The Linux Boot Process

What You Will Learn

- BIOS
- Boot loaders
- Linux Kernel
- Runlevels

BIOS

- Basic Input/Output System
- Special firmware
- It's operating system independent
  - This is not unique to the Linux OS
- Primary purpose is to find and execute the boot loader
- Performs the POST
  - Power-On Self Test

BIOS

- Knows about bootable devices
  - Hard drives
  - USB drives
  - DVD drives
  - etc.
- The boot device search order can be changed.

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Boot Loaders

- LILO
  - **Li**nux **Lo**ader
- GRUB
  - **Gr**and **U**nified **B**ootloader
  - Replaced LILO
- Boot loaders start the operating system
- Boot loaders can start the operating system with different options

Initial RAM Disk

- initrd
  - initial RAM disk
- Temporary filesystem that is loaded from disk and stored in memory.
- Contains helpers and modules required to load the permanent OS file system.

The /boot Directory

- /boot
  - Contains the files required to boot Linux
  - initrd
  - kernel
  - boot loader configuration

```
$ ls -F /boot
abi-3.13.0-46-generic        initrd.img-3.13.0-46-generic
config-3.13.0-46-generic     System.map-3.13.0-46-generic
grub/                        vmlinuz-3.13.0-46-generic
```

Kernel Ring Buffer

- Contains messages from the Linux kernel
- `dmesg`
- `/var/log/dmesg`

Runlevels / Description

0   Shuts down the system

1, S, s   Single user mode. Used for maintenance.

2   Multi-user mode with graphical interface.
                      (Debian/Ubuntu)

3   Multi-user text mode (RedHat/CentOS)

4   Undefined

5   Multi-user mode with graphical interface.
                      (RedHat/CentOS)

6   Reboot

Init

`/etc/inittab:`

`id:3:initdefault:`

- Being phased out by systemd.

Systemd

- Uses targets instead of runlevels.

```
# cd /lib/systemd/system

# ls -l runlevel5.target

lrwxrwxrwx. 1 root root 16 Jul 17  2014
runlevel5.target -> graphical.target

# systemctl set-default graphical.target
```

Changing runlevels or targets

- telinit RUNLEVEL
  - `telinit 5`
- systemctl isolate TARGET
  - `systemctl isolate graphical.target`

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Rebooting

```
# telinit 6
# systemctl isolate reboot.target
# reboot
```

Rebooting

```
shutdown [options] time [message]

# shutdown -r 15:30 "rebooting!"

# shutdown -r +5 "rebooting soon!"

# shutdown -r now
```

Poweroff

```
# telinit 0
# systemctl isolate poweroff.target
# poweroff
```

Summary

- BIOS
- Boot Loaders
  - LILO
  - GRUB
- /boot
- initrd
- vmlinux or vmlinuz

Summary

- dmesg or /var/log/dmesg
- runlevels and targets
- telinit (init)
- systemctl (systemd)
- shutdown, reboot, poweroff