Windows to Linux

Understanding How Your Computer Starts Up and Load Different OS

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Understanding the Boot Process

Learn the fundamental steps of how your computer starts up

Computer Boot Process: Essential Guide

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Overview

The computer boot process transforms your computer from powered-off state to a fully operational system. This guide covers the essential steps and concepts needed to understand how computers start.

Boot Process Steps

Step 1: Firmware Initialization

When you press the power button:

- **CPU** executes the first program BIOS/UEFI
  - **BIOS** (Basic Input/Output System) - Legacy firmware (used in old computers)
  - **UEFI** (Unified Extensible Firmware Interface) - Modern firmware

Step 2: POST and Boot Device Detection

POST (Power-On Self Test):

- Tests CPU, RAM, and storage devices
- Validates hardware components

Boot Device Selection:

- Reads **Boot Order** from firmware settings
- **GPT drives**: Looks for EFI System Partition
- **MBR drives**: Checks Master Boot Record in first sector

Step 3: Bootloader Execution

Common Bootloaders:
Linux or Window bootloader, both can scan and start any OS windows or linux.
- **Linux**: GRUB2, LILO, systemd-boot - **Windows**: Windows Boot Manager
Bootloader Tasks:

- Scans partitions for installed operating systems
- Presents boot menu (if multiple OS found)

- Loads selected OS kernel into memory

Step 4: Operating System Loading

Linux OS Boot:

1. Kernel loads and initializes hardware
2. **systemd** starts (modern init system)
3. System services launch
4. User login interface appears

Windows OS Boot:

1. **NT Kernel** (`ntoskrnl.exe`) loads
2. **Hardware Abstraction Layer** initializes
3. **Registry** and system drivers load
4. **Session Manager** starts Windows subsystems
5. **Windows Logon** presents login interface

Partition Styles vs File Systems

Partition Styles

Partition styles define how a drive is divided into sections:

Feature	MBR	GPT
Max Partitions	4 primary OR 3 primary + 1 extended	128 primary
Max Storage	2 TB	18+ exabytes
Boot Support	BIOS only	BIOS + UEFI

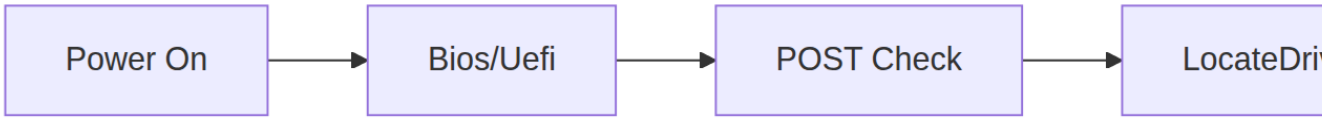
File Systems

File systems determine how data is stored within partitions:

File System	OS	Use Case
NTFS	Windows	System drives, large files
FAT32	Cross-platform	USB drives, compatibility
ext4	Linux	Linux system drives
APFS	macOS	macOS system drives

Boot Process Summary

Phase	Component	Purpose
1	Firmware (BIOS/UEFI)	Hardware initialization
2	POST	Hardware verification
3	Bootloader	OS selection and loading
4	OS Kernel	System initialization



Frequently Asked Questions

Q1: What's the difference between BIOS and UEFI?

Feature	BIOS	UEFI
Interface	Text-only	Graphical possible
Storage Support	2 TB max	No practical limit
Security	Basic	Secure Boot
Speed	Slower	Faster

Q2: What's the difference between partition style and file system?

Partition Style: Defines how the drive is divided (MBR vs GPT) **File System:** Defines how files are stored within each partition (NTFS, ext4, etc.)

Q3: Can I dual boot multiple operating systems?

Yes, by:

- Installing each OS on separate partitions
- Using a bootloader that detects all systems
- Selecting which OS to boot at startup

Resources

Video Tutorials

- Boot Process (English)
- Boot Process (Hindi)
- Windows Partitions (Hindi)

- Boot Process (English) https://www.youtube.com/embed/XpFsMB6FoOs
- Boot Process (Hindi) https://www.youtube.com/embed/sebgrmiYdk4
- Windows Partitions (Hindi) https://www.youtube.com/embed/K2NsltEIUlI

Windows Subsystem for Linux (WSL)

Run Linux seamlessly on Windows

Install WSL in Windows

We will use windows powershell to install wsl.

Check WSL-2 Installed or not?

- Open PowerShell
- `wsl --version` or `wsl.exe --version`
- If any above command shows wsl version 2 , then it is already installed

If WSL 2 Not Instlled

- Search `Turn Windows features on or off`
- Enable `Virtual Machine Platform`, `Windows Hypervisor Platform`, `Windows Subsytem for Linux`
- `Restart` Computer (Not power on/off, click on restart)
- Install WSL WSL-2 Setup
- Switch to WSL-2 `wsl --set-default-version 2`

If already installed then Remove Previous Installed Distributions

`wsl --list --verbose`
For Each Listed distribution
- `wsl --unregister <DistributionName>`
- `Open Settings → Apps → Installed apps` - Find each Linux distribution, click the three-dot menu, and select Uninstall

Update WSL –> Ubuntu Installation

- `wsl --update`
- `wsl --list --online`
- `wsl --install Ubuntu-24.04` –> Install Ubuntu
- `sudo apt update && sudo apt upgrade -y` –> Update Ubuntu
  Example

```
PS C:\Users\hrith> wsl --install Ubuntu-24.04
Downloading: Ubuntu 24.04 LTS
Installing: Ubuntu 24.04 LTS
Distribution successfully installed. It can be launched via 'wsl.exe -d Ubuntu-24.04'
Launching Ubuntu-24.04...
Provisioning the new WSL instance Ubuntu-24.04
This might take a while...
Create a default Unix user account: hrm
New password:
Retype new password:
passwd: password updated successfully
To run a command as administrator (user "root"), use "sudo <command>".
See "man sudo_root" for details.

hrm@bitnd:/mnt/c/Users/hrith$ sudo apt update && sudo apt upgrade -y
[sudo] password for hrm:
Hit:1 http://archive.ubuntu.com/ubuntu noble InRelease
Get:2 http://security.ubuntu.com/ubuntu noble-security InRelease [126 kB]
```

Install JavaScript Tools

- nvm install visit and run bash script `https://github.com/nvm-sh/nvm`
- node install `https://nodejs.org/en/download`
  - `nvm install 22`
  - `nvm list nvm use 22 nvm current`
  - `corepack enable yarn`
  - `corepack enable pnpm`

  Check
  - `nvm -v`
  - `node -v`
  - `npm -v npx -v`
  - `pnpm -v`
  - `yarn -v`

Install Python Tools

1) Python VENV
   - `python3 -m venv .venv` –> Copy error code and run `sudo apt install python3.12-venv`
2) PIPX
   - `sudo apt install pipx`
3) UV - Rust-based Python package installer
   - `pipx install uv` It will maintain isolation
4) LLM
   - `pipx install llm` –> `pipx ensurepath`
   - Configure it
     - `llm install llm-gemini` or `llm install llm-ollama`
     - `llm keys set gemini`
     - `llm -m gemini-2.0-flash 'Tell me fun facts about Mountain View'`

5) MiniConda
   - Download .sh `https://www.anaconda.com/download/success`
   - `bash <pathto .sh file>`
   - `conda config --set auto_activate_base false`

Install C/C++ Tools

`sudo apt install build-essential`

- `gcc` –> The C compiler
- `g++` –> The C++ compiler
  Check - gcc –verison
  - g++ –version

Install Java Tools

`sudo apt install default-jdk`
This command installs:
`Java Development Kit (JDK) - Compiler, debugger, and development tools`
`Java Runtime Environment (JRE) - Required to run Java applications`
`Java Virtual Machine (JVM) - Core execution environment`

- Configure `JAVA_HOME` Environment Variable
  - `echo 'export JAVA_HOME="/usr/lib/jvm/default-java"' >> ~/.bashrc`
    ## confirm the path first using below update-alternatiove… command
  - restart shell
- Install other versions of java
  - `sudo apt install openjdk-17-jdk`
- Set Default Java/Javac installed version
  - `sudo update-alternatives --config java`
  - `sudo update-alternatives --config javac`

  Check
  - `java --version`
  - `javac --version`
  - `echo $JAVA_HOME`

Resources

Video Tutorials

- WSL-2 Setup https://www.youtube.com/embed/G4AVNkd_u0E

Virtual Machine Setup

Create isolated computing environments

In Windows

Using Type-2 Hypervisor

- Download and Install Virtual Box
  - Link
- Download .iso file of any distribution

  - e.g. Ubuntu
- Install iso file in Virtual Box
  - Click on New
  - Select Iso and fill required data...

Resources

Video Tutorials

- Virtual Box Setup (Hindi) https://www.youtube.com/embed/4j2juiMJIhg

! Dual Boot Configuration

Run multiple operating systems on one machine

Dual-Boot Setup Guide

This guide will help you install another operating system (Linux) alongside your existing Windows installation.

Disclaimer

`Do this at your own risk.` Please watch various YouTube videos and proceed with dual boot only when you are 100% sure about the process.

If you want to minimize the risk:

1. **Use External SSD/HDD** to install Linux

- This will prevent almost 99% of any accidental damage to your main system

2. **Install Kubuntu**

- Since dual boot requires creating partitions
- Kubuntu has a `Replace Partition` option which avoids most of the headache

Requirements

1. New SSD/HDD or at least 30GB free storage on your current Windows drive
   - If installing on the same SSD/HDD where Windows is installed:
   - I recommend shrinking at least a 30GB partition
     - How To Shrink Partition
2. Pendrive/USB drive (8GB or larger)
3. One ISO file of any Linux distribution. Kubuntu
4. Software to create a bootable USB drive. Ventoy

Prepare the USB Drive

1. Insert your USB drive and run Ventoy
2. Format your USB drive with Ventoy to make it bootable
3. Just Copy and paste the Linux distribution ISO files into the USB drive
4. To be sure that iso file not got corrupted, you can run sha256sum and check both on local and server matches or not

Prepare Your Laptop/Computer

- Restart your computer
- Go to BIOS/UEFI Settings
  - On HP laptops: restart and keep pressing the `F10` key
- Navigate to Boot Settings

- `Disable Secure Boot` (you can re-enable it after installation)

Installation Process

Once your USB drive and laptop BIOS/UEFI settings are ready, proceed with the installation:

- Restart your computer
- Go to Boot Device Options
  - On HP laptops: keep pressing the `F9` key
- Choose your USB Drive
- If using Ventoy:
  - It will ask which OS to boot (based on the ISOs you've copied)
- If using BalenaEtcher: it will directly boot into that particular OS
- For Kubuntu installation:
  - Click on "Install"
  - Select language, keyboard layout, etc.
  - When choosing where to install or configure `partitions`:
    - Choose `Replace Partition` –> then Select the newly created(shrinked) 30GB partition
    - The installer will format two partitions
      - One for your Linux installation that you just selected
      - One will be EFI partition of windows(first partition in most cases)
  - Choose your username, password, etc., and proceed
  - Once installation is complete, your computer will automatically reboot or ask you to remove the USB drive and press Enter
  - Remove the USB drive and press Enter to reboot

Final Computer Setup

- Restart your computer
- Go to BIOS/UEFI settings
  - You can enable Secure Boot if desired
- Most importantly:
  - Navigate to Boot Settings
  - Change the boot order
  - Set Ubuntu/Linux as the first boot option

Final Notes

- When you turn on your computer, you'll have the option to boot into Ubuntu or Windows
- **Important**:
  - The first time you boot into Windows after installation:
    - You may see a blue screen asking for a BitLocker recovery key
    - You can easily log in with your Microsoft account and retrieve the password from BitLocker Recovery
    - This will only be asked once.

Resources

- BitLocker Recovery
- Kubuntu ISO
- Ventoy

Video Tutorials

- Shrink Partition https://www.youtube.com/embed/eJYwbqlAMd4