `'()`)
: A list of *nginx-location-configuration* or *nginx-named-location-configuration* records to use within this server block.

`index` (default: `(list "index.html")`)
: Index files to look for when clients ask for a directory. If it cannot be found, Nginx will send the list of files in the directory.

`try-files` (default: `'()`)
: A list of files whose existence is checked in the specified order. `nginx` will use the first file it finds to process the request.

`ssl-certificate` (default: `#f`)
: Where to find the certificate for secure connections. Set it to `#f` if you don't have a certificate or you don't want to use HTTPS.

`ssl-certificate-key` (default: `#f`)
: Where to find the private key for secure connections. Set it to `#f` if you don't have a key or you don't want to use HTTPS.

`server-tokens?` (default: `#f`)
: Whether the server should add its configuration to response.

`raw-content` (default: `'()`)
: A list of strings or file-like objects to be appended to the server block. Each item is prefixed with indentation and suffixed with a new line. Nested lists are flattened.

`nginx-upstream-configuration` [Data Type]

Data type representing the configuration of an nginx `upstream` block. This type has the following parameters:

`name` Name for this group of servers.

`servers` Specify the addresses of the servers in the group. The address can be specified as a IP address (e.g. '`127.0.0.1`'), domain name (e.g. '`backend1.example.com`') or a path to a UNIX socket using the prefix '`unix:`'. For addresses using an IP address or domain name, the default port is 80, and a different port can be specified explicitly.

`extra-content`
: Additional content to be appended to the upstream block. Can be a string or file-like object or list of thereof. In case of list, each item is prefixed with indentation and suffixed with a new line. Nested lists are flattened.

```
(extra-content "include /etc/nginx/custom-config.conf;")
(extra-content `("include /etc/nginx/custom-config.conf;"
                 ("include " ,%custom-config.conf ";")))
```

`nginx-location-configuration` [Data Type]
Data type representing the configuration of an nginx `location` block. This type has the following parameters:

`uri` URI which this location block matches.

`corpo` Body of the location block, specified as a list of strings or file-like objects. Each item is prefixed with indentation and suffixed with a new line. Nested lists are flattened.

For example, to pass requests to a upstream server group defined using an `nginx-upstream-configuration` block, the following directive would be specified in the body '`(list "proxy_pass http://upstream-name;")`'.

`nginx-named-location-configuration` [Data Type]
Data type representing the configuration of an nginx named location block. Named location blocks are used for request redirection, and not used for regular request processing. This type has the following parameters:

`name` Name to identify this location block.

`corpo` Veja [nginx-location-configuration body], Página 464, as the body for named location blocks can be used in a similar way to the `nginx-location-configuration body`. One restriction is that the body of a named location block cannot contain location blocks.

Varnish Cache

Varnish is a fast cache server that sits in between web applications and end users. It proxies requests from clients and caches the accessed URLs such that multiple requests for the same resource only creates one request to the back-end.

`varnish-service-type` [Variável]
Service type for the Varnish daemon.

`varnish-configuration` [Data Type]
Data type representing the `varnish` service configuration. This type has the following parameters:

`package` (default: `varnish`)
The Varnish package to use.

`name` (default: `"default"`)
A name for this Varnish instance. Varnish will create a directory in `/var/varnish/` with this name and keep temporary files there. If the name starts with a forward slash, it is interpreted as an absolute directory name.

Pass the `-n` argument to other Varnish programs to connect to the named instance, e.g. `varnishncsa -n default`.

`backend` (default: `"localhost:8080"`)
The backend to use. This option has no effect if `vcl` is set.

`vcl` (default: #f)
: The *VCL* (Varnish Configuration Language) program to run. If this is `#f`, Varnish will proxy `backend` using the default configuration. Otherwise this must be a file-like object with valid VCL syntax.

  For example, to mirror www.gnu.org (`https://www.gnu.org`) with VCL you can do something along these lines:

```
(define %gnu-mirror
  (plain-file "gnu.vcl"
              "vcl 4.1;
backend gnu { .host = \"www.gnu.org\"; }"))

(operating-system
  ;; ...
  (services (cons (service varnish-service-type
                           (varnish-configuration
                            (listen '(":80"))
                            (vcl %gnu-mirror)))
                  %base-services)))
```

  The configuration of an already running Varnish instance can be inspected and changed using the `varnishadm` program.

  Consult the Varnish User Guide (`https://varnish-cache.org/docs/`) and Varnish Book (`https://book.varnish-software.com/4.0/`) for comprehensive documentation on Varnish and its configuration language.

`listen` (default: `'("localhost:80")`)
: List of addresses Varnish will listen on.

`storage` (default: `'("malloc,128m")`)
: List of storage backends that will be available in VCL.

`parameters` (default: `'()`)
: List of run-time parameters in the form `'(("parameter" . "value"))`.

`extra-options` (default: `'()`)
: Additional arguments to pass to the `varnishd` process.

Whoogle Search

Whoogle Search (`https://github.com/benbusby/whoogle-search`) is a self-hosted, ad-free, privacy-respecting meta search engine that collects and displays Google search results. By default, you can configure it by adding this line to the `services` field of your operating system declaration:

```
(service whoogle-service-type)
```

As a result, Whoogle Search runs as local Web server, which you can access by opening '`http://localhost:5000`' in your browser. The configuration reference is given below.

`whoogle-service-type` [Variável]
: Service type for Whoogle Search. Its value must be a `whoogle-configuration` record—see below.

`whoogle-configuration` [Data Type]
Data type representing Whoogle Search service configuration.

`package` (default: `whoogle-search`)
The Whoogle Search package to use.

`host` (default: `"127.0.0.1"`)
The host address to run Whoogle on.

`port` (default: `5000`)
The port where Whoogle will be exposed.

`environment-variables` (default: `'()`)
A list of strings with the environment variables to configure Whoogle. You can consult its environment variables template (`https://github.com/benbusby/whoogle-search/blob/main/whoogle.template.env`) for the list of available options.

Patchwork

Patchwork is a patch tracking system. It can collect patches sent to a mailing list, and display them in a web interface.

`patchwork-service-type` [Variável]
Service type for Patchwork.

The following example is an example of a minimal service for Patchwork, for the `patchwork.example.com` domain.

```
(service patchwork-service-type
         (patchwork-configuration
          (domain "patchwork.example.com")
          (settings-module
           (patchwork-settings-module
            (allowed-hosts (list domain))
            (default-from-email "patchwork@patchwork.example.com")))
          (getmail-retriever-config
           (getmail-retriever-configuration
            (type "SimpleIMAPSSLRetriever")
            (server "imap.example.com")
            (port 993)
            (username "patchwork")
            (password-command
             (list (file-append coreutils "/bin/cat")
                   "/etc/getmail-patchwork-imap-password"))
            (extra-parameters
            '((mailboxes . ("Patches")))))))))
```

There are three records for configuring the Patchwork service. The `<patchwork-configuration>` relates to the configuration for Patchwork within the HTTPD service.

The `settings-module` field within the `<patchwork-configuration>` record can be populated with the `<patchwork-settings-module>` record, which describes a settings module that is generated within the Guix store.

For the `database-configuration` field within the `<patchwork-settings-module>`, the `<patchwork-database-configuration>` must be used.

`patchwork-configuration` [Data Type]

Data type representing the Patchwork service configuration. This type has the following parameters:

`patchwork` (default: `patchwork`)
The Patchwork package to use.

`domain` The domain to use for Patchwork, this is used in the HTTPD service virtual host.

`settings-module`
The settings module to use for Patchwork. As a Django application, Patchwork is configured with a Python module containing the settings. This can either be an instance of the `<patchwork-settings-module>` record, any other record that represents the settings in the store, or a directory outside of the store.

`static-path` (default: `"/static/"`)
The path under which the HTTPD service should serve the static files.

`getmail-retriever-config`
The getmail-retriever-configuration record value to use with Patchwork. Getmail will be configured with this value, the messages will be delivered to Patchwork.

`patchwork-settings-module` [Data Type]

Data type representing a settings module for Patchwork. Some of these settings relate directly to Patchwork, but others relate to Django, the web framework used by Patchwork, or the Django Rest Framework library. This type has the following parameters:

`database-configuration` (default: `(patchwork-database-configuration)`)
The database connection settings used for Patchwork. See the `<patchwork-database-configuration>` record type for more information.

`secret-key-file` (default: `"/etc/patchwork/django-secret-key"`)
Patchwork, as a Django web application uses a secret key for cryptographically signing values. This file should contain a unique unpredictable value.

If this file does not exist, it will be created and populated with a random value by the patchwork-setup shepherd service.

This setting relates to Django.

`allowed-hosts`
: A list of valid hosts for this Patchwork service. This should at least include the domain specified in the `<patchwork-configuration>` record.

  This is a Django setting.

`default-from-email`
: The email address from which Patchwork should send email by default.

  This is a Patchwork setting.

`static-url` (default: `#f`)
: The URL to use when serving static assets. It can be part of a URL, or a full URL, but must end in a `/`.

  If the default value is used, the `static-path` value from the `<patchwork-configuration>` record will be used.

  This is a Django setting.

`admins` (default: `'()`)
: Email addresses to send the details of errors that occur. Each value should be a list containing two elements, the name and then the email address.

  This is a Django setting.

`debug?` (default: `#f`)
: Whether to run Patchwork in debug mode. If set to `#t`, detailed error messages will be shown.

  This is a Django setting.

`enable-rest-api?` (default: `#t`)
: Whether to enable the Patchwork REST API.

  This is a Patchwork setting.

`enable-xmlrpc?` (default: `#t`)
: Whether to enable the XML RPC API.

  This is a Patchwork setting.

`force-https-links?` (default: `#t`)
: Whether to use HTTPS links on Patchwork pages.

  This is a Patchwork setting.

`extra-settings` (default: `""`)
: Extra code to place at the end of the Patchwork settings module.

`patchwork-database-configuration` [Data Type]

Data type representing the database configuration for Patchwork.

`engine` (default: `"django.db.backends.postgresql_psycopg2"`)
: The database engine to use.

`name` (default: `"patchwork"`)
: The name of the database to use.

`user` (default: `"httpd"`)
: The user to connect to the database as.

`password` (default: `""`)
: The password to use when connecting to the database.

`host` (default: `""`)
: The host to make the database connection to.

`port` (default: `""`)
: The port on which to connect to the database.

Mumi

Mumi (`https://git.savannah.gnu.org/cgit/guix/mumi.git/`) is a Web interface to the Debbugs bug tracker, by default for the GNU instance (`https://bugs.gnu.org`). Mumi is a Web server, but it also fetches and indexes mail retrieved from Debbugs.

`mumi-service-type` [Variável]
: This is the service type for Mumi.

`mumi-configuration` [Data Type]
: Data type representing the Mumi service configuration. This type has the following fields:

  `mumi` (default: `mumi`)
  : The Mumi package to use.

  `mailer?` (default: `#true`)
  : Whether to enable or disable the mailer component.

  `mumi-configuration-sender`
  : The email address used as the sender for comments.

  `mumi-configuration-smtp`
  : A URI to configure the SMTP settings for Mailutils. This could be something like `sendmail:///path/to/bin/msmtp` or any other URI supported by Mailutils. Veja Seção "SMTP Mailboxes" em *GNU Mailutils*.

FastCGI

FastCGI is an interface between the front-end and the back-end of a web service. It is a somewhat legacy facility; new web services should generally just talk HTTP between the front-end and the back-end. However there are a number of back-end services such as PHP or the optimized HTTP Git repository access that use FastCGI, so we have support for it in Guix.

To use FastCGI, you configure the front-end web server (e.g., nginx) to dispatch some subset of its requests to the fastcgi backend, which listens on a local TCP or UNIX socket. There is an intermediary `fcgiwrap` program that sits between the actual backend process and the web server. The front-end indicates which backend program to run, passing that information to the `fcgiwrap` process.

`fcgiwrap-service-type` [Variável]
: A service type for the `fcgiwrap` FastCGI proxy.

`fcgiwrap-configuration` [Data Type]

Data type representing the configuration of the `fcgiwrap` service. This type has the following parameters:

`package` (default: `fcgiwrap`)
: The fcgiwrap package to use.

`socket` (default: `tcp:127.0.0.1:9000`)
: The socket on which the `fcgiwrap` process should listen, as a string. Valid *socket* values include `unix:/path/to/unix/socket`, `tcp:dot.ted.qu.ad:port` and `tcp6:[ipv6_addr]:port`.

`user` (default: `fcgiwrap`)
`group` (default: `fcgiwrap`)
: The user and group names, as strings, under which to run the `fcgiwrap` process. The `fastcgi` service will ensure that if the user asks for the specific user or group names `fcgiwrap` that the corresponding user and/or group is present on the system.

  It is possible to configure a FastCGI-backed web service to pass HTTP authentication information from the front-end to the back-end, and to allow `fcgiwrap` to run the back-end process as a corresponding local user. To enable this capability on the back-end, run `fcgiwrap` as the `root` user and group. Note that this capability also has to be configured on the front-end as well.

PHP-FPM

PHP-FPM (FastCGI Process Manager) is an alternative PHP FastCGI implementation with some additional features useful for sites of any size.

These features include:

- Adaptive process spawning
- Basic statistics (similar to Apache's mod_status)
- Advanced process management with graceful stop/start
- Ability to start workers with different uid/gid/chroot/environment and different php.ini (replaces safe_mode)
- Stdout & stderr logging
- Emergency restart in case of accidental opcode cache destruction
- Accelerated upload support
- Support for a "slowlog"
- Enhancements to FastCGI, such as fastcgi_finish_request() - a special function to finish request & flush all data while continuing to do something time-consuming (video converting, stats processing, etc.)

... e muito mais.

`php-fpm-service-type` [Variável]

A Service type for `php-fpm`.

`php-fpm-configuration` [Data Type]

Data Type for php-fpm service configuration.

`php` (default: `php`)
The php package to use.

`socket` (default: `(string-append "/var/run/php" (version-major (package-version php)) "-fpm.sock")`)
The address on which to accept FastCGI requests. Valid syntaxes are:

`"ip.add.re.ss:port"`
Listen on a TCP socket to a specific address on a specific port.

`"port"` Listen on a TCP socket to all addresses on a specific port.

`"/path/to/unix/socket"`
Listen on a unix socket.

`user` (default: `php-fpm`)
User who will own the php worker processes.

`group` (default: `php-fpm`)
Group of the worker processes.

`socket-user` (default: `php-fpm`)
User who can speak to the php-fpm socket.

`socket-group` (default: `nginx`)
Group that can speak to the php-fpm socket.

`pid-file` (default: `(string-append "/var/run/php" (version-major (package-version php)) "-fpm.pid")`)
The process id of the php-fpm process is written to this file once the service has started.

`log-file` (default: `(string-append "/var/log/php" (version-major (package-version php)) "-fpm.log")`)
Log for the php-fpm master process.

`process-manager` (default: `(php-fpm-dynamic-process-manager-configuration)`)
Detailed settings for the php-fpm process manager. Must be one of:

`<php-fpm-dynamic-process-manager-configuration>`
`<php-fpm-static-process-manager-configuration>`
`<php-fpm-on-demand-process-manager-configuration>`

`display-errors` (default `#f`)
Determines whether php errors and warning should be sent to clients and displayed in their browsers. This is useful for local php development, but a security risk for public sites, as error messages can reveal passwords and personal data.

`timezone` (default `#f`)
Specifies `php_admin_value[date.timezone]` parameter.

`workers-logfile` (default `(string-append "/var/log/php" (version-major (package-version php)) "-fpm.www.log")`)
: This file will log the `stderr` outputs of php worker processes. Can be set to `#f` to disable logging.

`file` (default `#f`)
: An optional override of the whole configuration. You can use the `mixed-text-file` function or an absolute filepath for it.

`php-ini-file` (default `#f`)
: An optional override of the default php settings. It may be any "file-like" object (veja Seção 8.12 [Expressões-G], Página 163). You can use the `mixed-text-file` function or an absolute filepath for it.

  For local development it is useful to set a higher timeout and memory limit for spawned php processes. This be accomplished with the following operating system configuration snippet:

```
(define %local-php-ini
  (plain-file "php.ini"
              "memory_limit = 2G
max_execution_time = 1800"))

(operating-system
  ;; ...
  (services (cons (service php-fpm-service-type
                           (php-fpm-configuration
                            (php-ini-file %local-php-ini)))
                  %base-services)))
```

  Consult the core php.ini directives (`https://www.php.net/manual/en/ini.core.php`) for comprehensive documentation on the acceptable `php.ini` directives.

`php-fpm-dynamic-process-manager-configuration` [Data type]
: Data Type for the `dynamic` php-fpm process manager. With the `dynamic` process manager, spare worker processes are kept around based on its configured limits.

  `max-children` (default: `5`)
  : Maximum of worker processes.

  `start-servers` (default: `2`)
  : How many worker processes should be started on start-up.

  `min-spare-servers` (default: `1`)
  : How many spare worker processes should be kept around at minimum.

  `max-spare-servers` (default: `3`)
  : How many spare worker processes should be kept around at maximum.

`php-fpm-static-process-manager-configuration` [Data type]
: Data Type for the `static` php-fpm process manager. With the `static` process manager, an unchanging number of worker processes are created.

`max-children` (default: `5`)
Maximum of worker processes.

`php-fpm-on-demand-process-manager-configuration` [Data type]
Data Type for the `on-demand` php-fpm process manager. With the `on-demand` process manager, worker processes are only created as requests arrive.

`max-children` (default: `5`)
Maximum of worker processes.

`process-idle-timeout` (default: `10`)
The time in seconds after which a process with no requests is killed.

`nginx-php-location` [*#:nginx-package nginx*] [*socket* (*string-append* "*/var/run/php*" (*version-major* (*package-version* php)) "-fpm.sock")] [Procedure]
A helper function to quickly add php to an `nginx-server-configuration`.

A simple services setup for nginx with php can look like this:

```
(services (cons* (service dhcp-client-service-type)
                 (service php-fpm-service-type)
                 (service nginx-service-type
                          (nginx-server-configuration
                           (server-name '("example.com"))
                           (root "/srv/http/")
                           (locations
                            (list (nginx-php-location)))
                           (listen '("80"))
                           (ssl-certificate #f)
                           (ssl-certificate-key #f)))
                 %base-services))
```

The cat avatar generator is a simple service to demonstrate the use of php-fpm in `Nginx`. It is used to generate cat avatar from a seed, for instance the hash of a user's email address.

`cat-avatar-generator-service` [*#:cache-dir* "*/var/cache/cat-avatar-generator*"] [*#:package* cat-avatar-generator] [#:configuration (nginx-server-configuration)] [Procedure]
Returns an nginx-server-configuration that inherits `configuration`. It extends the nginx configuration to add a server block that serves `package`, a version of cat-avatar-generator. During execution, cat-avatar-generator will be able to use `cache-dir` as its cache directory.

A simple setup for cat-avatar-generator can look like this:

```
(services (cons* (cat-avatar-generator-service
                  #:configuration
                  (nginx-server-configuration
                    (server-name '("example.com"))))
                 ...
                 %base-services))
```

Hpcguix-web

The hpcguix-web (`https://github.com/UMCUGenetics/hpcguix-web/`) program is a customizable web interface to browse Guix packages, initially designed for users of high-performance computing (HPC) clusters.

`hpcguix-web-service-type` [Variável]
The service type for `hpcguix-web`.

`hpcguix-web-configuration` [Data Type]
Data type for the hpcguix-web service configuration.

`specs` (default: `#f`)
Either `#f` or a gexp (veja Seção 8.12 [Expressões-G], Página 163) specifying the hpcguix-web service configuration as an `hpcguix-web-configuration` record. The main fields of that record type are:

`title-prefix` (default: `"hpcguix | "`)
The page title prefix.

`guix-command` (default: `"guix"`)
The `guix` command to use in examples that appear on HTML pages.

`package-filter-proc` (default: `(const #t)`)
A procedure specifying how to filter packages that are displayed.

`package-page-extension-proc` (default: `(const '())`)
Extension package for `hpcguix-web`.

`menu` (default: `'()`)
Additional entry in page `menu`.

`channels` (default: `%default-channels`)
List of channels from which the package list is built (veja Capítulo 6 [Canais], Página 69).

`package-list-expiration` (default: `(* 12 3600)`)
The expiration time, in seconds, after which the package list is rebuilt from the latest instances of the given channels.

See the hpcguix-web repository for a complete example (`https://github.com/UMCUGenetics/hpcguix-web/blob/master/hpcweb-configuration.scm`).

`package` (default: `hpcguix-web`)
The hpcguix-web package to use.

`address` (default: `"127.0.0.1"`)
The IP address to listen to.

`port` (default: `5000`)
The port number to listen to.

A typical hpcguix-web service declaration looks like this:

```
(service hpcguix-web-service-type
         (hpcguix-web-configuration
          (specs
           #~(hpcweb-configuration
              (title-prefix "Guix-HPC - ")
              (menu '(("/about" "ABOUT")))))))
```

Nota: The hpcguix-web service periodically updates the package list it publishes by pulling channels from Git. To that end, it needs to access X.509 certificates so that it can authenticate Git servers when communicating over HTTPS, and it assumes that `/etc/ssl/certs` contains those certificates.

A certificate package, `nss-certs`, is provided by default as part of `%base-packages`. Seção 11.12 [Certificados X.509], Página 604, for more information on X.509 certificates.

gmnisrv

The gmnisrv (`https://git.sr.ht/~sircmpwn/gmnisrv`) program is a simple Gemini (`https://gemini.circumlunar.space/`) protocol server.

`gmnisrv-service-type` [Variável]

This is the type of the gmnisrv service, whose value should be a `gmnisrv-configuration` object, as in this example:

```
(service gmnisrv-service-type
         (gmnisrv-configuration
           (config-file (local-file "./my-gmnisrv.ini"))))
```

`gmnisrv-configuration` [Data Type]

Data type representing the configuration of gmnisrv.

`package` (default: *gmnisrv*)
: Package object of the gmnisrv server.

`config-file` (default: `%default-gmnisrv-config-file`)
: File-like object of the gmnisrv configuration file to use. The default configuration listens on port 1965 and serves files from `/srv/gemini`. Certificates are stored in `/var/lib/gemini/certs`. For more information, run `man gmnisrv` and `man gmnisrv.ini`.

Agate

The Agate (`gemini://qwertqwefsday.eu/agate.gmi`) (GitHub page over HTTPS (`https://github.com/mbrubeck/agate`)) program is a simple Gemini (`https://gemini.circumlunar.space/`) protocol server written in Rust.

`agate-service-type` [Variável]

This is the type of the agate service, whose value should be an `agate-service-type` object, as in this example:

```
(service agate-service-type
 (agate-configuration
```

```
        (content "/srv/gemini")
        (certificates "/srv/gemini-certs")))
```

The example above represents the minimal tweaking necessary to get Agate up and running. Specifying the path to the certificate and key directory is always necessary, as the Gemini protocol requires TLS by default.

If the specified `certificates` path is writable by Agate, and contains no valid pre-generated key and certificate, Agate will try to generate them on the first start. In this case you should pass at least one hostname using the `hostnames` option. If the specified directory is read-only, key and certificate should be pre-generated by the user.

To obtain a certificate and a key in DER format, you could, for example, use OpenSSL, running commands similar to the following example:

```
openssl genpkey -out key.der -outform DER -algorithm RSA \
    -pkeyopt rsa_keygen_bits:4096
openssl req -x509 -key key.der -outform DER -days 3650 -out cert.der \
    -subj "/CN=example.com"
```

Of course, you'll have to replace *example.com* with your own domain name, and then point the Agate configuration towards the path of the directory with the generated key and certificate using the `certificates` option.

`agate-configuration` [Data Type]

Data type representing the configuration of Agate.

`package` (default: `agate`)
: The package object of the Agate server.

`content` (default: `"/srv/gemini"`)
: The directory from which Agate will serve files.

`certificates` (default: `"/srv/gemini-certs"`)
: Root of the certificate directory. Must be filled in with a value from the user.

`addresses` (default: `'("[::]:1965" "0.0.0.0:1965")`)
: A list of the addresses to listen on.

`hostnames` (default: `'()`)
: Virtual hosts for the Gemini server. If multiple values are specified, corresponding directory names should be present in the `content` directory. Optional.

`languages` (default: `#f`)
: RFC 4646 language code(s) for text/gemini documents. Optional.

`only-tls13?` (default: `#f`)
: Set to `#t` to disable support for TLSv1.2.

`serve-secret?` (default: `#f`)
: Set to `#t` to serve secret files (files/directories starting with a dot).

`central-configuration?` (default: `#f`)
: Set to `#t` to look for the .meta configuration file in the `content` root directory and will ignore `.meta` files in other directories

`ed25519?` (default: `#f`)
: Set to `#t` to generate keys using the Ed25519 signature algorithm instead of the default ECDSA.

`skip-port-check?` (default: `#f`)
: Set to `#t` to skip URL port check even when a `hostname` is specified.

`log-ip?` (default: `#t`)
: Whether or not to output IP addresses when logging.

`user` (default: `"agate"`)
: Owner of the `agate` process.

`group` (default: `"agate"`)
: Owner's group of the `agate` process.

`log-file` (default: `"/var/log/agate.log"`)
: The file which should store the logging output of Agate.

11.10.21 Serviços de certificado

The `(gnu services certbot)` module provides a service to automatically obtain a valid TLS certificate from the Let's Encrypt certificate authority. These certificates can then be used to serve content securely over HTTPS or other TLS-based protocols, with the knowledge that the client will be able to verify the server's authenticity.

Let's Encrypt (`https://letsencrypt.org/`) provides the `certbot` tool to automate the certification process. This tool first securely generates a key on the server. It then makes a request to the Let's Encrypt certificate authority (CA) to sign the key. The CA checks that the request originates from the host in question by using a challenge-response protocol, requiring the server to provide its response over HTTP. If that protocol completes successfully, the CA signs the key, resulting in a certificate. That certificate is valid for a limited period of time, and therefore to continue to provide TLS services, the server needs to periodically ask the CA to renew its signature.

The certbot service automates this process: the initial key generation, the initial certification request to the Let's Encrypt service, the web server challenge/response integration, writing the certificate to disk, the automated periodic renewals, and the deployment tasks associated with the renewal (e.g. reloading services, copying keys with different permissions).

Certbot is run twice a day, at a random minute within the hour. It won't do anything until your certificates are due for renewal or revoked, but running it regularly would give your service a chance of staying online in case a Let's Encrypt-initiated revocation happened for some reason.

By using this service, you agree to the ACME Subscriber Agreement, which can be found there: `https://acme-v01.api.letsencrypt.org/directory`.

`certbot-service-type` [Variável]
: A service type for the `certbot` Let's Encrypt client. Its value must be a `certbot-configuration` record as in this example:

```
(service certbot-service-type
         (certbot-configuration
          (email "foo@example.net")
          (certificates
           (list
            (certificate-configuration
             (domains '("example.net" "www.example.net")))
            (certificate-configuration
             (domains '("bar.example.net")))))))
```

See below for details about `certbot-configuration`.

`certbot-configuration` [Data Type]

Data type representing the configuration of the `certbot` service. This type has the following parameters:

`package` (default: `certbot`)
: The certbot package to use.

`webroot` (default: `/var/www`)
: The directory from which to serve the Let's Encrypt challenge/response files.

`certificates` (default: `'()`)
: A list of `certificates-configuration`s for which to generate certificates and request signatures. Each certificate has a `name` and several `domains`.

`email` (default: `#f`)
: Optional email address used for registration and recovery contact. Setting this is encouraged as it allows you to receive important notifications about the account and issued certificates.

`server` (default: `#f`)
: Optional URL of ACME server. Setting this overrides certbot's default, which is the Let's Encrypt server.

`rsa-key-size` (default: `2048`)
: Size of the RSA key.

`default-location` (default: *see below*)
: The default `nginx-location-configuration`. Because `certbot` needs to be able to serve challenges and responses, it needs to be able to run a web server. It does so by extending the `nginx` web service with an `nginx-server-configuration` listening on the *domains* on port 80, and which has a `nginx-location-configuration` for the `/.well-known/` URI path subspace used by Let's Encrypt. Veja Seção 11.10.20 [Serviços Web], Página 457, for more on these nginx configuration data types.

  Requests to other URL paths will be matched by the `default-location`, which if present is added to all `nginx-server-configuration`s.

  By default, the `default-location` will issue a redirect from `http://domain/...` to `https://domain/...`, leaving you to define what to serve on your site via `https`.

Pass `#f` to not issue a default location.

`certificate-configuration` [Data Type]

Data type representing the configuration of a certificate. This type has the following parameters:

`name` (default: *see below*)

This name is used by Certbot for housekeeping and in file paths; it doesn't affect the content of the certificate itself. To see certificate names, run `certbot certificates`.

Its default is the first provided domain.

`domains` (default: `'()`)

The first domain provided will be the subject CN of the certificate, and all domains will be Subject Alternative Names on the certificate.

`challenge` (default: `#f`)

The challenge type that has to be run by certbot. If `#f` is specified, default to the HTTP challenge. If a value is specified, defaults to the manual plugin (see `authentication-hook`, `cleanup-hook` and the documentation at `https://certbot.eff.org/docs/using.html#hooks`), and gives Let's Encrypt permission to log the public IP address of the requesting machine.

`csr` (default: `#f`)

File name of Certificate Signing Request (CSR) in DER or PEM format. If `#f` is specified, this argument will not be passed to certbot. If a value is specified, certbot will use it to obtain a certificate, instead of using a self-generated CSR. The domain-name(s) mentioned in `domains`, must be consistent with the domain-name(s) mentioned in CSR file.

`authentication-hook` (default: `#f`)

Command to be run in a shell once for each certificate challenge to be answered. For this command, the shell variable `$CERTBOT_DOMAIN` will contain the domain being authenticated, `$CERTBOT_VALIDATION` contains the validation string and `$CERTBOT_TOKEN` contains the file name of the resource requested when performing an HTTP-01 challenge.

`cleanup-hook` (default: `#f`)

Command to be run in a shell once for each certificate challenge that have been answered by the `auth-hook`. For this command, the shell variables available in the `auth-hook` script are still available, and additionally `$CERTBOT_AUTH_OUTPUT` will contain the standard output of the `auth-hook` script.

`deploy-hook` (default: `#f`)

Command to be run in a shell once for each successfully issued certificate. For this command, the shell variable `$RENEWED_LINEAGE` will point to the config live subdirectory (for example, ‘`"/etc/letsencrypt/live/example.com"`’) containing the new certificates and keys; the shell variable `$RENEWED_DOMAINS` will contain

a space-delimited list of renewed certificate domains (for example, '"example.com www.example.com"'.

`start-self-signed?` (default: `#t`)
Whether to generate an initial self-signed certificate during system activation. This option is particularly useful to allow `nginx` to start before `certbot` has run, because `certbot` relies on `nginx` running to perform HTTP challenges.

For each `certificate-configuration`, the certificate is saved to `/etc/certs/`*name*`/fullchain.pem` and the key is saved to `/etc/certs/`*name*`/privkey.pem`.

11.10.22 Serviços DNS

The `(gnu services dns)` module provides services related to the *domain name system* (DNS). It provides a server service for hosting an *authoritative* DNS server for multiple zones, slave or master. This service uses Knot DNS (`https://www.knot-dns.cz/`). And also a caching and forwarding DNS server for the LAN, which uses dnsmasq (`http://www.thekelleys.org.uk/dnsmasq/doc.html`).

Knot Service

An example configuration of an authoritative server for two zones, one master and one slave, is:

```
(define-zone-entries example.org.zone
;; Name TTL Class Type Data
  ("@"  ""  "IN"  "A"  "127.0.0.1")
  ("@"  ""  "IN"  "NS" "ns")
  ("ns" ""  "IN"  "A"  "127.0.0.1"))

(define master-zone
  (knot-zone-configuration
    (domain "example.org")
    (zone (zone-file
            (origin "example.org")
            (entries example.org.zone)))))

(define slave-zone
  (knot-zone-configuration
    (domain "plop.org")
    (dnssec-policy "default")
    (master (list "plop-master"))))

(define plop-master
  (knot-remote-configuration
    (id "plop-master")
    (address (list "208.76.58.171"))))

(operating-system
```

```
  ;; ...
  (services (cons* (service knot-service-type
                    (knot-configuration
                      (remotes (list plop-master))
                      (zones (list master-zone slave-zone))))
                   ;; ...
                   %base-services)))
```

`knot-service-type` [Variável]

This is the type for the Knot DNS server.

Knot DNS is an authoritative DNS server, meaning that it can serve multiple zones, that is to say domain names you would buy from a registrar. This server is not a resolver, meaning that it can only resolve names for which it is authoritative. This server can be configured to serve zones as a master server or a slave server as a per-zone basis. Slave zones will get their data from masters, and will serve it as an authoritative server. From the point of view of a resolver, there is no difference between master and slave.

The following data types are used to configure the Knot DNS server:

`knot-key-configuration` [Data Type]

Data type representing a key. This type has the following parameters:

`id` (default: `""`)
: An identifier for other configuration fields to refer to this key. IDs must be unique and must not be empty.

`algorithm` (default: `#f`)
: The algorithm to use. Choose between `#f`, `'hmac-md5`, `'hmac-sha1`, `'hmac-sha224`, `'hmac-sha256`, `'hmac-sha384` and `'hmac-sha512`.

`secret` (default: `""`)
: The secret key itself.

`knot-acl-configuration` [Data Type]

Data type representing an Access Control List (ACL) configuration. This type has the following parameters:

`id` (default: `""`)
: An identifier for other configuration fields to refer to this key. IDs must be unique and must not be empty.

`address` (default: `'()`)
: An ordered list of IP addresses, network subnets, or network ranges represented with strings. The query must match one of them. Empty value means that address match is not required.

`key` (default: `'()`)
: An ordered list of references to keys represented with strings. The string must match a key ID defined in a `knot-key-configuration`. No key means that a key is not require to match that ACL.

`action` (default: `'()`)
: An ordered list of actions that are permitted or forbidden by this ACL. Possible values are lists of zero or more elements from `'transfer`, `'notify` and `'update`.

`deny?` (padrão: `#f`)
: When true, the ACL defines restrictions. Listed actions are forbidden. When false, listed actions are allowed.

`zone-entry` [Data Type]

Data type representing a record entry in a zone file. This type has the following parameters:

`name` (default: `"@"`)
: The name of the record. `"@"` refers to the origin of the zone. Names are relative to the origin of the zone. For example, in the `example.org` zone, `"ns.example.org"` actually refers to `ns.example.org.example.org`. Names ending with a dot are absolute, which means that `"ns.example.org."` refers to `ns.example.org`.

`ttl` (default: `""`)
: The Time-To-Live (TTL) of this record. If not set, the default TTL is used.

`class` (default: `"IN"`)
: The class of the record. Knot currently supports only `"IN"` and partially `"CH"`.

`type` (default: `"A"`)
: The type of the record. Common types include A (IPv4 address), AAAA (IPv6 address), NS (Name Server) and MX (Mail eXchange). Many other types are defined.

`data` (default: `""`)
: The data contained in the record. For instance an IP address associated with an A record, or a domain name associated with an NS record. Remember that domain names are relative to the origin unless they end with a dot.

`zone-file` [Data Type]

Data type representing the content of a zone file. This type has the following parameters:

`entries` (default: `'()`)
: The list of entries. The SOA record is taken care of, so you don't need to put it in the list of entries. This list should probably contain an entry for your primary authoritative DNS server. Other than using a list of entries directly, you can use `define-zone-entries` to define a object containing the list of entries more easily, that you can later pass to the `entries` field of the `zone-file`.

`origin` (default: `""`)
: The name of your zone. This parameter cannot be empty.

`ns` (default: `"ns"`)
: The domain of your primary authoritative DNS server. The name is relative to the origin, unless it ends with a dot. It is mandatory that this primary DNS server corresponds to an NS record in the zone and that it is associated to an IP address in the list of entries.

`mail` (default: `"hostmaster"`)
: An email address people can contact you at, as the owner of the zone. This is translated as `<mail>@<origin>`.

`serial` (default: `1`)
: The serial number of the zone. As this is used to keep track of changes by both slaves and resolvers, it is mandatory that it *never* decreases. Always increment it when you make a change in your zone.

`refresh` (default: `(* 2 24 3600)`)
: The frequency at which slaves will do a zone transfer. This value is a number of seconds. It can be computed by multiplications or with `(string->duration)`.

`retry` (default: `(* 15 60)`)
: The period after which a slave will retry to contact its master when it fails to do so a first time.

`expiry` (default: `(* 14 24 3600)`)
: Default TTL of records. Existing records are considered correct for at most this amount of time. After this period, resolvers will invalidate their cache and check again that it still exists.

`nx` (default: `3600`)
: Default TTL of inexistent records. This delay is usually short because you want your new domains to reach everyone quickly.

`knot-remote-configuration` [Data Type]
Data type representing a remote configuration. This type has the following parameters:

`id` (default: `""`)
: An identifier for other configuration fields to refer to this remote. IDs must be unique and must not be empty.

`address` (default: `'()`)
: An ordered list of destination IP addresses. Addresses are tried in sequence. An optional port can be given with the @ separator. For instance: `(list "1.2.3.4" "2.3.4.5@53")`. Default port is 53.

`via` (default: `'()`)
: An ordered list of source IP addresses. An empty list will have Knot choose an appropriate source IP. An optional port can be given with the @ separator. The default is to choose at random.

`key` (default: `#f`)
: A reference to a key, that is a string containing the identifier of a key defined in a `knot-key-configuration` field.

`knot-keystore-configuration` [Data Type]

Data type representing a keystore to hold dnssec keys. This type has the following parameters:

`id` (default: `""`)
: The id of the keystore. It must not be empty.

`backend` (default: `'pem`)
: The backend to store the keys in. Can be `'pem` or `'pkcs11`.

`config` (default: `"/var/lib/knot/keys/keys"`)
: The configuration string of the backend. An example for the PKCS#11 is: `"pkcs11:token=knot;pin-value=1234 /gnu/store/.../lib/pkcs11/libsofthsm2.so"`. For the pem backend, the string represents a path in the file system.

`knot-policy-configuration` [Data Type]

Data type representing a dnssec policy. Knot DNS is able to automatically sign your zones. It can either generate and manage your keys automatically or use keys that you generate.

Dnssec is usually implemented using two keys: a Key Signing Key (KSK) that is used to sign the second, and a Zone Signing Key (ZSK) that is used to sign the zone. In order to be trusted, the KSK needs to be present in the parent zone (usually a top-level domain). If your registrar supports dnssec, you will have to send them your KSK's hash so they can add a DS record in their zone. This is not automated and need to be done each time you change your KSK.

The policy also defines the lifetime of keys. Usually, ZSK can be changed easily and use weaker cryptographic functions (they use lower parameters) in order to sign records quickly, so they are changed often. The KSK however requires manual interaction with the registrar, so they are changed less often and use stronger parameters because they sign only one record.

This type has the following parameters:

`id` (default: `""`)
: The id of the policy. It must not be empty.

`keystore` (default: `"default"`)
: A reference to a keystore, that is a string containing the identifier of a keystore defined in a `knot-keystore-configuration` field. The `"default"` identifier means the default keystore (a kasp database that was setup by this service).

`manual?` (default: `#f`)
: Whether the key management is manual or automatic.

`single-type-signing?` (default: `#f`)
: When `#t`, use the Single-Type Signing Scheme.

`algorithm` (default: `"ecdsap256sha256"`)
: An algorithm of signing keys and issued signatures.

`ksk-size` (default: `256`)
: The length of the KSK. Note that this value is correct for the default algorithm, but would be unsecure for other algorithms.

`zsk-size` (default: `256`)
: The length of the ZSK. Note that this value is correct for the default algorithm, but would be unsecure for other algorithms.

`dnskey-ttl` (default: `'default`)
: The TTL value for DNSKEY records added into zone apex. The special `'default` value means same as the zone SOA TTL.

`zsk-lifetime` (default: `(* 30 24 3600)`)
: The period between ZSK publication and the next rollover initiation.

`propagation-delay` (default: `(* 24 3600)`)
: An extra delay added for each key rollover step. This value should be high enough to cover propagation of data from the master server to all slaves.

`rrsig-lifetime` (default: `(* 14 24 3600)`)
: A validity period of newly issued signatures.

`rrsig-refresh` (default: `(* 7 24 3600)`)
: A period how long before a signature expiration the signature will be refreshed.

`nsec3?` (padrão: `#f`)
: When `#t`, NSEC3 will be used instead of NSEC.

`nsec3-iterations` (default: `5`)
: The number of additional times the hashing is performed.

`nsec3-salt-length` (default: `8`)
: The length of a salt field in octets, which is appended to the original owner name before hashing.

`nsec3-salt-lifetime` (default: `(* 30 24 3600)`)
: The validity period of newly issued salt field.

`knot-zone-configuration` [Data Type]

Data type representing a zone served by Knot. This type has the following parameters:

`domain` (default: `""`)
: The domain served by this configuration. It must not be empty.

`file` (default: `""`)
: The file where this zone is saved. This parameter is ignored by master zones. Empty means default location that depends on the domain name.

`zone` (default: `(zone-file)`)
: The content of the zone file. This parameter is ignored by slave zones. It must contain a zone-file record.

`master` (default: `'()`)
: A list of master remotes. When empty, this zone is a master. When set, this zone is a slave. This is a list of remotes identifiers.

`ddns-master` (default: `#f`)
: The main master. When empty, it defaults to the first master in the list of masters.

`notify` (default: `'()`)
: A list of slave remote identifiers.

`acl` (default: `'()`)
: A list of acl identifiers.

`semantic-checks?` (default: `#f`)
: When set, this adds more semantic checks to the zone.

`zonefile-sync` (default: `0`)
: The delay between a modification in memory and on disk. 0 means immediate synchronization.

`zonefile-load` (default: `#f`)
: The way the zone file contents are applied during zone load. Possible values are:

  - `#f` for using the default value from Knot,
  - `'none` for not using the zone file at all,
  - `'difference` for computing the difference between already available contents and zone contents and applying it to the current zone contents,
  - `'difference-no-serial` for the same as `'difference`, but ignoring the SOA serial in the zone file, while the server takes care of it automatically.
  - `'whole` for loading zone contents from the zone file.

`journal-content` (default: `#f`)
: The way the journal is used to store zone and its changes. Possible values are `'none` to not use it at all, `'changes` to store changes and `'all` to store contents. `#f` does not set this option, so the default value from Knot is used.

`max-journal-usage` (default: `#f`)
: The maximum size for the journal on disk. `#f` does not set this option, so the default value from Knot is used.

`max-journal-depth` (default: `#f`)
: The maximum size of the history. `#f` does not set this option, so the default value from Knot is used.

`max-zone-size` (default: `#f`)
: The maximum size of the zone file. This limit is enforced for incoming transfer and updates. `#f` does not set this option, so the default value from Knot is used.

`dnssec-policy` (default: `#f`)
: A reference to a `knot-policy-configuration` record, or the special name `"default"`. If the value is `#f`, there is no dnssec signing on this zone.

`serial-policy` (default: `'increment`)
: A policy between `'increment` and `'unixtime`.

`knot-configuration` [Data Type]

Data type representing the Knot configuration. This type has the following parameters:

`knot` (default: `knot`)
: The Knot package.

`run-directory` (default: `"/var/run/knot"`)
: The run directory. This directory will be used for pid file and sockets.

`includes` (default: `'()`)
: A list of strings or file-like objects denoting other files that must be included at the top of the configuration file.

  This can be used to manage secrets out-of-band. For example, secret keys may be stored in an out-of-band file not managed by Guix, and thus not visible in `/gnu/store`—e.g., you could store secret key configuration in `/etc/knot/secrets.conf` and add this file to the `includes` list.

  One can generate a secret tsig key (for nsupdate and zone transfers with the keymgr command from the knot package. Note that the package is not automatically installed by the service. The following example shows how to generate a new tsig key:

  ```
  keymgr -t mysecret > /etc/knot/secrets.conf
  chmod 600 /etc/knot/secrets.conf
  ```

  Also note that the generated key will be named *mysecret*, so it is the name that needs to be used in the *key* field of the `knot-acl-configuration` record and in other places that need to refer to that key.

  It can also be used to add configuration not supported by this interface.

`listen-v4` (default: `"0.0.0.0"`)
: An ip address on which to listen.

`listen-v6` (default: `"::"`)
: An ip address on which to listen.

`listen-port` (default: `53`)
: A port on which to listen.

`keys` (default: `'()`)
: The list of knot-key-configuration used by this configuration.

`acls` (default: `'()`)
: The list of knot-acl-configuration used by this configuration.

`remotes` (default: `'()`)
: The list of knot-remote-configuration used by this configuration.

`zones` (default: `'()`)
: The list of knot-zone-configuration used by this configuration.

Knot Resolver Service

`knot-resolver-service-type` [Variável]
: This is the type of the knot resolver service, whose value should be a `knot-resolver-configuration` object as in this example:

```
(service knot-resolver-service-type
         (knot-resolver-configuration
           (kresd-config-file (plain-file "kresd.conf" "
net.listen('192.168.0.1', 5353)
user('knot-resolver', 'knot-resolver')
modules = { 'hints > iterate', 'stats', 'predict' }
cache.size = 100 * MB
"))))
```

For more information, refer its manual (`https://knot-resolver.readthedocs.io/en/stable/config-overview.html`).

`knot-resolver-configuration` [Data Type]
: Data type representing the configuration of knot-resolver.

`package` (default: *knot-resolver*)
: Package object of the knot DNS resolver.

`kresd-config-file` (default: %kresd.conf)
: File-like object of the kresd configuration file to use, by default it will listen on `127.0.0.1` and `::1`.

`garbage-collection-interval` (default: 1000)
: Number of milliseconds for `kres-cache-gc` to periodically trim the cache.

Dnsmasq Service

`dnsmasq-service-type` [Variável]
: This is the type of the dnsmasq service, whose value should be a `dnsmasq-configuration` object as in this example:

```
(service dnsmasq-service-type
         (dnsmasq-configuration
           (no-resolv? #t)
           (servers '("192.168.1.1"))))
```

`dnsmasq-configuration` [Data Type]
: Data type representing the configuration of dnsmasq.

`package` (default: *dnsmasq*)
: Package object of the dnsmasq server.

`no-hosts?` (padrão: `#f`)
: When true, don't read the hostnames in /etc/hosts.

`porta` (default: `53`)
: The port to listen on. Setting this to zero completely disables DNS responses, leaving only DHCP and/or TFTP functions.

`local-service?` (default: `#t`)
: Accept DNS queries only from hosts whose address is on a local subnet, ie a subnet for which an interface exists on the server.

`listen-addresses` (default: `'()`)
: Listen on the given IP addresses.

`resolv-file` (default: `"/etc/resolv.conf"`)
: The file to read the IP address of the upstream nameservers from.

`no-resolv?` (padrão: `#f`)
: When true, don't read *resolv-file*.

`forward-private-reverse-lookup?` (default: `#t`)
: When false, all reverse lookups for private IP ranges are answered with "no such domain" rather than being forwarded upstream.

`query-servers-in-order?` (default: `#f`)
: When true, dnsmasq queries the servers in the same order as they appear in *servers*.

`servers` (default: `'()`)
: Specify IP address of upstream servers directly.

`servers-file` (default: `#f`)
: Specify file containing upstream servers. This file is re-read when dnsmasq receives SIGHUP. Could be either a string or a file-like object.

`addresses` (default: `'()`)
: For each entry, specify an IP address to return for any host in the given domains. Queries in the domains are never forwarded and always replied to with the specified IP address.

  This is useful for redirecting hosts locally, for example:

```
(service dnsmasq-service-type
         (dnsmasq-configuration
           (addresses
             '(; Redirect to a local web-server.
               "/example.org/127.0.0.1"
               ; Redirect subdomain to a specific IP.
               "/subdomain.example.org/192.168.1.42"))))
```

  Note that rules in `/etc/hosts` take precedence over this.

`cache-size` (default: `150`)
: Set the size of dnsmasq's cache. Setting the cache size to zero disables caching.

`negative-cache?` (padrão: `#t`)
: When false, disable negative caching.

`cpe-id` (default: `#f`)
: If set, add a CPE (Customer-Premises Equipment) identifier to DNS queries which are forwarded upstream.

`tftp-enable?` (default: `#f`)
: Whether to enable the built-in TFTP server.

`tftp-no-fail?` (default: `#f`)
: If true, does not fail dnsmasq if the TFTP server could not start up.

`tftp-single-port?` (default: `#f`)
: Whether to use only one single port for TFTP.

`tftp-secure?` (default: `#f`)
: If true, only files owned by the user running the dnsmasq process are accessible.

  If dnsmasq is being run as root, different rules apply: `tftp-secure?` has no effect, but only files which have the world-readable bit set are accessible.

`tftp-max` (default: `#f`)
: If set, sets the maximal number of concurrent connections allowed.

`tftp-mtu` (default: `#f`)
: If set, sets the MTU for TFTP packets to that value.

`tftp-no-blocksize?` (default: `#f`)
: If true, stops the TFTP server from negotiating the blocksize with a client.

`tftp-lowercase?` (default: `#f`)
: Whether to convert all filenames in TFTP requests to lowercase.

`tftp-port-range` (default: `#f`)
: If set, fixes the dynamical ports (one per client) to the given range (`"<start>,<end>"`).

`tftp-root` (default: `/var/empty,lo`)
: Look for files to transfer using TFTP relative to the given directory. When this is set, TFTP paths which include '`..`' are rejected, to stop clients getting outside the specified root. Absolute paths (starting with '`/`') are allowed, but they must be within the TFTP-root. If the optional interface argument is given, the directory is only used for TFTP requests via that interface.

`tftp-unique-root` (default: `#f`)
: If set, add the IP or hardware address of the TFTP client as a path component on the end of the TFTP-root. Only valid if a TFTP root is set and the directory exists. Defaults to adding IP address (in standard dotted-quad format).

  For instance, if `--tftp-root` is '`/tftp`' and client '`1.2.3.4`' requests file `myfile` then the effective path will be `/tftp/1.2.3.4/myfile` if

`/tftp/1.2.3.4` exists or `/tftp/myfile` otherwise. When '`=mac`' is specified it will append the MAC address instead, using lowercase zero padded digits separated by dashes, e.g.: '`01-02-03-04-aa-bb`'. Note that resolving MAC addresses is only possible if the client is in the local network or obtained a DHCP lease from dnsmasq.

`extra-options` (default: `'()`)
: This option provides an "escape hatch" for the user to provide arbitrary command-line arguments to `dnsmasq` as a list of strings.

11.10.23 VNC Services

The `(gnu services vnc)` module provides services related to *Virtual Network Computing* (VNC), which makes it possible to locally use graphical Xorg applications running on a remote machine. Combined with a graphical manager that supports the *X Display Manager Control Protocol*, such as GDM (veja [gdm], Página 332) or LightDM (veja [lightdm], Página 337), it is possible to remote an entire desktop for a multi-user environment.

Xvnc

Xvnc is a VNC server that spawns its own X window server; which means it can run on headless servers. The Xvnc implementations provided by the `tigervnc-server` and `turbovnc` aim to be fast and efficient.

`xvnc-service-type` [Variável]
: The `xvnc-service-type` service can be configured via the `xvnc-configuration` record, documented below. A second virtual display could be made available on a remote machine via the following configuration:

```
(service xvnc-service-type
         (xvnc-configuration (display-number 10)))
```

As a demonstration, the `xclock` command could then be started on the remote machine on display number 10, and it could be displayed locally via the `vncviewer` command:

```
# Start xclock on the remote machine.
ssh -L5910:localhost:5910 your-host -- guix shell xclock \
    -- env DISPLAY=:10 xclock
# Access it via VNC.
guix shell tigervnc-client -- vncviewer localhost:5910
```

The following configuration combines XDMCP and Inetd to allow multiple users to concurrently use the remote system and login graphically via the GDM display manager:

```
(operating-system
  [...]
  (services (cons*
             [...]
             (service xvnc-service-type (xvnc-configuration
                                         (display-number 5)
                                         (localhost? #f)
                                         (xdmcp? #t)
                                         (inetd? #t)))
```

```
(modify-services %desktop-services
  (gdm-service-type config => (gdm-configuration
                                (inherit config)
                                (auto-suspend? #f)
                                (xdmcp? #t)))))))
```

A remote user could then connect to it by using the `vncviewer` command or a compatible VNC client and start a desktop session of their choosing:

```
vncviewer remote-host:5905
```

Aviso: Unless your machine is in a controlled environment, for security reasons, the `localhost?` configuration of the `xvnc-configuration` record should be left to its default `#t` value and exposed via a secure means such as an SSH port forward. The XDMCP port, UDP 177 should also be blocked from the outside by a firewall, as it is not a secure protocol and can expose login credentials in clear.

`xvnc-configuration` [Data Type]

Available `xvnc-configuration` fields are:

`xvnc` (default: `tigervnc-server`) (type: file-like)
: The package that provides the Xvnc binary.

`display-number` (default: `0`) (type: number)
: The display number used by Xvnc. You should set this to a number not already used a Xorg server.

`geometry` (default: `"1024x768"`) (type: string)
: The size of the desktop to be created.

`depth` (default: `24`) (type: color-depth)
: The pixel depth in bits of the desktop to be created. Accepted values are 16, 24 or 32.

`port` (type: maybe-port)
: The port on which to listen for connections from viewers. When left unspecified, it defaults to 5900 plus the display number.

`ipv4?` (default: `#t`) (type: boolean)
: Use IPv4 for incoming and outgoing connections.

`ipv6?` (default: `#t`) (type: boolean)
: Use IPv6 for incoming and outgoing connections.

`password-file` (type: maybe-string)
: The password file to use, if any. Refer to vncpasswd(1) to learn how to generate such a file.

`xdmcp?` (default: `#f`) (type: boolean)
: Query the XDMCP server for a session. This enables users to log in a desktop session from the login manager screen. For a multiple users scenario, you'll want to enable the `inetd?` option as well, so that each connection to the VNC server is handled separately rather than shared.

`inetd?` (default: `#f`) (type: boolean)
Use an Inetd-style service, which runs the Xvnc server on demand.

`frame-rate` (default: `60`) (type: number)
The maximum number of updates per second sent to each client.

`security-types` (default: `'("None")`) (type: security-types)
The allowed security schemes to use for incoming connections. The default is "None", which is safe given that Xvnc is configured to authenticate the user via the display manager, and only for local connections. Accepted values are any of the following: ("None" "VncAuth" "Plain" "TLSNone" "TLSVnc" "TLSPlain" "X509None" "X509Vnc")

`localhost?` (default: `#t`) (type: boolean)
Only allow connections from the same machine. It is set to #true by default for security, which means SSH or another secure means should be used to expose the remote port.

`log-level` (default: `30`) (type: log-level)
The log level, a number between 0 and 100, 100 meaning most verbose output. The log messages are output to syslog.

`extra-options` (default: `'()`) (type: strings)
This can be used to provide extra Xvnc options not exposed via this <xvnc-configuration> record.

11.10.24 Serviços VPN

The `(gnu services vpn)` module provides services related to *virtual private networks* (VPNs).

Bitmask

`bitmask-service-type` [Variável]
A service type for the Bitmask (`https://bitmask.net`) VPN client. It makes the client available in the system and loads its polkit policy. Please note that the client expects an active polkit-agent, which is either run by your desktop-environment or should be run manually.

OpenVPN

It provides a *client* service for your machine to connect to a VPN, and a *server* service for your machine to host a VPN. Both `openvpn-client-service-type` and `openvpn-server-service-type` can be run simultaneously.

`openvpn-client-service-type` [Variável]
Type of the service that runs `openvpn`, a VPN daemon, as a client.

The value for this service is a `<openvpn-client-configuration>` object.

`openvpn-server-service-type` [Variável]
Type of the service that runs `openvpn`, a VPN daemon, as a server.

The value for this service is a `<openvpn-server-configuration>` object.

`openvpn-client-configuration` [Data Type]

Available `openvpn-client-configuration` fields are:

`openvpn` (default: `openvpn`) (type: file-like)
The OpenVPN package.

`pid-file` (default: `"/var/run/openvpn/openvpn.pid"`) (type: string)
The OpenVPN pid file.

`proto` (default: `udp`) (type: proto)
The protocol (UDP or TCP) used to open a channel between clients and servers.

`dev` (default: `tun`) (type: dev)
The device type used to represent the VPN connection.

`ca` (default: `"/etc/openvpn/ca.crt"`) (type: maybe-string)
The certificate authority to check connections against.

`cert` (default: `"/etc/openvpn/client.crt"`) (type: maybe-string)
The certificate of the machine the daemon is running on. It should be signed by the authority given in `ca`.

`key` (default: `"/etc/openvpn/client.key"`) (type: maybe-string)
The key of the machine the daemon is running on. It must be the key whose certificate is `cert`.

`comp-lzo?` (default: `#t`) (type: boolean)
Whether to use the lzo compression algorithm.

`persist-key?` (default: `#t`) (type: boolean)
Don't re-read key files across SIGUSR1 or –ping-restart.

`persist-tun?` (default: `#t`) (type: boolean)
Don't close and reopen TUN/TAP device or run up/down scripts across SIGUSR1 or –ping-restart restarts.

`fast-io?` (default: `#f`) (type: boolean)
(Experimental) Optimize TUN/TAP/UDP I/O writes by avoiding a call to poll/epoll/select prior to the write operation.

`verbosity` (default: `3`) (type: number)
Verbosity level.

`tls-auth` (default: `#f`) (type: tls-auth-client)
Add an additional layer of HMAC authentication on top of the TLS control channel to protect against DoS attacks.

`auth-user-pass` (type: maybe-string)
Authenticate with server using username/password. The option is a file containing username/password on 2 lines. Do not use a file-like object as it would be added to the store and readable by any user.

`verify-key-usage?` (default: `#t`) (type: key-usage)
Whether to check the server certificate has server usage extension.

`bind?` (default: `#f`) (type: bind)
Bind to a specific local port number.

`resolv-retry?` (default: `#t`) (type: resolv-retry)
Retry resolving server address.

`remote` (default: `'()`) (type: openvpn-remote-list)
A list of remote servers to connect to.

`openvpn-remote-configuration` [Data Type]
Available `openvpn-remote-configuration` fields are:

`name` (default: `"my-server"`) (type: string)
Server name.

`port` (default: `1194`) (type: number)
Port number the server listens to.

`openvpn-server-configuration` [Data Type]
Available `openvpn-server-configuration` fields are:

`openvpn` (default: `openvpn`) (type: file-like)
The OpenVPN package.

`pid-file` (default: `"/var/run/openvpn/openvpn.pid"`) (type: string)
The OpenVPN pid file.

`proto` (default: `udp`) (type: proto)
The protocol (UDP or TCP) used to open a channel between clients and servers.

`dev` (default: `tun`) (type: dev)
The device type used to represent the VPN connection.

`ca` (default: `"/etc/openvpn/ca.crt"`) (type: maybe-string)
The certificate authority to check connections against.

`cert` (default: `"/etc/openvpn/client.crt"`) (type: maybe-string)
The certificate of the machine the daemon is running on. It should be signed by the authority given in `ca`.

`key` (default: `"/etc/openvpn/client.key"`) (type: maybe-string)
The key of the machine the daemon is running on. It must be the key whose certificate is `cert`.

`comp-lzo?` (default: `#t`) (type: boolean)
Whether to use the lzo compression algorithm.

`persist-key?` (default: `#t`) (type: boolean)
Don't re-read key files across SIGUSR1 or –ping-restart.

`persist-tun?` (default: `#t`) (type: boolean)
Don't close and reopen TUN/TAP device or run up/down scripts across SIGUSR1 or –ping-restart restarts.

`fast-io?` (default: `#f`) (type: boolean)
: (Experimental) Optimize TUN/TAP/UDP I/O writes by avoiding a call to poll/epoll/select prior to the write operation.

`verbosity` (default: `3`) (type: number)
: Verbosity level.

`tls-auth` (default: `#f`) (type: tls-auth-server)
: Add an additional layer of HMAC authentication on top of the TLS control channel to protect against DoS attacks.

`port` (default: `1194`) (type: number)
: Specifies the port number on which the server listens.

`server` (default: `"10.8.0.0 255.255.255.0"`) (type: ip-mask)
: An ip and mask specifying the subnet inside the virtual network.

`server-ipv6` (default: `#f`) (type: cidr6)
: A CIDR notation specifying the IPv6 subnet inside the virtual network.

`dh` (default: `"/etc/openvpn/dh2048.pem"`) (type: string)
: The Diffie-Hellman parameters file.

`ifconfig-pool-persist` (default: `"/etc/openvpn/ipp.txt"`) (type: string)
: The file that records client IPs.

`redirect-gateway?` (default: `#f`) (type: gateway)
: When true, the server will act as a gateway for its clients.

`client-to-client?` (default: `#f`) (type: boolean)
: When true, clients are allowed to talk to each other inside the VPN.

`keepalive` (default: `(10 120)`) (type: keepalive)
: Causes ping-like messages to be sent back and forth over the link so that each side knows when the other side has gone down. `keepalive` requires a pair. The first element is the period of the ping sending, and the second element is the timeout before considering the other side down.

`max-clients` (default: `100`) (type: number)
: The maximum number of clients.

`status` (default: `"/var/run/openvpn/status"`) (type: string)
: The status file. This file shows a small report on current connection. It is truncated and rewritten every minute.

`client-config-dir` (default: `'()`) (type: openvpn-ccd-list)
: The list of configuration for some clients.

strongSwan

Currently, the strongSwan service only provides legacy-style configuration with `ipsec.conf` and `ipsec.secrets` files.

`strongswan-service-type` [Variável]
: A service type for configuring strongSwan for IPsec VPN (Virtual Private Networking). Its value must be a `strongswan-configuration` record as in this example:

```
(service strongswan-service-type
         (strongswan-configuration
          (ipsec-conf "/etc/ipsec.conf")
          (ipsec-secrets "/etc/ipsec.secrets")))
```

`strongswan-configuration` [Data Type]

Data type representing the configuration of the StrongSwan service.

`strongswan`
: The strongSwan package to use for this service.

`ipsec-conf` (default: `#f`)
: The file name of your `ipsec.conf`. If not `#f`, then this and `ipsec-secrets` must both be strings.

`ipsec-secrets` (default `#f`)
: The file name of your `ipsec.secrets`. If not `#f`, then this and `ipsec-conf` must both be strings.

Wireguard

`wireguard-service-type` [Variável]

A service type for a Wireguard tunnel interface. Its value must be a `wireguard-configuration` record as in this example:

```
(service wireguard-service-type
         (wireguard-configuration
          (peers
           (list
            (wireguard-peer
             (name "my-peer")
             (endpoint "my.wireguard.com:51820")
             (public-key "hzpKg9X1yqu1axN6iJp0mWf6BZGo8m1wteKwtTmDGF4=")
             (allowed-ips '("10.0.0.2/32")))))))
```

`wireguard-configuration` [Data Type]

Data type representing the configuration of the Wireguard service.

`wireguard`
: The wireguard package to use for this service.

`interface` (default: `"wg0"`)
: The interface name for the VPN.

`addresses` (default: `'("10.0.0.1/32")`)
: The IP addresses to be assigned to the above interface.

`port` (default: `51820`)
: The port on which to listen for incoming connections.

`dns` (default: `'()`)
: The DNS server(s) to announce to VPN clients via DHCP.

`monitor-ips?` (default: `#f`)
: Whether to monitor the resolved Internet addresses (IPs) of the endpoints of the configured peers, resetting the peer endpoints using an IP address that no longer correspond to their freshly resolved host name. Set this to `#t` if one or more endpoints use host names provided by a dynamic DNS service to keep the sessions alive.

`monitor-ips-interval` (default: `'(next-minute (range 0 60 5))`)
: The time interval at which the IP monitoring job should run, provided as an mcron time specification (veja Seção "Guile Syntax" em `mcron`).

`private-key` (default: `"/etc/wireguard/private.key"`)
: The private key file for the interface. It is automatically generated if the file does not exist.

`peers` (default: `'()`)
: The authorized peers on this interface. This is a list of *wireguard-peer* records.

`pre-up` (default: `'()`)
: The script commands to be run before setting up the interface.

`post-up` (default: `'()`)
: The script commands to be run after setting up the interface.

`pre-down` (default: `'()`)
: The script commands to be run before tearing down the interface.

`post-down` (default: `'()`)
: The script commands to be run after tearing down the interface.

`table` (default: `"auto"`)
: The routing table to which routes are added, as a string. There are two special values: `"off"` that disables the creation of routes altogether, and `"auto"` (the default) that adds routes to the default table and enables special handling of default routes.

`wireguard-peer` [Data Type]

Data type representing a Wireguard peer attached to a given interface.

`name` The peer name.

`endpoint` (default: `#f`)
: The optional endpoint for the peer, such as `"demo.wireguard.com:51820"`.

`public-key`
: The peer public-key represented as a base64 string.

`preshared-key` (default: `#f`)
: An optional pre-shared key file for this peer. The given file will not be autogenerated.

`allowed-ips`
: A list of IP addresses from which incoming traffic for this peer is allowed and to which incoming traffic for this peer is directed.

`keep-alive` (default: `#f`)
: An optional time interval in seconds. A packet will be sent to the server endpoint once per time interval. This helps receiving incoming connections from this peer when you are behind a NAT or a firewall.

11.10.25 Sistema de arquivos de rede

The `(gnu services nfs)` module provides the following services, which are most commonly used in relation to mounting or exporting directory trees as *network file systems* (NFS).

While it is possible to use the individual components that together make up a Network File System service, we recommended to configure an NFS server with the `nfs-service-type`.

NFS Service

The NFS service takes care of setting up all NFS component services, kernel configuration file systems, and installs configuration files in the locations that NFS expects.

`nfs-service-type` [Variável]
: A service type for a complete NFS server.

`nfs-configuration` [Data Type]
: This data type represents the configuration of the NFS service and all of its subsystems.

  It has the following parameters:

  `nfs-utils` (default: `nfs-utils`)
  : The nfs-utils package to use.

  `nfs-versions` (default: `'("4.2" "4.1" "4.0")`)
  : If a list of string values is provided, the `rpc.nfsd` daemon will be limited to supporting the given versions of the NFS protocol.

  `exports` (default: `'()`)
  : This is a list of directories the NFS server should export. Each entry is a list consisting of two elements: a directory name and a string containing all options. This is an example in which the directory `/export` is served to all NFS clients as a read-only share:

    ```
    (nfs-configuration
     (exports
      '(("/export"
         "*(ro,insecure,no_subtree_check,crossmnt,fsid=0)"))))
    ```

  `rpcmountd-port` (default: `#f`)
  : The network port that the `rpc.mountd` daemon should use.

  `rpcstatd-port` (default: `#f`)
  : The network port that the `rpc.statd` daemon should use.

  `rpcbind` (default: `rpcbind`)
  : The rpcbind package to use.

`idmap-domain` (default: `"localdomain"`)
The local NFSv4 domain name.

`nfsd-port` (default: `2049`)
The network port that the `nfsd` daemon should use.

`nfsd-threads` (default: `8`)
The number of threads used by the `nfsd` daemon.

`nfsd-tcp?` (default: `#t`)
Whether the `nfsd` daemon should listen on a TCP socket.

`nfsd-udp?` (default: `#f`)
Whether the `nfsd` daemon should listen on a UDP socket.

`pipefs-directory` (default: `"/var/lib/nfs/rpc_pipefs"`)
The directory where the pipefs file system is mounted.

`debug` (default: `'()`")
A list of subsystems for which debugging output should be enabled. This is a list of symbols. Any of these symbols are valid: `nfsd`, `nfs`, `rpc`, `idmap`, `statd`, or `mountd`.

If you don't need a complete NFS service or prefer to build it yourself you can use the individual component services that are documented below.

RPC Bind Service

The RPC Bind service provides a facility to map program numbers into universal addresses. Many NFS related services use this facility. Hence it is automatically started when a dependent service starts.

`rpcbind-service-type` [Variável]
A service type for the RPC portmapper daemon.

`rpcbind-configuration` [Data Type]
Data type representing the configuration of the RPC Bind Service. This type has the following parameters:

`rpcbind` (default: `rpcbind`)
The rpcbind package to use.

`warm-start?` (default: `#t`)
If this parameter is `#t`, then the daemon will read a state file on startup thus reloading state information saved by a previous instance.

Pipefs Pseudo File System

The pipefs file system is used to transfer NFS related data between the kernel and user space programs.

`pipefs-service-type` [Variável]
A service type for the pipefs pseudo file system.

`pipefs-configuration` [Data Type]
Data type representing the configuration of the pipefs pseudo file system service. This type has the following parameters:

`mount-point` (default: `"/var/lib/nfs/rpc_pipefs"`)
The directory to which the file system is to be attached.

GSS Daemon Service

The *global security system* (GSS) daemon provides strong security for RPC based protocols. Before exchanging RPC requests an RPC client must establish a security context. Typically this is done using the Kerberos command `kinit` or automatically at login time using PAM services (veja Seção 11.10.18 [Serviços Kerberos], Página 445).

`gss-service-type` [Variável]
A service type for the Global Security System (GSS) daemon.

`gss-configuration` [Data Type]
Data type representing the configuration of the GSS daemon service. This type has the following parameters:

`nfs-utils` (default: `nfs-utils`)
The package in which the `rpc.gssd` command is to be found.

`pipefs-directory` (default: `"/var/lib/nfs/rpc_pipefs"`)
The directory where the pipefs file system is mounted.

IDMAP Daemon Service

The idmap daemon service provides mapping between user IDs and user names. Typically it is required in order to access file systems mounted via NFSv4.

`idmap-service-type` [Variável]
A service type for the Identity Mapper (IDMAP) daemon.

`idmap-configuration` [Data Type]
Data type representing the configuration of the IDMAP daemon service. This type has the following parameters:

`nfs-utils` (default: `nfs-utils`)
The package in which the `rpc.idmapd` command is to be found.

`pipefs-directory` (default: `"/var/lib/nfs/rpc_pipefs"`)
The directory where the pipefs file system is mounted.

`domain` (default: `#f`)
The local NFSv4 domain name. This must be a string or `#f`. If it is `#f` then the daemon will use the host's fully qualified domain name.

`verbosity` (default: `0`)
The verbosity level of the daemon.

11.10.26 Samba Services

The `(gnu services samba)` module provides service definitions for Samba as well as additional helper services. Currently it provides the following services.

Samba

Samba (`https://www.samba.org`) provides network shares for folders and printers using the SMB/CIFS protocol commonly used on Windows. It can also act as an Active Directory Domain Controller (AD DC) for other hosts in an heterougenious network with different types of Computer systems.

`samba-service-type` [Variável]

The service type to enable the samba services `samba`, `nmbd`, `smbd` and `winbindd`. By default this service type does not run any of the Samba daemons; they must be enabled individually.

Below is a basic example that configures a simple, anonymous (unauthenticated) Samba file share exposing the `/public` directory.

> **Tip:** The `/public` directory and its contents must be world readable/writable, so you'll want to run '`chmod -R 777 /public`' on it.
>
> **Caution:** Such a Samba configuration should only be used in controlled environments, and you should not share any private files using it, as anyone connecting to your network would be able to access them.

```
(service samba-service-type (samba-configuration
                             (enable-smbd? #t)
                             (config-file (plain-file "smb.conf" "\
[global]
map to guest = Bad User
logging = syslog@1

[public]
browsable = yes
path = /public
read only = no
guest ok = yes
guest only = yes\n"))))
```

`samba-service-configuration` [Data Type]

Configuration record for the Samba suite.

`package` (default: `samba`)
: The samba package to use.

`config-file` (default: `#f`)
: The config file to use. To learn about its syntax, run '`man smb.conf`'.

`enable-samba?` (default: `#f`)
: Enable the `samba` daemon.

`enable-smbd?` (default: `#f`)
: Enable the `smbd` daemon.

`enable-nmbd?` (default: `#f`)
: Enable the `nmbd` daemon.

`enable-winbindd?` (default: `#f`)
: Enable the `winbindd` daemon.

Daemon de Descoberta de Serviço da Web

The WSDD (Web Service Discovery daemon) implements the Web Services Dynamic Discovery (`http://docs.oasis-open.org/ws-dd/discovery/1.1/os/wsdd-discovery-1.1-spec-os.html`) protocol that enables host discovery over Multicast DNS, similar to what Avahi does. It is a drop-in replacement for SMB hosts that have had SMBv1 disabled for security reasons.

`wsdd-service-type` [Variável]
Service type for the WSD host daemon. The value for this service type is a `wsdd-configuration` record. The details for the `wsdd-configuration` record type are given below.

`wsdd-configuration` [Data Type]
This data type represents the configuration for the wsdd service.

`package` (default: `wsdd`)
The wsdd package to use.

`ipv4only?` (default: `#f`)
Only listen to IPv4 addresses.

`ipv6only` (default: `#f`)
Only listen to IPv6 addresses. Please note: Activating both options is not possible, since there would be no IP versions to listen to.

`chroot` (default: `#f`)
Chroot into a separate directory to prevent access to other directories. This is to increase security in case there is a vulnerability in `wsdd`.

`hop-limit` (default: `1`)
Limit to the level of hops for multicast packets. The default is *1* which should prevent packets from leaving the local network.

`interface` (default: `'()`)
Limit to the given list of interfaces to listen to. By default wsdd will listen to all interfaces. Except the loopback interface is never used.

`uuid-device` (default: `#f`)
The WSD protocol requires a device to have a UUID. Set this to manually assign the service a UUID.

`domain` (default: `#f`)
Notify this host is a member of an Active Directory.

`host-name` (default: `#f`)
Manually set the hostname rather than letting `wsdd` inherit this host's hostname. Only the host name part of a possible FQDN will be used in the default case.

`preserve-case?` (default: `#f`)
By default `wsdd` will convert the hostname in workgroup to all uppercase. The opposite is true for hostnames in domains. Setting this parameter will preserve case.

`workgroup` (default: "*WORKGROUP*")
: Change the name of the workgroup. By default `wsdd` reports this host being member of a workgroup.

11.10.27 Integração Contínua

Cuirass (`https://guix.gnu.org/cuirass/`) is a continuous integration tool for Guix. It can be used both for development and for providing substitutes to others (veja Seção 5.3 [Substitutos], Página 47).

The `(gnu services cuirass)` module provides the following service.

`cuirass-service-type` [Procedure]
: The type of the Cuirass service. Its value must be a `cuirass-configuration` object, as described below.

To add build jobs, you have to set the `specifications` field of the configuration. For instance, the following example will build all the packages provided by the `my-channel` channel.

```
(define %cuirass-specs
  #~(list (specification
           (name 'my-channel)
           (build '(channels my-channel))
           (channels
            (cons (channel
                   (name 'my-channel)
                   (url "https://my-channel.git"))
                  %default-channels)))))

(service cuirass-service-type
         (cuirass-configuration
          (specifications %cuirass-specs)))
```

To build the `linux-libre` package defined by the default Guix channel, one can use the following configuration.

```
(define %cuirass-specs
  #~(list (specification
           (name 'my-linux)
           (build '(packages "linux-libre")))))

(service cuirass-service-type
         (cuirass-configuration
          (specifications %cuirass-specs)))
```

The other configuration possibilities, as well as the specification record itself are described in the Cuirass manual (veja Seção “Specifications” em *Cuirass*).

While information related to build jobs is located directly in the specifications, global settings for the `cuirass` process are accessible in other `cuirass-configuration` fields.

`cuirass-configuration` [Data Type]

Data type representing the configuration of Cuirass.

`cuirass` (default: `cuirass`)
The Cuirass package to use.

`log-file` (default: `"/var/log/cuirass.log"`)
Location of the log file.

`web-log-file` (default: `"/var/log/cuirass-web.log"`)
Location of the log file used by the web interface.

`cache-directory` (default: `"/var/cache/cuirass"`)
Location of the repository cache.

`user` (default: `"cuirass"`)
Owner of the `cuirass` process.

`group` (default: `"cuirass"`)
Owner's group of the `cuirass` process.

`interval` (default: `60`)
Number of seconds between the poll of the repositories followed by the Cuirass jobs.

`ttl` (default: `2592000`)
Duration to keep build results' GC roots alive, in seconds.

`threads` (default: `#f`)
Number of kernel threads to use for Cuirass. The default value should be appropriate for most cases.

`parameters` (default: `#f`)
Read parameters from the given *parameters* file. The supported parameters are described here (veja Seção "Parameters" em *Cuirass*).

`remote-server` (default: `#f`)
A `cuirass-remote-server-configuration` record to use the build remote mechanism or `#f` to use the default build mechanism.

`database` (default: `"dbname=cuirass host=/var/run/postgresql"`)
Use *database* as the database containing the jobs and the past build results. Since Cuirass uses PostgreSQL as a database engine, *database* must be a string such as `"dbname=cuirass host=localhost"`.

`porta` (default: `8081`)
Port number used by the HTTP server.

`host` (default: `"localhost"`)
Listen on the network interface for *host*. The default is to accept connections from localhost.

`specifications` (default: `#~'()`)
A gexp (veja Seção 8.12 [Expressões-G], Página 163) that evaluates to a list of specifications records. The specification record is described in the Cuirass manual (veja Seção "Specifications" em *Cuirass*).

`one-shot?` (default: `#f`)
: Only evaluate specifications and build derivations once.

`fallback?` (padrão: `#f`)
: When substituting a pre-built binary fails, fall back to building packages locally.

`extra-options` (default: `'()`)
: Extra options to pass when running the `cuirass register` process.

`web-extra-options` (default: `'()`)
: Extra options to pass when running the `cuirass web` process.

Cuirass remote building

Cuirass supports two mechanisms to build derivations.

- Using the local Guix daemon. This is the default build mechanism. Once the build jobs are evaluated, they are sent to the local Guix daemon. Cuirass then listens to the Guix daemon output to detect the various build events.
- Using the remote build mechanism. The build jobs are not submitted to the local Guix daemon. Instead, a remote server dispatches build requests to the connect remote workers, according to the build priorities.

To enable this build mode a `cuirass-remote-server-configuration` record must be passed as `remote-server` argument of the `cuirass-configuration` record. The `cuirass-remote-server-configuration` record is described below.

This build mode scales way better than the default build mode. This is the build mode that is used on the GNU Guix build farm at `https://ci.guix.gnu.org`. It should be preferred when using Cuirass to build large amount of packages.

`cuirass-remote-server-configuration` [Data Type]
: Data type representing the configuration of the Cuirass remote-server.

  `backend-port` (default: `5555`)
  : The TCP port for communicating with `remote-worker` processes using ZMQ. It defaults to `5555`.

  `log-port` (default: `5556`)
  : The TCP port of the log server. It defaults to `5556`.

  `publish-port` (default: `5557`)
  : The TCP port of the publish server. It defaults to `5557`.

  `log-file` (default: `"/var/log/cuirass-remote-server.log"`)
  : Location of the log file.

  `cache` (default: `"/var/cache/cuirass/remote"`)
  : Use *cache* directory to cache build log files.

  `log-expiry` (default: 6 months)
  : The duration in seconds after which build logs collected by `cuirass remote-worker` may be deleted.

`trigger-url` (default: `#f`)
: Once a substitute is successfully fetched, trigger substitute baking at *trigger-url*.

`publish?` (padrão: `#t`)
: If set to false, do not start a publish server and ignore the `publish-port` argument. This can be useful if there is already a standalone publish server standing next to the remote server.

`public-key`
`private-key`
: Use the specific *file*s as the public/private key pair used to sign the store items being published.

At least one remote worker must also be started on any machine of the local network to actually perform the builds and report their status.

`cuirass-remote-worker-configuration` [Data Type]
Data type representing the configuration of the Cuirass remote-worker.

`cuirass` (default: `cuirass`)
: The Cuirass package to use.

`workers` (default: `1`)
: Start *workers* parallel workers.

`server` (default: `#f`)
: Do not use Avahi discovery and connect to the given `server` IP address instead.

`systems` (default: `(list (%current-system))`)
: Only request builds for the given *systems*.

`log-file` (default: `"/var/log/cuirass-remote-worker.log"`)
: Location of the log file.

`publish-port` (default: `5558`)
: The TCP port of the publish server. It defaults to `5558`.

`substitute-urls` (default: `%default-substitute-urls`)
: The list of URLs where to look for substitutes by default.

`public-key`
`private-key`
: Use the specific *file*s as the public/private key pair used to sign the store items being published.

Laminar

Laminar (`https://laminar.ohwg.net/`) is a lightweight and modular Continuous Integration service. It doesn't have a configuration web UI instead uses version-controllable configuration files and scripts.

Laminar encourages the use of existing tools such as bash and cron instead of reinventing them.

`laminar-service-type` [Variável]

The type of the Laminar service. Its value must be a `laminar-configuration` object, as described below.

All configuration values have defaults, a minimal configuration to get Laminar running is shown below. By default, the web interface is available on port 8080.

```
(service laminar-service-type)
```

`laminar-configuration` [Data Type]

Data type representing the configuration of Laminar.

`laminar` (default: `laminar`)
The Laminar package to use.

`home-directory` (default: `"/var/lib/laminar"`)
The directory for job configurations and run directories.

`supplementary-groups` (default: `()`)
Supplementary groups for the Laminar user account.

`bind-http` (default: `"*:8080"`)
The interface/port or unix socket on which laminard should listen for incoming connections to the web frontend.

`bind-rpc` (default: `"unix-abstract:laminar"`)
The interface/port or unix socket on which laminard should listen for incoming commands such as build triggers.

`title` (default: `"Laminar"`)
The page title to show in the web frontend.

`keep-rundirs` (default: `0`)
Set to an integer defining how many rundirs to keep per job. The lowest-numbered ones will be deleted. The default is 0, meaning all run dirs will be immediately deleted.

`archive-url` (default: `#f`)
The web frontend served by laminard will use this URL to form links to artefacts archived jobs.

`base-url` (default: `#f`)
Base URL to use for links to laminar itself.

11.10.28 Serviços de gerenciamento de energia

Power Profiles Daemon

The `(gnu services pm)` module provides a Guix service definition for the Linux Power Profiles Daemon, which makes power profiles handling available over D-Bus.

The available profiles consist of the default '`balanced`' mode, a '`power-saver`' mode and on supported systems a '`performance`' mode.

Importante: The `power-profiles-daemon` conflicts with other power management tools like `tlp`. Using both together is not recommended.

`power-profiles-daemon-service-type` [Variável]

This is the service type for the Power Profiles Daemon (`https://gitlab.freedesktop.org/upower/power-profiles-daemon/`). The value for this service is a `power-profiles-daemon-configuration`.

To enable the Power Profiles Daemon with default configuration add this line to your services:

```
(service power-profiles-daemon-service-type)
```

`power-profiles-daemon-configuration` [Data Type]

Data type representing the configuration of `power-profiles-daemon-service-type`.

`power-profiles-daemon` (default: `power-profiles-daemon`) (type: file-like)
Package object of power-profiles-daemon.

TLP daemon

The `(gnu services pm)` module provides a Guix service definition for the Linux power management tool TLP.

TLP enables various powersaving modes in userspace and kernel. Contrary to `upower-service`, it is not a passive, monitoring tool, as it will apply custom settings each time a new power source is detected. More information can be found at TLP home page (`https://linrunner.de/en/tlp/tlp.html`).

`tlp-service-type` [Variável]

The service type for the TLP tool. The default settings are optimised for battery life on most systems, but you can tweak them to your heart's content by adding a valid `tlp-configuration`:

```
(service tlp-service-type
         (tlp-configuration
          (cpu-scaling-governor-on-ac (list "performance"))
          (sched-powersave-on-bat? #t)))
```

Each parameter definition is preceded by its type; for example, '`boolean foo`' indicates that the `foo` parameter should be specified as a boolean. Types starting with `maybe-` denote parameters that won't show up in TLP config file when their value is left unset, or is explicitly set to the `%unset-value` value.

Available `tlp-configuration` fields are:

`package tlp` [`tlp-configuration` parameter]

The TLP package.

`boolean tlp-enable?` [`tlp-configuration` parameter]

Set to true if you wish to enable TLP.

Defaults to '`#t`'.

`string tlp-default-mode` [`tlp-configuration` parameter]

Default mode when no power supply can be detected. Alternatives are AC and BAT.

Defaults to '`"AC"`'.

`non-negative-integer disk-idle-secs-on-ac` [`tlp-configuration` parameter]
Number of seconds Linux kernel has to wait after the disk goes idle, before syncing on AC.

Defaults to '`0`'.

`non-negative-integer disk-idle-secs-on-bat` [`tlp-configuration` parameter]
Same as `disk-idle-ac` but on BAT mode.

Defaults to '`2`'.

`non-negative-integer max-lost-work-secs-on-ac` [`tlp-configuration` parameter]
Dirty pages flushing periodicity, expressed in seconds.

Defaults to '`15`'.

`non-negative-integer max-lost-work-secs-on-bat` [`tlp-configuration` parameter]
Same as `max-lost-work-secs-on-ac` but on BAT mode.

Defaults to '`60`'.

`maybe-space-separated-string-list cpu-scaling-governor-on-ac` [`tlp-configuration` parameter]
CPU frequency scaling governor on AC mode. With intel_pstate driver, alternatives are powersave and performance. With acpi-cpufreq driver, alternatives are ondemand, powersave, performance and conservative.

Defaults to '`disabled`'.

`maybe-space-separated-string-list cpu-scaling-governor-on-bat` [`tlp-configuration` parameter]
Same as `cpu-scaling-governor-on-ac` but on BAT mode.

Defaults to '`disabled`'.

`maybe-non-negative-integer cpu-scaling-min-freq-on-ac` [`tlp-configuration` parameter]
Set the min available frequency for the scaling governor on AC.

Defaults to '`disabled`'.

`maybe-non-negative-integer cpu-scaling-max-freq-on-ac` [`tlp-configuration` parameter]
Set the max available frequency for the scaling governor on AC.

Defaults to '`disabled`'.

`maybe-non-negative-integer cpu-scaling-min-freq-on-bat` [`tlp-configuration` parameter]
Set the min available frequency for the scaling governor on BAT.

Defaults to '`disabled`'.

`maybe-non-negative-integer` [`tlp-configuration` parameter]
`cpu-scaling-max-freq-on-bat`

Set the max available frequency for the scaling governor on BAT.

Defaults to '`disabled`'.

`maybe-non-negative-integer` [`tlp-configuration` parameter]
`cpu-min-perf-on-ac`

Limit the min P-state to control the power dissipation of the CPU, in AC mode. Values are stated as a percentage of the available performance.

Defaults to '`disabled`'.

`maybe-non-negative-integer` [`tlp-configuration` parameter]
`cpu-max-perf-on-ac`

Limit the max P-state to control the power dissipation of the CPU, in AC mode. Values are stated as a percentage of the available performance.

Defaults to '`disabled`'.

`maybe-non-negative-integer` [`tlp-configuration` parameter]
`cpu-min-perf-on-bat`

Same as `cpu-min-perf-on-ac` on BAT mode.

Defaults to '`disabled`'.

`maybe-non-negative-integer` [`tlp-configuration` parameter]
`cpu-max-perf-on-bat`

Same as `cpu-max-perf-on-ac` on BAT mode.

Defaults to '`disabled`'.

`maybe-boolean cpu-boost-on-ac?` [`tlp-configuration` parameter]

Enable CPU turbo boost feature on AC mode.

Defaults to '`disabled`'.

`maybe-boolean cpu-boost-on-bat?` [`tlp-configuration` parameter]

Same as `cpu-boost-on-ac?` on BAT mode.

Defaults to '`disabled`'.

`boolean sched-powersave-on-ac?` [`tlp-configuration` parameter]

Allow Linux kernel to minimize the number of CPU cores/hyper-threads used under light load conditions.

Defaults to '`#f`'.

`boolean sched-powersave-on-bat?` [`tlp-configuration` parameter]

Same as `sched-powersave-on-ac?` but on BAT mode.

Defaults to '`#t`'.

`boolean nmi-watchdog?` [`tlp-configuration` parameter]

Enable Linux kernel NMI watchdog.

Defaults to '`#f`'.

`maybe-string phc-controls` [`tlp-configuration` parameter]
For Linux kernels with PHC patch applied, change CPU voltages. An example value would be '`"F:V F:V F:V F:V"`'.

Defaults to '`disabled`'.

`string energy-perf-policy-on-ac` [`tlp-configuration` parameter]
Set CPU performance versus energy saving policy on AC. Alternatives are performance, normal, powersave.

Defaults to '`"performance"`'.

`string energy-perf-policy-on-bat` [`tlp-configuration` parameter]
Same as `energy-perf-policy-ac` but on BAT mode.

Defaults to '`"powersave"`'.

`space-separated-string-list disks-devices` [`tlp-configuration` parameter]
Hard disk devices.

`space-separated-string-list disk-apm-level-on-ac` [`tlp-configuration` parameter]
Hard disk advanced power management level.

`space-separated-string-list disk-apm-level-on-bat` [`tlp-configuration` parameter]
Same as `disk-apm-bat` but on BAT mode.

`maybe-space-separated-string-list disk-spindown-timeout-on-ac` [`tlp-configuration` parameter]
Hard disk spin down timeout. One value has to be specified for each declared hard disk.

Defaults to '`disabled`'.

`maybe-space-separated-string-list disk-spindown-timeout-on-bat` [`tlp-configuration` parameter]
Same as `disk-spindown-timeout-on-ac` but on BAT mode.

Defaults to '`disabled`'.

`maybe-space-separated-string-list disk-iosched` [`tlp-configuration` parameter]
Select IO scheduler for disk devices. One value has to be specified for each declared hard disk. Example alternatives are cfq, deadline and noop.

Defaults to '`disabled`'.

`string sata-linkpwr-on-ac` [`tlp-configuration` parameter]
SATA aggressive link power management (ALPM) level. Alternatives are min_power, medium_power, max_performance.

Defaults to '`"max_performance"`'.

`string sata-linkpwr-on-bat` [`tlp-configuration` parameter]
Same as `sata-linkpwr-ac` but on BAT mode.

Defaults to '`"min_power"`'.

`maybe-string sata-linkpwr-blacklist` [`tlp-configuration` parameter]
Exclude specified SATA host devices for link power management.

Defaults to '`disabled`'.

`maybe-on-off-boolean ahci-runtime-pm-on-ac?` [`tlp-configuration` parameter]
Enable Runtime Power Management for AHCI controller and disks on AC mode.

Defaults to '`disabled`'.

`maybe-on-off-boolean ahci-runtime-pm-on-bat?` [`tlp-configuration` parameter]
Same as `ahci-runtime-pm-on-ac` on BAT mode.

Defaults to '`disabled`'.

`non-negative-integer ahci-runtime-pm-timeout` [`tlp-configuration` parameter]
Seconds of inactivity before disk is suspended.

Defaults to '`15`'.

`string pcie-aspm-on-ac` [`tlp-configuration` parameter]
PCI Express Active State Power Management level. Alternatives are default, performance, powersave.

Defaults to '`"performance"`'.

`string pcie-aspm-on-bat` [`tlp-configuration` parameter]
Same as `pcie-aspm-ac` but on BAT mode.

Defaults to '`"powersave"`'.

`maybe-non-negative-integer start-charge-thresh-bat0` [`tlp-configuration` parameter]
Percentage when battery 0 should begin charging. Only supported on some laptops.

Defaults to '`disabled`'.

`maybe-non-negative-integer stop-charge-thresh-bat0` [`tlp-configuration` parameter]
Percentage when battery 0 should stop charging. Only supported on some laptops.

Defaults to '`disabled`'.

`maybe-non-negative-integer start-charge-thresh-bat1` [`tlp-configuration` parameter]
Percentage when battery 1 should begin charging. Only supported on some laptops.

Defaults to '`disabled`'.

`maybe-non-negative-integer stop-charge-thresh-bat1` [`tlp-configuration` parameter]
Percentage when battery 1 should stop charging. Only supported on some laptops.

Defaults to '`disabled`'.

`string radeon-power-profile-on-ac` [`tlp-configuration` parameter]
Radeon graphics clock speed level. Alternatives are low, mid, high, auto, default.

Defaults to '`"high"`'.

`string radeon-power-profile-on-bat` [`tlp-configuration` parameter]
Same as `radeon-power-ac` but on BAT mode.

Defaults to '`"low"`'.

`string radeon-dpm-state-on-ac` [`tlp-configuration` parameter]
Radeon dynamic power management method (DPM). Alternatives are battery, performance.

Defaults to '`"performance"`'.

`string radeon-dpm-state-on-bat` [`tlp-configuration` parameter]
Same as `radeon-dpm-state-ac` but on BAT mode.

Defaults to '`"battery"`'.

`string radeon-dpm-perf-level-on-ac` [`tlp-configuration` parameter]
Radeon DPM performance level. Alternatives are auto, low, high.

Defaults to '`"auto"`'.

`string radeon-dpm-perf-level-on-bat` [`tlp-configuration` parameter]
Same as `radeon-dpm-perf-ac` but on BAT mode.

Defaults to '`"auto"`'.

`on-off-boolean wifi-pwr-on-ac?` [`tlp-configuration` parameter]
Wifi power saving mode.

Defaults to '`#f`'.

`on-off-boolean wifi-pwr-on-bat?` [`tlp-configuration` parameter]
Same as `wifi-power-ac?` but on BAT mode.

Defaults to '`#t`'.

`y-n-boolean wol-disable?` [`tlp-configuration` parameter]
Disable wake on LAN.

Defaults to '`#t`'.

`non-negative-integer sound-power-save-on-ac` [`tlp-configuration` parameter]
Timeout duration in seconds before activating audio power saving on Intel HDA and AC97 devices. A value of 0 disables power saving.

Defaults to '`0`'.

`non-negative-integer sound-power-save-on-bat` [`tlp-configuration` parameter]
Same as `sound-powersave-ac` but on BAT mode.

Defaults to '`1`'.

`y-n-boolean sound-power-save-controller?` [`tlp-configuration` parameter]
Disable controller in powersaving mode on Intel HDA devices.

Defaults to '`#t`'.

`boolean bay-poweroff-on-bat?` [`tlp-configuration` parameter]
Enable optical drive in UltraBay/MediaBay on BAT mode. Drive can be powered on again by releasing (and reinserting) the eject lever or by pressing the disc eject button on newer models.

Defaults to '`#f`'.

`string bay-device` [`tlp-configuration` parameter]
Name of the optical drive device to power off.

Defaults to '`"sr0"`'.

`string runtime-pm-on-ac` [`tlp-configuration` parameter]
Runtime Power Management for PCI(e) bus devices. Alternatives are on and auto.

Defaults to '`"on"`'.

`string runtime-pm-on-bat` [`tlp-configuration` parameter]
Same as `runtime-pm-ac` but on BAT mode.

Defaults to '`"auto"`'.

`boolean runtime-pm-all?` [`tlp-configuration` parameter]
Runtime Power Management for all PCI(e) bus devices, except blacklisted ones.

Defaults to '`#t`'.

`maybe-space-separated-string-list` [`tlp-configuration` parameter]
`runtime-pm-blacklist`
Exclude specified PCI(e) device addresses from Runtime Power Management.

Defaults to '`disabled`'.

`space-separated-string-list` [`tlp-configuration` parameter]
`runtime-pm-driver-blacklist`
Exclude PCI(e) devices assigned to the specified drivers from Runtime Power Management.

`boolean usb-autosuspend?` [`tlp-configuration` parameter]
Enable USB autosuspend feature.

Defaults to '`#t`'.

`maybe-string usb-blacklist` [`tlp-configuration` parameter]
Exclude specified devices from USB autosuspend.

Defaults to '`disabled`'.

`boolean usb-blacklist-wwan?` [`tlp-configuration` parameter]
Exclude WWAN devices from USB autosuspend.

Defaults to '`#t`'.

`maybe-string usb-whitelist` [`tlp-configuration` parameter]
Include specified devices into USB autosuspend, even if they are already excluded by the driver or via `usb-blacklist-wwan?`.

Defaults to '`disabled`'.

`maybe-boolean usb-autosuspend-disable-on-shutdown?` [`tlp-configuration` parameter]
Enable USB autosuspend before shutdown.

Defaults to '`disabled`'.

`boolean restore-device-state-on-startup?` [`tlp-configuration` parameter]
Restore radio device state (bluetooth, wifi, wwan) from previous shutdown on system startup.

Defaults to '`#f`'.

Thermald daemon

The `(gnu services pm)` module provides an interface to thermald, a CPU frequency scaling service which helps prevent overheating.

`thermald-service-type` [Variável]
This is the service type for thermald (`https://01.org/linux-thermal-daemon/`), the Linux Thermal Daemon, which is responsible for controlling the thermal state of processors and preventing overheating.

`thermald-configuration` [Data Type]
Data type representing the configuration of `thermald-service-type`.

`adaptive?` (default: `#f`)
Use DPTF (Dynamic Power and Thermal Framework) adaptive tables when present.

`ignore-cpuid-check?` (default: `#f`)
Ignore cpuid check for supported CPU models.

`thermald` (default: *thermald*)
Package object of thermald.

11.10.29 Serviços de áudio

The `(gnu services audio)` module provides a service to start MPD (the Music Player Daemon).

Daemon do reprodutor de música

The Music Player Daemon (MPD) is a service that can play music while being controlled from the local machine or over the network by a variety of clients.

The following example shows the simplest configuration to locally expose, via PulseAudio, a music collection kept at `/srv/music`, with `mpd` running as the default '`mpd`' user. This user will spawn its own PulseAudio daemon, which may compete for the sound card access

with that of your own user. In this configuration, you may have to stop the playback of your user audio applications to hear MPD's output and vice-versa.

```
(service mpd-service-type
         (mpd-configuration
          (music-directory "/srv/music")))
```

Importante: The music directory must be readable to the MPD user, by default, 'mpd'. Permission problems will be reported via 'Permission denied' errors in the MPD logs, which appear in /var/log/messages by default.

Most MPD clients will trigger a database update upon connecting, but you can also use the update action do to so:

```
herd update mpd
```

All the MPD configuration fields are documented below, and a more complex example follows.

mpd-service-type [Variável]

The service type for mpd

mpd-configuration [Data Type]

Available mpd-configuration fields are:

package (default: mpd) (type: file-like)
: The MPD package.

user (type: user-account)
: The user to run mpd as.

group (type: user-group)
: The group to run mpd as.

  The default %mpd-group is a system group with name "mpd".

shepherd-requirement (default: '()) (type: list-of-symbols)
: A list of symbols naming Shepherd services that this service will depend on.

environment-variables (default: '("PULSE_CLIENTCONFIG=/etc/pulse/client.conf" "PULSE_CONFIG=/etc/pulse/daemon.conf")) (type: list-of-strings)
: A list of strings specifying environment variables.

log-file (type: maybe-string)
: The location of the log file. Unless specified, logs are sent to the local syslog daemon. Alternatively, a log file name can be specified, for example /var/log/mpd.log.

log-level (type: maybe-string)
: Supress any messages below this threshold. The available values, in decreasing order of verbosity, are: verbose, info, notice, warning and error.

music-directory (type: maybe-string)
: The directory to scan for music files.

`music-dir` (type: maybe-string)
The directory to scan for music files.

`playlist-directory` (type: maybe-string)
The directory to store playlists.

`playlist-dir` (type: maybe-string)
The directory to store playlists.

`db-file` (type: maybe-string)
The location of the music database. When left unspecified, `~/.cache/db` is used.

`state-file` (type: maybe-string)
The location of the file that stores current MPD's state.

`sticker-file` (type: maybe-string)
The location of the sticker database.

`default-port` (default: `6600`) (type: maybe-port)
The default port to run mpd on.

`endpoints` (type: maybe-list-of-strings)
The addresses that mpd will bind to. A port different from *default-port* may be specified, e.g. `localhost:6602` and IPv6 addresses must be enclosed in square brackets when a different port is used. To use a Unix domain socket, an absolute path or a path starting with `~` can be specified here.

`address` (type: maybe-string)
The address that mpd will bind to. To use a Unix domain socket, an absolute path can be specified here.

`database` (type: maybe-mpd-plugin)
MPD database plugin configuration.

`partitions` (default: `'()`) (type: list-of-mpd-partition)
List of MPD "partitions".

`neighbors` (default: `'()`) (type: list-of-mpd-plugin)
List of MPD neighbor plugin configurations.

`inputs` (default: `'()`) (type: list-of-mpd-plugin)
List of MPD input plugin configurations.

`archive-plugins` (default: `'()`) (type: list-of-mpd-plugin)
List of MPD archive plugin configurations.

`auto-update?` (type: maybe-boolean)
Whether to automatically update the music database when files are changed in the *music-directory*.

`input-cache-size` (type: maybe-string)
MPD input cache size.

`decoders` (default: `'()`) (type: list-of-mpd-plugin)
List of MPD decoder plugin configurations.

`resampler` (type: maybe-mpd-plugin)
: MPD resampler plugin configuration.

`filters` (default: `'()`) (type: list-of-mpd-plugin)
: List of MPD filter plugin configurations.

`outputs` (type: list-of-mpd-plugin-or-output)
: The audio outputs that MPD can use. By default this is a single output using pulseaudio.

`playlist-plugins` (default: `'()`) (type: list-of-mpd-plugin)
: List of MPD playlist plugin configurations.

`extra-options` (default: `'()`) (type: alist)
: An association list of option symbols/strings to string values to be appended to the configuration.

`mpd-plugin` [Data Type]

Data type representing a `mpd` plugin.

`plugin` (type: maybe-string)
: Plugin name.

`name` (type: maybe-string)
: Name.

`enabled?` (type: maybe-boolean)
: Whether the plugin is enabled/disabled.

`extra-options` (default: `'()`) (type: alist)
: An association list of option symbols/strings to string values to be appended to the plugin configuration. See MPD plugin reference (`https://mpd.readthedocs.io/en/latest/plugins.html`) for available options.

`mpd-partition` [Data Type]

Data type representing a `mpd` partition.

`name` (type: string)
: Partition name.

`extra-options` (default: `'()`) (type: alist)
: An association list of option symbols/strings to string values to be appended to the partition configuration. See Configuring Partitions (`https://mpd.readthedocs.io/en/latest/user.html#configuring-partitions`) for available options.

`mpd-output` [Data Type]

Available `mpd-output` fields are:

`name` (default: `"MPD"`) (type: string)
: The name of the audio output.

`type` (default: `"pulse"`) (type: string)
: The type of audio output.

`enabled?` (default: `#t`) (type: boolean)
: Specifies whether this audio output is enabled when MPD is started. By default, all audio outputs are enabled. This is just the default setting when there is no state file; with a state file, the previous state is restored.

`format` (type: maybe-string)
: Force a specific audio format on output. See Global Audio Format (`https://mpd.readthedocs.io/en/latest/user.html#audio-output-format`) for a more detailed description.

`tags?` (default: `#t`) (type: boolean)
: If set to `#f`, then MPD will not send tags to this output. This is only useful for output plugins that can receive tags, for example the `httpd` output plugin.

`always-on?` (default: `#f`) (type: boolean)
: If set to `#t`, then MPD attempts to keep this audio output always open. This may be useful for streaming servers, when you don't want to disconnect all listeners even when playback is accidentally stopped.

`mixer-type` (type: maybe-string)
: This field accepts a string that specifies which mixer should be used for this audio output: the `hardware` mixer, the `software` mixer, the `null` mixer (allows setting the volume, but with no effect; this can be used as a trick to implement an external mixer External Mixer) or no mixer (`none`). When left unspecified, a `hardware` mixer is used for devices that support it.

`replay-gain-handler` (type: maybe-string)
: This field accepts a string that specifies how Replay Gain (`https://mpd.readthedocs.io/en/latest/user.html#replay-gain`) is to be applied. `software` uses an internal software volume control, `mixer` uses the configured (hardware) mixer control and `none` disables replay gain on this audio output.

`extra-options` (default: `'()`) (type: alist)
: An association list of option symbols/strings to string values to be appended to the audio output configuration.

The following example shows a configuration of `mpd` that configures some of its plugins and provides a HTTP audio streaming output.

```
(service mpd-service-type
         (mpd-configuration
           (outputs
             (list (mpd-output
                     (name "streaming")
                     (type "httpd")
                     (mixer-type 'null)
                     (extra-options
                      `((encoder . "vorbis")
```

```
                (port    . "8080"))))))
          (decoders
            (list (mpd-plugin
                    (plugin "mikmod")
                    (enabled? #f))
                  (mpd-plugin
                    (plugin "openmpt")
                    (enabled? #t)
                    (extra-options `((repeat-count . -1)
                                     (interpolation-filter . 1))))))
          (resampler (mpd-plugin
                       (plugin "libsamplerate")
                       (extra-options `((type . 0)))))))
```

myMPD

myMPD (`https://jcorporation.github.io/myMPD/`) is a web server frontend for MPD that provides a mobile friendly web client for MPD.

The following example shows a myMPD instance listening on port 80, with album cover caching disabled.

```
(service mympd-service-type
         (mympd-configuration
          (port 80)
          (covercache-ttl 0)))
```

`mympd-service-type` [Variável]

The service type for `mympd`.

`mympd-configuration` [Data Type]

Available `mympd-configuration` fields are:

`package` (default: `mympd`) (type: file-like)
: The package object of the myMPD server.

`shepherd-requirement` (default: `'()`) (type: list-of-symbols)
: This is a list of symbols naming Shepherd services that this service will depend on.

`user` (default: `%mympd-user`) (type: user-account)
: Owner of the `mympd` process.

  The default `%mympd-user` is a system user with the name “mympd”, who is a part of the group *group* (see below).

`group` (default: `%mympd-group`) (type: user-group)
: Owner group of the `mympd` process.

  The default `%mympd-group` is a system group with name “mympd”.

`work-directory` (default: `"/var/lib/mympd"`) (type: string)
: Where myMPD will store its data.

`cache-directory` (default: `"/var/cache/mympd"`) (type: string)
Where myMPD will store its cache.

`acl` (type: maybe-mympd-ip-acl)
ACL to access the myMPD webserver.

`covercache-ttl` (default: `31`) (type: maybe-integer)
How long to keep cached covers, `0` disables cover caching.

`http?` (default: `#t`) (type: boolean)
HTTP support.

`host` (default: `"[::]"`) (type: string)
Host name to listen on.

`port` (default: `80`) (type: maybe-port)
HTTP port to listen on.

`log-level` (default: `5`) (type: integer)
How much detail to include in logs, possible values: `0` to `7`.

`log-to` (type: maybe-string)
Where to send logs. Unless specified, the service logs to the local syslog service under the '`daemon`' facility. Alternatively, a log file name can be specified, for example `/var/log/mympd.log`.

`lualibs` (default: `"all"`) (type: maybe-string)
See `https://jcorporation.github.io/myMPD/scripting/#lua-standard-libraries`.

`uri` (type: maybe-string)
Override URI to myMPD. See `https://github.com/jcorporation/myMPD/issues/950`.

`script-acl` (default: `(mympd-ip-acl (allow '("127.0.0.1")))`) (type: maybe-mympd-ip-acl)
ACL to access the myMPD script backend.

`ssl?` (default: `#f`) (type: boolean)
SSL/TLS support.

`ssl-port` (default: `443`) (type: maybe-port)
Port to listen for HTTPS.

`ssl-cert` (type: maybe-string)
Path to PEM encoded X.509 SSL/TLS certificate (public key).

`ssl-key` (type: maybe-string)
Path to PEM encoded SSL/TLS private key.

`pin-hash` (type: maybe-string)
SHA-256 hashed pin used by myMPD to control settings access by prompting a pin from the user.

`save-caches?` (type: maybe-boolean)
Whether to preserve caches between service restarts.

`mympd-ip-acl` [Data Type]

Available `mympd-ip-acl` fields are:

`allow` (default: `'()`) (type: list-of-strings)
Allowed IP addresses.

`deny` (default: `'()`) (type: list-of-strings)
Disallowed IP addresses.

11.10.30 Serviços de virtualização

The `(gnu services virtualization)` module provides services for the libvirt and virtlog daemons, as well as other virtualization-related services.

Libvirt daemon

`libvirtd` is the server side daemon component of the libvirt virtualization management system. This daemon runs on host servers and performs required management tasks for virtualized guests. To connect to the libvirt daemon as an unprivileged user, it must be added to the '`libvirt`' group, as shown in the example below.

`libvirt-service-type` [Variável]

This is the type of the libvirt daemon (`https://libvirt.org`). Its value must be a `libvirt-configuration`.

```
(users (cons (user-account
              (name "user")
              (group "users")
              (supplementary-groups '("libvirt"
                                      "audio" "video" "wheel")))
             %base-user-accounts))
(service libvirt-service-type
         (libvirt-configuration
          (tls-port "16555")))
```

Available `libvirt-configuration` fields are:

`package libvirt` [`libvirt-configuration` parameter]

Libvirt package.

`boolean listen-tls?` [`libvirt-configuration` parameter]

Flag listening for secure TLS connections on the public TCP/IP port. You must set `listen` for this to have any effect.

It is necessary to setup a CA and issue server certificates before using this capability.

Defaults to '`#t`'.

`boolean listen-tcp?` [`libvirt-configuration` parameter]

Listen for unencrypted TCP connections on the public TCP/IP port. You must set `listen` for this to have any effect.

Using the TCP socket requires SASL authentication by default. Only SASL mechanisms which support data encryption are allowed. This is DIGEST_MD5 and GSSAPI (Kerberos5).

Defaults to '`#f`'.

`string tls-port` [`libvirt-configuration` parameter]
Port for accepting secure TLS connections. This can be a port number, or service name.

Defaults to ‘`"16514"`’.

`string tcp-port` [`libvirt-configuration` parameter]
Port for accepting insecure TCP connections. This can be a port number, or service name.

Defaults to ‘`"16509"`’.

`string listen-addr` [`libvirt-configuration` parameter]
IP address or hostname used for client connections.

Defaults to ‘`"0.0.0.0"`’.

`boolean mdns-adv?` [`libvirt-configuration` parameter]
Flag toggling mDNS advertisement of the libvirt service.

Alternatively can disable for all services on a host by stopping the Avahi daemon.

Defaults to ‘`#f`’.

`string mdns-name` [`libvirt-configuration` parameter]
Default mDNS advertisement name. This must be unique on the immediate broadcast network.

Defaults to ‘`"Virtualization Host <hostname>"`’.

`string unix-sock-group` [`libvirt-configuration` parameter]
UNIX domain socket group ownership. This can be used to allow a 'trusted' set of users access to management capabilities without becoming root.

Defaults to ‘`"libvirt"`’.

`string unix-sock-ro-perms` [`libvirt-configuration` parameter]
UNIX socket permissions for the R/O socket. This is used for monitoring VM status only.

Defaults to ‘`"0777"`’.

`string unix-sock-rw-perms` [`libvirt-configuration` parameter]
UNIX socket permissions for the R/W socket. Default allows only root. If PolicyKit is enabled on the socket, the default will change to allow everyone (eg, 0777)

Defaults to ‘`"0770"`’.

`string unix-sock-admin-perms` [`libvirt-configuration` parameter]
UNIX socket permissions for the admin socket. Default allows only owner (root), do not change it unless you are sure to whom you are exposing the access to.

Defaults to ‘`"0777"`’.

`string unix-sock-dir` [`libvirt-configuration` parameter]
The directory in which sockets will be found/created.

Defaults to ‘`"/var/run/libvirt"`’.

`string auth-unix-ro` [`libvirt-configuration` parameter]
Authentication scheme for UNIX read-only sockets. By default socket permissions allow anyone to connect

Defaults to ‘`"polkit"`’.

`string auth-unix-rw` [`libvirt-configuration` parameter]
Authentication scheme for UNIX read-write sockets. By default socket permissions only allow root. If PolicyKit support was compiled into libvirt, the default will be to use 'polkit' auth.

Defaults to ‘`"polkit"`’.

`string auth-tcp` [`libvirt-configuration` parameter]
Authentication scheme for TCP sockets. If you don't enable SASL, then all TCP traffic is cleartext. Don't do this outside of a dev/test scenario.

Defaults to ‘`"sasl"`’.

`string auth-tls` [`libvirt-configuration` parameter]
Authentication scheme for TLS sockets. TLS sockets already have encryption provided by the TLS layer, and limited authentication is done by certificates.

It is possible to make use of any SASL authentication mechanism as well, by using 'sasl' for this option

Defaults to ‘`"none"`’.

`optional-list access-drivers` [`libvirt-configuration` parameter]
API access control scheme.

By default an authenticated user is allowed access to all APIs. Access drivers can place restrictions on this.

Defaults to ‘`'()`’.

`string key-file` [`libvirt-configuration` parameter]
Server key file path. If set to an empty string, then no private key is loaded.

Defaults to ‘`""`’.

`string cert-file` [`libvirt-configuration` parameter]
Server key file path. If set to an empty string, then no certificate is loaded.

Defaults to ‘`""`’.

`string ca-file` [`libvirt-configuration` parameter]
Server key file path. If set to an empty string, then no CA certificate is loaded.

Defaults to ‘`""`’.

`string crl-file` [`libvirt-configuration` parameter]
Certificate revocation list path. If set to an empty string, then no CRL is loaded.

Defaults to ‘`""`’.

`boolean tls-no-sanity-cert` [`libvirt-configuration` parameter]
Disable verification of our own server certificates.

When libvirtd starts it performs some sanity checks against its own certificates.

Defaults to ‘`#f`’.

`boolean tls-no-verify-cert` [`libvirt-configuration` parameter]
Disable verification of client certificates.

Client certificate verification is the primary authentication mechanism. Any client which does not present a certificate signed by the CA will be rejected.

Defaults to '`#f`'.

`optional-list tls-allowed-dn-list` [`libvirt-configuration` parameter]
Whitelist of allowed x509 Distinguished Name.

Defaults to '`'()`'.

`optional-list sasl-allowed-usernames` [`libvirt-configuration` parameter]
Whitelist of allowed SASL usernames. The format for username depends on the SASL authentication mechanism.

Defaults to '`'()`'.

`string tls-priority` [`libvirt-configuration` parameter]
Override the compile time default TLS priority string. The default is usually '`"NORMAL"`' unless overridden at build time. Only set this is it is desired for libvirt to deviate from the global default settings.

Defaults to '`"NORMAL"`'.

`integer max-clients` [`libvirt-configuration` parameter]
Maximum number of concurrent client connections to allow over all sockets combined.

Defaults to '`5000`'.

`integer max-queued-clients` [`libvirt-configuration` parameter]
Maximum length of queue of connections waiting to be accepted by the daemon. Note, that some protocols supporting retransmission may obey this so that a later reattempt at connection succeeds.

Defaults to '`1000`'.

`integer max-anonymous-clients` [`libvirt-configuration` parameter]
Maximum length of queue of accepted but not yet authenticated clients. Set this to zero to turn this feature off

Defaults to '`20`'.

`integer min-workers` [`libvirt-configuration` parameter]
Number of workers to start up initially.

Defaults to '`5`'.

`integer max-workers` [`libvirt-configuration` parameter]
Maximum number of worker threads.

If the number of active clients exceeds `min-workers`, then more threads are spawned, up to max_workers limit. Typically you'd want max_workers to equal maximum number of clients allowed.

Defaults to '`20`'.

`integer prio-workers` [`libvirt-configuration` parameter]
Number of priority workers. If all workers from above pool are stuck, some calls marked as high priority (notably domainDestroy) can be executed in this pool.

Defaults to '`5`'.

`integer max-requests` [`libvirt-configuration` parameter]
Total global limit on concurrent RPC calls.

Defaults to '`20`'.

`integer max-client-requests` [`libvirt-configuration` parameter]
Limit on concurrent requests from a single client connection. To avoid one client monopolizing the server this should be a small fraction of the global max_requests and max_workers parameter.

Defaults to '`5`'.

`integer admin-min-workers` [`libvirt-configuration` parameter]
Same as `min-workers` but for the admin interface.

Defaults to '`1`'.

`integer admin-max-workers` [`libvirt-configuration` parameter]
Same as `max-workers` but for the admin interface.

Defaults to '`5`'.

`integer admin-max-clients` [`libvirt-configuration` parameter]
Same as `max-clients` but for the admin interface.

Defaults to '`5`'.

`integer admin-max-queued-clients` [`libvirt-configuration` parameter]
Same as `max-queued-clients` but for the admin interface.

Defaults to '`5`'.

`integer admin-max-client-requests` [`libvirt-configuration` parameter]
Same as `max-client-requests` but for the admin interface.

Defaults to '`5`'.

`integer log-level` [`libvirt-configuration` parameter]
Logging level. 4 errors, 3 warnings, 2 information, 1 debug.

Defaults to '`3`'.

`string log-filters` [`libvirt-configuration` parameter]
Logging filters.

A filter allows to select a different logging level for a given category of logs. The format for a filter is one of:

- x:name
- x:+name

where `name` is a string which is matched against the category given in the `VIR_LOG_INIT()` at the top of each libvirt source file, e.g., '`"remote"`', '`"qemu"`', or '`"util.json"`' (the name in the filter can be a substring of the full category name, in order to match multiple similar categories), the optional '`"+"`' prefix tells libvirt to log stack trace for each message matching name, and `x` is the minimal level where matching messages should be logged:

- 1: DEBUG
- 2: INFO
- 3: WARNING
- 4: ERROR

Multiple filters can be defined in a single filters statement, they just need to be separated by spaces.

Defaults to '`"3:remote 4:event"`'.

`string log-outputs` [`libvirt-configuration` parameter]

Logging outputs.

An output is one of the places to save logging information. The format for an output can be:

`x:stderr` output goes to stderr

`x:syslog:name`
: use syslog for the output and use the given name as the ident

`x:file:file_path`
: saída para um arquivo, com o caminho de arquivo dado

`x:journald`
: output to journald logging system

In all case the x prefix is the minimal level, acting as a filter

- 1: DEBUG
- 2: INFO
- 3: WARNING
- 4: ERROR

Multiple outputs can be defined, they just need to be separated by spaces.

Defaults to '`"3:stderr"`'.

`integer audit-level` [`libvirt-configuration` parameter]

Allows usage of the auditing subsystem to be altered

- 0: disable all auditing
- 1: enable auditing, only if enabled on host
- 2: enable auditing, and exit if disabled on host.

Defaults to '`1`'.

`boolean audit-logging` [`libvirt-configuration` parameter]
Send audit messages via libvirt logging infrastructure.

Defaults to '`#f`'.

`optional-string host-uuid` [`libvirt-configuration` parameter]
Host UUID. UUID must not have all digits be the same.

Defaults to '`""`'.

`string host-uuid-source` [`libvirt-configuration` parameter]
Source to read host UUID.

- `smbios`: fetch the UUID from `dmidecode -s system-uuid`
- `machine-id`: fetch the UUID from `/etc/machine-id`

If `dmidecode` does not provide a valid UUID a temporary UUID will be generated.

Defaults to '`"smbios"`'.

`integer keepalive-interval` [`libvirt-configuration` parameter]
A keepalive message is sent to a client after `keepalive_interval` seconds of inactivity to check if the client is still responding. If set to -1, libvirtd will never send keepalive requests; however clients can still send them and the daemon will send responses.

Defaults to '`5`'.

`integer keepalive-count` [`libvirt-configuration` parameter]
Maximum number of keepalive messages that are allowed to be sent to the client without getting any response before the connection is considered broken.

In other words, the connection is automatically closed approximately after `keepalive_interval * (keepalive_count + 1)` seconds since the last message received from the client. When `keepalive-count` is set to 0, connections will be automatically closed after `keepalive-interval` seconds of inactivity without sending any keepalive messages.

Defaults to '`5`'.

`integer admin-keepalive-interval` [`libvirt-configuration` parameter]
Same as above but for admin interface.

Defaults to '`5`'.

`integer admin-keepalive-count` [`libvirt-configuration` parameter]
Same as above but for admin interface.

Defaults to '`5`'.

`integer ovs-timeout` [`libvirt-configuration` parameter]
Timeout for Open vSwitch calls.

The `ovs-vsctl` utility is used for the configuration and its timeout option is set by default to 5 seconds to avoid potential infinite waits blocking libvirt.

Defaults to '`5`'.

Virtlog daemon

The virtlogd service is a server side daemon component of libvirt that is used to manage logs from virtual machine consoles.

This daemon is not used directly by libvirt client applications, rather it is called on their behalf by `libvirtd`. By maintaining the logs in a standalone daemon, the main `libvirtd` daemon can be restarted without risk of losing logs. The `virtlogd` daemon has the ability to re-exec() itself upon receiving `SIGUSR1`, to allow live upgrades without downtime.

`virtlog-service-type` [Variável]
This is the type of the virtlog daemon. Its value must be a `virtlog-configuration`.

```
(service virtlog-service-type
         (virtlog-configuration
          (max-clients 1000)))
```

`package libvirt` [`libvirt` parameter]
Libvirt package.

`integer log-level` [`virtlog-configuration` parameter]
Logging level. 4 errors, 3 warnings, 2 information, 1 debug.

Defaults to '`3`'.

`string log-filters` [`virtlog-configuration` parameter]
Logging filters.

A filter allows to select a different logging level for a given category of logs The format for a filter is one of:

- x:name
- x:+name

where `name` is a string which is matched against the category given in the `VIR_LOG_INIT()` at the top of each libvirt source file, e.g., "remote", "qemu", or "util.json" (the name in the filter can be a substring of the full category name, in order to match multiple similar categories), the optional `"+"` prefix tells libvirt to log stack trace for each message matching name, and `x` is the minimal level where matching messages should be logged:

- 1: DEBUG
- 2: INFO
- 3: WARNING
- 4: ERROR

Multiple filters can be defined in a single filters statement, they just need to be separated by spaces.

Defaults to '`"3:remote 4:event"`'.

`string log-outputs` [`virtlog-configuration` parameter]
Logging outputs.

An output is one of the places to save logging information The format for an output can be:

`x:stderr` output goes to stderr

`x:syslog:name`
: use syslog for the output and use the given name as the ident

`x:file:file_path`
: saída para um arquivo, com o caminho de arquivo dado

`x:journald`
: output to journald logging system

In all case the x prefix is the minimal level, acting as a filter

- 1: DEBUG
- 2: INFO
- 3: WARNING
- 4: ERROR

Multiple outputs can be defined, they just need to be separated by spaces.

Defaults to '`"3:stderr"`'.

`integer max-clients` [`virtlog-configuration` parameter]
: Maximum number of concurrent client connections to allow over all sockets combined.

  Defaults to '`1024`'.

`integer max-size` [`virtlog-configuration` parameter]
: Maximum file size before rolling over.

  Defaults to '`2MB`'

`integer max-backups` [`virtlog-configuration` parameter]
: Maximum number of backup files to keep.

  Defaults to '`3`'

Transparent Emulation with QEMU

`qemu-binfmt-service-type` provides support for transparent emulation of program binaries built for different architectures—e.g., it allows you to transparently execute an ARMv7 program on an x86_64 machine. It achieves this by combining the QEMU (`https://www.qemu.org`) emulator and the `binfmt_misc` feature of the kernel Linux. This feature only allows you to emulate GNU/Linux on a different architecture, but see below for GNU/Hurd support.

`qemu-binfmt-service-type` [Variável]
: This is the type of the QEMU/binfmt service for transparent emulation. Its value must be a `qemu-binfmt-configuration` object, which specifies the QEMU package to use as well as the architecture we want to emulated:

```
(service qemu-binfmt-service-type
         (qemu-binfmt-configuration
           (platforms (lookup-qemu-platforms "arm" "aarch64"))))
```

  In this example, we enable transparent emulation for the ARM and aarch64 platforms. Running `herd stop qemu-binfmt` turns it off, and running `herd start qemu-binfmt` turns it back on (veja Seção "Invoking herd" em *The GNU Shepherd Manual*).

`qemu-binfmt-configuration` [Data Type]

This is the configuration for the `qemu-binfmt` service.

`platforms` (default: `'()`)

The list of emulated QEMU platforms. Each item must be a *platform object* as returned by `lookup-qemu-platforms` (see below).

For example, let's suppose you're on an x86_64 machine and you have this service:

```
(service qemu-binfmt-service-type
         (qemu-binfmt-configuration
           (platforms (lookup-qemu-platforms "arm"))))
```

You can run:

```
guix build -s armhf-linux inkscape
```

and it will build Inkscape for ARMv7 *as if it were a native build*, transparently using QEMU to emulate the ARMv7 CPU. Pretty handy if you'd like to test a package build for an architecture you don't have access to!

`qemu` (default: `qemu`)

The QEMU package to use.

`lookup-qemu-platforms` *platforms...* [Procedure]

Return the list of QEMU platform objects corresponding to *platforms*.... *platforms* must be a list of strings corresponding to platform names, such as `"arm"`, `"sparc"`, `"mips64el"`, and so on.

`qemu-platform?` *obj* [Procedure]

Return true if *obj* is a platform object.

`qemu-platform-name` *platform* [Procedure]

Return the name of *platform*—a string such as `"arm"`.

QEMU Guest Agent

The QEMU guest agent provides control over the emulated system to the host. The `qemu-guest-agent` service runs the agent on Guix guests. To control the agent from the host, open a socket by invoking QEMU with the following arguments:

```
qemu-system-x86_64 \
-chardev socket,path=/tmp/qga.sock,server=on,wait=off,id=qga0 \
-device virtio-serial \
-device virtserialport,chardev=qga0,name=org.qemu.guest_agent.0 \
...
```

This creates a socket at `/tmp/qga.sock` on the host. Once the guest agent is running, you can issue commands with `socat`:

```
$ guix shell socat -- socat unix-connect:/tmp/qga.sock stdio
{"execute": "guest-get-host-name"}
{"return": {"host-name": "guix"}}
```

See QEMU guest agent documentation (`https://wiki.qemu.org/Features/GuestAgent`) for more options and commands.

`qemu-guest-agent-service-type` [Variável]
Tipo de serviço para o serviço de agente convidado QEMU.

`qemu-guest-agent-configuration` [Data Type]
Configuration for the `qemu-guest-agent` service.

`qemu` (default: `qemu-minimal`)
The QEMU package to use.

`device` (default: `""`)
File name of the device or socket the agent uses to communicate with the host. If empty, QEMU uses a default file name.

Virtual Build Machines

Virtual build machines or "build VMs" let you offload builds to a fully controlled environment. "How can it be more controlled than regular builds? And why would it be useful?", you ask. Good questions.

Builds spawned by `guix-daemon` indeed run in a controlled environment; specifically the daemon spawns build processes in separate namespaces and in a chroot, such as that build processes only see their declared dependencies and a well-defined subset of the file system tree (veja Seção 2.2.1 [Configuração do ambiente de compilação], Página 6, for details). A few aspects of the environments are not controlled though: the operating system kernel, the CPU model, and the date. Most of the time, these aspects have no impact on the build process: the level of isolation `guix-daemon` provides is "good enough".

However, there are occasionally cases where those aspects *do* influence the build process. A typical example is *time traps*: build processes that stop working after a certain date[8]. Another one is software that optimizes for the CPU microarchitecture it is built on or, worse, bugs that manifest only on specific CPUs.

To address that, `virtual-build-machine-service-type` lets you add a virtual build machine on your system, as in this example:

```
(use-modules (gnu services virtualization))

(operating-system
  ;; ...
  (services (append (list (service virtual-build-machine-service-type))
                    %base-services)))
```

By default, you have to explicitly start the build machine when you need it, at which point builds may be offloaded to it (veja Seção 2.2.2 [Configuração de descarregamento de daemon], Página 8):

```
herd start build-vm
```

With the default setting shown above, the build VM runs with its clock set to a date several years in the past, and on a CPU model that corresponds to that date—a model possibly older than that of your machine. This lets you rebuild today software from the

[8] The most widespread example of time traps is test suites that involve checking the expiration date of a certificate. Such tests exists in TLS implementations such as OpenSSL and GnuTLS, but also in high-level software such as Python.

past that would otherwise fail to build due to a time trap or other issues in its build process. You can view the VM's config like this:

```
herd configuration build-vm
```

You can configure the build VM, as in this example:

```
(service virtual-build-machine-service-type
         (virtual-build-machine
          (cpu "Westmere")
          (cpu-count 8)
          (memory-size (* 1 1024))
          (auto-start? #t)))
```

The available options are shown below.

`virtual-build-machine-service-type` [Variável]

This is the service type to run *virtual build machines*. Virtual build machines are configured so that builds are offloaded to them when they are running.

`virtual-build-machine` [Data Type]

This is the data type specifying the configuration of a build machine. It contains the fields below:

`name` (default: `'build-vm`)
: The name of this build VM. It is used to construct the name of its Shepherd service.

`imagem`
: The image of the virtual machine (veja Capítulo 16 [Imagens do sistema], Página 697). This notably specifies the virtual disk size and the operating system running into it (veja Seção 11.3 [Referência do operating-system], Página 247). The default value is a minimal operating system image.

`qemu` (default: `qemu-minimal`)
: The QEMU package to run the image.

`cpu`
: The CPU model being emulated as a string denoting a model known to QEMU.

  The default value is a model that matches `date` (see below). To see what CPU models are available, run, for example:

  ```
  qemu-system-x86_64 -cpu help
  ```

`cpu-count` (default: `4`)
: The number of CPUs emulated by the virtual machine.

`memory-size` (default: `2048`)
: Size in mebibytes (MiB) of the virtual machine's main memory (RAM).

`date` (default: a few years ago)
: Date inside the virtual machine when it starts; this must be a SRFI-19 date object (veja Seção "SRFI-19 Date" em *GNU Guile Reference Manual*).

`port-forwardings` (default: 11022 and 11004)
: TCP ports of the virtual machine forwarded to the host. By default, the SSH and secrets ports are forwarded into the host.

`systems` (default: `(list (%current-system))`)
: List of system types supported by the build VM—e.g., `"x86_64-linux"`.

`auto-start?` (default: `#f`)
: Whether to start the virtual machine when the system boots.

In the next section, you'll find a variant on this theme: GNU/Hurd virtual machines!

The Hurd in a Virtual Machine

Service `hurd-vm` provides support for running GNU/Hurd in a virtual machine (VM), a so-called *childhurd*. This service is meant to be used on GNU/Linux and the given GNU/Hurd operating system configuration is cross-compiled. The virtual machine is a Shepherd service that can be referred to by the names `hurd-vm` and `childhurd` and be controlled with commands such as:

```
herd start hurd-vm
herd stop childhurd
```

When the service is running, you can view its console by connecting to it with a VNC client, for example with:

```
guix shell tigervnc-client -- vncviewer localhost:5900
```

The default configuration (see `hurd-vm-configuration` below) spawns a secure shell (SSH) server in your GNU/Hurd system, which QEMU (the virtual machine emulator) redirects to port 10022 on the host. By default, the service enables *offloading* such that the host `guix-daemon` automatically offloads GNU/Hurd builds to the childhurd (veja Seção 2.2.2 [Configuração de descarregamento de daemon], Página 8). This is what happens when running a command like the following one, where `i586-gnu` is the system type of 32-bit GNU/Hurd:

```
guix build emacs-minimal -s i586-gnu
```

The childhurd is volatile and stateless: it starts with a fresh root file system every time you restart it. By default though, all the files under `/etc/childhurd` on the host are copied as is to the root file system of the childhurd when it boots. This allows you to initialize "secrets" inside the VM: SSH host keys, authorized substitute keys, and so on—see the explanation of `secret-root` below.

You will probably find it useful to create an account for you in the GNU/Hurd virtual machine and to authorize logins with your SSH key. To do that, you can define the GNU/Hurd system in the usual way (veja Seção 11.2 [Usando o sistema de configuração], Página 238), and then pass that operating system as the `os` field of `hurd-vm-configuration`, as in this example:

```
(define childhurd-os
  ;; Definition of my GNU/Hurd system, derived from the default one.
  (operating-system
    (inherit %hurd-vm-operating-system)

    ;; Add a user account.
    (users (cons (user-account
                  (name "charlie")
                  (comment "This is me!")
```

```
                    (group "users")
                    (supplementary-groups '("wheel"))) ;for 'sudo'
                   %base-user-accounts))

        (services
         ;; Modify the SSH configuration to allow login as "root"
         ;; and as "charlie" using public key authentication.
         (modify-services (operating-system-user-services
                           %hurd-vm-operating-system)
           (openssh-service-type
            config => (openssh-configuration
                       (inherit config)
                       (authorized-keys
                        `(("root"
                           ,(local-file
                             "/home/charlie/.ssh/id_rsa.pub"))
                          ("charlie"
                           ,(local-file
                             "/home/charlie/.ssh/id_rsa.pub")))))))))

    (operating-system
      ;; ...
      (services
        ;; Add the 'hurd-vm' service, configured to use the
        ;; operating system configuration above.
        (append (list (service hurd-vm-service-type
                               (hurd-vm-configuration
                                 (os %childhurd-os))))
                %base-services)))
```

That's it! The remainder of this section provides the reference of the service configuration.

`hurd-vm-service-type` [Variável]

This is the type of the Hurd in a Virtual Machine service. Its value must be a `hurd-vm-configuration` object, which specifies the operating system (veja Seção 11.3 [Referência do operating-system], Página 247) and the disk size for the Hurd Virtual Machine, the QEMU package to use as well as the options for running it.

Por exemplo:

```
(service hurd-vm-service-type
         (hurd-vm-configuration
          (disk-size (* 5000 (expt 2 20))) ;5G
          (memory-size 1024)))             ;1024MiB
```

would create a disk image big enough to build GNU Hello, with some extra memory.

`hurd-vm-configuration` [Data Type]

The data type representing the configuration for `hurd-vm-service-type`.

`os` (default: *%hurd-vm-operating-system*)
: The operating system to instantiate. This default is bare-bones with a permissive OpenSSH secure shell daemon listening on port 2222 (veja Seção 11.10.5 [Serviços de Rede], Página 306).

`qemu` (default: `qemu-minimal`)
: The QEMU package to use.

`image` (default: *hurd-vm-disk-image*)
: The image object representing the disk image of this virtual machine (veja Capítulo 16 [Imagens do sistema], Página 697).

`disk-size` (default: `'guess`)
: The size of the disk image.

`memory-size` (default: `512`)
: The memory size of the Virtual Machine in mebibytes.

`options` (default: `'("--snapshot")`)
: The extra options for running QEMU.

`id` (default: `#f`)
: If set, a non-zero positive integer used to parameterize Childhurd instances. It is appended to the service's name, e.g. `childhurd1`.

`net-options` (default: *hurd-vm-net-options*)
: The procedure used to produce the list of QEMU networking options.

  By default, it produces

```
'("--device" "rtl8139,netdev=net0"
  "--netdev" (string-append
              "user,id=net0,"
              "hostfwd=tcp:127.0.0.1:secrets-port-:1004,"
              "hostfwd=tcp:127.0.0.1:ssh-port-:2222,"
              "hostfwd=tcp:127.0.0.1:vnc-port-:5900"))
```

  with forwarded ports:

```
secrets-port: (+ 11004 (* 1000 ID))
ssh-port: (+ 10022 (* 1000 ID))
vnc-port: (+ 15900 (* 1000 ID))
```

`offloading?` (default: `#t`)
: Whether to automatically set up offloading of builds to the childhurd.

  When enabled, this lets you run GNU/Hurd builds on the host and have them transparently offloaded to the VM, for instance when running a command like this:

```
guix build coreutils -s i586-gnu
```

  This option automatically sets up offloading like so:

  1. Authorizing the childhurd's key on the host so that the host accepts build results coming from the childhurd, which can be done like so (veja Seção 5.11 [Invocando guix archive], Página 66, for more on that).

2. Creating a user account called `offloading` dedicated to offloading in the childhurd.
3. Creating an SSH key pair on the host and making it an authorized key of the `offloading` account in the childhurd.
4. Adding the childhurd to `/etc/guix/machines.scm` (veja Seção 2.2.2 [Configuração de descarregamento de daemon], Página 8).

`secret-root` (default: `/etc/childhurd`)
: The root directory with out-of-band secrets to be installed into the childhurd once it runs. Childhurds are volatile which means that on every startup, secrets such as the SSH host keys and Guix signing key are recreated.

  If the `/etc/childhurd` directory does not exist, the `secret-service` running in the Childhurd will be sent an empty list of secrets.

  By default, the service automatically populates `/etc/childhurd` with the following non-volatile secrets, unless they already exist:

  ```
  /etc/childhurd/etc/guix/acl
  /etc/childhurd/etc/guix/signing-key.pub
  /etc/childhurd/etc/guix/signing-key.sec
  /etc/childhurd/etc/ssh/authorized_keys.d/offloading
  /etc/childhurd/etc/ssh/ssh_host_ed25519_key
  /etc/childhurd/etc/ssh/ssh_host_ecdsa_key
  /etc/childhurd/etc/ssh/ssh_host_ed25519_key.pub
  /etc/childhurd/etc/ssh/ssh_host_ecdsa_key.pub
  ```

Note that by default the VM image is volatile, i.e., once stopped the contents are lost. If you want a stateful image instead, override the configuration's `image` and `options` without the `--snapshot` flag using something along these lines:

```
(service hurd-vm-service-type
         (hurd-vm-configuration
          (image   (const "/out/of/store/writable/hurd.img"))
          (options '())))
```

Ganeti

> **Nota:** This service is considered experimental. Configuration options may be changed in a backwards-incompatible manner, and not all features have been thorougly tested. Users of this service are encouraged to share their experience at `guix-devel@gnu.org`.

Ganeti is a virtual machine management system. It is designed to keep virtual machines running on a cluster of servers even in the event of hardware failures, and to make maintenance and recovery tasks easy. It consists of multiple services which are described later in this section. In addition to the Ganeti service, you will need the OpenSSH service (veja Seção 11.10.5 [Serviços de Rede], Página 306), and update the `/etc/hosts` file (veja Seção 11.19.3 [Referência de Service], Página 634) with the cluster name and address (or use a DNS server).

All nodes participating in a Ganeti cluster should have the same Ganeti and `/etc/hosts` configuration. Here is an example configuration for a Ganeti cluster node that supports multiple storage backends, and installs the `debootstrap` and `guix` *OS providers*:

```
(use-package-modules virtualization)
(use-service-modules base ganeti networking ssh)
(operating-system
  ;; ...
  (host-name "node1")

  ;; Install QEMU so we can use KVM-based instances, and LVM, DRBD and Ceph
  ;; in order to use the "plain", "drbd" and "rbd" storage backends.
  (packages (append (map specification->package
                         '("qemu" "lvm2" "drbd-utils" "ceph"
                           ;; Add the debootstrap and guix OS providers.
                           "ganeti-instance-guix" "ganeti-instance-debootstrap"))
                    %base-packages))
  (services
   (append (list (service static-networking-service-type
                          (list (static-networking
                                 (addresses
                                  (list (network-address
                                         (device "eth0")
                                         (value "192.168.1.201/24"))))
                                 (routes
                                  (list (network-route
                                         (destination "default")
                                         (gateway "192.168.1.254"))))
                                 (name-servers '("192.168.1.252"
                                                 "192.168.1.253")))))

                 ;; Ganeti uses SSH to communicate between nodes.
                 (service openssh-service-type
                          (openssh-configuration
                           (permit-root-login 'prohibit-password)))

                 (simple-service 'ganeti-hosts-entries hosts-service-type
                                 (list
                                   (host "192.168.1.200" "ganeti.example.com")
                                   (host "192.168.1.201" "node1.example.com"
                                         '("node1"))
                                   (host "192.168.1.202" "node2.example.com"
                                         '("node2"))))

                 (service ganeti-service-type
                          (ganeti-configuration
                           ;; This list specifies allowed file system paths
```

```
                                ;; for storing virtual machine images.
                                (file-storage-paths '("/srv/ganeti/file-storage"))
                                ;; This variable configures a single "variant" for
                                ;; both Debootstrap and Guix that works with KVM.
                                (os %default-ganeti-os))))
                  %base-services)))
```

Users are advised to read the Ganeti administrators guide (`https://docs.ganeti.org/docs/ganeti/3.0/html/admin.html`) to learn about the various cluster options and day-to-day operations. There is also a blog post (`https://guix.gnu.org/blog/2020/running-a-ganeti-cluster-on-guix/`) describing how to configure and initialize a small cluster.

`ganeti-service-type` [Variável]

This is a service type that includes all the various services that Ganeti nodes should run.

Its value is a `ganeti-configuration` object that defines the package to use for CLI operations, as well as configuration for the various daemons. Allowed file storage paths and available guest operating systems are also configured through this data type.

`ganeti-configuration` [Data Type]

The `ganeti` service takes the following configuration options:

`ganeti` (default: `ganeti`)
: The `ganeti` package to use. It will be installed to the system profile and make `gnt-cluster`, `gnt-instance`, etc available. Note that the value specified here does not affect the other services as each refer to a specific `ganeti` package (see below).

`noded-configuration` (default: `(ganeti-noded-configuration)`)
`confd-configuration` (default: `(ganeti-confd-configuration)`)
`wconfd-configuration` (default: `(ganeti-wconfd-configuration)`)
`luxid-configuration` (default: `(ganeti-luxid-configuration)`)
`rapi-configuration` (default: `(ganeti-rapi-configuration)`)
`kvmd-configuration` (default: `(ganeti-kvmd-configuration)`)
`mond-configuration` (default: `(ganeti-mond-configuration)`)
`metad-configuration` (default: `(ganeti-metad-configuration)`)
`watcher-configuration` (default: `(ganeti-watcher-configuration)`)
`cleaner-configuration` (default: `(ganeti-cleaner-configuration)`)
: These options control the various daemons and cron jobs that are distributed with Ganeti. The possible values for these are described in detail below. To override a setting, you must use the configuration type for that service:

```
(service ganeti-service-type
         (ganeti-configuration
          (rapi-configuration
           (ganeti-rapi-configuration
            (interface "eth1"))))
          (watcher-configuration
```

```
                          (ganeti-watcher-configuration
                           (rapi-ip "10.0.0.1"))))
```

`file-storage-paths` (default: `'()`)
: List of allowed directories for file storage backend.

`hooks` (default: `#f`)
: When set, this should be a file-like object containing a directory with cluster execution hooks (`https://docs.ganeti.org/docs/ganeti/3.0/html/hooks.html`).

`os` (default: `%default-ganeti-os`)
: List of `<ganeti-os>` records.

In essence `ganeti-service-type` is shorthand for declaring each service individually:

```
(service ganeti-noded-service-type)
(service ganeti-confd-service-type)
(service ganeti-wconfd-service-type)
(service ganeti-luxid-service-type)
(service ganeti-kvmd-service-type)
(service ganeti-mond-service-type)
(service ganeti-metad-service-type)
(service ganeti-watcher-service-type)
(service ganeti-cleaner-service-type)
```

Plus a service extension for `etc-service-type` that configures the file storage backend and OS variants.

`ganeti-os` [Data Type]

This data type is suitable for passing to the `os` parameter of `ganeti-configuration`. It takes the following parameters:

`name`
: The name for this OS provider. It is only used to specify where the configuration ends up. Setting it to "debootstrap" will create `/etc/ganeti/instance-debootstrap`.

`extension` (default: `#f`)
: The file extension for variants of this OS type. For example `.conf` or `.scm`. It will be appended to the variant file name if set.

`variants` (default: `'()`)
: This must be either a list of `ganeti-os-variant` objects for this OS, or a "file-like" object (veja Seção 8.12 [Expressões-G], Página 163) representing the variants directory.

  To use the Guix OS provider with variant definitions residing in a local directory instead of declaring individual variants (see *guix-variants* below), you can do:

```
(ganeti-os
 (name "guix")
 (variants (local-file "ganeti-guix-variants"
                       #:recursive? #true)))
```

Note that you will need to maintain the `variants.list` file (see `ganeti-os-interface(7) (https://docs.ganeti.org/docs/ganeti/3.0/man/ganeti-os-interface.html)`) manually in this case.

`ganeti-os-variant` [Data Type]

This is the data type for a Ganeti OS variant. It takes the following parameters:

`name` The name of this variant.

`configuration`
A configuration file for this variant.

`%default-debootstrap-hooks` [Variável]

This variable contains hooks to configure networking and the GRUB bootloader.

`%default-debootstrap-extra-pkgs` [Variável]

This variable contains a list of packages suitable for a fully-virtualized guest.

`debootstrap-configuration` [Data Type]

This data type creates configuration files suitable for the debootstrap OS provider.

`hooks` (default: `%default-debootstrap-hooks`)
When not `#f`, this must be a G-expression that specifies a directory with scripts that will run when the OS is installed. It can also be a list of `(name . file-like)` pairs. For example:

```
`((99-hello-world . ,(plain-file "#!/bin/sh\necho Hello, World")))
```

That will create a directory with one executable named `99-hello-world` and run it every time this variant is installed. If set to `#f`, hooks in `/etc/ganeti/instance-debootstrap/hooks` will be used, if any.

`proxy` (default: `#f`)
Optional HTTP proxy to use.

`mirror` (default: `#f`)
The Debian mirror. Typically something like `http://ftp.no.debian.org/debian`. The default varies depending on the distribution.

`arch` (default: `#f`)
The dpkg architecture. Set to `armhf` to debootstrap an ARMv7 instance on an AArch64 host. Default is to use the current system architecture.

`suite` (default: `"stable"`)
When set, this must be a Debian distribution “suite” such as `buster` or `focal`. If set to `#f`, the default for the OS provider is used.

`extra-pkgs` (default: `%default-debootstrap-extra-pkgs`)
List of extra packages that will get installed by dpkg in addition to the minimal system.

`components` (default: `#f`)
When set, must be a list of Debian repository “components”. For example `'("main" "contrib")`.

`generate-cache?` (default: `#t`)
: Whether to automatically cache the generated debootstrap archive.

`clean-cache` (default: `14`)
: Discard the cache after this amount of days. Use `#f` to never clear the cache.

`partition-style` (default: `'msdos`)
: The type of partition to create. When set, it must be one of `'msdos`, `'none` or a string.

`partition-alignment` (default: `2048`)
: Alignment of the partition in sectors.

`debootstrap-variant` *name configuration* [Procedure]
: This is a helper procedure that creates a `ganeti-os-variant` record. It takes two parameters: a name and a `debootstrap-configuration` object.

`debootstrap-os` *variants...* [Procedure]
: This is a helper procedure that creates a `ganeti-os` record. It takes a list of variants created with `debootstrap-variant`.

`guix-variant` *name configuration* [Procedure]
: This is a helper procedure that creates a `ganeti-os-variant` record for use with the Guix OS provider. It takes a name and a G-expression that returns a "file-like" (veja Seção 8.12 [Expressões-G], Página 163) object containing a Guix System configuration.

`guix-os` *variants...* [Procedure]
: This is a helper procedure that creates a `ganeti-os` record. It takes a list of variants produced by `guix-variant`.

`%default-debootstrap-variants` [Variável]
: This is a convenience variable to make the debootstrap provider work "out of the box" without users having to declare variants manually. It contains a single debootstrap variant with the default configuration:

```
(list (debootstrap-variant
       "default"
       (debootstrap-configuration)))
```

`%default-guix-variants` [Variável]
: This is a convenience variable to make the Guix OS provider work without additional configuration. It creates a virtual machine that has an SSH server, a serial console, and authorizes the Ganeti hosts SSH keys.

```
(list (guix-variant
       "default"
       (file-append ganeti-instance-guix
                    "/share/doc/ganeti-instance-guix/examples/dynamic.scm")))
```

Users can implement support for OS providers unbeknownst to Guix by extending the `ganeti-os` and `ganeti-os-variant` records appropriately. For example:

```
(ganeti-os
 (name "custom")
 (extension ".conf")
 (variants
  (list (ganeti-os-variant
         (name "foo")
         (configuration (plain-file "bar" "this is fine"))))))
```

That creates `/etc/ganeti/instance-custom/variants/foo.conf` which points to a file in the store with contents `this is fine`. It also creates `/etc/ganeti/instance-custom/variants/variants.list` with contents `foo`.

Obviously this may not work for all OS providers out there. If you find the interface limiting, please reach out to `guix-devel@gnu.org`.

The rest of this section documents the various services that are included by `ganeti-service-type`.

`ganeti-noded-service-type` [Variável]

`ganeti-noded` is the daemon responsible for node-specific functions within the Ganeti system. The value of this service must be a `ganeti-noded-configuration` object.

`ganeti-noded-configuration` [Data Type]

This is the configuration for the `ganeti-noded` service.

`ganeti` (default: `ganeti`)
: The `ganeti` package to use for this service.

`port` (default: `1811`)
: The TCP port on which the node daemon listens for network requests.

`address` (default: `"0.0.0.0"`)
: The network address that the daemon will bind to. The default address means bind to all available addresses.

`interface` (default: `#f`)
: When this is set, it must be a specific network interface (e.g. `eth0`) that the daemon will bind to.

`max-clients` (default: `20`)
: This sets a limit on the maximum number of simultaneous client connections that the daemon will handle. Connections above this count are accepted, but no responses will be sent until enough connections have closed.

`ssl?` (default: `#t`)
: Whether to use SSL/TLS to encrypt network communications. The certificate is automatically provisioned by the cluster and can be rotated with `gnt-cluster renew-crypto`.

`ssl-key` (default: `"/var/lib/ganeti/server.pem"`)
: This can be used to provide a specific encryption key for TLS communications.

`ssl-cert` (default: `"/var/lib/ganeti/server.pem"`)
: This can be used to provide a specific certificate for TLS communications.

`debug?` (default: `#f`)
: When true, the daemon performs additional logging for debugging purposes. Note that this will leak encryption details to the log files, use with caution.

`ganeti-confd-service-type` [Variável]
`ganeti-confd` answers queries related to the configuration of a Ganeti cluster. The purpose of this daemon is to have a highly available and fast way to query cluster configuration values. It is automatically active on all *master candidates*. The value of this service must be a `ganeti-confd-configuration` object.

`ganeti-confd-configuration` [Data Type]
This is the configuration for the `ganeti-confd` service.

`ganeti` (default: `ganeti`)
: The `ganeti` package to use for this service.

`port` (default: `1814`)
: The UDP port on which to listen for network requests.

`address` (default: `"0.0.0.0"`)
: Network address that the daemon will bind to.

`debug?` (default: `#f`)
: When true, the daemon performs additional logging for debugging purposes.

`ganeti-wconfd-service-type` [Variável]
`ganeti-wconfd` is the daemon that has authoritative knowledge about the cluster configuration and is the only entity that can accept changes to it. All jobs that need to modify the configuration will do so by sending appropriate requests to this daemon. It only runs on the *master node* and will automatically disable itself on other nodes.

The value of this service must be a `ganeti-wconfd-configuration` object.

`ganeti-wconfd-configuration` [Data Type]
This is the configuration for the `ganeti-wconfd` service.

`ganeti` (default: `ganeti`)
: The `ganeti` package to use for this service.

`no-voting?` (default: `#f`)
: The daemon will refuse to start if the majority of cluster nodes does not agree that it is running on the master node. Set to `#t` to start even if a quorum can not be reached (dangerous, use with caution).

`debug?` (default: `#f`)
: When true, the daemon performs additional logging for debugging purposes.

`ganeti-luxid-service-type` [Variável]

`ganeti-luxid` is a daemon used to answer queries related to the configuration and the current live state of a Ganeti cluster. Additionally, it is the authoritative daemon for the Ganeti job queue. Jobs can be submitted via this daemon and it schedules and starts them.

It takes a `ganeti-luxid-configuration` object.

`ganeti-luxid-configuration` [Data Type]

This is the configuration for the `ganeti-luxid` service.

`ganeti` (default: `ganeti`)
: The `ganeti` package to use for this service.

`no-voting?` (default: `#f`)
: The daemon will refuse to start if it cannot verify that the majority of cluster nodes believes that it is running on the master node. Set to `#t` to ignore such checks and start anyway (this can be dangerous).

`debug?` (default: `#f`)
: When true, the daemon performs additional logging for debugging purposes.

`ganeti-rapi-service-type` [Variável]

`ganeti-rapi` provides a remote API for Ganeti clusters. It runs on the master node and can be used to perform cluster actions programmatically via a JSON-based RPC protocol.

Most query operations are allowed without authentication (unless *require-authentication?* is set), whereas write operations require explicit authorization via the `/var/lib/ganeti/rapi/users` file. See the Ganeti Remote API documentation (`https://docs.ganeti.org/docs/ganeti/3.0/html/rapi.html`) for more information.

The value of this service must be a `ganeti-rapi-configuration` object.

`ganeti-rapi-configuration` [Data Type]

This is the configuration for the `ganeti-rapi` service.

`ganeti` (default: `ganeti`)
: The `ganeti` package to use for this service.

`require-authentication?` (default: `#f`)
: Whether to require authentication even for read-only operations.

`port` (default: `5080`)
: The TCP port on which to listen to API requests.

`address` (default: `"0.0.0.0"`)
: The network address that the service will bind to. By default it listens on all configured addresses.

`interface` (default: `#f`)
: When set, it must specify a specific network interface such as `eth0` that the daemon will bind to.

`max-clients` (default: `20`)
: The maximum number of simultaneous client requests to handle. Further connections are allowed, but no responses are sent until enough connections have closed.

`ssl?` (default: `#t`)
: Whether to use SSL/TLS encryption on the RAPI port.

`ssl-key` (default: `"/var/lib/ganeti/server.pem"`)
: This can be used to provide a specific encryption key for TLS communications.

`ssl-cert` (default: `"/var/lib/ganeti/server.pem"`)
: This can be used to provide a specific certificate for TLS communications.

`debug?` (default: `#f`)
: When true, the daemon performs additional logging for debugging purposes. Note that this will leak encryption details to the log files, use with caution.

`ganeti-kvmd-service-type` [Variável]

`ganeti-kvmd` is responsible for determining whether a given KVM instance was shut down by an administrator or a user. Normally Ganeti will restart an instance that was not stopped through Ganeti itself. If the cluster option `user_shutdown` is true, this daemon monitors the `QMP` socket provided by QEMU and listens for shutdown events, and marks the instance as *USER_down* instead of *ERROR_down* when it shuts down gracefully by itself.

It takes a `ganeti-kvmd-configuration` object.

`ganeti-kvmd-configuration` [Data Type]

`ganeti` (default: `ganeti`)
: The `ganeti` package to use for this service.

`debug?` (default: `#f`)
: When true, the daemon performs additional logging for debugging purposes.

`ganeti-mond-service-type` [Variável]

`ganeti-mond` is an optional daemon that provides Ganeti monitoring functionality. It is responsible for running data collectors and publish the collected information through a HTTP interface.

It takes a `ganeti-mond-configuration` object.

`ganeti-mond-configuration` [Data Type]

`ganeti` (default: `ganeti`)
: The `ganeti` package to use for this service.

`port` (default: `1815`)
: The port on which the daemon will listen.

`address` (default: `"0.0.0.0"`)
: The network address that the daemon will bind to. By default it binds to all available interfaces.

`debug?` (default: `#f`)
: When true, the daemon performs additional logging for debugging purposes.

`ganeti-metad-service-type` [Variável]

`ganeti-metad` is an optional daemon that can be used to provide information about the cluster to instances or OS install scripts.

It takes a `ganeti-metad-configuration` object.

`ganeti-metad-configuration` [Data Type]

`ganeti` (default: `ganeti`)
: The `ganeti` package to use for this service.

`port` (default: `80`)
: The port on which the daemon will listen.

`address` (default: `#f`)
: If set, the daemon will bind to this address only. If left unset, the behavior depends on the cluster configuration.

`debug?` (default: `#f`)
: When true, the daemon performs additional logging for debugging purposes.

`ganeti-watcher-service-type` [Variável]

`ganeti-watcher` is a script designed to run periodically and ensure the health of a cluster. It will automatically restart instances that have stopped without Ganeti's consent, and repairs DRBD links in case a node has rebooted. It also archives old cluster jobs and restarts Ganeti daemons that are not running. If the cluster parameter `ensure_node_health` is set, the watcher will also shutdown instances and DRBD devices if the node it is running on is declared offline by known master candidates.

It can be paused on all nodes with `gnt-cluster watcher pause`.

The service takes a `ganeti-watcher-configuration` object.

`ganeti-watcher-configuration` [Data Type]

`ganeti` (default: `ganeti`)
: The `ganeti` package to use for this service.

`schedule` (default: `'(next-second-from (next-minute (range 0 60 5)))`)
: How often to run the script. The default is every five minutes.

`rapi-ip` (default: `#f`)
: This option needs to be specified only if the RAPI daemon is configured to use a particular interface or address. By default the cluster address is used.

`job-age` (default: `(* 6 3600)`)
: Archive cluster jobs older than this age, specified in seconds. The default is 6 hours. This keeps `gnt-job list` manageable.

`verify-disks?` (default: `#t`)
: If this is `#f`, the watcher will not try to repair broken DRBD links automatically. Administrators will need to use `gnt-cluster verify-disks` manually instead.

`debug?` (default: `#f`)
: When `#t`, the script performs additional logging for debugging purposes.

`ganeti-cleaner-service-type` [Variável]
: `ganeti-cleaner` is a script designed to run periodically and remove old files from the cluster. This service type controls two *cron jobs*: one intended for the master node that permanently purges old cluster jobs, and one intended for every node that removes expired X509 certificates, keys, and outdated `ganeti-watcher` information. Like all Ganeti services, it is safe to include even on non-master nodes as it will disable itself as necessary.

  It takes a `ganeti-cleaner-configuration` object.

`ganeti-cleaner-configuration` [Data Type]
: `ganeti` (default: `ganeti`)
  : The `ganeti` package to use for the `gnt-cleaner` command.

  `master-schedule` (default: `"45 1 * * *"`)
  : How often to run the master cleaning job. The default is once per day, at 01:45:00.

  `node-schedule` (default: `"45 2 * * *"`)
  : How often to run the node cleaning job. The default is once per day, at 02:45:00.

11.10.31 Serviços de controlando versão

The `(gnu services version-control)` module provides a service to allow remote access to local Git repositories. There are three options: the `git-daemon-service-type`, which provides access to repositories via the `git://` unsecured TCP-based protocol, extending the `nginx` web server to proxy some requests to `git-http-backend`, or providing a web interface with `cgit-service-type`.

`git-daemon-service-type` [Variável]
: Type for a service that runs `git daemon`, a simple TCP server to expose repositories over the Git protocol for anonymous access.

  The value for this service type is a `<git-daemon-configuration>` record, by default it allows read-only access to exported[9] repositories under `/srv/git`.

[9] By creating the magic file `git-daemon-export-ok` in the repository directory.

`git-daemon-configuration` [Data Type]

Data type representing the configuration for `git-daemon-service-type`.

`package` (default: `git`)
: Package object of the Git distributed version control system.

`export-all?` (default: `#f`)
: Whether to allow access for all Git repositories, even if they do not have the `git-daemon-export-ok` file.

`base-path` (default: `/srv/git`)
: Whether to remap all the path requests as relative to the given path. If you run `git daemon` with `(base-path "/srv/git")` on '`example.com`', then if you later try to pull '`git://example.com/hello.git`', git daemon will interpret the path as `/srv/git/hello.git`.

`user-path` (default: `#f`)
: Whether to allow `~user` notation to be used in requests. When specified with empty string, requests to '`git://host/~alice/foo`' is taken as a request to access `foo` repository in the home directory of user `alice`. If `(user-path "path")` is specified, the same request is taken as a request to access *`path`*`/foo` repository in the home directory of user `alice`.

`listen` (default: `'()`)
: Whether to listen on specific IP addresses or hostnames, defaults to all.

`port` (default: `#f`)
: Whether to listen on an alternative port, which defaults to 9418.

`whitelist` (default: `'()`)
: If not empty, only allow access to this list of directories.

`extra-options` (default: `'()`)
: Extra options that will be passed to `git daemon`.[10]

The `git://` protocol lacks authentication. When you pull from a repository fetched via `git://`, you don't know whether the data you receive was modified or is even coming from the specified host, and your connection is subject to eavesdropping. It's better to use an authenticated and encrypted transport, such as `https`. Although Git allows you to serve repositories using unsophisticated file-based web servers, there is a faster protocol implemented by the `git-http-backend` program. This program is the back-end of a proper Git web service. It is designed to sit behind a FastCGI proxy. Veja Seção 11.10.20 [Serviços Web], Página 457, for more on running the necessary `fcgiwrap` daemon.

Guix has a separate configuration data type for serving Git repositories over HTTP.

`git-http-configuration` [Data Type]

Data type representing the configuration for a future `git-http-service-type`; can currently be used to configure Nginx through `git-http-nginx-location-configuration`.

`package` (default: *git*)
: Package object of the Git distributed version control system.

[10] Run `man git-daemon` for more information.

`git-root` (default: `/srv/git`)
: Directory containing the Git repositories to expose to the world.

`export-all?` (default: `#f`)
: Whether to expose access for all Git repositories in *git-root*, even if they do not have the `git-daemon-export-ok` file.

`uri-path` (default: '`/git/`')
: Path prefix for Git access. With the default '`/git/`' prefix, this will map '`http://server/git/repo.git`' to `/srv/git/repo.git`. Requests whose URI paths do not begin with this prefix are not passed on to this Git instance.

`fcgiwrap-socket` (default: `127.0.0.1:9000`)
: The socket on which the `fcgiwrap` daemon is listening. Veja Seção 11.10.20 [Serviços Web], Página 457.

There is no `git-http-service-type`, currently; instead you can create an `nginx-location-configuration` from a `git-http-configuration` and then add that location to a web server.

`git-http-nginx-location-configuration` [Procedure]
[*config*=(*git-http-configuration*)] *Compute an* `nginx-location-configuration` that corresponds to the given Git http configuration. An example nginx service definition to serve the default `/srv/git` over HTTPS might be:

```
(service nginx-service-type
         (nginx-configuration
          (server-blocks
           (list
            (nginx-server-configuration
             (listen '("443 ssl"))
             (server-name "git.my-host.org")
             (ssl-certificate
              "/etc/certs/git.my-host.org/fullchain.pem")
             (ssl-certificate-key
              "/etc/certs/git.my-host.org/privkey.pem")
             (locations
              (list
               (git-http-nginx-location-configuration
                (git-http-configuration (uri-path "/"))))))))))
```

This example assumes that you are using Let's Encrypt to get your TLS certificate. Veja Seção 11.10.21 [Serviços de certificado], Página 477. The default `certbot` service will redirect all HTTP traffic on `git.my-host.org` to HTTPS. You will also need to add an `fcgiwrap` proxy to your system services. Veja Seção 11.10.20 [Serviços Web], Página 457.

Cgit Service

Cgit (`https://git.zx2c4.com/cgit/`) is a web frontend for Git repositories written in C.

The following example will configure the service with default values. By default, Cgit can be accessed on port 80 (`http://localhost:80`).

```
(service cgit-service-type)
```

The `file-object` type designates either a file-like object (veja Seção 8.12 [Expressões-G], Página 163) or a string.

Available `cgit-configuration` fields are:

`package package` [`cgit-configuration` parameter]
The CGIT package.

`nginx-server-configuration-list nginx` [`cgit-configuration` parameter]
NGINX configuration.

`file-object about-filter` [`cgit-configuration` parameter]
Specifies a command which will be invoked to format the content of about pages (both top-level and for each repository).

Defaults to ‘`""`’.

`string agefile` [`cgit-configuration` parameter]
Specifies a path, relative to each repository path, which can be used to specify the date and time of the youngest commit in the repository.

Defaults to ‘`""`’.

`file-object auth-filter` [`cgit-configuration` parameter]
Specifies a command that will be invoked for authenticating repository access.

Defaults to ‘`""`’.

`string branch-sort` [`cgit-configuration` parameter]
Flag which, when set to ‘`age`’, enables date ordering in the branch ref list, and when set ‘`name`’ enables ordering by branch name.

Defaults to ‘`"name"`’.

`string cache-root` [`cgit-configuration` parameter]
Path used to store the cgit cache entries.

Defaults to ‘`"/var/cache/cgit"`’.

`integer cache-static-ttl` [`cgit-configuration` parameter]
Number which specifies the time-to-live, in minutes, for the cached version of repository pages accessed with a fixed SHA1.

Defaults to ‘`-1`’.

`integer cache-dynamic-ttl` [`cgit-configuration` parameter]
Number which specifies the time-to-live, in minutes, for the cached version of repository pages accessed without a fixed SHA1.

Defaults to ‘`5`’.

`integer cache-repo-ttl` [`cgit-configuration` parameter]
Number which specifies the time-to-live, in minutes, for the cached version of the repository summary page.

Defaults to '`5`'.

`integer cache-root-ttl` [`cgit-configuration` parameter]
Number which specifies the time-to-live, in minutes, for the cached version of the repository index page.

Defaults to '`5`'.

`integer cache-scanrc-ttl` [`cgit-configuration` parameter]
Number which specifies the time-to-live, in minutes, for the result of scanning a path for Git repositories.

Defaults to '`15`'.

`integer cache-about-ttl` [`cgit-configuration` parameter]
Number which specifies the time-to-live, in minutes, for the cached version of the repository about page.

Defaults to '`15`'.

`integer cache-snapshot-ttl` [`cgit-configuration` parameter]
Number which specifies the time-to-live, in minutes, for the cached version of snapshots.

Defaults to '`5`'.

`integer cache-size` [`cgit-configuration` parameter]
The maximum number of entries in the cgit cache. When set to '`0`', caching is disabled.

Defaults to '`0`'.

`boolean case-sensitive-sort?` [`cgit-configuration` parameter]
Sort items in the repo list case sensitively.

Defaults to '`#t`'.

`list clone-prefix` [`cgit-configuration` parameter]
List of common prefixes which, when combined with a repository URL, generates valid clone URLs for the repository.

Defaults to '`'()`'.

`list clone-url` [`cgit-configuration` parameter]
List of `clone-url` templates.

Defaults to '`'()`'.

`file-object commit-filter` [`cgit-configuration` parameter]
Command which will be invoked to format commit messages.

Defaults to '`""`'.

`string commit-sort` [`cgit-configuration` parameter]
Flag which, when set to '`date`', enables strict date ordering in the commit log, and when set to '`topo`' enables strict topological ordering.

Defaults to '`"git log"`'.

`file-object css` [`cgit-configuration` parameter]
URL which specifies the css document to include in all cgit pages.

Defaults to '`"/share/cgit/cgit.css"`'.

`file-object email-filter` [`cgit-configuration` parameter]
Specifies a command which will be invoked to format names and email address of committers, authors, and taggers, as represented in various places throughout the cgit interface.

Defaults to '`""`'.

`boolean embedded?` [`cgit-configuration` parameter]
Flag which, when set to '`#t`', will make cgit generate a HTML fragment suitable for embedding in other HTML pages.

Defaults to '`#f`'.

`boolean enable-commit-graph?` [`cgit-configuration` parameter]
Flag which, when set to '`#t`', will make cgit print an ASCII-art commit history graph to the left of the commit messages in the repository log page.

Defaults to '`#f`'.

`boolean enable-filter-overrides?` [`cgit-configuration` parameter]
Flag which, when set to '`#t`', allows all filter settings to be overridden in repository-specific cgitrc files.

Defaults to '`#f`'.

`boolean enable-follow-links?` [`cgit-configuration` parameter]
Flag which, when set to '`#t`', allows users to follow a file in the log view.

Defaults to '`#f`'.

`boolean enable-http-clone?` [`cgit-configuration` parameter]
If set to '`#t`', cgit will act as an dumb HTTP endpoint for Git clones.

Defaults to '`#t`'.

`boolean enable-index-links?` [`cgit-configuration` parameter]
Flag which, when set to '`#t`', will make cgit generate extra links `"summary"`, `"commit"`, `"tree"` for each repo in the repository index.

Defaults to '`#f`'.

`boolean enable-index-owner?` [`cgit-configuration` parameter]
Flag which, when set to '`#t`', will make cgit display the owner of each repo in the repository index.

Defaults to '`#t`'.

`boolean enable-log-filecount?` [`cgit-configuration` parameter]
Flag which, when set to '`#t`', will make cgit print the number of modified files for each commit on the repository log page.

Defaults to '`#f`'.

`boolean enable-log-linecount?` [`cgit-configuration` parameter]
Flag which, when set to '`#t`', will make cgit print the number of added and removed lines for each commit on the repository log page.

Defaults to '`#f`'.

`boolean enable-remote-branches?` [`cgit-configuration` parameter]
Flag which, when set to `#t`, will make cgit display remote branches in the summary and refs views.

Defaults to '`#f`'.

`boolean enable-subject-links?` [`cgit-configuration` parameter]
Flag which, when set to `1`, will make cgit use the subject of the parent commit as link text when generating links to parent commits in commit view.

Defaults to '`#f`'.

`boolean enable-html-serving?` [`cgit-configuration` parameter]
Flag which, when set to '`#t`', will make cgit use the subject of the parent commit as link text when generating links to parent commits in commit view.

Defaults to '`#f`'.

`boolean enable-tree-linenumbers?` [`cgit-configuration` parameter]
Flag which, when set to '`#t`', will make cgit generate linenumber links for plaintext blobs printed in the tree view.

Defaults to '`#t`'.

`boolean enable-git-config?` [`cgit-configuration` parameter]
Flag which, when set to '`#f`', will allow cgit to use Git config to set any repo specific settings.

Defaults to '`#f`'.

`file-object favicon` [`cgit-configuration` parameter]
URL used as link to a shortcut icon for cgit.

Defaults to '`"/favicon.ico"`'.

`string footer` [`cgit-configuration` parameter]
The content of the file specified with this option will be included verbatim at the bottom of all pages (i.e. it replaces the standard "generated by..." message).

Defaults to '`""`'.

`string head-include` [`cgit-configuration` parameter]
The content of the file specified with this option will be included verbatim in the HTML HEAD section on all pages.

Defaults to '`""`'.

`string header` [`cgit-configuration` parameter]
The content of the file specified with this option will be included verbatim at the top of all pages.

Defaults to '`""`'.

`file-object include` [`cgit-configuration` parameter]
Name of a configfile to include before the rest of the current config- file is parsed.

Defaults to '`""`'.

`string index-header` [`cgit-configuration` parameter]
The content of the file specified with this option will be included verbatim above the repository index.

Defaults to '`""`'.

`string index-info` [`cgit-configuration` parameter]
The content of the file specified with this option will be included verbatim below the heading on the repository index page.

Defaults to '`""`'.

`boolean local-time?` [`cgit-configuration` parameter]
Flag which, if set to '`#t`', makes cgit print commit and tag times in the servers timezone.

Defaults to '`#f`'.

`file-object logo` [`cgit-configuration` parameter]
URL which specifies the source of an image which will be used as a logo on all cgit pages.

Defaults to '`"/share/cgit/cgit.png"`'.

`string logo-link` [`cgit-configuration` parameter]
URL loaded when clicking on the cgit logo image.

Defaults to '`""`'.

`file-object owner-filter` [`cgit-configuration` parameter]
Command which will be invoked to format the Owner column of the main page.

Defaults to '`""`'.

`integer max-atom-items` [`cgit-configuration` parameter]
Number of items to display in atom feeds view.

Defaults to '`10`'.

`integer max-commit-count` [`cgit-configuration` parameter]
Number of entries to list per page in "log" view.

Defaults to '`50`'.

`integer max-message-length` [`cgit-configuration` parameter]
Number of commit message characters to display in "log" view.

Defaults to '`80`'.

`integer max-repo-count` [`cgit-configuration` parameter]
Specifies the number of entries to list per page on the repository index page.
Defaults to '`50`'.

`integer max-repodesc-length` [`cgit-configuration` parameter]
Specifies the maximum number of repo description characters to display on the repository index page.
Defaults to '`80`'.

`integer max-blob-size` [`cgit-configuration` parameter]
Specifies the maximum size of a blob to display HTML for in KBytes.
Defaults to '`0`'.

`string max-stats` [`cgit-configuration` parameter]
Maximum statistics period. Valid values are '`week`','`month`', '`quarter`' and '`year`'.
Defaults to '`""`'.

`mimetype-alist mimetype` [`cgit-configuration` parameter]
Mimetype for the specified filename extension.
Defaults to '`((gif "image/gif") (html "text/html") (jpg "image/jpeg") (jpeg "image/jpeg") (pdf "application/pdf") (png "image/png") (svg "image/svg+xml"))`'.

`file-object mimetype-file` [`cgit-configuration` parameter]
Specifies the file to use for automatic mimetype lookup.
Defaults to '`""`'.

`string module-link` [`cgit-configuration` parameter]
Text which will be used as the formatstring for a hyperlink when a submodule is printed in a directory listing.
Defaults to '`""`'.

`boolean nocache?` [`cgit-configuration` parameter]
If set to the value '`#t`' caching will be disabled.
Defaults to '`#f`'.

`boolean noplainemail?` [`cgit-configuration` parameter]
If set to '`#t`' showing full author email addresses will be disabled.
Defaults to '`#f`'.

`boolean noheader?` [`cgit-configuration` parameter]
Flag which, when set to '`#t`', will make cgit omit the standard header on all pages.
Defaults to '`#f`'.

`project-list project-list` [`cgit-configuration` parameter]
A list of subdirectories inside of `repository-directory`, relative to it, that should loaded as Git repositories. An empty list means that all subdirectories will be loaded.
Defaults to '`'()`'.

`file-object readme` [`cgit-configuration` parameter]
Text which will be used as default `repository-cgit-configuration readme`.
Defaults to '`""`'.

`boolean remove-suffix?` [`cgit-configuration` parameter]
If set to `#t` and `repository-directory` is enabled, if any repositories are found with a suffix of `.git`, this suffix will be removed for the URL and name.
Defaults to '`#f`'.

`integer renamelimit` [`cgit-configuration` parameter]
Maximum number of files to consider when detecting renames.
Defaults to '`-1`'.

`string repository-sort` [`cgit-configuration` parameter]
The way in which repositories in each section are sorted.
Defaults to '`""`'.

`robots-list robots` [`cgit-configuration` parameter]
Text used as content for the `robots` meta-tag.
Defaults to '`'("noindex" "nofollow")`'.

`string root-desc` [`cgit-configuration` parameter]
Text printed below the heading on the repository index page.
Defaults to '`"a fast webinterface for the git dscm"`'.

`string root-readme` [`cgit-configuration` parameter]
The content of the file specified with this option will be included verbatim below the "about" link on the repository index page.
Defaults to '`""`'.

`string root-title` [`cgit-configuration` parameter]
Text printed as heading on the repository index page.
Defaults to '`""`'.

`boolean scan-hidden-path` [`cgit-configuration` parameter]
If set to '`#t`' and repository-directory is enabled, repository-directory will recurse into directories whose name starts with a period. Otherwise, repository-directory will stay away from such directories, considered as "hidden". Note that this does not apply to the `.git` directory in non-bare repos.
Defaults to '`#f`'.

`list snapshots` [`cgit-configuration` parameter]
Text which specifies the default set of snapshot formats that cgit generates links for.
Defaults to '`'()`'.

`repository-directory` [`cgit-configuration` parameter]
`repository-directory`
Name of the directory to scan for repositories (represents `scan-path`).
Defaults to '`"/srv/git"`'.

`string section` [`cgit-configuration` parameter]
The name of the current repository section - all repositories defined after this option will inherit the current section name.

Defaults to '`""`'.

`string section-sort` [`cgit-configuration` parameter]
Flag which, when set to '`1`', will sort the sections on the repository listing by name.

Defaults to '`""`'.

`integer section-from-path` [`cgit-configuration` parameter]
A number which, if defined prior to repository-directory, specifies how many path elements from each repo path to use as a default section name.

Defaults to '`0`'.

`boolean side-by-side-diffs?` [`cgit-configuration` parameter]
If set to '`#t`' shows side-by-side diffs instead of unidiffs per default.

Defaults to '`#f`'.

`file-object source-filter` [`cgit-configuration` parameter]
Specifies a command which will be invoked to format plaintext blobs in the tree view.

Defaults to '`""`'.

`integer summary-branches` [`cgit-configuration` parameter]
Specifies the number of branches to display in the repository "summary" view.

Defaults to '`10`'.

`integer summary-log` [`cgit-configuration` parameter]
Specifies the number of log entries to display in the repository "summary" view.

Defaults to '`10`'.

`integer summary-tags` [`cgit-configuration` parameter]
Specifies the number of tags to display in the repository "summary" view.

Defaults to '`10`'.

`string strict-export` [`cgit-configuration` parameter]
Filename which, if specified, needs to be present within the repository for cgit to allow access to that repository.

Defaults to '`""`'.

`string virtual-root` [`cgit-configuration` parameter]
URL which, if specified, will be used as root for all cgit links.

Defaults to '`"/"`'.

`repository-cgit-configuration-list repositories` [`cgit-configuration` parameter]
A list of `repository-cgit-configuration` records.

Defaults to '`'()`'.

Available `repository-cgit-configuration` fields are:

`repo-list snapshots` [`repository-cgit-configuration` parameter]
A mask of snapshot formats for this repo that cgit generates links for, restricted by the global `snapshots` setting.

Defaults to ‘`'()`’.

`repo-file-object` [`repository-cgit-configuration` parameter]
`source-filter`
Override the default `source-filter`.

Defaults to ‘`""`’.

`repo-string url` [`repository-cgit-configuration` parameter]
The relative URL used to access the repository.

Defaults to ‘`""`’.

`repo-file-object` [`repository-cgit-configuration` parameter]
`about-filter`
Override the default `about-filter`.

Defaults to ‘`""`’.

`repo-string branch-sort` [`repository-cgit-configuration` parameter]
Flag which, when set to ‘`age`’, enables date ordering in the branch ref list, and when set to ‘`name`’ enables ordering by branch name.

Defaults to ‘`""`’.

`repo-list clone-url` [`repository-cgit-configuration` parameter]
A list of URLs which can be used to clone repo.

Defaults to ‘`'()`’.

`repo-file-object` [`repository-cgit-configuration` parameter]
`commit-filter`
Override the default `commit-filter`.

Defaults to ‘`""`’.

`repo-string commit-sort` [`repository-cgit-configuration` parameter]
Flag which, when set to ‘`date`’, enables strict date ordering in the commit log, and when set to ‘`topo`’ enables strict topological ordering.

Defaults to ‘`""`’.

`repo-string defbranch` [`repository-cgit-configuration` parameter]
The name of the default branch for this repository. If no such branch exists in the repository, the first branch name (when sorted) is used as default instead. By default branch pointed to by HEAD, or “master” if there is no suitable HEAD.

Defaults to ‘`""`’.

`repo-string desc` [`repository-cgit-configuration` parameter]
The value to show as repository description.

Defaults to ‘`""`’.

`repo-string homepage` [`repository-cgit-configuration` parameter]
The value to show as repository homepage.

Defaults to '`""`'.

`repo-file-object email-filter` [`repository-cgit-configuration` parameter]
Override the default `email-filter`.

Defaults to '`""`'.

`maybe-repo-boolean enable-commit-graph?` [`repository-cgit-configuration` parameter]
A flag which can be used to disable the global setting `enable-commit-graph?`.

Defaults to '`disabled`'.

`maybe-repo-boolean enable-log-filecount?` [`repository-cgit-configuration` parameter]
A flag which can be used to disable the global setting `enable-log-filecount?`.

Defaults to '`disabled`'.

`maybe-repo-boolean enable-log-linecount?` [`repository-cgit-configuration` parameter]
A flag which can be used to disable the global setting `enable-log-linecount?`.

Defaults to '`disabled`'.

`maybe-repo-boolean enable-remote-branches?` [`repository-cgit-configuration` parameter]
Flag which, when set to `#t`, will make cgit display remote branches in the summary and refs views.

Defaults to '`disabled`'.

`maybe-repo-boolean enable-subject-links?` [`repository-cgit-configuration` parameter]
A flag which can be used to override the global setting `enable-subject-links?`.

Defaults to '`disabled`'.

`maybe-repo-boolean enable-html-serving?` [`repository-cgit-configuration` parameter]
A flag which can be used to override the global setting `enable-html-serving?`.

Defaults to '`disabled`'.

`repo-boolean hide?` [`repository-cgit-configuration` parameter]
Flag which, when set to `#t`, hides the repository from the repository index.

Defaults to '`#f`'.

`repo-boolean ignore?` [`repository-cgit-configuration` parameter]
Flag which, when set to '`#t`', ignores the repository.

Defaults to '`#f`'.

`repo-file-object logo` [`repository-cgit-configuration` parameter]
URL which specifies the source of an image which will be used as a logo on this repo's pages.

Defaults to '`""`'.

`repo-string logo-link` [`repository-cgit-configuration` parameter]
URL loaded when clicking on the cgit logo image.

Defaults to '`""`'.

`repo-file-object owner-filter` [`repository-cgit-configuration` parameter]
Override the default `owner-filter`.

Defaults to '`""`'.

`repo-string module-link` [`repository-cgit-configuration` parameter]
Text which will be used as the formatstring for a hyperlink when a submodule is printed in a directory listing. The arguments for the formatstring are the path and SHA1 of the submodule commit.

Defaults to '`""`'.

`module-link-path module-link-path` [`repository-cgit-configuration` parameter]
Text which will be used as the formatstring for a hyperlink when a submodule with the specified subdirectory path is printed in a directory listing.

Defaults to '`'()`'.

`repo-string max-stats` [`repository-cgit-configuration` parameter]
Override the default maximum statistics period.

Defaults to '`""`'.

`repo-string name` [`repository-cgit-configuration` parameter]
The value to show as repository name.

Defaults to '`""`'.

`repo-string owner` [`repository-cgit-configuration` parameter]
A value used to identify the owner of the repository.

Defaults to '`""`'.

`repo-string path` [`repository-cgit-configuration` parameter]
An absolute path to the repository directory.

Defaults to '`""`'.

`repo-string readme` [`repository-cgit-configuration` parameter]
A path (relative to repo) which specifies a file to include verbatim as the "About" page for this repo.

Defaults to '`""`'.

`repo-string section` [`repository-cgit-configuration` parameter]
The name of the current repository section - all repositories defined after this option will inherit the current section name.

Defaults to ‘`""`’.

`repo-list extra-options` [`repository-cgit-configuration` parameter]
Extra options will be appended to cgitrc file.

Defaults to ‘`''()`’.

`list extra-options` [`cgit-configuration` parameter]
Extra options will be appended to cgitrc file.

Defaults to ‘`''()`’.

However, it could be that you just want to get a `cgitrc` up and running. In that case, you can pass an `opaque-cgit-configuration` as a record to `cgit-service-type`. As its name indicates, an opaque configuration does not have easy reflective capabilities.

Available `opaque-cgit-configuration` fields are:

`package cgit` [`opaque-cgit-configuration` parameter]
The cgit package.

`string string` [`opaque-cgit-configuration` parameter]
The contents of the `cgitrc`, as a string.

For example, if your `cgitrc` is just the empty string, you could instantiate a cgit service like this:

```
(service cgit-service-type
         (opaque-cgit-configuration
          (cgitrc "")))
```

Gitolite Service

Gitolite (`https://gitolite.com/gitolite/`) is a tool for hosting Git repositories on a central server.

Gitolite can handle multiple repositories and users, and supports flexible configuration of the permissions for the users on the repositories.

The following example will configure Gitolite using the default `git` user, and the provided SSH public key.

```
(service gitolite-service-type
         (gitolite-configuration
           (admin-pubkey (plain-file
                          "yourname.pub"
                          "ssh-rsa AAAA... guix@example.com"))))
```

Gitolite is configured through a special admin repository which you can clone, for example, if you setup Gitolite on `example.com`, you would run the following command to clone the admin repository.

```
git clone git@example.com:gitolite-admin
```

When the Gitolite service is activated, the provided `admin-pubkey` will be inserted in to the `keydir` directory in the gitolite-admin repository. If this results in a change in the repository, it will be committed using the message "gitolite setup by GNU Guix".

`gitolite-configuration` [Data Type]

Data type representing the configuration for `gitolite-service-type`.

`package` (default: *gitolite*)
: Gitolite package to use. There are optional Gitolite dependencies that are not included in the default package, such as Redis and git-annex. These features can be made available by using the `make-gitolite` procedure in the `(gnu packages version-control)` module to produce a variant of Gitolite with the desired additional dependencies.

  The following code returns a package in which the Redis and git-annex programs can be invoked by Gitolite's scripts:

```
(use-modules (gnu packages databases)
             (gnu packages haskell-apps)
             (gnu packages version-control))
(make-gitolite (list redis git-annex))
```

`user` (default: *git*)
: User to use for Gitolite. This will be user that you use when accessing Gitolite over SSH.

`group` (default: *git*)
: Group to use for Gitolite.

`home-directory` (default: "*/var/lib/gitolite*")
: Directory in which to store the Gitolite configuration and repositories.

`rc-file` (padrão: *(gitolite-rc-file)*)
: A "file-like" object (veja Seção 8.12 [Expressões-G], Página 163), representing the configuration for Gitolite.

`admin-pubkey` (default: *#f*)
: A "file-like" object (veja Seção 8.12 [Expressões-G], Página 163) used to setup Gitolite. This will be inserted in to the `keydir` directory within the gitolite-admin repository.

  To specify the SSH key as a string, use the `plain-file` function.

```
(plain-file "yourname.pub" "ssh-rsa AAAA... guix@example.com")
```

`gitolite-rc-file` [Data Type]

Data type representing the Gitolite RC file.

`umask` (default: `#o0077`)
: This controls the permissions Gitolite sets on the repositories and their contents.

  A value like `#o0027` will give read access to the group used by Gitolite (by default: `git`). This is necessary when using Gitolite with software like cgit or gitweb.

`local-code` (default: `"$rc{GL_ADMIN_BASE}/local"`)
: Allows you to add your own non-core programs, or even override the shipped ones with your own.

  Please supply the FULL path to this variable. By default, directory called "local" in your gitolite clone is used, providing the benefits of versioning them as well as making changes to them without having to log on to the server.

`unsafe-pattern` (default: `#f`)
: An optional Perl regular expression for catching unsafe configurations in the configuration file. See Gitolite's documentation (`https://gitolite.com/gitolite/git-config.html#compensating-for-unsafe_patt`) for more information.

  When the value is not `#f`, it should be a string containing a Perl regular expression, such as '`"[`~#\$\&()|;<>]"`', which is the default value used by gitolite. It rejects any special character in configuration that might be interpreted by a shell, which is useful when sharing the administration burden with other people that do not otherwise have shell access on the server.

`git-config-keys` (default: `""`)
: Gitolite allows you to set git config values using the '`config`' keyword. This setting allows control over the config keys to accept.

`roles` (default: `'(("READERS" . 1) ("WRITERS" . ))`)
: Set the role names allowed to be used by users running the perms command.

`enable` (default: `'("help" "desc" "info" "perms" "writable" "ssh-authkeys" "git-config" "daemon" "gitweb")`)
: This setting controls the commands and features to enable within Gitolite.

Gitile Service

Gitile (`https://git.lepiller.eu/gitile`) is a Git forge for viewing public git repository contents from a web browser.

Gitile works best in collaboration with Gitolite, and will serve the public repositories from Gitolite by default. The service should listen only on a local port, and a webserver should be configured to serve static resources. The gitile service provides an easy way to extend the Nginx service for that purpose (veja [NGINX], Página 459).

The following example will configure Gitile to serve repositories from a custom location, with some default messages for the home page and the footers.

```
(service gitile-service-type
         (gitile-configuration
           (repositories "/srv/git")
           (base-git-url "https://myweb.site/git")
           (index-title "My git repositories")
           (intro '((p "This is all my public work!")))
           (footer '((p "This is the end")))
```

```
                (nginx
                  (nginx-server-configuration
                    (ssl-certificate
                      "/etc/certs/myweb.site/fullchain.pem")
                    (ssl-certificate-key
                      "/etc/certs/myweb.site/privkey.pem")
                    (listen '("443 ssl http2" "[::]:443 ssl http2"))
                    (locations
                      (list
                        ;; Allow for https anonymous fetch on /git/ urls.
                        (git-http-nginx-location-configuration
                          (git-http-configuration
                            (uri-path "/git/")
                            (git-root "/var/lib/gitolite/repositories")))))))))
```

In addition to the configuration record, you should configure your git repositories to contain some optional information. First, your public repositories need to contain the `git-daemon-export-ok` magic file that allows Git to export the repository. Gitile uses the presence of this file to detect public repositories it should make accessible. To do so with Gitolite for instance, modify your `conf/gitolite.conf` to include this in the repositories you want to make public:

```
repo foo
    R = daemon
```

In addition, Gitile can read the repository configuration to display more information on the repository. Gitile uses the gitweb namespace for its configuration. As an example, you can use the following in your `conf/gitolite.conf`:

```
repo foo
    R = daemon
    desc = A long description, optionally with <i>HTML</i>, shown on the index page
    config gitweb.name = The Foo Project
    config gitweb.synopsis = A short description, shown on the main page of the projec
```

Do not forget to commit and push these changes once you are satisfied. You may need to change your gitolite configuration to allow the previous configuration options to be set. One way to do that is to add the following service definition:

```
(service gitolite-service-type
          (gitolite-configuration
            (admin-pubkey (local-file "key.pub"))
            (rc-file
              (gitolite-rc-file
                (umask #o0027)
                ;; Allow to set any configuration key
                (git-config-keys ".*")
                ;; Allow any text as a valid configuration value
                (unsafe-patt "^$")))))
```

`gitile-configuration` [Data Type]

Data type representing the configuration for `gitile-service-type`.

`package` (default: *gitile*)
: Gitile package to use.

`host` (default: `"localhost"`)
: The host on which gitile is listening.

`port` (default: `8080`)
: The port on which gitile is listening.

`database` (default: `"/var/lib/gitile/gitile-db.sql"`)
: The location of the database.

`repositories` (default: `"/var/lib/gitolite/repositories"`)
: The location of the repositories. Note that only public repositories will be shown by Gitile. To make a repository public, add an empty `git-daemon-export-ok` file at the root of that repository.

`base-git-url`
: The base git url that will be used to show clone commands.

`index-title` (default: `"Index"`)
: The page title for the index page that lists all the available repositories.

`intro` (default: `'()`)
: The intro content, as a list of sxml expressions. This is shown above the list of repositories, on the index page.

`footer` (default: `'()`)
: The footer content, as a list of sxml expressions. This is shown on every page served by Gitile.

`nginx`
: An nginx server block that will be extended and used as a reverse proxy by Gitile to serve its pages, and as a normal web server to serve its assets.

  You can use this block to add more custom URLs to your domain, such as a `/git/` URL for anonymous clones, or serving any other files you would like to serve.

11.10.32 Serviços de jogos

Joycond service

The joycond service allows the pairing of Nintendo joycon game controllers over Bluetooth. (veja Seção 11.10.9 [Serviços de desktop], Página 354, for setting up Bluetooth.)

`joycond-configuration` [Data Type]
: Data type representing the configuration of `joycond`.

  `package` (default: `joycond`)
  : The joycond package to use.

`joycond-service-type` [Variável]
: Service type for the joycond service. It also extends the `udev-service-type` with the `joycond` package (provided via the `joycond-configuration` configuration), so that joycond controllers can be detected and used by an unprivileged user.

The Battle for Wesnoth Service

The Battle for Wesnoth (`https://wesnoth.org`) is a fantasy, turn based tactical strategy game, with several single player campaigns, and multiplayer games (both networked and local).

`wesnothd-service-type` [Variável]

Service type for the wesnothd service. Its value must be a `wesnothd-configuration` object. To run wesnothd in the default configuration, instantiate it as:

```
(service wesnothd-service-type)
```

`wesnothd-configuration` [Data Type]

Data type representing the configuration of `wesnothd`.

`package` (default: `wesnoth-server`)
The wesnoth server package to use.

`porta` (default: `15000`)
The port to bind the server to.

11.10.33 Serviço de montagem PAM

The `(gnu services pam-mount)` module provides a service allowing users to mount volumes when they log in. It should be able to mount any volume format supported by the system.

`pam-mount-service-type` [Variável]

Service type for PAM Mount support.

`pam-mount-configuration` [Data Type]

Data type representing the configuration of PAM Mount.

It takes the following parameters:

`rules` The configuration rules that will be used to generate `/etc/security/pam_mount.conf.xml`.

The configuration rules are SXML elements (veja Seção "SXML" em *GNU Guile Reference Manual*), and the default ones don't mount anything for anyone at login:

```
`((debug (@ (enable "0")))
  (mntoptions (@ (allow ,(string-join
                          '("nosuid" "nodev" "loop"
                            "encryption" "fsck" "nonempty"
                            "allow_root" "allow_other")
                          ","))))
  (mntoptions (@ (require "nosuid,nodev")))
  (logout (@ (wait "0")
             (hup "0")
             (term "no")
             (kill "no")))
  (mkmountpoint (@ (enable "1")
                   (remove "true"))))
```

Some `volume` elements must be added to automatically mount volumes at login. Here's an example allowing the user `alice` to mount her encrypted `HOME` directory and allowing the user `bob` to mount the partition where he stores his data:

```
(define pam-mount-rules
`((debug (@ (enable "0")))
            (volume (@ (user "alice")
                       (fstype "crypt")
                       (path "/dev/sda2")
                       (mountpoint "/home/alice")))
            (volume (@ (user "bob")
                       (fstype "auto")
                       (path "/dev/sdb3")
                       (mountpoint "/home/bob/data")
                       (options "defaults,autodefrag,compress")))
            (mntoptions (@ (allow ,(string-join
                                    '("nosuid" "nodev" "loop"
                                      "encryption" "fsck" "nonempty"
                                      "allow_root" "allow_other")
                                    ","))))
            (mntoptions (@ (require "nosuid,nodev")))
            (logout (@ (wait "0")
                       (hup "0")
                       (term "no")
                       (kill "no")))
            (mkmountpoint (@ (enable "1")
                             (remove "true")))))

(service pam-mount-service-type
         (pam-mount-configuration
           (rules pam-mount-rules)))
```

The complete list of possible options can be found in the man page for pam_mount.conf (`http://pam-mount.sourceforge.net/pam_mount.conf.5.html`).

PAM Mount Volume Service

PAM mount volumes are automatically mounted at login by the PAM login service according to a set of per-volume rules. Because they are mounted by PAM the password entered during login may be used directly to mount authenticated volumes, such as `cifs`, using the same credentials.

These volumes will be added in addition to any volumes directly specified in `pam-mount-rules`.

Here is an example of a rule which will mount a remote CIFS share from `//remote-server/share` into a sub-directory of `/shares` named after the user logging in:

```
(simple-service 'pam-mount-remote-share pam-mount-volume-service-type
                (list (pam-mount-volume
```

```
                    (secondary-group "users")
                    (file-system-type "cifs")
                    (server "remote-server")
                    (file-name "share")
                    (mount-point "/shares/%(USER)")
                    (options "nosuid,nodev,seal,cifsacl"))))
```

`pam-mount-volume-service-type` [Data Type]

Configuration for a single volume to be mounted. Any fields not specified will be omitted from the run-time PAM configuration. See the man page (`http://pam-mount.sourceforge.net/pam_mount.conf.5.html`) for the default values when unspecified.

`user-name` (type: maybe-string)
: Mount the volume for the given user.

`user-id` (type: maybe-integer-or-range)
: Mount the volume for the user with this ID. This field may also be specified as a pair of `(start . end)` indicating a range of user IDs for whom to mount the volume.

`primary-group` (type: maybe-string)
: Mount the volume for users with this primary group name.

`group-id` (type: maybe-integer-or-range)
: Mount the volume for the users with this primary group ID. This field may also be specified as a cons cell of `(start . end)` indicating a range of group ids for whom to mount the volume.

`secondary-group` (type: maybe-string)
: Mount the volume for users who are members of this group as either a primary or secondary group.

`file-system-type` (type: maybe-string)
: The file system type for the volume being mounted (e.g., `cifs`)

`no-mount-as-root?` (type: maybe-boolean)
: Whether or not to mount the volume with root privileges. This is normally disabled, but may be enabled for mounts of type `fuse`, or other user-level mounts.

`server` (type: maybe-string)
: The name of the remote server to mount the volume from, when necessary.

`file-name` (type: maybe-string)
: The location of the volume, either local or remote, depending on the `file-system-type`.

`mount-point` (type: maybe-string)
: Where to mount the volume in the local file-system. This may be set to `~` to indicate the home directory of the user logging in. If this field is omitted then `/etc/fstab` is consulted for the mount destination.

`options` (type: maybe-string)
: The options to be passed as-is to the underlying mount program.

`ssh?` (type: maybe-boolean)
: Enable this option to pass the login password to SSH for use with mounts involving SSH (e.g., `sshfs`).

`cipher` (type: maybe-string)
: Cryptsetup cipher name for the volume. To be used with the `crypt` `file-system-type`.

`file-system-key-cipher` (type: maybe-string)
: Cipher name used by the target volume.

`file-system-key-hash` (type: maybe-string)
: SSL hash name used by the target volume.

`file-system-key-file-name` (type: maybe-string)
: File name of the file system key for the target volume.

11.10.34 Serviços Guix

Build Farm Front-End (BFFE)

The Build Farm Front-End (`https://git.cbaines.net/guix/bffe/`) assists with building Guix packages in bulk. It's responsible for submitting builds and displaying the status of the build farm.

`bffe-service-type` [Variável]
: Service type for the Build Farm Front-End. Its value must be a `bffe-configuration` object.

`bffe-configuration` [Data Type]
: Data type representing the configuration of the Build Farm Front-End.

  `package` (default: `bffe`)
  : The Build Farm Front-End package to use.

  `user` (default: `"bffe"`)
  : The system user to run the service as.

  `group` (default: `"bffe"`)
  : The system group to run the service as.

  `arguments`
  : A list of arguments to the Build Farm Front-End. These are passed to the `run-bffe-service` procedure when starting the service.

    For example, the following value directs the Build Farm Front-End to submit builds for derivations available from `data.guix.gnu.org` to the Build Coordinator instance assumed to be running on the same machine.

```
(list
 #:build
 (list
  (build-from-guix-data-service
   (data-service-url "https://data.guix.gnu.org")
```

```
                    (build-coordinator-url "http://127.0.0.1:8746")
                    (branches '("master"))
                    (systems '("x86_64-linux" "i686-linux"))
                    (systems-and-targets
                     (map (lambda (target)
                            (cons "x86_64-linux" target))
                          '("aarch64-linux-gnu"
                            "i586-pc-gnu")))
                    (build-priority (const 0))))
                  #:web-server-args
                  '(#:event-source "https://example.com"
                    #:controller-args
                    (#:title "example.com build farm")))
```

`extra-environment-variables` (default: *'()*)
: Extra environment variables to set via the shepherd service.

Guix Build Coordinator

The Guix Build Coordinator (`https://git.cbaines.net/guix/build-coordinator/`) aids in distributing derivation builds among machines running an *agent*. The build daemon is still used to build the derivations, but the Guix Build Coordinator manages allocating builds and working with the results.

The Guix Build Coordinator consists of one *coordinator*, and one or more connected *agent* processes. The coordinator process handles clients submitting builds, and allocating builds to agents. The agent processes talk to a build daemon to actually perform the builds, then send the results back to the coordinator.

There is a script to run the coordinator component of the Guix Build Coordinator, but the Guix service uses a custom Guile script instead, to provide better integration with G-expressions used in the configuration.

`guix-build-coordinator-service-type` [Variável]
: Service type for the Guix Build Coordinator. Its value must be a `guix-build-coordinator-configuration` object.

`guix-build-coordinator-configuration` [Data Type]
: Data type representing the configuration of the Guix Build Coordinator.

  `package` (default: `guix-build-coordinator`)
  : The Guix Build Coordinator package to use.

  `user` (default: `"guix-build-coordinator"`)
  : The system user to run the service as.

  `group` (default: `"guix-build-coordinator"`)
  : The system group to run the service as.

  `database-uri-string` (default: `"sqlite:///var/lib/guix-build-coordinator/guix_build_coordinator.db"`)
  : The URI to use for the database.

`agent-communication-uri` (default: `"http://0.0.0.0:8745"`)
: The URI describing how to listen to requests from agent processes.

`client-communication-uri` (default: `"http://127.0.0.1:8746"`)
: The URI describing how to listen to requests from clients. The client API allows submitting builds and currently isn't authenticated, so take care when configuring this value.

`allocation-strategy` (default: `#~basic-build-allocation-strategy`)
: A G-expression for the allocation strategy to be used. This is a procedure that takes the datastore as an argument and populates the allocation plan in the database.

`hooks` (default: *'()*)
: An association list of hooks. These provide a way to execute arbitrary code upon certain events, like a build result being processed.

`parallel-hooks` (default: *'()*)
: Hooks can be configured to run in parallel. This parameter is an association list of hooks to do in parallel, where the key is the symbol for the hook and the value is the number of threads to run.

`guile` (default: `guile-3.0-latest`)
: The Guile package with which to run the Guix Build Coordinator.

`extra-environment-variables` (default: *'()*)
: Extra environment variables to set via the shepherd service.

`guix-build-coordinator-agent-service-type` [Variável]
: Service type for a Guix Build Coordinator agent. Its value must be a `guix-build-coordinator-agent-configuration` object.

`guix-build-coordinator-agent-configuration` [Data Type]
: Data type representing the configuration a Guix Build Coordinator agent.

`package` (default: `guix-build-coordinator/agent-only`)
: The Guix Build Coordinator package to use.

`user` (default: `"guix-build-coordinator-agent"`)
: The system user to run the service as.

`coordinator` (default: `"http://localhost:8745"`)
: The URI to use when connecting to the coordinator.

`authentication`
: Record describing how this agent should authenticate with the coordinator. Possible record types are described below.

`systems` (default: `#f`)
: The systems for which this agent should fetch builds. The agent process will use the current system it's running on as the default.

`max-parallel-builds` (default: `#f`)
: The number of builds to perform in parallel.

`max-parallel-uploads` (default: `#f`)
: The number of uploads to perform in parallel.

`max-allocated-builds` (default: `#f`)
: The maximum number of builds this agent can be allocated.

`max-1min-load-average` (default: `#f`)
: Load average value to look at when considering starting new builds, if the 1 minute load average exceeds this value, the agent will wait before starting new builds.

  This will be unspecified if the value is `#f`, and the agent will use the number of cores reported by the system as the max 1 minute load average.

`derivation-substitute-urls` (default: `#f`)
: URLs from which to attempt to fetch substitutes for derivations, if the derivations aren't already available.

`non-derivation-substitute-urls` (default: `#f`)
: URLs from which to attempt to fetch substitutes for build inputs, if the input store items aren't already available.

`extra-options` (default: *'()*)
: Extra command line options for `guix-build-coordinator-agent`.

`guix-build-coordinator-agent-password-auth` [Data Type]
Data type representing an agent authenticating with a coordinator via a UUID and password.

`uuid` The UUID of the agent. This should be generated by the coordinator process, stored in the coordinator database, and used by the intended agent.

`senha` The password to use when connecting to the coordinator.

`guix-build-coordinator-agent-password-file-auth` [Data Type]
Data type representing an agent authenticating with a coordinator via a UUID and password read from a file.

`uuid` The UUID of the agent. This should be generated by the coordinator process, stored in the coordinator database, and used by the intended agent.

`password-file`
: A file containing the password to use when connecting to the coordinator.

`guix-build-coordinator-agent-dynamic-auth` [Data Type]
Data type representing an agent authenticating with a coordinator via a dynamic auth token and agent name.

`agent-name`
: Name of an agent, this is used to match up to an existing entry in the database if there is one. When no existing entry is found, a new entry is automatically added.

`token` Dynamic auth token, this is created and stored in the coordinator database, and is used by the agent to authenticate.

`guix-build-coordinator-agent-dynamic-auth-with-file` [Data Type]
Data type representing an agent authenticating with a coordinator via a dynamic auth token read from a file and agent name.

`agent-name`
Name of an agent, this is used to match up to an existing entry in the database if there is one. When no existing entry is found, a new entry is automatically added.

`token-file`
File containing the dynamic auth token, this is created and stored in the coordinator database, and is used by the agent to authenticate.

Guix Data Service

The Guix Data Service (`http://data.guix.gnu.org`) processes, stores and provides data about GNU Guix. This includes information about packages, derivations and lint warnings.

The data is stored in a PostgreSQL database, and available through a web interface.

`guix-data-service-type` [Variável]
Service type for the Guix Data Service. Its value must be a `guix-data-service-configuration` object. The service optionally extends the getmail service, as the guix-commits mailing list is used to find out about changes in the Guix git repository.

`guix-data-service-configuration` [Data Type]
Data type representing the configuration of the Guix Data Service.

`package` (default: `guix-data-service`)
The Guix Data Service package to use.

`user` (default: `"guix-data-service"`)
The system user to run the service as.

`group` (default: `"guix-data-service"`)
The system group to run the service as.

`port` (default: `8765`)
The port to bind the web service to.

`host` (default: `"127.0.0.1"`)
The host to bind the web service to.

`getmail-idle-mailboxes` (default: `#f`)
If set, this is the list of mailboxes that the getmail service will be configured to listen to.

`commits-getmail-retriever-configuration` (default: `#f`)
If set, this is the `getmail-retriever-configuration` object with which to configure getmail to fetch mail from the guix-commits mailing list.

`extra-options` (default: *'()*)
Extra command line options for `guix-data-service`.

`extra-process-jobs-options` (default: *'()*)
: Extra command line options for `guix-data-service-process-jobs`.

Guix Home Service

The Guix Home service is a way to let Guix System deploy the home environment of one or more users (veja Capítulo 13 [Home Configuration], Página 652, for more on Guix Home). That way, the system configuration embeds declarations of the home environment of those users and can be used to deploy everything consistently at once, saving users the need to run `guix home reconfigure` independently.

`guix-home-service-type` [Variável]
: Service type for the Guix Home service. Its value must be a list of lists containing user and home environment pairs. The key of each pair is a string representing the user to deploy the configuration under and the value is a home-environment configuration.

```
(use-modules (gnu home))

(define my-home
  (home-environment
    ...))

(operating-system
  (services (append (list (service guix-home-service-type
                                   `(("alice" ,my-home))))
                    %base-services)))
```

This service can be extended by other services to add additional home environments, as in this example:

```
(simple-service 'my-extra-home guix-home-service-type
                `(("bob" ,my-extra-home))))
```

Nar Herder

The Nar Herder (`https://git.cbaines.net/guix/nar-herder/about/`) is a utility for managing a collection of nars.

`nar-herder-type` [Variável]
: Service type for the Guix Data Service. Its value must be a `nar-herder-configuration` object. The service optionally extends the getmail service, as the guix-commits mailing list is used to find out about changes in the Guix git repository.

`nar-herder-configuration` [Data Type]
: Data type representing the configuration of the Guix Data Service.

`package` (default: `nar-herder`)
: The Nar Herder package to use.

`user` (default: `"nar-herder"`)
: The system user to run the service as.

`group` (default: `"nar-herder"`)
: The system group to run the service as.

`port` (default: `8734`)
: The port to bind the server to.

`host` (default: `"127.0.0.1"`)
: The host to bind the server to.

`mirror` (default: `#f`)
: Optional URL of the other Nar Herder instance which should be mirrored. This means that this Nar Herder instance will download it's database, and keep it up to date.

`database` (default: `"/var/lib/nar-herder/nar_herder.db"`)
: Location for the database. If this Nar Herder instance is mirroring another, the database will be downloaded if it doesn't exist. If this Nar Herder instance isn't mirroring another, an empty database will be created.

`database-dump` (default: `"/var/lib/nar-herder/nar_herder_dump.db"`)
: Location of the database dump. This is created and regularly updated by taking a copy of the database. This is the version of the database that is available to download.

`storage` (default: `#f`)
: Optional location in which to store nars.

`storage-limit` (default: `"none"`)
: Limit in bytes for the nars stored in the storage location. This can also be set to "none" so that there is no limit.

  When the storage location exceeds this size, nars are removed according to the nar removal criteria.

`storage-nar-removal-criteria` (default: `'()`)
: Criteria used to remove nars from the storage location. These are used in conjunction with the storage limit.

  When the storage location exceeds the storage limit size, nars will be checked against the nar removal criteria and if any of the criteria match, they will be removed. This will continue until the storage location is below the storage limit size.

  Each criteria is specified by a string, then an equals sign, then another string. Currently, only one criteria is supported, checking if a nar is stored on another Nar Herder instance.

`ttl` (default: `#f`)
: Produce `Cache-Control` HTTP headers that advertise a time-to-live (TTL) of *ttl*. *ttl* must denote a duration: `5d` means 5 days, `1m` means 1 month, and so on.

  This allows the user's Guix to keep substitute information in cache for *ttl*.

`new-ttl` (default: `#f`)
: If specified, this will override the `ttl` setting when used for the `Cache-Control` headers, but this value will be used when scheduling the removal of nars.

  Use this setting when the TTL is being reduced to avoid removing nars while clients still have cached narinfos.

`negative-ttl` (default: `#f`)
: Similarly produce `Cache-Control` HTTP headers to advertise the time-to-live (TTL) of *negative* lookups—missing store items, for which the HTTP 404 code is returned. By default, no negative TTL is advertised.

`log-level` (default: `'DEBUG`)
: Log level to use, specify a log level like `'INFO` to stop logging individual requests.

`cached-compressions` (default: `'()`)
: Activate generating cached nars with different compression details from the stored nars. This is a list of nar-herder-cached-compression-configuration records.

`min-uses` (default: `3`)
: When cached-compressions are enabled, generate cached nars when at least this number of requests are made for a nar.

`workers` (default: `2`)
: Number of cached nars to generate at a time.

`nar-source` (default: `#f`)
: Location to fetch nars from when computing cached compressions. By default, the storage location will be used.

`extra-environment-variables` (default: `'()`)
: Extra environment variables to set via the shepherd service.

`nar-herder-cached-compression-configuration` [Data Type]

Data type representing the cached compression configuration.

`tipo` Type of compression to use, e.g. `'zstd`.

`workers` (default: `#f`)
: Level of the compression to use.

`directory` (default: `#f`)
: Location to store the cached nars. If unspecified, they will be stored in /var/cache/nar-herder/nar/TYPE.

`directory-max-size` (default: `#f`)
: Maximum size in bytes of the directory.

`unused-removal-duration` (default: `#f`)
: If a cached nar isn't used for `unused-removal-duration`, it will be scheduled for removal.

  unused-removal-duration must denote a duration: `5d` means 5 days, `1m` means 1 month, and so on.

`ttl` (default: `#f`)
: If specified this overrides the `ttl` used for narinfos when this cached compression is available.

`new-ttl` (default: `#f`)
: As with the `new-ttl` option for `nar-herder-configuration`, this value will override the `ttl` when used for narinfo requests.

11.10.35 Serviços Linux

Early OOM Service

Early OOM (`https://github.com/rfjakob/earlyoom`), also known as Earlyoom, is a minimalist out of memory (OOM) daemon that runs in user space and provides a more responsive and configurable alternative to the in-kernel OOM killer. It is useful to prevent the system from becoming unresponsive when it runs out of memory.

`earlyoom-service-type` [Variável]
: The service type for running `earlyoom`, the Early OOM daemon. Its value must be a `earlyoom-configuration` object, described below. The service can be instantiated in its default configuration with:

```
(service earlyoom-service-type)
```

`earlyoom-configuration` [Data Type]
: This is the configuration record for the `earlyoom-service-type`.

`earlyoom` (default: *earlyoom*)
: The Earlyoom package to use.

`minimum-available-memory` (default: `10`)
: The threshold for the minimum *available* memory, in percentages.

`minimum-free-swap` (default: `10`)
: The threshold for the minimum free swap memory, in percentages.

`prefer-regexp` (default: `#f`)
: A regular expression (as a string) to match the names of the processes that should be preferably killed.

`avoid-regexp` (default: `#f`)
: A regular expression (as a string) to match the names of the processes that should *not* be killed.

`memory-report-interval` (default: `0`)
: The interval in seconds at which a memory report is printed. It is disabled by default.

`ignore-positive-oom-score-adj?` (default: `#f`)
: A boolean indicating whether the positive adjustments set in `/proc/*/oom_score_adj` should be ignored.

`show-debug-messages?` (default: `#f`)
: A boolean indicating whether debug messages should be printed. The logs are saved at `/var/log/earlyoom.log`.

`send-notification-command` (default: `#f`)
: This can be used to provide a custom command used for sending notifications.

fstrim Service

The command `fstrim` can be used to discard (or *trim*) unused blocks on a mounted file system.

> **Aviso:** Running `fstrim` frequently, or even using `mount -o discard`, might negatively affect the lifetime of poor-quality SSD devices. For most desktop and server systems a sufficient trimming frequency is once a week. Note that not all devices support a queued trim, so each trim command incurs a performance penalty on whatever else might be trying to use the disk at the time.

`fstrim-service-type` [Variável]
: Type for a service that periodically runs `fstrim`, whose value must be an `<fstrim-configuration>` object. The service can be instantiated in its default configuration with:

```
(service fstrim-service-type)
```

`fstrim-configuration` [Data Type]
: Available `fstrim-configuration` fields are:

`package` (default: `util-linux`) (type: file-like)
: The package providing the `fstrim` command.

`schedule` (default: `"0 0 * * 0"`) (type: mcron-time)
: Schedule for launching `fstrim`. This can be a procedure, a list or a string. For additional information, see Seção “Job specification” em *the mcron manual*. By default this is set to run weekly on Sunday at 00:00.

`listed-in` (default: `'("/etc/fstab" "/proc/self/mountinfo")`) (type: maybe-list-of-strings)
: List of files in fstab or kernel mountinfo format. All missing or empty files are silently ignored. The evaluation of the list *stops* after the first non-empty file. File systems with `X-fstrim.notrim` mount option in fstab are skipped.

`verbose?` (default: `#t`) (type: boolean)
: Verbose execution.

`quiet-unsupported?` (default: `#t`) (type: boolean)
: Suppress error messages if trim operation (ioctl) is unsupported.

`extra-arguments` (type: maybe-list-of-strings)
: Extra options to append to `fstrim` (run ‘`man fstrim`’ for more information).

Kernel Module Loader Service

The kernel module loader service allows one to load loadable kernel modules at boot. This is especially useful for modules that don’t autoload and need to be manually loaded, as is the case with `ddcci`.

`kernel-module-loader-service-type` [Variável]

The service type for loading loadable kernel modules at boot with `modprobe`. Its value must be a list of strings representing module names. For example loading the drivers provided by `ddcci-driver-linux`, in debugging mode by passing some module parameters, can be done as follow:

```
(use-modules (gnu) (gnu services))
(use-package-modules linux)
(use-service-modules linux)

(define ddcci-config
  (plain-file "ddcci.conf"
              "options ddcci dyndbg delay=120"))

(operating-system
  ...
  (services (cons* (service kernel-module-loader-service-type
                            '("ddcci" "ddcci_backlight"))
                   (simple-service 'ddcci-config etc-service-type
                                   (list `("modprobe.d/ddcci.conf"
                                           ,ddcci-config)))
                   %base-services))
  (kernel-loadable-modules (list ddcci-driver-linux)))
```

Cachefilesd Service

The Cachefilesd service starts a daemon that caches network file system data locally. It is especially useful for NFS and AFS shares, where it reduces latencies for repeated access when reading files.

The daemon can be configured as follows:

```
(service cachefilesd-service-type
         (cachefilesd-configuration
           (cache-directory "/var/cache/fscache")))
```

`cachefilesd-service-type` [Variável]

The service type for starting `cachefilesd`. The value for this service type is a `cachefilesd-configuration`, whose only required field is *cache-directory*.

`cachefilesd-configuration` [Data Type]

Available `cachefilesd-configuration` fields are:

`cachefilesd` (default: `cachefilesd`) (type: file-like)
The cachefilesd package to use.

`debug-output?` (default: `#f`) (type: boolean)
Print debugging output to stderr.

`use-syslog?` (default: `#t`) (type: boolean)
Log to syslog facility instead of stdout.

`scan?` (default: `#t`) (type: boolean)
Scan for cachable objects.

`cache-directory` (type: maybe-string)
Location of the cache directory.

`cache-name` (default: `"CacheFiles"`) (type: maybe-string)
Name of cache (keep unique).

`security-context` (type: maybe-string)
SELinux security context.

`pause-culling-for-block-percentage` (default: `7`) (type: maybe-non-negative-integer)
Pause culling when available blocks exceed this percentage.

`pause-culling-for-file-percentage` (default: `7`) (type: maybe-non-negative-integer)
Pause culling when available files exceed this percentage.

`resume-culling-for-block-percentage` (default: `5`) (type: maybe-non-negative-integer)
Start culling when available blocks drop below this percentage.

`resume-culling-for-file-percentage` (default: `5`) (type: maybe-non-negative-integer)
Start culling when available files drop below this percentage.

`pause-caching-for-block-percentage` (default: `1`) (type: maybe-non-negative-integer)
Pause further allocations when available blocks drop below this percentage.

`pause-caching-for-file-percentage` (default: `1`) (type: maybe-non-negative-integer)
Pause further allocations when available files drop below this percentage.

`log2-table-size` (default: `12`) (type: maybe-non-negative-integer)
Size of tables holding cullable objects in logarithm of base 2.

`cull?` (default: `#t`) (type: boolean)
Create free space by culling (consumes system load).

`trace-function-entry-in-kernel-module?` (default: `#f`) (type: boolean)
Trace function entry in the kernel module (for debugging).

`trace-function-exit-in-kernel-module?` (default: `#f`) (type: boolean)
Trace function exit in the kernel module (for debugging).

`trace-internal-checkpoints-in-kernel-module?` (default: `#f`) (type: boolean)
Trace internal checkpoints in the kernel module (for debugging).

Rasdaemon Service

The Rasdaemon service provides a daemon which monitors platform RAS (Reliability, Availability, and Serviceability) reports from Linux kernel trace events, logging them to syslogd.

Reliability, Availability and Serviceability is a concept used on servers meant to measure their robustness.

Relability is the probability that a system will produce correct outputs:

- Generally measured as Mean Time Between Failures (MTBF), and
- Enhanced by features that help to avoid, detect and repair hardware faults

Availability is the probability that a system is operational at a given time:

- Generally measured as a percentage of downtime per a period of time, and
- Often uses mechanisms to detect and correct hardware faults in runtime.

Serviceability is the simplicity and speed with which a system can be repaired or maintained:

- Generally measured on Mean Time Between Repair (MTBR).

Among the monitoring measures, the most usual ones include:

- CPU – detect errors at instruction execution and at L1/L2/L3 caches;
- Memory – add error correction logic (ECC) to detect and correct errors;
- I/O – add CRC checksums for transferred data;
- Storage – RAID, journal file systems, checksums, Self-Monitoring, Analysis and Reporting Technology (SMART).

By monitoring the number of occurrences of error detections, it is possible to identify if the probability of hardware errors is increasing, and, on such case, do a preventive maintenance to replace a degraded component while those errors are correctable.

For detailed information about the types of error events gathered and how to make sense of them, see the kernel administrator's guide at `https://www.kernel.org/doc/html/latest/admin-guide/ras.html`.

`rasdaemon-service-type` [Variável]

Service type for the `rasdaemon` service. It accepts a `rasdaemon-configuration` object. Instantiating like

```
(service rasdaemon-service-type)
```

will load with a default configuration, which monitors all events and logs to syslogd.

`rasdaemon-configuration` [Data Type]

The data type representing the configuration of `rasdaemon`.

`record?` (default: `#f`)

A boolean indicating whether to record the events in an SQLite database. This provides a more structured access to the information contained in the log file. The database location is hard-coded to `/var/lib/rasdaemon/ras-mc_event.db`.

Zram Device Service

The Zram device service provides a compressed swap device in system memory. The Linux Kernel documentation has more information about zram (`https://www.kernel.org/doc/html/latest/admin-guide/blockdev/zram.html`) devices.

`zram-device-service-type` [Variável]

This service creates the zram block device, formats it as swap and enables it as a swap device. The service's value is a `zram-device-configuration` record.

`zram-device-configuration` [Data Type]
This is the data type representing the configuration for the zram-device service.

`size` (default `"1G"`)
This is the amount of space you wish to provide for the zram device. It accepts a string and can be a number of bytes or use a suffix, eg.: `"512M"` or `1024000`.

`compression-algorithm` (default `'lzo`)
This is the compression algorithm you wish to use. It is difficult to list all the possible compression options, but common ones supported by Guix's Linux Libre Kernel include `'lzo`, `'lz4` and `'zstd`.

`memory-limit` (default `0`)
This is the maximum amount of memory which the zram device can use. Setting it to '0' disables the limit. While it is generally expected that compression will be 2:1, it is possible that uncompressable data can be written to swap and this is a method to limit how much memory can be used. It accepts a string and can be a number of bytes or use a suffix, eg.: `"2G"`.

`priority` (default `#f`)
This is the priority of the swap device created from the zram device. Veja Seção 11.6 [Espaço de troca (swap)], Página 259, for a description of swap priorities. You might want to set a specific priority for the zram device, otherwise it could end up not being used much for the reasons described there.

11.10.36 Serviços Hurd

`hurd-console-service-type` [Variável]
This service starts the fancy `VGA` console client on the Hurd.
The service's value is a `hurd-console-configuration` record.

`hurd-console-configuration` [Data Type]
This is the data type representing the configuration for the hurd-console-service.

`hurd` (default: *hurd*)
The Hurd package to use.

`hurd-getty-service-type` [Variável]
This service starts a tty using the Hurd `getty` program.
The service's value is a `hurd-getty-configuration` record.

`hurd-getty-configuration` [Data Type]
This is the data type representing the configuration for the hurd-getty-service.

`hurd` (default: *hurd*)
The Hurd package to use.

`tty` The name of the console this Getty runs on—e.g., `"tty1"`.

`baud-rate` (default: `38400`)
An integer specifying the baud rate of the tty.

11.10.37 Serviços diversos

Fingerprint Service

The `(gnu services authentication)` module provides a DBus service to read and identify fingerprints via a fingerprint sensor.

`fprintd-service-type` [Variável]
The service type for `fprintd`, which provides the fingerprint reading capability.

```
(service fprintd-service-type)
```

System Control Service

The `(gnu services sysctl)` provides a service to configure kernel parameters at boot.

`sysctl-service-type` [Variável]
The service type for `sysctl`, which modifies kernel parameters under `/proc/sys/`. To enable IPv4 forwarding, it can be instantiated as:

```
(service sysctl-service-type
         (sysctl-configuration
           (settings '(("net.ipv4.ip_forward" . "1")))))
```

Since `sysctl-service-type` is used in the default lists of services, `%base-services` and `%desktop-services`, you can use `modify-services` to change its configuration and add the kernel parameters that you want (veja Seção 11.19.3 [Referência de Service], Página 634).

```
(modify-services %base-services
  (sysctl-service-type config =>
                       (sysctl-configuration
                         (settings (append '(("net.ipv4.ip_forward" . "1"))
                                           %default-sysctl-settings)))))
```

`sysctl-configuration` [Data Type]
The data type representing the configuration of `sysctl`.

`sysctl` (default: `(file-append procps "/sbin/sysctl")`)
The `sysctl` executable to use.

`settings` (default: `%default-sysctl-settings`)
An association list specifies kernel parameters and their values.

`%default-sysctl-settings` [Variável]
An association list specifying the default `sysctl` parameters on Guix System.

PC/SC Smart Card Daemon Service

The `(gnu services security-token)` module provides the following service to run `pcscd`, the PC/SC Smart Card Daemon. `pcscd` is the daemon program for pcsc-lite and the MuscleCard framework. It is a resource manager that coordinates communications with smart card readers, smart cards and cryptographic tokens that are connected to the system.

`pcscd-service-type` [Variável]
Service type for the `pcscd` service. Its value must be a `pcscd-configuration` object. To run pcscd in the default configuration, instantiate it as:

```
(service pcscd-service-type)
```

`pcscd-configuration` [Data Type]
The data type representing the configuration of `pcscd`.

`pcsc-lite` (default: `pcsc-lite`)
The pcsc-lite package that provides pcscd.

`usb-drivers` (default: `(list ccid)`)
List of packages that provide USB drivers to pcscd. Drivers are expected to be under `pcsc/drivers` in the store directory of the package.

LIRC Service

The `(gnu services lirc)` module provides the following service.

`lirc-service-type` [Variável]
Type for a service that runs LIRC (`http://www.lirc.org`), a daemon that decodes infrared signals from remote controls.

The value for this service is a `<lirc-configuration>` object.

`lirc-configuration` [Data Type]
Data type representing the configuration of `lircd`.

`lirc` (default: `lirc`) (type: file-like)
Package object for `lirc`.

`device` (default: `#f`) (type: string)
`driver` (default: `#f`) (type: string)
`config-file` (default: `#f`) (type: string-or-file-like)
TODO. See `lircd` manual for details.

`extra-options` (default: `'()`) (type: list-of-string)
Additional command-line options to pass to `lircd`.

SPICE Service

The `(gnu services spice)` module provides the following service.

`spice-vdagent-service-type` [Variável]
Type of the service that runs VDAGENT (`https://www.spice-space.org`), a daemon that enables sharing the clipboard with a vm and setting the guest display resolution when the graphical console window resizes.

`spice-vdagent-configuration` [Data Type]
Data type representing the configuration of `spice-vdagent-service-type`.

`spice-vdagent` (default: `spice-vdagent`) (type: file-like)
Package object for VDAGENT.

inputattach Service

The inputattach (`https://linuxwacom.github.io/`) service allows you to use input devices such as Wacom tablets, touchscreens, or joysticks with the Xorg display server.

`inputattach-service-type` [Variável]
Type of a service that runs `inputattach` on a device and dispatches events from it.

`inputattach-configuration` [Data Type]

`device-type` (default: `"wacom"`)
The type of device to connect to. Run `inputattach --help`, from the `inputattach` package, to see the list of supported device types.

`device` (padrão: `"/dev/ttyS0"`)
The device file to connect to the device.

`baud-rate` (default: `#f`)
Baud rate to use for the serial connection. Should be a number or `#f`.

`log-file` (default: `#f`)
If true, this must be the name of a file to log messages to.

Dictionary Service

The `(gnu services dict)` module provides the following service:

`dicod-service-type` [Variável]
This is the type of the service that runs the `dicod` daemon, an implementation of DICT server (veja Seção "Dicod" em *GNU Dico Manual*).

You can add `open localhost` to your `~/.dico` file to make `localhost` the default server for `dico` client (veja Seção "Initialization File" em *GNU Dico Manual*).

> **Nota:** This service is also available for Guix Home, where it runs directly with your user privileges (veja Seção 13.3.17 [Miscellaneous Home Services], Página 688).

`dicod-configuration` [Data Type]
Data type representing the configuration of dicod.

`dico` (default: *dico*)
Package object of the GNU Dico dictionary server.

`interfaces` (default: *'("localhost")*)
This is the list of IP addresses and ports and possibly socket file names to listen to (veja Seção "Server Settings" em *GNU Dico Manual*).

`handlers` (default: *'()*)
List of `<dicod-handler>` objects denoting handlers (module instances).

`databases` (default: *(list %dicod-database:gcide)*)
List of `<dicod-database>` objects denoting dictionaries to be served.

`dicod-handler` [Data Type]
Data type representing a dictionary handler (module instance).

`name` Name of the handler (module instance).

`module` (default: *#f*)
: Name of the dicod module of the handler (instance). If it is `#f`, the module has the same name as the handler. (veja Seção "Modules" em *GNU Dico Manual*).

`options`
: List of strings or gexps representing the arguments for the module handler

`dicod-database` [Data Type]
: Data type representing a dictionary database.

`name`
: Name of the database, will be used in DICT commands.

`handler`
: Name of the dicod handler (module instance) used by this database (veja Seção "Handlers" em *GNU Dico Manual*).

`complex?` (default: *#f*)
: Whether the database configuration complex. The complex configuration will need a corresponding `<dicod-handler>` object, otherwise not.

`options`
: List of strings or gexps representing the arguments for the database (veja Seção "Databases" em *GNU Dico Manual*).

`%dicod-database:gcide` [Variável]
: A `<dicod-database>` object serving the GNU Collaborative International Dictionary of English using the `gcide` package.

The following is an example `dicod-service-type` configuration.

```
(service dicod-service-type
         (dicod-configuration
          (handlers (list
                     (dicod-handler
                      (name "wordnet")
                      (module "wordnet")
                      (options
                       (list #~(string-append "wnhome=" #$wordnet))))))
          (databases (list
                      (dicod-database
                       (name "wordnet")
                       (complex? #t)
                       (handler "wordnet"))
                      %dicod-database:gcide))))
```

Docker Service

The `(gnu services docker)` module provides the following services.

`containerd-service-type` [Variável]
: This service type operates containerd containerd (`https://containerd.io`), a daemon responsible for overseeing the entire container lifecycle on its host system. This includes image handling, storage management, container execution, supervision, low-level storage operations, network connections, and more.

`containerd-configuration` [Data Type]

This is the data type representing the configuration of containerd.

`containerd` (default: `containerd`)
: The containerd daemon package to use.

`debug?` (default `#f`)
: Enable or disable debug output.

`environment-variables` (default: `'()`)
: List of environment variables to set for `containerd`.

: This must be a list of strings where each string has the form '*`key=value`*' as in this example:

```
(list "HTTP_PROXY=socks5://127.0.0.1:9150"
      "HTTPS_PROXY=socks5://127.0.0.1:9150")
```

`docker-service-type` [Variável]

This is the type of the service that runs Docker (`https://www.docker.com`), a daemon that can execute application bundles (sometimes referred to as "containers") in isolated environments.

The `containerd-service-type` service need to be added to a system configuration, otherwise a message about not any service provides `containerd` will be displayed during `guix system reconfigure`.

`docker-configuration` [Data Type]

This is the data type representing the configuration of Docker and Containerd.

`docker` (default: `docker`)
: The Docker daemon package to use.

`docker-cli` (default: `docker-cli`)
: The Docker client package to use.

`containerd` (default: *containerd*)
: This field is deprecated in favor of `containerd-service-type` service.

`proxy` (default *docker-libnetwork-cmd-proxy*)
: The Docker user-land networking proxy package to use.

`enable-proxy?` (default `#t`)
: Enable or disable the use of the Docker user-land networking proxy.

`debug?` (default `#f`)
: Enable or disable debug output.

`enable-iptables?` (default `#t`)
: Enable or disable the addition of iptables rules.

`environment-variables` (default: `'()`)
: List of environment variables to set for `dockerd`.

: This must be a list of strings where each string has the form '*`key=value`*' as in this example:

```
(list "LANGUAGE=eo:ca:eu"
      "TMPDIR=/tmp/dockerd")
```

`config-file` (type: maybe-file-like)
JSON configuration file pass to `dockerd`.

`singularity-service-type` [Variável]
This is the type of the service that allows you to run Singularity (`https://www.sylabs.io/singularity/`), a Docker-style tool to create and run application bundles (aka. "containers"). The value for this service is the Singularity package to use.

The service does not install a daemon; instead, it installs helper programs as setuid-root (veja Seção 11.11 [Privileged Programs], Página 603) such that unprivileged users can invoke `singularity run` and similar commands.

OCI backed services

Should you wish to manage your Docker containers with the same consistent interface you use for your other Shepherd services, *oci-container-service-type* is the tool to use: given an Open Container Initiative (OCI) container image, it will run it in a Shepherd service. One example where this is useful: it lets you run services that are available as Docker/OCI images but not yet packaged for Guix.

`oci-container-service-type` [Variável]
This is a thin wrapper around Docker's CLI that executes OCI images backed processes as Shepherd Services.

```
(service oci-container-service-type
         (list
          (oci-container-configuration
           (network "host")
           (image
            (oci-image
             (repository "guile")
             (tag "3")
             (value (specifications->manifest '("guile")))
             (pack-options '(#:symlinks (("/bin/guile" -> "bin/guile"))
                             #:max-layers 2))))
           (entrypoint "/bin/guile")
           (command
            '("-c" "(display \"hello!\n\")")))
          (oci-container-configuration
           (image "prom/prometheus")
           (ports
             '(("9000" . "9000")
               ("9090" . "9090"))))
          (oci-container-configuration
           (image "grafana/grafana:10.0.1")
           (network "host")
           (volumes
             '("/var/lib/grafana:/var/lib/grafana")))))
```

In this example three different Shepherd services are going to be added to the system. Each `oci-container-configuration` record translates to a `docker run` invocation

and its fields directly map to options. You can refer to the upstream (`https://docs.docker.com/engine/reference/commandline/run`) documentation for the semantics of each value. If the images are not found, they will be pulled (`https://docs.docker.com/engine/reference/commandline/pull/`). The services with `(network "host")` are going to be attached to the host network and are supposed to behave like native processes with regard to networking.

`oci-container-configuration` [Data Type]

Available `oci-container-configuration` fields are:

`user` (default: `"oci-container"`) (type: string)
: The user under whose authority docker commands will be run.

`group` (default: `"docker"`) (type: string)
: The group under whose authority docker commands will be run.

`command` (default: `'()`) (type: list-of-strings)
: Overwrite the default command (`CMD`) of the image.

`entrypoint` (default: `""`) (type: string)
: Overwrite the default entrypoint (`ENTRYPOINT`) of the image.

`host-environment` (default: `'()`) (type: list)
: Set environment variables in the host environment where `docker run` is invoked. This is especially useful to pass secrets from the host to the container without having them on the `docker run`'s command line: by setting the `MYSQL_PASSWORD` on the host and by passing `--env MYSQL_PASSWORD` through the `extra-arguments` field, it is possible to securely set values in the container environment. This field's value can be a list of pairs or strings, even mixed:

```
(list '("LANGUAGE\" . "eo:ca:eu")
      "JAVA_HOME=/opt/java")
```

Pair members can be strings, gexps or file-like objects. Strings are passed directly to `make-forkexec-constructor`.

`environment` (default: `'()`) (type: list)
: Set environment variables. This can be a list of pairs or strings, even mixed:

```
(list '("LANGUAGE" . "eo:ca:eu")
      "JAVA_HOME=/opt/java")
```

Pair members can be strings, gexps or file-like objects. Strings are passed directly to the Docker CLI. You can refer to the upstream (`https://docs.docker.com/engine/reference/commandline/run/#env`) documentation for semantics.

`image` (type: string-or-oci-image)
: The image used to build the container. It can be a string or an `oci-image` record. Strings are resolved by the Docker Engine, and follow the usual format `myregistry.local:5000/testing/test-image:tag`.

`provision` (default: `""`) (type: string)
: Set the name of the provisioned Shepherd service.

`requirement` (default: `'()`) (type: list-of-symbols)
: Set additional Shepherd services dependencies to the provisioned Shepherd service.

`log-file` (type: maybe-string)
: When `log-file` is set, it names the file to which the service's standard output and standard error are redirected. `log-file` is created if it does not exist, otherwise it is appended to.

`auto-start?` (default: `#t`) (type: boolean)
: Whether this service should be started automatically by the Shepherd. If it is `#f`, the service has to be started manually with `herd start`.

`respawn?` (default: `#f`) (type: boolean)
: Whether to have Shepherd restart the service when it stops, for instance when the underlying process dies.

`shepherd-actions` (default: `'()`) (type: list-of-symbols)
: This is a list of `shepherd-action` records defining actions supported by the service.

`network` (default: `""`) (type: string)
: Set a Docker network for the spawned container.

`ports` (default: `'()`) (type: list)
: Set the port or port ranges to expose from the spawned container. This can be a list of pairs or strings, even mixed:

```
(list '("8080" . "80")
      "10443:443")
```

: Pair members can be strings, gexps or file-like objects. Strings are passed directly to the Docker CLI. You can refer to the upstream (`https://docs.docker.com/engine/reference/commandline/run/#publish`) documentation for semantics.

`volumes` (default: `'()`) (type: list)
: Set volume mappings for the spawned container. This can be a list of pairs or strings, even mixed:

```
(list '("/root/data/grafana" . "/var/lib/grafana")
      "/gnu/store:/gnu/store")
```

: Pair members can be strings, gexps or file-like objects. Strings are passed directly to the Docker CLI. You can refer to the upstream (`https://docs.docker.com/engine/reference/commandline/run/#volume`) documentation for semantics.

`container-user` (default: `""`) (type: string)
: Set the current user inside the spawned container. You can refer to the upstream (`https://docs.docker.com/engine/reference/run/#user`) documentation for semantics.

`workdir` (default: `""`) (type: string)
: Set the current working directory for the spawned Shepherd service. You can refer to the upstream (`https://docs.docker.com/engine/reference/run/#workdir`) documentation for semantics.

`extra-arguments` (default: `'()`) (type: list)
: A list of strings, gexps or file-like objects that will be directly passed to the `docker run` invocation.

`oci-image` [Data Type]

Available `oci-image` fields are:

`repository` (type: string)
: A string like `myregistry.local:5000/testing/test-image` that names the OCI image.

`tag` (default: `"latest"`) (type: string)
: A string representing the OCI image tag. Defaults to `latest`.

`value` (type: oci-lowerable-image)
: A `manifest` or `operating-system` record that will be lowered into an OCI compatible tarball. Otherwise this field's value can be a gexp or a file-like object that evaluates to an OCI compatible tarball.

`pack-options` (default: `'()`) (type: list)
: An optional set of keyword arguments that will be passed to the `docker-image` procedure from `guix scripts pack`. They can be used to replicate `guix pack` behavior:

```
(oci-image
  (repository "guile")
  (tag "3")
  (value
    (specifications->manifest '("guile")))
  (pack-options '(#:symlinks (("/bin/guile" -> "bin/guile"))
                  #:max-layers 2)))
```

  If the `value` field is an `operating-system` record, this field's value will be ignored.

`system` (default: `""`) (type: string)
: Attempt to build for a given system, e.g. `"i686-linux"`

`target` (default: `""`) (type: string)
: Attempt to cross-build for a given triple, e.g. `"aarch64-linux-gnu"`

`grafts?` (default: `#f`) (type: boolean)
: Whether to allow grafting or not in the pack build.

Auditd Service

The `(gnu services auditd)` module provides the following service.

`auditd-service-type` [Variável]

This is the type of the service that runs auditd (`https://people.redhat.com/sgrubb/audit/`), a daemon that tracks security-relevant information on your system.

Examples of things that can be tracked:

1. File accesses
2. System calls
3. Invoked commands
4. Failed login attempts
5. Firewall filtering
6. Network access

`auditctl` from the `audit` package can be used in order to add or remove events to be tracked (until the next reboot). In order to permanently track events, put the command line arguments of auditctl into a file called `audit.rules` in the configuration directory (see below). `aureport` from the `audit` package can be used in order to view a report of all recorded events. The audit daemon by default logs into the file `/var/log/audit.log`.

`auditd-configuration` [Data Type]

This is the data type representing the configuration of auditd.

`audit` (default: `audit`)
: The audit package to use.

`configuration-directory` (default: `%default-auditd-configuration-directory`)
: The directory containing the configuration file for the audit package, which must be named `auditd.conf`, and optionally some audit rules to instantiate on startup.

R-Shiny service

The `(gnu services science)` module provides the following service.

`rshiny-service-type` [Variável]

This is a type of service which is used to run a webapp created with `r-shiny`. This service sets the `R_LIBS_USER` environment variable and runs the provided script to call `runApp`.

`rshiny-configuration` [Data Type]

This is the data type representing the configuration of rshiny.

`package` (default: `r-shiny`)
: The package to use.

`binary` (default `"rshiny"`)
: The name of the binary or shell script located at `package/bin/` to run when the service is run.

  The common way to create this file is as follows:

  ...

```
(let* ((out       (assoc-ref %outputs "out"))
       (targetdir (string-append out "/share/" ,name))
       (app       (string-append out "/bin/" ,name))
       (Rbin      (search-input-file %build-inputs "/bin/Rscript")
  ;; ...
  (mkdir-p (string-append out "/bin"))
  (call-with-output-file app
    (lambda (port)
      (format port
"#!~a
library(shiny)
setwd(\"~a\")
runApp(launch.browser=0, port=4202)~%\n"
      Rbin targetdir))))
```

Nix service

The `(gnu services nix)` module provides the following service.

`nix-service-type` [Variável]

This is the type of the service that runs build daemon of the Nix (`https://nixos.org/nix/`) package manager. Here is an example showing how to use it:

```
(use-modules (gnu))
(use-service-modules nix)
(use-package-modules package-management)

(operating-system
  ;; ...
  (packages (append (list nix)
                    %base-packages))

  (services (append (list (service nix-service-type))
                    %base-services)))
```

After `guix system reconfigure` configure Nix for your user:

- Add a Nix channel and update it. See Nix channels (`https://wiki.nixos.org/wiki/Nix_channels`) for more information about the available channels. If you would like to use the unstable Nix channel you can do this by running:

```
$ nix-channel --add https://nixos.org/channels/nixpkgs-unstable
$ nix-channel --update
```

- Create your Nix profile directory:

```
$ sudo mkdir -p /nix/var/nix/profiles/per-user/$USER
$ sudo chown $USER:root /nix/var/nix/profiles/per-user/$USER
```

- Create a symlink to your profile and activate Nix profile:

```
$ ln -s "/nix/var/nix/profiles/per-user/$USER/profile" ~/.nix-profile
$ source /run/current-system/profile/etc/profile.d/nix.sh
```

`nix-configuration` [Data Type]

This data type represents the configuration of the Nix daemon.

`nix` (default: `nix`)
The Nix package to use.

`sandbox` (default: `#t`)
Specifies whether builds are sandboxed by default.

`build-directory` (default: `"/tmp"`)
The directory where build directory are stored during builds. This is useful to change if, for example, the default location does not have enough space to hold build trees for big packages.

This is similar to setting the `TMPDIR` environment variable for `guix-daemon`. Seção 2.2.1 [Configuração do ambiente de compilação], Página 6, for more info.

`build-sandbox-items` (default: `'()`)
This is a list of strings or objects appended to the `build-sandbox-items` field of the configuration file.

`extra-config` (default: `'()`)
This is a list of strings or objects appended to the configuration file. It is used to pass extra text to be added verbatim to the configuration file.

`extra-options` (default: `'()`)
Extra command line options for `nix-service-type`.

Fail2Ban service

`fail2ban` (`http://www.fail2ban.org/`) scans log files (e.g. `/var/log/apache/error_log`) and bans IP addresses that show malicious signs – repeated password failures, attempts to make use of exploits, etc.

`fail2ban-service-type` service type is provided by the `(gnu services security)` module.

This service type runs the `fail2ban` daemon. It can be configured in various ways, which are:

Basic configuration
The basic parameters of the Fail2Ban service can be configured via its `fail2ban` configuration, which is documented below.

User-specified jail extensions
The `fail2ban-jail-service` function can be used to add new Fail2Ban jails.

Shepherd extension mechanism
Service developers can extend the `fail2ban-service-type` service type itself via the usual service extension mechanism.

`fail2ban-service-type` [Variável]

This is the type of the service that runs `fail2ban` daemon. Below is an example of a basic, explicit configuration:

```
(append
```

```
(list
 (service fail2ban-service-type
          (fail2ban-configuration
           (extra-jails
            (list
             (fail2ban-jail-configuration
              (name "sshd")
              (enabled? #t))))))
 ;; There is no implicit dependency on an actual SSH
 ;; service, so you need to provide one.
 (service openssh-service-type))
%base-services)
```

`fail2ban-jail-service` *svc-type jail* [Procedure]

Extend *svc-type*, a `<service-type>` object with *jail*, a `fail2ban-jail-configuration` object.

Por exemplo:

```
(append
 (list
  (service
   ;; The 'fail2ban-jail-service' procedure can extend any service type
   ;; with a fail2ban jail.  This removes the requirement to explicitly
   ;; extend services with fail2ban-service-type.
   (fail2ban-jail-service
    openssh-service-type
    (fail2ban-jail-configuration
     (name "sshd")
     (enabled? #t)))
   (openssh-configuration ...))))
```

Below is the reference for the different `jail-service-type` configuration records.

`fail2ban-configuration` [Data Type]

Available `fail2ban-configuration` fields are:

`fail2ban` (default: `fail2ban`) (type: package)
: The `fail2ban` package to use. It is used for both binaries and as base default configuration that is to be extended with `<fail2ban-jail-configuration>` objects.

`run-directory` (default: `"/var/run/fail2ban"`) (type: string)
: The state directory for the `fail2ban` daemon.

`jails` (default: `'()`) (type: list-of-fail2ban-jail-configurations)
: Instances of `<fail2ban-jail-configuration>` collected from extensions.

`extra-jails` (default: `'()`) (type: list-of-fail2ban-jail-configurations)
: Instances of `<fail2ban-jail-configuration>` explicitly provided.

`extra-content` (default: `'()`) (type: text-config)
: Extra raw content to add to the end of the `jail.local` file, provided as a list of file-like objects.

`fail2ban-ignore-cache-configuration` [Data Type]

Available `fail2ban-ignore-cache-configuration` fields are:

`key` (type: string)
: Cache key.

`max-count` (type: integer)
: Cache size.

`max-time` (type: integer)
: Cache time.

`fail2ban-jail-action-configuration` [Data Type]

Available `fail2ban-jail-action-configuration` fields are:

`name` (type: string)
: Action name.

`arguments` (default: `'()`) (type: list-of-arguments)
: Action arguments.

`fail2ban-jail-configuration` [Data Type]

Available `fail2ban-jail-configuration` fields are:

`name` (type: string)
: Required name of this jail configuration.

`enabled?` (default: `#t`) (type: boolean)
: Whether this jail is enabled.

`backend` (type: maybe-symbol)
: Backend to use to detect changes in the `log-path`. The default is 'auto. To consult the defaults of the jail configuration, refer to the `/etc/fail2ban/jail.conf` file of the `fail2ban` package.

`max-retry` (type: maybe-integer)
: The number of failures before a host gets banned (e.g. `(max-retry 5)`).

`max-matches` (type: maybe-integer)
: The number of matches stored in ticket (resolvable via tag `<matches>`) in action.

`find-time` (type: maybe-string)
: The time window during which the maximum retry count must be reached for an IP address to be banned. A host is banned if it has generated `max-retry` during the last `find-time` seconds (e.g. `(find-time "10m")`). It can be provided in seconds or using Fail2Ban's "time abbreviation format", as described in `man 5 jail.conf`.

`ban-time` (type: maybe-string)
: The duration, in seconds or time abbreviated format, that a ban should last. (e.g. `(ban-time "10m")`).

`ban-time-increment?` (type: maybe-boolean)
: Whether to consider past bans to compute increases to the default ban time of a specific IP address.

`ban-time-factor` (type: maybe-string)
: The coefficient to use to compute an exponentially growing ban time.

`ban-time-formula` (type: maybe-string)
: This is the formula used to calculate the next value of a ban time.

`ban-time-multipliers` (type: maybe-string)
: Used to calculate next value of ban time instead of formula.

`ban-time-max-time` (type: maybe-string)
: The maximum number of seconds a ban should last.

`ban-time-rnd-time` (type: maybe-string)
: The maximum number of seconds a randomized ban time should last. This can be useful to stop "clever" botnets calculating the exact time an IP address can be unbanned again.

`ban-time-overall-jails?` (type: maybe-boolean)
: When true, it specifies the search of an IP address in the database should be made across all jails. Otherwise, only the current jail of the ban IP address is considered.

`ignore-self?` (type: maybe-boolean)
: Never ban the local machine's own IP address.

`ignore-ip` (default: `'()`) (type: list-of-strings)
: A list of IP addresses, CIDR masks or DNS hosts to ignore. `fail2ban` will not ban a host which matches an address in this list.

`ignore-cache` (type: maybe-fail2ban-ignore-cache-configuration)
: Provide cache parameters for the ignore failure check.

`filter` (type: maybe-fail2ban-jail-filter-configuration)
: The filter to use by the jail, specified via a `<fail2ban-jail-filter-configuration>` object. By default, jails have names matching their filter name.

`log-time-zone` (type: maybe-string)
: The default time zone for log lines that do not have one.

`log-encoding` (type: maybe-symbol)
: The encoding of the log files handled by the jail. Possible values are: `'ascii`, `'utf-8` and `'auto`.

`log-path` (default: `'()`) (type: list-of-strings)
: The file names of the log files to be monitored.

`action` (default: `'()`) (type: list-of-fail2ban-jail-actions)
: A list of `<fail2ban-jail-action-configuration>`.

`extra-content` (default: `'()`) (type: text-config)
: Extra content for the jail configuration, provided as a list of file-like objects.

`fail2ban-jail-filter-configuration` [Data Type]

Available `fail2ban-jail-filter-configuration` fields are:

`name` (type: string)
: Filter to use.

`mode` (type: maybe-string)
: Mode for filter.

Backup Services

The `(gnu services backup)` module offers services for backing up file system trees. For now, it provides the `restic-backup-service-type`.

With `restic-backup-service-type`, you can periodically back up directories and files with Restic (`https://restic.net/`), which supports end-to-end encryption and deduplication. Consider the following configuration:

```
(use-service-modules backup ...) ;for 'restic-backup-service-type'
(use-package-modules sync ...)   ;for 'rclone'

(operating-system
  ;; ...
  (packages (append (list rclone)    ;for use by restic
                    %base-packages))
  (services
    (list
      (service restic-backup-service-type
               (restic-backup-configuration
                 (jobs
                   (list (restic-backup-job
                           (name "remote-ftp")
                           (repository "rclone:remote-ftp:backup/restic")
                           (password-file "/root/.restic")
                           ;; Every day at 23.
                           (schedule "0 23 * * *")
                           (files '("/root/.restic"
                                    "/root/.config/rclone"
                                    "/etc/ssh/ssh_host_rsa_key"
                                    "/etc/ssh/ssh_host_rsa_key.pub"
                                    "/etc/guix/signing-key.pub"
                                    "/etc/guix/signing-key.sec")))))))))
```

Each `restic-backup-job` translates to an mcron job which sets the `RESTIC_PASSWORD` environment variable by reading the first line of `password-file` and runs `restic backup`, creating backups using rclone of all the files listed in the `files` field.

The `restic-backup-service-type` installs as well `restic-guix` to the system profile, a `restic` utility wrapper that allows for easier interaction with the Guix configured backup jobs. For example the following could be used to instantaneusly trigger a backup for the above shown configuration, without waiting for the scheduled job:

```
restic-guix backup remote-ftp
```

`restic-backup-configuration` [Data Type]

Available `restic-backup-configuration` fields are:

`jobs` (default: `'()`) (type: list-of-restic-backup-jobs)
The list of backup jobs for the current system.

`restic-backup-job` [Data Type]

Available `restic-backup-job` fields are:

`restic` (default: `restic`) (type: package)
The restic package to be used for the current job.

`user` (default: `"root"`) (type: string)
The user used for running the current job.

`repository` (type: string)
The restic repository target of this job.

`name` (type: string)
A string denoting a name for this job.

`password-file` (type: string)
Name of the password file, readable by the configured `user`, that will be used to set the `RESTIC_PASSWORD` environment variable for the current job.

`schedule` (type: gexp-or-string)
A string or a gexp that will be passed as time specification in the mcron job specification (veja Seção "Syntax" em *GNU mcron*).

`files` (default: `'()`) (type: list-of-lowerables)
The list of files or directories to be backed up. It must be a list of values that can be lowered to strings.

`verbose?` (default: `#f`) (type: boolean)
Whether to enable verbose output for the current backup job.

`extra-flags` (default: `'()`) (type: list-of-lowerables)
A list of values that are lowered to strings. These will be passed as command-line arguments to the current job `restic backup` invokation.

DLNA/UPnP Services

The `(gnu services upnp)` module offers services related to UPnP (Universal Plug and Play) and DLNA (Digital Living Network Alliance), networking protocols that can be used for media streaming and device interoperability within a local network. For now, this module provides the `readymedia-service-type`.

ReadyMedia (`https://sourceforge.net/projects/minidlna/`) (formerly known as MiniDLNA) is a DLNA/UPnP-AV media server. The project's daemon, `minidlnad`, can serve media files (audio, pictures, and video) to DLNA/UPnP-AV clients available on the network. `readymedia-service-type` is a Guix service that wraps around ReadyMedia's `minidlnad`.

Consider the following configuration:

```
(use-service-modules upnp ...)
```

```
(operating-system
  ...
  (services
   (list (service readymedia-service-type
                  (readymedia-configuration
                   (media-directories
                    (list (readymedia-media-directory
                           (path "/media/audio")
                           (types '(A)))
                          (readymedia-media-directory
                           (path "/media/video")
                           (types '(V)))
                          (readymedia-media-directory
                           (path "/media/misc"))))
                   (extra-config '(("notify_interval" . "60")))))
         ...)))
```

This sets up the ReadyMedia daemon to serve files from the media folders specified in `media-directories`. The `media-directories` field is mandatory. All other fields (such as network ports and the server name) come with a predefined default and can be omitted.

`readymedia-configuration` [Data Type]

Available `readymedia-configuration` fields are:

`readymedia` (default: `readymedia`) (type: package)
The ReadyMedia package to be used for the service.

`friendly-name` (default: `#f`) (type: maybe-string)
A custom name that will be displayed on connected clients.

`media-directories` (type: list)
The list of media folders to serve content from. Each item is a `readymedia-media-directory`.

`cache-directory` (default: `"/var/cache/readymedia"`) (type: string)
A folder for ReadyMedia's cache files. If not existing already, the folder will be created as part of the service activation and the ReadyMedia user will be assigned ownership.

`log-directory` (default: `"/var/log/readymedia"`) (type: string)
A folder for ReadyMedia's log files. If not existing already, the folder will be created as part of the service activation and the ReadyMedia user will be assigned ownership.

`port` (default: `#f`) (type: maybe-integer)
A custom port that the service will be listening on.

`extra-config` (default: `'()`) (type: alist)
An association list of further options, as accepted by ReadyMedia.

`readymedia-media-directory` [Data Type]

A `media-directories` entry includes a folder `path` and, optionally, the `types` of media files included within the folder.

`path` (type: string)
The media folder location.

`types` (default: `'()`) (type: list)
A list indicating the types of file included in the media folder. Valid values are combinations of individual media types, i.e. symbol `A` for audio, `P` for pictures, `V` for video. An empty list means that no type is specified.

11.11 Privileged Programs

Some programs need to run with elevated privileges, even when they are launched by unprivileged users. A notorious example is the `passwd` program, which users can run to change their password, and which needs to access the `/etc/passwd` and `/etc/shadow` files—something normally restricted to root, for obvious security reasons. To address that, `passwd` should be *setuid-root*, meaning that it always runs with root privileges (veja Seção "How Change Persona" em *The GNU C Library Reference Manual*, for more info about the setuid mechanism).

The store itself *cannot* contain privileged programs: that would be a security issue since any user on the system can write derivations that populate the store (veja Seção 8.9 [O armazém], Página 154). Thus, a different mechanism is used: instead of directly granting permissions to files that are in the store, we let the system administrator *declare* which programs should be entrusted with these additional privileges.

The `privileged-programs` field of an `operating-system` declaration contains a list of `<privileged-program>` denoting the names of programs to have a setuid or setgid bit set (veja Seção 11.2 [Usando o sistema de configuração], Página 238). For instance, the `mount.nfs` program, which is part of the nfs-utils package, with a setuid root can be designated like this:

```
(privileged-program
  (program (file-append nfs-utils "/sbin/mount.nfs"))
  (setuid? #t))
```

And then, to make `mount.nfs` setuid on your system, add the previous example to your operating system declaration by appending it to `%default-privileged-programs` like this:

```
(operating-system
  ;; Some fields omitted...
  (privileged-programs
    (append (list (privileged-program
                    (program (file-append nfs-utils "/sbin/mount.nfs"))
                    (setuid? #t))
                  %default-privileged-programs)))
```

`privileged-program` [Data Type]

This data type represents a program with special privileges, such as setuid

`program` A file-like object to which all given privileges should apply.

`setuid?` (default: `#f`)
: Whether to set user setuid bit.

`setgid?` (default: `#f`)
: Whether to set group setgid bit.

`user` (default: `0`)
: UID (integer) or user name (string) for the user owner of the program, defaults to root.

`group` (default: `0`)
: GID (integer) group name (string) for the group owner of the program, defaults to root.

`capabilities` (default: `#f`)
: A string representing the program's POSIX capabilities, as described by the `cap_to_text(3)` man page from the libcap package, or `#f` to make no changes.

A default set of privileged programs is defined by the `%default-privileged-programs` variable of the `(gnu system)` module.

`Scheme Variable` *%default-privileged-programs* [Variável]
: A list of `<privileged-program>` denoting common programs with elevated privileges.

  The list includes commands such as `passwd`, `ping`, `su`, and `sudo`.

Under the hood, the actual privileged programs are created in the `/run/privileged/bin` directory at system activation time. The files in this directory refer to the "real" binaries, which are in the store.

11.12 Certificados X.509

Web servers available over HTTPS (that is, HTTP over the transport-layer security mechanism, TLS) send client programs an *X.509 certificate* that the client can then use to *authenticate* the server. To do that, clients verify that the server's certificate is signed by a so-called *certificate authority* (CA). But to verify the CA's signature, clients must have first acquired the CA's certificate.

Web browsers such as GNU IceCat include their own set of CA certificates, such that they are able to verify CA signatures out-of-the-box.

However, most other programs that can talk HTTPS—`wget`, `git`, `w3m`, etc.—need to be told where CA certificates can be found.

For users of Guix System, this is done by adding a package that provides certificates to the `packages` field of the `operating-system` declaration (veja Seção 11.3 [Referência do operating-system], Página 247). Guix includes one such package, `nss-certs`, which is a set of CA certificates provided as part of Mozilla's Network Security Services.

This package is part of `%base-packages`, so there is no need to explicitly add it. The `/etc/ssl/certs` directory, which is where most applications and libraries look for certificates by default, points to the certificates installed globally.

Unprivileged users, including users of Guix on a foreign distro, can also install their own certificate package in their profile. A number of environment variables need to be defined

so that applications and libraries know where to find them. Namely, the OpenSSL library honors the `SSL_CERT_DIR` and `SSL_CERT_FILE` variables. Some applications add their own environment variables; for instance, the Git version control system honors the certificate bundle pointed to by the `GIT_SSL_CAINFO` environment variable. Thus, you would typically run something like:

```
guix install nss-certs
export SSL_CERT_DIR="$HOME/.guix-profile/etc/ssl/certs"
export SSL_CERT_FILE="$HOME/.guix-profile/etc/ssl/certs/ca-certificates.crt"
export GIT_SSL_CAINFO="$SSL_CERT_FILE"
```

As another example, R requires the `CURL_CA_BUNDLE` environment variable to point to a certificate bundle, so you would have to run something like this:

```
guix install nss-certs
export CURL_CA_BUNDLE="$HOME/.guix-profile/etc/ssl/certs/ca-certificates.crt"
```

For other applications you may want to look up the required environment variable in the relevant documentation.

11.13 Name Service Switch

The `(gnu system nss)` module provides bindings to the configuration file of the libc *name service switch* or *NSS* (veja Seção "NSS Configuration File" em *The GNU C Library Reference Manual*). In a nutshell, the NSS is a mechanism that allows libc to be extended with new "name" lookup methods for system databases, which includes host names, service names, user accounts, and more (veja Seção "Name Service Switch" em *The GNU C Library Reference Manual*).

The NSS configuration specifies, for each system database, which lookup method is to be used, and how the various methods are chained together—for instance, under which circumstances NSS should try the next method in the list. The NSS configuration is given in the `name-service-switch` field of `operating-system` declarations (veja Seção 11.3 [Referência do operating-system], Página 247).

As an example, the declaration below configures the NSS to use the `nss-mdns` back-end (`https://0pointer.de/lennart/projects/nss-mdns/`), which supports host name lookups over multicast DNS (mDNS) for host names ending in `.local`:

```
(name-service-switch
   (hosts (list %files    ;first, check /etc/hosts

                ;; If the above did not succeed, try
                ;; with 'mdns_minimal'.
                (name-service
                  (name "mdns_minimal")

                  ;; 'mdns_minimal' is authoritative for
                  ;; '.local'.  When it returns "not found",
                  ;; no need to try the next methods.
                  (reaction (lookup-specification
                             (not-found => return))))
```

```
;; Then fall back to DNS.
(name-service
  (name "dns"))

;; Finally, try with the "full" 'mdns'.
(name-service
  (name "mdns")))))
```

Do not worry: the `%mdns-host-lookup-nss` variable (see below) contains this configuration, so you will not have to type it if all you want is to have `.local` host lookup working.

Note that, in this case, in addition to setting the `name-service-switch` of the `operating-system` declaration, you also need to use `avahi-service-type` (veja Seção 11.10.5 [Serviços de Rede], Página 306), or `%desktop-services`, which includes it (veja Seção 11.10.9 [Serviços de desktop], Página 354). Doing this makes `nss-mdns` accessible to the name service cache daemon (veja Seção 11.10.1 [Serviços básicos], Página 268).

For convenience, the following variables provide typical NSS configurations.

`%default-nss` [Variável]
This is the default name service switch configuration, a `name-service-switch` object.

`%mdns-host-lookup-nss` [Variável]
This is the name service switch configuration with support for host name lookup over multicast DNS (mDNS) for host names ending in `.local`.

The reference for name service switch configuration is given below. It is a direct mapping of the configuration file format of the C library , so please refer to the C library manual for more information (veja Seção "NSS Configuration File" em *The GNU C Library Reference Manual*). Compared to the configuration file format of libc NSS, it has the advantage not only of adding this warm parenthetic feel that we like, but also static checks: you will know about syntax errors and typos as soon as you run `guix system`.

`name-service-switch` [Data Type]
This is the data type representation the configuration of libc's name service switch (NSS). Each field below represents one of the supported system databases.

`aliases`
`ethers`
`grupo`
`gshadow`
`hosts`
`initgroups`
`netgroup`
`networks`
`senha`
`public-key`
`rpc`
`services`
`shadow` The system databases handled by the NSS. Each of these fields must be a list of `<name-service>` objects (see below).

`name-service` [Data Type]

This is the data type representing an actual name service and the associated lookup action.

`name` A string denoting the name service (veja Seção "Services in the NSS configuration" em *The GNU C Library Reference Manual*).

Note that name services listed here must be visible to nscd. This is achieved by passing the `#:name-services` argument to `nscd-service` the list of packages providing the needed name services (veja Seção 11.10.1 [Serviços básicos], Página 268).

`reaction` An action specified using the `lookup-specification` macro (veja Seção "Actions in the NSS configuration" em *The GNU C Library Reference Manual*). For example:

```
(lookup-specification (unavailable => continue)
                      (success => return))
```

11.14 Disco de RAM inicial

For bootstrapping purposes, the Linux-Libre kernel is passed an *initial RAM disk*, or *initrd*. An initrd contains a temporary root file system as well as an initialization script. The latter is responsible for mounting the real root file system, and for loading any kernel modules that may be needed to achieve that.

The `initrd-modules` field of an `operating-system` declaration allows you to specify Linux-libre kernel modules that must be available in the initrd. In particular, this is where you would list modules needed to actually drive the hard disk where your root partition is—although the default value of `initrd-modules` should cover most use cases. For example, assuming you need the `megaraid_sas` module in addition to the default modules to be able to access your root file system, you would write:

```
(operating-system
  ;; ...
  (initrd-modules (cons "megaraid_sas" %base-initrd-modules)))
```

`%base-initrd-modules` [Variável]

This is the list of kernel modules included in the initrd by default.

Furthermore, if you need lower-level customization, the `initrd` field of an `operating-system` declaration allows you to specify which initrd you would like to use. The `(gnu system linux-initrd)` module provides three ways to build an initrd: the high-level `base-initrd` procedure and the low-level `raw-initrd` and `expression->initrd` procedures.

The `base-initrd` procedure is intended to cover most common uses. For example, if you want to add a bunch of kernel modules to be loaded at boot time, you can define the `initrd` field of the operating system declaration like this:

```
(initrd (lambda (file-systems . rest)
          ;; Create a standard initrd but set up networking
          ;; with the parameters QEMU expects by default.
          (apply base-initrd file-systems
                 #:qemu-networking? #t
```

```
                    rest)))
```

The `base-initrd` procedure also handles common use cases that involves using the system as a QEMU guest, or as a "live" system with volatile root file system.

The `base-initrd` procedure is built from `raw-initrd` procedure. Unlike `base-initrd`, `raw-initrd` doesn't do anything high-level, such as trying to guess which kernel modules and packages should be included to the initrd. An example use of `raw-initrd` is when a user has a custom Linux kernel configuration and default kernel modules included by `base-initrd` are not available.

The initial RAM disk produced by `base-initrd` or `raw-initrd` honors several options passed on the Linux kernel command line (that is, arguments passed *via* the `linux` command of GRUB, or the `-append` option of QEMU), notably:

`gnu.load=`*boot*
: Tell the initial RAM disk to load *boot*, a file containing a Scheme program, once it has mounted the root file system.

  Guix uses this option to yield control to a boot program that runs the service activation programs and then spawns the GNU Shepherd, the initialization system.

`root=`*root*
: Mount *root* as the root file system. *root* can be a device name like `/dev/sda1`, a file system label, or a file system UUID. When unspecified, the device name from the root file system of the operating system declaration is used.

`rootfstype=`*type*
: Set the type of the root file system. It overrides the `type` field of the root file system specified via the `operating-system` declaration, if any.

`rootflags=`*options*
: Set the mount *options* of the root file system. It overrides the `options` field of the root file system specified via the `operating-system` declaration, if any.

`fsck.mode=`*mode*
: Whether to check the *root* file system for errors before mounting it. *mode* is one of `skip` (never check), `force` (always check), or `auto` to respect the root `<file-system>` object's `check?` setting (veja Seção 11.4 [Sistemas de arquivos], Página 251) and run a full scan only if the file system was not cleanly shut down.

  `auto` is the default if this option is not present or if *mode* is not one of the above.

`fsck.repair=`*level*
: The level of repairs to perform automatically if errors are found in the *root* file system. *level* is one of `no` (do not write to *root* at all if possible), `yes` (repair as much as possible), or `preen` to repair problems considered safe to repair automatically.

  `preen` is the default if this option is not present or if *level* is not one of the above.

`gnu.system=`*system*
: Have `/run/booted-system` and `/run/current-system` point to *system*.

`modprobe.blacklist=`*modules*`...`
: Instruct the initial RAM disk as well as the `modprobe` command (from the kmod package) to refuse to load *modules*. *modules* must be a comma-separated list of module names—e.g., `usbkbd,9pnet`.

`gnu.repl`
: Start a read-eval-print loop (REPL) from the initial RAM disk before it tries to load kernel modules and to mount the root file system. Our marketing team calls it *boot-to-Guile*. The Schemer in you will love it. Veja Seção "Using Guile Interactively" em *GNU Guile Reference Manual*, for more information on Guile's REPL.

Now that you know all the features that initial RAM disks produced by `base-initrd` and `raw-initrd` provide, here is how to use it and customize it further.

`raw-initrd` *file-systems* [*#:linux-modules '()*] [*#:pre-mount #t*] [*#:mapped-devices '()*] [*#:keyboard-layout #f*] [*#:helper-packages '()*] [*#:qemu-networking? #f*] [#:volatile-root? #f] [Procedure]

Return a derivation that builds a raw initrd. *file-systems* is a list of file systems to be mounted by the initrd, possibly in addition to the root file system specified on the kernel command line via `root`. *linux-modules* is a list of kernel modules to be loaded at boot time. *mapped-devices* is a list of device mappings to realize before *file-systems* are mounted (veja Seção 11.5 [Dispositivos mapeados], Página 256). *pre-mount* is a G-expression to evaluate before realizing *mapped-devices*. *helper-packages* is a list of packages to be copied in the initrd. It may include `e2fsck/static` or other packages needed by the initrd to check the root file system.

When true, *keyboard-layout* is a `<keyboard-layout>` record denoting the desired console keyboard layout. This is done before *mapped-devices* are set up and before *file-systems* are mounted such that, should the user need to enter a passphrase or use the REPL, this happens using the intended keyboard layout.

When *qemu-networking?* is true, set up networking with the standard QEMU parameters. When *virtio?* is true, load additional modules so that the initrd can be used as a QEMU guest with para-virtualized I/O drivers.

When *volatile-root?* is true, the root file system is writable but any changes to it are lost.

`base-initrd` *file-systems* [*#:mapped-devices '()*] [*#:keyboard-layout #f*] [*#:qemu-networking? #f*] [#:volatile-root? #f] [#:linux-modules '()] [Procedure]

Return as a file-like object a generic initrd, with kernel modules taken from *linux*. *file-systems* is a list of file-systems to be mounted by the initrd, possibly in addition to the root file system specified on the kernel command line via `root`. *mapped-devices* is a list of device mappings to realize before *file-systems* are mounted.

When true, *keyboard-layout* is a `<keyboard-layout>` record denoting the desired console keyboard layout. This is done before *mapped-devices* are set up and before *file-systems* are mounted such that, should the user need to enter a passphrase or use the REPL, this happens using the intended keyboard layout.

qemu-networking? and *volatile-root?* behaves as in `raw-initrd`.

The initrd is automatically populated with all the kernel modules necessary for *file-systems* and for the given options. Additional kernel modules can be listed in *linux-modules*. They will be added to the initrd, and loaded at boot time in the order in which they appear.

Needless to say, the initrds we produce and use embed a statically-linked Guile, and the initialization program is a Guile program. That gives a lot of flexibility. The `expression->initrd` procedure builds such an initrd, given the program to run in that initrd.

`expression->initrd` *exp* [*#:guile %guile-static-initrd*] [*#:name "guile-initrd"*] *Return as a file-like* [Procedure]
object a Linux initrd (a gzipped cpio archive) containing *guile* and that evaluates *exp*, a G-expression, upon booting. All the derivations referenced by *exp* are automatically copied to the initrd.

11.15 Configuração do carregador de inicialização

The operating system supports multiple bootloaders. The bootloader is configured using `bootloader-configuration` declaration. All the fields of this structure are bootloader agnostic except for one field, `bootloader` that indicates the bootloader to be configured and installed.

Some of the bootloaders do not honor every field of `bootloader-configuration`. For instance, the extlinux bootloader does not support themes and thus ignores the `theme` field.

`bootloader-configuration` [Data Type]
The type of a bootloader configuration declaration.

`bootloader`
The bootloader to use, as a `bootloader` object. For now `grub-bootloader`, `grub-efi-bootloader`, `grub-efi-removable-bootloader`, `grub-efi-netboot-bootloader`, `grub-efi-netboot-removable-bootloader`, `extlinux-bootloader` and `u-boot-bootloader` are supported.

Available bootloaders are described in `(gnu bootloader ...)` modules. In particular, `(gnu bootloader u-boot)` contains definitions of bootloaders for a wide range of ARM and AArch64 systems, using the U-Boot bootloader (`https://www.denx.de/wiki/U-Boot/`).

`grub-bootloader` allows you to boot in particular Intel-based machines in "legacy" BIOS mode.

`grub-efi-bootloader` allows to boot on modern systems using the *Unified Extensible Firmware Interface* (UEFI). This is what you should use if the installation image contains a `/sys/firmware/efi` directory when you boot it on your system.

`grub-efi-removable-bootloader` allows you to boot your system from removable media by writing the GRUB file to the UEFI-specification location of `/EFI/BOOT/BOOTX64.efi` of the boot directory, usually `/boot/efi`. This is also useful for some UEFI firmwares that "forget" their configuration from their non-volatile storage. Like

`grub-efi-bootloader`, this can only be used if the `/sys/firmware/efi` directory is available.

> **Nota:** This *will* overwrite the GRUB file from any other operating systems that also place their GRUB file in the UEFI-specification location; making them unbootable.

`grub-efi-netboot-bootloader` allows you to boot your system over network through TFTP. In combination with an NFS root file system this allows you to build a diskless Guix system.

The installation of the `grub-efi-netboot-bootloader` generates the content of the TFTP root directory at `targets` (veja Seção 11.15 [Configuração do carregador de inicialização], Página 610) below the subdirectory `efi/Guix`, to be served by a TFTP server. You may want to mount your TFTP server directories onto the `targets` to move the required files to the TFTP server automatically during installation.

If you plan to use an NFS root file system as well (actually if you mount the store from an NFS share), then the TFTP server needs to serve the file `/boot/grub/grub.cfg` and other files from the store (like GRUBs background image, the kernel (veja Seção 11.3 [Referência do operating-system], Página 247) and the initrd (veja Seção 11.3 [Referência do operating-system], Página 247)), too. All these files from the store will be accessed by GRUB through TFTP with their normal store path, for example as `tftp://tftp-server/gnu/store/...-initrd/initrd.cpio.gz`.

Two symlinks are created to make this possible. For each target in the `targets` field, the first symlink is '`target`'`/efi/Guix/boot/grub/grub.cfg` pointing to `../../../boot/grub/grub.cfg`, where '`target`' may be `/boot`. In this case the link is not leaving the served TFTP root directory, but otherwise it does. The second link is '`target`'`/gnu/store` and points to `../gnu/store`. This link is leaving the served TFTP root directory.

The assumption behind all this is that you have an NFS server exporting the root file system for your Guix system, and additionally a TFTP server exporting your `targets` directories—usually a single `/boot`—from that same root file system for your Guix system. In this constellation the symlinks will work.

For other constellations you will have to program your own bootloader installer, which then takes care to make necessary files from the store accessible through TFTP, for example by copying them into the TFTP root directory for your `targets`.

It is important to note that symlinks pointing outside the TFTP root directory may need to be allowed in the configuration of your TFTP server. Further the store link exposes the whole store through TFTP. Both points need to be considered carefully for security aspects. It is advised to disable any TFTP write access!

Please note, that this bootloader will not modify the 'UEFI Boot Manager' of the system.

Beside the `grub-efi-netboot-bootloader`, the already mentioned TFTP and NFS servers, you also need a properly configured DHCP server to make the booting over netboot possible. For all this we can currently only recommend you to look for instructions about PXE (Preboot eXecution Environment).

If a local EFI System Partition (ESP) or a similar partition with a FAT file system is mounted in `targets`, then symlinks cannot be created. In this case everything will be prepared for booting from local storage, matching the behavior of `grub-efi-bootloader`, with the difference that all GRUB binaries are copied to `targets`, necessary for booting over the network.

`grub-efi-netboot-removable-bootloader` is identical to `grub-efi-netboot-bootloader` with the exception that the sub-directory `efi/boot` will be used instead of `efi/Guix` to comply with the UEFI specification for removable media.

> **Nota:** This *will* overwrite the GRUB file from any other operating systems that also place their GRUB file in the UEFI-specification location; making them unbootable.

`targets` This is a list of strings denoting the targets onto which to install the bootloader.

The interpretation of targets depends on the bootloader in question. For `grub-bootloader`, for example, they should be device names understood by the bootloader `installer` command, such as `/dev/sda` or `(hd0)` (veja Seção "Invoking grub-install" em *GNU GRUB Manual*). For `grub-efi-bootloader` and `grub-efi-removable-bootloader` they should be mount points of the EFI file system, usually `/boot/efi`. For `grub-efi-netboot-bootloader`, `targets` should be the mount points corresponding to TFTP root directories served by your TFTP server.

`menu-entries` (default: `'()`)
A possibly empty list of `menu-entry` objects (see below), denoting entries to appear in the bootloader menu, in addition to the current system entry and the entry pointing to previous system generations.

`default-entry` (default: `0`)
The index of the default boot menu entry. Index 0 is for the entry of the current system.

`timeout` (default: `5`)
The number of seconds to wait for keyboard input before booting. Set to 0 to boot immediately, and to -1 to wait indefinitely.

`keyboard-layout` (default: `#f`)
If this is `#f`, the bootloader's menu (if any) uses the default keyboard layout, usually US English ("qwerty").

Otherwise, this must be a `keyboard-layout` object (veja Seção 11.8 [Disposição do teclado], Página 264).

Nota: This option is currently ignored by bootloaders other than `grub` and `grub-efi`.

`theme` (default: *#f*)
The bootloader theme object describing the theme to use. If no theme is provided, some bootloaders might use a default theme, that's true for GRUB.

`terminal-outputs` (default: `'(gfxterm)`)
The output terminals used for the bootloader boot menu, as a list of symbols. GRUB accepts the values: `console`, `serial`, `serial_{0-3}`, `gfxterm`, `vga_text`, `mda_text`, `morse`, and `pkmodem`. This field corresponds to the GRUB variable `GRUB_TERMINAL_OUTPUT` (veja Seção "Simple configuration" em *GNU GRUB manual*).

`terminal-inputs` (default: `'()`)
The input terminals used for the bootloader boot menu, as a list of symbols. For GRUB, the default is the native platform terminal as determined at run-time. GRUB accepts the values: `console`, `serial`, `serial_{0-3}`, `at_keyboard`, and `usb_keyboard`. This field corresponds to the GRUB variable `GRUB_TERMINAL_INPUT` (veja Seção "Simple configuration" em *GNU GRUB manual*).

`serial-unit` (default: `#f`)
The serial unit used by the bootloader, as an integer from 0 to 3. For GRUB, it is chosen at run-time; currently GRUB chooses 0, which corresponds to COM1 (veja Seção "Serial terminal" em *GNU GRUB manual*).

`serial-speed` (default: `#f`)
The speed of the serial interface, as an integer. For GRUB, the default value is chosen at run-time; currently GRUB chooses 9600 bps (veja Seção "Serial terminal" em *GNU GRUB manual*).

`device-tree-support?` (default: `#t`)
Whether to support Linux device tree (`https://en.wikipedia.org/wiki/Devicetree`) files loading.

This option in enabled by default. In some cases involving the `u-boot` bootloader, where the device tree has already been loaded in RAM, it can be handy to disable the option by setting it to `#f`.

`extra-initrd` (default: `#f`)
File name of an additional initrd to load during the boot. It may or may not point to a file in the store, but the main use case is for out-of-store files containing secrets.

In order to be able to provide decryption keys for the LUKS device, they need to be available in the initial ram disk. However they cannot be stored inside the usual initrd, since it is stored in the store and being a world-readable (as files in the store are) is not a desired property for a initrd containing decryption keys. You can therefore use this field to instruct GRUB to also load a manually created initrd not stored in the store.

For any use case not involving secrets, you should use regular initrd (veja Seção 11.3 [Referência do operating-system], Página 247) instead.

Suitable image can be created for example like this:

```
echo /key-file.bin | cpio -oH newc >/key-file.cpio
chmod 0000 /key-file.cpio
```

After it is created, you can use it in this manner:

```
;; Operating system with encrypted boot partition
(operating-system
  ...
  (bootloader (bootloader-configuration
               (bootloader grub-efi-bootloader)
               (targets '("/boot/efi"))
               ;; Load the initrd with a key file
               (extra-initrd "/key-file.cpio")))
  (mapped-devices
   (list (mapped-device
          (source (uuid "12345678-1234-1234-1234-123456789abc"))
          (target "my-root")
          (type (luks-device-mapping-with-options
                 ;; And use it to unlock the root device
                 #:key-file "/key-file.bin"))))))
```

Be careful when using this option, since pointing to a file that is not readable by the grub while booting will cause the boot to fail and require a manual edit of the initrd line in the grub menu.

Currently only supported by GRUB.

Should you want to list additional boot menu entries *via* the `menu-entries` field above, you will need to create them with the `menu-entry` form. For example, imagine you want to be able to boot another distro (hard to imagine!), you can define a menu entry along these lines:

```
(menu-entry
  (label "The Other Distro")
  (linux "/boot/old/vmlinux-2.6.32")
  (linux-arguments '("root=/dev/sda2"))
  (initrd "/boot/old/initrd"))
```

Details below.

`menu-entry` [Data Type]

The type of an entry in the bootloader menu.

`rótulo` The label to show in the menu—e.g., `"GNU"`.

`linux` (default: `#f`)

The Linux kernel image to boot, for example:

```
(file-append linux-libre "/bzImage")
```

For GRUB, it is also possible to specify a device explicitly in the file path using GRUB's device naming convention (veja Seção "Naming convention" em *GNU GRUB manual*), for example:

```
"(hd0,msdos1)/boot/vmlinuz"
```

If the device is specified explicitly as above, then the `device` field is ignored entirely.

`linux-arguments` (default: `'()`)
: The list of extra Linux kernel command-line arguments—e.g., `'("console=ttyS0")`.

`initrd` (default: `#f`)
: A G-Expression or string denoting the file name of the initial RAM disk to use (veja Seção 8.12 [Expressões-G], Página 163).

`device` (default: `#f`)
: The device where the kernel and initrd are to be found—i.e., for GRUB, *root* for this menu entry (veja Seção "root" em *GNU GRUB manual*).

  This may be a file system label (a string), a file system UUID (a bytevector, veja Seção 11.4 [Sistemas de arquivos], Página 251), or `#f`, in which case the bootloader will search the device containing the file specified by the `linux` field (veja Seção "search" em *GNU GRUB manual*). It must *not* be an OS device name such as `/dev/sda1`.

`multiboot-kernel` (default: `#f`)
: The kernel to boot in Multiboot-mode (veja Seção "multiboot" em *GNU GRUB manual*). When this field is set, a Multiboot menu-entry is generated. For example:

  ```
  (file-append mach "/boot/gnumach")
  ```

`multiboot-arguments` (default: `'()`)
: The list of extra command-line arguments for the multiboot-kernel.

  For example, when running in QEMU it can be useful to use a text-based console (use options `--nographic --serial mon:stdio`):

  ```
  '("console=com0")
  ```

  To use the new and still experimental rumpdisk user-level disk driver (`https://darnassus.sceen.net/~hurd-web/rump_kernel/`) instead of GNU Mach's in-kernel IDE driver, set `kernel-arguments` to:

  ```
  '("noide")
  ```

  Of course, these options can be combined:

  ```
  '("console=com0" "noide")
  ```

`multiboot-modules` (default: `'()`)
: The list of commands for loading Multiboot modules. For example:

  ```
  (list (list (file-append hurd "/hurd/ext2fs.static") "ext2fs"
              ...)
        (list (file-append libc "/lib/ld.so.1") "exec"
              ...))
  ```

`chain-loader` (default: `#f`)
: A string that can be accepted by `grub`'s `chainloader` directive. This has no effect if either `linux` or `multiboot-kernel` fields are specified. The following is an example of chainloading a different GNU/Linux system.

```
(bootloader
 (bootloader-configuration
  ;; ...
  (menu-entries
   (list
    (menu-entry
     (label "GNU/Linux")
     (device (uuid "1C31-A17C" 'fat))
     (chain-loader "/EFI/GNULinux/grubx64.efi"))))))
```

For now only GRUB has theme support. GRUB themes are created using the `grub-theme` form, which is not fully documented yet.

`grub-theme` [Data Type]
: Data type representing the configuration of the GRUB theme.

  `gfxmode` (default: `'("auto")`)
  : The GRUB `gfxmode` to set (a list of screen resolution strings, veja Seção "gfxmode" em *GNU GRUB manual*).

`grub-theme` [Procedure]
: Return the default GRUB theme used by the operating system if no `theme` field is specified in `bootloader-configuration` record.

  It comes with a fancy background image displaying the GNU and Guix logos.

For example, to override the default resolution, you may use something like

```
(bootloader
 (bootloader-configuration
 ;; ...
 (theme (grub-theme
         (inherit (grub-theme))
         (gfxmode '("1024x786x32" "auto"))))))
```

11.16 Invoking `guix system`

Once you have written an operating system declaration as seen in the previous section, it can be *instantiated* using the `guix system` command. The synopsis is:

```
guix system options... action file
```

file must be the name of a file containing an `operating-system` declaration. *action* specifies how the operating system is instantiated. Currently the following values are supported:

`pesquisa` Display available service type definitions that match the given regular expressions, sorted by relevance:

```
$ guix system search console
```

```
name: console-fonts
location: gnu/services/base.scm:806:2
extends: shepherd-root
description: Install the given fonts on the specified ttys (fonts are per
+ virtual console on GNU/Linux).  The value of this service is a list of
+ tty/font pairs.  The font can be the name of a font provided by the `kbd'
+ package or any valid argument to `setfont', as in this example:
+
+      '(("tty1" . "LatGrkCyr-8x16")
+        ("tty2" . (file-append
+                       font-tamzen
+                       "/share/kbd/consolefonts/TamzenForPowerline10x20.psf"
+        ("tty3" . (file-append
+                       font-terminus
+                       "/share/consolefonts/ter-132n"))) ; for HDPI
relevance: 9

name: mingetty
location: gnu/services/base.scm:1190:2
extends: shepherd-root
description: Provide console login using the `mingetty' program.
relevance: 2

name: login
location: gnu/services/base.scm:860:2
extends: pam
description: Provide a console log-in service as specified by its
+ configuration value, a `login-configuration' object.
relevance: 2

...
```

As for `guix package --search`, the result is written in `recutils` format, which makes it easy to filter the output (veja *GNU recutils manual*).

`edit` Edit or view the definition of the given service types.

For example, the command below opens your editor, as specified by the `EDITOR` environment variable, on the definition of the `openssh` service type:

```
guix system edit openssh
```

`reconfigure`

Build the operating system described in *file*, activate it, and switch to it[11].

Nota: It is highly recommended to run `guix pull` once before you run `guix system reconfigure` for the first time (veja Seção 5.7 [Invocando guix pull], Página 57). Failing to do that you would see an older version of Guix once `reconfigure` has completed.

[11] This action (and the related actions `switch-generation` and `roll-back`) are usable only on systems already running Guix System.

This effects all the configuration specified in *file*: user accounts, system services, global package list, privileged programs, etc. The command starts system services specified in *file* that are not currently running; if a service is currently running this command will arrange for it to be upgraded the next time it is stopped (e.g. by `herd stop X` or `herd restart X`).

This command creates a new generation whose number is one greater than the current generation (as reported by `guix system list-generations`). If that generation already exists, it will be overwritten. This behavior mirrors that of `guix package` (veja Seção 5.2 [Invocando guix package], Página 37).

It also adds a bootloader menu entry for the new OS configuration, —unless `--no-bootloader` is passed. For GRUB, it moves entries for older configurations to a submenu, allowing you to choose an older system generation at boot time should you need it.

Upon completion, the new system is deployed under `/run/current-system`. This directory contains *provenance meta-data*: the list of channels in use (veja Capítulo 6 [Canais], Página 69) and *file* itself, when available. You can view it by running:

```
guix system describe
```

This information is useful should you later want to inspect how this particular generation was built. In fact, assuming *file* is self-contained, you can later rebuild generation *n* of your operating system with:

```
guix time-machine \
  -C /var/guix/profiles/system-n-link/channels.scm -- \
  system reconfigure \
  /var/guix/profiles/system-n-link/configuration.scm
```

You can think of it as some sort of built-in version control! Your system is not just a binary artifact: *it carries its own source*. Veja Seção 11.19.3 [Referência de Service], Página 634, for more information on provenance tracking.

By default, `reconfigure` *prevents you from downgrading your system*, which could (re)introduce security vulnerabilities and also cause problems with "stateful" services such as database management systems. You can override that behavior by passing `--allow-downgrades`.

`switch-generation`

Switch to an existing system generation. This action atomically switches the system profile to the specified system generation. It also rearranges the system's existing bootloader menu entries. It makes the menu entry for the specified system generation the default, and it moves the entries for the other generations to a submenu, if supported by the bootloader being used. The next time the system boots, it will use the specified system generation.

The bootloader itself is not being reinstalled when using this command. Thus, the installed bootloader is used with an updated configuration file.

The target generation can be specified explicitly by its generation number. For example, the following invocation would switch to system generation 7:

```
guix system switch-generation 7
```

The target generation can also be specified relative to the current generation with the form `+N` or `-N`, where `+3` means "3 generations ahead of the current generation," and `-1` means "1 generation prior to the current generation." When specifying a negative value such as `-1`, you must precede it with `--` to prevent it from being parsed as an option. For example:

```
guix system switch-generation -- -1
```

Currently, the effect of invoking this action is *only* to switch the system profile to an existing generation and rearrange the bootloader menu entries. To actually start using the target system generation, you must reboot after running this action. In the future, it will be updated to do the same things as `reconfigure`, like activating and deactivating services.

This action will fail if the specified generation does not exist.

`roll-back`

Switch to the preceding system generation. The next time the system boots, it will use the preceding system generation. This is the inverse of `reconfigure`, and it is exactly the same as invoking `switch-generation` with an argument of `-1`.

Currently, as with `switch-generation`, you must reboot after running this action to actually start using the preceding system generation.

`delete-generations`

Delete system generations, making them candidates for garbage collection (veja Seção 5.6 [Invocando guix gc], Página 54, for information on how to run the "garbage collector").

This works in the same way as '`guix package --delete-generations`' (veja Seção 5.2 [Invocando guix package], Página 37). With no arguments, all system generations but the current one are deleted:

```
guix system delete-generations
```

You can also select the generations you want to delete. The example below deletes all the system generations that are more than two months old:

```
guix system delete-generations 2m
```

Running this command automatically reinstalls the bootloader with an updated list of menu entries—e.g., the "old generations" sub-menu in GRUB no longer lists the generations that have been deleted.

`build` Build the derivation of the operating system, which includes all the configuration files and programs needed to boot and run the system. This action does not actually install anything.

`init` Populate the given directory with all the files necessary to run the operating system specified in *file*. This is useful for first-time installations of Guix System. For instance:

```
guix system init my-os-config.scm /mnt
```

copies to `/mnt` all the store items required by the configuration specified in `my-os-config.scm`. This includes configuration files, packages, and so on. It also

creates other essential files needed for the system to operate correctly—e.g., the `/etc`, `/var`, and `/run` directories, and the `/bin/sh` file.

This command also installs bootloader on the targets specified in `my-os-config`, unless the `--no-bootloader` option was passed.

`vm` Build a virtual machine (VM) that contains the operating system declared in *file*, and return a script to run that VM.

> **Nota:** The `vm` action and others below can use KVM support in the Linux-libre kernel. Specifically, if the machine has hardware virtualization support, the corresponding KVM kernel module should be loaded, and the `/dev/kvm` device node must exist and be readable and writable by the user and by the build users of the daemon (veja Seção 2.2.1 [Configuração do ambiente de compilação], Página 6).

Arguments given to the script are passed to QEMU as in the example below, which enables networking and requests 1 GiB of RAM for the emulated machine:

```
$ /gnu/store/...-run-vm.sh -m 1024 -smp 2 -nic user,model=virtio-net-pci
```

It's possible to combine the two steps into one:

```
$ $(guix system vm my-config.scm) -m 1024 -smp 2 -nic user,model=virtio-net-
```

The VM shares its store with the host system.

By default, the root file system of the VM is mounted volatile; the `--persistent` option can be provided to make it persistent instead. In that case, the VM disk-image file will be copied from the store to the `TMPDIR` directory to make it writable.

Additional file systems can be shared between the host and the VM using the `--share` and `--expose` command-line options: the former specifies a directory to be shared with write access, while the latter provides read-only access to the shared directory.

The example below creates a VM in which the user's home directory is accessible read-only, and where the `/exchange` directory is a read-write mapping of `$HOME/tmp` on the host:

```
guix system vm my-config.scm \
   --expose=$HOME --share=$HOME/tmp=/exchange
```

On GNU/Linux, the default is to boot directly to the kernel; this has the advantage of requiring only a very tiny root disk image since the store of the host can then be mounted.

The `--full-boot` option forces a complete boot sequence, starting with the bootloader. This requires more disk space since a root image containing at least the kernel, initrd, and bootloader data files must be created.

The `--image-size` option can be used to specify the size of the image.

The `--no-graphic` option will instruct `guix system` to spawn a headless VM that will use the invoking tty for IO. Among other things, this enables copy-pasting, and scrollback. Use the *`ctrl-a`* prefix to issue QEMU commands; e.g. *`ctrl-a h`* prints a help, *`ctrl-a x`* quits the VM, and *`ctrl-a c`* switches between the QEMU monitor and the VM.

`imagem` The `image` command can produce various image types. The image type can be selected using the `--image-type` option. It defaults to `mbr-hybrid-raw`. When its value is `iso9660`, the `--label` option can be used to specify a volume ID with `image`. By default, the root file system of a disk image is mounted non-volatile; the `--volatile` option can be provided to make it volatile instead. When using `image`, the bootloader installed on the generated image is taken from the provided `operating-system` definition. The following example demonstrates how to generate an image that uses the `grub-efi-bootloader` bootloader and boot it with QEMU:

```
image=$(guix system image --image-type=qcow2 \
        gnu/system/examples/lightweight-desktop.tmpl)
cp $image /tmp/my-image.qcow2
chmod +w /tmp/my-image.qcow2
qemu-system-x86_64 -enable-kvm -hda /tmp/my-image.qcow2 -m 1000 \
                   -bios $(guix build ovmf-x86-64)/share/firmware/ovmf_x64.b
```

When using the `mbr-hybrid-raw` image type, a raw disk image is produced; it can be copied as is to a USB stick, for instance. Assuming `/dev/sdc` is the device corresponding to a USB stick, one can copy the image to it using the following command:

```
# dd if=$(guix system image my-os.scm) of=/dev/sdc status=progress
```

The `--list-image-types` command lists all the available image types.

When using the `qcow2` image type, the returned image is in qcow2 format, which the QEMU emulator can efficiently use. Veja Seção 11.18 [Executando Guix em uma VM], Página 629, for more information on how to run the image in a virtual machine. The `grub-bootloader` bootloader is always used independently of what is declared in the `operating-system` file passed as argument. This is to make it easier to work with QEMU, which uses the SeaBIOS BIOS by default, expecting a bootloader to be installed in the Master Boot Record (MBR).

When using the `docker` image type, a Docker image is produced. Guix builds the image from scratch, not from a pre-existing Docker base image. As a result, it contains *exactly* what you define in the operating system configuration file. You can then load the image and launch a Docker container using commands like the following:

```
image_id="$(docker load < guix-system-docker-image.tar.gz)"
container_id="$(docker create $image_id)"
docker start $container_id
```

This command starts a new Docker container from the specified image. It will boot the Guix system in the usual manner, which means it will start any services you have defined in the operating system configuration. You can get an interactive shell running in the container using `docker exec`:

```
docker exec -ti $container_id /run/current-system/profile/bin/bash --login
```

Depending on what you run in the Docker container, it may be necessary to give the container additional permissions. For example, if you intend to build software using Guix inside of the Docker container, you may need to pass the `--privileged` option to `docker create`.

Last, the `--network` option applies to `guix system docker-image`: it produces an image where network is supposedly shared with the host, and thus without services like nscd or NetworkManager.

`recipiente`
: Return a script to run the operating system declared in *file* within a container. Containers are a set of lightweight isolation mechanisms provided by the kernel Linux-libre. Containers are substantially less resource-demanding than full virtual machines since the kernel, shared objects, and other resources can be shared with the host system; this also means they provide thinner isolation.

  Currently, the script must be run as root in order to support more than a single user and group. The container shares its store with the host system.

  As with the `vm` action (veja [guix system vm], Página 620), additional file systems to be shared between the host and container can be specified using the `--share` and `--expose` options:

```
guix system container my-config.scm \
   --expose=$HOME --share=$HOME/tmp=/exchange
```

  The `--share` and `--expose` options can also be passed to the generated script to bind-mount additional directories into the container.

  Nota: This option requires Linux-libre 3.19 or newer.

options can contain any of the common build options (veja Seção 9.1.1 [Opções de compilação comum], Página 177). In addition, *options* can contain one of the following:

`--expression=`*expr*
`-e` *expr*
: Consider the operating-system *expr* evaluates to. This is an alternative to specifying a file which evaluates to an operating system. This is used to generate the Guix system installer veja Seção 3.9 [Compilando a imagem de instalação], Página 32).

`--system=`*system*
`-s` *sistema*
: Attempt to build for *system* instead of the host system type. This works as per `guix build` (veja Seção 9.1 [Invocando guix build], Página 177).

`--target=`*triplet*
: Cross-build for *triplet*, which must be a valid GNU triplet, such as `"aarch64-linux-gnu"` (veja Seção “Specifying target triplets” em *Autoconf*).

`--derivation`
`-d`
: Return the derivation file name of the given operating system without building anything.

`--save-provenance`
: As discussed above, `guix system init` and `guix system reconfigure` always save provenance information *via* a dedicated service (veja Seção 11.19.3 [Referência de Service], Página 634). However, other commands don't do that by default. If you wish to, say, create a virtual machine image that contains provenance information, you can run:

```
guix system image -t qcow2 --save-provenance config.scm
```

That way, the resulting image will effectively "embed its own source" in the form of meta-data in `/run/current-system`. With that information, one can rebuild the image to make sure it really contains what it pretends to contain; or they could use that to derive a variant of the image.

`--image-type=`*type*

`-t` *tipo* For the `image` action, create an image with given *type*.

When this option is omitted, `guix system` uses the `mbr-hybrid-raw` image type.

`--image-type=iso9660` produces an ISO-9660 image, suitable for burning on CDs and DVDs.

`--image-size=`*size*

For the `image` action, create an image of the given *size*. *size* may be a number of bytes, or it may include a unit as a suffix (veja Seção "Block size" em *GNU Coreutils*).

When this option is omitted, `guix system` computes an estimate of the image size as a function of the size of the system declared in *file*.

`--network`

`-N` For the `container` action, allow containers to access the host network, that is, do not create a network namespace.

`--root=`*arquivo*

`-r` *arquivo*

Make *file* a symlink to the result, and register it as a garbage collector root.

`--skip-checks`

Skip pre-installation safety checks.

By default, `guix system init` and `guix system reconfigure` perform safety checks: they make sure the file systems that appear in the `operating-system` declaration actually exist (veja Seção 11.4 [Sistemas de arquivos], Página 251), and that any Linux kernel modules that may be needed at boot time are listed in `initrd-modules` (veja Seção 11.14 [Disco de RAM inicial], Página 607). Passing this option skips these tests altogether.

`--allow-downgrades`

Instruct `guix system reconfigure` to allow system downgrades.

By default, `reconfigure` prevents you from downgrading your system. It achieves that by comparing the provenance info of your system (shown by `guix system describe`) with that of your `guix` command (shown by `guix describe`). If the commits for `guix` are not descendants of those used for your system, `guix system reconfigure` errors out. Passing `--allow-downgrades` allows you to bypass these checks.

> **Nota:** Make sure you understand its security implications before using `--allow-downgrades`.

`--on-error=`*strategy*

Apply *strategy* when an error occurs when reading *file*. *strategy* may be one of the following:

`nothing-special`
: Report the error concisely and exit. This is the default strategy.

`backtrace`
: Likewise, but also display a backtrace.

`depuração`
: Report the error and enter Guile's debugger. From there, you can run commands such as `,bt` to get a backtrace, `,locals` to display local variable values, and more generally inspect the state of the program. Veja Seção "Debug Commands" em *GNU Guile Reference Manual*, for a list of available debugging commands.

Once you have built, configured, re-configured, and re-re-configured your Guix installation, you may find it useful to list the operating system generations available on disk—and that you can choose from the bootloader boot menu:

`describe` Describe the running system generation: its file name, the kernel and bootloader used, etc., as well as provenance information when available.

The `--list-installed` flag is available, with the same syntax that is used in `guix package --list-installed` (veja Seção 5.2 [Invocando guix package], Página 37). When the flag is used, the description will include a list of packages that are currently installed in the system profile, with optional filtering based on a regular expression.

> **Nota:** The *running* system generation—referred to by `/run/current-system`—is not necessarily the *current* system generation—referred to by `/var/guix/profiles/system`: it differs when, for instance, you chose from the bootloader menu to boot an older generation.
>
> It can also differ from the *booted* system generation—referred to by `/run/booted-system`—for instance because you reconfigured the system in the meantime.

`list-generations`
: List a summary of each generation of the operating system available on disk, in a human-readable way. This is similar to the `--list-generations` option of `guix package` (veja Seção 5.2 [Invocando guix package], Página 37).

Optionally, one can specify a pattern, with the same syntax that is used in `guix package --list-generations`, to restrict the list of generations displayed. For instance, the following command displays generations that are up to 10 days old:

```
$ guix system list-generations 10d
```

The `--list-installed` flag may also be specified, with the same syntax that is used in `guix package --list-installed`. This may be helpful if trying to determine when a package was added to the system.

The `guix system` command has even more to offer! The following sub-commands allow you to visualize how your system services relate to each other:

`extension-graph`

Emit to standard output the *service extension graph* of the operating system defined in *file* (veja Seção 11.19.1 [Composição de serviço], Página 631, for more information on service extensions). By default the output is in Dot/Graphviz format, but you can choose a different format with `--graph-backend`, as with `guix graph` (veja Seção 9.10 [Invocando guix graph], Página 216):

O comando:

```
$ guix system extension-graph file | xdot -
```

shows the extension relations among services.

Nota: The `dot` program is provided by the `graphviz` package.

`shepherd-graph`

Emit to standard output the *dependency graph* of shepherd services of the operating system defined in *file*. Veja Seção 11.19.4 [Serviços de Shepherd], Página 638, for more information and for an example graph.

Again, the default output format is Dot/Graphviz, but you can pass `--graph-backend` to select a different one.

11.17 Invoking `guix deploy`

We've already seen `operating-system` declarations used to manage a machine's configuration locally. Suppose you need to configure multiple machines, though—perhaps you're managing a service on the web that's comprised of several servers. `guix deploy` enables you to use those same `operating-system` declarations to manage multiple remote hosts at once as a logical "deployment".

Nota: The functionality described in this section is still under development and is subject to change. Get in touch with us on `guix-devel@gnu.org`!

```
guix deploy file
```

Such an invocation will deploy the machines that the code within *file* evaluates to. As an example, *file* might contain a definition like this:

```
;; This is a Guix deployment of a "bare bones" setup, with
;; no X11 display server, to a machine with an SSH daemon
;; listening on localhost:2222. A configuration such as this
;; may be appropriate for virtual machine with ports
;; forwarded to the host's loopback interface.

(use-service-modules networking ssh)
(use-package-modules bootloaders)

(define %system
  (operating-system
   (host-name "gnu-deployed")
   (timezone "Etc/UTC")
   (bootloader (bootloader-configuration
                (bootloader grub-bootloader)
                (targets '("/dev/vda"))
```

```
                (terminal-outputs '(console))))
    (file-systems (cons (file-system
                          (mount-point "/")
                          (device "/dev/vda1")
                          (type "ext4"))
                        %base-file-systems))
    (services
     (append (list (service dhcp-client-service-type)
                   (service openssh-service-type
                            (openssh-configuration
                             (permit-root-login #t)
                             (allow-empty-passwords? #t))))
             %base-services))))

(list (machine
       (operating-system %system)
       (environment managed-host-environment-type)
       (configuration (machine-ssh-configuration
                       (host-name "localhost")
                       (system "x86_64-linux")
                       (user "alice")
                       (identity "./id_rsa")
                       (port 2222)))))
```

The file should evaluate to a list of *machine* objects. This example, upon being deployed, will create a new generation on the remote system realizing the `operating-system` declaration `%system`. `environment` and `configuration` specify how the machine should be provisioned—that is, how the computing resources should be created and managed. The above example does not create any resources, as a `'managed-host` is a machine that is already running the Guix system and available over the network. This is a particularly simple case; a more complex deployment may involve, for example, starting virtual machines through a Virtual Private Server (VPS) provider. In such a case, a different *environment* type would be used.

Do note that you first need to generate a key pair on the coordinator machine to allow the daemon to export signed archives of files from the store (veja Seção 5.11 [Invocando guix archive], Página 66), though this step is automatic on Guix System:

```
# guix archive --generate-key
```

Each target machine must authorize the key of the master machine so that it accepts store items it receives from the coordinator:

```
# guix archive --authorize < coordinator-public-key.txt
```

`user`, in this example, specifies the name of the user account to log in as to perform the deployment. Its default value is `root`, but root login over SSH may be forbidden in some cases. To work around this, `guix deploy` can log in as an unprivileged user and employ `sudo` to escalate privileges. This will only work if `sudo` is currently installed on the remote and can be invoked non-interactively as `user`. That is, the line in `sudoers` granting `user` the ability to use `sudo` must contain the `NOPASSWD` tag. This can be accomplished with the following operating system configuration snippet:

```
(use-modules ...
             (gnu system))                ;for %sudoers-specification

(define %user "username")

(operating-system
  ...
  (sudoers-file
     (plain-file "sudoers"
                 (string-append (plain-file-content %sudoers-specification)
                                (format #f "~a ALL = NOPASSWD: ALL~%"
                                        %user)))))
```

For more information regarding the format of the `sudoers` file, consult `man sudoers`.

Once you've deployed a system on a set of machines, you may find it useful to run a command on all of them. The `--execute` or `-x` option lets you do that; the example below runs `uname -a` on all the machines listed in the deployment file:

```
guix deploy file -x -- uname -a
```

One thing you may often need to do after deployment is restart specific services on all the machines, which you can do like so:

```
guix deploy file -x -- herd restart service
```

The `guix deploy -x` command returns zero if and only if the command succeeded on all the machines.

Below are the data types you need to know about when writing a deployment file.

`machine` [Data Type]

This is the data type representing a single machine in a heterogeneous Guix deployment.

`sistema operacional`
: The object of the operating system configuration to deploy.

`environment`
: An `environment-type` describing how the machine should be provisioned.

`configuration` (default: `#f`)
: An object describing the configuration for the machine's `environment`. If the `environment` has a default configuration, `#f` may be used. If `#f` is used for an environment with no default configuration, however, an error will be thrown.

`machine-ssh-configuration` [Data Type]

This is the data type representing the SSH client parameters for a machine with an `environment` of `managed-host-environment-type`.

`host-name`

`build-locally?` (default: `#t`)
: If false, system derivations will be built on the machine being deployed to.

`system`
: The system type describing the architecture of the machine being deployed to—e.g., `"x86_64-linux"`.

`authorize?` (default: `#t`)
: If true, the coordinator's signing key will be added to the remote's ACL keyring.

`port` (padrão: `22`)

`user` (default: `"root"`)

`identity` (default: `#f`)
: If specified, the path to the SSH private key to use to authenticate with the remote host.

`host-key` (default: `#f`)
: This should be the SSH host key of the machine, which looks like this:

```
ssh-ed25519 AAAAC3Nz... root@example.org
```

: When `host-key` is `#f`, the server is authenticated against the `~/.ssh/known_hosts` file, just like the OpenSSH `ssh` client does.

`allow-downgrades?` (default: `#f`)
: Whether to allow potential downgrades.

: Like `guix system reconfigure`, `guix deploy` compares the channel commits currently deployed on the remote host (as returned by `guix system describe`) to those currently in use (as returned by `guix describe`) to determine whether commits currently in use are descendants of those deployed. When this is not the case and `allow-downgrades?` is false, it raises an error. This ensures you do not accidentally downgrade remote machines.

`safety-checks?` (default: `#t`)
: Whether to perform "safety checks" before deployment. This includes verifying that devices and file systems referred to in the operating system configuration actually exist on the target machine, and making sure that Linux modules required to access storage devices at boot time are listed in the `initrd-modules` field of the operating system.

: These safety checks ensure that you do not inadvertently deploy a system that would fail to boot. Be careful before turning them off!

`digital-ocean-configuration` [Data Type]

This is the data type describing the Droplet that should be created for a machine with an `environment` of `digital-ocean-environment-type`.

`ssh-key`
: The path to the SSH private key to use to authenticate with the remote host. In the future, this field may not exist.

`tags`
: A list of string "tags" that uniquely identify the machine. Must be given such that no two machines in the deployment have the same set of tags.

`region` A Digital Ocean region slug, such as `"nyc3"`.

`tamanho` A Digital Ocean size slug, such as `"s-1vcpu-1gb"`

`enable-ipv6?`
Whether or not the droplet should be created with IPv6 networking.

11.18 Usando o Guix em uma Máquina Virtual

To run Guix in a virtual machine (VM), one can use the pre-built Guix VM image distributed at `https://ftp.gnu.org/gnu/guix/guix-system-vm-image-ba3a031.x86_64-linux.qcow2`. This image is a compressed image in QCOW format. You can pass it to an emulator such as QEMU (`https://qemu.org/`) (see below for details).

This image boots the Xfce graphical environment and it contains some commonly used tools. You can install more software in the image by running `guix package` in a terminal (veja Seção 5.2 [Invocando guix package], Página 37). You can also reconfigure the system based on its initial configuration file available as `/run/current-system/configuration.scm` (veja Seção 11.2 [Usando o sistema de configuração], Página 238).

Instead of using this pre-built image, one can also build their own image using `guix system image` (veja Seção 11.16 [Invocando guix system], Página 616).

If you built your own image, you must copy it out of the store (veja Seção 8.9 [O armazém], Página 154) and give yourself permission to write to the copy before you can use it. When invoking QEMU, you must choose a system emulator that is suitable for your hardware platform. Here is a minimal QEMU invocation that will boot the result of `guix system image -t qcow2` on x86_64 hardware:

```
$ qemu-system-x86_64 \
   -nic user,model=virtio-net-pci \
   -enable-kvm -m 2048 \
   -device virtio-blk,drive=myhd \
   -drive if=none,file=guix-system-vm-image-ba3a031.x86_64-linux.qcow2,id=myhd
```

Here is what each of these options means:

`qemu-system-x86_64`
This specifies the hardware platform to emulate. This should match the host.

`-nic user,model=virtio-net-pci`
Enable the unprivileged user-mode network stack. The guest OS can access the host but not vice versa. This is the simplest way to get the guest OS online. `model` specifies which network device to emulate: `virtio-net-pci` is a special device made for virtualized operating systems and recommended for most uses. Assuming your hardware platform is x86_64, you can get a list of available NIC models by running `qemu-system-x86_64 -nic model=help`.

`-enable-kvm`
If your system has hardware virtualization extensions, enabling the virtual machine support (KVM) of the Linux kernel will make things run faster.

`-m 2048` RAM available to the guest OS, in mebibytes. Defaults to 128 MiB, which may be insufficient for some operations.

`-device virtio-blk,drive=myhd`
: Create a `virtio-blk` drive called "myhd". `virtio-blk` is a "paravirtualization" mechanism for block devices that allows QEMU to achieve better performance than if it were emulating a complete disk drive. See the QEMU and KVM documentation for more info.

`-drive if=none,file=/tmp/qemu-image,id=myhd`
: Use our QCOW image, the `guix-system-vm-image-ba3a031.x86_64-linux.qcow2` file, as the backing store of the "myhd" drive.

The default `run-vm.sh` script that is returned by an invocation of `guix system vm` does not add a `-nic user` flag by default. To get network access from within the vm add the `(dhcp-client-service)` to your system definition and start the VM using `$(guix system vm config.scm) -nic user`. An important caveat of using `-nic user` for networking is that `ping` will not work, because it uses the ICMP protocol. You'll have to use a different command to check for network connectivity, for example `guix download`.

11.18.1 Connecting Through SSH

To enable SSH inside a VM you need to add an SSH server like `openssh-service-type` to your VM (veja Seção 11.10.5 [Serviços de Rede], Página 306). In addition you need to forward the SSH port, 22 by default, to the host. You can do this with

```
$(guix system vm config.scm) -nic user,model=virtio-net-pci,hostfwd=tcp::10022-:22
```

To connect to the VM you can run

```
ssh -o UserKnownHostsFile=/dev/null -o StrictHostKeyChecking=no -p 10022 localhost
```

The `-p` tells `ssh` the port you want to connect to. `-o UserKnownHostsFile=/dev/null` prevents `ssh` from complaining every time you modify your `config.scm` file and the `-o StrictHostKeyChecking=no` prevents you from having to allow a connection to an unknown host every time you connect.

> **Nota:** If you find the above '`hostfwd`' example not to be working (e.g., your SSH client hangs attempting to connect to the mapped port of your VM), make sure that your Guix System VM has networking support, such as by using the `dhcp-client-service-type` service type.

11.18.2 Using `virt-viewer` with Spice

As an alternative to the default `qemu` graphical client you can use the `remote-viewer` from the `virt-viewer` package. To connect pass the `-spice port=5930,disable-ticketing` flag to `qemu`. See previous section for further information on how to do this.

Spice also allows you to do some nice stuff like share your clipboard with your VM. To enable that you'll also have to pass the following flags to `qemu`:

```
-device virtio-serial-pci,id=virtio-serial0,max_ports=16,bus=pci.0,addr=0x5
-chardev spicevmc,name=vdagent,id=vdagent
-device virtserialport,nr=1,bus=virtio-serial0.0,chardev=vdagent,\
name=com.redhat.spice.0
```

You'll also need to add the `(spice-vdagent-service)` to your system definition (veja Seção 11.10.37 [Serviços diversos], Página 585).

11.19 Definindo serviços

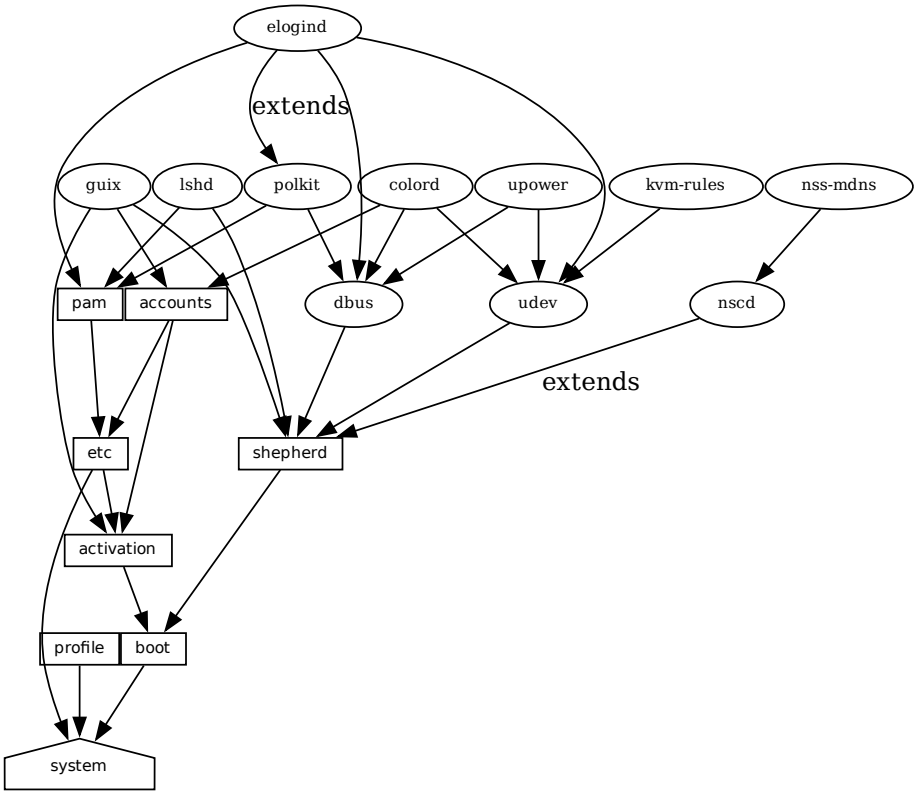
The previous sections show the available services and how one can combine them in an `operating-system` declaration. But how do we define them in the first place? And what is a service anyway?

11.19.1 Composição de serviço

Here we define a *service* as, broadly, something that extends the functionality of the operating system. Often a service is a process—a *daemon*—started when the system boots: a secure shell server, a Web server, the Guix build daemon, etc. Sometimes a service is a daemon whose execution can be triggered by another daemon—e.g., an FTP server started by `inetd` or a D-Bus service activated by `dbus-daemon`. Occasionally, a service does not map to a daemon. For instance, the "account" service collects user accounts and makes sure they exist when the system runs; the "udev" service collects device management rules and makes them available to the eudev daemon; the `/etc` service populates the `/etc` directory of the system.

Guix system services are connected by *extensions*. For instance, the secure shell service *extends* the Shepherd—the initialization system, running as PID 1—by giving it the command lines to start and stop the secure shell daemon (veja Seção 11.10.5 [Serviços de Rede], Página 306); the UPower service extends the D-Bus service by passing it its `.service` specification, and extends the udev service by passing it device management rules (veja Seção 11.10.9 [Serviços de desktop], Página 354); the Guix daemon service extends the Shepherd by passing it the command lines to start and stop the daemon, and extends the account service by passing it a list of required build user accounts (veja Seção 11.10.1 [Serviços básicos], Página 268).

All in all, services and their "extends" relations form a directed acyclic graph (DAG). If we represent services as boxes and extensions as arrows, a typical system might provide something like this:



At the bottom, we see the *system service*, which produces the directory containing everything to run and boot the system, as returned by the `guix system build` command. Veja Seção 11.19.3 [Referência de Service], Página 634, to learn about the other service types shown here. Veja [system-extension-graph], Página 624, for information on how to generate this representation for a particular operating system definition.

Technically, developers can define *service types* to express these relations. There can be any number of services of a given type on the system—for instance, a system running two instances of the GNU secure shell server (lsh) has two instances of `lsh-service-type`, with different parameters.

The following section describes the programming interface for service types and services.

11.19.2 Tipos de Service e Serviços

A *service type* is a node in the DAG described above. Let us start with a simple example, the service type for the Guix build daemon (veja Seção 2.3 [Invocando guix-daemon], Página 13):

```
(define guix-service-type
  (service-type
   (name 'guix)
   (extensions
```

```
        (list (service-extension shepherd-root-service-type guix-shepherd-service)
              (service-extension account-service-type guix-accounts)
              (service-extension activation-service-type guix-activation)))
       (default-value (guix-configuration))))
```

It defines three things:

1. A name, whose sole purpose is to make inspection and debugging easier.
2. A list of *service extensions*, where each extension designates the target service type and a procedure that, given the parameters of the service, returns a list of objects to extend the service of that type.

   Every service type has at least one service extension. The only exception is the *boot service type*, which is the ultimate service.
3. Optionally, a default value for instances of this type.

In this example, `guix-service-type` extends three services:

`shepherd-root-service-type`
: The `guix-shepherd-service` procedure defines how the Shepherd service is extended. Namely, it returns a `<shepherd-service>` object that defines how `guix-daemon` is started and stopped (veja Seção 11.19.4 [Serviços de Shepherd], Página 638).

`account-service-type`
: This extension for this service is computed by `guix-accounts`, which returns a list of `user-group` and `user-account` objects representing the build user accounts (veja Seção 2.3 [Invocando guix-daemon], Página 13).

`activation-service-type`
: Here `guix-activation` is a procedure that returns a gexp, which is a code snippet to run at "activation time"—e.g., when the service is booted.

A service of this type is instantiated like this:

```
(service guix-service-type
         (guix-configuration
           (build-accounts 5)
           (extra-options '("--gc-keep-derivations"))))
```

The second argument to the `service` form is a value representing the parameters of this specific service instance. Veja [guix-configuration-type], Página 277, for information about the `guix-configuration` data type. When the value is omitted, the default value specified by `guix-service-type` is used:

```
(service guix-service-type)
```

`guix-service-type` is quite simple because it extends other services but is not extensible itself.

The service type for an *extensible* service looks like this:

```
(define udev-service-type
  (service-type (name 'udev)
                (extensions
                 (list (service-extension shepherd-root-service-type
```

```
                                        udev-shepherd-service)))

                    (compose concatenate)       ;concatenate the list of rules
                    (extend (lambda (config rules)
                              (udev-configuration
                               (inherit config)
                               (rules (append (udev-configuration-rules config)
                                              rules)))))))
```

This is the service type for the eudev device management daemon (`https://github.com/eudev-project/eudev`). Compared to the previous example, in addition to an extension of `shepherd-root-service-type`, we see two new fields:

`compose` This is the procedure to *compose* the list of extensions to services of this type.

Services can extend the udev service by passing it lists of rules; we compose those extensions simply by concatenating them.

`extend` This procedure defines how the value of the service is *extended* with the composition of the extensions.

Udev extensions are composed into a list of rules, but the udev service value is itself a `<udev-configuration>` record. So here, we extend that record by appending the list of rules it contains to the list of contributed rules.

`description`
This is a string giving an overview of the service type. The string can contain Texinfo markup (veja Seção "Overview" em *GNU Texinfo*). The `guix system search` command searches these strings and displays them (veja Seção 11.16 [Invocando guix system], Página 616).

There can be only one instance of an extensible service type such as `udev-service-type`. If there were more, the `service-extension` specifications would be ambiguous.

Still here? The next section provides a reference of the programming interface for services.

11.19.3 Referência de Service

We have seen an overview of service types (veja Seção 11.19.2 [Tipos de Service e Serviços], Página 632). This section provides a reference on how to manipulate services and service types. This interface is provided by the `(gnu services)` module.

`service` *type* [*value*] [Procedure]
Return a new service of *type*, a `<service-type>` object (see below). *value* can be any object; it represents the parameters of this particular service instance.

When *value* is omitted, the default value specified by *type* is used; if *type* does not specify a default value, an error is raised.

For instance, this:

```
(service openssh-service-type)
```

is equivalent to this:

```
(service openssh-service-type
         (openssh-configuration))
```

In both cases the result is an instance of `openssh-service-type` with the default configuration.

`service?` *obj* [Procedure]
Return true if *obj* is a service.

`service-kind` *service* [Procedure]
Return the type of *service*—i.e., a `<service-type>` object.

`service-value` *service* [Procedure]
Return the value associated with *service*. It represents its parameters.

Here is an example of how a service is created and manipulated:

```
(define s
  (service nginx-service-type
           (nginx-configuration
            (nginx nginx)
            (log-directory log-directory)
            (run-directory run-directory)
            (file config-file))))

(service? s)
⇒ #t

(eq? (service-kind s) nginx-service-type)
⇒ #t
```

The `modify-services` form provides a handy way to change the parameters of some of the services of a list such as `%base-services` (veja Seção 11.10.1 [Serviços básicos], Página 268). It evaluates to a list of services. Of course, you could always use standard list combinators such as `map` and `fold` to do that (veja Seção "SRFI-1" em *GNU Guile Reference Manual*); `modify-services` simply provides a more concise form for this common pattern.

`modify-services` *services* (*type variable* `=>` *body*) ... [Forma Especial]
Modify the services listed in *services* according to the given clauses. Each clause has the form:

```
(type variable => body)
```

where *type* is a service type—e.g., `guix-service-type`—and *variable* is an identifier that is bound within the *body* to the service parameters—e.g., a `guix-configuration` instance—of the original service of that *type*.

The *body* should evaluate to the new service parameters, which will be used to configure the new service. This new service will replace the original in the resulting list. Because a service's service parameters are created using `define-record-type*`, you can write a succinct *body* that evaluates to the new service parameters by using the `inherit` feature that `define-record-type*` provides.

Clauses can also have the following form:

```
(delete type)
```

Such a clause removes all services of the given *type* from *services*.

Veja Seção 11.2 [Usando o sistema de configuração], Página 238, for example usage.

Next comes the programming interface for service types. This is something you want to know when writing new service definitions, but not necessarily when simply looking for ways to customize your `operating-system` declaration.

`service-type` [Data Type]
This is the representation of a *service type* (veja Seção 11.19.2 [Tipos de Service e Serviços], Página 632).

`name` This is a symbol, used only to simplify inspection and debugging.

`extensions`
A non-empty list of `<service-extension>` objects (see below).

`compose` (default: `#f`)
If this is `#f`, then the service type denotes services that cannot be extended—i.e., services that do not receive "values" from other services.

Otherwise, it must be a one-argument procedure. The procedure is called by `fold-services` and is passed a list of values collected from extensions. It may return any single value.

`extend` (default: `#f`)
If this is `#f`, services of this type cannot be extended.

Otherwise, it must be a two-argument procedure: `fold-services` calls it, passing it the initial value of the service as the first argument and the result of applying `compose` to the extension values as the second argument. It must return a value that is a valid parameter value for the service instance.

`description`
This is a string, possibly using Texinfo markup, describing in a couple of sentences what the service is about. This string allows users to find about the service through `guix system search` (veja Seção 11.16 [Invocando guix system], Página 616).

`default-value` (default: `&no-default-value`)
The default value associated for instances of this service type. This allows users to use the `service` form without its second argument:

```
(service type)
```

The returned service in this case has the default value specified by *type*.

Veja Seção 11.19.2 [Tipos de Service e Serviços], Página 632, for examples.

`service-extension` *target-type compute* [Procedure]
Return a new extension for services of type *target-type*. *compute* must be a one-argument procedure: `fold-services` calls it, passing it the value associated with the service that provides the extension; it must return a valid value for the target service.

`service-extension?` *obj* [Procedure]
Return true if *obj* is a service extension.

Occasionally, you might want to simply extend an existing service. This involves creating a new service type and specifying the extension of interest, which can be verbose; the `simple-service` procedure provides a shorthand for this.

`simple-service` *name target value* [Procedure]
Return a service that extends *target* with *value*. This works by creating a singleton service type *name*, of which the returned service is an instance.

For example, this extends mcron (veja Seção 11.10.2 [Execução de trabalho agendado], Página 289) with an additional job:

```
(simple-service 'my-mcron-job mcron-service-type
                #~(job '(next-hour (3)) "guix gc -F 2G"))
```

At the core of the service abstraction lies the `fold-services` procedure, which is responsible for "compiling" a list of services down to a single directory that contains everything needed to boot and run the system—the directory shown by the `guix system build` command (veja Seção 11.16 [Invocando guix system], Página 616). In essence, it propagates service extensions down the service graph, updating each node parameters on the way, until it reaches the root node.

`fold-services` *services* [*#:target-type system-service-type*] [Procedure]
Fold *services* by propagating their extensions down to the root of type *target-type*; return the root service adjusted accordingly.

Lastly, the `(gnu services)` module also defines several essential service types, some of which are listed below.

`system-service-type` [Variável]
This is the root of the service graph. It produces the system directory as returned by the `guix system build` command.

`boot-service-type` [Variável]
The type of the "boot service", which produces the *boot script*. The boot script is what the initial RAM disk runs when booting.

`etc-service-type` [Variável]
The type of the `/etc` service. This service is used to create files under `/etc` and can be extended by passing it name/file tuples such as:

```
(list `("issue" ,(plain-file "issue" "Welcome!\n")))
```

In this example, the effect would be to add an `/etc/issue` file pointing to the given file.

`privileged-program-service-type` [Variável]
Type for the "privileged-program service". This service collects lists of executable file names, passed as gexps, and adds them to the set of privileged programs on the system (veja Seção 11.11 [Privileged Programs], Página 603).

`profile-service-type` [Variável]
Type of the service that populates the *system profile*—i.e., the programs under `/run/current-system/profile`. Other services can extend it by passing it lists of packages to add to the system profile.

`provenance-service-type` [Variável]

This is the type of the service that records *provenance meta-data* in the system itself. It creates several files under `/run/current-system`:

`channels.scm`
: This is a "channel file" that can be passed to `guix pull -C` or `guix time-machine -C`, and which describes the channels used to build the system, if that information was available (veja Capítulo 6 [Canais], Página 69).

`configuration.scm`
: This is the file that was passed as the value for this `provenance-service-type` service. By default, `guix system reconfigure` automatically passes the OS configuration file it received on the command line.

`provenance`
: This contains the same information as the two other files but in a format that is more readily processable.

In general, these two pieces of information (channels and configuration file) are enough to reproduce the operating system "from source".

> **Caveats:** This information is necessary to rebuild your operating system, but it is not always sufficient. In particular, `configuration.scm` itself is insufficient if it is not self-contained—if it refers to external Guile modules or to extra files. If you want `configuration.scm` to be self-contained, we recommend that modules or files it refers to be part of a channel.
>
> Besides, provenance meta-data is "silent" in the sense that it does not change the bits contained in your system, *except for the meta-data bits themselves*. Two different OS configurations or sets of channels can lead to the same system, bit-for-bit; when `provenance-service-type` is used, these two systems will have different meta-data and thus different store file names, which makes comparison less trivial.

This service is automatically added to your operating system configuration when you use `guix system reconfigure`, `guix system init`, or `guix deploy`.

`linux-loadable-module-service-type` [Variável]

Type of the service that collects lists of packages containing kernel-loadable modules, and adds them to the set of kernel-loadable modules.

This service type is intended to be extended by other service types, such as below:

```
(simple-service 'installing-module
                linux-loadable-module-service-type
                (list module-to-install-1
                      module-to-install-2))
```

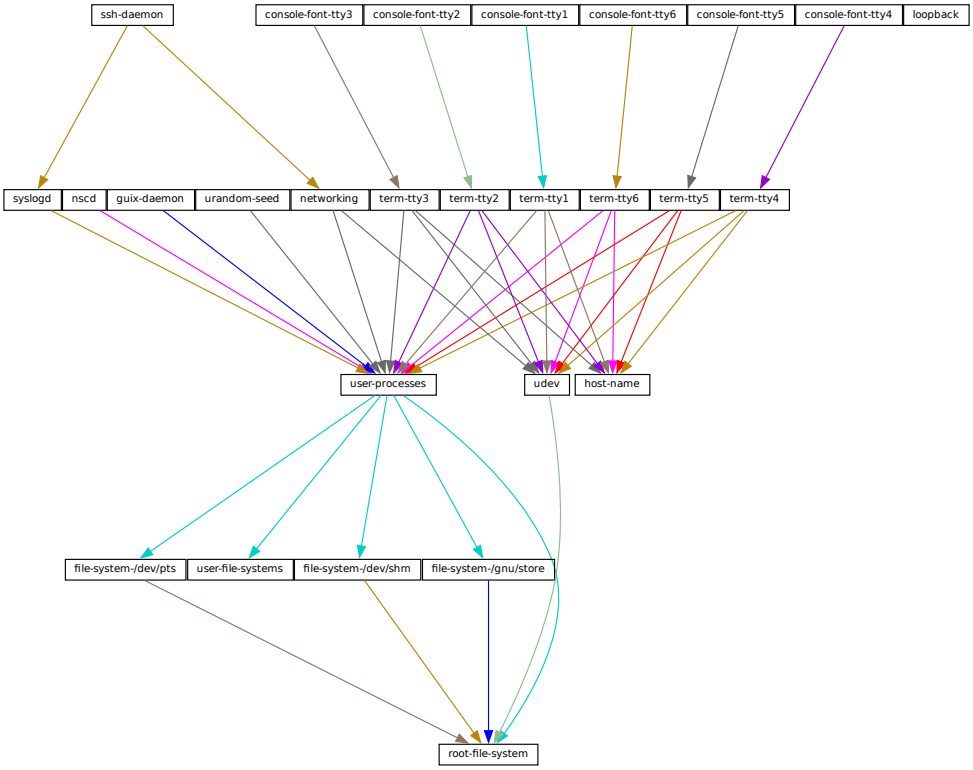
This does not actually load modules at bootup, only adds it to the kernel profile so that it *can* be loaded by other means.

11.19.4 Serviços de Shepherd

The `(gnu services shepherd)` module provides a way to define services managed by the GNU Shepherd, which is the initialization system—the first process that is started when

the system boots, also known as PID 1 (veja Seção “Introduction” em *The GNU Shepherd Manual*).

Services in the Shepherd can depend on each other. For instance, the SSH daemon may need to be started after the syslog daemon has been started, which in turn can only happen once all the file systems have been mounted. The simple operating system defined earlier (veja Seção 11.2 [Usando o sistema de configuração], Página 238) results in a service graph like this:



You can actually generate such a graph for any operating system definition using the `guix system shepherd-graph` command (veja [system-shepherd-graph], Página 625).

The `%shepherd-root-service` is a service object representing PID 1, of type `shepherd-root-service-type`; it can be extended by passing it lists of `<shepherd-service>` objects.

`shepherd-service` [Data Type]

The data type representing a service managed by the Shepherd.

`provision`

This is a list of symbols denoting what the service provides.

These are the names that may be passed to `herd start`, `herd status`, and similar commands (veja Seção “Invoking herd” em *The GNU*

Shepherd Manual). Veja Seção "Defining Services" em *The GNU Shepherd Manual*, for details.

`requirement` (default: `'()`)
: List of symbols denoting the Shepherd services this one depends on.

`one-shot?` (default: `#f`)
: Whether this service is *one-shot*. One-shot services stop immediately after their `start` action has completed. Veja Seção "Slots of services" em *The GNU Shepherd Manual*, for more info.

`respawn?` (padrão: `#t`)
: Whether to restart the service when it stops, for instance when the underlying process dies.

`respawn-limit` (default: `#f`)
: Set a limit on how many times and how frequently a service may be restarted by Shepherd before it is disabled. Veja Seção "Defining Services" em *The GNU Shepherd Manual*, for details.

`respawn-delay` (default: `#f`)
: When true, this is the delay in seconds before restarting a failed service.

`start` (default: `#~(const #t)`)
`stop` (default: `#~(const #f)`)
: The `start` and `stop` fields refer to the Shepherd's facilities to start and stop processes (veja Seção "Service De- and Constructors" em *The GNU Shepherd Manual*). They are given as G-expressions that get expanded in the Shepherd configuration file (veja Seção 8.12 [Expressões-G], Página 163).

`actions` (default: `'()`)
: This is a list of `shepherd-action` objects (see below) defining *actions* supported by the service, in addition to the standard `start` and `stop` actions. Actions listed here become available as `herd` sub-commands:

```
herd action service [arguments...]
```

`free-form` (default: `#f`)
: When set, this field replaces the `start`, `stop`, and `actions` fields. It is meant to be used when the service definition comes from some other source, typically the service collection provided by the Shepherd proper (veja Seção "Service Collection" em *The GNU Shepherd Manual*).

  For example, the snippet below defines a service for the Shepherd's built-in REPL (read-eval-print loop) service (veja Seção "REPL Service" em *The GNU Shepherd Manual*):

```
(shepherd-service
  (provision '(repl))
  (modules '((shepherd service repl)))
  (free-form #~(repl-service)))
```

  In this case, the service object is returned by the `repl-service` procedure of the Shepherd, so all the `free-form` G-expression does is call that

procedure. Note that the `provision` field must be consistent with the actual service provision.

`auto-start?` (default: `#t`)
Whether this service should be started automatically by the Shepherd. If it is `#f` the service has to be started manually with `herd start`.

`documentação`
A documentation string, as shown when running:

```
herd doc service-name
```

where *service-name* is one of the symbols in `provision` (veja Seção "Invoking herd" em *The GNU Shepherd Manual*).

`modules` (default: `%default-modules`)
This is the list of modules that must be in scope when `start` and `stop` are evaluated.

The example below defines a Shepherd service that spawns `syslogd`, the system logger from the GNU Networking Utilities (veja Seção "syslogd invocation" em *GNU Inetutils*):

```
(let ((config (plain-file "syslogd.conf" "...")))
  (shepherd-service
    (documentation "Run the syslog daemon (syslogd).")
    (provision '(syslogd))
    (requirement '(user-processes))
    (start #~(make-forkexec-constructor
              (list #$(file-append inetutils "/libexec/syslogd")
                    "--rcfile" #$config)
              #:pid-file "/var/run/syslog.pid"))
    (stop #~(make-kill-destructor))))
```

Key elements in this example are the `start` and `stop` fields: they are *staged* code snippets that use the `make-forkexec-constructor` procedure provided by the Shepherd and its dual, `make-kill-destructor` (veja Seção "Service De- and Constructors" em *The GNU Shepherd Manual*). The `start` field will have `shepherd` spawn `syslogd` with the given option; note that we pass `config` after `--rcfile`, which is a configuration file declared above (contents of this file are omitted). Likewise, the `stop` field tells how this service is to be stopped; in this case, it is stopped by making the `kill` system call on its PID. Code staging is achieved using G-expressions: `#~` stages code, while `#$` "escapes" back to host code (veja Seção 8.12 [Expressões-G], Página 163).

`shepherd-action` [Data Type]
This is the data type that defines additional actions implemented by a Shepherd service (see above).

`name` Symbol naming the action.

`documentação`
This is a documentation string for the action. It can be viewed by running:

```
herd doc service action action
```

`procedure`
: This should be a gexp that evaluates to a procedure of at least one argument, which is the "running value" of the service (veja Seção "Slots of services" em *The GNU Shepherd Manual*).

The following example defines an action called `say-hello` that kindly greets the user:

```
(shepherd-action
  (name 'say-hello)
  (documentation "Say hi!")
  (procedure #~(lambda (running . args)
                 (format #t "Hello, friend! arguments: ~s\n"
                         args)
                 #t)))
```

Assuming this action is added to the `example` service, then you can do:

```
# herd say-hello example
Hello, friend! arguments: ()
# herd say-hello example a b c
Hello, friend! arguments: ("a" "b" "c")
```

This, as you can see, is a fairly sophisticated way to say hello. Veja Seção "Defining Services" em *The GNU Shepherd Manual*, for more info on actions.

`shepherd-configuration-action` [Procedure]
Return a `configuration` action to display *file*, which should be the name of the service's configuration file.

It can be useful to equip services with that action. For example, the service for the Tor anonymous router (veja Seção 11.10.5 [Serviços de Rede], Página 306) is defined roughly like this:

```
(let ((torrc (plain-file "torrc" ...)))
  (shepherd-service
    (provision '(tor))
    (requirement '(user-processes loopback syslogd))

    (start #~(make-forkexec-constructor
              (list #$(file-append tor "/bin/tor") "-f" #$torrc)
              #:user "tor" #:group "tor"))
    (stop #~(make-kill-destructor))
    (actions (list (shepherd-configuration-action torrc)))
    (documentation "Run the Tor anonymous network overlay.")))
```

Thanks to this action, administrators can inspect the configuration file passed to `tor` with this shell command:

```
cat $(herd configuration tor)
```

This can come in as a handy debugging tool!

`shepherd-root-service-type` [Variável]
The service type for the Shepherd "root service"—i.e., PID 1.

This is the service type that extensions target when they want to create shepherd services (veja Seção 11.19.2 [Tipos de Service e Serviços], Página 632, for an example). Each extension must pass a list of `<shepherd-service>`. Its value must be a `shepherd-configuration`, as described below.

`shepherd-configuration` [Data Type]

This data type represents the Shepherd's configuration.

`shepherd (default: shepherd)`
: The Shepherd package to use.

`services (default: '())`
: A list of `<shepherd-service>` to start. You should probably use the service extension mechanism instead (veja Seção 11.19.4 [Serviços de Shepherd], Página 638).

The following example specifies the Shepherd package for the operating system:

```
(operating-system
  ;; ...
  (services (append (list openssh-service-type))
            ;; ...
            %desktop-services)
  ;; ...
  ;; Use own Shepherd package.
  (essential-services
   (modify-services (operating-system-default-essential-services
                     this-operating-system)
     (shepherd-root-service-type config => (shepherd-configuration
                                            (inherit config)
                                            (shepherd my-shepherd))))))
```

`%shepherd-root-service` [Variável]

This service represents PID 1.

11.19.5 Complex Configurations

Some programs might have rather complex configuration files or formats, and to make it easier to create Scheme bindings for these configuration files, you can use the utilities defined in the `(gnu services configuration)` module.

The main utility is the `define-configuration` macro, a helper used to define a Scheme record type (veja Seção "Record Overview" em *GNU Guile Reference Manual*). The fields from this Scheme record can be serialized using *serializers*, which are procedures that take some kind of Scheme value and translates them into another Scheme value or Seção 8.12 [Expressões-G], Página 163.

`define-configuration` *name clause1 clause2 ...* [Macro]

Create a record type named *`name`* that contains the fields found in the clauses.

A clause has the following form:

```
(field-name
```

```
type-decl
documentation
option*
...)
```

field-name is an identifier that denotes the name of the field in the generated record.

type-decl is either `type` for fields that require a value to be set or `(type default-value)` otherwise.

type is the type of the value corresponding to *field-name*; since Guile is untyped, a predicate procedure—`type?`—will be called on the value corresponding to the field to ensure that the value is of the correct type. This means that if say, *type* is `package`, then a procedure named `package?` will be applied on the value to make sure that it is indeed a `<package>` object.

default-value is the default value corresponding to the field; if none is specified, the user is forced to provide a value when creating an object of the record type.

documentation is a string formatted with Texinfo syntax which should provide a description of what setting this field does.

*option** is one of the following subclauses:

`empty-serializer`
: Exclude this field from serialization.

`(serializer` *serializer*`)`
: *serializer* is the name of a procedure which takes two arguments, the first is the name of the field, and the second is the value corresponding to the field. The procedure should return a string or Seção 8.12 [Expressões-G], Página 163, that represents the content that will be serialized to the configuration file. If none is specified, a procedure of the name `serialize-type` will be used.

  An example of a simple serializer procedure:

```
(define (serialize-boolean field-name value)
  (let ((value (if value "true" "false")))
    #~(string-append '#$field-name " = " #$value)))
```

`(sanitizer` *sanitizer*`)`
: *sanitizer* is a procedure which takes one argument, a user-supplied value, and returns a "sanitized" value for the field. If no sanitizer is specified, a default sanitizer is used, which raises an error if the value is not of type *type*.

  An example of a sanitizer for a field that accepts both strings and symbols looks like this:

```
(define (sanitize-foo value)
  (cond ((string? value) value)
        ((symbol? value) (symbol->string value))
        (else (error "bad value"))))
```

In some cases multiple different configuration records might be defined in the same file, but their serializers for the same type might have to be different, because they

have different configuration formats. For example, the `serialize-boolean` procedure for the Getmail service would have to be different from the one for the Transmission service. To make it easier to deal with this situation, one can specify a serializer prefix by using the `prefix` literal in the `define-configuration` form. This means that one doesn't have to manually specify a custom *serializer* for every field.

```
(define (foo-serialize-string field-name value)
  ...)

(define (bar-serialize-string field-name value)
  ...)

(define-configuration foo-configuration
  (label
   string
   "The name of label.")
  (prefix foo-))

(define-configuration bar-configuration
  (ip-address
   string
   "The IPv4 address for this device.")
  (prefix bar-))
```

However, in some cases you might not want to serialize any of the values of the record, to do this, you can use the `no-serialization` literal. There is also the `define-configuration/no-serialization` macro which is a shorthand of this.

```
;; Nothing will be serialized to disk.
(define-configuration foo-configuration
  (field
   (string "test")
   "Some documentation.")
  (no-serialization))

;; The same thing as above.
(define-configuration/no-serialization bar-configuration
  (field
   (string "test")
   "Some documentation."))
```

`define-maybe` *type* [Macro]

Sometimes a field should not be serialized if the user doesn't specify a value. To achieve this, you can use the `define-maybe` macro to define a "maybe type"; if the value of a maybe type is left unset, or is set to the `%unset-value` value, then it will not be serialized.

When defining a "maybe type", the corresponding serializer for the regular type will be used by default. For example, a field of type `maybe-string` will be serialized using the `serialize-string` procedure by default, you can of course change this by

specifying a custom serializer procedure. Likewise, the type of the value would have to be a string, or left unspecified.

```
(define-maybe string)

(define (serialize-string field-name value)
  ...)

(define-configuration baz-configuration
  (name
   ;; If set to a string, the `serialize-string' procedure will be used
   ;; to serialize the string.  Otherwise this field is not serialized.
   maybe-string
   "The name of this module."))
```

Like with `define-configuration`, one can set a prefix for the serializer name by using the `prefix` literal.

```
(define-maybe integer
  (prefix baz-))

(define (baz-serialize-integer field-name value)
  ...)
```

There is also the `no-serialization` literal, which when set means that no serializer will be defined for the "maybe type", regardless of whether its value is set or not. `define-maybe/no-serialization` is a shorthand for specifying the `no-serialization` literal.

```
(define-maybe/no-serialization symbol)

(define-configuration/no-serialization test-configuration
  (mode
   maybe-symbol
   "Docstring."))
```

`maybe-value-set?` *value* [Procedure]
Predicate to check whether a user explicitly specified the value of a maybe field.

`serialize-configuration` *configuration fields* [Procedure]
Return a G-expression that contains the values corresponding to the *fields* of *configuration*, a record that has been generated by `define-configuration`. The G-expression can then be serialized to disk by using something like `mixed-text-file`.

Once you have defined a configuration record, you will most likely also want to document it so that other people know to use it. To help with that, there are two procedures, both of which are documented below.

`generate-documentation` *documentation documentation-name* [Procedure]
Generate a Texinfo fragment from the docstrings in *documentation*, a list of `(label fields sub-documentation ...)`. *label* should be a symbol and should be the name

of the configuration record. *fields* should be a list of all the fields available for the configuration record.

sub-documentation is a `(field-name configuration-name)` tuple. *field-name* is the name of the field which takes another configuration record as its value, and *configuration-name* is the name of that configuration record. The same value may be used for multiple *field-name*s, in case a field accepts different types of configurations.

sub-documentation is only needed if there are nested configuration records. For example, the `getmail-configuration` record (veja Seção 11.10.13 [Serviços de correio], Página 381) accepts a `getmail-configuration-file` record in one of its `rcfile` field, therefore documentation for `getmail-configuration-file` is nested in `getmail-configuration`.

```
(generate-documentation
  `((getmail-configuration ,getmail-configuration-fields
     (rcfile getmail-configuration-file))
    ...)
  'getmail-configuration)
```

documentation-name should be a symbol and should be the name of the configuration record.

`configuration->documentation` *configuration-symbol* [Procedure]

Take *configuration-symbol*, the symbol corresponding to the name used when defining a configuration record with `define-configuration`, and print the Texinfo documentation of its fields. This is useful if there aren't any nested configuration records since it only prints the documentation for the top-level fields.

As of right now, there is no automated way to generate documentation for configuration records and put them in the manual. Instead, every time you make a change to the docstrings of a configuration record, you have to manually call `generate-documentation` or `configuration->documentation`, and paste the output into the `doc/guix.texi` file.

Below is an example of a record type created using `define-configuration` and friends.

```
(use-modules (gnu services)
             (guix gexp)
             (gnu services configuration)
             (srfi srfi-26)
             (srfi srfi-1))

;; Turn field names, which are Scheme symbols into strings
(define (uglify-field-name field-name)
  (let ((str (symbol->string field-name)))
    ;; field? -> is-field
    (if (string-suffix? "?" str)
        (string-append "is-" (string-drop-right str 1))
        str)))

(define (serialize-string field-name value)
  #~(string-append #$(uglify-field-name field-name) " = " #$value "\n"))
```

```
(define (serialize-integer field-name value)
  (serialize-string field-name (number->string value)))

(define (serialize-boolean field-name value)
  (serialize-string field-name (if value "true" "false")))

(define (serialize-contact-name field-name value)
  #~(string-append "\n[" #$value "]\n"))

(define (list-of-contact-configurations? lst)
  (every contact-configuration? lst))

(define (serialize-list-of-contact-configurations field-name value)
  #~(string-append #$@(map (cut serialize-configuration <>
                                contact-configuration-fields)
                           value)))

(define (serialize-contacts-list-configuration configuration)
  (mixed-text-file
   "contactrc"
   #~(string-append "[Owner]\n"
                    #$(serialize-configuration
                       configuration contacts-list-configuration-fields))))

(define-maybe integer)
(define-maybe string)

(define-configuration contact-configuration
  (name
   string
   "The name of the contact."
   serialize-contact-name)
  (phone-number
   maybe-integer
   "The person's phone number.")
  (email
   maybe-string
   "The person's email address.")
  (married?
   boolean
   "Whether the person is married."))

(define-configuration contacts-list-configuration
  (name
   string
   "The name of the owner of this contact list.")
```

```
  (email
   string
   "The owner's email address.")
  (contacts
   (list-of-contact-configurations '())
   "A list of @code{contact-configuration} records which contain
information about all your contacts."))
```

A contacts list configuration could then be created like this:

```
(define my-contacts
  (contacts-list-configuration
   (name "Alice")
   (email "alice@example.org")
   (contacts
    (list (contact-configuration
           (name "Bob")
           (phone-number 1234)
           (email "bob@gnu.org")
           (married? #f))
          (contact-configuration
           (name "Charlie")
           (phone-number 0000)
           (married? #t))))))
```

After serializing the configuration to disk, the resulting file would look like this:

```
[owner]
name = Alice
email = alice@example.org

[Bob]
phone-number = 1234
email = bob@gnu.org
is-married = false

[Charlie]
phone-number = 0
is-married = true
```

12 Dicas para solução de problemas do sistema

Guix System allows rebooting into a previous generation should the last one be malfunctioning, which makes it quite robust against being broken irreversibly. This feature depends on GRUB being correctly functioning though, which means that if for whatever reasons your GRUB installation becomes corrupted during a system reconfiguration, you may not be able to easily boot into a previous generation. A technique that can be used in this case is to *chroot* into your broken system and reconfigure it from there. Such technique is explained below.

12.1 Acessando um sistema existente via chroot

This section details how to *chroot* to an already installed Guix System with the aim of reconfiguring it, for example to fix a broken GRUB installation. The process is similar to how it would be done on other GNU/Linux systems, but there are some Guix System particularities such as the daemon and profiles that make it worthy of explaining here.

1. Obtain a bootable image of Guix System. It is recommended the latest development snapshot so the kernel and the tools used are at least as as new as those of your installed system; it can be retrieved from the https://ci.guix.gnu.org (`https://ci.guix.gnu.org/search/latest/ISO-9660?query=spec:images+status:success+system:x86_64-linux+image.iso`) URL. Follow the veja Seção 3.3 [Instalação em um pendrive e em DVD], Página 23, section for copying it to a bootable media.
2. Boot the image, and proceed with the graphical text-based installer until your network is configured. Alternatively, you could configure the network manually by following the [manual-installation-networking], Página 27, section. If you get the error '`RTNETLINK answers: Operation not possible due to RF-kill`', try '`rfkill list`' followed by '`rfkill unblock 0`', where '`0`' is your device identifier (ID).
3. Switch to a virtual console (tty) if you haven't already by pressing simultaneously the *`Control`* + *`Alt`* + *`F4`* keys. Mount your file system at `/mnt`. Assuming your root partition is `/dev/sda2`, you would do:

   ```
   mount /dev/sda2 /mnt
   ```

4. Mount special block devices and Linux-specific directories:

   ```
   mount --rbind /proc /mnt/proc
   mount --rbind /sys /mnt/sys
   mount --rbind /dev /mnt/dev
   ```

   If your system is EFI-based, you must also mount the ESP partition. Assuming it is `/dev/sda1`, you can do so with:

   ```
   mount /dev/sda1 /mnt/boot/efi
   ```

5. Enter your system via chroot:

   ```
   chroot /mnt /bin/sh
   ```

6. Source the system profile as well as your *user* profile to setup the environment, where *user* is the user name used for the Guix System you are attempting to repair:

   ```
   source /var/guix/profiles/system/profile/etc/profile
   ```

```
source /home/user/.guix-profile/etc/profile
```

To ensure you are working with the Guix revision you normally would as your normal user, also source your current Guix profile:

```
source /home/user/.config/guix/current/etc/profile
```

7. Start a minimal `guix-daemon` in the background:

```
guix-daemon --build-users-group=guixbuild --disable-chroot &
```

8. Edit your Guix System configuration if needed, then reconfigure with:

```
guix system reconfigure your-config.scm
```

9. Finally, you should be good to reboot the system to test your fix.

13 Home Configuration

Guix supports declarative configuration of *home environments* by utilizing the configuration mechanism described in the previous chapter (veja Seção 11.19 [Definindo serviços], Página 631), but for user's dotfiles and packages. It works both on Guix System and foreign distros and allows users to declare all the packages and services that should be installed and configured for the user. Once a user has written a file containing a `home-environment` record, such a configuration can be *instantiated* by an unprivileged user with the `guix home` command (veja Seção 13.4 [Invocando guix home], Página 689).

The user's home environment usually consists of three basic parts: software, configuration, and state. Software in mainstream distros are usually installed system-wide, but with GNU Guix most software packages can be installed on a per-user basis without needing root privileges, and are thus considered part of the user's *home environment*. Packages on their own are not very useful in many cases, because often they require some additional configuration, usually config files that reside in `XDG_CONFIG_HOME` (`~/.config` by default) or other directories. Everything else can be considered state, like media files, application databases, and logs.

Using Guix for managing home environments provides a number of advantages:

- All software can be configured in one language (Guile Scheme), this gives users the ability to share values between configurations of different programs.
- A well-defined home environment is self-contained and can be created in a declarative and reproducible way—there is no need to grab external binaries or manually edit some configuration file.
- After every `guix home reconfigure` invocation, a new home environment generation will be created. This means that users can rollback to a previous home environment generation so they don't have to worry about breaking their configuration.
- It is possible to manage stateful data with Guix Home, this includes the ability to automatically clone Git repositories on the initial setup of the machine, and periodically running commands like `rsync` to sync data with another host. This functionality is still in an experimental stage, though.

13.1 Declarando o ambiente pessoal

The home environment is configured by providing a `home-environment` declaration in a file that can be passed to the `guix home` command (veja Seção 13.4 [Invocando guix home], Página 689). The easiest way to get started is by generating an initial configuration with `guix home import`:

```
guix home import ~/src/guix-config
```

The `guix home import` command reads some of the "dot files" such as `~/.bashrc` found in your home directory and copies them to the given directory, `~/src/guix-config` in this case; it also reads the contents of your profile, `~/.guix-profile`, and, based on that, it populates `~/src/guix-config/home-configuration.scm` with a Home configuration that resembles your current configuration.

A simple setup can include Bash and a custom text configuration, like in the example below. Don't be afraid to declare home environment parts, which overlaps with your current

dot files: before installing any configuration files, Guix Home will back up existing config files to a separate place in the home directory.

> **Nota:** It is highly recommended that you manage your shell or shells with Guix Home, because it will make sure that all the necessary scripts are sourced by the shell configuration file. Otherwise you will need to do it manually. (veja Seção 13.2 [Configurando o "Shell"], Página 654).

```
(use-modules (gnu home)
             (gnu home services)
             (gnu home services shells)
             (gnu services)
             (gnu packages admin)
             (guix gexp))


(home-environment
 (packages (list htop))
 (services
  (list
   (service home-bash-service-type
            (home-bash-configuration
             (guix-defaults? #t)
             (bash-profile (list (plain-file "bash-profile" "\
export HISTFILE=$XDG_CACHE_HOME/.bash_history")))))

   (simple-service 'test-config
                   home-xdg-configuration-files-service-type
                   (list `("test.conf"
                           ,(plain-file "tmp-file.txt"
                                        "the content of
                                          ~/.config/test.conf")))))))
```

The `packages` field should be self-explanatory, it will install the list of packages into the user's profile. The most important field is `services`, it contains a list of *home services*, which are the basic building blocks of a home environment.

There is no daemon (at least not necessarily) related to a home service, a home service is just an element that is used to declare part of home environment and extend other parts of it. The extension mechanism discussed in the previous chapter (veja Seção 11.19 [Definindo serviços], Página 631) should not be confused with Shepherd services (veja Seção 11.19.4 [Serviços de Shepherd], Página 638). Using this extension mechanism and some Scheme code that glues things together gives the user the freedom to declare their own, very custom, home environments.

Once the configuration looks good, you can first test it in a throw-away "container":

```
guix home container config.scm
```

The command above spawns a shell where your home environment is running. The shell runs in a container, meaning it's isolated from the rest of the system, so it's a good way to

try out your configuration—you can see if configuration bits are missing or misbehaving, if daemons get started, and so on. Once you exit that shell, you're back to the prompt of your original shell "in the real world".

Once you have a configuration file that suits your needs, you can reconfigure your home by running:

```
guix home reconfigure config.scm
```

This "builds" your home environment and creates `~/.guix-home` pointing to it. Voilà!

> **Nota:** Make sure the operating system has elogind, systemd, or a similar mechanism to create the XDG run-time directory and has the `XDG_RUNTIME_DIR` variable set. Failing that, the `on-first-login` script will not execute anything, and processes like user Shepherd and its descendants will not start.

If you're using Guix System, you can embed your home configuration in your system configuration such that `guix system reconfigure` will deploy both the system *and* your home at once! Veja [guix-home-service-type], Página 576, for how to do that.

13.2 Configurando o "Shell"

This section is safe to skip if your shell or shells are managed by Guix Home. Otherwise, read it carefully.

There are a few scripts that must be evaluated by a login shell to activate the home environment. The shell startup files only read by login shells often have `profile` suffix. For more information about login shells see Seção "Invoking Bash" em *The GNU Bash Reference Manual* and see Seção "Bash Startup Files" em *The GNU Bash Reference Manual*.

The first script that needs to be sourced is `setup-environment`, which sets all the necessary environment variables (including variables declared by the user) and the second one is `on-first-login`, which starts Shepherd for the current user and performs actions declared by other home services that extends `home-run-on-first-login-service-type`.

Guix Home will always create `~/.profile`, which contains the following lines:

```
HOME_ENVIRONMENT=$HOME/.guix-home
. $HOME_ENVIRONMENT/setup-environment
$HOME_ENVIRONMENT/on-first-login
```

This makes POSIX compliant login shells activate the home environment. However, in most cases this file won't be read by most modern shells, because they are run in non POSIX mode by default and have their own `*profile` startup files. For example Bash will prefer `~/.bash_profile` in case it exists and only if it doesn't will it fallback to `~/.profile`. Zsh (if no additional options are specified) will ignore `~/.profile`, even if `~/.zprofile` doesn't exist.

To make your shell respect `~/.profile`, add `. ~/.profile` or `source ~/.profile` to the startup file for the login shell. In case of Bash, it is `~/.bash_profile`, and in case of Zsh, it is `~/.zprofile`.

> **Nota:** This step is only required if your shell is *not* managed by Guix Home. Otherwise, everything will be done automatically.

13.3 Serviços pessoais

A *home service* is not necessarily something that has a daemon and is managed by Shepherd (veja Seção "Jump Start" em *The GNU Shepherd Manual*), in most cases it doesn't. It's a simple building block of the home environment, often declaring a set of packages to be installed in the home environment profile, a set of config files to be symlinked into `XDG_CONFIG_HOME` (`~/.config` by default), and environment variables to be set by a login shell.

There is a service extension mechanism (veja Seção 11.19.1 [Composição de serviço], Página 631) which allows home services to extend other home services and utilize capabilities they provide; for example: declare mcron jobs (veja *GNU Mcron*) by extending Seção 13.3.3 [Mcron Home Service], Página 665; declare daemons by extending Seção 13.3.5 [Shepherd Home Service], Página 667; add commands, which will be invoked on by the Bash by extending Seção 13.3.2 [Shells Home Services], Página 660.

A good way to discover available home services is using the `guix home search` command (veja Seção 13.4 [Invocando guix home], Página 689). After the required home services are found, include its module with the `use-modules` form (veja Seção "Using Guile Modules" em *The GNU Guile Reference Manual*), or the `#:use-modules` directive (veja Seção "Creating Guile Modules" em *The GNU Guile Reference Manual*) and declare a home service using the `service` function, or extend a service type by declaring a new service with the `simple-service` procedure from `(gnu services)`.

13.3.1 Serviços essenciais pessoais

There are a few essential home services defined in `(gnu home services)`, they are mostly for internal use and are required to build a home environment, but some of them will be useful for the end user.

`home-environment-variables-service-type` [Variável]

The service of this type will be instantiated by every home environment automatically by default, there is no need to define it, but someone may want to extend it with a list of pairs to set some environment variables.

```
(list ("ENV_VAR1" . "value1")
      ("ENV_VAR2" . "value2"))
```

The easiest way to extend a service type, without defining a new service type is to use the `simple-service` helper from `(gnu services)`.

```
(simple-service 'some-useful-env-vars-service
home-environment-variables-service-type
`(("LESSHISTFILE" . "$XDG_CACHE_HOME/.lesshst")
                  ("SHELL" . ,(file-append zsh "/bin/zsh"))
                  ("USELESS_VAR" . #f)
                  ("_JAVA_AWT_WM_NONREPARENTING" . #t)
                  ("LITERAL_VALUE" . ,(literal-string "${abc}"))))
```

If you include such a service in you home environment definition, it will add the following content to the `setup-environment` script (which is expected to be sourced by the login shell):

```
export LESSHISTFILE="$XDG_CACHE_HOME/.lesshst"
export SHELL="/gnu/store/2hsg15n644f0glrcbkb1kqknmmqdar03-zsh-5.8/bin/zsh"
```

```
export _JAVA_AWT_WM_NONREPARENTING
export LITERAL_VALUE='${abc}'
```

Notice that `literal-string` above lets us declare that a value is to be interpreted as a *literal string*, meaning that "special characters" such as the dollar sign will not be interpreted by the shell.

> **Nota:** Make sure that module `(gnu packages shells)` is imported with `use-modules` or any other way, this namespace contains the definition of the `zsh` package, which is used in the example above.

The association list (veja Seção "Association Lists" em *The GNU Guile Reference manual*) is a data structure containing key-value pairs, for `home-environment-variables-service-type` the key is always a string, the value can be a string, string-valued gexp (veja Seção 8.12 [Expressões-G], Página 163), file-like object (veja Seção 8.12 [Expressões-G], Página 163) or boolean. For gexps, the variable will be set to the value of the gexp; for file-like objects, it will be set to the path of the file in the store (veja Seção 8.9 [O armazém], Página 154); for `#t`, it will export the variable without any value; and for `#f`, it will omit variable.

`home-profile-service-type` [Variável]

The service of this type will be instantiated by every home environment automatically, there is no need to define it, but you may want to extend it with a list of packages if you want to install additional packages into your profile. Other services, which need to make some programs available to the user will also extend this service type.

The extension value is just a list of packages:

```
(list htop vim emacs)
```

The same approach as `simple-service` (veja Seção 11.19.3 [Referência de Service], Página 634) for `home-environment-variables-service-type` can be used here, too. Make sure that modules containing the specified packages are imported with `use-modules`. To find a package or information about its module use `guix search` (veja Seção 5.2 [Invocando guix package], Página 37). Alternatively, `specification->package` can be used to get the package record from a string without importing its related module.

There are few more essential services, but users are not expected to extend them.

`home-service-type` [Variável]

The root of home services DAG, it generates a folder, which later will be symlinked to `~/.guix-home`, it contains configurations, profile with binaries and libraries, and some necessary scripts to glue things together.

`home-run-on-first-login-service-type` [Variável]

The service of this type generates a Guile script, which is expected to be executed by the login shell. It is only executed if the special flag file inside `XDG_RUNTIME_DIR` hasn't been created, this prevents redundant executions of the script if multiple login shells are spawned.

It can be extended with a gexp. However, to autostart an application, users *should not* use this service, in most cases it's better to extend `home-shepherd-service-type` with a Shepherd service (veja Seção 11.19.4 [Serviços de Shepherd], Página 638), or

extend the shell's startup file with the required command using the appropriate service type.

`home-files-service-type` [Variável]

The service of this type allows to specify a list of files, which will go to `~/.guix-home/files`, usually this directory contains configuration files (to be more precise it contains symlinks to files in `/gnu/store`), which should be placed in `$XDG_CONFIG_DIR` or in rare cases in `$HOME`. It accepts extension values in the following format:

```
`((".sway/config" ,sway-file-like-object)
  (".tmux.conf" ,(local-file "./tmux.conf")))
```

Each nested list contains two values: a subdirectory and file-like object. After building a home environment `~/.guix-home/files` will be populated with appropriate content and all nested directories will be created accordingly, however, those files won't go any further until some other service will do it. By default a `home-symlink-manager-service-type`, which creates necessary symlinks in home folder to files from `~/.guix-home/files` and backs up already existing, but clashing configs and other things, is a part of essential home services (enabled by default), but it's possible to use alternative services to implement more advanced use cases like read-only home. Feel free to experiment and share your results.

It is often the case that Guix Home users already have a setup for versioning their user configuration files (also known as *dot files*) in a single directory, and some way of automatically deploy changes to their user home.

The `home-dotfiles-service-type` from `(gnu home services dotfiles)` is designed to ease the way into using Guix Home for this kind of users, allowing them to point the service to their dotfiles directory without migrating them to Guix native configurations.

Please keep in mind that it is advisable to keep your dotfiles directories under version control, for example in the same repository where you'd track your Guix Home configuration.

There are two supported dotfiles directory layouts, for now. The `'plain` layout, which is structured as follows:

```
~$ tree -a ./dotfiles/
dotfiles/
 .gitconfig
 .gnupg
    gpg-agent.conf
    gpg.conf
 .guile
 .config
    guix
       channels.scm
    nixpkgs
        config.nix
 .nix-channels
 .tmux.conf
 .vimrc
```

This tree structure is installed as is to the home directory upon `guix home reconfigure`.

The `'stow` layout, which must follow the layout suggested by GNU Stow (`https://www.gnu.org/software/stow/`) presents an additional application specific directory layer, just like:

```
~$ tree -a ./dotfiles/
dotfiles/
 git
    .gitconfig
 gpg
    .gnupg
        gpg-agent.conf
        gpg.conf
 guile
    .guile
 guix
    .config
        guix
            channels.scm
 nix
    .config
       nixpkgs
           config.nix
    .nix-channels
 tmux
    .tmux.conf
 vim
     .vimrc

13 directories, 10 files
```

For an informal specification please refer to the Stow manual (veja *Introduction*). This tree structure is installed following GNU Stow's logic to the home directory upon `guix home reconfigure`.

A suitable configuration with a `'plain` layout could be:

```
(home-environment
  ;; ...
  (services
    (service home-dotfiles-service-type
             (home-dotfiles-configuration
               (directories '("./dotfiles"))))))
```

The expected home directory state would then be:

```
.
 .config
    guix
       channels.scm
    nixpkgs
        config.nix
```

```
.gitconfig
.gnupg
   gpg-agent.conf
   gpg.conf
.guile
.nix-channels
.tmux.conf
.vimrc
```

`home-dotfiles-service-type` [Variável]

Return a service which is very similiar to `home-files-service-type` (and actually extends it), but designed to ease the way into using Guix Home for users that already track their dotfiles under some kind of version control. This service allows users to point Guix Home to their dotfiles directory and have their files automatically provisioned to their home directory, without migrating all of their dotfiles to Guix native configurations.

`home-dotfiles-configuration` [Data Type]

Available `home-dotfiles-configuration` fields are:

`source-directory` (default: `(current-source-directory)`) (type: string)
: The path where dotfile directories are resolved. By default dotfile directories are resolved relative the source location where `home-dotfiles-configuration` appears.

`layout` (default: `'plain`) (type: symbol)
: The intended layout of the specified `directory`. It can be either `'stow` or `'plain`.

`directories` (default: `'()`) (type: list-of-strings)
: The list of dotfiles directories where `home-dotfiles-service-type` will look for application dotfiles.

`packages` (type: maybe-list-of-strings)
: The names of a subset of the GNU Stow package layer directories. When provided the `home-dotfiles-service-type` will only provision dotfiles from this subset of applications. This field will be ignored if `layout` is set to `'plain`.

`excluded` (default: `'(".*~" ".*\\.swp" "\\.git" "\\.gitignore")`) (type: list-of-strings)
: The list of file patterns `home-dotfiles-service-type` will exclude while visiting each one of the `directories`.

`home-xdg-configuration-files-service-type` [Variável]

The service is very similar to `home-files-service-type` (and actually extends it), but used for defining files, which will go to `~/.guix-home/files/.config`, which will be symlinked to `$XDG_CONFIG_DIR` by `home-symlink-manager-service-type` (for example) during activation. It accepts extension values in the following format:

```
`(("sway/config" ,sway-file-like-object)
```

```
;; -> ~/.guix-home/files/.config/sway/config
;; -> $XDG_CONFIG_DIR/sway/config (by symlink-manager)
("tmux/tmux.conf" ,(local-file "./tmux.conf")))
```

`home-activation-service-type` [Variável]

The service of this type generates a guile script, which runs on every `guix home reconfigure` invocation or any other action, which leads to the activation of the home environment.

`home-symlink-manager-service-type` [Variável]

The service of this type generates a guile script, which will be executed during activation of home environment, and do a few following steps:

1. Reads the content of `files/` directory of current and pending home environments.
2. Cleans up all symlinks created by symlink-manager on previous activation. Also, sub-directories, which become empty also will be cleaned up.
3. Creates new symlinks the following way: It looks `files/` directory (usually defined with `home-files-service-type`, `home-xdg-configuration-files-service-type` and maybe some others), takes the files from `files/.config/` subdirectory and put respective links in `XDG_CONFIG_DIR`. For example symlink for `files/.config/sway/config` will end up in `$XDG_CONFIG_DIR/sway/config`. The rest files in `files/` outside of `files/.config/` subdirectory will be treated slightly different: symlink will just go to `$HOME`. `files/.some-program/config` will end up in `$HOME/.some-program/config`.
4. If some sub-directories are missing, they will be created.
5. If there is a clashing files on the way, they will be backed up.

symlink-manager is a part of essential home services and is enabled and used by default.

13.3.2 Shells

Shells play a quite important role in the environment initialization process, you can configure them manually as described in section Seção 13.2 [Configurando o "Shell"], Página 654, but the recommended way is to use home services listed below. It's both easier and more reliable.

Each home environment instantiates `home-shell-profile-service-type`, which creates a `~/.profile` startup file for all POSIX-compatible shells. This file contains all the necessary steps to properly initialize the environment, but many modern shells like Bash or Zsh prefer their own startup files, that's why the respective home services (`home-bash-service-type` and `home-zsh-service-type`) ensure that `~/.profile` is sourced by `~/.bash_profile` and `~/.zprofile`, respectively.

Shell Profile Service

`home-shell-profile-configuration` [Data Type]

Available `home-shell-profile-configuration` fields are:

`profile` (default: `'()`) (type: text-config)

`home-shell-profile` is instantiated automatically by `home-environment`, DO NOT create this service manually, it can only

be extended. `profile` is a list of file-like objects, which will go to `~/.profile`. By default `~/.profile` contains the initialization code which must be evaluated by the login shell to make home-environment's profile available to the user, but other commands can be added to the file if it is really necessary. In most cases shell's configuration files are preferred places for user's customizations. Extend home-shell-profile service only if you really know what you do.

Bash Home Service

`home-bash-configuration` [Data Type]

Available `home-bash-configuration` fields are:

`package` (default: `bash`) (type: package)
The Bash package to use.

`guix-defaults?` (default: `#t`) (type: boolean)
Add sane defaults like reading `/etc/bashrc` and coloring the output of `ls` to the top of the `.bashrc` file.

`environment-variables` (default: `'()`) (type: alist)
Association list of environment variables to set for the Bash session. The rules for the `home-environment-variables-service-type` apply here (veja Seção 13.3.1 [Serviços essenciais pessoais], Página 655). The contents of this field will be added after the contents of the `bash-profile` field.

`aliases` (default: `'()`) (type: alist)
Association list of aliases to set for the Bash session. The aliases will be defined after the contents of the `bashrc` field has been put in the `.bashrc` file. The alias will automatically be quoted, so something like this:

```
'(("ls" . "ls -alF"))
```

turns into

```
alias ls="ls -alF"
```

`bash-profile` (default: `'()`) (type: text-config)
List of file-like objects, which will be added to `.bash_profile`. Used for executing user's commands at start of login shell (In most cases the shell started on tty just after login). `.bash_login` won't be ever read, because `.bash_profile` always present.

`bashrc` (default: `'()`) (type: text-config)
List of file-like objects, which will be added to `.bashrc`. Used for executing user's commands at start of interactive shell (The shell for interactive usage started by typing `bash` or by terminal app or any other program).

`bash-logout` (default: `'()`) (type: text-config)
List of file-like objects, which will be added to `.bash_logout`. Used for executing user's commands at the exit of login shell. It won't be read in some cases (if the shell terminates by exec'ing another process for example).

You can extend the Bash service by using the `home-bash-extension` configuration record, whose fields must mirror that of `home-bash-configuration` (veja [home-bash-configuration], Página 661). The contents of the extensions will be added to the end of the corresponding Bash configuration files (veja Seção "Bash Startup Files" em *The GNU Bash Reference Manual*.

For example, here is how you would define a service that extends the Bash service such that `~/.bash_profile` defines an additional environment variable, `PS1`:

```
(define bash-fancy-prompt-service
  (simple-service 'bash-fancy-prompt
                  home-bash-service-type
                  (home-bash-extension
                   (environment-variables
                    '(("PS1" . "\\u \\wλ "))))))
```

You would then add `bash-fancy-prompt-service` to the list in the `services` field of your `home-environment`. The reference of `home-bash-extension` follows.

`home-bash-extension` [Data Type]

Available `home-bash-extension` fields are:

`environment-variables` (default: `'()`) (type: alist)
: Additional environment variables to set. These will be combined with the environment variables from other extensions and the base service to form one coherent block of environment variables.

`aliases` (default: `'()`) (type: alist)
: Additional aliases to set. These will be combined with the aliases from other extensions and the base service.

`bash-profile` (default: `'()`) (type: text-config)
: Additional text blocks to add to `.bash_profile`, which will be combined with text blocks from other extensions and the base service.

`bashrc` (default: `'()`) (type: text-config)
: Additional text blocks to add to `.bashrc`, which will be combined with text blocks from other extensions and the base service.

`bash-logout` (default: `'()`) (type: text-config)
: Additional text blocks to add to `.bash_logout`, which will be combined with text blocks from other extensions and the base service.

Zsh Home Service

`home-zsh-configuration` [Data Type]

Available `home-zsh-configuration` fields are:

`package` (default: `zsh`) (type: package)
: The Zsh package to use.

`xdg-flavor?` (default: `#t`) (type: boolean)
: Place all the configs to `$XDG_CONFIG_HOME/zsh`. Makes `~/.zshenv` to set `ZDOTDIR` to `$XDG_CONFIG_HOME/zsh`. Shell startup process will continue with `$XDG_CONFIG_HOME/zsh/.zshenv`.

`environment-variables` (default: `'()`) (type: alist)
: Association list of environment variables to set for the Zsh session.

`zshenv` (default: `'()`) (type: text-config)
: List of file-like objects, which will be added to `.zshenv`. Used for setting user's shell environment variables. Must not contain commands assuming the presence of tty or producing output. Will be read always. Will be read before any other file in `ZDOTDIR`.

`zprofile` (default: `'()`) (type: text-config)
: List of file-like objects, which will be added to `.zprofile`. Used for executing user's commands at start of login shell (In most cases the shell started on tty just after login). Will be read before `.zlogin`.

`zshrc` (default: `'()`) (type: text-config)
: List of file-like objects, which will be added to `.zshrc`. Used for executing user's commands at start of interactive shell (The shell for interactive usage started by typing `zsh` or by terminal app or any other program).

`zlogin` (default: `'()`) (type: text-config)
: List of file-like objects, which will be added to `.zlogin`. Used for executing user's commands at the end of starting process of login shell.

`zlogout` (default: `'()`) (type: text-config)
: List of file-like objects, which will be added to `.zlogout`. Used for executing user's commands at the exit of login shell. It won't be read in some cases (if the shell terminates by exec'ing another process for example).

Inputrc Profile Service

The GNU Readline package (`https://tiswww.cwru.edu/php/chet/readline/rltop.html`) includes Emacs and vi editing modes, with the ability to customize the configuration with settings in the `~/.inputrc` file. With the `gnu home services shells` module, you can setup your readline configuration in a predictable manner, as shown below. For more information about configuring an `~/.inputrc` file, veja Seção "Readline Init File" em *GNU Readline*.

`home-inputrc-service-type` [Variável]
: This is the service to setup various `.inputrc` configurations. The settings in `.inputrc` are read by all programs which are linked with GNU Readline.

  Here is an example of a service and its configuration that you could add to the `services` field of your `home-environment`:

```
(service home-inputrc-service-type
         (home-inputrc-configuration
           (key-bindings
            `(("Control-l" . "clear-screen")))
           (variables
            `(("bell-style" . "visible")
              ("colored-completion-prefix" . #t)
              ("editing-mode" . "vi")
```

```
   ("show-mode-in-prompt" . #t)))
 (conditional-constructs
  `(("$if mode=vi" .
     ,(home-inputrc-configuration
        (variables
         `(("colored-stats" . #t)
           ("enable-bracketed-paste" . #t)))))
    ("$else" .
     ,(home-inputrc-configuration
        (variables
         `(("show-all-if-ambiguous" . #t)))))
    ("endif" . #t)
    ("$include" . "/etc/inputrc")
    ("$include" . ,(file-append
                    (specification->package "readline")
                    "/etc/inputrc"))))))
```

The example above starts with a combination of `key-bindings` and `variables`. The `conditional-constructs` show how it is possible to add conditionals and includes. In the example above `colored-stats` is only enabled if the editing mode is `vi` style, and it also reads any additional configuration located in `/etc/inputrc` or in `/gnu/store/...-readline/etc/inputrc`.

The value associated with a `home-inputrc-service-type` instance must be a `home-inputrc-configuration` record, as described below.

`home-inputrc-configuration` [Data Type]

Available `home-inputrc-configuration` fields are:

`key-bindings` (default: `'()`) (type: alist)

Association list of readline key bindings to be added to the `~/.inputrc` file.

```
'((\"Control-l\" . \"clear-screen\"))
```

turns into

```
Control-l: clear-screen
```

`variables` (default: `'()`) (type: alist)

Association list of readline variables to set.

```
'((\"bell-style\" . \"visible\")
  (\"colored-completion-prefix\" . #t))
```

turns into

```
set bell-style visible
set colored-completion-prefix on
```

`conditional-constructs` (default: `'()`) (type: alist)

Association list of conditionals to add to the initialization file. This includes `$if`, `else`, `endif` and `include` and they receive a value of another `home-inputrc-configuration`.

```
(conditional-constructs
```

```
`((\"$if mode=vi\" .
    ,(home-inputrc-configuration
       (variables
        `((\"show-mode-in-prompt\" . #t)))))
  (\"$else\" .
    ,(home-inputrc-configuration
       (key-bindings
        `((\"Control-l\" . \"clear-screen\")))))
  (\"$endif\" . #t)))
```

turns into

```
$if mode=vi
set show-mode-in-prompt on
$else
Control-l: clear-screen
$endif
```

`extra-content` (default: `""`) (type: text-config)
: Extra content appended as-is to the configuration file. Run `man readline` for more information about all the configuration options.

13.3.3 Scheduled User's Job Execution

The `(gnu home services mcron)` module provides an interface to GNU mcron, a daemon to run jobs at scheduled times (veja *GNU mcron*). The information about system's mcron is applicable here (veja Seção 11.10.2 [Execução de trabalho agendado], Página 289), the only difference for home services is that they have to be declared in a `home-environment` record instead of an `operating-system` record.

`home-mcron-service-type` [Variável]
: This is the type of the `mcron` home service, whose value is a `home-mcron-configuration` object. It allows to manage scheduled tasks.

  This service type can be the target of a service extension that provides additional job specifications (veja Seção 11.19.1 [Composição de serviço], Página 631). In other words, it is possible to define services that provide additional mcron jobs to run.

`home-mcron-configuration` [Data Type]
: Available `home-mcron-configuration` fields are:

  `mcron` (default: `mcron`) (type: file-like)
  : The mcron package to use.

  `jobs` (default: `'()`) (type: list-of-gexps)
  : This is a list of gexps (veja Seção 8.12 [Expressões-G], Página 163), where each gexp corresponds to an mcron job specification (veja Seção "Syntax" em *GNU mcron*).

  `log?` (default: `#t`) (type: boolean)
  : Log messages to standard output.

  `log-format` (default: `"~1@*~a ~a: ~a~%"`) (type: string)
  : `(ice-9 format)` format string for log messages. The default value produces messages like "'*pid name*: *message*"' (veja Seção "Invoking mcron"

em *GNU mcron*). Each message is also prefixed by a timestamp by GNU Shepherd.

13.3.4 Power Management Home Services

The `(gnu home services pm)` module provides home services pertaining to battery power.

`home-batsignal-service-type` [Variável]

Service for `batsignal`, a program that monitors battery levels and warns the user through desktop notifications when their battery is getting low. You can also configure a command to be run when the battery level passes a point deemed "dangerous". This service is configured with the `home-batsignal-configuration` record.

`home-batsignal-configuration` [Data Type]

Data type representing the configuration for batsignal.

`warning-level` (default: `15`)
: The battery level to send a warning message at.

`warning-message` (default: `#f`)
: The message to send as a notification when the battery level reaches the `warning-level`. Setting to `#f` uses the default message.

`critical-level` (default: `5`)
: The battery level to send a critical message at.

`critical-message` (default: `#f`)
: The message to send as a notification when the battery level reaches the `critical-level`. Setting to `#f` uses the default message.

`danger-level` (default: `2`)
: The battery level to run the `danger-command` at.

`danger-command` (default: `#f`)
: The command to run when the battery level reaches the `danger-level`. Setting to `#f` disables running the command entirely.

`full-level` (default: `#f`)
: The battery level to send a full message at. Setting to `#f` disables sending the full message entirely.

`full-message` (default: `#f`)
: The message to send as a notification when the battery level reaches the `full-level`. Setting to `#f` uses the default message.

`batteries` (default: `'()`)
: The batteries to monitor. Setting to `'()` tries to find batteries automatically.

`poll-delay` (default: `60`)
: The time in seconds to wait before checking the batteries again.

`icon` (default: `#f`)
: A file-like object to use as the icon for battery notifications. Setting to `#f` disables notification icons entirely.

`notifications?` (default: `#t`)
: Whether to send any notifications.

`notifications-expire?` (default: `#f`)
: Whether notifications sent expire after a time.

`notification-command` (default: `#f`)
: Command to use to send messages. Setting to `#f` sends a notification through `libnotify`.

`ignore-missing?` (default: `#f`)
: Whether to ignore missing battery errors.

13.3.5 Managing User Daemons

The `(gnu home services shepherd)` module supports the definitions of per-user Shepherd services (veja Seção "Introduction" em *The GNU Shepherd Manual*). You extend `home-shepherd-service-type` with new services; Guix Home then takes care of starting the `shepherd` daemon for you when you log in, which in turns starts the services you asked for.

`home-shepherd-service-type` [Variável]
: The service type for the userland Shepherd, which allows one to manage long-running processes or one-shot tasks. User's Shepherd is not an init process (PID 1), but almost all other information described in (veja Seção 11.19.4 [Serviços de Shepherd], Página 638) is applicable here too.

  This is the service type that extensions target when they want to create shepherd services (veja Seção 11.19.2 [Tipos de Service e Serviços], Página 632, for an example). Each extension must pass a list of `<shepherd-service>`. Its value must be a `home-shepherd-configuration`, as described below.

`home-shepherd-configuration` [Data Type]
: This data type represents the Shepherd's configuration.

  `shepherd (default: shepherd)`
  : The Shepherd package to use.

  `auto-start? (default: #t)`
  : Whether or not to start Shepherd on first login.

  `daemonize? (default: #t)`
  : Whether or not to run Shepherd in the background.

  `silent? (default: #t)`
  : When true, the `shepherd` process does not write anything to standard output when started automatically.

  `services (default: '())`
  : A list of `<shepherd-service>` to start. You should probably use the service extension mechanism instead (veja Seção 11.19.4 [Serviços de Shepherd], Página 638).

13.3.6 Secure Shell

The OpenSSH package (`https://www.openssh.com`) includes a client, the `ssh` command, that allows you to connect to remote machines using the SSH (secure shell) protocol. With the `(gnu home services ssh)` module, you can set up OpenSSH so that it works in a predictable fashion, almost independently of state on the local machine. To do that, you instantiate `home-openssh-service-type` in your Home configuration, as explained below.

`home-openssh-service-type` [Variável]

This is the type of the service to set up the OpenSSH client. It takes care of several things:

- providing a `~/.ssh/config` file based on your configuration so that `ssh` knows about hosts you regularly connect to and their associated parameters;
- providing a `~/.ssh/authorized_keys`, which lists public keys that the local SSH server, `sshd`, may accept to connect to this user account;
- optionally providing a `~/.ssh/known_hosts` file so that `ssh` can authenticate hosts you connect to.

Here is an example of a service and its configuration that you could add to the `services` field of your `home-environment`:

```
(service home-openssh-service-type
         (home-openssh-configuration
          (hosts
           (list (openssh-host (name "ci.guix.gnu.org")
                               (user "charlie"))
                 (openssh-host (name "chbouib")
                               (host-name "chbouib.example.org")
                               (user "supercharlie")
                               (port 10022))))
          (authorized-keys (list (local-file "alice.pub")))))
```

The example above lists two hosts and their parameters. For instance, running `ssh chbouib` will automatically connect to `chbouib.example.org` on port 10022, logging in as user '`supercharlie`'. Further, it marks the public key in `alice.pub` as authorized for incoming connections.

The value associated with a `home-openssh-service-type` instance must be a `home-openssh-configuration` record, as describe below.

`home-openssh-configuration` [Data Type]

This is the datatype representing the OpenSSH client and server configuration in one's home environment. It contains the following fields:

`hosts` (default: `'()`)

A list of `openssh-host` records specifying host names and associated connection parameters (see below). This host list goes into `~/.ssh/config`, which `ssh` reads at startup.

`known-hosts` (default: `*unspecified*`)

This must be either:

- `*unspecified*`, in which case `home-openssh-service-type` leaves it up to `ssh` and to the user to maintain the list of known hosts at `~/.ssh/known_hosts`, or
- a list of file-like objects, in which case those are concatenated and emitted as `~/.ssh/known_hosts`.

The `~/.ssh/known_hosts` contains a list of host name/host key pairs that allow `ssh` to authenticate hosts you connect to and to detect possible impersonation attacks. By default, `ssh` updates it in a *TOFU, trust-on-first-use* fashion, meaning that it records the host's key in that file the first time you connect to it. This behavior is preserved when `known-hosts` is set to `*unspecified*`.

If you instead provide a list of host keys upfront in the `known-hosts` field, your configuration becomes self-contained and stateless: it can be replicated elsewhere or at another point in time. Preparing this list can be relatively tedious though, which is why `*unspecified*` is kept as a default.

`authorized-keys` (default: `#false`)
The default `#false` value means: Leave any `~/.ssh/authorized_keys` file alone. Otherwise, this must be a list of file-like objects, each of which containing an SSH public key that should be authorized to connect to this machine.

Concretely, these files are concatenated and made available as `~/.ssh/authorized_keys`. If an OpenSSH server, `sshd`, is running on this machine, then it *may* take this file into account: this is what `sshd` does by default, but be aware that it can also be configured to ignore it.

`add-keys-to-agent` (default: `no`)
This string specifies whether keys should be automatically added to a running ssh-agent. If this option is set to `yes` and a key is loaded from a file, the key and its passphrase are added to the agent with the default lifetime, as if by `ssh-add`. If this option is set to `ask`, `ssh` will require confirmation. If this option is set to `confirm`, each use of the key must be confirmed. If this option is set to `no`, no keys are added to the agent. Alternately, this option may be specified as a time interval to specify the key's lifetime in `ssh-agent`, after which it will automatically be removed. The argument must be `no`, `yes`, `confirm` (optionally followed by a time interval), `ask` or a time interval.

`openssh-host` [Data Type]
Available `openssh-host` fields are:

`name` (type: string)
Name of this host declaration. A `openssh-host` must define only `name` or `match-criteria`. Use host-name `\"*\"` for top-level options.

`host-name` (type: maybe-string)
Host name—e.g., `"foo.example.org"` or `"192.168.1.2"`.

`match-criteria` (type: maybe-match-criteria)
: When specified, this string denotes the set of hosts to which the entry applies, superseding the `host-name` field. Its first element must be all or one of `ssh-match-keywords`. The rest of the elements are arguments for the keyword, or other criteria. A `openssh-host` must define only `name` or `match-criteria`. Other host configuration options will apply to all hosts matching `match-criteria`.

`address-family` (type: maybe-address-family)
: Address family to use when connecting to this host: one of `AF_INET` (for IPv4 only), `AF_INET6` (for IPv6 only). Additionally, the field can be left unset to allow any address family.

`identity-file` (type: maybe-string)
: The identity file to use—e.g., `"/home/charlie/.ssh/id_ed25519"`.

`port` (type: maybe-natural-number)
: TCP port number to connect to.

`user` (type: maybe-string)
: User name on the remote host.

`forward-x11?` (type: maybe-boolean)
: Whether to forward remote client connections to the local X11 graphical display.

`forward-x11-trusted?` (type: maybe-boolean)
: Whether remote X11 clients have full access to the original X11 graphical display.

`forward-agent?` (type: maybe-boolean)
: Whether the authentication agent (if any) is forwarded to the remote machine.

`compression?` (type: maybe-boolean)
: Whether to compress data in transit.

`proxy` (type: maybe-proxy-command-or-jump-list)
: The command to use to connect to the server or a list of SSH hosts to jump through before connecting to the server. The field may be set to either a `proxy-command` or a list of `proxy-jump` records.

  As an example, a `proxy-command` to connect via an HTTP proxy at 192.0.2.0 would be constructed with: `(proxy-command "nc -X connect -x 192.0.2.0:8080 %h %p")`.

  `proxy-jump` [Data Type]
  : Available `proxy-jump` fields are:

    `user` (type: maybe-string)
    : User name on the remote host.

    `host-name` (type: string)
    : Host name—e.g., `foo.example.org` or `192.168.1.2`.

`port` (type: maybe-natural-number)
TCP port number to connect to.

`host-key-algorithms` (type: maybe-string-list)
The list of accepted host key algorithms—e.g., `'("ssh-ed25519")`.

`accepted-key-types` (type: maybe-string-list)
The list of accepted user public key types.

`extra-content` (default: `""`) (type: raw-configuration-string)
Extra content appended as-is to this `Host` block in `~/.ssh/config`.

The `parcimonie` service runs a daemon that slowly refreshes a GnuPG public key from a keyserver. It refreshes one key at a time; between every key update parcimonie sleeps a random amount of time, long enough for the previously used Tor circuit to expire. This process is meant to make it hard for an attacker to correlate the multiple key update.

As an example, here is how you would configure `parcimonie` to refresh the keys in your GnuPG keyring, as well as those keyrings created by Guix, such as when running `guix import`:

```
(service home-parcimonie-service-type
         (home-parcimonie-configuration
           (refresh-guix-keyrings? #t)))
```

This assumes that the Tor anonymous routing daemon is already running on your system. On Guix System, this can be achieved by setting up `tor-service-type` (veja Seção 11.10.5 [Serviços de Rede], Página 306).

The service reference is given below.

`parcimonie-service-type` [Variável]
This is the service type for `parcimonie` (Parcimonie's web site (`https://salsa.debian.org/intrigeri/parcimonie`)). Its value must be a `home-parcimonie-configuration`, as shown below.

`home-parcimonie-configuration` [Data Table]
Available `home-parcimonie-configuration` fields are:

`parcimonie` (default: `parcimonie`) (type: file-like)
The parcimonie package to use.

`verbose?` (default: `#f`) (type: boolean)
Whether to have more verbose logging from the service.

`gnupg-already-torified?` (default: `#f`) (type: boolean)
Whether GnuPG is already configured to pass all traffic through Tor (`https://torproject.org`).

`refresh-guix-keyrings?` (default: `#f`) (type: boolean)
Guix creates a few keyrings in the *$XDG_CONFIG_DIR*, such as when running `guix import` (veja Seção 9.5 [Invocando guix import], Página 194). Setting this to `#t` will also refresh any keyrings which Guix has created.

`extra-content` (default: `#f`) (type: raw-configuration-string)
Raw content to add to the parcimonie command.

The OpenSSH package (`https://www.openssh.com`) includes a daemon, the `ssh-agent` command, that manages keys to connect to remote machines using the SSH (secure shell) protocol. With the `(gnu home services ssh)` service, you can configure the OpenSSH ssh-agent to run upon login. Veja Seção 13.3.7 [GNU Privacy Guard], Página 672, for an alternative to OpenSSH's `ssh-agent`.

Here is an example of a service and its configuration that you could add to the `services` field of your `home-environment`:

```
(service home-ssh-agent-service-type
         (home-ssh-agent-configuration
          (extra-options '("-t" "1h30m"))))
```

`home-ssh-agent-service-type` [Variável]
This is the type of the `ssh-agent` home service, whose value is a `home-ssh-agent-configuration` object.

`home-ssh-agent-configuration` [Data Type]
Available `home-ssh-agent-configuration` fields are:

`openssh` (default: `openssh`) (type: file-like)
The OpenSSH package to use.

`socket-directory` (default: `XDG_RUNTIME_DIR/ssh-agent"`) (type: gexp)
The directory to write the ssh-agent's `socket` file.

`extra-options` (default: `'()`)
Extra options will be passed to `ssh-agent`, please run `man ssh-agent` for more information.

13.3.7 GNU Privacy Guard

The `(gnu home services gnupg)` module provides services that help you set up the GNU Privacy Guard, also known as GnuPG or GPG, in your home environment.

The `gpg-agent` service configures and sets up GPG's agent, the program that is responsible for managing OpenPGP private keys and, optionally, OpenSSH (secure shell) private keys (veja Seção "Invoking GPG-AGENT" em *Using the GNU Privacy Guard*).

As an example, here is how you would configure `gpg-agent` with SSH support such that it uses the Emacs-based Pinentry interface when prompting for a passphrase:

```
(service home-gpg-agent-service-type
         (home-gpg-agent-configuration
          (pinentry-program
           (file-append pinentry-emacs "/bin/pinentry-emacs"))
          (ssh-support? #t)))
```

The service reference is given below.

`home-gpg-agent-service-type` [Variável]
This is the service type for `gpg-agent` (veja Seção "Invoking GPG-AGENT" em *Using the GNU Privacy Guard*). Its value must be a `home-gpg-agent-configuration`, as shown below.

`home-gpg-agent-configuration` [Data Type]

Available `home-gpg-agent-configuration` fields are:

`gnupg` (default: `gnupg`) (type: file-like)
The GnuPG package to use.

`pinentry-program` (type: file-like)
Pinentry program to use. Pinentry is a small user interface that `gpg-agent` delegates to anytime it needs user input for a passphrase or PIN (personal identification number) (veja *Using the PIN-Entry*).

`ssh-support?` (default: `#f`) (type: boolean)
Whether to enable SSH (secure shell) support. When true, `gpg-agent` acts as a drop-in replacement for OpenSSH's `ssh-agent` program, taking care of OpenSSH secret keys and directing passphrase requests to the chosen Pinentry program.

`default-cache-ttl` (default: `600`) (type: integer)
Time a cache entry is valid, in seconds.

`max-cache-ttl` (default: `7200`) (type: integer)
Maximum time a cache entry is valid, in seconds. After this time a cache entry will be expired even if it has been accessed recently.

`default-cache-ttl-ssh` (default: `1800`) (type: integer)
Time a cache entry for SSH keys is valid, in seconds.

`max-cache-ttl-ssh` (default: `7200`) (type: integer)
Maximum time a cache entry for SSH keys is valid, in seconds.

`extra-content` (default: `""`) (type: raw-configuration-string)
Raw content to add to the end of `~/.gnupg/gpg-agent.conf`.

13.3.8 Desktop Home Services

The `(gnu home services desktop)` module provides services that you may find useful on "desktop" systems running a graphical user environment such as Xorg.

`home-x11-service-type` [Variável]

This is the service type representing the X Window graphical display server (also referred to as "X11").

X Window is necessarily started by a system service; on Guix System, starting it is the responsibility of `gdm-service-type` and similar services (veja Seção 11.10.7 [X Window], Página 332). At the level of Guix Home, as an unprivileged user, we cannot start X Window; all we can do is check whether it is running. This is what this service does.

As a user, you probably don't need to worry or explicitly instantiate `home-x11-service-type`. Services that require an X Window graphical display, such as `home-redshift-service-type` below, instantiate it and depend on its corresponding `x11-display` Shepherd service (veja Seção 13.3.5 [Shepherd Home Service], Página 667).

When X Window is running, the `x11-display` Shepherd service starts and sets the `DISPLAY` environment variable of the `shepherd` process, using its original value if it was already set; otherwise, it fails to start.

The service can also be forced to use a given value for `DISPLAY`, like so:

```
herd start x11-display :3
```

In the example above, `x11-display` is instructed to set `DISPLAY` to `:3`.

`home-redshift-service-type` [Variável]

This is the service type for Redshift (`https://github.com/jonls/redshift`), a program that adjusts the display color temperature according to the time of day. Its associated value must be a `home-redshift-configuration` record, as shown below.

A typical configuration, where we manually specify the latitude and longitude, might look like this:

```
(service home-redshift-service-type
         (home-redshift-configuration
          (location-provider 'manual)
          (latitude 35.81)    ;northern hemisphere
          (longitude -0.80))) ;west of Greenwich
```

`home-redshift-configuration` [Data Type]

Available `home-redshift-configuration` fields are:

`redshift` (default: `redshift`) (type: file-like)
: Redshift package to use.

`location-provider` (default: `geoclue2`) (type: symbol)
: Geolocation provider—`'manual` or `'geoclue2`. In the former case, you must also specify the `latitude` and `longitude` fields so Redshift can determine daytime at your place. In the latter case, the Geoclue system service must be running; it will be queried for location information.

`adjustment-method` (default: `randr`) (type: symbol)
: Color adjustment method.

`daytime-temperature` (default: `6500`) (type: integer)
: Daytime color temperature (kelvins).

`nighttime-temperature` (default: `4500`) (type: integer)
: Nighttime color temperature (kelvins).

`daytime-brightness` (type: maybe-inexact-number)
: Daytime screen brightness, between 0.1 and 1.0, or left unspecified.

`nighttime-brightness` (type: maybe-inexact-number)
: Nighttime screen brightness, between 0.1 and 1.0, or left unspecified.

`latitude` (type: maybe-inexact-number)
: Latitude, when `location-provider` is `'manual`.

`longitude` (type: maybe-inexact-number)
: Longitude, when `location-provider` is `'manual`.

`dawn-time` (type: maybe-string)
: Custom time for the transition from night to day in the morning—`"HH:MM"` format. When specified, solar elevation is not used to determine the daytime/nighttime period.

`dusk-time` (type: maybe-string)
: Likewise, custom time for the transition from day to night in the evening.

`extra-content` (default: `""`) (type: raw-configuration-string)
: Extra content appended as-is to the Redshift configuration file. Run `man redshift` for more information about the configuration file format.

`home-dbus-service-type` [Variável]
This is the service type for running a session-specific D-Bus, for unprivileged applications that require D-Bus to be running.

`home-dbus-configuration` [Data Type]
The configuration record for `home-dbus-service-type`.

`dbus` (default: `dbus`)
: The package providing the `/bin/dbus-daemon` command.

`home-unclutter-service-type` [Variável]
This is the service type for Unclutter, a program that runs on the background of an X11 session and detects when the X pointer hasn't moved for a specified idle timeout, after which it hides the cursor so that you can focus on the text underneath. Its associated value must be a `home-unclutter-configuration` record, as shown below.

A typical configuration, where we manually specify the idle timeout (in seconds), might look like this:

```
(service home-unclutter-service-type
         (home-unclutter-configuration
          (idle-timeout 2)))
```

`home-unclutter-configuration` [Data Type]
The configuration record for `home-unclutter-service-type`.

`unclutter` (default: `unclutter`) (type: file-like)
: Unclutter package to use.

`idle-timeout` (default: `5`) (type: integer)
: A timeout in seconds after which to hide cursor.

`home-xmodmap-service-type` [Variável]
This is the service type for the xmodmap (`https://gitlab.freedesktop.org/xorg/app/xmodmap`) utility to modify keymaps and pointer button mappings under the Xorg display server. Its associated value must be a `home-xmodmap-configuration` record, as shown below.

The `key-map` field takes a list of objects, each of which is either a *statement* (a string) or an *assignment* (a pair of strings). As an example, the snippet below swaps around the *`Caps_Lock`* and the *`Control_L`* keys, by first removing the keysyms (on the right-hand side) from the corresponding modifier maps (on the left-hand side), re-assigning them by swapping each other out, and finally adding back the keysyms to the modifier maps.

```
(service home-xmodmap-service-type
         (home-xmodmap-configuration
```

```
(key-map '(("remove Lock" . "Caps_Lock")
           ("remove Control" . "Control_L")
           ("keysym Control_L" . "Caps_Lock")
           ("keysym Caps_Lock" . "Control_L")
           ("add Lock" . "Caps_Lock")
           ("add Control" . "Control_L")))))
```

`home-xmodmap-configuration` [Data Type]

The configuration record for `home-xmodmap-service-type`. Its available fields are:

`xmodmap` (default: `xmodmap`) (type: file-like)
: The `xmodmap` package to use.

`key-map` (default: `'()`) (type: list)
: The list of expressions to be read by `xmodmap` on service startup.

`home-startx-command-service-type` [Variável]

Add `startx` to the home profile putting it onto `PATH`.

The value for this service is a `<xorg-configuration>` object which is passed to the `xorg-start-command-xinit` procedure producing the `startx` used. Default value is `(xorg-configuration)`.

13.3.9 Guix Home Services

The `(gnu home services guix)` module provides services for user-specific Guix configuration.

`home-channels-service-type` [Variável]

This is the service type for managing `$XDG_CONFIG_HOME/guix/channels.scm`, the file that controls the channels received on `guix pull` (veja Capítulo 6 [Canais], Página 69). Its associated value is a list of `channel` records, defined in the `(guix channels)` module.

Generally, it is better to extend this service than to directly configure it, as its default value is the default guix channel(s) defined by `%default-channels`. If you configure this service directly, be sure to include a guix channel. Veja Seção 6.1 [Especificando canais adicionais], Página 69, and Seção 6.2 [Usando um canal Guix personalizado], Página 69, for more details.

A typical extension for adding a channel might look like this:

```
(simple-service 'variant-packages-service
                home-channels-service-type
                (list
                 (channel
                  (name 'variant-packages)
                  (url "https://example.org/variant-packages.git"))))
```

13.3.10 Fonts Home Services

The `(gnu home services fontutils)` module provides services for user-specific Fontconfig setup. The Fontconfig (`https://www.freedesktop.org/wiki/Software/fontconfig`) library is used by many applications to access fonts on the system.

`home-fontconfig-service-type` [Variável]

This is the service type for generating configurations for Fontconfig. Its associated value is a list of either strings (or gexps) pointing to fonts locations, or SXML (veja Seção "SXML" em *GNU Guile Reference Manual*) fragments to be converted into XML and put inside the main `fontconfig` node.

Generally, it is better to extend this service than to directly configure it, as its default value is the default Guix Home's profile font installation path (`~/.guix-home/profile/share/fonts`). If you configure this service directly, be sure to include the above directory.

Here's how you'd extend it to include fonts installed with the Nix package manager, and to prefer your favourite monospace font:

```
(simple-service 'additional-fonts-service
                home-fontconfig-service-type
                (list "~/.nix-profile/share/fonts"
                      '(alias
                        (family "monospace")
                        (prefer
                         (family "Liberation Mono")))))
```

13.3.11 Sound Home Services

The `(gnu home services sound)` module provides services related to sound support.

PulseAudio RTP Streaming Services

The following services dynamically reconfigure the PulseAudio sound server (`https://pulseaudio.org`): they let you toggle broadcast of audio output over the network using the RTP (real-time transport protocol) and, correspondingly, playback of sound received over RTP. Once `home-pulseaudio-rtp-sink-service-type` is among your home services, you can start broadcasting audio output by running this command:

```
herd start pulseaudio-rtp-sink
```

You can then run a PulseAudio-capable mixer, such as `pavucontrol` or `pulsemixer` (both from the same-named package) to control which audio stream(s) should be sent to the RTP "sink".

By default, audio is broadcasted to a multicast address: any device on the LAN (local area network) receives it and may play it. Using multicast in this way puts a lot of pressure on the network and degrades its performance, so you may instead prefer sending to specifically one device. The first way to do that is by specifying the IP address of the target device when starting the service:

```
herd start pulseaudio-rtp-sink 192.168.1.42
```

The other option is to specify this IP address as the one to use by default in your home environment configuration:

```
(service home-pulseaudio-rtp-sink-service-type
         "192.168.1.42")
```

On the device where you intend to receive and play the RTP stream, you can use `home-pulseaudio-rtp-source-service-type`, like so:

```
(service home-pulseaudio-rtp-source-service-type)
```

This will then let you start the receiving module for PulseAudio:

```
herd start pulseaudio-rtp-source
```

Again, by default it will listen on the multicast address. If, instead, you'd like it to listen for direct incoming connections, you can do that by running:

```
(service home-pulseaudio-rtp-source-service-type
         "0.0.0.0")
```

The reference of these services is given below.

`home-pulseaudio-rtp-sink-service-type` [Variável]
`home-pulseaudio-rtp-source-service-type` [Variável]

This is the type of the service to send, respectively receive, audio streams over RTP (real-time transport protocol).

The value associated with this service is the IP address (a string) where to send, respectively receive, the audio stream. By default, audio is sent/received on multicast address `%pulseaudio-rtp-multicast-address`.

This service defines one Shepherd service: `pulseaudio-rtp-sink`, respectively `pulseaudio-rtp-source`. The service is not started by default, so you have to explicitly start it when you want to turn it on, as in this example:

```
herd start pulseaudio-rtp-sink
```

Stopping the Shepherd service turns off broadcasting.

`%pulseaudio-rtp-multicast-address` [Variável]

This is the multicast address used by default by the two services above.

PipeWire Home Service

PipeWire (`https://pipewire.org`) provides a low-latency, graph-based audio and video processing service. In addition to its native protocol, it can also be used as a replacement for both JACK and PulseAudio.

While PipeWire provides the media processing and API, it does not, directly, know about devices such as sound cards, nor how you might want to connect applications, hardware, and media processing filters. Instead, PipeWire relies on a *session manager* to specify all these relationships. While you may use any session manager you wish, for most people the WirePlumber (`https://pipewire.pages.freedesktop.org/wireplumber/`) session manager, a reference implementation provided by the PipeWire project itself, suffices, and that is the one `home-pipewire-service-type` uses.

PipeWire can be used as a replacement for PulseAudio by setting `enable-pulseaudio?` to `#t` in `home-pipewire-configuration`, so that existing PulseAudio clients may use it without any further configuration.

In addition, JACK clients may connect to PipeWire by using the `pw-jack` program, which comes with PipeWire. Simply prefix the command with `pw-jack` when you run it, and audio data should go through PipeWire:

```
pw-jack mpv -ao=jack sound-file.wav
```

For more information on PulseAudio emulation, see `https://gitlab.freedesktop.org/pipewire/pipewire/-/wikis/Config-PulseAudio`, for JACK, see `https://gitlab.freedesktop.org/pipewire/pipewire/-/wikis/Config-JACK`.

As PipeWire does not use `dbus` to start its services on demand (as PulseAudio does), `home-pipewire-service-type` uses Shepherd to start services when logged in, provisioning the `pipewire`, `wireplumber`, and, if configured, `pipewire-pulseaudio` services. Veja Seção 13.3.5 [Shepherd Home Service], Página 667.

`home-pipewire-service-type` [Variável]

This provides the service definition for `pipewire`, which will run on login. Its value is a `home-pipewire-configuration` object.

To start the service, add it to the `service` field of your `home-environment`, such as:

```
(service home-pipewire-service-type)
```

`home-pipewire-configuration` [Data Type]

Available `home-pipewire-configuration` fields are:

`pipewire` (default: `pipewire`) (type: file-like)
The PipeWire package to use.

`wireplumber` (default: `wireplumber`) (type: file-like)
The WirePlumber package to use.

`enable-pulseaudio?` (default: `#t`) (type: boolean)
When true, enable PipeWire's PulseAudio emulation support, allowing PulseAudio clients to use PipeWire transparently.

13.3.12 Mail Home Services

The `(gnu home services mail)` module provides services that help you set up the tools to work with emails in your home environment.

MSMTP (`https://marlam.de/msmtp`) is a SMTP (Simple Mail Transfer Protocol) client. It sends mail to a predefined SMTP server that takes care of proper delivery.

The service reference is given below.

`home-msmtp-service-type` [Variável]

This is the service type for `msmtp`. Its value must be a `home-msmtp-configuration`, as shown below. It provides the `~/.config/msmtp/config` file.

As an example, here is how you would configure `msmtp` for a single account:

```
(service home-msmtp-service-type
         (home-msmtp-configuration
          (accounts
           (list
            (msmtp-account
             (name "alice")
             (configuration
              (msmtp-configuration
               (host "mail.example.org")
               (port 587)
               (user "alice")
               (password-eval "pass Mail/alice")))))))))
```

`home-msmtp-configuration` [Data Type]

Available `home-msmtp-configuration` fields are:

`defaults` (type: msmtp-configuration)
The configuration that will be set as default for all accounts.

`accounts` (default: `'()`) (type: list-of-msmtp-accounts)
A list of `msmtp-account` records which contain information about all your accounts.

`default-account` (type: maybe-string)
Set the default account.

`extra-content` (default: `""`) (type: string)
Extra content appended as-is to the configuration file. Run `man msmtp` for more information about the configuration file format.

`msmtp-account` [Data Type]

Available `msmtp-account` fields are:

`name` (type: string)
The unique name of the account.

`configuration` (type: msmtp-configuration)
The configuration for this given account.

`msmtp-configuration` [Data Type]

Available `msmtp-configuration` fields are:

`auth?` (type: maybe-boolean)
Enable or disable authentication.

`tls?` (type: maybe-boolean)
Enable or disable TLS (also known as SSL) for secured connections.

`tls-starttls?` (type: maybe-boolean)
Choose the TLS variant: start TLS from within the session (‘on’, default), or tunnel the session through TLS (‘off’).

`tls-trust-file` (type: maybe-string)
Activate server certificate verification using a list of trusted Certification Authorities (CAs).

`log-file` (type: maybe-string)
Enable logging to the specified file. An empty argument disables logging. The file name ‘-’ directs the log information to standard output.

`host` (type: maybe-string)
The SMTP server to send the mail to.

`port` (type: maybe-integer)
The port that the SMTP server listens on. The default is 25 (`"smtp"`), unless TLS without STARTTLS is used, in which case it is 465 (`"smtps"`).

`user` (type: maybe-string)
Set the user name for authentication.

`from` (type: maybe-string)
: Set the envelope-from address.

`password-eval` (type: maybe-string)
: Set the password for authentication to the output (stdout) of the command cmd.

`extra-content` (default: `""`) (type: string)
: Extra content appended as-is to the configuration block. Run `man msmtp` for more information about the configuration file format.

13.3.13 Messaging Home Services

The ZNC bouncer (`https://znc.in`) can be run as a daemon to manage your IRC presence. With the `(gnu home services messaging)` service, you can configure ZNC to run upon login.

You will have to provide a `~/.znc/configs/znc.conf` separately.

Here is an example of a service and its configuration that you could add to the `services` field of your `home-environment`:

```
(service home-znc-service-type)
```

`home-znc-service-type` [Variável]
: This is the type of the ZNC home service, whose value is a `home-znc-configuration` object.

`home-znc-configuration` [Data Type]
: Available `home-znc-configuration` fields are:

`znc` (default: `znc`) (type: file-like)
: The ZNC package to use.

`extra-options` (default: `'()`)
: Extra options will be passed to `znc`, please run `man znc` for more information.

13.3.14 Media Home Services

The Kodi media center (`https://kodi.tv`) can be run as a daemon on a media server. With the `(gnu home services kodi)` service, you can configure Kodi to run upon login.

Here is an example of a service and its configuration that you could add to the `services` field of your `home-environment`:

```
(service home-kodi-service-type
  (home-kodi-configuration
   (extra-options '("--settings="<settings-file>"))))
```

`home-kodi-service-type` [Variável]
: This is the type of the Kodi home service, whose value is a `home-kodi-configuration` object.

`home-kodi-configuration` [Data Type]

Available `home-kodi-configuration` fields are:

`kodi` (default: `kodi`) (type: file-like)
The Kodi package to use.

`extra-options` (default: `'()`)
Extra options will be passed to `kodi`, please run `man kodi` for more information.

13.3.15 Gerenciador de janelas Sway

The `(gnu home services sway)` module provides `home-sway-service-type`, a home service to configure the Sway window manager for Wayland (`https://github.com/swaywm/sway`) in a declarative way.

Here is an example of a service and its configuration that you could add to the `services` field of your `home-environment`:

```
(service home-sway-service-type
         (sway-configuration
          (gestures
           '((swipe:3:down . "move to scratchpad")
             (swipe:3:up   . "scratchpad show")))
          (outputs
           (list (sway-output
                  (identifier '*)
                  (background (file-append sway
                                           "\
/share/backgrounds/sway/Sway_Wallpaper_Blue_1920x1080.png")))))))
```

The above example describes a Sway configuration in which

- all monitors use a particular wallpaper whose `.png` is provided by the `sway` package;
- swiping down (resp. up) with three fingers moves the active window to the scratchpad (resp. shows/hides the scratchpad).

Nota: This home service only sets up the configuration file and profile packages for Sway. It does *not* start Sway in any way. If you want to do so, you might be interested in using `greetd-wlgreet-sway-session` instead.

The procedure `sway-configuration->file` defined below can be used to provide the value for the *optional* `sway-configuration` field of `greetd-wlgreet-sway-session`.

`sway-configuration->file` *config* [Procedure]

This procedure takes one argument `config`, which must be a `sway-configuration` record (defined below), and returns a file-like object representing the serialized configuration.

`home-sway-service-type` [Variável]

This is a home service type to set up Sway. It takes care of:

- providing a `~/.config/sway/config` file,
- adding Sway-related packages to your profile.

`sway-configuration` [Data Type]

This configuration record describes the Sway configuration (see *sway(5)*). Available fields are:

`variables` (default: `%sway-default-variables`)

The value of this field is an association list in which keys are symbols and values are either strings, G-expressions or file-like objects (veja Seção 8.12 [Expressões-G], Página 163).

Example:

```
(variables `((mod . "Mod4") ; string
             (term ; file-append
              . ,(file-append foot "/bin/foot"))
             (Term ; G-expression
              . ,#~(string-append #$foot "/bin/foot"))))
```

Nota: Default keybindings assume the existence of variables named `$mod`, `$left`, `$right`, `$up` and `$down`. If you choose not to define these variables, make sure to remove keybindings referring to them.

`keybindings` (default: `%sway-default-keybindings`)

This field describes keybindings for the *default* mode. The value is an association list: keys are symbols and values are either strings or G-expressions.

The following snippet launches the terminal when pressing *`$mod+t`* and *`$mod+Shift+t`* (assuming that a variable `$term` is defined):

```
`(($mod+t . ,#~(string-append "exec " #$foot "/bin/foot"))
  ($mod+Shift+t . "exec $term"))
```

`gestures` (default: `%sway-default-gestures`)

Similar to the previous field, but for finger-gestures.

The following snippet allows to navigate through workspaces by swiping right and left with three fingers:

```
'((swipe:3:right . "workspace next_on_output")
  (swipe:3:left  . "workspace prev_on_output"))
```

`packages` (default: `%sway-default-packages`)

This field describes a list of packages to add to the user profile. At the moment, the default value only adds `sway` to the profile.

`inputs` (default: `'()`)

List of `sway-input` configuration records (described below).

`outputs` (default: `'()`)

List of `sway-output` configuration records (described below).

`bar` (optional `sway-bar` record)

Optional `sway-bar` record (described below) to configure a Sway bar.

`modes` (default: `%sway-default-modes`)
: List of `sway-mode` records (described below) to add modes to the Sway configuration. The default value `%sway-default-modes` adds the "resize" mode of the default Sway configuration (as described below).

`startup+reload-programs` (default: `'()`)
: Programs to execute at startup time *and* after every configuration reload. The value of this field is a list of strings, G-expressions or file-like objects (veja Seção 8.12 [Expressões-G], Página 163).

`startup-programs` (default: `%sway-default-execs`)
: Programs to execute at startup time. As above, values of this field are a list of strings, G-expressions or file-like objects.

  The default value, `%sway-default-execs`, executes `swayidle` in order to lock the screen after 5 minutes of inactivity (displaying a background distributed with Sway) and turn the screen off after 10 minutes of inactivity.

`extra-content` (default: `'()`)
: Lines to add to the configuration file. The value of this field is a list of strings or G-expressions.

`sway-input` [Data Type]

`sway-input` records describe input blocks (see *sway-input(5)*). For example, the following snippet makes all keyboards use a French layout, in which *`capslock`* has been remapped to *`ctrl`*:

```
(sway-input (identifier "type:keyboard")
            (layout
              (keyboard-layout "fr" #:options '("ctrl:nocaps"))))
```

Available fields for `sway-input` configuration records are:

`identifier` (default: `'*`)
: Identifier of the input. The field accepts symbols and strings. If the `identifier` is a symbol, it is inserted as is; if it is a string, it will be quoted in the configuration file.

`layout` (optional `<keyboard-layout>` record)
: Keyboard specific option. Field specifying the layout to use for the input. The value must be a `<keyboard-layout>` record (veja Seção 11.8 [Disposição do teclado], Página 264).

  > **Nota:** `(gnu home services sway)` does not re-export the `keyboard-layout` procedure.

`disable-while-typing` (optional boolean)
: If `#t` (resp. `#f`) enables (resp. disables) the "disable while typing" option for this input.

`disable-while-trackpointing` (optional boolean)
: If `#t` (resp. `#f`), enables (resp. disables) the "disable while track-pointing" option for this input.

`tap` (optional boolean)
: Enables or disables the "tap" option, which allows clicking by tapping on a touchpad.

`extra-content` (default: `'()`)
: Lines to add to the input block. The value of this field must a list whose elements are either strings or G-expressions.

`sway-output` [Data Type]

`sway-output` records describe Sway outputs (see *sway-output(5)*). Available fields are:

`identifier` (default: `'*`)
: Identifier of the monitor. The field accepts symbols and strings. If the `identifier` is a symbol, it is inserted as is; if it is a string, it will be quoted in the configuration file.

`resolution` (optional string)
: This string defines the resolution of the monitor.

`position` (optional)
: The (optional) value of this field must be a `point`. Example:

```
(position
 (point (x 1920)
        (y 0)))
```

`background` (optional)
: The value of this field describes what wallpaper to use on this output. The field accepts the following types of values:

  - a string,
  - a G-expression,
  - a file-like object,
  - a pair. The first argument of this pair must be a string, a G-expression or a file-like object. The second element describes how the wallpaper will be displayed. It must be a symbol among `stretch`, `fill`, `fit`, `center` and `tile`.

    If the second element is not specified (*i.e.* when the value is not a pair), the `fill` mode will be used.

    > **Nota:** In order to use an SVG file, you must have `librsvg` in your profile (*e.g.* by adding it in the `packages` field of `sway-configuration`).

`extra-content` (default: `'()`)
: List defining additional lines to add to the output configuration block. Elements of the list must be either strings or G-expressions.

`sway-border-color` [Data Type]

`border` Color of the border.

`background`
: Color of the background.

`text`
: Color of the text.

`sway-color` [Data Type]

`background` (optional string)
: Background color of the bar.

`statusline` (optional string)
: Text color of the status line.

`focused-background` (optional string)
: Background color of the bar on the currently focused monitor.

`focused-statusline` (optional string)
: Text color of the statusline on the currently focused monitor.

`focused-workspace` (optional `sway-border-color`)
: Color scheme for focused workspaces.

`active-workspace` (optional `sway-border-color`)
: Color scheme for active workspaces.

`inactive-workspace` (optional `sway-border-color`)
: Color scheme for inactive workspaces.

`urgent-workspace` (optional `sway-border-color`)
: Color scheme for workspaces containing “urgent windows”.

`binding-mode` (optional `sway-border-color`)
: Color scheme for the binding mode indicator.

`sway-bar` [Data Type]

Describes the Sway bar (see *sway-bar(5)*).

`identifier` (default: `'bar0`)
: Identifier of the bar. The value must be a symbol.

`position` (optional)
: Specify the position of the bar. Accepted values are `'top` or `'bottom`.

`hidden-state` (optional)
: Specify the appearance of the bar when it is hidden. Accepted values are `'hide` or `'show`.

`binding-mode-indicator` (optional)
: Boolean enabling or disabling the binding mode indicator.

`colors` (optional)
: An optional `sway-color` configuration record.

`status-command` (optional)
: This field accept strings, G-expressions and executable file-like values. The default value is a command (string) that prints the date and time every second.

Each line printed on `stdout` by this command (or script) will be displayed on the status area of the bar.

Below are a few examples using:

- a string: `"while date +'%Y-%m-%d %X'; do sleep 1; done"`,
- a G-exp:

```
#~(string-append "while "
                 #$coreutils "/bin/date"
                 " +'%Y-%m-%d %X'; do sleep 1; done")
```

- an executable file:

```
(program-file
 "sway-bar-status"
 #~(begin
     (use-modules (ice-9 format)
                  (srfi srfi-19))
     (let loop ()
       (let* ((date (date->string
                     (current-date)
                     "~d/~m/~Y (~a) • ~H:~M:~S")))
         (format #t "~a~%~!" date)
         (sleep 1)
         (loop)))))
```

`mouse-bindings` (default: `'()`)

This field accepts an associative list. Keys are integers describing mouse events. Values can either be strings or G-expressions.

The module `(gnu home services sway)` exports constants `%ev-code-mouse-left`, `%ev-code-mouse-right` and `%ev-code-mouse-scroll-click` whose values are integers corresponding to left, right and scroll click respectively. For example, with `(mouse-bindings` `` `((,%ev-code-mouse-left . "exec $term"))) ``, left clicks in the status bar open the terminal (assuming that the variable `$term` is bound to a terminal).

`sway-mode` [Data Type]

Describes a Sway mode (see *sway(5)*). For example, the following snippet defines the resize mode of the default Sway configuration:

```
(sway-mode
 (mode-name "resize")
 (keybindings
  '(($left  . "resize shrink width 10px")
    ($right . "resize grow width 10px")
    ($down  . "resize grow height 10px")
    ($up    . "resize shrink height 10px")
    (Left   . "resize shrink width 10px")
    (Right  . "resize grow width 10px")
    (Down   . "resize grow height 10px")
```

```
          (Up     . "resize shrink height 10px")
          (Return . "mode \"default\"")
          (Escape . "mode \"default\"")))
```

`mode-name` (default: `"default"`)
: Name of the mode. This field accepts strings.

`keybindings` (default: `'()`)
: This field describes keybindings. The value is an association list: keys are symbols and values are either strings or G-expressions, as above.

`mouse-bindings` (default: `'()`)
: Ditto, but keys are mouse events (integers). Constants `%ev-code-mouse-*` described above can be used as helpers to define mouse bindings.

13.3.16 Networking Home Services

This section lists services somewhat networking-related that you may use with Guix Home.

The `(gnu home services syncthing)` module provides a service to set up the https://syncthing.net (`Syncthing`) continuous file backup service.

`home-syncthing-service-type` [Variável]
: This is the service type for the `syncthing` daemon; it is the Home counterpart of the `syncthing-service-type` system service (veja Seção 11.10.5 [Serviços de Rede], Página 306). The value for this service type is a `syncthing-configuration`.

  Here is how you would set it up with the default configuration:

  ```
  (service home-syncthing-service-type)
  ```

  For a custom configuration, wrap you `syncthing-configuration` in `for-home`, as in this example:

  ```
  (service home-syncthing-service-type
           (for-home
            (syncthing-configuration (logflags 5))))
  ```

  For details about `syncthing-configuration`, check out the documentation of the system service (veja Seção 11.10.5 [Serviços de Rede], Página 306).

13.3.17 Miscellaneous Home Services

This section lists Home services that lack a better place.

Beets Service

The `(gnu home services music)` module provides the following service:

`home-beets-service-type` [Variável]
: Beets (`https://beets.io`) is a music file and metadata manager that can be used via its command-line interface, `beet`. Beets requires a YAML configuration file and this Guix Home service is to create such file.

The service can be used as follows:

```
(service home-beets-service-type
         (home-beets-configuration (directory "/home/alice/music")))
```

Additional options can be specified via the service wild-card field `extra-options`:

```
(service home-beets-service-type
         (home-beets-configuration
          (directory "/home/alice/music")
          (extra-options '("
import:
  move: yes"))))
```

Dictionary Service

The `(gnu home services dict)` module provides the following service:

`home-dicod-service-type` [Variável]

This is the type of the service that runs the `dicod` daemon, an implementation of DICT server (veja Seção "Dicod" em *GNU Dico Manual*).

You can add `open localhost` to your `~/.dico` file to make `localhost` the default server for `dico` client (veja Seção "Initialization File" em *GNU Dico Manual*).

This service is a direct mapping of the `dicod-service-type` system service (veja Seção 11.10.37 [Serviços diversos], Página 585). You can use it like this:

```
(service home-dicod-service-type)
```

You may specify a custom configuration by providing a `dicod-configuration` record, exactly like for `dicod-service-type`, but wrapping it in `for-home`:

```
(service home-dicod-service-type
         (for-home
          (dicod-configuration ...)))
```

13.4 Invoking `guix home`

Once you have written a home environment declaration (veja Seção 13.1 [Declarando o ambiente pessoal], Página 652, it can be *instantiated* using the `guix home` command. The synopsis is:

```
guix home options... action file
```

file must be the name of a file containing a `home-environment` declaration. *action* specifies how the home environment is instantiated, but there are few auxiliary actions which don't instantiate it. Currently the following values are supported:

`pesquisa` Display available home service type definitions that match the given regular expressions, sorted by relevance:

```
$ guix home search shell
name: home-shell-profile
location: gnu/home/services/shells.scm:100:2
extends: home-files
description: Create `~/.profile', which is used for environment initializati
+ This service type can be extended with a list of file-like objects.
relevance: 6
```

```
name: home-fish
location: gnu/home/services/shells.scm:640:2
extends: home-files home-profile
description: Install and configure Fish, the friendly interactive shell.
relevance: 3

name: home-zsh
location: gnu/home/services/shells.scm:290:2
extends: home-files home-profile
description: Install and configure Zsh.
relevance: 1

name: home-bash
location: gnu/home/services/shells.scm:508:2
extends: home-files home-profile
description: Install and configure GNU Bash.
relevance: 1

...
```

As for `guix search`, the result is written in `recutils` format, which makes it easy to filter the output (veja *GNU recutils manual*).

`recipiente`

Spawn a shell in an isolated environment—a *container*—containing your home as specified by *file*.

For example, this is how you would start an interactive shell in a container with your home:

```
guix home container config.scm
```

This is a throw-away container where you can lightheartedly fiddle with files; any changes made within the container, any process started—all this disappears as soon as you exit that shell.

As with `guix shell`, several options control that container:

`--network`
`-N`
: Enable networking within the container (it is disabled by default).

`--expose=`*fonte*`[=`*alvo*`]`
`--share=`*fonte*`[=`*alvo*`]`
: As with `guix shell`, make directory *source* of the host system available as *target* inside the container—read-only if you pass `--expose`, and writable if you pass `--share` (veja Seção 7.1 [Invocando guix shell], Página 79).

Additionally, you can run a command in that container, instead of spawning an interactive shell. For instance, here is how you would check which Shepherd services are started in a throw-away home container:

```
guix home container config.scm -- herd status
```

The command to run in the container must come after `--` (double hyphen).

`edit` Edit or view the definition of the given Home service types.

For example, the command below opens your editor, as specified by the `EDITOR` environment variable, on the definition of the `home-mcron` service type:

```
guix home edit home-mcron
```

`reconfigure`

Build the home environment described in *file*, and switch to it. Switching means that the activation script will be evaluated and (in basic scenario) symlinks to configuration files generated from `home-environment` declaration will be created in `~`. If the file with the same path already exists in home folder it will be moved to `~/`*timestamp*`-guix-home-legacy-configs-backup`, where *timestamp* is a current UNIX epoch time.

> **Nota:** It is highly recommended to run `guix pull` once before you run `guix home reconfigure` for the first time (veja Seção 5.7 [Invocando guix pull], Página 57).

This effects all the configuration specified in *file*. The command starts Shepherd services specified in *file* that are not currently running; if a service is currently running, this command will arrange for it to be upgraded the next time it is stopped (e.g. by `herd stop` *`service`* or `herd restart` *`service`*).

This command creates a new generation whose number is one greater than the current generation (as reported by `guix home list-generations`). If that generation already exists, it will be overwritten. This behavior mirrors that of `guix package` (veja Seção 5.2 [Invocando guix package], Página 37).

Upon completion, the new home is deployed under `~/.guix-home`. This directory contains *provenance meta-data*: the list of channels in use (veja Capítulo 6 [Canais], Página 69) and *file* itself, when available. You can view the provenance information by running:

```
guix home describe
```

This information is useful should you later want to inspect how this particular generation was built. In fact, assuming *file* is self-contained, you can later rebuild generation *n* of your home environment with:

```
guix time-machine \
  -C /var/guix/profiles/per-user/USER/guix-home-n-link/channels.scm -- \
  home reconfigure \
  /var/guix/profiles/per-user/USER/guix-home-n-link/configuration.scm
```

You can think of it as some sort of built-in version control! Your home is not just a binary artifact: *it carries its own source*.

> **Nota:** If you're using Guix System, [guix-home-service-type], Página 576, on how to embed your home configuration in your system configuration such that `guix system reconfigure` deploys both your system and your home.

`switch-generation`

Switch to an existing home generation. This action atomically switches the home profile to the specified home generation.

The target generation can be specified explicitly by its generation number. For example, the following invocation would switch to home generation 7:

```
guix home switch-generation 7
```

The target generation can also be specified relative to the current generation with the form `+N` or `-N`, where `+3` means "3 generations ahead of the current generation," and `-1` means "1 generation prior to the current generation." When specifying a negative value such as `-1`, you must precede it with `--` to prevent it from being parsed as an option. For example:

```
guix home switch-generation -- -1
```

This action will fail if the specified generation does not exist.

`roll-back`
: Switch to the preceding home generation. This is the inverse of `reconfigure`, and it is exactly the same as invoking `switch-generation` with an argument of `-1`.

`delete-generations`
: Delete home generations, making them candidates for garbage collection (veja Seção 5.6 [Invocando guix gc], Página 54, for information on how to run the "garbage collector").

  This works in the same way as '`guix package --delete-generations`' (veja Seção 5.2 [Invocando guix package], Página 37). With no arguments, all home generations but the current one are deleted:

  ```
  guix home delete-generations
  ```

  You can also select the generations you want to delete. The example below deletes all the home generations that are more than two months old:

  ```
  guix home delete-generations 2m
  ```

`build` Build the derivation of the home environment, which includes all the configuration files and programs needed. This action does not actually install anything.

`describe` Describe the current home generation: its file name, as well as provenance information when available.

To show installed packages in the current home generation's profile, the `--list-installed` flag is provided, with the same syntax that is used in `guix package --list-installed` (veja Seção 5.2 [Invocando guix package], Página 37). For instance, the following command shows a table of all the packages with "emacs" in their name that are installed in the current home generation's profile:

```
guix home describe --list-installed=emacs
```

`list-generations`
: List a summary of each generation of the home environment available on disk, in a human-readable way. This is similar to the `--list-generations` option of `guix package` (veja Seção 5.2 [Invocando guix package], Página 37).

  Optionally, one can specify a pattern, with the same syntax that is used in `guix package --list-generations`, to restrict the list of generations displayed. For

instance, the following command displays generations that are up to 10 days old:

```
guix home list-generations 10d
```

The `--list-installed` flag may also be specified, with the same syntax that is used in `guix home describe`. This may be helpful if trying to determine when a package was added to the home profile.

`import` Generate a *home environment* from the packages in the default profile and configuration files found in the user's home directory. The configuration files will be copied to the specified directory, and a `home-configuration.scm` will be populated with the home environment. Note that not every home service that exists is supported (veja Seção 13.3 [Serviços pessoais], Página 655).

```
$ guix home import ~/guix-config
guix home: '/home/alice/guix-config' populated with all the Home configurati
```

And there's more! `guix home` also provides the following sub-commands to visualize how the services of your home environment relate to one another:

`extension-graph`
: Emit to standard output the *service extension graph* of the home environment defined in *file* (veja Seção 11.19.1 [Composição de serviço], Página 631, for more information on service extensions). By default the output is in Dot/Graphviz format, but you can choose a different format with `--graph-backend`, as with `guix graph` (veja Seção 9.10 [Invocando guix graph], Página 216):

  O comando:

  ```
  guix home extension-graph file | xdot -
  ```

  shows the extension relations among services.

`shepherd-graph`
: Emit to standard output the *dependency graph* of shepherd services of the home environment defined in *file*. Veja Seção 11.19.4 [Serviços de Shepherd], Página 638, for more information and for an example graph.

  Again, the default output format is Dot/Graphviz, but you can pass `--graph-backend` to select a different one.

options can contain any of the common build options (veja Seção 9.1.1 [Opções de compilação comum], Página 177). In addition, *options* can contain one of the following:

`--expression=expr`
`-e expr` Consider the home-environment *expr* evaluates to. This is an alternative to specifying a file which evaluates to a home environment.

`--allow-downgrades`
: Instruct `guix home reconfigure` to allow system downgrades.

  Just like `guix system`, `guix home reconfigure`, by default, prevents you from downgrading your home to older or unrelated revisions compared to the channel revisions that were used to deploy it—those shown by `guix home describe`. Using `--allow-downgrades` allows you to bypass that check, at the risk of downgrading your home—be careful!

14 Documentação

In most cases packages installed with Guix come with documentation. There are two main documentation formats: “Info”, a browsable hypertext format used for GNU software, and “manual pages” (or “man pages”), the linear documentation format traditionally found on Unix. Info manuals are accessed with the `info` command or with Emacs, and man pages are accessed using `man`.

You can look for documentation of software installed on your system by keyword. For example, the following command searches for information about “TLS” in Info manuals:

```
$ info -k TLS
"(emacs)Network Security" -- STARTTLS
"(emacs)Network Security" -- TLS
"(gnutls)Core TLS API" -- gnutls_certificate_set_verify_flags
"(gnutls)Core TLS API" -- gnutls_certificate_set_verify_function
...
```

The command below searches for the same keyword in man pages[1]:

```
$ man -k TLS
SSL (7)              - OpenSSL SSL/TLS library
certtool (1)         - GnuTLS certificate tool
...
```

These searches are purely local to your computer so you have the guarantee that documentation you find corresponds to what you have actually installed, you can access it off-line, and your privacy is respected.

Once you have these results, you can view the relevant documentation by running, say:

```
$ info "(gnutls)Core TLS API"
```

or:

```
$ man certtool
```

Info manuals contain sections and indices as well as hyperlinks like those found in Web pages. The `info` reader (veja *Stand-alone GNU Info*) and its Emacs counterpart (veja Seção “Misc Help” em *The GNU Emacs Manual*) provide intuitive key bindings to navigate manuals. Veja Seção “Getting Started” em *Info: An Introduction*, for an introduction to Info navigation.

[1] The database searched by `man -k` is only created in profiles that contain the `man-db` package.

15 Plataformas

The packages and systems built by Guix are intended, like most computer programs, to run on a CPU with a specific instruction set, and under a specific operating system. Those programs are often also targeting a specific kernel and system library. Those constraints are captured by Guix in `platform` records.

15.1 `platform` Reference

The `platform` data type describes a *platform*: an ISA (instruction set architecture), combined with an operating system and possibly additional system-wide settings such as the ABI (application binary interface).

`platform` [Data Type]

This is the data type representing a platform.

`target` This field specifies the platform's GNU triplet as a string (veja Seção "Specifying Target Triplets" em *Autoconf*).

`system` This string is the system type as it is known to Guix and passed, for instance, to the `--system` option of most commands.

It usually has the form `"cpu-kernel"`, where *cpu* is the target CPU and *kernel* the target operating system kernel.

It can be for instance `"aarch64-linux"` or `"armhf-linux"`. You will encounter system types when you perform native builds (veja Seção 10.2 [Construções nativas], Página 234).

`linux-architecture` (default: `#false`)
This optional string field is only relevant if the kernel is Linux. In that case, it corresponds to the ARCH variable used when building Linux, `"mips"` for instance.

`rust-target` (default: `#false`)
This optional string field is used to determine which rust target is best supported by this platform. For example, the base level system targeted by `armhf-linux` system is closest to `armv7-unknown-linux-gnueabihf`.

`glibc-dynamic-linker`
This field is the name of the GNU C Library dynamic linker for the corresponding system, as a string. It can be `"/lib/ld-linux-armhf.so.3"`.

15.2 Supported Platforms

The `(guix platforms ...)` modules export the following variables, each of which is bound to a `platform` record.

`armv7-linux` [Variável]

Platform targeting ARM v7 CPU running GNU/Linux.

`aarch64-linux` [Variável]

Platform targeting ARM v8 CPU running GNU/Linux.

`mips64-linux` [Variável]
Platform targeting MIPS little-endian 64-bit CPU running GNU/Linux.

`powerpc-linux` [Variável]
Platform targeting PowerPC big-endian 32-bit CPU running GNU/Linux.

`powerpc64le-linux` [Variável]
Platform targeting PowerPC little-endian 64-bit CPU running GNU/Linux.

`riscv64-linux` [Variável]
Platform targeting RISC-V 64-bit CPU running GNU/Linux.

`i686-linux` [Variável]
Platform targeting x86 CPU running GNU/Linux.

`x86_64-linux` [Variável]
Platform targeting x86 64-bit CPU running GNU/Linux.

`x86_64-linux-x32` [Variável]
Platform targeting x86 64-bit CPU running GNU/Linux with the run-time using the X32 ABI.

`i686-mingw` [Variável]
Platform targeting x86 CPU running Windows, with run-time support from MinGW.

`x86_64-mingw` [Variável]
Platform targeting x86 64-bit CPU running Windows, with run-time support from MinGW.

`i586-gnu` [Variável]
Platform targeting x86 CPU running GNU/Hurd (also referred to as “GNU”).

`avr` [Variável]
Platform targeting AVR CPUs without an operating system, with run-time support from AVR Libc.

`or1k-elf` [Variável]
Platform targeting OpenRISC 1000 CPU without an operating system and without a C standard library.

`xtensa-ath9k-elf` [Variável]
Platform targeting Xtensa CPU used in the Qualcomm Atheros AR7010 and AR9271 USB 802.11n NICs (Network Interface Controllers).

16 Creating System Images

When it comes to installing Guix System for the first time on a new machine, you can basically proceed in three different ways. The first one is to use an existing operating system on the machine to run the `guix system init` command (veja Seção 11.16 [Invocando guix system], Página 616). The second one, is to produce an installation image (veja Seção 3.9 [Compilando a imagem de instalação], Página 32). This is a bootable system which role is to eventually run `guix system init`. Finally, the third option would be to produce an image that is a direct instantiation of the system you wish to run. That image can then be copied on a bootable device such as an USB drive or a memory card. The target machine would then directly boot from it, without any kind of installation procedure.

The `guix system image` command is able to turn an operating system definition into a bootable image. This command supports different image types, such as `mbr-hybrid-raw`, `iso9660` and `docker`. Any modern `x86_64` machine will probably be able to boot from an `iso9660` image. However, there are a few machines out there that require specific image types. Those machines, in general using `ARM` processors, may expect specific partitions at specific offsets.

This chapter explains how to define customized system images and how to turn them into actual bootable images.

16.1 `image` Reference

The `image` record, described right after, allows you to define a customized bootable system image.

`image` [Data Type]

This is the data type representing a system image.

`name` (default: `#false`)
: The image name as a symbol, `'my-iso9660` for instance. The name is optional and it defaults to `#false`.

`format`
: The image format as a symbol. The following formats are supported:

  - `disk-image`, a raw disk image composed of one or multiple partitions.
  - `compressed-qcow2`, a compressed qcow2 image composed of one or multiple partitions.
  - `docker`, a Docker image.
  - `iso9660`, an ISO-9660 image.
  - `tarball`, a tar.gz image archive.
  - `wsl2`, a WSL2 image.

`platform` (default: `#false`)
: The `platform` record the image is targeting (veja Capítulo 15 [Plataformas], Página 695), `aarch64-linux` for instance. By default, this field is set to `#false` and the image will target the host platform.

`size` (default: `'guess`)
: The image size in bytes or `'guess`. The `'guess` symbol, which is the default, means that the image size will be inferred based on the image content.

`sistema operacional`
: The image's `operating-system` record that is instantiated.

`partition-table-type` (default: `'mbr`)
: The image partition table type as a symbol. Possible values are `'mbr` and `'gpt`. It default to `'mbr`.

`partitions` (default: `'()`)
: The image partitions as a list of `partition` records (veja Seção 16.1.1 [partition Reference], Página 698).

`compression?` (default: `#true`)
: Whether the image content should be compressed, as a boolean. It defaults to `#true` and only applies to `'iso9660` image formats.

`volatile-root?` (default: `#true`)
: Whether the image root partition should be made volatile, as a boolean.

  This is achieved by using a RAM backed file system (overlayfs) that is mounted on top of the root partition by the initrd. It defaults to `#true`. When set to `#false`, the image root partition is mounted as read-write partition by the initrd.

`shared-store?` (default: `#false`)
: Whether the image's store should be shared with the host system, as a boolean. This can be useful when creating images dedicated to virtual machines. When set to `#false`, which is the default, the image's `operating-system` closure is copied to the image. Otherwise, when set to `#true`, it is assumed that the host store will be made available at boot, using a `9p` mount for instance.

`shared-network?` (default: `#false`)
: Se deve usar as interfaces de rede do host dentro da imagem, como um booleano. Isso é usado apenas para o formato de imagem `'docker`. O padrão é `#false`.

`substitutable?` (default: `#true`)
: Whether the image derivation should be substitutable, as a boolean. It defaults to `true`.

16.1.1 `partition` Reference

In `image` record may contain some partitions.

`partition` [Data Type]
: This is the data type representing an image partition.

`size` (default: `'guess`)
: The partition size in bytes or `'guess`. The `'guess` symbol, which is the default, means that the partition size will be inferred based on the partition content.

`offset` (default: `0`)
: The partition's start offset in bytes, relative to the image start or the previous partition end. It defaults to `0` which means that there is no offset applied.

`file-system` (default: `"ext4"`)
: The partition file system as a string, defaulting to `"ext4"`.

  The supported values are `"vfat"`, `"fat16"`, `"fat32"`, `"btrfs"`, and `"ext4"`.

  `"vfat"`, `"fat16"`, and `"fat32"` partitions without the `'esp` flag are by default LBA compatible.

`file-system-options` (default: `'()`)
: The partition file system creation options that should be passed to the partition creation tool, as a list of strings. This is only supported when creating `"vfat"`, `"fat16"`, `"fat32"` or `"ext4"` partitions.

  See the `"extended-options"` man page section of the `"mke2fs"` tool for a more complete reference.

`rótulo` The partition label as a mandatory string, `"my-root"` for instance.

`uuid` (default: `#false`)
: The partition UUID as an `uuid` record (veja Seção 11.4 [Sistemas de arquivos], Página 251). By default it is `#false`, which means that the partition creation tool will attribute a random UUID to the partition.

`flags` (default: `'()`)
: The partition flags as a list of symbols. Possible values are `'boot` and `'esp`. The `'boot` flags should be set if you want to boot from this partition. Exactly one partition should have this flag set, usually the root one. The `'esp` flag identifies a UEFI System Partition.

`initializer` (default: `#false`)
: The partition initializer procedure as a gexp. This procedure is called to populate a partition. If no initializer is passed, the `initialize-root-partition` procedure from the `(gnu build image)` module is used.

16.2 Instanciar uma imagem

Let's say you would like to create an MBR image with three distinct partitions:

- The ESP (EFI System Partition), a partition of 40 MiB at offset 1024 KiB with a vfat file system.
- an ext4 partition of 50 MiB data file, and labeled "data".
- an ext4 bootable partition containing the `%simple-os` operating-system.

You would then write the following image definition in a `my-image.scm` file for instance.

```
(use-modules (gnu)
             (gnu image)
             (gnu tests)
             (gnu system image)
             (guix gexp))

(define MiB (expt 2 20))

(image
 (format 'disk-image)
 (operating-system %simple-os)
 (partitions
  (list
   (partition
    (size (* 40 MiB))
    (offset (* 1024 1024))
    (label "GNU-ESP")
    (file-system "vfat")
    (flags '(esp))
    (initializer (gexp initialize-efi-partition)))
   (partition
    (size (* 50 MiB))
    (label "DATA")
    (file-system "ext4")
    (initializer #~(lambda* (root . rest)
                     (mkdir root)
                     (call-with-output-file
                         (string-append root "/data")
                       (lambda (port)
                         (format port "my-data"))))))
   (partition
    (size 'guess)
    (label root-label)
    (file-system "ext4")
    (flags '(boot))
    (initializer (gexp initialize-root-partition))))))
```

Note que a primeira e a terceira partições usam procedimentos de inicializadores genéricos, initialize-efi-partition e initialize-root-partition, respectivamente. O initialize-efi-partition instala um carregador EFI GRUB que está carregando o carregador de inicialização GRUB localizado na partição raiz. O initialize-root-partition instancia um sistema completo conforme definido pelo sistema operacional `%simple-os`.

Agora você pode executar:

```
guix system image my-image.scm
```

para instanciar a definição `image`. Isso produz uma imagem de disco que tem a estrutura esperada:

```
$ parted $(guix system image my-image.scm) print
...
Model:  (file)
Disk /gnu/store/yhylv1bp5b2ypb97pd3bbhz6jk5nbhxw-disk-image: 1714MB
Sector size (logical/physical): 512B/512B
Partition Table: msdos
Disk Flags:

Number  Start   End     Size    Type     File system  Flags
 1      1049kB  43.0MB  41.9MB  primary  fat16        esp
 2      43.0MB  95.4MB  52.4MB  primary  ext4
 3      95.4MB  1714MB  1619MB  primary  ext4         boot
```

The size of the `boot` partition has been inferred to `1619MB` so that it is large enough to host the `%simple-os` operating-system.

You can also use existing `image` record definitions and inherit from them to simplify the `image` definition. The `(gnu system image)` module provides the following `image` definition variables.

`mbr-disk-image` [Variável]
: An MBR disk-image composed of a single ROOT partition. The ROOT partition starts at a 1 MiB offset so that the bootloader can install itself in the post-MBR gap.

`mbr-hybrid-disk-image` [Variável]
: An MBR disk-image composed of two partitions: a 64 bits ESP partition and a ROOT boot partition. The ESP partition starts at a 1 MiB offset so that a BIOS compatible bootloader can install itself in the post-MBR gap. The image can be used by `x86_64` and `i686` machines supporting only legacy BIOS booting. The ESP partition ensures that it can also be used by newer machines relying on UEFI booting, hence the *hybrid* denomination.

`efi-disk-image` [Variável]
: A GPT disk-image composed of two partitions: a 64 bits ESP partition and a ROOT boot partition. This image can be used on most `x86_64` and `i686` machines, supporting BIOS or UEFI booting.

`efi32-disk-image` [Variável]
: Same as `efi-disk-image` but with a 32 bits EFI partition.

`iso9660-image` [Variável]
: An ISO-9660 image composed of a single bootable partition. This image can also be used on most `x86_64` and `i686` machines.

`docker-image` [Variável]
: Uma imagem do Docker que pode ser usada para gerar um contêiner do Docker.

Using the `efi-disk-image` we can simplify our previous `image` declaration this way:

```
(use-modules (gnu)
             (gnu image)
```

```
                (gnu tests)
                (gnu system image)
                (guix gexp)
                (ice-9 match))

(define MiB (expt 2 20))

(define data
  (partition
   (size (* 50 MiB))
   (label "DATA")
   (file-system "ext4")
   (initializer #~(lambda* (root . rest)
                    (mkdir root)
                    (call-with-output-file
                        (string-append root "/data")
                      (lambda (port)
                        (format port "my-data")))))))

(image
 (inherit efi-disk-image)
 (operating-system %simple-os)
 (partitions
  (match (image-partitions efi-disk-image)
    ((esp root)
     (list esp data root)))))
```

This will give the exact same `image` instantiation but the `image` declaration is simpler.

16.3 image-type Reference

The `guix system image` command can, as we saw above, take a file containing an `image` declaration as argument and produce an actual disk image from it. The same command can also handle a file containing an `operating-system` declaration as argument. In that case, how is the `operating-system` turned into an image?

That's where the `image-type` record intervenes. This record defines how to transform an `operating-system` record into an `image` record.

`image-type` [Data Type]

This is the data type representing an image-type.

`name` The image-type name as a mandatory symbol, `'efi32-raw` for instance.

`constructor`
The image-type constructor, as a mandatory procedure that takes an `operating-system` record as argument and returns an `image` record.

There are several `image-type` records provided by the `(gnu system image)` and the `(gnu system images ...)` modules.

`mbr-raw-image-type` [Variável]
Crie uma imagem baseada na imagem `mbr-disk-image`.

`mbr-hybrid-raw-image-type` [Variável]
Build an image based on the `mbr-hybrid-disk-image` image.

`efi-raw-image-type` [Variável]
Build an image based on the `efi-disk-image` image.

`efi32-raw-image-type` [Variável]
Build an image based on the `efi32-disk-image` image.

`qcow2-image-type` [Variável]
Build an image based on the `mbr-disk-image` image but with the `compressed-qcow2` image format.

`iso-image-type` [Variável]
Build a compressed image based on the `iso9660-image` image.

`uncompressed-iso-image-type` [Variável]
Build an image based on the `iso9660-image` image but with the `compression?` field set to `#false`.

`docker-image-type` [Variável]
Build an image based on the `docker-image` image.

`raw-with-offset-image-type` [Variável]
Crie uma imagem MBR com uma única partição começando em um deslocamento `1024KiB`. Isso é útil para deixar algum espaço para instalar um bootloader na lacuna pós-MBR.

`pinebook-pro-image-type` [Variável]
Build an image that is targeting the Pinebook Pro machine. The MBR image contains a single partition starting at a `9MiB` offset. The `u-boot-pinebook-pro-rk3399-bootloader` bootloader will be installed in this gap.

`rock64-image-type` [Variável]
Build an image that is targeting the Rock64 machine. The MBR image contains a single partition starting at a `16MiB` offset. The `u-boot-rock64-rk3328-bootloader` bootloader will be installed in this gap.

`novena-image-type` [Variável]
Build an image that is targeting the Novena machine. It has the same characteristics as `raw-with-offset-image-type`.

`pine64-image-type` [Variável]
Build an image that is targeting the Pine64 machine. It has the same characteristics as `raw-with-offset-image-type`.

`hurd-image-type` [Variável]
Build an image that is targeting a `i386` machine running the Hurd kernel. The MBR image contains a single ext2 partitions with specific `file-system-options` flags.

`hurd-qcow2-image-type` [Variável]
: Build an image similar to the one built by the `hurd-image-type` but with the `format` set to `'compressed-qcow2`.

`wsl2-image-type` [Variável]
: Build an image for the WSL2 (Windows Subsystem for Linux 2). It can be imported by running:

```
wsl --import Guix ./guix ./wsl2-image.tar.gz
wsl -d Guix
```

Então, se voltarmos ao comando `guix system image` tomando uma declaração `operating-system` como argumento. Por padrão, o `mbr-raw-image-type` é usado para transformar o `operating-system` fornecido em uma imagem inicializável real.

Para usar um `image-type` diferente, a opção `--image-type` pode ser usada. A opção `--list-image-types` listará todos os tipos de imagem suportados. Acontece que é uma listagem textual de todas as variáveis `image-types` descritas logo acima (veja Seção 11.16 [Invocando guix system], Página 616).

16.4 Módulos de imagem

Vamos pegar o exemplo do Pine64, uma máquina baseada em ARM. Para poder produzir uma imagem direcionada a essa placa, precisamos dos seguintes elementos:

- Um registro `operating-system` contendo pelo menos um kernel apropriado (`linux-libre-arm64-generic`) e bootloader `u-boot-pine64-lts-bootloader`) para o Pine64.
- Possibly, an `image-type` record providing a way to turn an `operating-system` record to an `image` record suitable for the Pine64.
- An actual `image` that can be instantiated with the `guix system image` command.

The `(gnu system images pine64)` module provides all those elements: `pine64-barebones-os`, `pine64-image-type` and `pine64-barebones-raw-image` respectively.

The module returns the `pine64-barebones-raw-image` in order for users to be able to run:

```
guix system image gnu/system/images/pine64.scm
```

Now, thanks to the `pine64-image-type` record declaring the `'pine64-raw image-type`, one could also prepare a `my-pine.scm` file with the following content:

```
(use-modules (gnu system images pine64))
(operating-system
  (inherit pine64-barebones-os)
  (timezone "Europe/Athens"))
```

to customize the `pine64-barebones-os`, and run:

```
$ guix system image --image-type=pine64-raw my-pine.scm
```

Note that there are other modules in the `gnu/system/images` directory targeting `Novena`, `Pine64`, `PinebookPro` and `Rock64` machines.

17 Instalando arquivos de depuração

Program binaries, as produced by the GCC compilers for instance, are typically written in the ELF format, with a section containing *debugging information*. Debugging information is what allows the debugger, GDB, to map binary code to source code; it is required to debug a compiled program in good conditions.

This chapter explains how to use separate debug info when packages provide it, and how to rebuild packages with debug info when it's missing.

17.1 Informações de depuração separadas

O problema com informações de depuração é que elas ocupam uma quantidade considerável de espaço em disco. Por exemplo, informações de depuração para a GNU C Library pesam mais de 60 MiB. Assim, como usuário, manter todas as informações de depuração de todos os programas instalados geralmente não é uma opção. No entanto, a economia de espaço não deve vir ao custo de um impedimento à depuração — especialmente no sistema GNU, o que deve tornar mais fácil para os usuários exercerem sua liberdade de computação (veja Seção 1.2 [Distribuição GNU], Página 2).

Thankfully, the GNU Binary Utilities (Binutils) and GDB provide a mechanism that allows users to get the best of both worlds: debugging information can be stripped from the binaries and stored in separate files. GDB is then able to load debugging information from those files, when they are available (veja Seção "Separate Debug Files" em *Debugging with GDB*).

The GNU distribution takes advantage of this by storing debugging information in the `lib/debug` sub-directory of a separate package output unimaginatively called `debug` (veja Seção 5.4 [Pacotes com múltiplas saídas], Página 52). Users can choose to install the `debug` output of a package when they need it. For instance, the following command installs the debugging information for the GNU C Library and for GNU Guile:

```
guix install glibc:debug guile:debug
```

GDB must then be told to look for debug files in the user's profile, by setting the `debug-file-directory` variable (consider setting it from the `~/.gdbinit` file, veja Seção "Startup" em *Debugging with GDB*):

```
(gdb) set debug-file-directory ~/.guix-profile/lib/debug
```

From there on, GDB will pick up debugging information from the `.debug` files under `~/.guix-profile/lib/debug`.

Below is an alternative GDB script which is useful when working with other profiles. It takes advantage of the optional Guile integration in GDB. This snippet is included by default on Guix System in the `~/.gdbinit` file.

```
guile
(use-modules (gdb))
(execute (string-append "set debug-file-directory "
                        (or (getenv "GDB_DEBUG_FILE_DIRECTORY")
                            "~/.guix-profile/lib/debug")))
end
```

In addition, you will most likely want GDB to be able to show the source code being debugged. To do that, you will have to unpack the source code of the package of interest (obtained with `guix build --source`, veja Seção 9.1 [Invocando guix build], Página 177), and to point GDB to that source directory using the `directory` command (veja Seção "Source Path" em *Debugging with GDB*).

The `debug` output mechanism in Guix is implemented by the `gnu-build-system` (veja Seção 8.5 [Sistemas de compilação], Página 121). Currently, it is opt-in—debugging information is available only for the packages with definitions explicitly declaring a `debug` output. To check whether a package has a `debug` output, use `guix package --list-available` (veja Seção 5.2 [Invocando guix package], Página 37).

Read on for how to deal with packages lacking a `debug` output.

17.2 Reconstruindo informações de depuração

As we saw above, some packages, but not all, provide debugging info in a `debug` output. What can you do when debugging info is missing? The `--with-debug-info` option provides a solution to that: it allows you to rebuild the package(s) for which debugging info is missing—and only those—and to graft those onto the application you're debugging. Thus, while it's not as fast as installing a `debug` output, it is relatively inexpensive.

Let's illustrate that. Suppose you're experiencing a bug in Inkscape and would like to see what's going on in GLib, a library that's deep down in its dependency graph. As it turns out, GLib does not have a `debug` output and the backtrace GDB shows is all sadness:

```
(gdb) bt
#0  0x00007ffff5f92190 in g_getenv ()
   from /gnu/store/...-glib-2.62.6/lib/libglib-2.0.so.0
#1  0x00007ffff608a7d6 in gobject_init_ctor ()
   from /gnu/store/...-glib-2.62.6/lib/libgobject-2.0.so.0
#2  0x00007ffff7fe275a in call_init (l=<optimized out>, argc=argc@entry=1, argv=argv@e
    env=env@entry=0x7fffffffcfe8) at dl-init.c:72
#3  0x00007ffff7fe2866 in call_init (env=0x7fffffffcfe8, argv=0x7fffffffcfd8, argc=1,
    at dl-init.c:118
```

To address that, you install Inkscape linked against a variant GLib that contains debug info:

```
guix install inkscape --with-debug-info=glib
```

This time, debugging will be a whole lot nicer:

```
$ gdb --args sh -c 'exec inkscape'
...
(gdb) b g_getenv
Function "g_getenv" not defined.
Make breakpoint pending on future shared library load? (y or [n]) y
Breakpoint 1 (g_getenv) pending.
(gdb) r
Starting program: /gnu/store/...-profile/bin/sh -c exec\ inkscape
...
(gdb) bt
```

```
#0  g_getenv (variable=variable@entry=0x7ffff60c7a2e "GOBJECT_DEBUG") at ../glib-2.62.
#1  0x00007ffff608a7d6 in gobject_init () at ../glib-2.62.6/gobject/gtype.c:4380
#2  gobject_init_ctor () at ../glib-2.62.6/gobject/gtype.c:4493
#3  0x00007ffff7fe275a in call_init (l=<optimized out>, argc=argc@entry=3, argv=argv@e
    env=env@entry=0x7fffffffd0a8) at dl-init.c:72
...
```

Much better!

Note that there can be packages for which `--with-debug-info` will not have the desired effect. Veja Seção 9.1.2 [Opções de transformação de pacote], Página 180, for more information.

18 Using TEX and LATEX

Guix provides packages for the TEX, LATEX, ConTeXt, LuaTeX, and related typesetting systems, taken from the TEX Live distribution (`https://www.tug.org/texlive/`). However, because TEX Live is so huge and because finding one's way in this maze is tricky, so this section provides some guidance on how to deploy the relevant packages to compile TEX and LATEX documents.

TEX Live currently comes in two mutually exclusive flavors in Guix:

- The "monolithic" `texlive` package: it comes with *every single TEX Live package* (roughly 4,200), but it is huge—more than 4 GiB for a single package!
- A "modular" TEX Live distribution, in which you only install the packages, always prefixed with '`texlive-`', you need.

So to insist, these two flavors cannot be combined[1]. If in the modular setting your document does not compile, the solution is not to add the monolithic `texlive` package, but to add the set of missing packages from the modular distribution.

Building a coherent system that provides all the essential tools and, at the same time, satisfies all of its internal dependencies can be a difficult task. It is therefore recommended to start with sets of packages, called *collections*, and *schemes*, the name for collections of collections. The following command lists available schemes and collections (veja [Invoking guix package], Página 43):

```
guix search texlive-\(scheme\|collection\) | recsel -p name,description
```

Se necessário, você pode completar seu sistema com pacotes individuais, principalmente quando eles pertencem a uma coleção grande na qual você não tem interesse.

For instance, the following manifest is a reasonable, yet frugal starting point for a French LATEX user:

```
(specifications->manifest
 '("rubber"

   "texlive-scheme-basic"
   "texlive-collection-latexrecommended"
   "texlive-collection-fontsrecommended"
   "texlive-babel-french"

   ;; From "latexextra" collection.
   "texlive-tabularray"
   ;; From "binextra" collection.
   "texlive-texdoc"))
```

If you come across a document that does not compile in such a basic setting, the main difficulty is finding the missing packages. In this case, `pdflatex` and similar commands tend to fail with obscure error messages along the lines of:

```
doc.tex: File `tikz.sty' not found.
```

[1] No rule without exception! As the monolithic TEX Live does not contain the `biber` executable, it is okay to combine it with `texlive-biber`, which does.

```
doc.tex:7: Emergency stop.
```

or, for a missing font:

```
kpathsea: Running mktexmf phvr7t
! I can't find file `phvr7t'.
```

How do you determine what the missing package is? In the first case, you will find the answer by running:

```
$ guix search texlive tikz
name: texlive-pgf
version: 59745
...
```

In the second case, `guix search` turns up nothing. Instead, you can search the TEX Live package database using the `tlmgr` command:

```
$ tlmgr info phvr7t
tlmgr: cannot find package phvr7t, searching for other matches:

Packages containing `phvr7t' in their title/description:

Packages containing files matching `phvr7t':
helvetic:
        texmf-dist/fonts/tfm/adobe/helvetic/phvr7t.tfm
        texmf-dist/fonts/tfm/adobe/helvetic/phvr7tn.tfm
        texmf-dist/fonts/vf/adobe/helvetic/phvr7t.vf
        texmf-dist/fonts/vf/adobe/helvetic/phvr7tn.vf
tex4ht:
        texmf-dist/tex4ht/ht-fonts/alias/adobe/helvetic/phvr7t.htf
```

O arquivo está disponível no pacote TEX Live `helvetic`, que é conhecido no Guix como `texlive-helvetic`. Uma viagem e tanto, mas você encontrou!

19 Atualizações de segurança

Ocasionalmente, vulnerabilidades de segurança importantes são descobertas em pacotes de software e devem ser corrigidas. Os desenvolvedores do Guix se esforçam para manter o controle das vulnerabilidades conhecidas e aplicar correções o mais rápido possível no branch `master` do Guix (ainda não fornecemos um branch "stable" contendo apenas atualizações de segurança). A ferramenta `guix lint` ajuda os desenvolvedores a descobrirem sobre versões vulneráveis de pacotes de software na distribuição:

```
$ guix lint -c cve
gnu/packages/base.scm:652:2: glibc@2.21: probably vulnerable to CVE-2015-1781, CVE-2015-7547
gnu/packages/gcc.scm:334:2: gcc@4.9.3: probably vulnerable to CVE-2015-5276
gnu/packages/image.scm:312:2: openjpeg@2.1.0: probably vulnerable to CVE-2016-1923, CVE-2016-1924
...
```

Veja Seção 9.8 [Invocando guix lint], Página 211, para mais informações.

Guix segue uma disciplina de gerenciamento de pacotes funcional (veja Capítulo 1 [Introdução], Página 1), o que implica que, quando um pacote é alterado, *todo pacote que depende dele* deve ser reconstruído. Isso pode desacelerar significativamente a implantação de correções em pacotes principais, como libc ou Bash, já que basicamente toda a distribuição precisaria ser reconstruída. Usar binários pré-construídos ajuda (veja Seção 5.3 [Substitutos], Página 47), mas a implantação ainda pode levar mais tempo do que o desejado.

To address this, Guix implements *grafts*, a mechanism that allows for fast deployment of critical updates without the costs associated with a whole-distribution rebuild. The idea is to rebuild only the package that needs to be patched, and then to "graft" it onto packages explicitly installed by the user and that were previously referring to the original package. The cost of grafting is typically very low, and order of magnitudes lower than a full rebuild of the dependency chain.

For instance, suppose a security update needs to be applied to Bash. Guix developers will provide a package definition for the "fixed" Bash, say `bash-fixed`, in the usual way (veja Seção 8.2 [Definindo pacotes], Página 101). Then, the original package definition is augmented with a `replacement` field pointing to the package containing the bug fix:

```
(define bash
  (package
    (name "bash")
    ;; ...
    (replacement bash-fixed)))
```

From there on, any package depending directly or indirectly on Bash—as reported by `guix gc --requisites` (veja Seção 5.6 [Invocando guix gc], Página 54)—that is installed is automatically "rewritten" to refer to `bash-fixed` instead of `bash`. This grafting process takes time proportional to the size of the package, usually less than a minute for an "average" package on a recent machine. Grafting is recursive: when an indirect dependency requires grafting, then grafting "propagates" up to the package that the user is installing.

Currently, the length of the name and version of the graft and that of the package it replaces (`bash-fixed` and `bash` in the example above) must be equal. This restriction mostly comes from the fact that grafting works by patching files, including binary files, directly. Other restrictions may apply: for instance, when adding a graft to a package providing a

shared library, the original shared library and its replacement must have the same `SONAME` and be binary-compatible.

The `--no-grafts` command-line option allows you to forcefully avoid grafting (veja Seção 9.1.1 [Opções de compilação comum], Página 177). Thus, the command:

```
guix build bash --no-grafts
```

returns the store file name of the original Bash, whereas:

```
guix build bash
```

returns the store file name of the "fixed", replacement Bash. This allows you to distinguish between the two variants of Bash.

To verify which Bash your whole profile refers to, you can run (veja Seção 5.6 [Invocando guix gc], Página 54):

```
guix gc -R $(readlink -f ~/.guix-profile) | grep bash
```

... e compare os nomes dos arquivos de armazém que você obtém com os acima. Da mesma forma para uma geração completa do sistema Guix:

```
guix gc -R $(guix system build my-config.scm) | grep bash
```

Por fim, para verificar quais processos Bash estão em execução, você pode usar o comando `lsof`:

```
lsof | grep /gnu/store/.*bash
```

20 Inicializando

Bootstrapping em nosso contexto se refere a como a distribuição é construída "do nada". Lembre-se de que o ambiente de construção de uma derivação não contém nada além de suas entradas declaradas (veja Capítulo 1 [Introdução], Página 1). Então há um problema óbvio de galinha e ovo: como o primeiro pacote é construído? Como o primeiro compilador é compilado?

É tentador pensar nessa questão como algo com que apenas hackers obstinados podem se importar. No entanto, embora a resposta a essa questão seja de natureza técnica, suas implicações são abrangentes. Como a distribuição é bootstrapped define até que ponto nós, como indivíduos e como um coletivo de usuários e hackers, podemos confiar no software que executamos. É uma preocupação central do ponto de vista da *segurança* e do ponto de vista da *liberdade do usuário*.

O sistema GNU é feito principalmente de código C, com libc em seu núcleo. O próprio sistema de construção GNU assume a disponibilidade de um Bourne shell e ferramentas de linha de comando fornecidas pelo GNU Coreutils, Awk, Findutils, 'sed' e 'grep'. Além disso, programas de construção — programas que executam `./configure`, `make`, etc. — são escritos em Guile Scheme (veja Seção 8.10 [Derivações], Página 156). Consequentemente, para ser capaz de construir qualquer coisa, do zero, Guix depende de binários pré-construídos de Guile, GCC, Binutils, libc e os outros pacotes mencionados acima — os *binários bootstrap*.

Esses binários bootstrap são "considerados garantidos", embora também possamos recriá-los se necessário (veja Seção 20.2 [Preparando para usar os binários do Bootstrap], Página 715).

20.1 O Bootstrap de código fonte completo

Guix—como outras distribuições GNU/Linux—é tradicionalmente bootstrapado a partir de um conjunto de binários bootstrap: Bourne shell, ferramentas de linha de comando fornecidas pelo GNU Coreutils, Awk, Findutils, "sed' e 'grep' e Guile, GCC, Binutils e a GNU C Library (veja Capítulo 20 [Inicializando], Página 712). Normalmente, esses binários bootstrap são "considerados garantidos."

Tomar os binários bootstrap como garantidos significa que os consideramos uma "semente" correta e confiável para construir o sistema completo. Aí está um problema: o tamanho combinado desses binários bootstrap é de cerca de 250 MB (veja Seção "Bootstrappable Builds" em *GNU Mes*). Auditar ou mesmo inspecionar isso é quase impossível.

Para `i686-linux` e `x86_64-linux`, o Guix agora apresenta um *full-source bootstrap*. Este bootstrap está enraizado em `hex0-seed` do pacote Stage0 (`https://savannah.gnu.org/projects/stage0`). O programa hex0 é um assembler minimalista: ele lê dígitos hexadecimais separados por espaços (nibbles) de um arquivo, possivelmente incluindo comentários, e emite na saída padrão os bytes correspondentes a esses números hexadecimais. O código-fonte deste programa hex0 inicial é um arquivo chamado `hex0_x86.hex0` (`https://github.com/oriansj/bootstrap-seeds/blob/master/POSIX/x86/hex0_x86.hex0`) e é escrito na linguagem `hex0`.

O Hex0 é auto-hospedado, o que significa que ele pode se construir:

```
./hex0-seed hex0_x86.hex0 hex0
```

Hex0 é o equivalente ASCII do programa binário e pode ser produzido fazendo algo muito parecido com:

```
sed 's/[;#].*$//g' hex0_x86.hex0 | xxd -r -p > hex0
chmod +x hex0
```

É por causa dessa equivalência ASCII-binário que podemos abençoar esse binário inicial de 357 bytes como fonte e, portanto, 'bootstrap de fonte completa".

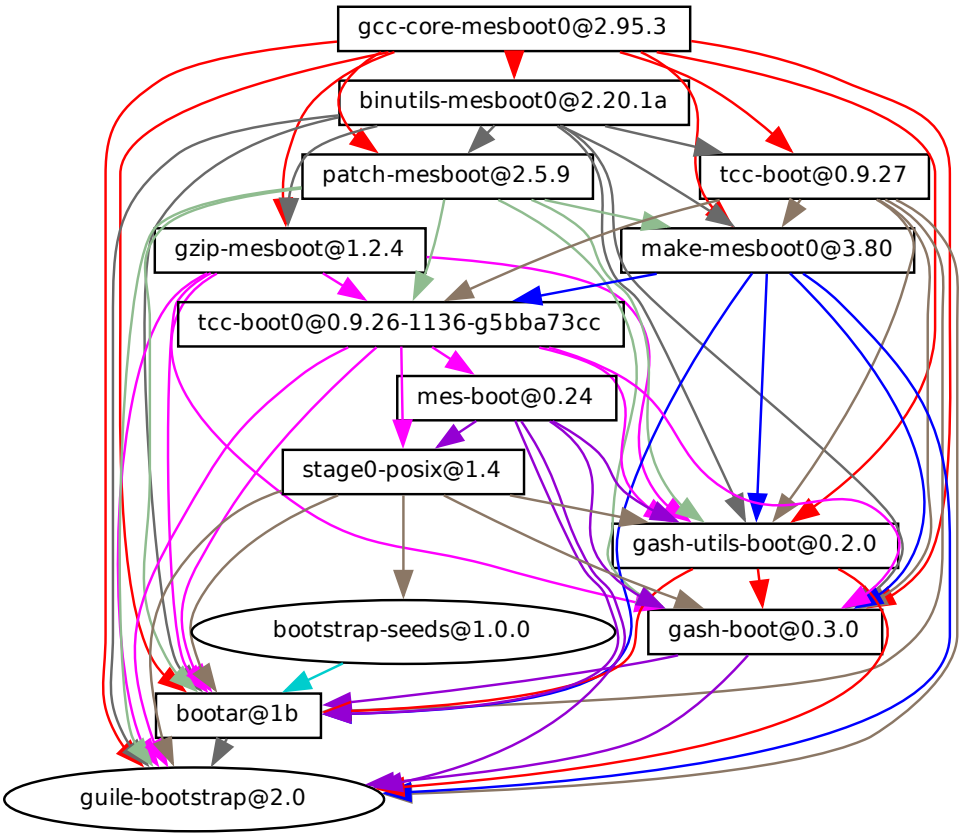
O bootstrap então continua: `hex0` constrói `hex1` e então para `M0`, `hex2`, `M1`, `mescc-tools` e finalmente `M2-Planet`. Então, usando `mescc-tools`, `M2-Planet` nós construímos Mes (veja *GNU Mes*, um interpretador Scheme e compilador C em Scheme). A partir daqui começa o bootstrap mais tradicional baseado em `C` do Sistema GNU.

Outro passo que o Guix tomou foi substituir o shell e todos os seus utilitários por implementações no Guile Scheme, o *Scheme-only bootstrap*. O Gash (veja Seção "Gash" em *The Gash manual*) é um shell compatível com POSIX que substitui o Bash, e vem com o Gash Utils, que tem substituições minimalistas para o Awk, o GNU Core Utilities, Grep, Gzip, Sed e Tar.

Atualmente, construir o Sistema GNU a partir do código-fonte só é possível adicionando alguns pacotes históricos do GNU como etapas intermediárias[1]. Conforme o Gash e o Gash Utils amadurecem, e os pacotes GNU se tornam mais inicializáveis novamente (por exemplo, novos lançamentos do GNU Sed também serão enviados como tarballs compactados novamente, como alternativa à compressão `xz` difícil de inicializar), esse conjunto de pacotes adicionados pode ser reduzido novamente.

O grafo abaixo mostra o grafo de dependência resultante para `gcc-core-mesboot0`, o compilador bootstrap usado para o bootstrap tradicional do restante do Sistema Guix.

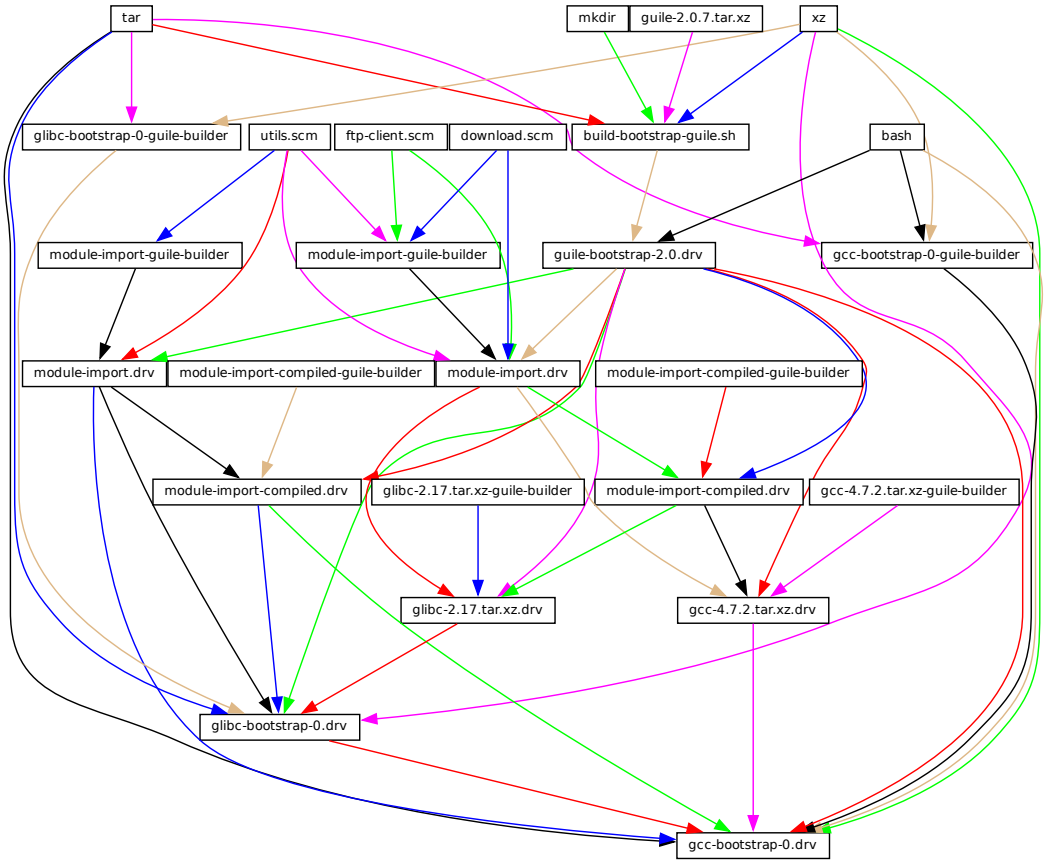
[1] Pacotes como `gcc-2.95.3`, `binutils-2.14`, `glibc-2.2.5`, `gzip-1.2.4`, `tar-1.22` e alguns outros. Para detalhes, veja `gnu/packages/commencement.scm`.



O trabalho está em andamento para levar esses bootstraps às arquiteturas `arm-linux` e `aarch64-linux` e ao Hurd.

Se você estiver interessado, junte-se a nós em '`#bootstrappable`' na rede IRC Libera.Chat ou discuta em `bug-mes@gnu.org` ou `gash-devel@nongnu.org`.

20.2 Preparando para usar os binários do Bootstrap



A figura acima mostra o início do grafo de dependência da distribuição, correspondendo às definições de pacote do módulo `(gnu packages bootstrap)`. Uma figura similar pode ser gerada com `guix graph` (veja Seção 9.10 [Invocando guix graph], Página 216), ao longo das linhas de:

```
guix graph -t derivation \
  -e '(@@ (gnu packages bootstrap) %bootstrap-gcc)' \
  | dot -Tps > gcc.ps
```

ou, para o bootstrap de semente binária reduzida

```
guix graph -t derivation  \
-e '(@@ (pacotes gnu bootstrap) %bootstrap-mes)' \
| ponto -Tps > mes.ps
```

Neste nível de detalhe, as coisas são um pouco complexas. Primeiro, o próprio Guile consiste em um executável ELF, junto com muitas fontes e arquivos de Scheme compilados que são carregados dinamicamente quando ele é executado. Isso é armazenado no tarball

`guile-2.0.7.tar.xz` mostrado neste grafo. Este tarball é parte da distribuição de "fontes" do Guix e é inserido no armazém com `add-to-store` (veja Seção 8.9 [O armazém], Página 154).

Mas como escrevemos uma derivação que descompacta esse tarball e o adiciona ao armazém? Para resolver esse problema, a derivação `guile-bootstrap-2.0.drv` — a primeira que é construída — usa `bash` como seu construtor, que executa `build-bootstrap-guile.sh`, que por sua vez chama `tar` para descompactar o tarball. Assim, `bash`, `tar`, `xz` e `mkdir` são binários estaticamente vinculados, também parte da distribuição de fontes do Guix, cujo único propósito é permitir que o tarball do Guile seja descompactado.

Uma vez que `guile-bootstrap-2.0.drv` é construído, temos um Guile funcional que pode ser usado para executar programas de construção subsequentes. Sua primeira tarefa é baixar tarballs contendo os outros binários pré-construídos — é isso que as derivações `.tar.xz.drv` fazem. Módulos Guix como `ftp-client.scm` são usados para esse propósito. As derivações `module-import.drv` importam esses módulos em um diretório no armazém, usando o layout original. As derivações `module-import-compiled.drv` compilam esses módulos e os escrevem em um diretório de saída com o layout correto. Isso corresponde ao argumento `#:modules` de `build-expression->derivation` (veja Seção 8.10 [Derivações], Página 156).

Por fim, os vários tarballs são descompactados pelas derivações `gcc-bootstrap-0.drv`, `glibc-bootstrap-0.drv` ou `bootstrap-mes-0.drv` e `bootstrap-mescc-tools-0.drv`, ponto em que temos uma cadeia de ferramentas C funcional.

Construindo as ferramentas de construção

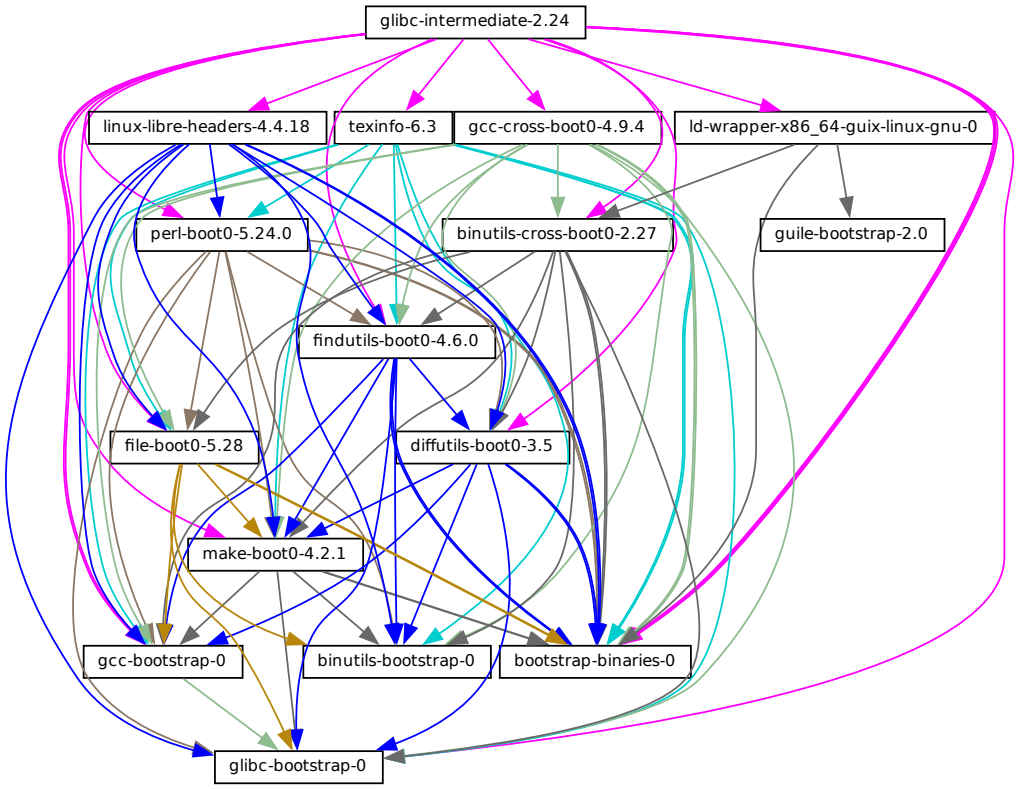
O bootstrapping está completo quando temos uma cadeia de ferramentas completa que não depende das ferramentas bootstrap pré-construídas discutidas acima. Esse requisito de não dependência é verificado verificando se os arquivos da cadeia de ferramentas final contêm referências aos diretórios `/gnu/store` das entradas bootstrap. O processo que leva a essa cadeia de ferramentas "final" é descrito pelas definições de pacote encontradas no módulo `(gnu packages commencement)`.

O comando `guix graph` nos permite "diminuir o zoom" em comparação ao grafo acima, observando o nível de objetos do pacote em vez de derivações individuais — lembre-se de que um pacote pode ser traduzido para várias derivações, normalmente uma derivação para baixar sua fonte, uma para construir os módulos Guile de que ele precisa e uma para realmente construir o pacote a partir da fonte. O comando:

```
guix graph -t bag \
  -e '(@@ (gnu packages commencement)
          glibc-final-with-bootstrap-bash)' | xdot -
```

exibe o grafo de dependência que leva à biblioteca C "final"[2], descrita abaixo.

[2] Você pode notar o rótulo `glibc-intermediate`, sugerindo que ela não é *completamente* final, mas como uma boa aproximação, a consideraremos final.



A primeira ferramenta que é construída com os binários bootstrap é o GNU Make—observado `make-boot0` acima—que é um pré-requisito para todos os pacotes seguintes. A partir daí, Findutils e Diffutils são construídos.

Então vêm os Binutils e GCC de primeiro estágio, construídos como pseudo cross tools—i.e., com `--target` igual a `--host`. Eles são usados para construir a libc. Graças a esse truque de cross-build, essa libc tem a garantia de não manter nenhuma referência à cadeia de ferramentas inicial.

A partir daí, os Binutils finais e o GCC (não mostrados acima) são construídos. O GCC usa `ld` dos Binutils finais e vincula programas à libc recém-construída. Essa cadeia de ferramentas é usada para construir os outros pacotes usados pelo Guix e pelo GNU Build System: Guile, Bash, Coreutils, etc.

E voilà! Neste ponto, temos o conjunto completo de ferramentas de construção que o GNU Build System espera. Elas estão na variável `%final-inputs` do módulo `(gnu packages commencement)` e são implicitamente usadas por qualquer pacote que use `gnu-build-system` (veja Seção 8.5 [Sistemas de compilação], Página 121).

Construindo os binários Bootstrap

Because the final tool chain does not depend on the bootstrap binaries, those rarely need to be updated. Nevertheless, it is useful to have an automated way to produce them, should an update occur, and this is what the `(gnu packages make-bootstrap)` module provides.

The following command builds the tarballs containing the bootstrap binaries (Binutils, GCC, glibc, for the traditional bootstrap and linux-libre-headers, bootstrap-mescc-tools, bootstrap-mes for the Reduced Binary Seed bootstrap, and Guile, and a tarball containing a mixture of Coreutils and other basic command-line tools):

```
guix build bootstrap-tarballs
```

The generated tarballs are those that should be referred to in the `(gnu packages bootstrap)` module mentioned at the beginning of this section.

Still here? Then perhaps by now you've started to wonder: when do we reach a fixed point? That is an interesting question! The answer is unknown, but if you would like to investigate further (and have significant computational and storage resources to do so), then let us know.

Reducing the Set of Bootstrap Binaries

Our traditional bootstrap includes GCC, GNU Libc, Guile, etc. That's a lot of binary code! Why is that a problem? It's a problem because these big chunks of binary code are practically non-auditable, which makes it hard to establish what source code produced them. Every unauditable binary also leaves us vulnerable to compiler backdoors as described by Ken Thompson in the 1984 paper *Reflections on Trusting Trust*.

This is mitigated by the fact that our bootstrap binaries were generated from an earlier Guix revision. Nevertheless it lacks the level of transparency that we get in the rest of the package dependency graph, where Guix always gives us a source-to-binary mapping. Thus, our goal is to reduce the set of bootstrap binaries to the bare minimum.

The Bootstrappable.org web site (`https://bootstrappable.org`) lists on-going projects to do that. One of these is about replacing the bootstrap GCC with a sequence of assemblers, interpreters, and compilers of increasing complexity, which could be built from source starting from a simple and auditable assembler.

Our first major achievement is the replacement of GCC, the GNU C Library and Binutils by MesCC-Tools (a simple hex linker and macro assembler) and Mes (veja *GNU Mes*, a Scheme interpreter and C compiler in Scheme). Neither MesCC-Tools nor Mes can be fully bootstrapped yet and thus we inject them as binary seeds. We call this the Reduced Binary Seed bootstrap, as it has halved the size of our bootstrap binaries! Also, it has eliminated the C compiler binary; i686-linux and x86_64-linux Guix packages are now bootstrapped without any binary C compiler.

Work is ongoing to make MesCC-Tools and Mes fully bootstrappable and we are also looking at any other bootstrap binaries. Your help is welcome!

21 Portando para uma nova plataforma

As discussed above, the GNU distribution is self-contained, and self-containment is achieved by relying on pre-built "bootstrap binaries" (veja Capítulo 20 [Inicializando], Página 712). These binaries are specific to an operating system kernel, CPU architecture, and application binary interface (ABI). Thus, to port the distribution to a platform that is not yet supported, one must build those bootstrap binaries, and update the `(gnu packages bootstrap)` module to use them on that platform.

Fortunately, Guix can *cross compile* those bootstrap binaries. When everything goes well, and assuming the GNU tool chain supports the target platform, this can be as simple as running a command like this one:

```
guix build --target=armv5tel-linux-gnueabi bootstrap-tarballs
```

For this to work, it is first required to register a new platform as defined in the `(guix platform)` module. A platform is making the connection between a GNU triplet (veja Seção "Specifying Target Triplets" em *Autoconf*), the equivalent *system* in Nix notation, the name of the *glibc-dynamic-linker*, and the corresponding Linux architecture name if applicable (veja Capítulo 15 [Plataformas], Página 695).

Once the bootstrap tarball are built, the `(gnu packages bootstrap)` module needs to be updated to refer to these binaries on the target platform. That is, the hashes and URLs of the bootstrap tarballs for the new platform must be added alongside those of the currently supported platforms. The bootstrap Guile tarball is treated specially: it is expected to be available locally, and `gnu/local.mk` has rules to download it for the supported architectures; a rule for the new platform must be added as well.

In practice, there may be some complications. First, it may be that the extended GNU triplet that specifies an ABI (like the `eabi` suffix above) is not recognized by all the GNU tools. Typically, glibc recognizes some of these, whereas GCC uses an extra `--with-abi` configure flag (see `gcc.scm` for examples of how to handle this). Second, some of the required packages could fail to build for that platform. Lastly, the generated binaries could be broken for some reason.

22 Contribuindo

Este projeto é um esforço cooperativo e precisamos da sua ajuda para fazê-lo crescer! Por favor, entre em contato conosco por meio de `guix-devel@gnu.org` e `#guix` na rede IRC do Libera Chat. Ideias, relatórios de bugs, patches e qualquer coisa que possa ser útil para o projeto são sempre bem-vindos. Nós particularmente agradecemos a ajuda no empacotamento das (veja Seção 22.8 [Diretrizes de empacotamento], Página 735).

Queremos oferecer um ambiente acolhedor, amigável e sem assédio, para que todos possam contribuir com o melhor de suas habilidades. Para este fim, nosso projeto usa um "Acordo de contribuição", que foi adaptado de `https://contributor-covenant.org/`. Você pode encontrar uma versão local no arquivo `CODE-OF-CONDUCT` na árvore de fontes.

Os contribuidores não são obrigados a usar seu nome legal em patches e comunicação on-line; eles podem usar qualquer nome ou pseudônimo de sua escolha.

22.1 Requisitos

Você pode facilmente hackear o próprio Guix usando Guix e Git, que usamos para controle de versão (veja Seção 22.2 [Compilando do git], Página 721).

Mas ao empacotar o Guix para distribuições estrangeiras ou ao inicializar em sistemas sem Guix, e se você decidir não confiar e instalar nosso binário prontamente criado (veja Seção 2.1 [Instalação de binários], Página 4), você pode baixar uma versão de lançamento do nosso tarball de código-fonte reproduzível e continuar lendo.

Esta seção lista os requisitos ao compilar o Guix a partir do fonte. O procedimento de compilação do Guix é o mesmo que para outros softwares GNU, e não é coberto aqui. Por favor, veja os arquivos `README` e `INSTALL` na árvore fonte do Guix para detalhes adicionais.

O GNU Guix está disponível para download em seu site em `http://www.gnu.org/software/guix/`.

GNU Guix depende dos seguintes pacotes:

- GNU Guile (`https://gnu.org/software/guile/`), versão 3.0.x, versão 3.0.3 ou posterior;
- Guile-Gcrypt (`https://notabug.org/cwebber/guile-gcrypt`), versão 0.1.0 ou posterior;
- Guile-GnuTLS (`https://gitlab.com/gnutls/guile/`) (veja Seção "gnutls-guile" em `GnuTLS-Guile`)[1];
- Guile-SQLite3 (`https://notabug.org/guile-sqlite3/guile-sqlite3`), versão 0.1.0 ou posterior;
- Guile-zlib (`https://notabug.org/guile-zlib/guile-zlib`), versão 0.1.0 ou posterior;
- Guile-lzlib (`https://notabug.org/guile-lzlib/guile-lzlib`);
- Guile-Avahi (`https://www.nongnu.org/guile-avahi/`);
- Guile-Git (`https://gitlab.com/guile-git/guile-git`), versão 0.5.0 ou posterior;

[1] As ligações do Guile para GnuTLS (`https://gnutls.org/`) foram distribuídas como parte do GnuTLS até a versão 3.7.8 incluída.

- Git (`https://git-scm.com`) (sim, ambos!);
- Guile-JSON (`https://savannah.nongnu.org/projects/guile-json/`) 4.3.0 ou posterior;
- GNU Make (`https://www.gnu.org/software/make/`).

As seguintes dependências são opcionais:

- O suporte para descarregamento de compilação (veja Seção 2.2.2 [Configuração de descarregamento de daemon], Página 8) e `guix copy` (veja Seção 9.13 [Invocando guix copy], Página 227) depende do Guile-SSH (`https://github.com/artyom-poptsov/guile-ssh`), versão 0.13.0 ou posterior.
- Guile-zstd (`https://notabug.org/guile-zstd/guile-zstd`), para compressão e descompressão zstd em `guix publish` e para substitutos (veja Seção 9.11 [Invocando guix publish], Página 221).
- Guile-Semver (`https://ngyro.com/software/guile-semver.html`) para o importador `crate` (veja Seção 9.5 [Invocando guix import], Página 194).
- Guile-Lib (`https://www.nongnu.org/guile-lib/doc/ref/htmlprag/`) para o importador `go` (veja Seção 9.5 [Invocando guix import], Página 194) e para alguns dos "atualizadores" (veja Seção 9.6 [Invocando guix refresh], Página 202).
- Quando libbz2 (`http://www.bzip.org`) está disponível, `guix-daemon` pode usá-lo para comprimir logs de compilação.

A menos que `--disable-daemon` tenha sido passado para `configure`, os seguintes pacotes também são necessários:

- GNU libgcrypt (`https://gnupg.org/`);
- SQLite 3 (`https://sqlite.org`);
- GCC's g++ (`https://gcc.gnu.org`), com suporte ao padrão C++11.

22.2 Compilando do git

Se você quiser hackear o próprio Guix, é recomendado usar a versão mais recente do repositório Git:

```
git clone https://git.savannah.gnu.org/git/guix.git
```

Como você garante que obteve uma cópia genuína do repositório? Para fazer isso, execute `guix git authenticate`, passando a ele o commit e a impressão digital OpenPGP do *introdução ao canal* (veja Seção 7.5 [Invocando guix git authenticate], Página 98):

```
git fetch origin keyring:keyring
guix git authenticate 9edb3f66fd807b096b48283debdcddccfea34bad \
  "BBB0 2DDF 2CEA F6A8 0D1D  E643 A2A0 6DF2 A33A 54FA"
```

Este comando é concluído com um código de saída zero em caso de sucesso; caso contrário, ele imprime uma mensagem de erro e sai com um código diferente de zero.

Como você pode ver, há um problema de ovo e galinha: primeiro você precisa ter o Guix instalado. Normalmente você instalaria o Guix System (veja Capítulo 3 [Instalação do sistema], Página 22) ou o Guix em cima de outra distro (veja Seção 2.1 [Instalação de

binários], Página 4); em ambos os casos, você verificaria a assinatura OpenPGP na mídia de instalação. Isso "bootstraps" a cadeia de confiança.

A maneira mais fácil de configurar um ambiente de desenvolvimento para Guix é, claro, usando Guix! O comando a seguir inicia um novo shell onde todas as dependências e variáveis de ambiente apropriadas são configuradas para hackear em Guix:

```
guix shell -D guix -CPW
```

ou mesmo, de dentro de uma árvore de trabalho Git para Guix:

```
guix shell -CPW
```

Se `-C` (abreviação de `--container`) não for compatível com seu sistema, tente `--pure` em vez de `-CPW`. Veja Seção 7.1 [Invocando guix shell], Página 79, para obter mais informações sobre esse comando.

Se você não conseguir usar o Guix ao criar o Guix a partir de um checkout, a seguir estão os pacotes necessários, além daqueles mencionados nas instruções de instalação (veja Seção 22.1 [Requisitos], Página 720).

- GNU Autoconf (`https://gnu.org/software/autoconf/`);
- GNU Automake (`https://gnu.org/software/automake/`);
- GNU Gettext (`https://gnu.org/software/gettext/`);
- GNU Texinfo (`https://gnu.org/software/texinfo/`);
- Graphviz (`https://www.graphviz.org/`);
- GNU Help2man (opcional) (`https://www.gnu.org/software/help2man/`).

No Guix, dependências extras podem ser adicionadas executando `guix shell`:

```
guix shell -D guix help2man git strace --pure
```

A partir daí você pode gerar a infraestrutura do sistema de construção usando Autoconf e Automake:

```
./bootstrap
```

Se você receber um erro como este:

```
configure.ac:46: error: possibly undefined macro: PKG_CHECK_MODULES
```

provavelmente significa que o Autoconf não conseguiu encontrar o `pkg.m4`, que é fornecido pelo pkg-config. Certifique-se de que `pkg.m4` esteja disponível. O mesmo vale para o conjunto de macros `guile.m4` fornecido pelo Guile. Por exemplo, se você instalou o Automake em `/usr/local`, ele não procuraria arquivos `.m4` em `/usr/share`. Nesse caso, você tem que invocar o seguinte comando:

```
export ACLOCAL_PATH=/usr/share/aclocal
```

Veja Seção "Macro Search Path" em *The GNU Automake Manual*, para mais informações.

Então, execute:

```
./configure
```

... onde `/var` é o valor normal de `localstatedir` (veja Seção 8.9 [O armazém], Página 154, para obter informações sobre isso) e `/etc` é o valor normal de `sysconfdir`. Observe que você provavelmente não executará `make install` no final (não é necessário), mas ainda é importante passar os valores `localstatedir` e `sysconfdir` corretos, que são registrados no `(guix config)` Módulo Guile.

Finalmente, você pode construir o Guix e, se desejar, executar os testes (veja Seção 22.3 [Executando o conjunto de testes], Página 724):

```
make
make check
```

Se alguma coisa falhar, dê uma olhada nas instruções de instalação (veja Capítulo 2 [Instalação], Página 4) ou envie uma mensagem para a a lista de discussão.

A partir daí, você pode autenticar todos os commits incluídos no seu checkout executando:

```
guix git authenticate \
  9edb3f66fd807b096b48283debdcddccfea34bad \
  "BBB0 2DDF 2CEA F6A8 0D1D  E643 A2A0 6DF2 A33A 54FA"
```

A primeira execução leva alguns minutos, mas as execuções subsequentes são mais rápidas. Em execuções subsequentes, você pode executar o comando sem argumentos, já que o *introduction* (o ID de confirmação e as impressões digitais do OpenPGP acima) terão sido registrados[2]:

```
guix git authenticate
```

Quando sua configuração para seu repositório Git local não corresponde ao padrão, você pode fornecer a referência para o branch `keyring` *via* a opção `-k`. O exemplo a seguir pressupõe que você tenha um Git remoto chamado '`myremote`' apontando para o repositório oficial:

```
guix git authenticate \
  -k myremote/keyring \
  9edb3f66fd807b096b48283debdcddccfea34bad \
  "BBB0 2DDF 2CEA F6A8 0D1D  E643 A2A0 6DF2 A33A 54FA"
```

Veja Seção 7.5 [Invocando guix git authenticate], Página 98, para mais informações sobre este comando.

> **Nota:** Por padrão, os hooks são instalados de forma que `guix git authenticate` seja invocado sempre que você executar `git pull` ou `git push`.

Após atualizar o repositório, `make` pode falhar com um erro semelhante ao exemplo a seguir:

```
error: failed to load 'gnu/packages/linux.scm':
ice-9/eval.scm:293:34: In procedure abi-check: #<record-type <origin>>: record ABI mis
```

Isso significa que um dos tipos de registro que o Guix define (neste exemplo, o registro `origin`) foi alterado e todo o guix precisa ser recompilado para levar essa mudança em consideração. Para fazer isso, execute `make clean-go` seguido de `make`.

Caso `make` falhe com uma mensagem de erro do Automake após a atualização, você precisará repetir as etapas descritas nesta seção, começando com `./bootstrap`.

[2] Isso requer uma versão recente do Guix, de maio de 2024 ou mais recente.

22.3 Executando o conjunto de testes

Depois que um `configure` e `make` bem-sucedido forem executados, é uma boa ideia executar o conjunto de testes. Ele pode ajudar a detectar problemas com a configuração ou o ambiente, ou com bugs no próprio Guix – e realmente, relatar falhas de teste é uma boa maneira de ajudar a melhorar o software. Para executar o conjunto de testes, digite:

```
make check
```

Os casos de teste podem ser executados em paralelo: você pode usar a opção `-j` do GNU make para acelerar as coisas. A primeira execução pode levar alguns minutos em uma máquina recente; as execuções subsequentes serão mais rápidas porque o armazém criado para fins de teste já terá vários itens no cache.

Também é possível executar um subconjunto dos testes definindo a variável makefile `TESTS` como neste exemplo:

```
make check TESTS="tests/store.scm tests/cpio.scm"
```

Por padrão, os resultados dos testes são exibidos em um nível de arquivo. Para ver os detalhes de cada caso de teste individual, é possível definir a variável makefile `SCM_LOG_DRIVER_FLAGS` como neste exemplo:

```
make check TESTS="tests/base64.scm" SCM_LOG_DRIVER_FLAGS="--brief=no"
```

O driver de teste Automake personalizado SRFI 64 subjacente usado para o conjunto de testes 'check' (localizado em `build-aux/test-driver.scm`) também permite selecionar quais casos de teste executar em um nível mais fino, por meio de suas opções `--select` e `--exclude`. Aqui está um exemplo, para executar todos os casos de teste do arquivo de teste `tests/packages.scm` cujos nomes começam com "transaction-upgrade-entry":

```
export SCM_LOG_DRIVER_FLAGS="--select=^transaction-upgrade-entry"
make check TESTS="tests/packages.scm"
```

Aqueles que desejam inspecionar os resultados de testes com falha diretamente da linha de comando podem adicionar a opção `--errors-only=yes` à variável makefile `SCM_LOG_DRIVER_FLAGS` e definir a variável makefile do Automake `VERBOSE`, como em:

```
make check SCM_LOG_DRIVER_FLAGS="--brief=no --errors-only=yes" VERBOSE=1
```

A opção `--show-duration=yes` pode ser usada para imprimir a duração dos casos de teste individuais, quando usada em combinação com `--brief=no`:

```
make check SCM_LOG_DRIVER_FLAGS="--brief=no --show-duration=yes"
```

Veja Seção "Parallel Test Harness" em *GNU Automake* para mais informações sobre o Automake Parallel Test Harness.

Em caso de falha, envie um e-mail para `bug-guix@gnu.org` e anexe o arquivo `test-suite.log`. Por favor, especifique a versão do Guix que está sendo usada, bem como os números de versão das dependências (veja Seção 22.1 [Requisitos], Página 720) em sua mensagem.

O Guix também vem com um conjunto de testes de sistema completo que testa instâncias completas do Guix System. Ele só pode ser executado em sistemas nos quais o Guix já está instalado, usando:

```
make check-system
```

ou, novamente, definindo `TESTS` para selecionar um subconjunto de testes a serem executados:

```
make check-system TESTS="basic mcron"
```

Esses testes de sistema são definidos nos módulos `(gnu tests ...)`. Eles trabalham executando os sistemas operacionais em teste com instrumentação leve em uma máquina virtual (VM). Eles podem ser computacionalmente intensivos ou bastante baratos, dependendo se os substitutos estão disponíveis para suas dependências (veja Seção 5.3 [Substitutos], Página 47). Alguns deles exigem muito espaço de armazenamento para armazenar imagens de VM.

Se você encontrar um erro como:

```
Compilando módulos do Scheme...
ice-9/eval.scm:142:16: No procedimento compile-top-call:
erro: all-system-tests: variável não vinculada
dica: Você esqueceu `(use-modules (gnu tests))'?
```

pode haver inconsistências na árvore de trabalho de compilações anteriores. Para resolver isso, tente executar `make clean-go` seguido por `make`.

Novamente, em caso de falhas nos testes, por favor envie `bug-guix@gnu.org` todos os detalhes.

22.4 Executando guix antes dele ser instalado

Para manter um ambiente de trabalho saudável, você achará útil testar as alterações feitas na árvore local de fontes sem realmente instalá-las. Para que você possa distinguir entre o seu chapéude "usuário final" e sua fantasia "misturada".

Para esse fim, todas as ferramentas de linha de comando podem ser usadas mesmo se você não tiver executado `make install`. Para fazer isso, primeiro você precisa ter um ambiente com todas as dependências disponíveis (veja Seção 22.2 [Compilando do git], Página 721) e, em seguida, simplesmente prefixar cada comando com `./pre-inst-env` (o `pre-inst-env` fica na árvore de construção superior do Guix; veja Seção 22.2 [Compilando do git], Página 721, para gerá-lo). Como exemplo, aqui está como você construiria o pacote `hello` conforme definido em sua árvore de trabalho (isso pressupõe que `guix-daemon` já esteja em execução em seu sistema; não há problema se for uma versão diferente):

```
$ ./pre-inst-env guix build hello
```

Da mesma forma, um exemplo para uma sessão do Guile usando os módulos Guix:

```
$ ./pre-inst-env guile -c '(use-modules (guix utils)) (pk (%current-system))'

;;; ("x86_64-linux")
```

... e para um REPL (veja Seção 8.14 [Using Guix Interactively], Página 174):

```
$ ./pre-inst-env guile
scheme@(guile-user)> ,use(guix)
scheme@(guile-user)> ,use(gnu)
scheme@(guile-user)> (define snakes
                       (fold-packages
                         (lambda (package lst)
```

```
                              (if (string-prefix? "python"
                                                  (package-name package))
                                  (cons package lst)
                                  lst))
                            '()))
scheme@(guile-user)> (length snakes)
$1 = 361
```

Se você estiver hackeando o daemon e seu código de suporte ou se `guix-daemon` ainda não estiver em execução no seu sistema, você pode iniciá-lo diretamente da build tree[3]:

```
$ sudo -E ./pre-inst-env guix-daemon --build-users-group=guixbuild
```

O script `pre-inst-env` configura todas as variáveis de ambiente necessárias para prover suporte a isso, incluindo `PATH` e `GUILE_LOAD_PATH`.

Observe que `./pre-inst-env guix pull` *não* atualiza a área de fontes local; ele simplesmente atualiza o link simbólico `~/.config/guix/current` (veja Seção 5.7 [Invocando guix pull], Página 57). Execute `git pull` em vez disso, se você quiser atualizar sua árvore de fontes local.

Às vezes, especialmente se você atualizou seu repositório recentemente, executar `./pre-inst-env` imprimirá uma mensagem semelhante ao exemplo a seguir:

```
;;; note: source file /home/user/projects/guix/guix/progress.scm
;;;       newer than compiled /home/user/projects/guix/guix/progress.go
```

Esta é apenas uma nota e você pode ignorá-la com segurança. Você pode se livrar da mensagem executando `make -j4`. Até que você faça isso, o Guile será executado um pouco mais devagar porque interpretará o código em vez de usar arquivos de objeto Guile preparados (`.go`).

Você pode executar `make` automaticamente enquanto trabalha usando `watchexec` do pacote `watchexec`. Por exemplo, para compilar novamente cada vez que você atualizar um arquivo de pacote, execute '`watchexec -w gnu/packages -- make -j4`'.

22.5 A configuração perfeita

A configuração perfeita para hackear no Guix é basicamente a configuração perfeita usada para hackear o Guile (veja Seção "Using Guile in Emacs" em *Manual de referência do GNU Guile*). Primeiro, você precisa de mais do que um editor, você precisa de Emacs (`https://www.gnu.org/software/emacs`), capacitado pelo maravilhoso Geiser (`https://nongnu.org/geiser/`). Para configurar isso, execute:

```
guix install emacs guile emacs-geiser emacs-geiser-guile
```

O Geiser permite desenvolvimento interativo e incremental de dentro do Emacs: compilação e avaliação de código de dentro de buffers, acesso à documentação on-line (docstrings), conclusão sensível ao contexto, `M-.` para pular para uma definição de objeto, um REPL para testar seu código e muito mais (veja Seção "Introduction" em *Manual do Usuário do Geiser*). Se você permitir que o Emacs carregue o arquivo `.dir-locals.el` na raiz do checkout do projeto, isso fará com que o Geiser adicione automaticamente as fontes locais do Guix ao caminho de carregamento do Guile.

[3] O sinalizador `-E` para `sudo` garante que `GUILE_LOAD_PATH` esteja configurado corretamente para que `guix-daemon` e as ferramentas que ele usa possam encontrar os módulos Guile necessários.

Para realmente editar o código, o Emacs já possui um modo Scheme bacana. Mas além disso, você não deve perder Paredit (`https://www.emacswiki.org/emacs/ParEdit`). Ele fornece recursos para operar diretamente na árvore sintática, como aumentar ou agrupar uma expressão simbólica (S-expression), engolir ou rejeitar a expressão simbólica seguinte, etc.

Também fornecemos modelos para mensagens comuns de commit do git e definições de pacotes no diretório `etc/snippets`. Esses modelos podem ser usados para expandir sequências curtas de gatilho para trechos de texto interativos. Se você usar YASnippet (`https://joaotavora.github.io/yasnippet/`), você pode querer adicionar o diretório de snippets `etc/snippets/yas` ao *yas-snippet-dirs* variável. Se você usar Tempel (`https://github.com/minad/tempel/`), você pode querer adicionar o caminho `etc/snippets/tempel/*` à variável *tempel-path* no Emacs.

```
;; Assuming the Guix checkout is in ~/src/guix.
;; Yasnippet configuration
(with-eval-after-load 'yasnippet
  (add-to-list 'yas-snippet-dirs "~/src/guix/etc/snippets/yas"))
;; Tempel configuration
(with-eval-after-load 'tempel
   ;; Certifique-se de que tempel-path seja uma lista --- também pode ser uma string.
   (unless (listp 'tempel-path)
     (setq tempel-path (list tempel-path)))
   (add-to-list 'tempel-path "~/src/guix/etc/snippets/tempel/*"))
```

Os trechos de mensagens de commit dependem de Magit (`https://magit.vc/`) para exibir arquivos "staged". Ao editar uma mensagem de commit, digite `add` seguido por *TAB* para inserir um modelo de mensagem de commit para adicionar um pacote; digite `update` seguido por *TAB* para inserir um modelo para atualizar um pacote; digite `https` seguido por *TAB* para inserir um modelo para alterar a URI da página inicial de um pacote para HTTPS.

O trecho principal para `scheme-mode` é acionado digitando `package ...` seguido de *TAB*. Esse trecho também insere a string de acionamento `origin...`, que pode ser expandida ainda mais. O trecho `origin`, por sua vez, pode inserir outras strings acionadoras que terminam em `...`, que também podem ser expandidas.

Além disso, fornecemos inserção e atualização automática de direitos autorais em `etc/copyright.el`. Você pode definir seu nome completo, e-mail e carregar um arquivo.

```
(setq user-full-name "Alice Doe")
(setq user-mail-address "alice@mail.org")
;; Supondo que o checkout do Guix esteja em ~/src/guix.
(load-file "~/src/guix/etc/copyright.el")
```

Para inserir um copyright na linha atual, invoque `M-x guix-copyright`.

Para atualizar um copyright você precisa especificar um `copyright-names-regexp`.

```
(setq copyright-names-regexp
      (format "%s <%s>" user-full-name user-mail-address))
```

Você pode verificar se seus direitos autorais estão atualizados avaliando `M-x copyright-update`. Se você quiser fazer isso automaticamente após cada salvamento de buffer, adicione `(add-hook 'after-save-hook 'copyright-update)` no Emacs.

22.5.1 Visualizando Bugs no Emacs

O Emacs tem um modo secundário interessante chamado `bug-reference`, que, quando combinado com '`emacs-debbugs`' (o pacote Emacs), pode ser usado para abrir links como '`<https://bugs .gnu.org/58697>`' ou '`<https://issues.guix.gnu.org/58697>`' como buffers de relatório de bugs. A partir daí você pode facilmente consultar o tópico do email através da interface do Gnus, responder ou modificar o status do bug, tudo sem sair do conforto do Emacs! Abaixo está um exemplo de configuração para adicionar ao seu arquivo de configuração `~/.emacs`:

```
;;; Bug references.
(require 'bug-reference)
(add-hook 'prog-mode-hook #'bug-reference-prog-mode)
(add-hook 'gnus-mode-hook #'bug-reference-mode)
(add-hook 'erc-mode-hook #'bug-reference-mode)
(add-hook 'gnus-summary-mode-hook #'bug-reference-mode)
(add-hook 'gnus-article-mode-hook #'bug-reference-mode)

;;; Isso estende a expressão padrão (a primeira expressão mais alta
;;; fornecida para 'or') para também corresponder a URLs como
;;; <https://issues.guix.gnu.org/58697> ou <https://bugs.gnu.org/58697>.
;;; Também é estendido para detectar trailers git "Correções: #NNNNN".(setq bug-refere
      (rx (group (or (seq word-boundary
                          (or (seq (char "Bb") "ug"
                                   (zero-or-one " ")
                                   (zero-or-one "#"))
                              (seq (char "Pp") "atch"
                                   (zero-or-one " ")
                                   "#")
                              (seq (char "Ff") "ixes"
                                   (zero-or-one ":")
                                   (zero-or-one " ") "#")
                              (seq "RFE"
                                   (zero-or-one " ") "#")
                              (seq "PR "
                                   (one-or-more (char "a-z+-")) "/"))
                          (group (one-or-more (char "0-9"))
                                 (zero-or-one
                                  (seq "#" (one-or-more
                                            (char "0-9"))))))
                     (seq (? "<") "https://bugs.gnu.org/"
                          (group-n 2 (one-or-more (char "0-9")))
                          (? ">"))
                     (seq (? "<") "https://issues.guix.gnu.org/"
                          (? "issue/")
                          (group-n 2 (one-or-more (char "0-9")))
                          (? ">"))))))
(setq bug-reference-url-format "https://issues.guix.gnu.org/%s")
```

```
(require 'debbugs)
(require 'debbugs-browse)
(add-hook 'bug-reference-mode-hook #'debbugs-browse-mode)
(add-hook 'bug-reference-prog-mode-hook #'debbugs-browse-mode)

;; O seguinte permite que o usuário do Emacs Debbugs abra o problema diretamente dentr
(setq debbugs-browse-url-regexp
      (rx line-start
          "http" (zero-or-one "s") "://"
          (or "debbugs" "issues.guix" "bugs")
          ".gnu.org" (one-or-more "/")
          (group (zero-or-one "cgi/bugreport.cgi?bug="))
          (group-n 3 (one-or-more digit))
          line-end))

;; Altera o padrão quando executado como 'M-x debbugs-gnu'.
(setq debbugs-gnu-default-packages '("guix" "guix-patches"))

;; Mostrar solicitações de recursos.
(setq debbugs-gnu-default-severities
 '("serious" "important" "normal" "minor" "wishlist"))
```

Para obter mais informações, consulte Seção “Bug Reference” em *The GNU Emacs Manual* e Seção “Minor Mode” em *The Debbugs User Guide*.

22.6 Configurações alternativas

Configurações alternativas ao Emacs podem permitir que você trabalhe no Guix com uma experiência de desenvolvimento semelhante e podem funcionar melhor com as ferramentas que você usa atualmente ou ajudá-lo a fazer a transição para o Emacs.

As opções listadas abaixo fornecem apenas alternativas à configuração baseada em Emacs, que é a mais utilizada na comunidade Guix. Se você quiser realmente entender como a configuração perfeita para o desenvolvimento do Guix deve funcionar, nós o encorajamos a ler a seção anterior, independentemente do editor que você escolher usar.

22.6.1 Guile Estúdio

Guile Studio é um Emacs pré-configurado com praticamente tudo que você precisa para começar a hackear no Guile. Se você não estiver familiarizado com o Emacs, a transição será mais fácil para você.

```
guix install guile-studio
```

Guile Studio vem com Geiser pré-instalado e preparado para ação.

22.6.2 Vim e NeoVim

O Vim (e o NeoVim) também são empacotados no Guix, caso você decida seguir o caminho do mal.

```
guix install vim
```

Se você deseja desfrutar de uma experiência de desenvolvimento semelhante à configuração perfeita, você deve instalar vários plugins para configurar o editor. O Vim (e o NeoVim) têm o equivalente ao Paredit, `paredit.vim` (`https://www.vim.org/scripts/script.php?script_id=3998`), que irá ajudá-lo com a estrutura edição de arquivos Scheme (embora o suporte para arquivos muito grandes não seja ótimo).

```
guix install vim-paredit
```

Também recomendamos que você execute `:set autoindent` para que seu código seja recuado automaticamente conforme você digita.

Para a interação com Git, `fugitive.vim` (`https://www.vim.org/scripts/script.php?script_id=2975`) é o plugin mais comumente usado:

```
guix install vim-fugitive
```

E claro, se você quiser interagir com o Guix diretamente de dentro do vim, usando o emulador de terminal integrado, temos nosso próprio pacote `guix.vim`!

```
guix install vim-guix-vim
```

No NeoVim você pode até fazer uma configuração semelhante ao Geiser usando Conjure (`https://conjure.fun/`) que permite conectar-se a um processo Guile em execução e injetar seu código ao vivo (infelizmente ainda não está empacotado no Guix) .

22.7 Estrutura da árvore de origem

Se você estiver disposto a contribuir com o Guix além dos pacotes, ou se quiser aprender como tudo se encaixa, esta seção fornece um tour guiado na base de código que pode ser útil.

No geral, a árvore de origem do Guix contém quase exclusivamente Guile *módulos*, cada um dos quais pode ser visto como uma biblioteca independente (veja Seção "Modules" em *Manual de Referência do GNU Guile*).

A tabela a seguir fornece uma visão geral dos principais diretórios e o que eles contêm. Lembre-se de que no Guile, cada nome de módulo é derivado de seu nome de arquivo—por exemplo, o módulo no arquivo `guix/packages.scm` é chamado `(guix packages)`.

`guix` Esta é a localização dos mecanismos principais do Guix. Para ilustrar o que significa "core", aqui estão alguns exemplos, começando com ferramentas de baixo nível e indo em direção a ferramentas de nível mais alto:

`(guix store)`
: Conectando e interagindo com o daemon de compilação (veja Seção 8.9 [O armazém], Página 154).

`(guix derivations)`
: Criando derivações (veja Seção 8.10 [Derivações], Página 156).

`(guix gexps)`
: Escrevendo expressões-G (veja Seção 8.12 [Expressões-G], Página 163).

`(guix packages)`
: Definindo pacotes e origens (veja Seção 8.2.1 [Referência do package], Página 104).

`(guix download)`
`(guix git-download)`
: Os métodos de download de origem `url-fetch` e `git-fetch` (veja Seção 8.2.2 [Referência do origin], Página 108).

`(guix swh)`
: Obtendo código-fonte do arquivo Software Heritage (`https://archive.softwareheritage.org`).

`(guix search-paths)`
: Implementando caminhos de pesquisa (veja Seção 8.8 [Caminhos de pesquisa], Página 151).

`(guix build-system)`
: A interface do sistema de compilação (veja Seção 8.5 [Sistemas de compilação], Página 121).

`(guix profiles)`
: Implementing profiles.

`guix/build-system`
: Este diretório contém implementações específicas do sistema de compilação (veja Seção 8.5 [Sistemas de compilação], Página 121), como:

`(guix build-system gnu)`
: the GNU build system;

`(guix build-system cmake)`
: the CMake build system;

`(guix build-system pyproject)`
: The Python "pyproject" build system.

`guix/build`
: Isto contém código geralmente usado no "lado da construção" (veja Seção 8.12 [Expressões-G], Página 163). Isto inclui código usado para construir pacotes ou outros componentes do sistema operacional, assim como utilitários:

`(guix build utils)`
: Utilitários para definições de pacotes e muito mais (veja Seção 8.7 [Construir utilitários], Página 144).

`(guix build gnu-build-system)`
`(guix build cmake-build-system)`
`(guix build pyproject-build-system)`
: Implementação de sistemas de construção e, em particular, definição de suas fases de construção (veja Seção 8.6 [Fases de construção], Página 141).

`(guix build syscalls)`
: Interface para a biblioteca C e para chamadas de sistema Linux.

`guix/scripts`
: Isto contém módulos correspondentes aos subcomandos `guix`. Por exemplo, o módulo `(guix scripts shell)` exporta o procedimento `guix-shell`, que cor-

responde diretamente ao comando `guix shell` (veja Seção 7.1 [Invocando guix shell], Página 79).

`guix/import`
: Isto contém código de suporte para os importadores e atualizadores (veja Seção 9.5 [Invocando guix import], Página 194, e veja Seção 9.6 [Invocando guix refresh], Página 202). Por exemplo, `(guix import pypi)` define a interface para PyPI, que é usada pelo comando `guix import pypi`.

Todos os diretórios que vimos até agora estão em `guix/`. O outro lugar importante é o diretório `gnu/`, que contém principalmente definições de pacotes, bem como bibliotecas e ferramentas para Guix System (veja Capítulo 11 [Configuração do sistema], Página 236) e Guix Home (veja Capítulo 13 [Home Configuration], Página 652), todos os quais se baseiam na funcionalidade fornecida pelos módulos `(guix ...)`[4].

`gnu/packages`
: Este é de longe o diretório mais lotado da árvore de fontes: ele contém *package modules* que exportam definições de pacotes (veja Seção 8.1 [Módulos de pacote], Página 100). Alguns exemplos:

  `(gnu packages base)`
  : Módulo que fornece pacotes "base": `glibc`, `coreutils`, `grep`, etc.

  `(gnu packages guile)`
  : Guile e pacotes principais do Guile.

  `(gnu packages linux)`
  : O kernel Linux-libre e pacotes relacionados.

  `(gnu packages python)`
  : Python e pacotes principais do Python.

  `(gnu packages python-xyz)`
  : Pacotes Python diversos (não fomos muito criativos).

  Em qualquer caso, você pode pular para uma definição de pacote usando `guix edit` (veja Seção 9.2 [Invocando guix edit], Página 191) e visualizar sua localização com `guix show` (veja Seção 5.2 [Invocando guix package], Página 37).

`gnu/packages/patches`
: Este diretório contém patches aplicados aos pacotes e obtidos usando o procedimento `search-patches`.

`gnu/services`
: Isto contém definições de serviço, principalmente para Guix System (veja Seção 11.10 [Serviços], Página 268), mas algumas delas são adaptadas e reutilizadas para Guix Home, como veremos abaixo. Exemplos:

[4] Por esse motivo, os módulos `(guix ...)` geralmente não devem depender dos módulos `(gnu ...)`, com exceções notáveis: os módulos `(guix build-system ...)` podem procurar pacotes em tempo de execução — por exemplo, `(guix build-system cmake)` precisa acessar a variável `cmake` em tempo de execução — , `(guix scripts ...)` geralmente dependem dos módulos `(gnu ...)`, e o mesmo vale para alguns dos módulos `(guix import ...)` módulos.

`(gnu services)`
: A estrutura do serviço em si, que define os tipos de dados do serviço e do tipo de serviço (veja Seção 11.19.1 [Composição de serviço], Página 631).

`(gnu services base)`
: Serviços "Básicos" (veja Seção 11.10.1 [Serviços básicos], Página 268).

`(gnu services desktop)`
: Serviços "Desktop" (veja Seção 11.10.9 [Serviços de desktop], Página 354).

`(gnu services shepherd)`
: Apoio aos serviços Shepherd (veja Seção 11.19.4 [Serviços de Shepherd], Página 638).

Você pode pular para uma definição de serviço usando `guix system edit` e visualizar sua localização com `guix system search` (veja Seção 11.16 [Invocando guix system], Página 616).

`gnu/system`
: Estes são os principais módulos do sistema Guix, como:

`(gnu system)`
: Define `operating-system` (veja Seção 11.3 [Referência do operating-system], Página 247).

`(gnu system file-systems)`
: Define `file-system` (veja Seção 11.4 [Sistemas de arquivos], Página 251).

`(gnu system mapped-devices)`
: Define `mapped-device` (veja Seção 11.5 [Dispositivos mapeados], Página 256).

`gnu/build`
: Esses são módulos que são usados no "lado da compilação" ao criar sistemas operacionais ou pacotes, ou em tempo de execução pelos sistemas operacionais.

`(gnu build accounts)`
: Criando `/etc/passwd`, `/etc/shadow`, etc. (veja Seção 11.7 [Contas de usuário], Página 261).

`(gnu build activation)`
: Ativar um sistema operacional no momento da inicialização ou da reconfiguração.

`(gnu build file-systems)`
: Pesquisar, verificar e montar sistemas de arquivos.

`(gnu build linux-boot)`
`(gnu build hurd-boot)`
: Inicializando sistemas operacionais GNU/Linux e GNU/Hurd.

`(gnu build linux-initrd)`
: Criando um disco RAM inicial do Linux (veja Seção 11.14 [Disco de RAM inicial], Página 607).

`gnu/home` Isso contém todas as coisas do Guix Home (veja Capítulo 13 [Home Configuration], Página 652); exemplos:

`(gnu home services)`
: Serviços principais como `home-files-service-type`.

`(gnu home services ssh)`
: Serviços relacionados a SSH (veja Seção 13.3.6 [Secure Shell], Página 668).

`gnu/installer`
: Isso contém o instalador do sistema gráfico em modo texto (veja Seção 3.5 [Instalação gráfica guiada], Página 24).

`gnu/machine`
: Estas são as *abstrações de máquina* usadas por `guix deploy` (veja Seção 11.17 [Invocando guix deploy], Página 625).

`gnu/tests`
: Isso contém testes de sistema — testes que geram máquinas virtuais para verificar se os serviços do sistema funcionam conforme o esperado (veja Seção 22.3 [Executando o conjunto de testes], Página 724).

Por fim, há também alguns diretórios que contêm arquivos que não são módulos Guile:

`nix` Esta é a implementação C++ do `guix-daemon`, herdada do Nix (veja Seção 2.3 [Invocando guix-daemon], Página 13).

`tests` Esses são testes unitários, cada arquivo correspondendo mais ou menos a um módulo, em particular os módulos `(guix ...)` (veja Seção 22.3 [Executando o conjunto de testes], Página 724).

`doc` Esta é a documentação na forma de arquivos Texinfo: este manual e o Livro de receitas. Veja Seção "Writing a Texinfo File" em *GNU Texinfo*, para informações sobre a linguagem de marcação Texinfo.

`po` Este é o local das traduções do próprio Guix, das sinopses e descrições dos pacotes, do manual e do livro de receitas. Note que os arquivos `.po` que vivem aqui são retirados diretamente do Weblate (veja Seção 22.19 [Traduzindo o Guix], Página 766).

`etc` Arquivos diversos: conclusões de shell, suporte para systemd e outros sistemas init, ganchos do Git, etc.

Com tudo isso, uma boa parte do seu sistema operacional está na ponta dos seus dedos! Além de `grep` e `git grep`, veja Seção 22.5 [A configuração perfeita], Página 726, sobre como navegar no código do seu editor e veja Seção 8.14 [Using Guix Interactively], Página 174, para obter informações sobre como usar módulos Scheme interativamente. Aproveite!

22.8 Diretrizes de empacotamento

A distribuição do GNU é incipiente e pode muito bem não ter alguns dos seus pacotes favoritos. Esta seção descreve como você pode ajudar a fazer a distribuição crescer.

Pacotes de software livre geralmente são distribuídos na forma de *tarballs de código-fonte* – geralmente arquivos `tar.gz` que contêm todos os arquivos fonte. Adicionar um pacote à distribuição significa essencialmente duas coisas: adicionar uma *receita* que descreve como criar o pacote, incluindo uma lista de outros pacotes necessários para compilá-lo e adicionar *metadados de pacote* junto com essa receita, como uma descrição e informações de licenciamento.

No Guix, todas essas informações estão incorporadas em *configurações de pacote*. As definições de pacote fornecem uma visão de alto nível do pacote. Elas são escritas usando a sintaxe da linguagem de programação Scheme; de fato, para cada pacote, definimos uma variável vinculada à definição do pacote e exportamos essa variável de um módulo (veja Seção 8.1 [Módulos de pacote], Página 100). No entanto, o conhecimento profundo de Scheme *não* é um pré-requisito para a criação de pacotes. Para mais informações sobre definições de pacotes, veja Seção 8.2 [Definindo pacotes], Página 101.

Quando uma definição de pacote está em vigor, armazenada em um arquivo na árvore de fontes do Guix, ela pode ser testada usando o comando `guix build` (veja Seção 9.1 [Invocando guix build], Página 177). Por exemplo, supondo que o novo pacote seja chamado `gnew`, você pode executar este comando na árvore de construção do Guix (veja Seção 22.4 [Executando guix antes dele ser instalado], Página 725):

```
./pre-inst-env guix build gnew --keep-failed
```

O uso de `--keep-failed` facilita a depuração de falhas de compilação, pois fornece acesso à árvore de compilação com falha. Outra opção útil da linha de comando ao depurar é `--log-file`, para acessar o log de compilação.

Se o pacote for desconhecido para o comando `guix`, pode ser que o arquivo fonte contenha um erro de sintaxe ou não tenha uma cláusula `define-public` para exportar a variável do pacote. Para descobrir isso, você pode carregar o módulo do Guile para obter mais informações sobre o erro real:

```
./pre-inst-env guile -c '(use-modules (gnu packages gnew))'
```

Assim que seu pacote for compilado corretamente, envie-nos um patch (veja Seção 22.10 [Enviando patches], Página 746). Bem, se precisar de ajuda, ficaremos felizes em ajudá-lo também. Depois que o patch é confirmado no repositório Guix, o novo pacote é compilado automaticamente nas plataformas suportadas por nosso sistema de integração contínua (`https://bordeaux.guix.gnu.org`).

Os usuários podem obter a nova definição de pacote simplesmente executando `guix pull` (veja Seção 5.7 [Invocando guix pull], Página 57). Quando `bordeaux.guix.gnu.org` termina de construir o pacote, a instalação do pacote baixa automaticamente os binários de lá (veja Seção 5.3 [Substitutos], Página 47). O único lugar onde a intervenção humana é necessária é para revisar e aplicar o patch.

22.8.1 Liberdade de software

O sistema operacional GNU foi desenvolvido para que os usuários possam ter liberdade em sua computação. GNU é *software livre*, o que significa que os usuários têm a quatro liberdades essenciais (`https://www.gnu.org/philosophy/free-sw.html`): executar o programa,

estudar e alterar o programa em forma de código-fonte, para redistribuir cópias exatas e para distribuir versões modificadas. Os pacotes encontrados na distribuição GNU fornecem apenas softwares que transmitem essas quatro liberdades.

Além disso, a distribuição GNU segue o diretrizes de distribuição de software livre (`https://www.gnu.org/distros/free-system-distribution-guidelines.html`). Entre outras coisas, estas diretrizes rejeitam firmware não-livre, recomendações de software não-livre e discutem formas de lidar com marcas registradas e patentes.

Algumas fontes de pacotes upstream livres de outra forma contêm um subconjunto pequeno e opcional que viola as diretrizes acima, por exemplo, porque esse subconjunto é ele próprio um código não livre. Quando isso acontece, os itens incorretos são removidos com patches ou trechos de código apropriados no formato `origin` do pacote (veja Seção 8.2 [Definindo pacotes], Página 101). Dessa forma, o `guix build --source` retorna a fonte "lançada" em vez da fonte upstream não modificada.

22.8.2 Nomeando um pacote

Um pacote na verdade tem dois nomes associados a ele. Primeiro, há o nome da *variável Scheme*, a que segue `define-public`. Por esse nome, o pacote pode ser tornado conhecido no código Scheme, por exemplo, como entrada para outro pacote. Segundo, há a string no campo `name` de uma definição de pacote. Esse nome é usado por comandos de gerenciamento de pacotes, como `guix package` e `guix build`.

Ambos são geralmente iguais e correspondem à conversão em minúscula do nome do projeto escolhido a montante, com os sublinhados substituídos por hífenes. Por exemplo, o GNUnet está disponível como `gnunet` e SDL_net como `sdl-net`.

Uma exceção digna de nota a esta regra é quando o nome do projeto é apenas um único caractere, ou se já existe um projeto mantido mais antigo com o mesmo nome - independentemente de já ter sido empacotado para Guix. Use o bom senso para tornar esses nomes inequívocos e significativos. Por exemplo, o pacote do Guix para o shell chamado "s" upstream é `s-shell` e *não* `s`. Sinta-se à vontade para pedir inspiração a seus colegas hackers.

Não adicionamos prefixos `lib` para pacotes de bibliotecas, a menos que eles já façam parte do nome oficial do projeto. Mas veja Seção 22.8.8 [Módulos Python], Página 741, e Seção 22.8.9 [Módulos Perl], Página 742, para regras especiais relativas a módulos para as linguagens Python e Perl.

Nomes de pacote de fontes são lidados de forma diferente. Veja Seção 22.8.13 [Fontes], Página 744.

22.8.3 Números de versão

Geralmente, empacotamos apenas a versão mais recente de um determinado projeto de software livre. Mas, às vezes, por exemplo, para versões incompatíveis de bibliotecas, são necessárias duas (ou mais) versões do mesmo pacote. Isso requer nomes de variáveis Scheme diferentes. Usamos o nome como definido em Seção 22.8.2 [Nomeando um pacote], Página 736, para a versão mais recente; as versões anteriores usam o mesmo nome, com o sufixo `-` e o menor prefixo do número da versão que pode distinguir as duas versões.

O nome dentro da definição do pacote é o mesmo para todas as versões de um pacote e não contém nenhum número de versão.

Por exemplo, as versões 2.24.20 e 3.9.12 do GTK podem ser empacotados da seguinte forma:

```
(define-public gtk+
  (package
    (name "gtk+")
    (version "3.9.12")
    ...))
(define-public gtk+-2
  (package
    (name "gtk+")
    (version "2.24.20")
    ...))
```

Se também quiséssemos GTK 3.8.2, este seria empacotado como

```
(define-public gtk+-3.8
  (package
    (name "gtk+")
    (version "3.8.2")
    ...))
```

Ocasionalmente, empacotamos snapshots do sistema de controle de versão (VCS) do upstream em vez de lançamentos formais. Isso deve permanecer excepcional, porque cabe aos desenvolvedores upstream esclarecer qual é a versão estável. No entanto, às vezes é necessário. Então, o que devemos colocar no campo `version`?

Claramente, precisamos tornar o identificador de commit do snapshot VCS visível na string de versão, mas também precisamos garantir que a string de versão esteja aumentando monotonicamente para que o `guix package --upgrade` possa determinar qual versão é mais recente. Como os identificadores de commit, principalmente com o Git, não estão aumentando monotonicamente, adicionamos um número de revisão que aumentamos cada vez que atualizamos para um snapshot mais recente. A sequência da versão resultante é assim:

```
2.0.11-3.cabba9e
  ^    ^    ^
  |    |    `-- ID do commit do upstream
  |    |
  |    `--- revisão do pacote do Guix
  |
versão mais recente do upstream
```

É uma boa ideia reduzir os identificadores de commit no campo `version` para, digamos, 7 dígitos. Isso evita um incômodo estético (assumindo que a estética tenha um papel a desempenhar aqui), bem como problemas relacionados aos limites do sistema operacional, como o comprimento máximo do shebang (127 bytes para o kernel Linux). Existem funções auxiliares para fazer isso para pacotes usando `git-fetch` ou `hg-fetch` (veja abaixo). Porém, é melhor usar os identificadores de commit completos em `origin`s para evitar ambiguidades. Uma definição típica de pacote pode ser assim:

```
(define meu-pacote
  (let ((commit "c3f29bc928d5900971f65965feaae59e1272a3f7")
```

```
    (revision "1"))          ;revisão do pacote do Guix
(package
  (version (git-version "0.9" revision commit))
  (source (origin
            (method git-fetch)
            (uri (git-reference
                  (url "git://example.org/meu-pacote.git")
                  (commit commit)))
            (sha256 (base32 "1mbikn..."))
            (file-name (git-file-name name version))))
  ;; ...
  )))
```

`git-version` *VERSION REVISION COMMIT* [Procedimento]

Retorne a string de versão para pacotes usando `git-fetch`.

```
(git-version "0.2.3" "0" "93818c936ee7e2f1ba1b315578bde363a7d43d05")
⇒ "0.2.3-0.93818c9"
```

`hg-version` *VERSION REVISION CHANGESET* [Procedimento]

Retorne a string de versão para pacotes usando `hg-fetch`. Funciona da mesma forma que `git-version`.

22.8.4 Sinopses e descrições

Como vimos anteriormente, cada pacote no GNU Guix inclui uma sinopse e uma descrição (veja Seção 8.2 [Definindo pacotes], Página 101). Sinopses e descrições são importantes: são o que o `guix package --search` pesquisa e uma informação crucial para ajudar os usuários a determinar se um determinado pacote atende às suas necessidades. Consequentemente, os empacotadores devem prestar atenção ao que entra neles.

As sinopses devem começar com uma letra maiúscula e não devem terminar com um ponto. Elas não devem começar com "a" ou "the", que geralmente não traz nada; por exemplo, prefira "Tool-frobbing tool" em vez de "A tool that frobs files". A sinopse deve dizer o que é o pacote – por exemplo, "Core GNU utilities (file, text, shell)" – ou para que é usado – por exemplo, a sinopse do GNU grep é "Print lines matching a pattern".

Lembre-se de que a sinopse deve ser significativa para um público muito amplo. Por exemplo, "Manipulate alignments in the SAM format" pode fazer sentido para um pesquisador experiente em bioinformática, mas pode ser bastante inútil ou até enganoso para um público não especializado. É uma boa ideia apresentar uma sinopse que dê uma ideia do domínio do aplicativo do pacote. Neste exemplo, isso pode fornecer algo como "Manipulate nucleotide sequence alignments", o que, esperançosamente, dá ao usuário uma melhor ideia de se é isso que eles estão procurando.

Descrições devem levar entre cinco e dez linhas. Use sentenças completas e evite usar acrônimos sem primeiro apresentá-los. Por favor, evite frases de marketing como "inovação mundial", "força industrial" e "próxima geração", e evite superlativos como "a mais avançada" – eles não ajudam o usuário procurando por um pacote e podem atém parece suspeito. Em vez idsso, tente se ater aos fatos, mencionando casos de uso e recursos.

As descrições podem incluir marcação Texinfo, que é útil para introduzir ornamentos como `@code` ou `@dfn`, listas de marcadores ou hiperlinks (veja Seção "Overview" em *GNU*

Texinfo). No entanto, você deve ter cuidado ao usar alguns caracteres, por exemplo '`@`' e chaves, que são os caracteres especiais básicos em Texinfo (veja Seção "Special Characters" em *GNU Texinfo*). Interfaces de usuário como `guix show` cuidam de renderizá-lo apropriadamente.

Sinopses e descrições são traduzidas por voluntários no Weblate (`https://translate.fedoraproject.org/projects/guix/packages`) para que o maior número possível de usuários possam lê-las em seu idioma nativo. As interfaces de usuário os pesquisam e os exibem no idioma especificado pelo código do idioma atual.

Para permitir que `xgettext` extrai-as com strings traduzíveis, as sinopses e descrições *devem ser strings literais*. Isso significa que você não pode usar `string-append` ou `format` para construir essas strings:

```
(package
  ;; ...
  (synopsis "Isso é traduzível")
  (description (string-append "Isso " "*não*" " é traduzível.")))
```

Tradução é muito trabalhoso, então, como empacotador, por favor, tenha ainda mais atenção às suas sinopses e descrições, pois cada alteração pode implicar em trabalho adicional para tradutores. Para ajudá-loas, é possível tornar recomendações ou instruções visíveis inserindo comentários especiais como esse (veja Seção "xgettext Invocation" em *GNU Gettext*):

```
;; TRANSLATORS: "X11 resize-and-rotate" should not be translated.
(description "ARandR is designed to provide a simple visual front end
for the X11 resize-and-rotate (RandR) extension. ...")
```

22.8.5 Snippets versus Phases

A fronteira entre usar um snippet de origem e uma fase de construção para modificar as fontes de um pacote pode ser ilusória. Os snippets de origem são normalmente usados para remover arquivos indesejados, como bibliotecas agrupadas, fontes não livres ou para aplicar substituições simples. A fonte derivada de uma origem deve produzir uma fonte que possa ser usada para construir o pacote em qualquer sistema que o pacote suporte (ou seja, atuar como a fonte correspondente). Em particular, os snippets de origem não devem incorporar itens do armazém nas fontes; tal correção deve ser feita usando fases de construção. Consulte a documentação do registro `origin` para obter mais informações (veja Seção 8.2.2 [Referência do origin], Página 108).

22.8.6 Dependências do módulo cíclico

Embora não possa haver dependências circulares entre pacotes, o mecanismo frouxo de carregamento de módulos do Guile permite dependências circulares entre módulos do Guile, o que não causa problemas, desde que as seguintes condições sejam seguidas para dois módulos que fazem parte de um ciclo de dependência:

1. As macros não devem ser compartilhadas entre os módulos co-dependentes
2. Variáveis de nível superior são referenciadas apenas em campos de pacote atrasados (*thunked*): `arguments`, `native-inputs`, `inputs`, `propagated-inputs` ou `replacement`
3. Procedimentos que fazem referência a variáveis de nível superior de outro módulo não são chamados no nível superior de um módulo.

Afastar-se das regras acima pode funcionar enquanto não houver ciclos de dependência entre os módulos, mas como tais ciclos são confusos e difíceis de solucionar, é melhor seguir as regras para evitar a introdução de problemas no futuro.

Aqui está uma armadilha comum a ser evitada:

```
(define-public avr-binutils
  (package
    (inherit (cross-binutils "avr"))
    (name "avr-binutils")))
```

No exemplo acima, o pacote `avr-binutils` foi definido no módulo `(gnu packages avr)`, e o procedimento `cross-binutils` em `(gnu packages cross-base)`. Como o campo `inherit` não é atrasado (thunked), ele é avaliado no nível superior no momento do carregamento, o que é problemático na presença de ciclos de dependência do módulo. Isso pode ser resolvido transformando o pacote em um procedimento, como:

```
(define (make-avr-binutils)
  (package
    (inherit (cross-binutils "avr"))
    (name "avr-binutils")))
```

Seria necessário tomar cuidado para garantir que o procedimento acima só seja usado em campos atrasados de pacote ou dentro de outro procedimento também não chamado no nível superior.

22.8.7 Pacotes Emacs

Os pacotes Emacs devem preferencialmente usar o sistema de compilação Emacs (veja [emacs-build-system], Página 138), para uniformidade e os benefícios proporcionados por suas fases de compilação, como a geração automática do arquivo autoloads e a compilação de bytes das fontes. Como não existe uma maneira padronizada de executar um conjunto de testes para pacotes Emacs, os testes são desabilitados por padrão. Quando um conjunto de testes estiver disponível, ele deverá ser habilitado definindo o argumento `#:tests?` como `#true`. Por padrão, o comando para executar o teste é `make check`, mas qualquer comando pode ser especificado através do argumento `#:test-command`. O argumento `#:test-command` espera que uma lista contendo um comando e seus argumentos seja invocada durante a fase `check`.

As dependências Elisp dos pacotes Emacs são normalmente fornecidas como `propagated-inputs` quando necessário em tempo de execução. Quanto a outros pacotes, as dependências de construção ou teste devem ser especificadas como `native-inputs`.

Pacotes Emacs às vezes dependem de diretórios de recursos que devem ser instalados junto com os arquivos Elisp. O argumento `#:include` pode ser usado para esse propósito, especificando uma lista de regexps para corresponder. A melhor prática ao usar o argumento `#:include` é estender em vez de substituir seu valor padrão (acessível por meio da variável `%default-include`). Como exemplo, um pacote de extensão yasnippet normalmente inclui um diretório `snippets`, que pode ser copiado para o diretório de instalação usando:

```
#:include (cons "^snippets/" %default-include)
```

Ao encontrar problemas, é aconselhável verificar a presença do cabeçalho de extensão `Package-Requires` no arquivo de origem principal do pacote e se quaisquer dependências e suas versões listadas nele foram atendidas.

22.8.8 Módulos Python

Atualmente empacotamos Python 2 e Python 3, sob os nomes de variável Scheme `python-2` e `python` conforme explicado em Seção 22.8.3 [Números de versão], Página 736. Para evitar confusão e conflitos de nomes com outras linguagens de programação, parece desejável que o nome de um pacote para um módulo Python contenha a palavra `python`.

Alguns módulos são compatíveis com apenas uma versão do Python, outros com ambas. Se o pacote Foo for compilado com Python 3, nós o nomeamos `python-foo`. Se ele for compilado com Python 2, nós o nomeamos `python2-foo`. Pacotes Python 2 estão sendo removidos da distribuição; por favor, não envie nenhum pacote Python 2 novo.

Se um projeto já contém a palavra `python`, nós a descartamos; por exemplo, o módulo python-dateutil é empacotado sob os nomes `python-dateutil` e `python2-dateutil`. Se o nome do projeto começa com `py` (p.ex., `pytz`), nós o mantemos e o prefixamos conforme descrito acima.

> **Nota:** Atualmente, há dois sistemas de construção diferentes para pacotes Python no Guix: *python-build-system* e *pyproject-build-system*. Por muito tempo, os pacotes Python foram construídos a partir de um arquivo `setup.py` especificado informalmente. Isso funcionou incrivelmente bem, considerando o sucesso do Python, mas era difícil construir ferramentas em torno dele. Como resultado, uma série de sistemas de construção alternativos surgiram e a comunidade eventualmente decidiu por um padrão formal (`https://peps.python.org/pep-0517/`) para especificar os requisitos de construção. *pyproject-build-system* é a implementação do Guix desse padrão. Ele é considerado "experimental", pois ainda não suporta todos os vários *backends de construção* PEP-517, mas você é encorajado a experimentá-lo para novos pacotes Python e relatar quaisquer problemas. Ele eventualmente será descontinuado e mesclado ao *python-build-system*.

22.8.8.1 Especificando dependências

Dependency information for Python packages is usually available in the package source tree, with varying degrees of accuracy: in the `pyproject.toml` file, the `setup.py` file, in `requirements.txt`, or in `tox.ini` (the latter mostly for test dependencies).

Sua missão, ao escrever uma receita para um pacote Python, é mapear essas dependências para o tipo apropriado de "entrada" (veja Seção 8.2.1 [Referência do package], Página 104). Apesar do importador do `pypi` normalmente fazer um bom trabalho (veja Seção 9.5 [Invocando guix import], Página 194), você pode se interessar em verificar a lista de verificação a seguir para determinar qual dependência vai onde.

- We currently package Python with `setuptools` and `pip` installed per default. This is about to change, and users are encouraged to use `python-toolchain` if they want a build environment for Python.

  `guix lint` avisará se `setuptools` ou `pip` forem adicionados como entradas nativas porque geralmente não são necessários.

- Dependências de Python necessárias em tempo de execução vão em `propagated-inputs`. Elas geralmente são definidas com a palavra-chave `install_requires` em `setup.py` ou no arquivo `requirements.txt`.

- Python packages required only at build time—e.g., those listed under `build-system.requires` in `pyproject.toml` or with the `setup_requires` keyword in `setup.py`—or dependencies only for testing—e.g., those in `tests_require` or `tox.ini`—go into `native-inputs`. The rationale is that (1) they do not need to be propagated because they are not needed at run time, and (2) in a cross-compilation context, it's the "native" input that we'd want.

  Exemplos são os frameworks de teste `pytest`, `mock` e `nose`. É claro, se qualquer um desses pacotes também for necessário em tempo de compilação, ele precisa ir para `propagated-inputs`.
- Qualquer coisa que não encaixar nas categorias anteriores vai para `inputs`. Por exemplo, programas ou bibliotecas C necessárias para compilar pacotes Python contendo extensões C.
- Se um pacote Python tem dependências opcionais (`extras_require`), fica a seu critério adicioná-las ou não, com base na sua proporção de utilidade/sobrecarga (veja Seção 22.10 [Enviando patches], Página 746).

22.8.9 Módulos Perl

Os programas Perl próprios são nomeados como qualquer outro pacote, usando o nome upstream em letras minúsculas. Para pacotes Perl que contêm uma única classe, usamos o nome da classe em letras minúsculas, substituímos todas as ocorrências de `::` por traços e precede o prefixo `perl-`. Portanto, a classe `XML::Parser` se torna `perl-xml-parser`. Módulos contendo várias classes mantêm seu nome upstream em minúsculas e também são precedidos por `perl-`. Esses módulos tendem a ter a palavra `perl` em algum lugar do nome, que é descartada em favor do prefixo. Por exemplo, `libwww-perl` se torna `perl-libwww`.

22.8.10 Pacotes Java

Os programas Java próprios são nomeados como qualquer outro pacote, usando o nome do upstream em letras minúsculas.

Para evitar confusão e conflitos de nomes com outras linguagens de programação, é desejável que o nome de um pacote para um pacote Java seja prefixado com `java-`. Se um projeto já contém a palavra `java`, descartamos isso; por exemplo, o pacote `ngsjava` é empacotado com o nome `java-ngs`.

Para pacotes Java que contêm uma única classe ou uma pequena hierarquia de classes, usamos o nome da classe em letras minúsculas, substitua todas as ocorrências de `.` por traços e acrescente o prefixo `java-`. Assim, a classe `apache.commons.cli` se torna o pacote `java-apache-commons-cli`.

22.8.11 Rust Crates

Os programas Rust que se autodenominam são nomeados como qualquer outro pacote, usando o nome original em letras minúsculas.

Para evitar colisões de namespace, prefixamos todos os outros pacotes Rust com o prefixo `rust-`. O nome deve ser alterado para minúsculas conforme apropriado e os traços devem permanecer no lugar.

No ecossistema rust é comum que várias versões incompatíveis de um pacote sejam usadas a qualquer momento, então todas as definições de pacote devem ter um sufixo versionado. O

sufixo versionado é o dígito diferente de zero mais à esquerda (e quaisquer zeros à esquerda, é claro). Isso segue o esquema de versão "caret" pretendido pelo Cargo. Exemplos `rust-clap-2`, `rust-rand-0.6`.

Devido à dificuldade em reutilizar pacotes rust como entradas pré-compiladas para outros pacotes, o sistema de construção Cargo (veja Seção 8.5 [Sistemas de compilação], Página 121) apresenta as palavras-chave `#:cargo-inputs` e `cargo-development-inputs` como argumentos do sistema de construção. Seria útil pensar nelas como semelhantes a `propagated-inputs` e `native-inputs`. Rust `dependencies` e `build-dependencies` devem ir em `#:cargo-inputs`, e `dev-dependencies` deve ir em `#:cargo-development-inputs`. Se um pacote Rust vincular a outras bibliotecas, o posicionamento padrão em `inputs` e semelhantes deve ser usado.

Deve-se tomar cuidado para garantir que a versão correta das dependências seja usada; para esse fim, tentamos evitar pular os testes ou usar `#:skip-build?` quando possível. Claro que isso nem sempre é possível, pois o pacote pode ser desenvolvido para um sistema operacional diferente, depender de recursos do compilador Nightly Rust ou o conjunto de testes pode ter se atrofiado desde que foi lançado.

22.8.12 Pacotes Elm

Os aplicativos Elm podem ser nomeados como outros softwares: seus nomes não precisam mencionar Elm.

Pacotes no sentido Elm (veja `elm-build-system` em Seção 8.5 [Sistemas de compilação], Página 121) devem usar nomes no formato *author*`/`*project*, onde tanto *author* quanto *project* podem conter hifens internamente, e *author* às vezes contém letras maiúsculas.

Para formar o nome do pacote Guix a partir do nome upstream, seguimos uma convenção semelhante aos pacotes Python (veja Seção 22.8.8 [Módulos Python], Página 741), adicionando um prefixo `elm-`, a menos que o nome já comece com `elm-`.

Em muitos casos, podemos reconstruir o nome upstream de um pacote Elm heuristicamente, mas, como a conversão para um nome no estilo Guix envolve perda de informações, isso nem sempre é possível. Deve-se tomar cuidado para adicionar a propriedade `'upstream-name` quando necessário para que '`guix import elm`' funcione corretamente (veja Seção 9.5 [Invocando guix import], Página 194). Os cenários mais notáveis quando especificar explicitamente o nome upstream é necessário são:

1. Quando *author* é `elm` e *project* contém um ou mais hifens, como em `elm/virtual-dom`; e
2. Quando *author* contém hifens ou letras maiúsculas, como em `Elm-Canvas/raster-shapes`—a menos que *author* seja `elm-explorations`, que é tratado como um caso especial, então pacotes como `elm-explorations/markdown` *não* precisam usar a propriedade `'upstream-name`.

O módulo `(guix build-system elm)` fornece os seguintes utilitários para trabalhar com nomes e convenções relacionadas:

`elm-package-origin` *nome-elm versão hash* *Retorna uma origem Git usando o regime de nomenclatura e marcação* [Procedimento]

de repositório necessário para um pacote Elm publicado com o nome upstream *nome-elm* na versão *versão* com soma de verificação sha256 *hash*.

Por exemplo:

```
(package
  (name "elm-html")
  (version "1.0.0")
  (source
   (elm-package-origin
    "elm/html"
    version
    (base32 "15k1679ja57vvlpinpv06znmrxy09lbhzfkzdc89i01qa8c4gb4a")))
  ...)
```

`elm->package-name` *nome-elm* [Procedimento]
Retorna o nome do pacote no estilo Guix para um pacote Elm com nome upstream *nome-elm*.

Observe que há mais de um *nome-elm* possível para o qual `elm->package-name` produzirá um determinado resultado.

`guix-package->elm-name` *pacote* [Procedimento]
Dado um Elm *pacote*, retorna o nome upstream possivelmente inferido, ou `#f` o nome upstream não é especificado por meio da propriedade `'upstream-name` e não pode ser inferido por `infer-elm-package-name`.

`infer-elm-package-name` *guix-name* [Procedimento]
Dado o *guix-name* de um pacote Elm, retorna o nome upstream inferido, ou `#f` se o nome upstream não puder ser inferido. Se o resultado não for `#f`, fornecê-lo a `elm->package-name` produziria *guix-name*.

22.8.13 Fontes

Para fontes que geralmente não são instaladas por um usuário para fins de digitação ou que são distribuídas como parte de um pacote de software maior, contamos com as regras gerais de empacotamento de software; por exemplo, isso se aplica às fontes entregues como parte do sistema X.Org ou às fontes que fazem parte do TeX Live.

Para facilitar a busca de fontes por um usuário, os nomes de outros pacotes contendo apenas fontes são compilados da seguinte maneira, independentemente do nome do pacote upstream.

O nome de um pacote que contém apenas uma família de fontes começa com `font-`; é seguido pelo nome da fundição e um traço `-` se a fundição for conhecida e o nome da família da fonte, em que os espaços são substituídos por hífenes (e, como sempre, todas as letras maiúsculas são transformadas em minúsculas). Por exemplo, a família de fontes Gentium da SIL é empacotada com o nome `font-sil-gentium`.

Para um pacote que contém várias famílias de fontes, o nome da coleção é usado no lugar do nome da família de fontes. Por exemplo, as fontes Liberation consistem em três famílias, Liberation Sans, Liberation Serif e Liberation Mono. Eles podem ser empacotados separadamente com os nomes `font-liberation-sans` e assim por diante; mas como eles são distribuídos juntos com um nome comum, preferimos agrupá-los como `font-liberation`.

No caso de vários formatos da mesma família ou coleção de fontes serem empacotados separadamente, um formato abreviado do formato, precedido por um traço, é adicionado ao

nome do pacote. Usamos `-ttf` para fontes TrueType, `-otf` para fontes OpenType e `-type1` para fontes PostScript Type 1.

22.9 Estilo de código

Em geral, nosso código segue os Padrões de Codificação GNU (veja *GNU Coding Standards*). No entanto, eles não dizem muito sobre Scheme, então aqui estão algumas regras adicionais.

22.9.1 Paradigma de programação

O código Scheme no Guix é escrito em um estilo puramente funcional. Uma exceção é o código que envolve entrada/saída e procedimentos que implementam conceitos de baixo nível, como o procedimento `memoize`.

22.9.2 Módulos

Guile modules that are meant to be used on the builder side must live in the `(guix build ...)` name space. They must not refer to other Guix or GNU modules. However, it is OK for a "host-side" module to use a build-side module. As an example, the `(guix search-paths)` module should not be imported and used by a package since it isn't meant to be used as a "build-side" module. It would also couple the module with the package's dependency graph, which is undesirable.

Módulos que lidam com o sistema GNU mais amplo devem estar no espaço de nome `(gnu ...)` em vez de `(guix ...)`.

22.9.3 Tipos de dados e correspondência de padrão

A tendência no Lisp clássico é usar listas para representar tudo e, em seguida, pesquisá-las "à mão" usando `car`, `cdr`, `cadr` e co. Existem vários problemas com esse estilo, notadamente o fato de que é difícil de ler, propenso a erros e um obstáculo para os relatórios de erros de tipos adequados.

O código Guix deve definir tipos de dados apropriados (por exemplo, usando `define-record-type*`) em vez de listas de abuso. Além disso, ele deve usar correspondência de padrões, por meio do módulo `(ice-9 match)` do Guile, especialmente ao corresponder listas (veja Seção "Pattern Matching" em *Manual de Referência do GNU Guile*); a correspondência de padrões para registros é melhor feita usando `match-record` do `(guix records)`, que, diferentemente do `match`, verifica nomes de campos no momento da macroexpansão.

Ao definir um novo tipo de registro, mantenha o *record type descriptor* (RTD) privado (veja Seção "Records" em *GNU Guile Reference Manual*, para mais informações sobre registros e RTDs). Como exemplo, o módulo `(guix packages)` define `<package>` como o RTD para registros de pacote, mas não o exporta; em vez disso, ele exporta um predicado de tipo, um construtor e acessadores de campo. Exportar RTDs tornaria mais difícil alterar a interface binária do aplicativo (porque o código em outros módulos pode estar correspondendo campos por posição) e tornaria trivial para os usuários falsificar registros desse tipo, ignorando quaisquer verificações que possamos ter no construtor oficial (como "sanitizadores de campo").

22.9.4 Formatação de código

Ao escrever código Scheme, seguimos a sabedoria comum entre os programadores Scheme. Em geral, seguimos o Riastradh's Lisp Style Rules (`https://mumble.net/~campbell/scheme/style.txt`). Este documento descreve as convenções mais usadas no código de Guile também. Ele é muito bem pensado e bem escrito, então, por favor, leia.

Alguns formulários especiais introduzidos no Guix, como a macro `substitute*`, possuem regras especiais de recuo. Estes são definidos no arquivo `.dir-locals.el`, que o Emacs usa automaticamente. Observe também que o Emacs-Guix fornece o modo `guix-devel-mode` que recua e destaca o código Guix corretamente (veja Seção "Development " em *O manual de referência do Emacs-Guix*).

Se você não usa o Emacs, por favor, certifique-se que o seu editor conhece estas regras. Para recuar automaticamente uma definição de pacote, você também pode executar:

```
./pre-inst-env guix style package
```

Veja Seção 9.7 [Invocando guix style], Página 208, para mais informações.

Nós exigimos que todos os procedimentos de nível superior carreguem uma docstring. Porém, este requisito pode ser relaxado para procedimentos privados simples no espaço de nomes `(guix build ...)`.

Os procedimentos não devem ter mais de quatro parâmetros posicionais. Use os parâmetros de palavra-chave para procedimentos que levam mais de quatro parâmetros.

22.10 Enviando patches

O desenvolvimento é feito usando o sistema de controle de versão distribuído Git. Assim, o acesso ao repositório não é estritamente necessário. Aceitamos contribuições na forma de patches produzidos por `git format-patch` enviados para a lista de discussão `guix-patches@gnu.org` (veja Seção "Submitting patches to a project" em *Manual do usuário do Git*). Os colaboradores são encorajados a reservar um momento para definir algumas opções do repositório Git (veja Seção 22.10.1 [Configurando o Git], Página 749) primeiro, o que pode melhorar a legibilidade dos patches. Desenvolvedores Guix experientes também podem querer dar uma olhada na seção sobre acesso de commit (veja Seção 22.14 [Confirmar acesso], Página 757).

Esta lista de discussão é apoiada por uma instância do Debbugs, o que nos permite acompanhar os envios (veja Seção 22.11 [Rastreando Bugs e Mudanças], Página 751). Cada mensagem enviada para essa lista de discussão recebe um novo número de rastreamento atribuído; as pessoas podem então acompanhar o envio enviando um e-mail para *NÚMERO_DE_ISSÃO*`@debbugs.gnu.org`, onde *NÚMERO_DE_ISSÃO* é o número de rastreamento (veja Seção 22.10.2 [Enviando uma série de patches], Página 749).

Por favor, escreva os logs de commit no formato de ChangeLog (veja Seção "Change Logs " em *GNU Coding Standards*); você pode verificar o histórico de commit para exemplos.

Você pode ajudar a tornar o processo de revisão mais eficiente e aumentar a chance de que seu patch seja revisado rapidamente, descrevendo o contexto do seu patch e o impacto que você espera que ele tenha. Por exemplo, se seu patch estiver corrigindo algo que está quebrado, descreva o problema e como seu patch o corrige. Conte-nos como você testou seu patch. Os usuários do código alterado pelo seu patch terão que ajustar seu fluxo de

trabalho? Se sim, conte-nos como. Em geral, tente imaginar quais perguntas um revisor fará e responda a essas perguntas com antecedência.

Antes de enviar um patch que adicione ou modifique uma definição de pacote, execute esta lista de verificação:

1. Se os autores do software empacotado fornecerem uma assinatura criptográfica para o tarball de lançamento, faça um esforço para verificar a autenticidade do arquivo. Para um arquivo de assinatura GPG separado, isso seria feito com o comando `gpg --verify`.
2. Reserve algum tempo para fornecer uma sinopse e descrição adequadas para o pacote. Veja Seção 22.8.4 [Sinopses e descrições], Página 738, para algumas diretrizes.
3. Execute `guix lint` *pacote*, sendo *pacote* o nome do pacote novo ou modificado e corrija quaisquer erros que forem relatados (veja Seção 9.8 [Invocando guix lint], Página 211).
4. Run `guix style` *package* to format the new package definition according to the project's conventions (veja Seção 9.7 [Invocando guix style], Página 208).
5. Certifique-se de que o pacote compila em sua plataforma, usando `guix build` *pacote*.
6. We recommend you also try building the package on other supported platforms. As you may not have access to actual hardware platforms, we recommend using the `qemu-binfmt-service-type` to emulate them. In order to enable it, add the `virtualization` service module and the following service to the list of services in your `operating-system` configuration:

   ```
   (service qemu-binfmt-service-type
    (qemu-binfmt-configuration
      (platforms (lookup-qemu-platforms "arm" "aarch64"))))
   ```

   Então, reconfigure seu sistema.

   Você pode criar pacotes para plataformas diferentes especificando a opção `--system`. Por exemplo, para compilar o pacote "hello" para as arquiteturas armhf ou aarch64, você executaria os seguintes comandos, respectivamente:

   ```
   guix build --system=armhf-linux --rounds=2 hello
   guix build --system=aarch64-linux --rounds=2 hello
   ```

7. Verifique se o pacote não usa cópias de software já disponíveis como pacotes separados.

   Às vezes, os pacotes incluem cópias do código-fonte de suas dependências como uma conveniência para os usuários. No entanto, como uma distribuição, queremos garantir que esses pacotes acabem usando a cópia que já temos na distribuição, se houver. Isso melhora o uso de recursos (a dependência é criada e armazenada apenas uma vez) e permite que a distribuição faça alterações transversais, como aplicar atualizações de segurança para um determinado pacote de software em um único local e fazê-las afetar todo o sistema – algo que cópias incluídas impedem.

8. Dê uma olhada no perfil relatado por `guix size` (veja Seção 9.9 [Invocando guix size], Página 214). Isso permitirá que você perceba referências a outros pacotes retidos involuntariamente. Também pode ajudar a determinar se deve dividir o pacote (veja Seção 5.4 [Pacotes com múltiplas saídas], Página 52) e quais dependências opcionais devem ser usadas. Em particular, evite adicionar `texlive` como uma dependência: devido ao seu tamanho extremo, use o procedimento `texlive-updmap.cfg`.

9. Check that dependent packages (if applicable) are not affected by the change; `guix refresh --list-dependent` *package* will help you do that (veja Seção 9.6 [Invocando guix refresh], Página 202).
10. Verifique se o processo de compilação do pacote é determinístico. Isso normalmente significa verificar se uma compilação independente do pacote produz o mesmo resultado que você obteve, bit por bit.

    Uma maneira simples de fazer isso é compilar o mesmo pacote várias vezes seguidas em sua máquina (veja Seção 9.1 [Invocando guix build], Página 177):

    ```
    guix build --rounds=2 meu-pacote
    ```

    Isso é suficiente para capturar uma classe de problemas comuns de não-determinismo, como registros de data e hora ou saída gerada aleatoriamente no resultado da compilação.

    Outra opção é usar `guix challenge` (veja Seção 9.12 [Invocando guix challenge], Página 225). Você pode executá-lo uma vez que o pacote se tenha sido feito o commit e compilação por `SUBSTITUTE-SERVER-1` para verificar se obtém o mesmo resultado que você fez. Melhor ainda: encontre outra máquina que possa compilá-lo e executar `guix publish`. Como a máquina de compilação remota provavelmente é diferente da sua, isso pode capturar problemas de não determinismo relacionados ao hardware - por exemplo, uso de extensões de conjunto de instruções diferentes – ou ao kernel do sistema operacional – por exemplo, confiança em `uname` ou arquivos de `/proc`.
11. Ao escrever documentação, por favor, use palavras de gênero neutras ao se referir a pessoas, como singular "they", "their" , "them" (`https://en.wikipedia.org/wiki/Singular_they`), e assim por diante.
12. Verifique se o seu patch contém apenas um conjunto de alterações relacionadas. Agrupar mudanças não relacionadas juntas torna a revisão mais difícil e lenta.

    Exemplos de alterações não relacionadas incluem a adição de vários pacotes ou uma atualização de pacote juntamente com correções para esse pacote.
13. Siga nossas regras de formatação de código, possivelmente executando o script `guix style` para fazer isso automaticamente para você (veja Seção 22.9.4 [Formatação de código], Página 746).
14. Quando possível, use espelhos no URL fonte (veja Seção 9.3 [Invocando guix download], Página 191). Use URLs confiáveis, não os gerados. Por exemplo, os arquivos do GitHub não são necessariamente idênticos de uma geração para a seguinte, portanto, nesse caso, geralmente é melhor clonar o repositório. Não use o campo `name` no URL: não é muito útil e se o nome mudar, o URL provavelmente estará errado.
15. Verifique se o Guix compila (veja Seção 22.2 [Compilando do git], Página 721) e resolva os avisos, especialmente aqueles sobre o uso de símbolos indefinidos.
16. Certifique-se de que suas alterações não quebrem o Guix e simule um `guix pull` com:

    ```
    guix pull --url=/path/to/your/checkout --profile=/tmp/guix.master
    ```

Ao postar um patch na lista de discussão, use '`[PATCH] ...`' como assunto. Se seu patch for aplicado em uma ramificação diferente de `master`, digamos `core-updates`, especifique-o no assunto como '`[PATCH core-updates] ...`'.

Você pode usar seu cliente de e-mail, o comando `git send-email` (veja Seção 22.10.2 [Enviando uma série de patches], Página 749) ou o comando `mumi send-email` (veja

Seção 22.11.3 [Debbugs User Interfaces], Página 752). Preferimos obter patches em mensagens de texto simples, seja em linha ou como anexos MIME. É aconselhável que você preste atenção se seu cliente de e-mail alterar algo como quebras de linha ou recuo, o que pode potencialmente quebrar os patches.

Espere algum atraso quando você enviar seu primeiro patch para `guix-patches@gnu.org`. Você tem que esperar até receber uma confirmação com o número de rastreamento atribuído. Confirmações futuras não devem ser atrasadas.

Quando um erro for resolvido, feche o tópico enviando um e-mail para *`NÚMERO_DE_ISSÃO`*`-done@debbugs.gnu.org`.

22.10.1 Configurando o Git

Se você ainda não fez isso, você pode querer definir um nome e e-mail que serão associados aos seus commits (veja Seção "Telling Git your name" em *Git User Manual*). Se você quiser usar um nome ou e-mail diferente apenas para commits neste repositório, você pode usar `git config --local`, ou editar `.git/config` no repositório em vez de `~/.gitconfig`.

Outras configurações importantes do Git serão configuradas automaticamente ao construir o projeto (veja Seção 22.2 [Compilando do git], Página 721). Um hook `.git/hooks/commit-msg` será instalado, incorporando '`Change-Id`' Git *trailers* em suas mensagens de commit para fins de rastreabilidade. É importante preservá-los ao editar suas mensagens de commit, principalmente se uma primeira versão de suas alterações propostas já foi enviada para revisão. Se você tiver um hook `commit-msg` próprio que gostaria de usar com o Guix, pode colocá-lo no diretório `.git/hooks/commit-msg.d/`.

22.10.2 Enviando uma série de patches

Single Patches

O comando `git send-email` é a melhor maneira de enviar patches únicos e séries de patches (veja [Vários Patches], Página 750) para a lista de discussão do Guix. Enviar patches como anexos de e-mail pode dificultar sua revisão em alguns clientes de e-mail, e `git diff` não armazena metadados de commit.

> **Nota:** O comando `git send-email` é fornecido pela saída `send-email` do pacote `git`, ou seja, `git:send-email`.

O comando a seguir criará um e-mail de patch a partir do último commit, abrirá no seu *EDITOR* ou *VISUAL* para edição e o enviará para a lista de discussão do Guix para ser revisado e mesclado. Supondo que você já tenha configurado o Git de acordo com Veja Seção 22.10.1 [Configurando o Git], Página 749, você pode simplesmente usar:

```
$ git send-email --annotate -1
```

> **Tip:** Para adicionar um prefixo ao assunto do seu patch, você pode usar a opção `--subject-prefix`. O projeto Guix usa isso para especificar que o patch é destinado a um branch ou repositório diferente do branch `master` do `https://git.savannah.gnu.org/cgit/guix.git`.
>
> ```
> git send-email --annotate --subject-prefix='PATCH core-updates' -1
> ```

O e-mail do patch contém uma linha separadora de três traços após a mensagem de commit. Você pode "anotar" o patch com texto explicativo adicionando-o abaixo desta linha. Se não quiser anotar o e-mail, você pode remover a opção `--annotate`.

Se você precisar enviar um patch revisado, não o reenvie dessa forma ou envie um patch "fix" para ser aplicado sobre o último; em vez disso, use `git commit --amend` ou `git rebase` (`https://git-rebase.io`) para modificar o commit e use o endereço *`NÚMERO_DE_ISSÃO`*`@debbugs.gnu.org` e o sinalizador `-v` com `git send-email`.

```
$ git commit --amend
$ git send-email --annotate -vREVISÃO \
      --to=NÚMERO_DE_ISSÃO@debbugs.gnu.org -1
```

Nota: Devido a um bug aparente em `git send-email`, `-v` *`REVISÃO`* (com o espaço) não funcionará; você *deve* usar `-v`*`REVISÃO`*.

Você pode descobrir *NÚMERO_DE_ISSÃO* pesquisando na interface do mumi em `https://issues.guix.gnu.org` pelo nome do seu patch ou lendo o e-mail de confirmação enviado automaticamente pelo Debbugs em resposta a bugs e patches recebidos, que contém o número do bug.

Notificando equipes

Se o seu git checkout tiver sido configurado corretamente (veja Seção 22.10.1 [Configurando o Git], Página 749), o comando `git send-email` notificará automaticamente os membros apropriados da equipe, com base no escopo das suas alterações. Isso depende do script `etc/teams.scm`, que também pode ser invocado manualmente se você não usar o comando `git send-email` preferencial para enviar patches. Para listar as ações disponíveis do script, você pode invocá-lo por meio do comando `etc/teams.scm help`. Para obter mais informações sobre equipes, veja Seção 22.12 [Equipes], Página 756.

Nota: Em distros estrangeiras, talvez seja necessário usar `./pre-inst-env git send-email` para que `etc/teams.scm` funcione.

Vários Patches

Embora `git send-email` sozinho seja suficiente para um único patch, uma falha infeliz no Debbugs significa que você precisa ter mais cuidado ao enviar vários patches: se você enviá-los todos para o endereço `guix-patches@gnu.org`, um novo problema será criado para cada patch!

Ao enviar uma série de patches, é melhor enviar uma "carta de apresentação" do Git primeiro, para dar aos revisores uma visão geral da série de patches. Podemos criar um diretório chamado `outgoing` contendo nossa série de patches e uma carta de apresentação chamada `0000-cover-letter.patch` com `git format-patch`.

```
$ git format-patch -NUMBER_COMMITS -o outgoing \
      --cover-letter --base=auto
```

Agora podemos enviar *apenas* a carta de apresentação para o endereço `guix-patches@gnu.org`, o que criará um problema para o qual podemos enviar o restante dos patches.

```
$ git send-email outgoing/0000-cover-letter.patch --annotate
$ rm outgoing/0000-cover-letter.patch # we don't want to resend it!
```

Certifique-se de editar o e-mail para adicionar uma linha de assunto e um resumo apropriados antes de enviá-lo. Observe o shortlog e o diffstat gerados automaticamente abaixo do resumo.

Depois que o remetente do Debbugs responder ao seu e-mail de carta de apresentação, você poderá enviar os patches reais para o endereço do problema recém-criado.

```
$ git send-email outgoing/*.patch --to=NÚMERO_DE_ISSÃO@debbugs.gnu.org
$ rm -rf outgoing # we don't need these anymore
```

Felizmente, essa dança `git format-patch` não é necessária para enviar uma série de patches corrigida, pois já existe um problema para o conjunto de patches.

```
$ git send-email -NÚMERO_COMMITS -vREVISÃO \
      --to=NÚMERO_DE_ISSÃO@debbugs.gnu.org
```

Se necessário, você pode usar `--cover-letter --annotate` para enviar outra carta de apresentação, por exemplo, para explicar o que mudou desde a última revisão e se essas mudanças são necessárias.

22.11 Rastreando Bugs e Mudanças

Esta seção descreve como o projeto Guix rastreia seus relatórios de bugs, envios de patches e ramificações de tópicos.

22.11.1 O rastreador de problemas

Relatórios de bugs e envios de patches são atualmente rastreados usando a instância Debbugs em `https://bugs.gnu.org`. Relatórios de bugs são arquivados no "pacote" `guix` (no jargão do Debbugs), enviando um e-mail para `bug-guix@gnu.org`, enquanto envios de patches são arquivados no pacote `guix-patches` enviando um e-mail para `guix-patches@gnu.org` (veja Seção 22.10 [Enviando patches], Página 746).

22.11.2 Gerenciando Patches e Branches

As alterações devem ser postadas em `guix-patches@gnu.org`. Esta lista de discussão preenche o banco de dados de rastreamento de patches (veja Seção 22.11.1 [O rastreador de problemas], Página 751). Ela também permite que patches sejam coletados e testados pela ferramenta de garantia de qualidade; o resultado desse teste eventualmente aparece no painel em '`https://qa.guix.gnu.org/issue/`*NÚMERO_DE_ISSÃO*', onde *NÚMERO_DE_ISSÃO* é o número atribuído pelo rastreador de problemas. Reserve um tempo para uma revisão, sem comprometer nada.

Como exceção, algumas mudanças consideradas "triviais" ou "óbvias" podem ser enviadas diretamente para o branch `master`. Isso inclui mudanças para corrigir erros de digitação e reverter commits que causaram problemas imediatos. Isso está sujeito a ajustes, permitindo que indivíduos se comprometam diretamente com mudanças não controversas em partes com as quais estão familiarizados.

Alterações que afetam mais de 300 pacotes dependentes (veja Seção 9.6 [Invocando guix refresh], Página 202) devem primeiro ser enviadas para um branch de tópico diferente de `master`; o conjunto de alterações deve ser consistente, por exemplo, "GNOME update", "NumPy update", etc. Isso permite testes: o branch aparecerá automaticamente em '`https://qa.guix.gnu.org/branch/`*branch*', com uma indicação de seu status de compilação em várias plataformas.

Para ajudar a coordenar a fusão de branches, você deve criar um novo problema guix-patches sempre que criar um branch (veja Seção 22.11.1 [O rastreador de problemas],

Página 751). O título do problema que solicita a fusão de um branch deve ter o seguinte formato:

```
Solicitação de mesclagem do branch "name"
```

O infraestrutura de QA (`https://qa.guix.gnu.org/`) reconhece tais problemas e lista as solicitações de mesclagem em sua página principal. Os seguintes pontos se aplicam ao gerenciamento dessas ramificações:

1. Os commits no branch devem ser uma combinação dos patches relevantes para o branch. Patches não relacionados ao tópico do branch devem ir para outro lugar.
2. Quaisquer alterações que possam ser feitas no branch master, devem ser feitas no branch master. Se um commit puder ser dividido para aplicar parte das alterações no master, isso é bom de se fazer.
3. Deve ser possível recriar a ramificação iniciando pelo master e aplicando os patches relevantes.
4. Evite mesclar o master no branch. Prefira rebasear ou recriar o branch em cima de uma revisão master atualizada.
5. Minimize as alterações no master que estão faltando no branch antes de mesclar o branch no master. Isso significa que o estado do branch reflete melhor o estado do master caso o branch seja mesclado.
6. Se você não tiver acesso de commit, crie o issue "Request for merging" e solicite que alguém crie o branch. Inclua uma lista de issues/patches para incluir no branch.

Normalmente, os branches serão mesclados de uma maneira "primeiro a chegar, primeiro a ser mesclado", rastreados por meio dos problemas guix-patches. Se você concordar com uma ordem diferente com os envolvidos, você pode rastrear isso atualizando which issues block[5] which other issues. Portanto, para saber qual branch está na frente da fila, procure o issue mais antigo, ou o issue que não está *bloqueado* por nenhuma outra branch merges. Uma lista ordenada de branches com os issues abertos está disponível em `https://qa.guix.gnu.org`.

Uma vez que um branch esteja na frente da fila, espere até que tenha passado tempo suficiente para que as farms de build tenham processado as mudanças, e para que os testes necessários tenham acontecido. Por exemplo, você pode verificar '`https://qa.guix.gnu.org/branch/branch`' para ver informações sobre alguns builds e disponibilidade de substitutos.

Depois que a ramificação for mesclada, o problema deverá ser fechado e a ramificação excluída.

22.11.3 Debbugs User Interfaces

22.11.3.1 Web interface

Uma interface web (na verdade *duas* interfaces web!) está disponível para navegar pelos problemas:

[5] Você pode marcar um issue como bloqueado por outro enviando um e-mail para `control@debbugs.gnu.org` com a seguinte linha no corpo do e-mail: `block XXXXX by YYYYY`. Onde `XXXXX` é o número do issue bloqueado, e `YYYYY` é o número do issue que o está bloqueando.

- `https://issues.guix.gnu.org` fornece uma interface agradável alimentada por mumi[6] para navegar por relatórios de bugs e patches, e para participar de discussões; mumi também tem uma interface de linha de comando como veremos abaixo;
- `https://bugs.gnu.org/guix` lista relatórios de bugs;
- `https://bugs.gnu.org/guix-patches` lista envios de patches.

Para visualizar discussões relacionadas ao problema número *n*, acesse '`https://issues.guix.gnu.org/n`' ou '`https://bugs.gnu.org/n`'.

22.11.3.2 Command-Line Interface

O Mumi também vem com uma interface de linha de comando que pode ser usada para pesquisar problemas existentes, abrir novos problemas, compor respostas, aplicar e enviar patches. Você não precisa usar o Emacs para usar o cliente de linha de comando mumi. Você interage com ele apenas na linha de comando.

Para usar a interface de linha de comando mumi, navegue até um clone local do repositório git Guix e entre em um shell com mumi, git e git:send-email instalados.

```
$ cd guix
~/guix$ guix shell mumi git git:send-email
```

Para procurar problemas, diga todos os problemas abertos sobre "zig", execute

```
~/guix [env]$ mumi search zig is:open

#60889 Add zig-build-system
opened on 17 Jan 17:37 Z by Ekaitz Zarraga
#61036 [PATCH 0/3] Update zig to 0.10.1
opened on 24 Jan 09:42 Z by Efraim Flashner
#39136 [PATCH] gnu: services: Add endlessh.
opened on 14 Jan 2020 21:21 by Nicol? Balzarotti
#60424 [PATCH] gnu: Add python-online-judge-tools
opened on 30 Dec 2022 07:03 by gemmaro
#45601 [PATCH 0/6] vlang 0.2 update
opened on  1 Jan 2021 19:23 by Ryan Prior
```

Escolha uma questão e torne-a a questão "atual".

```
~/guix [env]$ mumi current 61036

#61036 [PATCH 0/3] Update zig to 0.10.1
opened on 24 Jan 09:42 Z by Efraim Flashner
```

Quando um problema é o problema atual, você pode abri-lo em um navegador da web, redigir respostas, aplicar patches, enviar patches, etc. com comandos curtos e sucintos.

Abra o problema no seu navegador da web usando

```
~/guix [env]$ mumi www
```

Redija uma resposta usando

```
~/guix [env]$ mumi compose
```

[6] Mumi é um bom software escrito em Guile, e você pode ajudar! Veja `https://git.savannah.gnu.org/cgit/guix/mumi.git`.

Redija uma resposta e feche o problema usando

```
~/guix [env]$ mumi compose --close
```

`mumi compose` abre seu cliente de e-mail passando URIs '`mailto:`' para `xdg-open`. Então, você precisa ter `xdg-open` configurado para abrir seu cliente de e-mail corretamente.

Aplique o patchset mais recente do problema usando

```
~/guix [env]$ mumi am
```

Você também pode aplicar um patchset de uma versão específica (digamos, v3) usando

```
~/guix [env]$ mumi am v3
```

Ou você pode aplicar um patch de uma mensagem de e-mail específica. Por exemplo, para aplicar o patch da 4ª mensagem (o índice da mensagem começa em 0), execute

```
~/guix [env]$ mumi am @4
```

`mumi am` é um wrapper em torno de `git am`. Você pode passar argumentos `git am` para ele depois de um '`--`'. Por exemplo, para adicionar um trailer Signed-off-by, execute

```
~/guix [env]$ mumi am -- -s
```

Crie e envie patches para o problema usando

```
~/guix [env]$ git format-patch origin/master
~/guix [env]$ mumi send-email foo.patch bar.patch
```

Observe que você não precisa passar os argumentos '`--to`' ou '`--cc`' para `git format-patch`. `mumi send-email` os inserirá corretamente ao enviar os patches.

Para abrir um novo problema, execute

```
~/guix [env]$ mumi new
```

e enviar um e-mail (usando `mumi compose`) ou patches (usando `mumi send-email`).

`mumi send-email` é realmente um wrapper em torno de `git send-email` que automatiza todos os detalhes do envio de patches. Ele usa o estado atual do problema para descobrir automaticamente o endereço '`To`' correto para enviar, outros participantes para '`Cc`', cabeçalhos para adicionar, etc.

Observe também que, diferentemente de `git send-email`, `mumi send-email` funciona perfeitamente bem com patches únicos e múltiplos. Ele automatiza a dança dos debbugs de enviar o primeiro patch, esperar por uma resposta dos debbugs e enviar os patches restantes. Ele faz isso enviando o primeiro patch, sondando o servidor para uma resposta e, em seguida, enviando os patches restantes. Infelizmente, essa sondagem pode levar alguns minutos. Então, seja paciente.

22.11.3.3 Emacs Interface

Se você usa o Emacs, pode achar mais conveniente interagir com problemas usando `debbugs.el`, que pode ser instalado com:

```
guix install emacs-debbugs
```

Por exemplo, para listar todos os problemas abertos em `guix-patches`, clique em:

C-u M-x `debbugs-gnu` *RET RET* `guix-patches` *RET* `n y`

Para uma maneira mais conveniente (mais curta) de acessar os envios de bugs e patches, você pode configurar as variáveis `debbugs-gnu-default-packages` e

`debbugs-gnu-default-severities` do Emacs (veja Seção 22.5.1 [Visualizando Bugs no Emacs], Página 728).

Para procurar bugs, '*M*-x `debbugs-gnu-guix-search`' pode ser usado.

Veja *Guia do usuário do Debbugs*, para mais informações sobre esta ferramenta bacana!

22.11.4 Debbugs Marcadores de usuário

O Debbugs fornece um recurso chamado *usertags* que permite que qualquer usuário marque qualquer bug com um rótulo arbitrário. Os bugs podem ser pesquisados por usertag, então esta é uma maneira útil de organizar bugs[7]. Se você usa o Emacs Debbugs, o ponto de entrada para consultar usertags existentes é o procedimento '`C-u M-x debbugs-gnu-usertags`'. Para definir um usertag, pressione '`C`' enquanto consulta um bug dentro do buffer *Guix-Patches* aberto com o buffer '`C-u M-x debbugs-gnu-bugs`', então selecione `usertag` e siga as instruções.

Por exemplo, para visualizar todos os relatórios de bugs (ou patches, no caso de `guix-patches`) marcados com a usertag `powerpc64le-linux` para o usuário `guix`, abra uma URL como a seguinte em um navegador da web: `https://debbugs.gnu.org/cgi-bin/pkgreport.cgi?tag=powerpc64le-linux;users=guix`.

Para mais informações sobre como usar usertags, consulte a documentação do Debbugs ou a documentação de qualquer ferramenta que você use para interagir com o Debbugs.

No Guix, estamos experimentando usertags para manter o controle de problemas específicos da arquitetura, bem como os revisados. Para facilitar a colaboração, todos os nossos usertags estão associados ao usuário único `guix`. Os seguintes usertags existem atualmente para esse usuário:

`powerpc64le-linux`
: O propósito desta usertag é facilitar a localização dos problemas mais importantes para o tipo de sistema `powerpc64le-linux`. Atribua esta usertag a bugs ou patches que afetam o `powerpc64le-linux`, mas não outros tipos de sistema. Além disso, você pode usá-la para identificar problemas que, por algum motivo, são particularmente importantes para o tipo de sistema `powerpc64le-linux`, mesmo que o problema afete outros tipos de sistema também.

`reprodutibilidade`
: Para problemas relacionados à reprodutibilidade. Por exemplo, seria apropriado atribuir esta usertag a um relatório de bug para um pacote que falha em construir de forma reprodutível.

`reviewed-looks-good`
: Você analisou a série e ela parece boa para você (LGTM).

Se você for um committer e quiser adicionar uma usertag, basta começar a usá-la com o usuário `guix`. Se a usertag for útil para você, considere atualizar esta seção do manual para que outros saibam o que sua usertag significa.

[7] A lista de usertags é uma informação pública, e qualquer um pode modificar a lista de usertags de qualquer usuário, então tenha isso em mente se você escolher usar este recurso.

22.11.5 Notificações de construção de Cuirass

O Cuirass inclui feeds RSS (Really Simple Syndication) como um de seus recursos (veja Seção "Notifications" em `cuirass`). Como Berlin (`https://ci.guix.gnu.org/`) executa uma instância do Cuirass, esse recurso pode ser usado para manter o controle de pacotes recentemente quebrados ou corrigidos causados por alterações enviadas ao repositório git do Guix. Qualquer cliente RSS pode ser usado. Um bom, incluído no Emacs, é Veja Seção "Gnus" em `gnus`. Para registrar o feed, copie sua URL e, a partir do buffer principal do Gnus, '`*Group*`', faça o seguinte:

```
G R https://ci.guix.gnu.org/events/rss/?specification=master RET
Guix CI - master RET Build events for specification master. RET
```

Então, de volta ao buffer '`*Group*`', pressione *s* para salvar o grupo RSS recém-adicionado. Assim como para qualquer outro grupo Gnus, você pode atualizar seu conteúdo pressionando a tecla *g*. Agora você deve receber notificações que dizem algo como:

```
. [ ?: Cuirass ] Build tree-sitter-meson.aarch64-linux on master is fixed.
. [ ?: Cuirass ] Build rust-pbkdf2.aarch64-linux on master is fixed.
. [ ?: Cuirass ] Build rust-pbkdf2.x86_64-linux on master is fixed.
```

onde cada entrada RSS contém um link para a página de detalhes da compilação do Cuirass associada.

22.12 Equipes

To organize work on Guix, including but not just development efforts, the project has a set of *teams*. Each team has its own focus and interests and is the primary contact point for questions and contributions in those areas. A team's primary mission is to coordinate and review the work of individuals in its scope (veja Seção 22.15 [Revendo o trabalho de outros], Página 761); it can make decisions within its scope, in agreement with other teams whenever there is overlap or a close connection, and in accordance with other project rules such as seeking consensus (veja Seção 22.13 [Making Decisions], Página 757).

Como exemplo, a equipe Python é responsável por questões de empacotamento do núcleo Python; ela pode decidir atualizar os pacotes principais do Python em uma ramificação dedicada `python-team`, em colaboração com qualquer equipe cujo escopo seja diretamente dependente do Python — por exemplo, a equipe Science — e seguindo regras de ramificação (veja Seção 22.11.2 [Gerenciando Patches e Branches], Página 751). A equipe Documentation ajuda a revisar as alterações na documentação e pode iniciar alterações abrangentes na documentação. A equipe Translations organiza a tradução do Guix e seu manual e coordena os esforços nessa área. A equipe Core é responsável pelo desenvolvimento da funcionalidade principal e das interfaces do Guix; devido à sua natureza central, parte de seu trabalho pode exigir a solicitação de contribuições da comunidade em geral e a busca de consenso antes de promulgar decisões que afetariam toda a comunidade.

As equipes são definidas no arquivo `etc/teams.scm` no repositório Guix. O escopo de cada equipe é definido, quando aplicável, como um conjunto de arquivos ou como uma expressão regular que corresponde a nomes de arquivos.

Qualquer pessoa interessada no domínio de uma equipe e disposta a contribuir com seu trabalho pode se candidatar para se tornar um membro entrando em contato com os membros atuais por e-mail; acesso de commit não é uma pré-condição. A filiação é formalizada

adicionando o nome e endereço de e-mail da pessoa em `etc/teams.scm`. Membros que não participam do trabalho da equipe por um ano ou mais podem ser removidos; eles são livres para se candidatar novamente para filiação mais tarde.

Uma ou mais pessoas podem propor a criação de uma nova equipe entrando em contato com a comunidade por e-mail em `guix-devel@gnu.org`, esclarecendo o escopo e o propósito pretendidos. Quando o consenso é alcançado sobre a criação desta equipe, alguém com acesso de commit formaliza sua criação adicionando-a e seus membros iniciais a `etc/teams.scm`.

Para listar as equipes existentes, execute o seguinte comando em um checkout do Guix:

```
$ ./etc/teams.scm list-teams
id: mentors
name: Mentors
description: A group of mentors who chaperone contributions by newcomers.
members:
+ Charlie Smith <charlie@example.org>
...
```

You can run the following command to have the Mentors team put in CC of a patch series:

```
$ git send-email --to=NÚMERO_DE_ISSÃO@debbugs.gnu.org \
  --header-cmd='etc/teams.scm cc-mentors-header-cmd' *.patch
```

A equipe ou equipes apropriadas também podem ser inferidas a partir dos arquivos modificados. Por exemplo, se você quiser enviar os dois últimos commits do repositório Git atual para revisão, você pode executar:

```
$ guix shell -D guix
[env]$ git send-email --to=NÚMERO_DE_ISSÃO@debbugs.gnu.org -2
```

22.13 Making Decisions

Espera-se de todos os contribuidores, e ainda mais dos committers, que ajudem a construir consenso e tomar decisões com base no consenso. Ao usar o consenso, estamos comprometidos em encontrar soluções com as quais todos possam conviver. Isso implica que nenhuma decisão é tomada contra preocupações significativas e essas preocupações são ativamente resolvidas com propostas que funcionam para todos.

Um colaborador (que pode ou não ter acesso de commit) que deseja bloquear uma proposta tem uma responsabilidade especial de encontrar alternativas, propor ideias/código ou explicar a lógica do status quo para resolver o impasse. Para aprender o que significa tomada de decisão por consenso e entender seus detalhes mais sutis, você é encorajado a ler `https://www.seedsforchange.org.uk/consensus`.

22.14 Confirmar acesso

Todos podem contribuir para o Guix sem ter acesso de commit (veja Seção 22.10 [Enviando patches], Página 746). No entanto, para contribuidores frequentes, ter acesso de gravação ao repositório pode ser conveniente. Como regra geral, um contribuidor deve ter acumulado cinquenta (50) commits revisados para ser considerado um committer e ter mantido sua atividade no projeto por pelo menos 6 meses. Isso garante interações suficientes com o contribuidor, o que é essencial para a orientação e avaliação se ele está pronto para se

tornar um committer. O acesso de commit não deve ser pensado como um "emblema de honra", mas sim como uma responsabilidade que um contribuidor está disposto a assumir para ajudar o projeto.

Committers are in a position where they enact technical decisions. Such decisions must be made by *actively building consensus* among interested parties and stakeholders. Seção 22.13 [Making Decisions], Página 757, for more on that.

As seções a seguir explicam como obter acesso de commit, como estar pronto para enviar commits e as políticas e expectativas da comunidade para commits enviados upstream.

22.14.1 Solicitando acesso de confirmação

Quando você julgar necessário, considere solicitar acesso de confirmação seguindo estas etapas:

1. Encontre três committers que atestariam por você. Você pode ver a lista de committers em `https://savannah.gnu.org/project/memberlist.php?group=guix`. Cada um deles deve enviar uma declaração por e-mail para `guix-maintainers@gnu.org` (um alias privado para o coletivo de mantenedores), assinado com sua chave OpenPGP.

   Espera-se que os committers tenham tido algumas interações com você como colaborador e sejam capazes de julgar se você está suficientemente familiarizado com as práticas do projeto. Não é um julgamento sobre o valor do seu trabalho, então uma recusa deve ser interpretada como "vamos tentar novamente mais tarde".

2. Envie para `guix-maintainers@gnu.org` uma mensagem informando sua intenção, listando os três committers que dão suporte ao seu aplicativo, assinados com a chave OpenPGP que você usará para assinar commits e fornecendo sua impressão digital (veja abaixo). Veja `https://emailselfdefense.fsf.org/en/`, para uma introdução à criptografia de chave pública com GnuPG.

   Configure o GnuPG de forma que ele nunca use o algoritmo de hash SHA1 para assinaturas digitais, que é conhecido por ser inseguro desde 2019, por exemplo, adicionando a seguinte linha em `~/.gnupg/gpg.conf` (veja Seção "GPG Esoteric Options" em *The GNU Privacy Guard Manual*):

   ```
   digest-algo sha512
   ```

3. Os mantenedores decidem, em última instância, se lhe concedem acesso de confirmação, geralmente seguindo a recomendação das suas referências.

4. Se e uma vez que você tenha recebido acesso, envie uma mensagem para `guix-devel@gnu.org` para dizer isso, novamente assinada com a chave OpenPGP que você usará para assinar os commits (faça isso antes de enviar seu primeiro commit). Dessa forma, todos podem notar e garantir que você controle essa chave OpenPGP.

   > **Importante:** Antes de poder fazer push pela primeira vez, os mantenedores devem:
   >
   > 1. adicione sua chave OpenPGP à ramificação `keyring`;
   > 2. adicione sua impressão digital OpenPGP ao arquivo `.guix-authorizations` da(s) ramificação(ões) para as quais você fará o commit.

5. Não deixe de ler o restante desta seção e... lucre!

> **Nota:** Os mantenedores ficarão felizes em dar acesso de comprometimento a pessoas que contribuem há algum tempo e têm um histórico. Não seja tímido e não subestime seu trabalho!
>
> No entanto, observe que o projeto está trabalhando em direção a um sistema de revisão e mesclagem de patches mais automatizado, o que, como consequência, pode nos levar a ter menos pessoas com acesso de commit ao repositório principal. Fique ligado!

Todos os commits que são enviados para o repositório central no Savannah devem ser assinados com uma chave OpenPGP, e a chave pública deve ser carregada para sua conta de usuário no Savannah e para servidores de chave pública, como `keys.openpgp.org`. Para configurar o Git para assinar commits automaticamente, execute:

```
git config commit.gpgsign true

# Substitua a impressão digital da sua chave PGP pública.
git config user.signingkey CABBA6EA1DC0FF33
```

Para verificar se os commits estão assinados com a chave correta, use:

```
guix git authenticate
```

Veja Seção 22.2 [Compilando do git], Página 721, para executar a primeira autenticação de um checkout do Guix.

Para evitar enviar acidentalmente commits não assinados ou assinados com a chave errada para o Savannah, certifique-se de configurar o Git de acordo com Veja Seção 22.10.1 [Configurando o Git], Página 749.

22.14.2 Política de Comprometimento

Se você obtiver acesso de confirmação, certifique-se de seguir a política abaixo (as discussões sobre a política podem ocorrer em `guix-devel@gnu.org`).

Certifique-se de estar ciente de como as alterações devem ser tratadas (veja Seção 22.11.2 [Gerenciando Patches e Branches], Página 751) antes de serem enviadas ao repositório, especialmente para a ramificação `master`.

Se você estiver fazendo commit e enviando suas próprias alterações, tente esperar pelo menos uma semana (duas semanas para alterações mais significativas, até um mês para alterações como remover um pacote—veja [package-removal-policy], Página 764) depois de enviá-las para revisão. Depois disso, se ninguém mais estiver disponível para revisá-las e se você estiver confiante sobre as alterações, está tudo bem fazer commit.

Ao enviar um commit em nome de outra pessoa, adicione uma linha `Signed-off-by` no final da mensagem de log do commit—por exemplo, com `git am --signoff`. Isso melhora o rastreamento de quem fez o quê.

Ao adicionar entradas de notícias do canal (veja Capítulo 6 [Canais], Página 69), certifique-se de que elas estejam bem formadas executando o seguinte comando antes de enviar:

```
make check-channel-news
```

22.14.3 Abordando questões

A revisão por pares (veja Seção 22.10 [Enviando patches], Página 746) e ferramentas como `guix lint` (veja Seção 9.8 [Invocando guix lint], Página 211) e o conjunto de testes (veja Seção 22.3 [Executando o conjunto de testes], Página 724) devem detectar problemas antes que eles sejam enviados. No entanto, confirmações que "quebram" a funcionalidade podem ocasionalmente passar. Quando isso acontece, há duas prioridades: mitigar o impacto e entender o que aconteceu para reduzir a chance de incidentes semelhantes no futuro. A responsabilidade por ambas as coisas recai principalmente sobre os envolvidos, mas, como tudo, este é um esforço de grupo.

Alguns problemas podem afetar diretamente todos os usuários, por exemplo, porque fazem com que `guix pull` falhe ou interrompa a funcionalidade principal, porque interrompem pacotes importantes (em tempo de compilação ou execução) ou porque introduzem vulnerabilidades de segurança conhecidas.

As pessoas envolvidas na criação, revisão e envio de tais confirmações devem estar na vanguarda para mitigar seu impacto em tempo hábil: enviando uma confirmação de acompanhamento para corrigi-lo (se possível) ou revertendo-o para dar tempo de encontrar uma correção adequada e comunicando-se com outros desenvolvedores sobre o problema.

Se essas pessoas não estiverem disponíveis para resolver o problema a tempo, outros responsáveis pelo commit têm o direito de reverter o(s) commit(s), explicando no log de commits e na lista de discussão qual era o problema, com o objetivo de dar tempo ao responsável pelo commit original, revisor(es) e autor(es) para propor um caminho a seguir.

Uma vez que o problema tenha sido resolvido, é responsabilidade dos envolvidos garantir que a situação seja compreendida. Se você estiver trabalhando para entender o que aconteceu, concentre-se em reunir informações e evite atribuir qualquer culpa. Peça aos envolvidos para descrever o que aconteceu, não peça para eles explicarem a situação — isso os culparia implicitamente, o que não ajuda. A responsabilização vem de um consenso sobre o problema, aprendendo com ele e melhorando os processos para que seja menos provável que ele ocorra novamente.

22.14.4 Commit Revocation

Para reduzir a possibilidade de erros, os responsáveis pelo commit terão suas contas Savannah removidas do projeto Guix Savannah e suas chaves removidas de `.guix-authorizations` após 12 meses de inatividade; eles podem solicitar o acesso de commit novamente enviando um e-mail aos mantenedores, sem passar pelo processo de garantia.

Mantenedores[8] também pode revogar os direitos de commit de um indivíduo, como último recurso, se a cooperação com o resto da comunidade tiver causado muito atrito — mesmo dentro dos limites do código de conduta do projeto (veja Capítulo 22 [Contribuindo], Página 720). Eles só fariam isso após discussão pública ou privada com o indivíduo e um aviso claro. Exemplos de comportamento que dificulta a cooperação e pode levar a tal decisão incluem:

- violação repetida da política de compromisso declarada acima;
- falha repetida em levar em consideração as críticas dos colegas;

[8] Veja `https://guix.gnu.org/pt-BR/about` para a lista atual de mantenedores. Você pode enviar um e-mail privado para eles em `guix-maintainers@gnu.org`.

- quebrando a confiança através de uma série de incidentes graves.

Quando os mantenedores recorrem a tal decisão, eles notificam os desenvolvedores em `guix-devel@gnu.org`; consultas podem ser enviadas para `guix-maintainers@gnu.org`. Dependendo da situação, o indivíduo ainda pode ser bem-vindo para contribuir.

22.14.5 Ajudando

Uma última coisa: o projeto continua avançando porque os committers não apenas empurram suas próprias mudanças incríveis, mas também oferecem parte do seu tempo *revisando* e empurrando as mudanças de outras pessoas. Como committer, você é bem-vindo para usar sua expertise e direitos de commit para ajudar outros contribuidores também!

22.15 Revendo o trabalho de outros

Perhaps the biggest action you can do to help GNU Guix grow as a project is to review the work contributed by others. You do not need to be a committer to do so; applying, reading the source, building, linting and running other people's series and sharing your comments about your experience will give some confidence to committers. You must ensure the check list found in the Seção 22.10 [Enviando patches], Página 746, section has been correctly followed. A reviewed patch series should give the best chances for the proposed change to be merged faster, so if a change you would like to see merged hasn't yet been reviewed, this is the most appropriate thing to do! If you would like to review changes in a specific area and to receive notifications for incoming patches relevant to that domain, consider joining the relevant team(s) (veja Seção 22.12 [Equipes], Página 756).

Comentários de revisão devem ser inequívocos; seja o mais claro e explícito possível sobre o que você acha que deve ser alterado, garantindo que o autor possa tomar medidas sobre isso. Tente manter as seguintes diretrizes em mente durante a revisão:

1. *Seja claro e explícito sobre as mudanças que você está sugerindo*, garantindo que o autor possa agir sobre isso. Em particular, é uma boa ideia pedir explicitamente por novas revisões quando você quiser.
2. *Mantenha o foco: não altere o escopo do trabalho que está sendo revisado.* Por exemplo, se a contribuição aborda um código que segue um padrão considerado difícil de manejar, seria injusto pedir ao remetente para corrigir todas as ocorrências desse padrão no código; para simplificar, se um problema não relacionado ao patch em questão já estava lá, não peça ao remetente para corrigi-lo.
3. *Garantir o progresso.* Conforme respondem à revisão, os remetentes podem enviar novas revisões de suas alterações; evite solicitar alterações que você não solicitou na rodada anterior de comentários. No geral, o remetente deve ter uma noção clara do progresso; o número de itens abertos para discussão deve diminuir claramente ao longo do tempo.
4. *Aim for finalization.* Revisar código consome tempo. Seu objetivo como revisor é colocar o processo em um caminho claro em direção à integração, possivelmente com mudanças acordadas, ou rejeição, com um raciocínio claro e mutuamente compreendido. Evite deixar o processo de revisão em um estado persistente sem uma saída clara.
5. *Review is a discussion.* The submitter's and reviewer's views on how to achieve a particular change may not always be aligned. To lead the discussion, remain focused,

ensure progress and aim for finalization, spending time proportional to the stakes[9]. As a reviewer, try hard to explain the rationale for suggestions you make, and to understand and take into account the submitter's motivation for doing things in a certain way. In other words, build consensus with everyone involved (veja Seção 22.13 [Making Decisions], Página 757).

Quando você considera a alteração proposta adequada e pronta para inclusão no Guix, a seguinte linha bem compreendida/codificada '`Reviewed-by: Your Name <your-email@example.com>`'[10] deve ser usada para assinar como revisor, o que significa que você revisou a alteração e que ela parece boa para você:

- Se a série *toda* (contendo vários commits) parecer boa para você, responda com '`Reviewed-by: Your Name <your-email@example.com>`' para a página de capa, se houver uma, ou para o último patch da série, caso contrário, adicionando outro comentário '`(para toda a série)`' na linha abaixo para explicitar esse fato.
- Se você quiser marcar um *único commit* como revisado (mas não a série inteira), basta responder com '`Reviewed-by: Your Name <your-email@example.com>`' para essa mensagem de commit.

Se você não for um colaborador, pode ajudar outras pessoas a encontrar uma *série* que você revisou mais facilmente adicionando uma usertag `reviewed-looks-good` para o usuário `guix` (veja Seção 22.11.4 [Debbugs Marcadores de usuário], Página 755).

22.16 Atualizando o Pacote Guix

Às vezes, é desejável atualizar o pacote `guix` em si (o pacote definido em `(gnu packages package-management)`), por exemplo, para tornar novos recursos de daemon disponíveis para uso pelo tipo de serviço `guix-service-type`. Para simplificar essa tarefa, o seguinte comando pode ser usado:

```
make update-guix-package
```

O destino de criação do `update-guix-package` usará o último *commit* conhecido correspondente ao `HEAD` no seu checkout do Guix, calculará o hash das fontes do Guix correspondentes a esse commit e atualizará o `commit`, `revision` e o hash da definição do pacote `guix`.

Para validar se os hashes do pacote `guix` atualizados estão corretos e se ele pode ser construído com sucesso, o seguinte comando pode ser executado no diretório do seu checkout Guix:

```
./pre-inst-env guix build guix
```

Para evitar a atualização acidental do pacote `guix` para um commit ao qual outros não podem se referir, é feita uma verificação de que o commit usado já foi enviado para o repositório git Guix hospedado em Savannah.

---

[9] The tendency to discuss minute details at length is often referred to as "bikeshedding", where much time is spent discussing each one's preference for the color of the shed at the expense of progress made on the project to keep bikes dry.

[10] O trailer do Git '`Reviewed-by`' é usado por outros projetos, como o Linux, e é compreendido por ferramentas de terceiros, como o subcomando '`b4 am`', que é capaz de recuperar o tópico completo do e-mail de envio de uma instância de caixa de entrada pública e adicionar os trailers do Git encontrados nas respostas aos patches de confirmação.

Esta verificação pode ser desabilitada, *por sua conta e risco*, definindo a variável de ambiente `GUIX_ALLOW_ME_TO_USE_PRIVATE_COMMIT`. Quando esta variável é definida, a fonte do pacote atualizado também é adicionada ao armazém. Isto é usado como parte do processo de lançamento do Guix.

22.17 Política de depreciação

Como qualquer projeto animado com um escopo amplo, o Guix muda o tempo todo e em todos os níveis. Como é extensível e programável pelo usuário, mudanças incompatíveis podem impactar diretamente os usuários e dificultar suas vidas. Portanto, é importante reduzir as mudanças incompatíveis visíveis ao usuário ao mínimo e, quando tais mudanças forem consideradas necessárias, comunicá-las claramente por meio de um *período de depreciação* para que todos possam se adaptar com o mínimo de problemas. Esta seção define os compromissos do projeto para uma depreciação suave e descreve procedimentos e mecanismos para honrá-los.

Há várias maneiras de usar Guix; como lidar com a descontinuação dependerá de cada caso de uso. Elas podem ser categorizadas aproximadamente assim:

- gerenciamento de pacotes exclusivamente através da linha de comando;
- gerenciamento avançado de pacotes usando as interfaces de manifesto e pacote;
- Gerenciamento de sistema e home, usando as interfaces `operating-system` e/ou `home-environment` juntamente com as interfaces de serviço;
- desenvolvimento ou utilização de ferramentas externas que utilizam interfaces de programação como os módulos `(guix ...)`.

Esses casos de uso formam um espectro com vários graus de acoplamento — de "distante" a fortemente acoplado. Com base nesse insight, definimos as seguintes *políticas de depreciação* que consideramos adequadas para cada um desses níveis.

Command-line tools
: Os subcomandos Guix devem ser pensados como permanecendo disponíveis "para sempre". Uma vez que um subcomando Guix deve ser removido, ele deve ser descontinuado primeiro, e então permanecer disponível por **pelo menos um ano** após o primeiro lançamento que o descontinuou.

  A descontinuação deve ser anunciada primeiro no manual e como uma entrada em `etc/news.scm`; comunicações adicionais, como uma postagem de blog explicando a justificativa, são bem-vindas. Meses antes da data de remoção programada, o comando deve imprimir um aviso explicando como migrar. Um exemplo disso é a substituição de `guix environment` por `guix shell`, iniciada em outubro de 2021[11].

  Devido ao amplo impacto de tal mudança, recomendamos realizar uma pesquisa com usuários antes de implementar um plano.

Package name changes
: Quando um nome de pacote muda, ele deve permanecer disponível sob seu nome antigo por **pelo menos um ano**. Por exemplo, `go-ipfs` foi renomeado para `kubo`

[11] Para mais detalhes sobre a transição do `guix shell`, consulte `https://guix.gnu.org/en/blog/2021/from-guix-environment-to-guix-shell/`.

após uma decisão tomada upstream; para comunicar a mudança de nome aos usuários, o módulo do pacote forneceu esta definição:

```
(define-public go-ipfs
  (deprecated-package "go-ipfs" kubo))
```

Dessa forma, alguém executando `guix install go-ipfs` ou similar verá um aviso de descontinuação mencionando o novo nome.

Package removal

Pacotes cujos desenvolvedores originais declararam que atingiram o "fim da vida útil" ou não são mantidos podem ser removidos; da mesma forma, pacotes que estão **falhando na compilação por dois meses ou mais** podem ser removidos.

Não há um mecanismo formal de descontinuação para este caso, a menos que exista uma substituição, caso em que o procedimento `deprecated-package` mencionado acima pode ser usado.

Se o pacote que está sendo removido for um "leaf" (nenhum outro pacote depende dele), ele poderá ser removido após um **período de revisão de um mês** do patch que o removeu (isso se aplica mesmo quando a remoção tem motivações adicionais, como problemas de segurança que afetam o pacote).

Se tiver muitos pacotes dependentes — como é o caso, por exemplo, com a versão Python 2 — a equipe relevante deve propor uma agenda de remoção de descontinuação e buscar consenso com outros empacotadores por **pelo menos um mês**. Também pode convidar feedback da comunidade de usuários mais ampla, por exemplo, por meio de uma pesquisa. A remoção de todos os pacotes impactados pode ser gradual, abrangendo vários meses, para acomodar todos os casos de uso.

Quando o pacote que está sendo removido é considerado popular, seja ou não uma folha, sua descontinuação deve ser anunciada como uma entrada em `etc/news.scm`.

Package upgrade

No caso de pacotes com muitos dependentes e/ou muitos usuários, uma atualização pode ser tratada como a *remoção* da versão anterior.

Exemplos incluem grandes atualizações de versões de implementações de linguagens de programação, como vimos acima com Python, e grandes atualizações de bibliotecas "grandes" como Qt ou GTK.

Serviços Mudanças nos serviços para Guix Home e Guix System têm um impacto direto na configuração do usuário. Para um usuário, ajustar-se a mudanças de interface raramente é recompensador, e é por isso que qualquer mudança desse tipo deve ser claramente comunicada com antecedência por meio de avisos de descontinuação e documentação.

A renomeação de variáveis relacionadas a configuração de serviço, home ou sistema deve ser comunicada por pelo menos seis meses antes da remoção usando os mecanismos `(guix deprecation)`. Por exemplo, a renomeação de `murmur-configuration` para `mumble-server-configuration` foi comunicada por meio de uma série de definições como esta:

```
(define-deprecated/public-alias
```

```
  murmur-configuration
  mumble-server-configuration)
```

Os procedimentos previstos para remoção podem ser definidos assim:

```
(define-deprecated (elogind-service #:key (config (elogind-configuration)))
  elogind-service-type
  (service elogind-service-type config))
```

Campos de registro, notavelmente campos de registros de configuração de serviço, devem seguir um período de depreciação similar. Isso geralmente é obtido por meio de *ad hoc*. Por exemplo, o campo `hosts-file` de `operating-system` foi depreciado pela adição de uma propriedade `sanitized` que emitiria um aviso:

```
(define-record-type* <operating-system>
  ;; ...
  (hosts-file %operating-system-hosts-file         ;deprecated
              (default #f)
              (sanitize warn-hosts-file-field-deprecation)))

(define-deprecated (operating-system-hosts-file os)
  hosts-service-type
  (%operating-system-hosts-file os))
```

Ao descontinuar interfaces em `operating-system`, `home-environment`, `(gnu services)` ou qualquer serviço popular, a descontinuação deve vir com uma entrada em `etc/news.scm`.

Core interfaces

Interfaces de programação principais, em particular os módulos `(guix ...)`, podem ser confiáveis por uma variedade de ferramentas e canais externos. Qualquer alteração incompatível deve ser formalmente descontinuada com `define-deprecated`, como mostrado acima, por **pelo menos um ano** antes da remoção. O manual deve documentar claramente a nova interface e, exceto em casos óbvios, explicar como migrar da antiga.

Como exemplo, o procedimento `build-expression->derivation` foi substituído por `gexp->derivation` e permaneceu disponível como um símbolo obsoleto:

```
(define-deprecated (build-expression->derivation store name exp
                                                 #:key ...)
  gexp->derivation
  ...)
```

Às vezes, bindings são movidos de um módulo para outro. Nesses casos, bindings devem ser reexportados do módulo original por pelo menos um ano.

Esta seção não cobre todas as situações possíveis, mas espera-se que permita que os usuários saibam o que esperar e que os desenvolvedores se mantenham fiéis ao seu espírito. Por favor, envie um e-mail para `guix-devel@gnu.org` para quaisquer perguntas.

22.18 Escrevendo Documentação

Guix é documentado usando o sistema Texinfo. Se você ainda não está familiarizado com ele, aceitamos contribuições para documentação na maioria dos formatos. Isso inclui texto simples, Markdown, Org, etc.

Contribuições de documentação podem ser enviadas para `guix-patches@gnu.org`. Adicione '`[DOCUMENTATION]`' ao assunto.

Quando você precisar fazer mais do que uma simples adição à documentação, preferimos que você envie um patch adequado em vez de enviar um e-mail como descrito acima. Veja Seção 22.10 [Enviando patches], Página 746, para obter mais informações sobre como enviar seus patches.

Para modificar a documentação, você precisa editar `doc/guix.texi` e `doc/contributing.texi` (que contém esta seção de documentação), ou `doc/guix-cookbook.texi` para o livro de receitas. Se você compilou o repositório Guix antes, você terá muito mais arquivos `.texi` que são traduções desses documentos. Não os modifique, a tradução é gerenciada através de Weblate (`https://translate.fedoraproject.org/projects/guix`). Veja Seção 22.19 [Traduzindo o Guix], Página 766, para mais informações.

Para renderizar a documentação, você deve primeiro certificar-se de que executou `./configure` na sua árvore de origem (veja Seção 22.4 [Executando guix antes dele ser instalado], Página 725). Depois disso, você pode executar um dos seguintes comandos:

- '`make doc/guix.info`' para compilar o manual de informações. Você pode verificar com `info doc/guix.info`.
- '`make doc/guix.html`' para compilar a versão HTML. Você pode apontar seu navegador para o arquivo relevante no diretório `doc/guix.html`.
- '`make doc/guix-cookbook.info`' para o manual de informações do livro de receitas.
- '`make doc/guix-cookbook.html`' para a versão HTML do livro de receitas.

22.19 Traduzindo o Guix

Escrever código e pacotes não é a única maneira de fornecer uma contribuição significativa para o Guix. Traduzir para um idioma que você fala é outro exemplo de uma contribuição valiosa que você pode fazer. Esta seção foi criada para descrever o processo de tradução. Ela dá conselhos sobre como você pode se envolver, o que pode ser traduzido, quais erros você deve evitar e o que podemos fazer para ajudar você!

Guix é um grande projeto que tem vários componentes que podem ser traduzidos. Nós coordenamos o esforço de tradução em uma instância Weblate (`https://translate.fedoraproject.org/projects/guix/`) hospedada por nossos amigos no Fedora. Você precisará de uma conta para enviar traduções.

Alguns dos softwares empacotados no Guix também contêm traduções. Não hospedamos uma plataforma de tradução para eles. Se você quiser traduzir um pacote fornecido pelo Guix, entre em contato com os desenvolvedores ou encontre as informações no site deles. Como exemplo, você pode encontrar a homepage do pacote `hello` digitando `guix show hello`. Na linha "homepage", você verá `https://www.gnu.org/software/hello/` como a homepage.

Muitos pacotes GNU e não-GNU podem ser traduzidos no Translation Project (`https://translationproject.org`). Alguns projetos com múltiplos componentes têm sua própria plataforma. Por exemplo, o GNOME tem sua própria plataforma, Damned Lies (`https://l10n.gnome.org/`).

O Guix tem cinco componentes hospedados no Weblate.

- `guix` contém todas as strings do software Guix (o instalador de sistema guiado, gerenciador de pacotes, etc.), excluindo pacotes.
- `packages` contém a sinopse (descrição de uma única frase de um pacote) e descrição (descrição mais longa) de pacotes no Guix.
- `website` contém o site oficial do Guix, exceto para postagens de blog e conteúdo multimídia.
- `documentation-manual` corresponde a este manual.
- `documentation-cookbook` é o componente do livro de receitas.

General Directions

Depois de obter uma conta, você deve conseguir selecionar um componente do o projeto guix (`https://translate.fedoraproject.org/projects/guix/`) e selecionar um idioma. Se seu idioma não aparecer na lista, vá até o final e clique no botão "niciar nova tradução". Selecione o idioma para o qual deseja traduzir na lista para iniciar sua nova tradução.

Como muitos outros pacotes de software livre, o Guix usa GNU Gettext (`https://www.gnu.org/software/gettext`) para suas traduções, com as quais sequências traduzíveis são extraídas do código-fonte para os chamados arquivos PO.

Embora os arquivos PO sejam arquivos de texto, as alterações não devem ser feitas com um editor de texto, mas com um software de edição PO. O Weblate integra a funcionalidade de edição PO. Como alternativa, os tradutores podem usar qualquer uma das várias ferramentas de software livre para preencher traduções, das quais Poedit (`https://poedit.net/`) é um exemplo, e (após efetuar login) upload (`https://docs.weblate.org/en/latest/user/files.html`) o arquivo alterado. Há também um modo de edição PO (`https://www.emacswiki.org/emacs/PoMode`) especial para usuários do GNU Emacs. Com o tempo, os tradutores descobrem com qual software estão satisfeitos e quais recursos precisam.

No Weblate, você encontrará vários links para o editor, que mostrarão vários subconjuntos (ou todos) das strings. Dê uma olhada ao redor e na documentation (`https://docs.weblate.org/en/latest/`) para se familiarizar com a plataforma.

Componentes de tradução

Nesta seção, fornecemos orientações mais detalhadas sobre o processo de tradução, bem como detalhes sobre o que você deve ou não fazer. Em caso de dúvida, entre em contato conosco, ficaremos felizes em ajudar!

guix
: Guix é escrito na linguagem de programação Guile, e algumas strings contêm formatação especial que é interpretada pelo Guile. Essas formatações especiais devem ser destacadas pelo Weblate. Elas começam com `~` seguido por um ou mais caracteres.

  Ao imprimir a string, Guile substitui os símbolos especiais de formatação por valores reais. Por exemplo, a string ‘`ambiguous package specification ``~a''`

seria substituída para conter a dita especificação de pacote em vez de `~a`. Para traduzir corretamente essa string, você deve manter o código de formatação em sua tradução, embora você possa colocá-lo onde fizer sentido em seu idioma. Por exemplo, a tradução francesa diz '`spécification du paquet « ~a » ambiguë`' porque o adjetivo precisa ser colocado no final da frase.

Se houver vários símbolos de formatação, certifique-se de respeitar a ordem. O Guile não sabe em qual ordem você pretendia que a string fosse lida, então ele substituirá os símbolos na mesma ordem da frase em inglês.

Por exemplo, você não pode traduzir '`package '~a' has been superseded by '~a'`' como '`'~a' superseeds package '~a'`', porque o significado seria invertido. Se *foo* for substituído por *bar*, a tradução seria '`'foo' superseeds package 'bar'`'. Para contornar esse problema, é possível usar uma formatação mais avançada para selecionar um dado pedaço de dados, em vez de seguir a ordem padrão em inglês. Veja Seção "Formatted Output" em *GNU Guile Reference Manual*, para mais informações sobre formatação no Guile.

pacotes

As descrições de pacotes ocasionalmente contêm marcação Texinfo (veja Seção 22.8.4 [Sinopses e descrições], Página 738). A marcação Texinfo se parece com '`@code{rm -rf}`', '`@emph{important}`', etc. Ao traduzir, deixe a marcação como está.

Os caracteres após "@" formam o nome da marcação, e o texto entre "{" e "}" é seu conteúdo. Em geral, você não deve traduzir o conteúdo de uma marcação como `@code`, pois ela contém código literal que não muda com o idioma. Você pode traduzir o conteúdo de uma marcação de formatação como `@emph`, `@i`, `@itemize`, `@item`. No entanto, não traduza o nome da marcação, ou ela não será reconhecida. Não traduza a palavra após `@end`, é o nome da marcação que é fechado nesta posição (por exemplo, `@itemize ... @end itemize`).

documentation-manual e documentation-cookbook

O primeiro passo para garantir uma tradução bem-sucedida do manual é encontrar e traduzir as seguintes strings *primeiro*:

- `version.texi`: Traduza esta string como `version-xx.texi`, onde `xx` é o código do seu idioma (aquele mostrado na URL no weblate).
- `contributing.texi`: Traduzir esta string como `contributing.xx.texi`, onde `xx` é o mesmo código de idioma.
- `Top`: Não traduza esta string, ela é importante para o Texinfo. Se você traduzi-lo, o documento estará vazio (faltando um nó Top). Por favor, procure por ele e registre `Top` como sua tradução.

Traduzir essas strings primeiro garante que podemos incluir sua tradução no repositório guix sem interromper o processo de criação ou a máquina `guix pull`.

O manual e o livro de receitas usam Texinfo. Quanto a `packages`, mantenha a marcação Texinfo como está. Há mais tipos de marcação possíveis no manual do que nas descrições de pacotes. Em geral, não traduza o conteúdo de `@code`, `@file`, `@var`, `@value`, etc. Você deve traduzir o conteúdo da marcação de formatação, como `@emph`, `@i`, etc.

O manual contém seções que podem ser referenciadas pelo nome por `@ref`, `@xref` e `@pxref`. Temos um mecanismo em vigor para que você não tenha que traduzir o conteúdo delas. Se você mantiver o título em inglês, nós o substituiremos automaticamente pela sua tradução desse título. Isso garante que o Texinfo sempre será capaz de encontrar o nó. Se você decidir alterar a tradução do título, as referências serão atualizadas automaticamente e você não terá que atualizá-las todas sozinho.

Ao traduzir referências do livro de receitas para o manual, você precisa substituir o nome do manual e o nome da seção. Por exemplo, para traduzir `@pxref{Defining Packages,,, guix, GNU Guix Reference Manual}`, você substituiria `Defining Packages` pelo título daquela seção no manual traduzido *somente* se aquele título estiver traduzido. Se o título ainda não estiver traduzido para o seu idioma, não o traduza aqui, ou o link será quebrado. Substitua `guix` por `guix.xx` onde `xx` é o código do seu idioma. `GNU Guix Reference Manual` é o texto do link. Você pode traduzi-lo como quiser.

website

As páginas do site são escritas usando SXML, uma versão s-expression do HTML, a linguagem básica da web. Temos um processo para extrair strings traduzíveis da fonte e substituir s-expressions complexas por uma marcação XML mais familiar, onde cada marcação é numerada. Os tradutores podem alterar arbitrariamente a ordem, como no exemplo a seguir.

```
#. TRANSLATORS: Defining Packages is a section name
#. in the English (en) manual.
#: apps/base/templates/about.scm:64
msgid "Packages are <1>defined<1.1>en</1.1><1.2>Defining-Packages.html</1.2>
msgstr "Pakete werden als reine <2>Guile</2>-Module <1>definiert<1.1>de</1.1
```

Note que você precisa incluir as mesmas marcações. Você não pode pular nenhuma.

Caso você cometa um erro, o componente pode falhar ao construir corretamente com seu idioma, ou até mesmo fazer o guix pull falhar. Para evitar isso, temos um processo em vigor para verificar o conteúdo dos arquivos antes de enviar para nosso repositório. Não poderemos atualizar a tradução para seu idioma no Guix, então iremos notificá-lo (por meio do weblate e/ou por e-mail) para que você tenha a chance de corrigir o problema.

Fora do Weblate

Atualmente, algumas partes do Guix não podem ser traduzidas no Weblate. Precisamos de ajuda!

- `guix pull` news pode ser traduzido em `news.scm`, mas não é disponível no Weblate. Se você quiser fornecer uma tradução, pode preparar um patch conforme descrito acima, ou simplesmente nos enviar sua tradução com o nome da entrada de notícias que você traduziu e seu idioma. Veja Seção 6.12 [Escrevendo notícias do canal], Página 77, para mais informações sobre notícias do canal.
- As postagens do blog Guix não podem ser traduzidas no momento.
- O script do instalador (para distribuições estrangeiras) é inteiramente em inglês.

- Algumas das bibliotecas que o Guix usa não podem ser traduzidas ou são traduzidas fora do projeto Guix. O Guile em si não é internacionalizado.
- Outros manuais vinculados a este manual ou ao livro de receitas podem não estar disponíveis traduzido.

Condições de inclusão

Não há condições para adicionar novas traduções dos componentes `guix` e `guix-packages`, além de que eles precisam de pelo menos uma string traduzida. Novos idiomas serão adicionados ao Guix o mais rápido possível. Os arquivos podem ser removidos se ficarem fora de sincronia e não tiverem mais strings traduzidas.

Dado que o site é dedicado a novos usuários, queremos que sua tradução esteja o mais completa possível antes de incluí-la no menu de idiomas. Para que um novo idioma seja incluído, ele precisa atingir pelo menos 80% de conclusão. Quando um idioma é incluído, ele pode ser removido no futuro se ficar fora de sincronia e ficar abaixo de 60% de conclusão.

O manual e o livro de receitas são adicionados automaticamente no destino de compilação padrão. Toda vez que sincronizamos traduções, os desenvolvedores precisam recompilar todos os manuais e livros de receitas traduzidos. Isso é inútil para o que é essencialmente o manual ou livro de receitas em inglês. Portanto, só incluiremos um novo idioma quando ele atingir 10% de conclusão no componente. Quando um idioma é incluído, ele pode ser removido no futuro se ficar fora de sincronia e cair abaixo de 5% de conclusão.

Infraestrutura de tradução

O Weblate é apoiado por um repositório git do qual ele descobre novas strings para traduzir e envia traduções novas e atualizadas. Normalmente, seria suficiente dar a ele acesso de commit para nossos repositórios. No entanto, decidimos usar um repositório separado por dois motivos. Primeiro, teríamos que dar ao Weblate acesso de commit e autorizar sua chave de assinatura, mas não confiamos nele da mesma forma que confiamos nos desenvolvedores do guix, especialmente porque não gerenciamos a instância nós mesmos. Segundo, se os tradutores bagunçarem alguma coisa, isso pode quebrar a geração do site e/ou o guix pull para todos os nossos usuários, independentemente do idioma deles.

Por esses motivos, usamos um repositório dedicado para hospedar as traduções e o sincronizamos com nossos repositórios guix e artworks após verificar se nenhum problema foi introduzido na tradução.

Os desenvolvedores podem baixar os arquivos PO mais recentes do weblate no repositório Guix executando o comando `make download-po`. Ele baixará automaticamente os arquivos mais recentes do weblate, os reformatará para um formato canônico e verificará se eles não contêm problemas. O manual precisa ser construído novamente para verificar se há problemas adicionais que podem travar o Texinfo.

Antes de enviar novos arquivos de tradução, os desenvolvedores devem adicioná-los à maquinaria de make para que as traduções estejam realmente disponíveis. O processo difere para os vários componentes.

- Novos arquivos po para os componentes `guix` e `packages` devem ser registrado adicionando o novo idioma em `po/guix/LINGUAS` ou `po/packages/LINGUAS`.
- Novos arquivos po para o componente `documentation-manual` devem ser registrado adicionando o nome do arquivo em `DOC_PO_FILES` em `po/doc/local.mk`, o manual

gerado em `%D%/guix.xx.texi` em `info_TEXINFOS` em `doc/local.mk` e o gerado em `%D%/guix.xx.texi` e `%D%/contributing.xx.texi` em `TRANSLATED_INFO` também em `doc/local.mk`.

- Novos arquivos po para o componente `documentation-cookbook` devem ser registrado adicionando o nome do arquivo em `DOC_COOKBOOK_PO_FILES` em `po/doc/local.mk`, o manual gerado em `%D%/guix-cookbook.xx.texi` em `info_TEXINFOS` em `doc/local.mk` e o gerado em `%D%/guix-cookbook.xx.texi` em `TRANSLATED_INFO` também em `doc/local.mk`.
- Novos arquivos po para o componente `website` devem ser adicionados ao Repositório `guix-artwork`, em `website/po/`. `website/po/LINGUAS` e `website/po/ietf-tags.scm` devem ser atualizados adequadamente (veja `website/i18n-howto.txt` para mais informações sobre o processo).

23 Agradecimentos

Guix is based on the Nix package manager (`https://nixos.org/nix/`), which was designed and implemented by Eelco Dolstra, with contributions from other people (see the `nix/AUTHORS` file in Guix). Nix pioneered functional package management, and promoted unprecedented features, such as transactional package upgrades and rollbacks, per-user profiles, and referentially transparent build processes. Without this work, Guix would not exist.

As distribuições de software baseadas em Nix, Nixpkgs e NixOS, também foram uma inspiração para o Guix.

O GNU Guix em si é um trabalho coletivo com contribuições de várias pessoas. Veja o arquivo `AUTHORS` no Guix para obter mais informações sobre essas pessoas legais. O arquivo `THANKS` lista as pessoas que ajudaram a relatar erros, cuidar da infraestrutura, fornecer ilustrações e temas, fazer sugestões e muito mais – obrigado!

Apêndice A Licença de Documentação Livre GNU

Version 1.3, 3 November 2008

0. PREAMBLE

The purpose of this License is to make a manual, textbook, or other functional and useful document *free* in the sense of freedom: to assure everyone the effective freedom to copy and redistribute it, with or without modifying it, either commercially or non-commercially. Secondarily, this License preserves for the author and publisher a way to get credit for their work, while not being considered responsible for modifications made by others.

This License is a kind of "copyleft", which means that derivative works of the document must themselves be free in the same sense. It complements the GNU General Public License, which is a copyleft license designed for free software.

We have designed this License in order to use it for manuals for free software, because free software needs free documentation: a free program should come with manuals providing the same freedoms that the software does. But this License is not limited to software manuals; it can be used for any textual work, regardless of subject matter or whether it is published as a printed book. We recommend this License principally for works whose purpose is instruction or reference.

1. APPLICABILITY AND DEFINITIONS

This License applies to any manual or other work, in any medium, that contains a notice placed by the copyright holder saying it can be distributed under the terms of this License. Such a notice grants a world-wide, royalty-free license, unlimited in duration, to use that work under the conditions stated herein. The "Document", below, refers to any such manual or work. Any member of the public is a licensee, and is addressed as "you". You accept the license if you copy, modify or distribute the work in a way requiring permission under copyright law.

A "Modified Version" of the Document means any work containing the Document or a portion of it, either copied verbatim, or with modifications and/or translated into another language.

A "Secondary Section" is a named appendix or a front-matter section of the Document that deals exclusively with the relationship of the publishers or authors of the Document to the Document's overall subject (or to related matters) and contains nothing that could fall directly within that overall subject. (Thus, if the Document is in part a textbook of mathematics, a Secondary Section may not explain any mathematics.) The relationship could be a matter of historical connection with the subject or with related matters, or of legal, commercial, philosophical, ethical or political position regarding them.

The "Invariant Sections" are certain Secondary Sections whose titles are designated, as being those of Invariant Sections, in the notice that says that the Document is released

under this License. If a section does not fit the above definition of Secondary then it is not allowed to be designated as Invariant. The Document may contain zero Invariant Sections. If the Document does not identify any Invariant Sections then there are none.

The "Cover Texts" are certain short passages of text that are listed, as Front-Cover Texts or Back-Cover Texts, in the notice that says that the Document is released under this License. A Front-Cover Text may be at most 5 words, and a Back-Cover Text may be at most 25 words.

A "Transparent" copy of the Document means a machine-readable copy, represented in a format whose specification is available to the general public, that is suitable for revising the document straightforwardly with generic text editors or (for images composed of pixels) generic paint programs or (for drawings) some widely available drawing editor, and that is suitable for input to text formatters or for automatic translation to a variety of formats suitable for input to text formatters. A copy made in an otherwise Transparent file format whose markup, or absence of markup, has been arranged to thwart or discourage subsequent modification by readers is not Transparent. An image format is not Transparent if used for any substantial amount of text. A copy that is not "Transparent" is called "Opaque".

Examples of suitable formats for Transparent copies include plain ASCII without markup, Texinfo input format, LaTeX input format, SGML or XML using a publicly available DTD, and standard-conforming simple HTML, PostScript or PDF designed for human modification. Examples of transparent image formats include PNG, XCF and JPG. Opaque formats include proprietary formats that can be read and edited only by proprietary word processors, SGML or XML for which the DTD and/or processing tools are not generally available, and the machine-generated HTML, PostScript or PDF produced by some word processors for output purposes only.

The "Title Page" means, for a printed book, the title page itself, plus such following pages as are needed to hold, legibly, the material this License requires to appear in the title page. For works in formats which do not have any title page as such, "Title Page" means the text near the most prominent appearance of the work's title, preceding the beginning of the body of the text.

The "publisher" means any person or entity that distributes copies of the Document to the public.

A section "Entitled XYZ" means a named subunit of the Document whose title either is precisely XYZ or contains XYZ in parentheses following text that translates XYZ in another language. (Here XYZ stands for a specific section name mentioned below, such as "Acknowledgements", "Dedications", "Endorsements", or "History".) To "Preserve the Title" of such a section when you modify the Document means that it remains a section "Entitled XYZ" according to this definition.

The Document may include Warranty Disclaimers next to the notice which states that this License applies to the Document. These Warranty Disclaimers are considered to be included by reference in this License, but only as regards disclaiming warranties: any other implication that these Warranty Disclaimers may have is void and has no effect on the meaning of this License.

2. VERBATIM COPYING

You may copy and distribute the Document in any medium, either commercially or noncommercially, provided that this License, the copyright notices, and the license notice saying this License applies to the Document are reproduced in all copies, and that you add no other conditions whatsoever to those of this License. You may not use technical measures to obstruct or control the reading or further copying of the copies you make or distribute. However, you may accept compensation in exchange for copies. If you distribute a large enough number of copies you must also follow the conditions in section 3.

You may also lend copies, under the same conditions stated above, and you may publicly display copies.

3. COPYING IN QUANTITY

   If you publish printed copies (or copies in media that commonly have printed covers) of the Document, numbering more than 100, and the Document's license notice requires Cover Texts, you must enclose the copies in covers that carry, clearly and legibly, all these Cover Texts: Front-Cover Texts on the front cover, and Back-Cover Texts on the back cover. Both covers must also clearly and legibly identify you as the publisher of these copies. The front cover must present the full title with all words of the title equally prominent and visible. You may add other material on the covers in addition. Copying with changes limited to the covers, as long as they preserve the title of the Document and satisfy these conditions, can be treated as verbatim copying in other respects.

   If the required texts for either cover are too voluminous to fit legibly, you should put the first ones listed (as many as fit reasonably) on the actual cover, and continue the rest onto adjacent pages.

   If you publish or distribute Opaque copies of the Document numbering more than 100, you must either include a machine-readable Transparent copy along with each Opaque copy, or state in or with each Opaque copy a computer-network location from which the general network-using public has access to download using public-standard network protocols a complete Transparent copy of the Document, free of added material. If you use the latter option, you must take reasonably prudent steps, when you begin distribution of Opaque copies in quantity, to ensure that this Transparent copy will remain thus accessible at the stated location until at least one year after the last time you distribute an Opaque copy (directly or through your agents or retailers) of that edition to the public.

   It is requested, but not required, that you contact the authors of the Document well before redistributing any large number of copies, to give them a chance to provide you with an updated version of the Document.

4. MODIFICATIONS

   You may copy and distribute a Modified Version of the Document under the conditions of sections 2 and 3 above, provided that you release the Modified Version under precisely this License, with the Modified Version filling the role of the Document, thus licensing distribution and modification of the Modified Version to whoever possesses a copy of it. In addition, you must do these things in the Modified Version:

   A. Use in the Title Page (and on the covers, if any) a title distinct from that of the Document, and from those of previous versions (which should, if there were any,

be listed in the History section of the Document). You may use the same title as a previous version if the original publisher of that version gives permission.

B. List on the Title Page, as authors, one or more persons or entities responsible for authorship of the modifications in the Modified Version, together with at least five of the principal authors of the Document (all of its principal authors, if it has fewer than five), unless they release you from this requirement.

C. State on the Title page the name of the publisher of the Modified Version, as the publisher.

D. Preserve all the copyright notices of the Document.

E. Add an appropriate copyright notice for your modifications adjacent to the other copyright notices.

F. Include, immediately after the copyright notices, a license notice giving the public permission to use the Modified Version under the terms of this License, in the form shown in the Addendum below.

G. Preserve in that license notice the full lists of Invariant Sections and required Cover Texts given in the Document's license notice.

H. Include an unaltered copy of this License.

I. Preserve the section Entitled "History", Preserve its Title, and add to it an item stating at least the title, year, new authors, and publisher of the Modified Version as given on the Title Page. If there is no section Entitled "History" in the Document, create one stating the title, year, authors, and publisher of the Document as given on its Title Page, then add an item describing the Modified Version as stated in the previous sentence.

J. Preserve the network location, if any, given in the Document for public access to a Transparent copy of the Document, and likewise the network locations given in the Document for previous versions it was based on. These may be placed in the "History" section. You may omit a network location for a work that was published at least four years before the Document itself, or if the original publisher of the version it refers to gives permission.

K. For any section Entitled "Acknowledgements" or "Dedications", Preserve the Title of the section, and preserve in the section all the substance and tone of each of the contributor acknowledgements and/or dedications given therein.

L. Preserve all the Invariant Sections of the Document, unaltered in their text and in their titles. Section numbers or the equivalent are not considered part of the section titles.

M. Delete any section Entitled "Endorsements". Such a section may not be included in the Modified Version.

N. Do not retitle any existing section to be Entitled "Endorsements" or to conflict in title with any Invariant Section.

O. Preserve any Warranty Disclaimers.

If the Modified Version includes new front-matter sections or appendices that qualify as Secondary Sections and contain no material copied from the Document, you may at your option designate some or all of these sections as invariant. To do this, add their

titles to the list of Invariant Sections in the Modified Version's license notice. These titles must be distinct from any other section titles.

You may add a section Entitled "Endorsements", provided it contains nothing but endorsements of your Modified Version by various parties—for example, statements of peer review or that the text has been approved by an organization as the authoritative definition of a standard.

You may add a passage of up to five words as a Front-Cover Text, and a passage of up to 25 words as a Back-Cover Text, to the end of the list of Cover Texts in the Modified Version. Only one passage of Front-Cover Text and one of Back-Cover Text may be added by (or through arrangements made by) any one entity. If the Document already includes a cover text for the same cover, previously added by you or by arrangement made by the same entity you are acting on behalf of, you may not add another; but you may replace the old one, on explicit permission from the previous publisher that added the old one.

The author(s) and publisher(s) of the Document do not by this License give permission to use their names for publicity for or to assert or imply endorsement of any Modified Version.

5. COMBINING DOCUMENTS

You may combine the Document with other documents released under this License, under the terms defined in section 4 above for modified versions, provided that you include in the combination all of the Invariant Sections of all of the original documents, unmodified, and list them all as Invariant Sections of your combined work in its license notice, and that you preserve all their Warranty Disclaimers.

The combined work need only contain one copy of this License, and multiple identical Invariant Sections may be replaced with a single copy. If there are multiple Invariant Sections with the same name but different contents, make the title of each such section unique by adding at the end of it, in parentheses, the name of the original author or publisher of that section if known, or else a unique number. Make the same adjustment to the section titles in the list of Invariant Sections in the license notice of the combined work.

In the combination, you must combine any sections Entitled "History" in the various original documents, forming one section Entitled "History"; likewise combine any sections Entitled "Acknowledgements", and any sections Entitled "Dedications". You must delete all sections Entitled "Endorsements."

6. COLLECTIONS OF DOCUMENTS

You may make a collection consisting of the Document and other documents released under this License, and replace the individual copies of this License in the various documents with a single copy that is included in the collection, provided that you follow the rules of this License for verbatim copying of each of the documents in all other respects.

You may extract a single document from such a collection, and distribute it individually under this License, provided you insert a copy of this License into the extracted document, and follow this License in all other respects regarding verbatim copying of that document.

7. AGGREGATION WITH INDEPENDENT WORKS

   A compilation of the Document or its derivatives with other separate and independent documents or works, in or on a volume of a storage or distribution medium, is called an "aggregate" if the copyright resulting from the compilation is not used to limit the legal rights of the compilation's users beyond what the individual works permit. When the Document is included in an aggregate, this License does not apply to the other works in the aggregate which are not themselves derivative works of the Document.

   If the Cover Text requirement of section 3 is applicable to these copies of the Document, then if the Document is less than one half of the entire aggregate, the Document's Cover Texts may be placed on covers that bracket the Document within the aggregate, or the electronic equivalent of covers if the Document is in electronic form. Otherwise they must appear on printed covers that bracket the whole aggregate.

8. TRANSLATION

   Translation is considered a kind of modification, so you may distribute translations of the Document under the terms of section 4. Replacing Invariant Sections with translations requires special permission from their copyright holders, but you may include translations of some or all Invariant Sections in addition to the original versions of these Invariant Sections. You may include a translation of this License, and all the license notices in the Document, and any Warranty Disclaimers, provided that you also include the original English version of this License and the original versions of those notices and disclaimers. In case of a disagreement between the translation and the original version of this License or a notice or disclaimer, the original version will prevail.

   If a section in the Document is Entitled "Acknowledgements", "Dedications", or "History", the requirement (section 4) to Preserve its Title (section 1) will typically require changing the actual title.

9. TERMINATION

   You may not copy, modify, sublicense, or distribute the Document except as expressly provided under this License. Any attempt otherwise to copy, modify, sublicense, or distribute it is void, and will automatically terminate your rights under this License.

   However, if you cease all violation of this License, then your license from a particular copyright holder is reinstated (a) provisionally, unless and until the copyright holder explicitly and finally terminates your license, and (b) permanently, if the copyright holder fails to notify you of the violation by some reasonable means prior to 60 days after the cessation.

   Moreover, your license from a particular copyright holder is reinstated permanently if the copyright holder notifies you of the violation by some reasonable means, this is the first time you have received notice of violation of this License (for any work) from that copyright holder, and you cure the violation prior to 30 days after your receipt of the notice.

   Termination of your rights under this section does not terminate the licenses of parties who have received copies or rights from you under this License. If your rights have been terminated and not permanently reinstated, receipt of a copy of some or all of the same material does not give you any rights to use it.

10. FUTURE REVISIONS OF THIS LICENSE

    The Free Software Foundation may publish new, revised versions of the GNU Free Documentation License from time to time. Such new versions will be similar in spirit to the present version, but may differ in detail to address new problems or concerns. See `https://www.gnu.org/copyleft/`.

    Each version of the License is given a distinguishing version number. If the Document specifies that a particular numbered version of this License "or any later version" applies to it, you have the option of following the terms and conditions either of that specified version or of any later version that has been published (not as a draft) by the Free Software Foundation. If the Document does not specify a version number of this License, you may choose any version ever published (not as a draft) by the Free Software Foundation. If the Document specifies that a proxy can decide which future versions of this License can be used, that proxy's public statement of acceptance of a version permanently authorizes you to choose that version for the Document.

11. RELICENSING

    "Massive Multiauthor Collaboration Site" (or "MMC Site") means any World Wide Web server that publishes copyrightable works and also provides prominent facilities for anybody to edit those works. A public wiki that anybody can edit is an example of such a server. A "Massive Multiauthor Collaboration" (or "MMC") contained in the site means any set of copyrightable works thus published on the MMC site.

    "CC-BY-SA" means the Creative Commons Attribution-Share Alike 3.0 license published by Creative Commons Corporation, a not-for-profit corporation with a principal place of business in San Francisco, California, as well as future copyleft versions of that license published by that same organization.

    "Incorporate" means to publish or republish a Document, in whole or in part, as part of another Document.

    An MMC is "eligible for relicensing" if it is licensed under this License, and if all works that were first published under this License somewhere other than this MMC, and subsequently incorporated in whole or in part into the MMC, (1) had no cover texts or invariant sections, and (2) were thus incorporated prior to November 1, 2008.

    The operator of an MMC Site may republish an MMC contained in the site under CC-BY-SA on the same site at any time before August 1, 2009, provided the MMC is eligible for relicensing.

ADDENDUM: How to use this License for your documents

To use this License in a document you have written, include a copy of the License in the document and put the following copyright and license notices just after the title page:

```
Copyright (C)  year  your name.
Permission is granted to copy, distribute and/or modify this document
under the terms of the GNU Free Documentation License, Version 1.3
or any later version published by the Free Software Foundation;
with no Invariant Sections, no Front-Cover Texts, and no Back-Cover
Texts.  A copy of the license is included in the section entitled ``GNU
Free Documentation License''.
```

If you have Invariant Sections, Front-Cover Texts and Back-Cover Texts, replace the "with. . . Texts." line with this:

```
with the Invariant Sections being list their titles, with
the Front-Cover Texts being list, and with the Back-Cover Texts
being list.
```

If you have Invariant Sections without Cover Texts, or some other combination of the three, merge those two alternatives to suit the situation.

If your document contains nontrivial examples of program code, we recommend releasing these examples in parallel under your choice of free software license, such as the GNU General Public License, to permit their use in free software.

Índice de conceitos

D

E

F

G

H

I

J

K

L

M

N

O

P

Q

R

S

T

U

V

W

X

Z

Índice de programação

G

H

I

K

L

M

N

O

P

Q

R

S

T

U

V

W

X