Composing System Services in GuixSD

or how we came to wonder what a "system service" really is

FOSDEM, February 2017

GuixSD

```
(operating-system
  (host-name "schememachine")
  (timezone "Europe/Brussels")
  (locale "fr_BE.utf8")
  (bootloader (grub-configuration (device "/dev/sda")))
  (file-systems (cons (file-system
                        (device "my-root")
                        (title 'label)
                        (mount-point "/")
                        (type "ext4"))
                      %base-file-systems))
  (users (cons (user-account
                 (name "charlie")
                 (group "users")
                 (home-directory "/home/charlie"))
               %base-user-accounts))
  (services (cons* (dhcp-client-service)
                   (service openssh-service-type)
                   %base-services)))
```

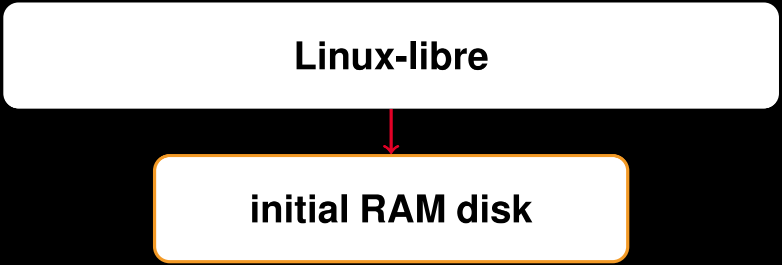
```
(service openssh-service-type
         (openssh-configuration
           (x11-forwarding? #t)
           (permit-root-login ’without-password)))
```

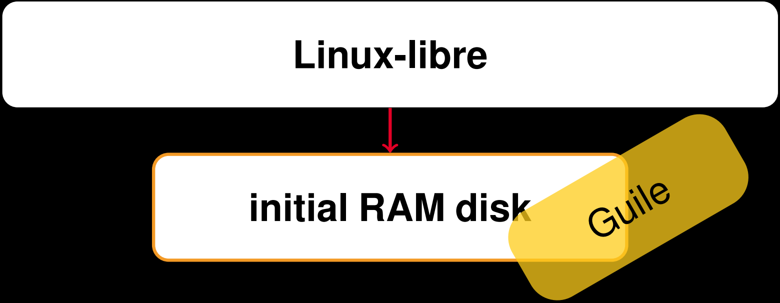
```
(operating-system
  ;; …
  (services (remove (lambda (service)
                      (eq? ntp-service-type
                           (service-kind service)))
                    %desktop-services)))
```

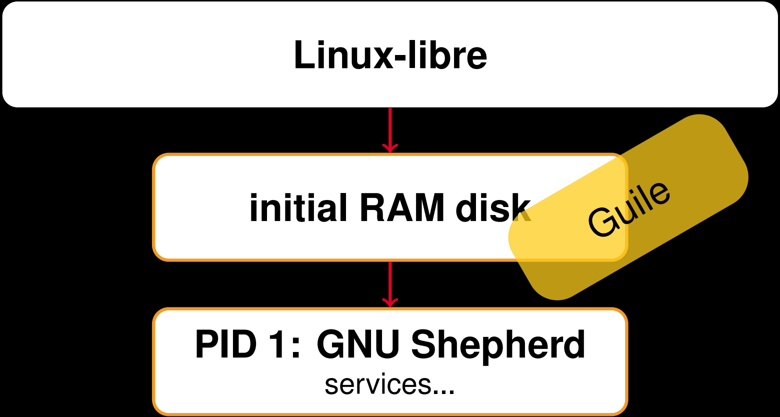
```scheme
(define %my-services
  ;; My very own list of services.
  (modify-services %desktop-services
    (mingetty-service-type config =>
                           (mingetty-configuration
                            (inherit config)
                            (motd (plain-file "motd"
                                    "Howdy FOSDEM!"))))
    (upower-service-type config =>
                         (upower-configuration
                          (inherit config)
                          (ignore-lid? #true)
                          (percentage-critical 5.)))))
```

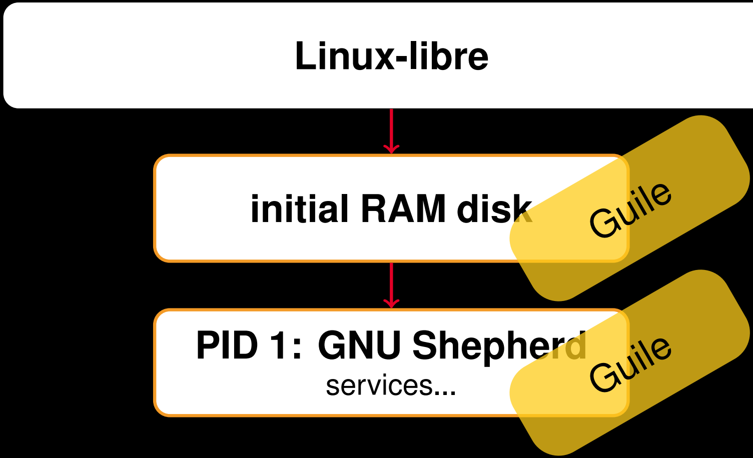
```
$ guix system build config.scm
…

$ guix system vm config.scm
…

$ guix system container config.scm
…

$ guix system reconfigure config.scm
…
```

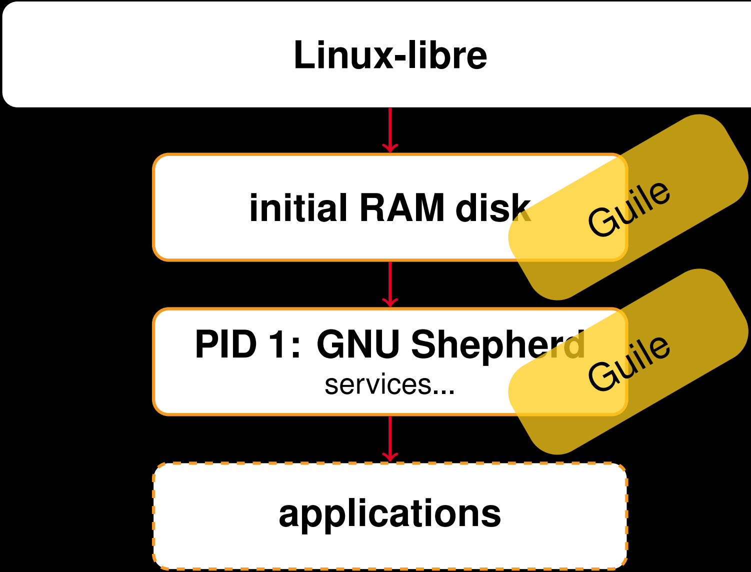
Linux-libre


Linux-libre
initial RAM disk


Linux-libre
initial RAM disk
Guile


Linux-libre
initial RAM disk
Guile
PID 1: GNU Shepherd
services...


Linux-libre
initial RAM disk
Guile
PID 1: GNU Shepherd
services...
Guile


Linux-libre
initial RAM disk
Guile
PID 1: GNU Shepherd
services...
Guile
applications

```scheme
;; Service definition for the GNU Shepherd (PID 1)
;; embedded in GuixSD.

(shepherd-service
  (provision '(mysql))
  (documentation "Run the MySQL server.")
  (start (let ((my.cnf (mysql-configuration-file config)))
           #~(make-forkexec-constructor
              (list (string-append #$mysql "/bin/mysqld")
                    (string-append "--defaults-file="
                                   #$my.cnf))
              #:user "mysql" #:group "mysql")))
  (stop #~(make-kill-destructor)))
```

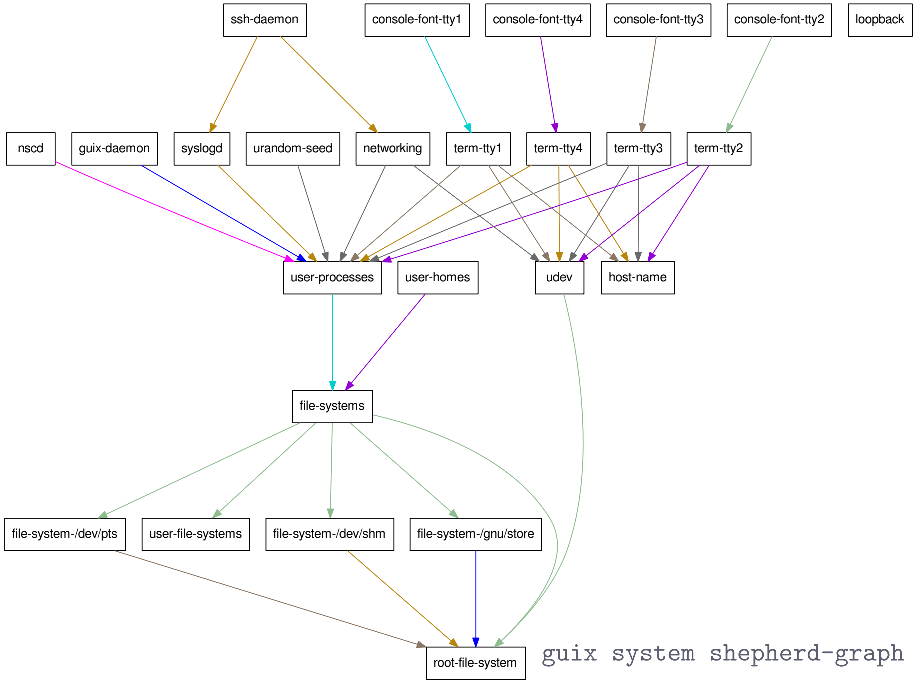
```
;; Shepherd service to mount/unmount a file system.

(with-imported-modules '((gnu build file-systems))
  (shepherd-service
    (provision '(file-system-/home))
    (start #~(lambda ()
               (mount "/dev/foo" "/home" "ext4")))
    (stop #~(lambda ()
              (umount "/home")))))
```

```
;; Shepherd service for the BitlBee IRC gateway daemon.


  (shepherd-service
    (provision '(bitlbee))
    (requirement '(loopback))
    (start #~(make-forkexec-constructor
              (list #$(file-append bitlbee "/sbin/bitlbee")
                    ...)))
    (stop  #~(make-kill-destructor)))
```

```
;; Shepherd service for the BitlBee IRC gateway daemon.
;; Running in a container!

(with-imported-modules '((gnu build linux-container))
  (shepherd-service
    (provision '(bitlbee))
    (requirement '(loopback))
    (start #~(make-forkexec-constructor/container
               (list #$(file-append bitlbee "/sbin/bitlbee"
                     ...)))
    (stop  #~(make-kill-destructor))))
```

world première!

Services, take #1.



`guix system shepherd-graph`

```
(service
  (provision '(postgres))
  (requirement '(user-processes loopback))
  (start #~(make-forkexec-constructor #$postgresql ...))
  (stop #~(make-kill-destructor)))
```

```
(service
  (provision '(postgres))
  (requirement '(user-processes loopback))
  (start #~(make-forkexec-constructor #$postgresql ...))
  (stop #~(make-kill-destructor))
  (activate #~(begin ...)))
```

```
(service
  (provision '(postgres))
  (requirement '(user-processes loopback))
  (start #~(make-forkexec-constructor #$postgresql ...))
  (stop #~(make-kill-destructor))
  (activate #~(begin ...))
  (user-groups (list (user-group
                      (name "postgres")
                      (system? #t))))
  (user-accounts (list (user-account
                        (name "postgres")
                        (group "postgres")
                        (system? #t)
                        (shell ...)))))
```

+ PAM

```
(service
  (provision '(postgres))
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  (start #~(make-forkexec-constructor #$postgresql ...))
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```

```
(service
  (provision '(postgres))
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  (start #~(make-forkexec-constructor #$postgresql ...))
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  (user-groups (list (user-group
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                       (system? #t))))
  (user-accounts (list (user-account
                         (name "postgres")
                         (group "postgres")
                         (system? #t)
                         (shell ...)))))
```

+ PAM

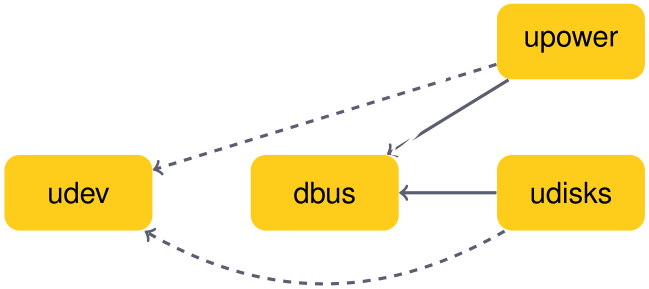
+ /etc

freedesktop.org

udev

dbus

freedesktop.org



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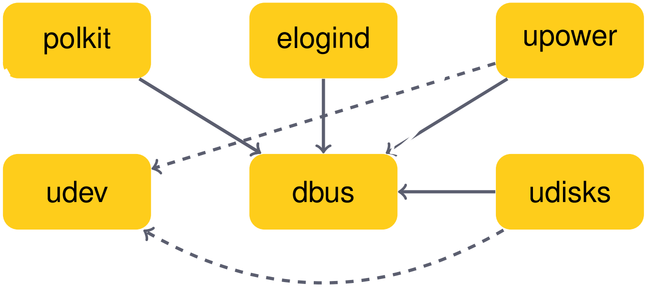

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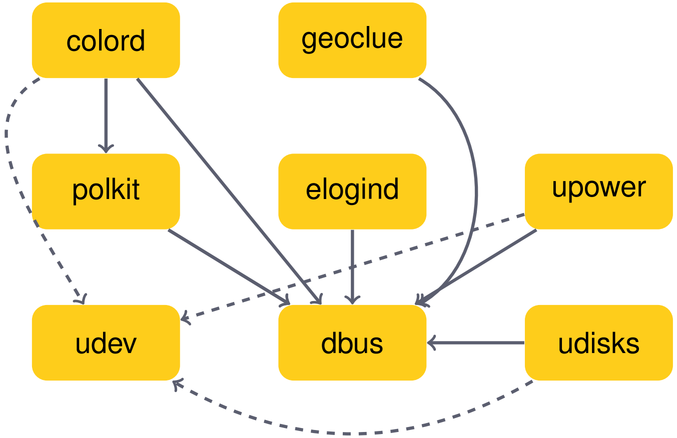


freedesktop.org

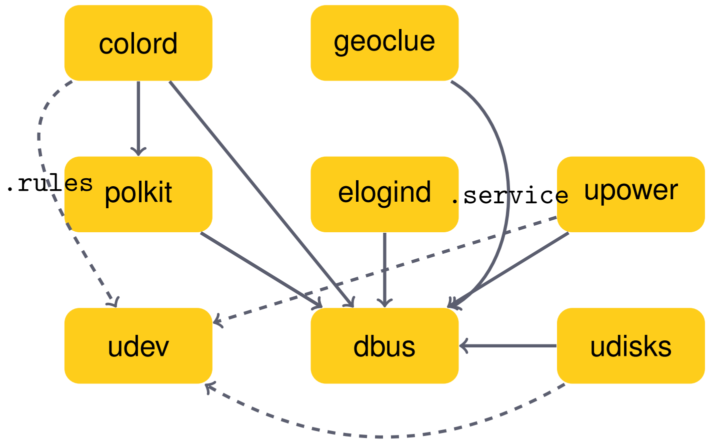
Composable services.

Key insight: services “extend” each other.

Digression:
NixOS configuration.

```
{ config, lib, pkgs, ... }:
let
  cfg = config.services.openssh;
in {
  options = …;

  config = mkIf cfg.enable {
    users.extraUsers.sshd = { isSystemUser = true; };
    environment.etc = authKeysFiles //
      { "ssh/moduli".source = cfg.moduliFile; };
    systemd.services.sshd-service =
      {  wantedBy = "multi-user.target";
         # …
      };
    security.pam.services.sshd =
      { startSession = true;
        unixAuth = cfg.passwordAuthentication;
      };
}
```


colord
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polkit
elogind
upower
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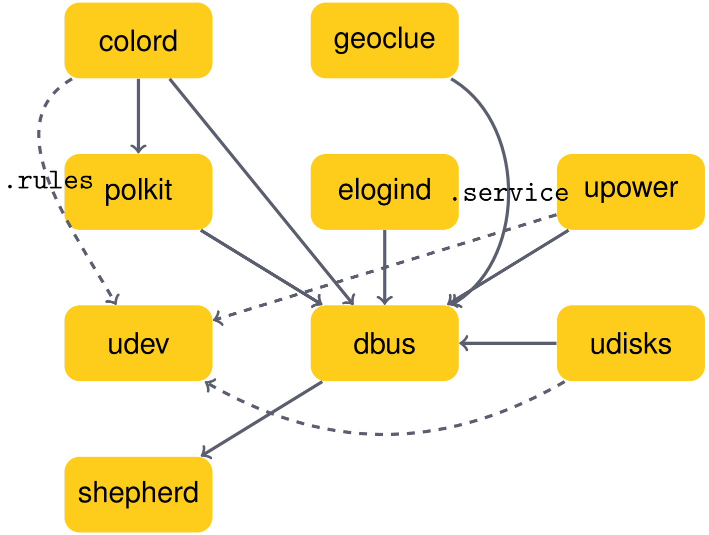
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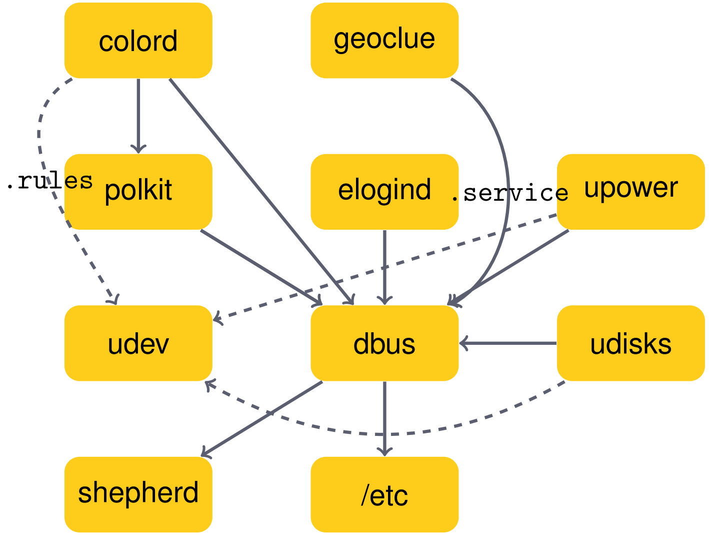
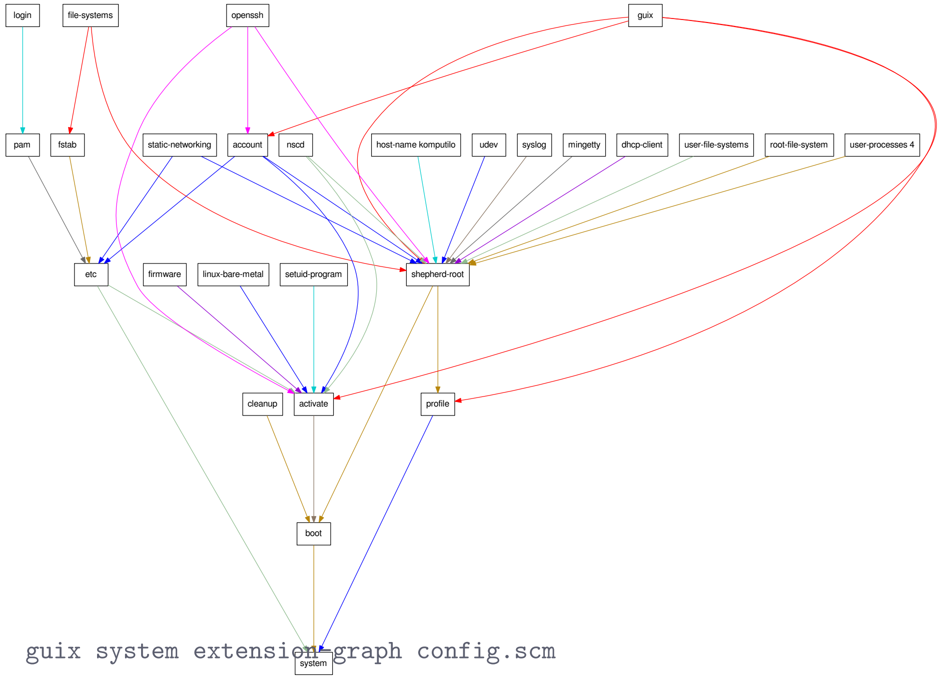

colord
geoclue
polkit
elogind
upower
.rules
.service
udev
dbus
udisks
shepherd
/etc

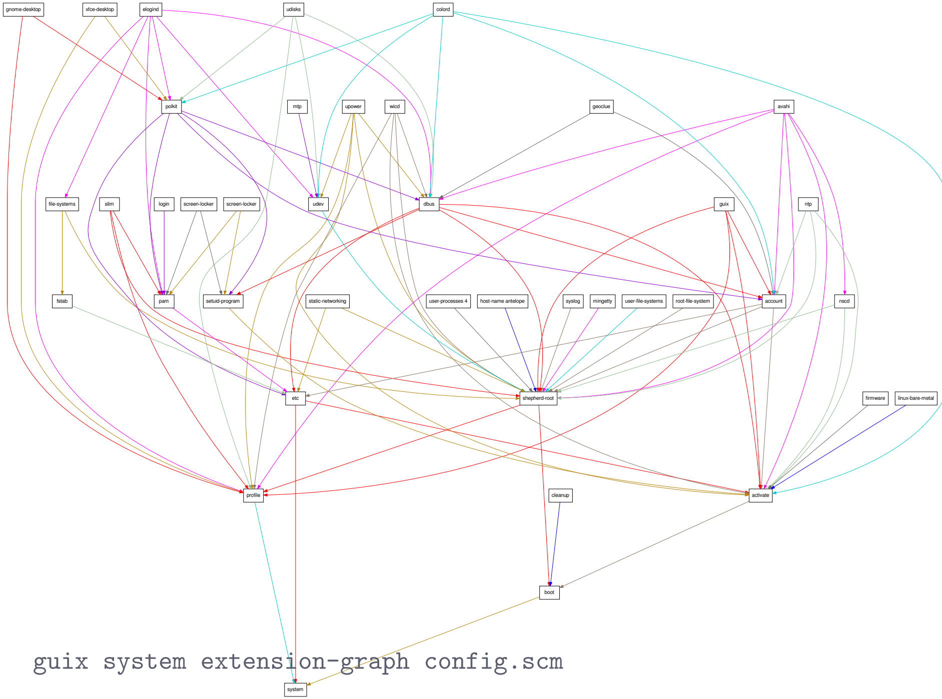
what users type

```
(operating-system
  (host-name "schememachine")
  ;; ...
  (services (cons* (dhcp-client-service)
                   (service openssh-service-type
                            (openssh-configuration
                              (x11-forwarding? #t)
                              (permit-root-login
                                'without-password)))
                   (service nginx-service-type ...)
                   %base-services)))
```

Services,
service types.



```
guix system extension-graph config.scm
```



```
guix system extension-graph config.scm
```

fold-services.

Dear Haskeller,
this is a monoid!

Wrap-up.

GuixSD leverages
a holistic approach
to system services.

- services can **use and extend** PID 1
- “service extensions” capture
  ***all* the service aspects**
- makes complex configurations **tractable**

- services can **use and extend** PID 1
- “service extensions” capture
  ***all* the service aspects**
- makes complex configurations **tractable**
- **come up with your own services!**

GuixSD

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https://gnu.org/software/guix/