Lesson 6: Booting, Initializing and Virtualizing Linux
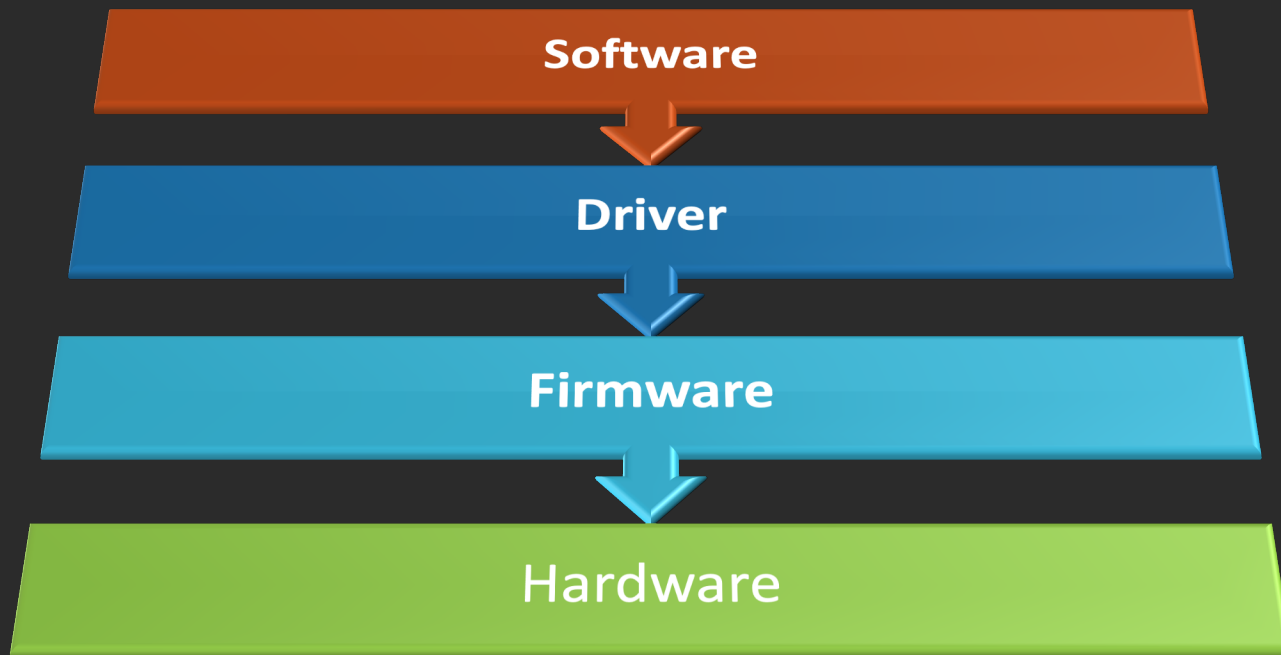
Objectives covered
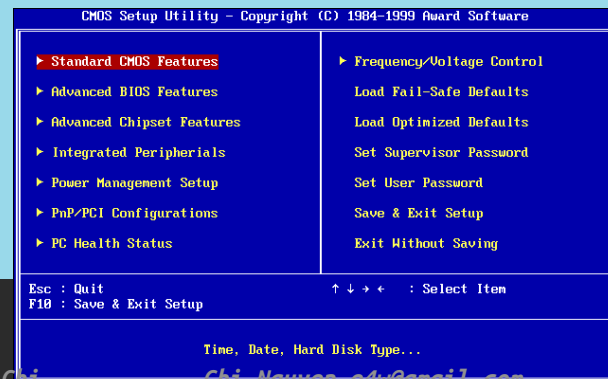
o *101.2 Boot the system (weight: 3)*

o *102.2 Install a boot manager (weight: 2)*

o *101.3 Change runlevels / boot targets and shutdown or reboot system (weight: 3)*

o *102.6 Linux as a virtualization guest (weight: 1)*

Boot the system

Firmware, driver and Software

Software

Driver

Firmware

Hardware

Computer firmware
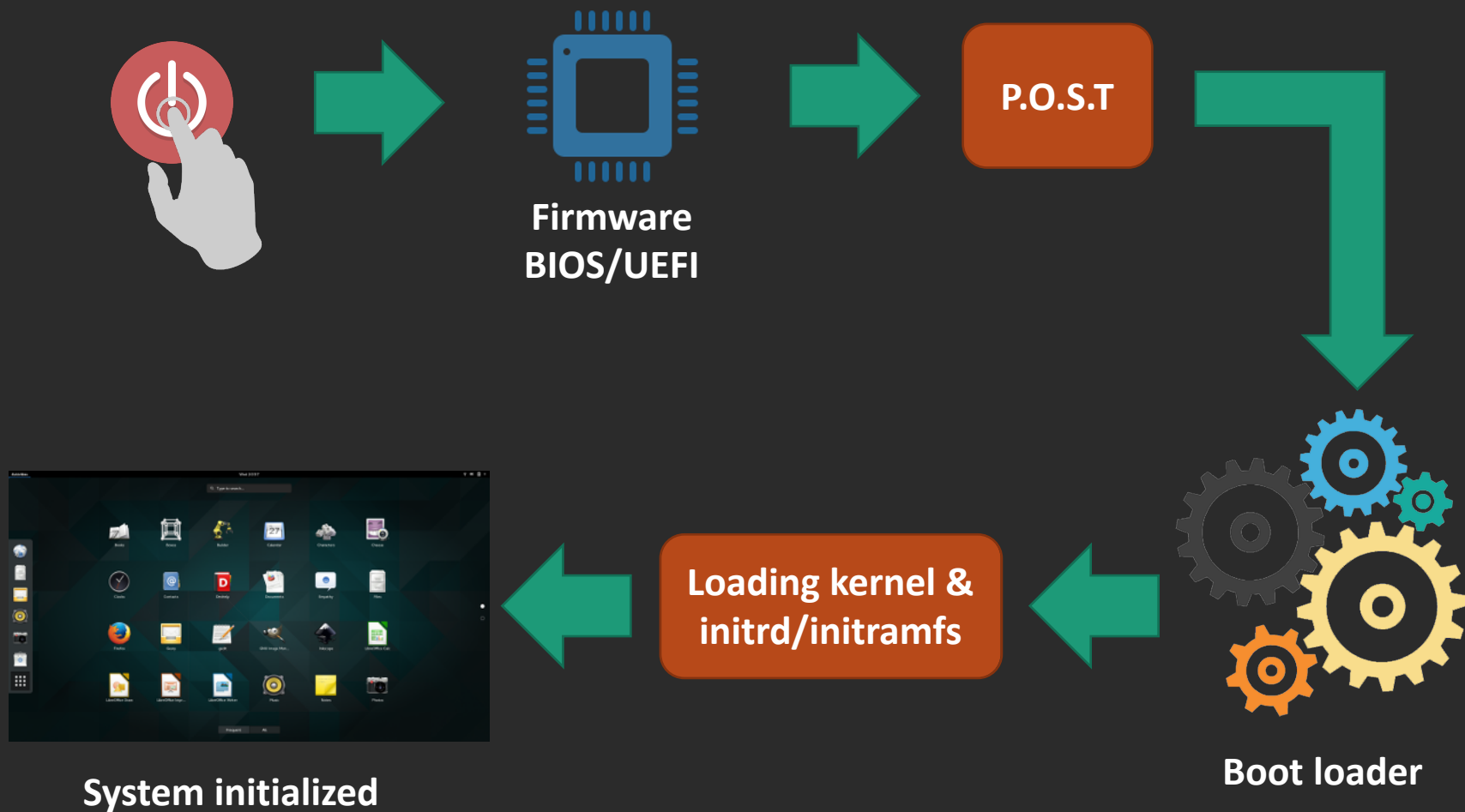
Boot loader

```
                    GNU GRUB  version 1.98-1ubuntu6

 Ubuntu, Linux 2.6.32-25-generic
 Ubuntu, Linux 2.6.32-25-generic (recovery mode)
 Ubuntu, Linux 2.6.32-24-generic
 Ubuntu, Linux 2.6.32-24-generic (recovery mode)




      Use the ↑ and ↓ keys to select which entry is highlighted.
      Press enter to boot the selected OS, 'e' to edit the comma
      booting or 'c' for a command-line. ESC to return previous
```

LILO	GRUB Legacy	GRUB 2
Systemd-boot loader	U-Boot	SYSLINUX project (including SYSLINUX, EXTLINUX, ISOLINUX, PXELINUX, MEMDISK)

Boot process

P.O.S.T

Firmware BIOS/UEFI

Loading kernel & initrd/initramfs

System initialized

Boot loader

Install a boot manager

Boot loader – Grub legacy


```
GNU GRUB   version 0.97   (640K lower / 1024852K upper memory)

┌──────────────────────────────────────────────────────────────────┐
│ Fedora (2.6.36.2local)                                             │
│ Fedora (2.6.35.10-74.fc14.x86_64)                                  │
│ Fedora dup (2.6.35.10-74.fc14.x86_64)                              │
│                                                                    │
│                                                                    │
│                                                                    │
│                                                                    │
│                                                                    │
└──────────────────────────────────────────────────────────────────┘

      Use the ↑ and ↓ keys to select which entry is highlighted.
      Press enter to boot the selected OS, 'e' to edit the
      commands before booting, 'a' to modify the kernel arguments
      before booting, or 'c' for a command-line.
```
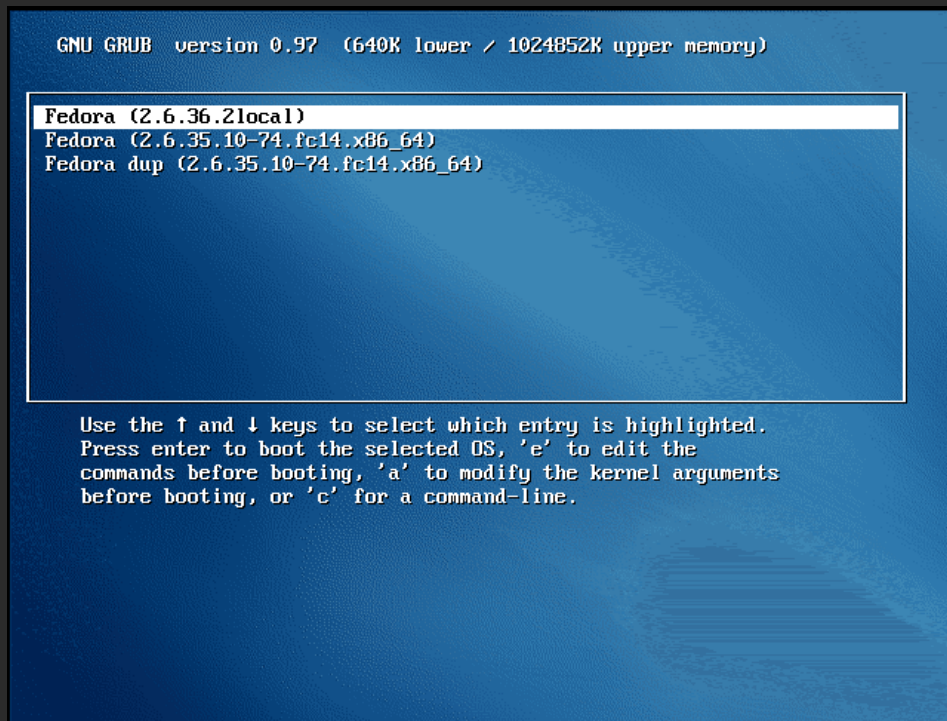
/boot/grub/menu.lst

Or

/boot/grub/grub.conf

Boot loader - Grub legacy

Installing grub legacy boot loader

```
# grub-install /dev/sda
```

```
# grub-install '(hd0)'
```

Boot loader – Grub legacy

Setting	Description
color	Specifies the foreground and background colors to use in the boot menu
default	Defines the default menu option to select
fallback	A secondary menu selection to use if the default menu option fails
hiddenmenu	Don't display the menu selection options
splashimage	Points to an image file to use as the background for the boot menu
timeout	Specifies the amount of time to wait for a menu selection before using the default

Global definitions

- Title: The first line for each boot definition section, this is what appears in the boot menu.

- Root: Defines the disk and partition where the GRUB /boot folder partition is located on the system.

- Kernel: Defines the kernel image file stored in the /boot folder to load.

- Initrd: Defines the initial RAM disk file or filesystem, which contains drivers necessary for the kernel to interact with the system hardware.

- Rootnoverify: Defines non-Linux boot partitions, such as Windows.

Operating system boot definitions

Example of menu.lst file

```
default 0
timeout 10
color white/blue yellow/blue

title CentOS Linux
root (hd1,0)
kernel (hd1,0)/boot/vmlinuz
initrd /boot/initrd

title Windows
rootnoverify (hd0,0)
```

Boot loader – Grub2

```
GNU GRUB   version 2.02

*Ubuntu
 Advanced options for Ubuntu
 Memory test (memtest86+)
 Memory test (memtest86+, serial console 115200)




 Use the ↑ and ↓ keys to select which entry is highlighted.
 Press enter to boot the selected OS, `e' to edit the commands
 before booting or `c' for a command-line.
```

/boot/grub/grub.cfg or /boot/grub2/grub.cfg for BIOS systems

/boot/efi/EFI/<distro-name>/grub.cfg for UEFI systems

Boot loader - Grub2

Installing grub2 boot loader

```
# grub2-install /dev/sda
```

For BIOS systems

```
# yum reinstall grub2-efi grub2-efi-modules  shim
```

For UEFI systems

Update the grub.cfg file

```
# grub2-mkconfig -o /boot/efi/EFI/redhat/grub.cfg
```

Boot loader - Grub2

- Menuentry: The first line for each boot definition section; this is what appears in the boot menu.

- set root: Defines the disk and partition where the GRUB2 /boot directory partition is located on the system.

- linux, linux16: For BIOS systems, defines the kernel image file stored in the /boot directory to load.

- Linuxefi: For UEFI systems, defines the kernel image file stored in the /boot directory to load.

- Initrd: For BIOS systems, defines the initial RAM filesystem, which contains drivers necessary for the kernel to interact with the system hardware.

- Initrdefi: For UEFI systems, defines the initial RAM filesystem, which contains drivers necessary for the kernel to interact with the system hardware.

```
[…]
menuentry "CentOS Linux" {
[…]
    set root=(hd1,1)
    linux16 /vmlinuz[…]
    initrd /initramfs[…]
}
menuentry "Windows" {
    set root=(hd0,1)
[…]
```

Boot loader – Grub2

```
               GNU GRUB  version 2.02

*Ubuntu
 Advanced options for Ubuntu
 Memory test (memtest86+)
 Memory test (memtest86+, serial console 115200)







 Use the ↑ and ↓ keys to select which entry is highlighted.
 Press enter to boot the selected OS, `e' to edit the commands
 before booting or `c' for a command-line.
```

```
               GNU GRUB  version 2.02

        insmod part_msdos
        insmod ext2
        set root='hd0,msdos1'
        if [ x$feature_platform_search_hint = xy ]; then
          search --no-floppy --fs-uuid --set=root --hint-bios=hd0,msdos1\
 --hint-efi=hd0,msdos1 --hint-baremetal=ahci0,msdos1  739c6e96-0cd3-4b39\
-a09a-3c408dcedf50
        else
          search --no-floppy --fs-uuid --set=root 739c6e96-0cd3-4b39-a09\
a-3c408dcedf50
        fi
        linux       /boot/vmlinuz-4.15.0-46-generic root=UUID=739c6e96-\
0cd3-4b39-a09a-3c408dcedf50 ro  quiet splash $vt_handoff
        initrd      /boot/initrd.img-4.15.0-46-generic

 Minimum Emacs-like screen editing is supported. TAB lists
 completions. Press Ctrl-x or F10 to boot, Ctrl-c or F2 for a
 command-line or ESC to discard edits and return to the GRUB
 menu.
```

Parameter	Description
console=	Set the console device
debug	Enable kernel debugging
init=	Execute the specified program, such as a Bash shell (/bin/bash) instead of /sbin/init
initrd=	Change the location of the initial RAM filesystem
mem	Set the total amount of available system memory
ro	Mount root filesystem as read-only
root=	Change the root filesystem
rootflags=	Set root filesystem's mount options
rw	Mount root filesystem as read-write
selinux	Disable SELinux at boot time
single, Single, 1, or S	Boot a SysVinit system to single-user mode
systemd.unit=	Boot a systemd system to specified target

Question...█