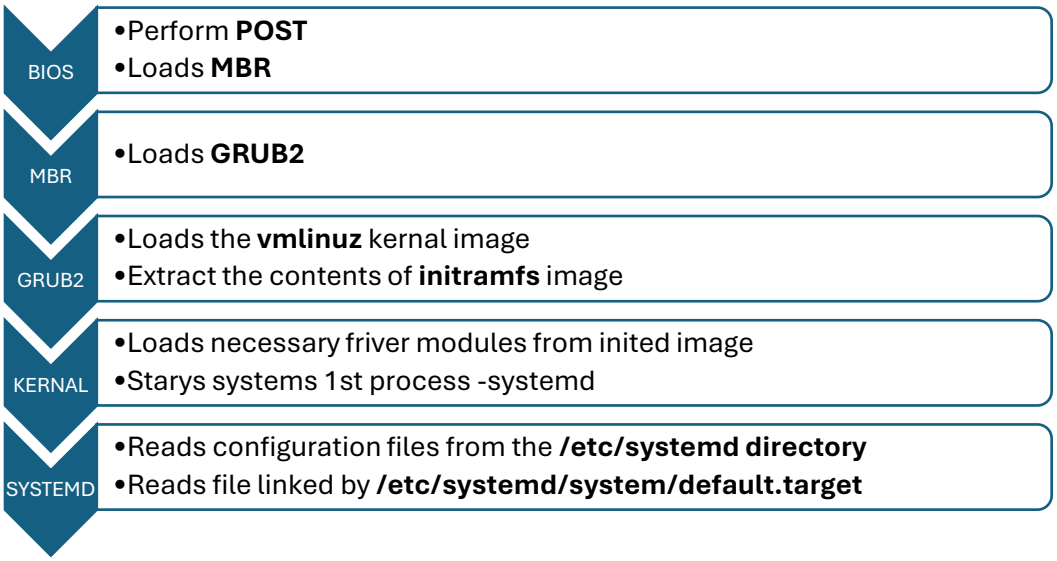
Booting and Shutting Down

Linux Booting Stage Diagram



Booting Stage 1: BIOS

- The BIOS (Basic Input/Output System), performs the POST (power on self-test) to detect, test and initialize system hardware components.
- Loads the MBR (Master boot record).
- If some hardware broke, System will notice.
- Once the boot loader program is detected and loaded into the memory, BIOS gives the control to it.
- So, in simple terms BIOS loads and executes the MBR boot loader.

Booting Stage 2: BIOS

- Master Boot Record (MBR)is the first sector of disk.
- It's at first 512 bytes of the boot drive that is read into memory by BIOS. Like the figure in next slide the MBR is divided into:
  - 446bytes is data of boot loader,
  - 64bytes contain the partition table for the disk, and
  - the last 2 bytes are the "Magic Number" which is used for error detection in sector.
- MBR discovers the bootable device and loads the GRUB2 boot loader into memory and transfers control over to it.
- So, in simple terms MBR loads and executes the GRUB boot loader.

Booting Stage 3: GRUB Bootloader

- GRUB stands for GRand Unified Bootloader, and it is the default boot loader program in most modern Linux distributions with Intel processors.
- GRUBv2replacestheolderversion called the **Legacy GRUB**

GRUB Mechanism

- GRUB displays a splash screen, waits for few seconds, if user don't enter anything, and If no other operating system is detected GRUB will boot straight into the default operating system and no menu will be displayed.
- If another operating system is detected the GRUB menu will display and user can select the OS to load.
- It searches and loads the compressed kernel image file located in **/boot /vmlinuz**
- GRUB mounts the initial RAM disk (initrd) is an initial root file system that is mounted before the real root file system.
- So, in simple terms GRUB just loads and executes Kernel and initrd images.

GRUB Menu Setting

- Changes made in the GRUB menu-settings file **/etc/default/grub** will not take effect and overwrites GRUB configuration file **/boot/grub2/grub.cfg** until the command below is executed **update-grub**
- Below are some example settings:

GRUB_DEFAULT Sets the default menu entry
GRUB_HIDDEN_TIMEOUT Wait this many seconds for the user to press a key.
GRUB_HIDDEN_TIMEOUT_QUIET Determines whether a countdown timer is displayed on a blank screen.
GRUB_TIMEOUT Sets the time period in seconds for the menu to be displayed before automatically booting.
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GRUB Command-Line Options

- Find – Finds file on all mountable partitions
- Root – Specifies the root device (a partition)
- ls – List hard disks, device or files
- help – Gets interactive help for a command
- boot -Boots the system from the specified kernel image
- reboot – Reboots the system

Booting Stage 4: Loading the Kernel

- Kernel is itself a program, and the first bootstrapping task is to get this program into memory so that it can be executed
- Linux system kernel- /boot/vmlinuz
- Kernel mounts filesystem in Two-stages:
    - initrd (init RAM disk): A transient root filesystem in RAM before a real root filesystem is available.
    - The real root filesystem
- Kernel executes init program located in /sbin/init
- Kernelloads device drivers
- Kernel threads creation

Booting Stage 5: Systemd

- Systemd is the grandfather of all processes on a system.
- Systemd reads the file linked by **/etc/systemd/system/default.target** to determine the default system target (equivalent to run level).
- The system target file defines the services that systemd starts.
- System performing system initialization tasks such as
    1. Setting the host name
    2. Initializing the network
    3. Initializing Linux based on its configuration
    4. Printing a welcome banner
    5. Cleaning up directories in /var
    6. Started swapping

Commands

- To Check the current default target **systemctl get-default**
- To set a new default target **sudo systemctl set-default graphical.target** or **sudo systemctl set-default multi-user.target**