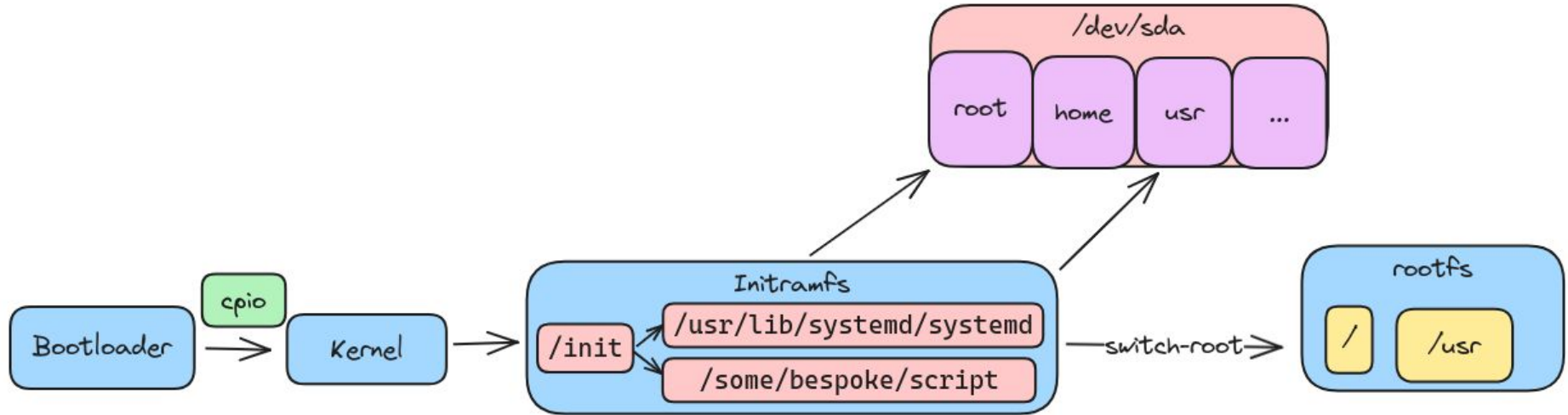# mkosi-initrd: Building initrds out of distribution packages
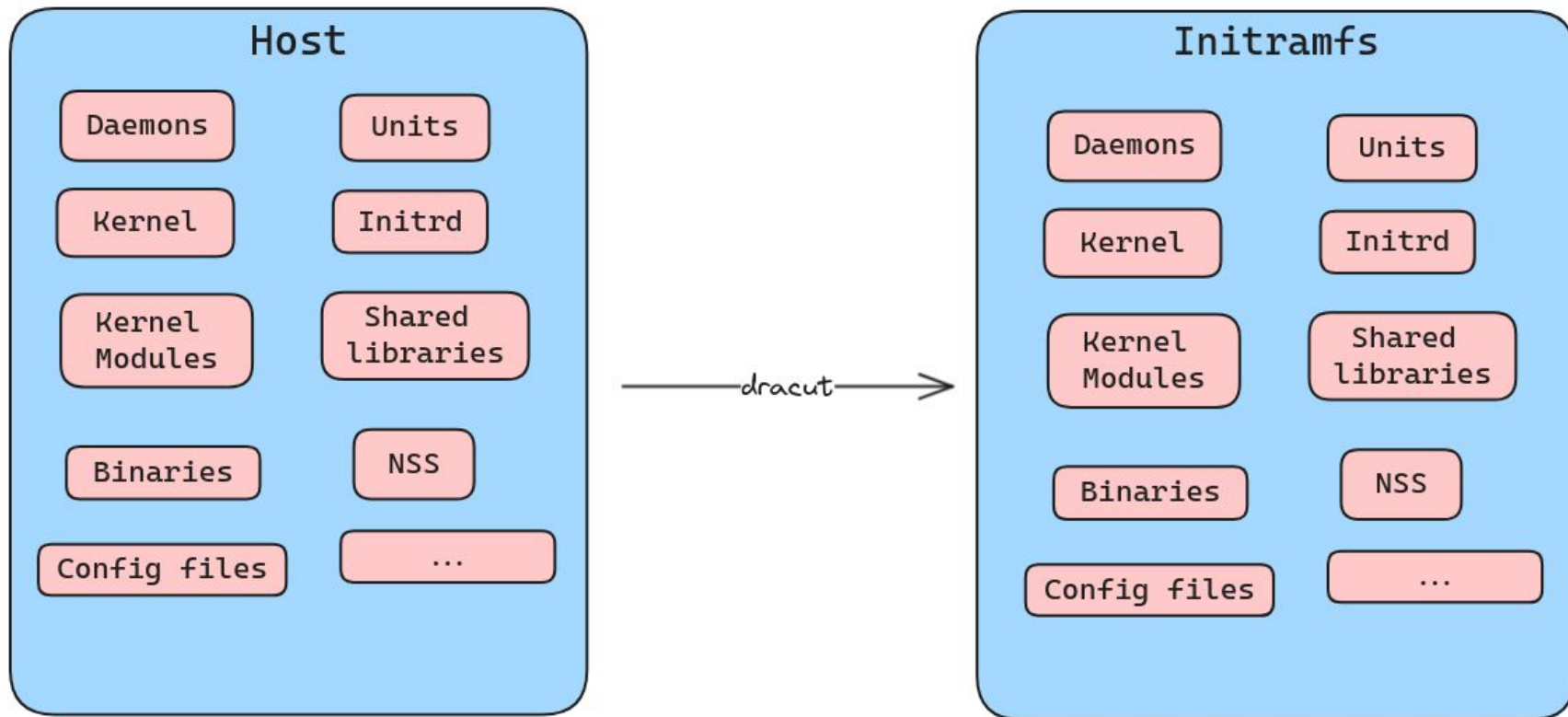
About Us

- Daan De Meyer

- systemd/mkosi maintainer

- Linux Userspace Team @ Meta

- Zbigniew Jędrzejewski-Szmek

- systemd/mkosi maintainer

- Fedora Engineering Steering Committee

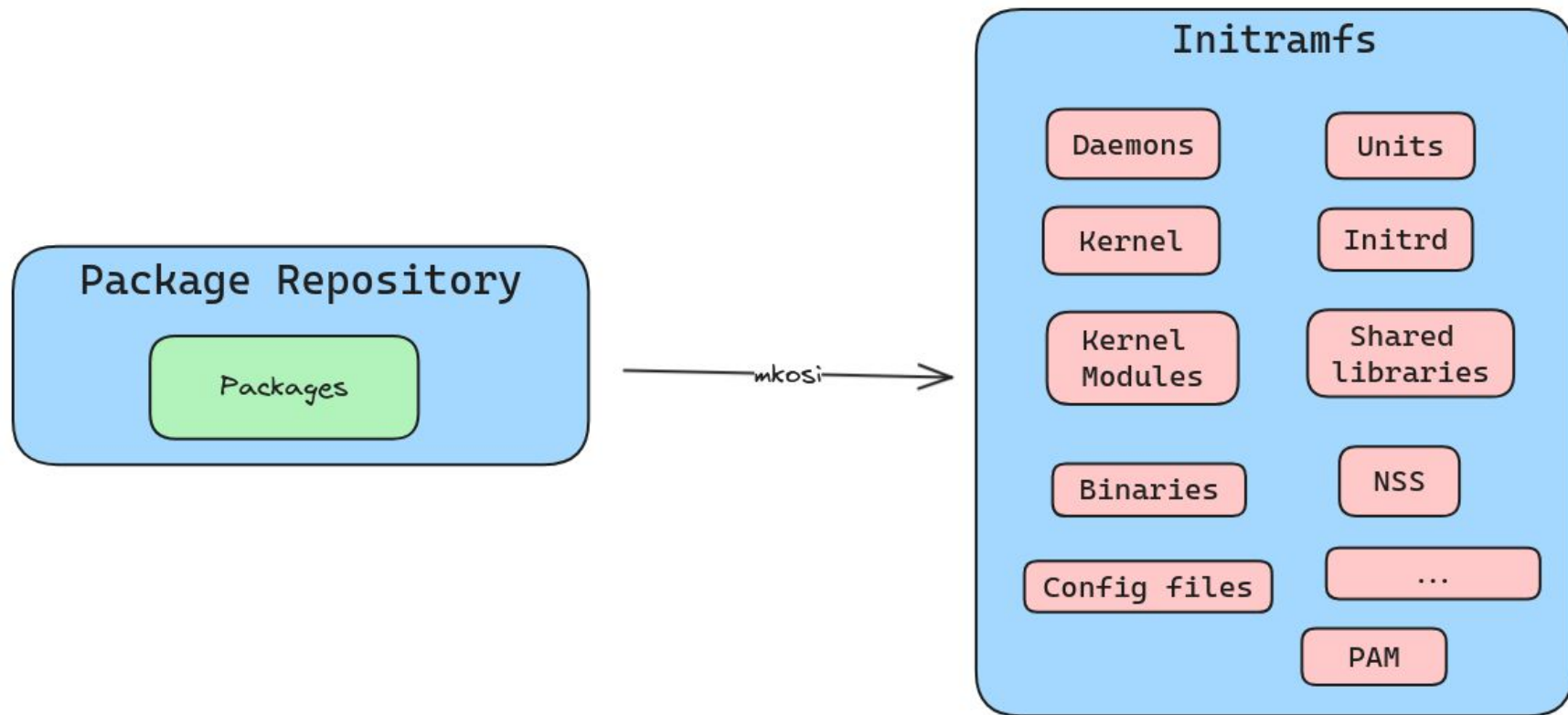- Linux Plumbers Team @ Red Hat

Why do we need an initrd?

Status quo

Problems with the Status Quo

- Packaging + dracut packaging => https://github.com/dracutdevs/dracut/pull/2535

- Unclear where to report bugs

- Hard to customize

- Slow

Goal

# Advantages of building the initrd out of packages

- Reliable installation => package managers are good at installing packages

- Sane dependency resolution => package managers are good at tracking dependencies

- Reproducible => We don't pull files from the host

- No need to learn yet another system

- Clear ownership of bugs

- Any packaging improvements automatically apply to the initrd

- Initrd can be built off-host and signed for secure boot via UKI

Requirements to build the initrd out of packages

- Careful packaging is required to keep the initramfs size manageable

- Low hanging fruit:

    - gcc-libs should be a split package

    - Kernel modules should be packaged separately from the kernel

    - There should be a minimal locale package

    - ...

What is mkosi?
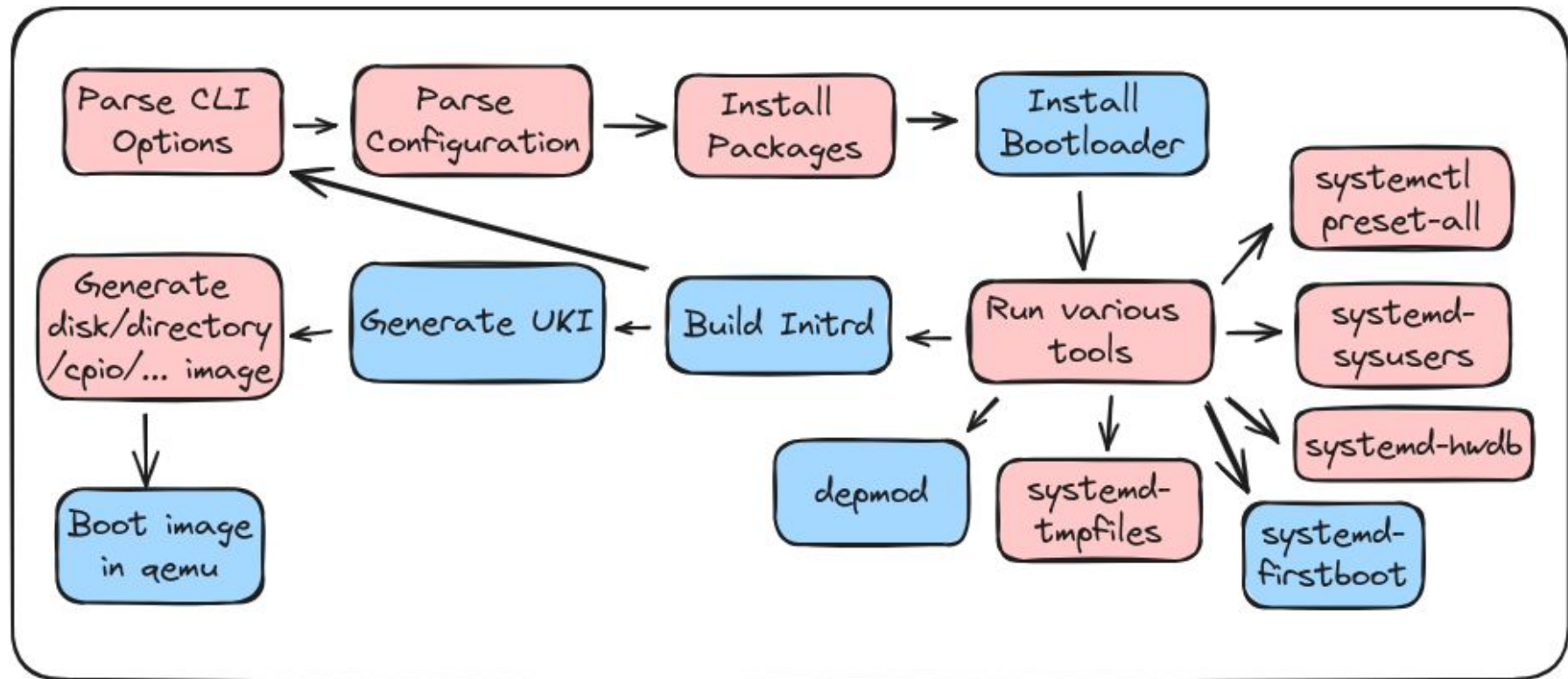
Quick Start

mkosi -d arch -p systemd -p linux --autologin qemu

```
CentOS Stream 9
Kernel 5.14.0-350.el9.x86_64 on an x86_64

localhost login: root (automatic login)

Last login: Wed Aug  9 12:44:36 on tty1
[root@localhost ~]#
```

```
localhost login: root (automatic login)

Have a lot of fun...
localhost:~ #
```

```
Debian GNU/Linux trixie/sid localhost ttyS0

localhost login: root (automatic login)

Linux localhost 6.4.0-1-amd64 #1 SMP PREEMPT_DYNAMIC Debian 6.4.4-2 (2023-07-30) x86_64

The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Wed Aug  9 10:30:29 UTC 2023 on tty1
root@localhost:~#
```

```
Arch Linux 6.4.8-arch1-1 (ttyS0)

archlinux login: root (automatic login)

[root@archlinux ~]#
```

```
Ubuntu 23.04 localhost ttyS0

localhost login: root (automatic login)

Welcome to Ubuntu 23.04 (GNU/Linux 6.2.0-1009-kvm x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/advantage
Last login: Wed Aug  9 10:25:24 UTC 2023 on ttyS0
root@localhost:~#
```

```
Fedora Linux 39 (Rawhide Prerelease)
Kernel 6.5.0-0.rc5.36.fc39.x86_64 on an x86_64 (ttyS0)

fedora login: root (automatic login)

[root@fedora ~]#
```

No root privileges required!
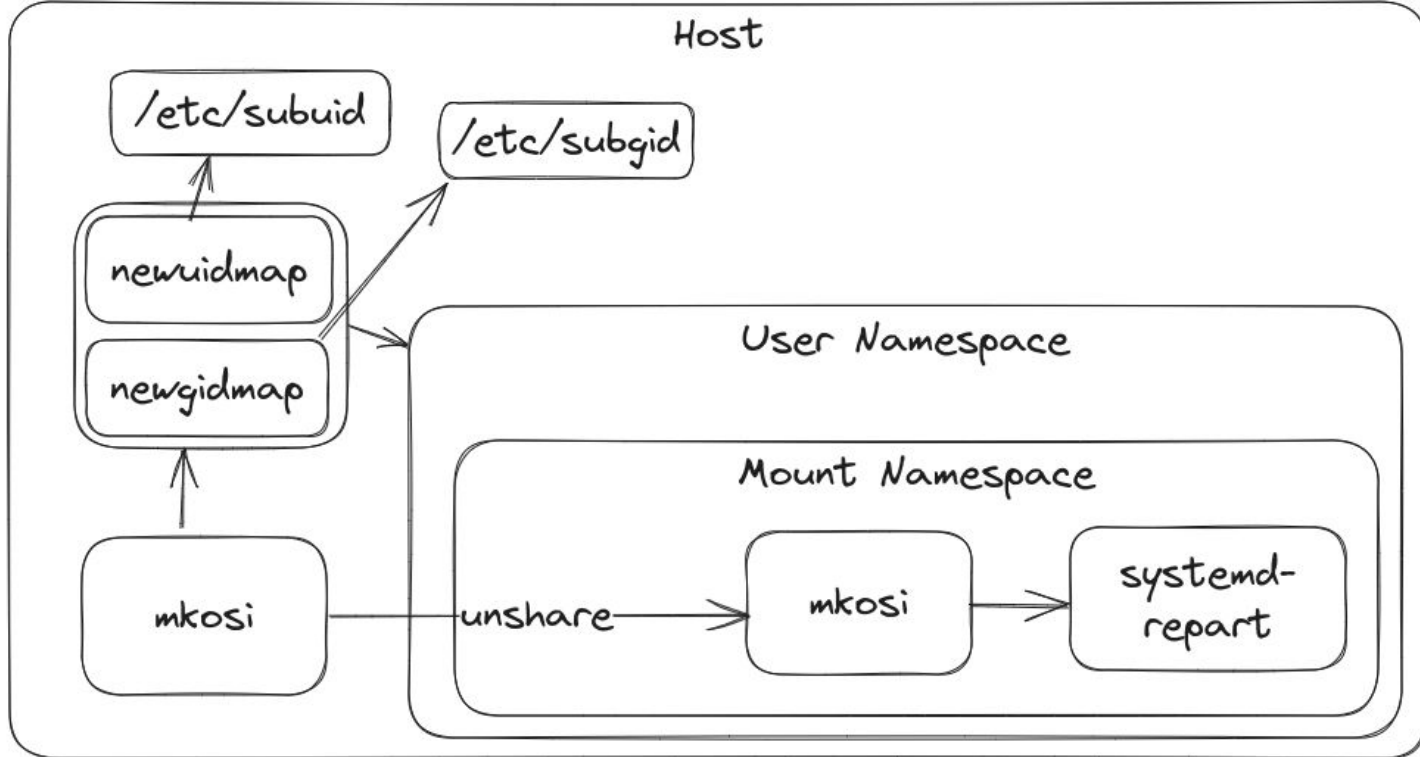
Configuration

```
[Match]
Distribution=fedora

[Distribution]
Release=rawhide

[Content]
Packages=kernel-core
         systemd
         systemd-boot
         udev
         util-linux
         grub2-pc
```

mkosi-initrd

- A mkosi configuration to build initramfs images

- Used to be standalone, now part of mkosi itself

- Used to build the default initramfs for mkosi images

- Support for Arch, Ubuntu, Debian, OpenSUSE, CentOS, Fedora, ...

mkosi-initrd kernel-install plugin

- Configured in install.conf

- Either as initrd generator or as UKI generator

- microcode is included

- Reuses package manager caches from /var

- Customizations in /usr/lib/mkosi-initrd or /etc/mkosi-initrd

```
initrd_generator=mkosi
uki_generator=ukify
layout=bls
```
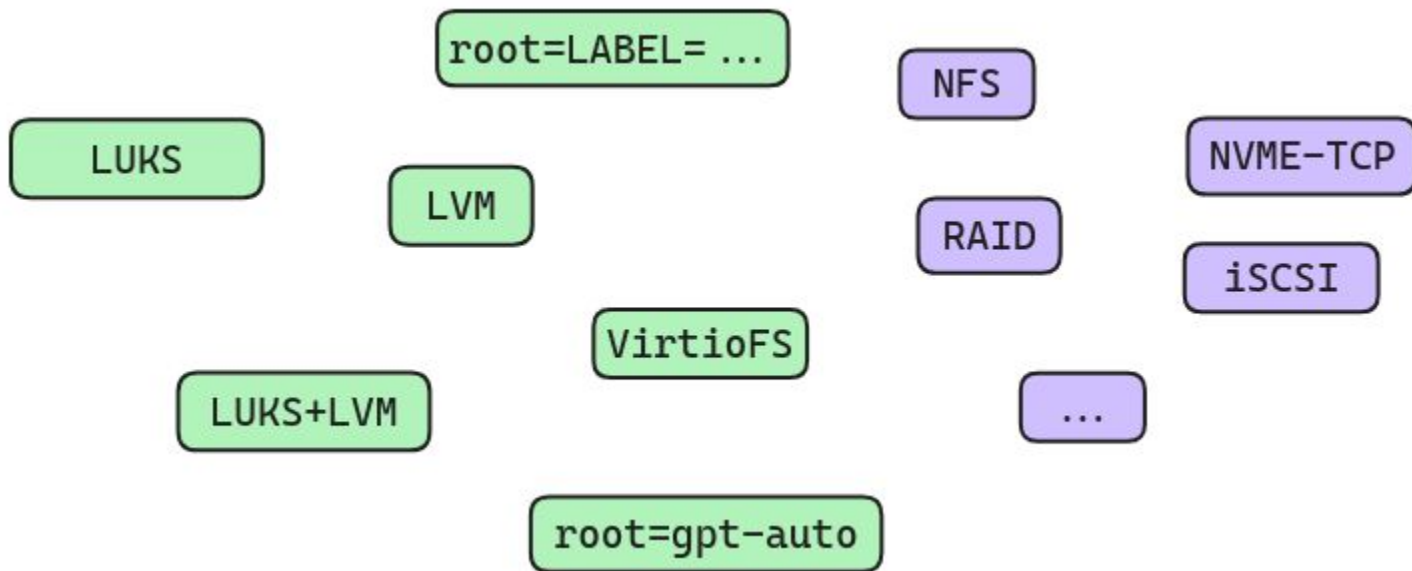
```
uki_generator=mkosi
layout=uki
```

mkosi-initrd standalone

```
mkosi
  --include mkosi-initrd
  --extra-tree /usr/lib/modules/$(uname -r):/usr/lib/modules/$(uname -r)
  --extra-tree /usr/lib/firmware:/usr/lib/firmware
  --kernel-modules-exclude=".*"
  --kernel-modules-include-host=yes
```

Integration tests

https://github.com/systemd/mkosi/tree/main/mkosi/resources/mkosi-initrd