

# Getting your system to boot with initrd and initramfs

Ryan Curtin

LUG@GT

# Goals

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### Configuring your bootloader

### Questions and Comments?

By the end of this presentation, hopefully, you should be able to:

- Know the basic history of initrd and initramfs, and why they exist
- Know how to configure GRUB / LILO to use an initrd or initramfs
- Unpack and look inside an initrd or initramfs
- Use standard tools to generate a new initrd or initramfs
- Modify an initrd and initramfs by hand or through configuration files
- Know how to configure a kernel to avoid using an initrd or initramfs

# History of initrd and initramfs

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Questions and Comments?

- The idea of an initrd has been around almost as long as Linux itself, going back to the 1.xx kernels<sup>a</sup>
- It exists to load modules that are required by the kernel at boot-time, but not compiled into the kernel
- The concept exists today in 2.6 kernels as `initramfs` and is used by distributions such as Fedora, Red Hat, Ubuntu, and Debian (there are more, of course)

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<sup>a</sup><http://ussg.iu.edu/hypermail/linux/kernel/9602/1289.html>

# Internals of an initrd

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- The initrd is usually a cpio archive passed through gzip
- Inside the archive is a straightforward simple directory hierarchy, similar to the standard Linux filesystem hierarchy
- You can crack open an archive with

```
$ gzip -dc initrd.img | cpio -idv
```

- /linuxrc and /init contain the script that is run to boot the system

# `/linuxrc` or `/init` - the initialization script

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- `/linuxrc` or `/init` is the first executable started once the `initrd` or `initramfs` is loaded by the kernel
- `/linuxrc` is used in the older `initrd`
- `/init` is used in the newer `initramfs`
- This executable is usually a shell script; Debian uses `/bin/sh` but Red Hat uses `/bin/nash`; it does not matter which shell/interpreter is used

# So what makes initrd and initramfs different?

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- Both `initrd` and `initramfs` exist to solve the same problem; however, `initramfs` is used by modern 2.6 kernels whereas `initrd` was used by older 2.4 (and earlier) kernels
- `initramfs` uses a dynamically-allocated RAM filesystem; `initrd` uses a statically-allocated RAM disk
- A filesystem driver is required to read a `initrd` image at boot-time; `initramfs` requires only a lightweight ramfs driver, which is built-in by default in 2.6 kernels
- `initramfs` makes NFS-mounted root filesystems easier; DHCP and logins may be necessary to mount an NFS share as root

# The Red Hat way

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- The Red Hat utility for generating an `initramfs` is `mkinitrd`
- This utility seems to use the term `initrd` and `initramfs` interchangeably, as it produces an `initramfs`

General syntax:

```
mkinitrd -allow-missing -f initrd.img kernel-version
```

The `mkinitrd` command is referenced by

- `/sbin/new-kernel-pkg`
- `/sbin/installkernel`

`/etc/modprobe.conf` controls the modules that are put into the `initramfs`.

# The Debian way

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- The Debian utility for creating an `initramfs` is the slightly-more-aptly-named `mkinitramfs`
- Another utility is `updateinitramfs`, which can update the `initramfs` for all kernels on your machine
- `yaird` will also generate an `initramfs`, but it is less tested than the other Debian tools

A comparison of methods -

- `yaird` will generate a rather small `initramfs` by default; `initramfs-tools` will not
- `initramfs-tools` will create an `initramfs` no matter what; `yaird` will stop if it cannot be sure that the generated `initramfs` will work
- An `initramfs` generated by `initramfs-tools` will have an emergency shell if it fails; `yaird` does not include this unless you explicitly specify it



# The Gentoo way

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- A kernel configured by hand generally does not require an `initramfs` - the install guide encourages you to compile everything you need into the kernel
- A kernel created with `genkernel` will also create an `initramfs`
- `mkinitrd` is in the Portage tree; this could also be used
- Gentoo-Wiki has an extensive article about configuring your own `initramfs` -  
[http://gentoo-wiki.com/HOWTO\\_Initramfs](http://gentoo-wiki.com/HOWTO_Initramfs)

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When the initrd filesystem is done, it should contain (for proper startup)

- An `/init` script (necessary)
- The shell necessary to run the `/init` script and its dependencies
- Any modules that need to be loaded to mount the root filesystem

Pack up the filesystem with

```
$ find ./ > file_list
$ cpio -o < file_list > initrd.cpio
$ gzip initrd.cpio
$ rm file_list
```

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## ■ GRUB - sample grub.conf excerpt

```
title        Debian GNU/Linux, kernel 2.6.18-4-686
root         (hd0,0)
kernel       /vmlinuz-2.6.18-4-686 root=/dev/hda3 ro
initrd       /initrd.img-2.6.18-4-686
```

## ■ LILO - sample lilo.conf excerpt

```
image=/vmlinuz
      label=Linux
      read-only
      initrd=/initrd.img
```

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