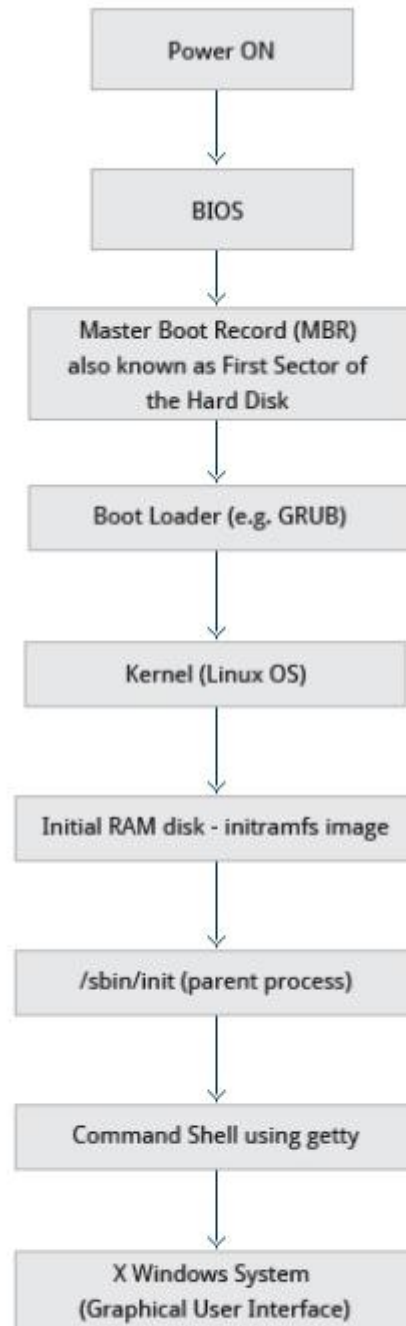


Boot Process

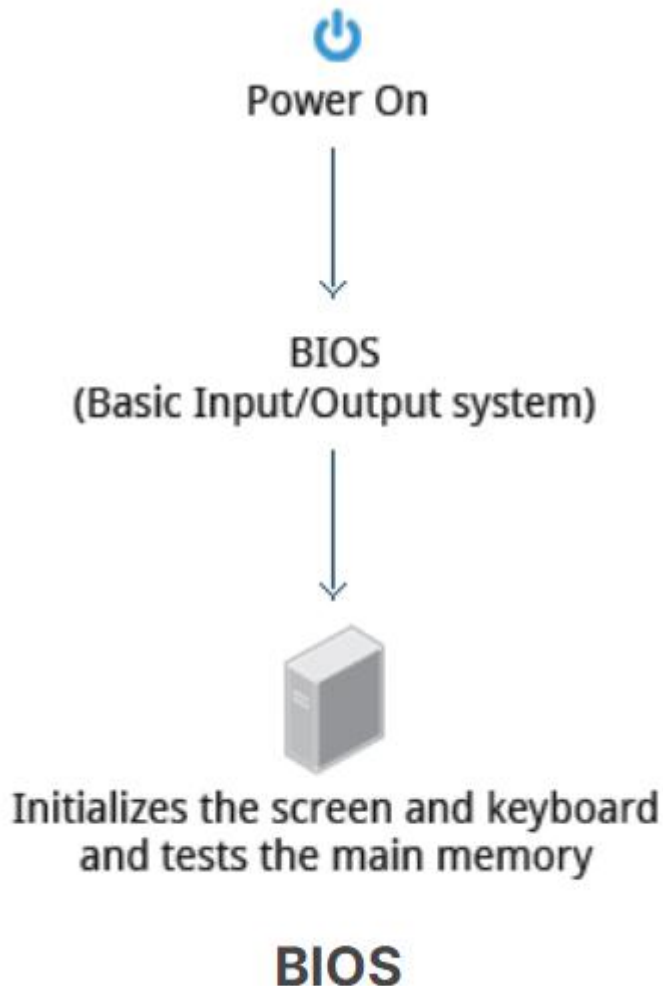
1. The Linux boot process is the procedure for initializing the system.
2. It consists of everything that happens from when the computer power is first switched on until the user interface is fully operational.



The Boot Process

BIOS - The First Step:

1. Starting an x86-based Linux system involves a number of steps.
2. When the computer is powered on, the Basic Input/Output System (BIOS) initializes the hardware, including the screen and keyboard, and tests the main memory. This process is also called POST (Power On Self Test).

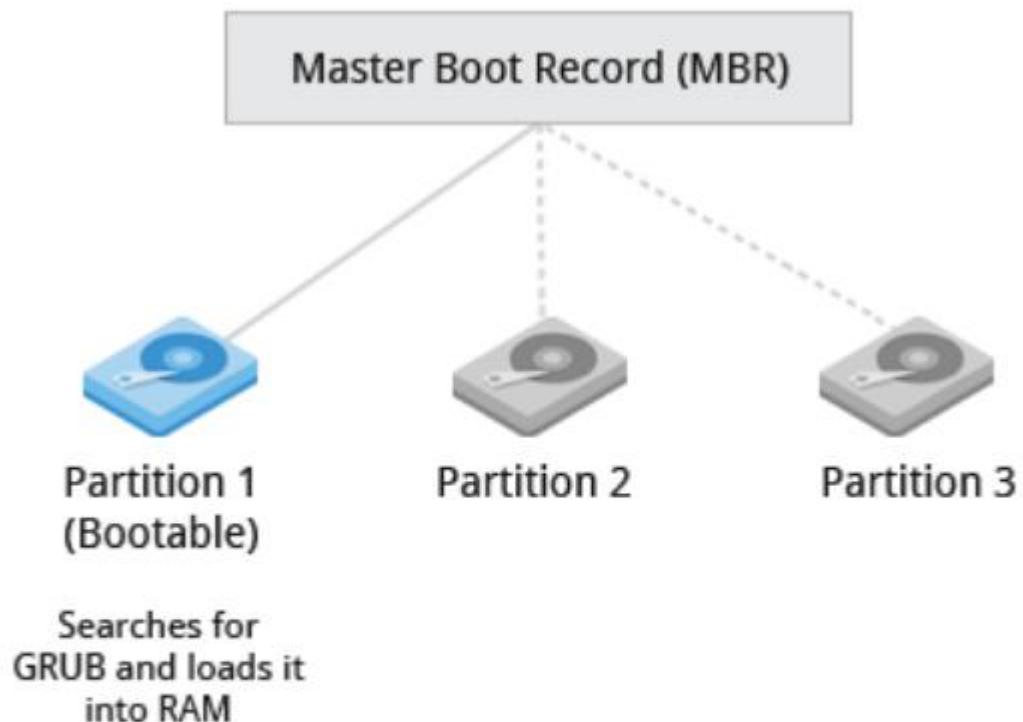


3. The BIOS software is stored on a ROM chip on the motherboard.
4. After this, the remainder of the boot process is controlled by the operating system (OS).

Master Boot Record (MBR) and Boot Loader:

1. Once the **POST** is completed, the system control passes from the **BIOS** to the boot loader.
2. The boot loader is usually stored on one of the hard disks in the system, either in the boot sector (for traditional **BIOS/MBR** systems) or the **EFI** partition (for more recent (Unified) Extensible Firmware Interface or **EFI/UEFI** systems).
3. Up to this stage, the machine does not access any mass storage media.

4. Thereafter, information on date, time, and the most important peripherals are loaded from the **CMOS** values (after a technology used for the battery-powered memory store which allows the system to keep track of the date and time even when it is powered off).
5. A number of boot loaders exist for Linux; the most common ones are **GRUB** (for GRand Unified Boot loader), **ISOLINUX** (for booting from removable media), and **DAS U-Boot** (for booting on embedded devices/appliances).
6. When booting Linux, the boot loader is responsible for loading the kernel image and the initial RAM disk or filesystem (which contains some critical files and device drivers needed to start the system) into memory.



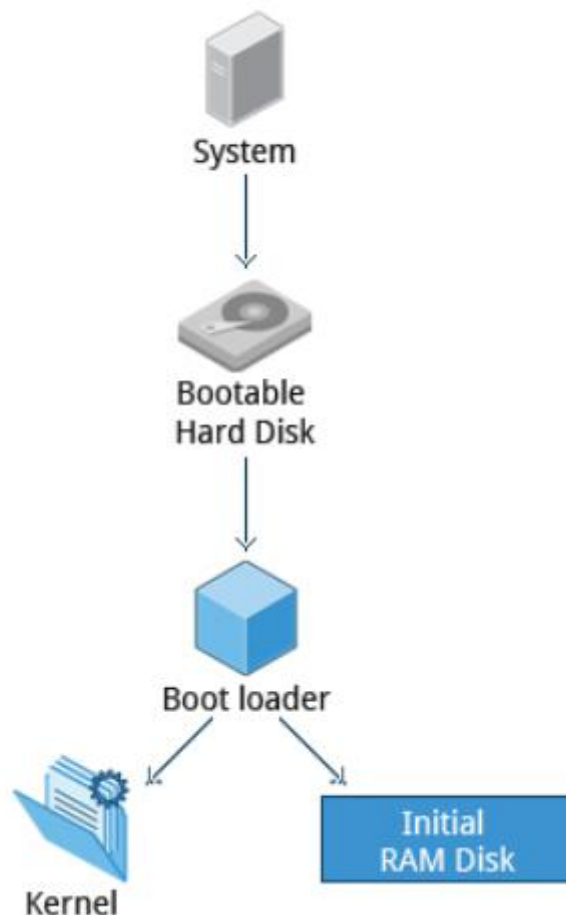
Master Boot Record

Boot Loader in Action:

The boot loader has two distinct stages:

1. For systems using the BIOS/MBR method, the boot loader resides at the first sector of the hard disk, also known as the Master Boot Record (MBR).
2. The size of the MBR is just 512 bytes.
3. In this stage, the boot loader examines the partition table and finds a bootable partition.
4. Once it finds a bootable partition, it then searches for the second stage boot loader, for example GRUB, and loads it into RAM (Random Access Memory).
5. The second stage boot loader resides under **/boot**.

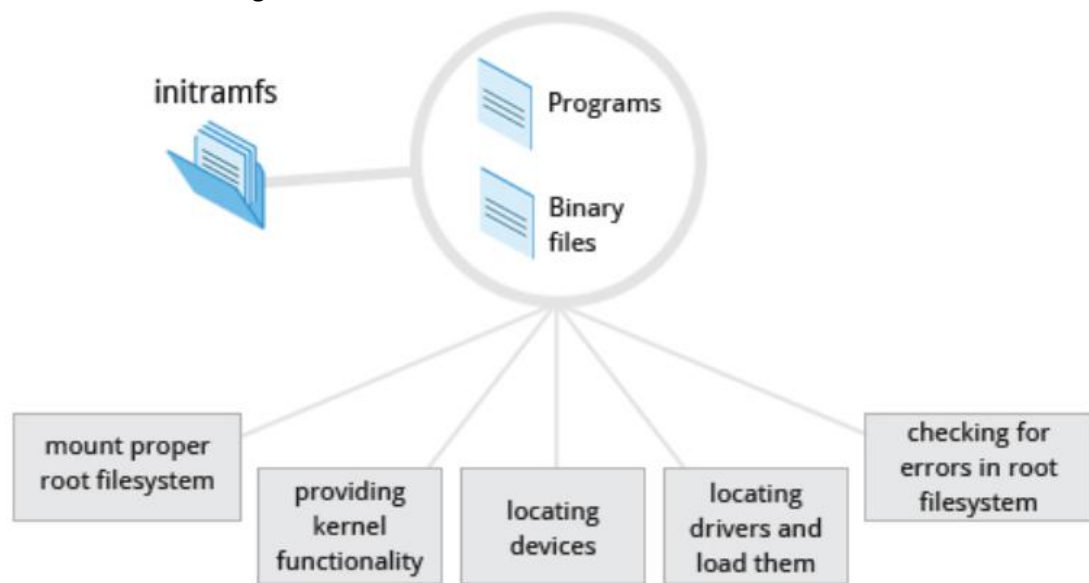
6. A splash screen is displayed, which allows us to choose which operating system (OS) to boot.
7. After choosing the OS, the boot loader loads the kernel of the selected operating system into RAM and passes control to it.
8. Kernels are almost always compressed, so its first job is to uncompress itself.
9. After this, it will check and analyze the system hardware and initialize any hardware device drivers built into the kernel.



Initial RAM Disk:

1. The initramfs filesystem image contains programs and binary files that perform all actions needed to mount the proper root filesystem, like providing kernel functionality for the needed filesystem and device drivers for mass storage controllers with a facility called udev (for user device), which is responsible for figuring out which devices are present, locating the device drivers they need to operate properly, and loading them.
2. After the root filesystem has been found, it is checked for errors and mounted.
3. The mount program instructs the operating system that a filesystem is ready for use, and associates it with a particular point in the overall hierarchy of the filesystem (the mount point).
4. If this is successful, the initramfs is cleared from RAM and the init program on the root filesystem (/sbin/init) is executed.
5. init handles the mounting and pivoting over to the final real root filesystem.

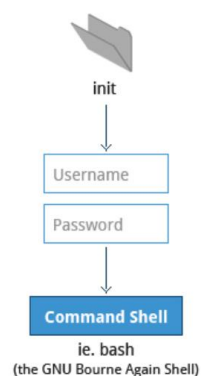
6. If special hardware drivers are needed before the mass storage can be accessed, they must be in the initramfs image.



The Initial RAM Disk

Text-Mode Login:

1. Near the end of the boot process, **init** starts a number of text-mode login prompts.
2. These enable you to type your username, followed by your password, and to eventually get a command shell.
3. However, if you are running a system with a graphical login interface, you will not see these at first.
4. Usually, the default command shell is **bash** (the **GNU Bourne Again Shell**), but there are a number of other advanced command shells available.
5. The shell prints a text prompt, indicating it is ready to accept commands; after the user types the command and presses Enter, the command is executed, and another prompt is displayed after the command is done.



Text-Mode Logins