BIOS = Basic Input and Output Setting (firmware interface)
POST = Power-On Self-Test started

MBR = Master Boot Record
Information saved in the first sector of a hard disk that indicates where the GRUB2 is located so it can be loaded in computer RAM

GRUB2 = Grand Unified Boot Loader v2
Loads Linux kernel
/boot/grub2/grub.cfg

Kernel = Core of Operating System
Loads required drivers from initrd.img
Starts the first OS process (systemd)

Systemd = System Daemon (PID # 1)
It then starts all the required processes
Reads = /etc/systemd/system/default.target to bring the system to the run-level
Total of 7 run-levels (0 thru 6)
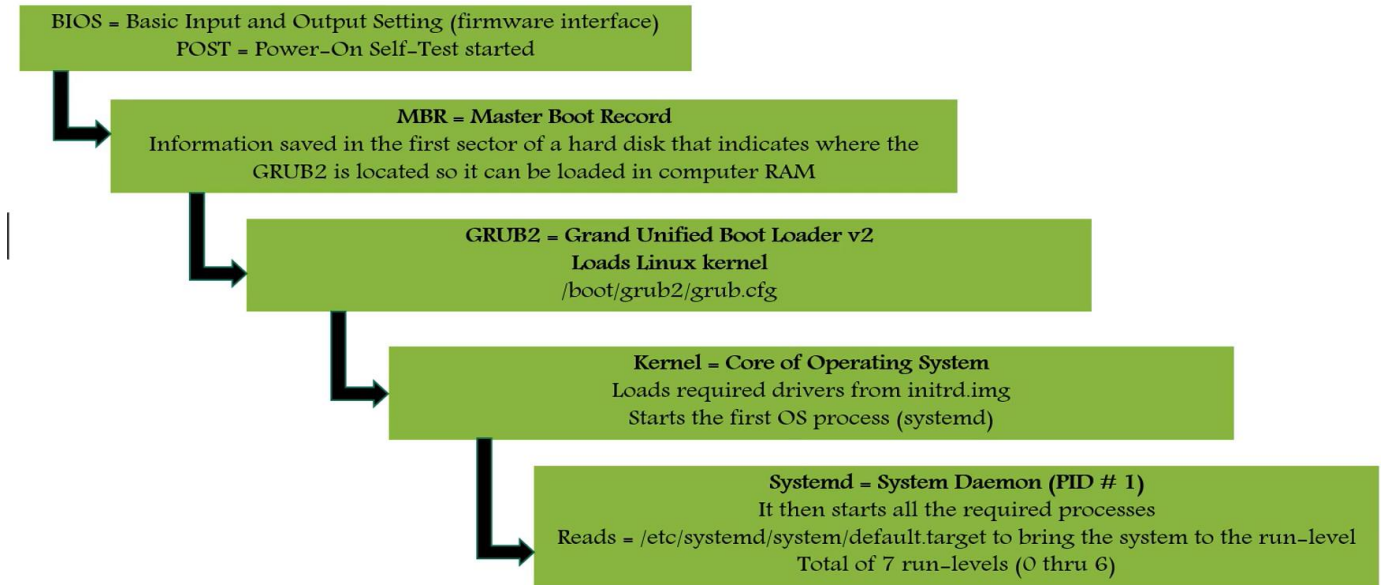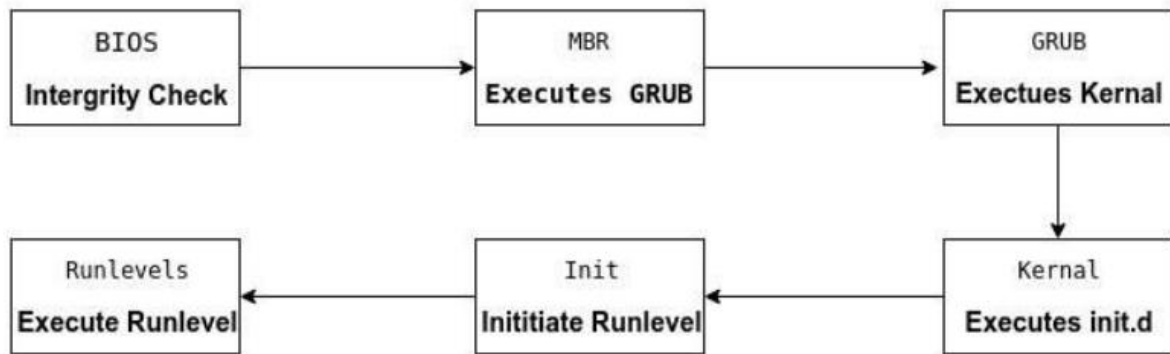
The boot sequence changes in CentOS/Redhat 7 and above

systemd is the new service manager in CentOS/RHEL 7 and above.

BIOS	Basic Input/Output System executes MBR
MBR	Master Boot Record executes GRUB
GRUB	Grand Unified Bootloader executes Kernel
Kernel	Kernel executes /sbin/init
Init	Init executes runlevel programs
Runlevel	Runlevel programs are executed from /etc/rc.d/rc*.d/

1. BIOS

BIOS stands for Basic Input/Output System. In simple terms, the BIOS loads and executes the Master Boot Record (MBR) boot loader.

When you first turn on your computer, the BIOS first performs some integrity checks of the HDD or SSD.

Then, the BIOS searches for, loads, and executes the boot loader program, which can be found in the Master Boot Record (MBR). The MBR is sometimes on a USB stick or CD-ROM such as with a live installation of Linux.

Once the boot loader program is detected, it's then loaded into memory and the BIOS gives control of the system to it.

2. MBR

MBR stands for Master Boot Record, and is responsible for loading and executing the GRUB boot loader.

The MBR is located in the 1st sector of the bootable disk, which is typically /dev/hda, or /dev/sda, depending on your hardware. The MBR also contains information about GRUB, or LILO (Linux Loader) in very old systems.

- ➢ MBR tells your computer how to start.
- ➢ MBR is less than 512 bytes in size
- ➢ Primary boot loader info in 1st 446 bytes
- ➢ Partition table info next 64 bytes
- ➢ MBR validation check in last 2 bytes

3. GRUB

Sometimes called GNU GRUB, which is short for GNU GRand Unified Bootloader, is the typical boot loader for most modern Linux systems.

The GRUB splash screen is often the first thing you see when you boot your computer. It has a simple menu where you can select some options. If you have multiple kernel images installed, you can use your keyboard to select the one you want your system to boot with. By default, the latest kernel image is selected.

The splash screen will wait a few seconds for you to select and option. If you don't, it will load the default kernel image.

It's a menu that appears when you turn on your computer
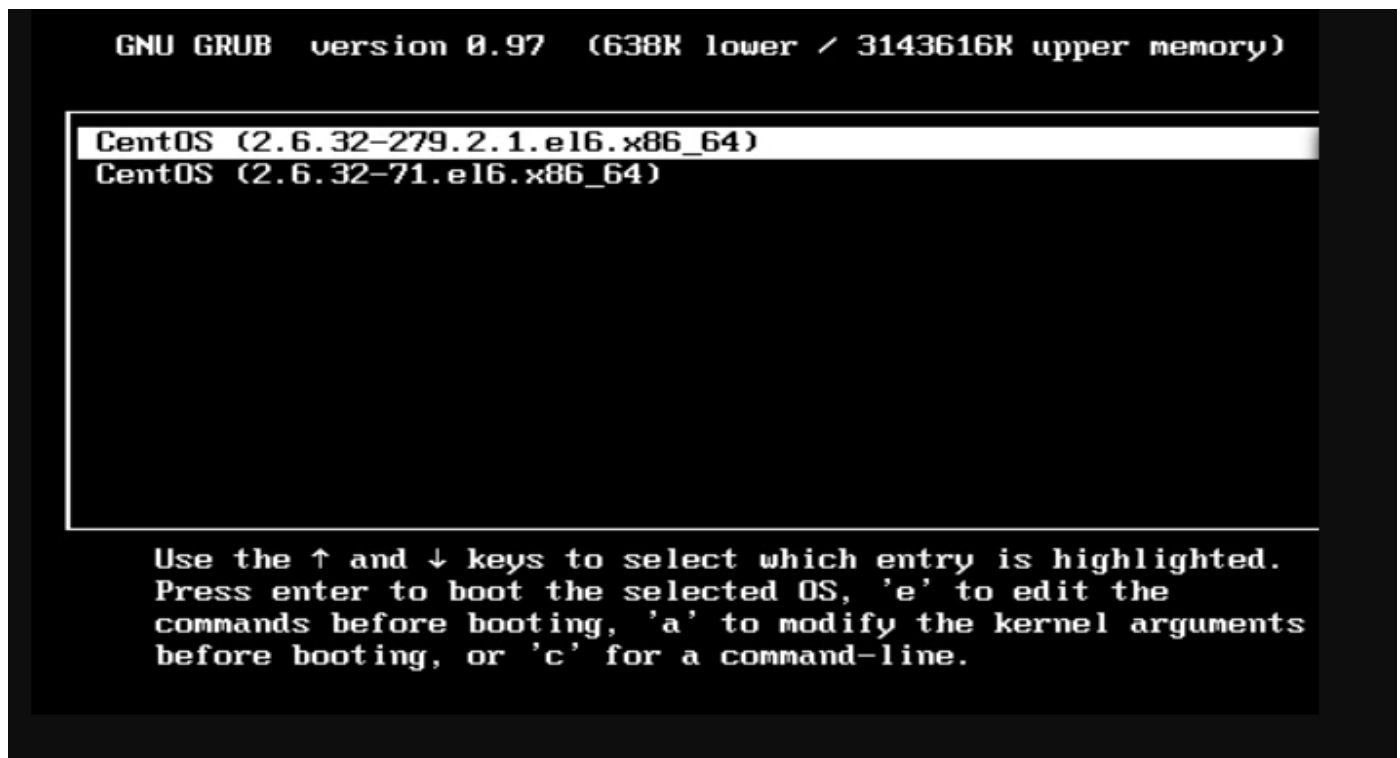
4. Kernel

The kernel is often referred to as the core of any operating system, Linux included. It has complete control over everything in your system.

In this stage of the boot process, the kernel that was selected by GRUB first mounts the root file system that's specified in the grub.conf file.

Then it executes the /sbin/init (systemd)program, which is always the first program to be executed. You can confirm this with its process id (PID), which should always be 1.

The kernel then establishes a temporary root file system using Initial RAM Disk (initrd) until the real file system is mounted.

The Kernel manages hardware resources like CPU, memory, and devices.

It ensures programs run smoothly and securely. The Kernel acts as a bridge between software and hardware

5. Init

At this point, your system executes runlevel programs. At one point it would look for an init file, usually found at /etc/inittab to decide the Linux run level.

Modern Linux systems use systemd to choose a run level instead

Run level 0 is matched by **poweroff.target** (and **runlevel0.target** is a symbolic link to **poweroff.target**).

Run level 1 is matched by **rescue.target** (and **runlevel1.target** is a symbolic link to **rescue.target**).

Run level 3 is emulated by **multi-user.target** (and **runlevel3.target** is a symbolic link to **multi-user.target**).

Run level 5 is emulated by **graphical.target** (and **runlevel5.target** is a symbolic link to **graphical.target**).

Run level 6 is emulated by **reboot.target** (and **runlevel6.target** is a symbolic link to **reboot.target**).

Emergency is matched by **emergency.target**.

systemd will then begin executing runlevel programs.

#systemctl get-default

#/etc/inittab

\#/etc/rc.d/rc*.d

\#/etc/systemd/system

6. Runlevel programs

Depending on which Linux distribution you have installed, you may be able to see different services getting started.

These are known as runlevel programs, and are executed from different directories depending on your run level.

Hence the fist process which is started in linux is init (systemd)process

Run level

- 0 - Shut down (or halt) the system

- 1 - Single-user mode or emergency mode, used for maintenance or emergency repairs

- 2 - Multiuser mode without networking

- 3 - Multiuser mode with networking, which is the standard runlevel for most   Linux-based servers (No GUI)

- 5 - Multiuser mode with networking and GUI,this is the standard runlevel for most of the LINUX-based systems.

- 6 - Reboot the system

(4 – unused)

Linux distributions have recently adopted a new system initialization process called Systemd, which uses targets instead of runlevels.