

ASSIGNMENT : 01

Booting Process of Operating System

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BOOTING PROCESS OF LINUX

Overview of Linux Booting

The series of actions that take place when a Linux-based system is turned on is known as the Linux booting process.

It is in charge of preparing the system for user interaction and loading the Linux operating system into memory. Because Linux booting is so adaptable and modular, it can be customised for embedded devices, desktop computers, and servers.

Early Stages of Linux Boot Process

1. BIOS/UEFI Initialization

- Initialisation of BIOS/UEFI The BIOS or UEFI firmware is the first to run when the system is turned on.
- It checks hardware like the CPU, RAM, keyboard, and storage devices using a Power-On Self-Test (POST).
- It looks for the bootable device (hard drive, SSD, USB, etc.) after verification.

2.Bootloader Execution (GRUB)

- The Linux kernel must be loaded by the bootloader.
- Grand Unified Bootloader, or GRUB, is a popular Linux bootloader.
- Users can select from a variety of kernels or operating systems using the menu that GRUB offers.

Final Stages of Linux Boot Process

3. Kernel Initialization

- The Linux kernel is the core of the operating system.
- Once loaded, it initializes :
 - Memory management
 - Device drivers
 - System hardware resources
- The kernel mounts the root filesystem, which contains system files.

4. Init/Systemd Startup

- The first user-space process started is called Init or Systemd (PID 1).
- Systemd starts background services such as networking, logging, and graphical interface.

5. Login Prompt

- Finally, the system presents a login screen or terminal.
- After authentication, the user can access the Linux environment.



BOOTING PROCESS OF WINDOWS

Overview of Windows Booting

- When a computer starts up, the Windows boot process is basically what gets Microsoft Windows loaded up into the memory. I mean, it's the main way the operating system kicks in after you hit the power button.
- The whole thing is set up to make sure everything stays stable, like initializing drivers and checking for security stuff along the way. It seems kind of important for not having crashes right from the start.
- And then there are these features it handles, Secure Boot to keep things safe from bad software, and Recovery Mode if something goes wrong. That part gets a bit technical, but yeah, it supports those.

Initial Windows Boot Stages

1. BIOS/UEFI POST

- The boot process begins when BIOS/UEFI runs hardware checks.
- It performs POST to ensure components like RAM and CPU are functioning properly.
- The firmware then identifies the boot disk containing Windows.

2. Windows Boot Manager

- Boot Manager is the first Windows-specific program executed.
- It reads Boot Configuration Data (BCD), which contains boot settings.
- It decides which Windows version or recovery environment to load.

3. Windows OS Loader

- Windows NT Kernel
- Hardware Abstraction Layer (HAL)
- Essential boot drivers

4. Kernel Initialization

- Process scheduling
- Memory allocation
- System resource management

5. Login and Desktop

- System services start in the background.
- The Windows login screen appears.
- After authentication, the desktop environment loads fully.



BOOTING PROCESS OF MAC

BOOTING PROCESS OF MAC

- Mac booting is the startup sequence used in Apple Macintosh systems.
- It is optimized because Apple controls both hardware and software.
- mac uses EFI firmware, which provides faster and more secure startup.

Core Boot Elements:

- EFI Firmware
- Bootloader
- macOS Kernel
- launchd Service Manager
- Graphical User Interface

Early Boot Steps in mac

1. EFI Firmware Initialization

- When the Mac is powered on, EFI firmware executes first.
- It checks hardware components and initializes system memory.
- EFI then locates the macOS boot disk.

2. Bootloader Execution

- The bootloader loads the macOS kernel into memory.
- It also prepares system configuration files needed during startup.
- This stage ensures smooth transition from firmware to OS.

3. Kernel Startup

The macOS kernel initializes system resources such as:

- CPU processes
- Device drivers
- File system access

4. launchd Initialization

- macOS uses launchd as the first process.
- It starts essential services like networking, security agents, and background apps.

5. Login and Desktop

- The login window appears.
- After authentication, Finder and the macOS desktop environment are loaded.



BOOTING PROCESS OF ANDROID MOBILE OS SYSTEM

Overview Of Android Mobile Os System

- Android booting is the process through which an Android mobile device starts and loads its operating system.
- Android is built on the Linux kernel but includes mobile-specific startup layers.
- Booting is designed with security features such as Verified Boot.

Main Boot Components:

- Boot ROM
- Bootloader
- Linux Kernel
- Init Process
- Zygote Runtime
- System Server

Early Android Boot Stages

1. Boot ROM Execution

- Boot ROM is the first code executed when a phone powers on.
- It is stored in hardware and cannot be modified.
- Its job is to locate and start the bootloader securely.

2. Bootloader Stage

- The bootloader loads the Android kernel.
- It verifies the OS image to prevent malware or unauthorized modification.
- This ensures device security before startup continues.

3. Linux Kernel Initialization

The Android Linux kernel initializes:

- CPU scheduling
- Memory allocation
- Device drivers (touchscreen, camera, Wi-Fi)

4. Init and Zygote Process

- Init starts core system daemons.
- Zygote launches the Android Runtime (ART), enabling apps to start quickly.

5. System Server + Home Screen

System Server starts major services like:

- Telephony
- Bluetooth
- Notifications



**THANK
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