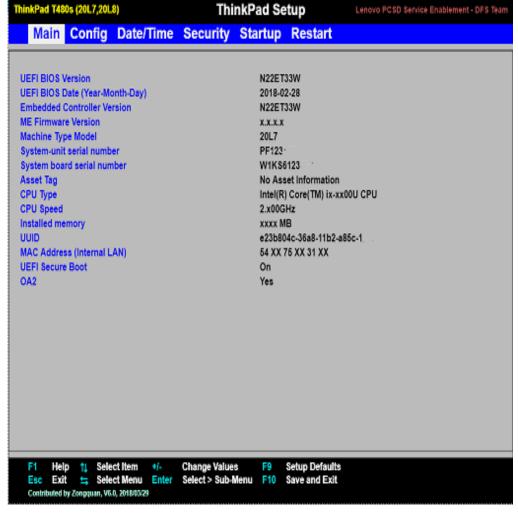
# HARDWARE

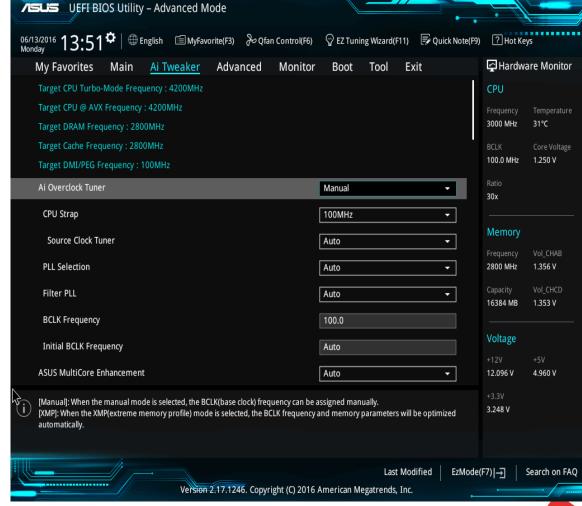
BIOS, BOOT PROCESS, STORAGE

## **BIOS**

 BIOS (Basic Input/Output System) is firmware used to perform hardware initialization and to provide runtime services for operating systems and software

 BIOS performs a power-on self-test (POST) to ensure all hardware is working properly before loading the operating system





 BIOS performs a power-on self-test (POST) to ensure all hardware is working properly before loading the operating system.

• BIOS provides instructions for controlling hardware components like keyboards, hard disks, and display screens.

 BIOS settings allow users to customize the computer's hardware, such as adjusting the time or changing system settings



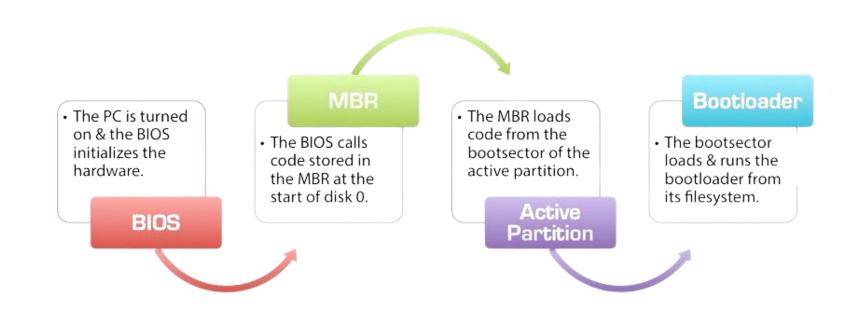
## **BIOS Types:**

• Legacy BIOS: Traditional BIOS that supports 16-bit processing and has a limited interface.

• **UEFI (Unified Extensible Firmware Interface):** A modern replacement for BIOS, offering better graphics, larger storage support, and enhanced security features.

# **BOOT PROCESS**

• The Windows boot sequence comprises multiple phases, starting with firmware-initiated system initialization and ending with the successful loading of the Windows OS



## Power-On Self-Test (POST)

Initiated by the BIOS/UEFI:

When the computer is powered on, the firmware (BIOS or UEFI) performs POST to check hardware components like memory, CPU, and storage.

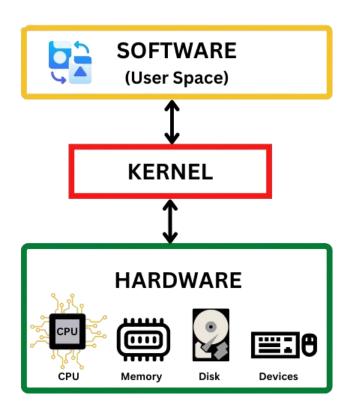
If POST succeeds, the firmware looks for a bootable device as specified in the boot order.

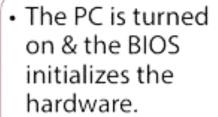
## **Bootloader Execution**

#### • BIOS vs. UEFI:

- In BIOS-based systems, the Master Boot Record (MBR) contains the bootloader.
- In UEFI-based systems, the bootloader is stored as an EFI (Extensible Firmware Interface) executable file on the EFI System Partition (ESP).
- The bootloader is responsible for loading the operating system kernel.

• System kernel is the core of a computer's operating system (OS) that acts as the bridge between the OS and the computer's hardware





BIOS

#### MBR

 The BIOS calls code stored in the MBR at the start of disk 0.  The MBR loads code from the bootsector of the active partition.

Active Partition

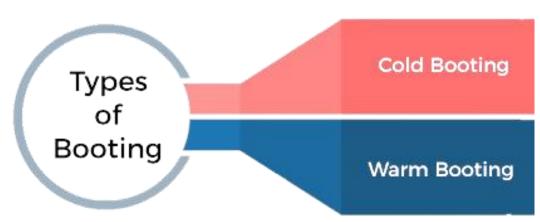
#### Bootloader

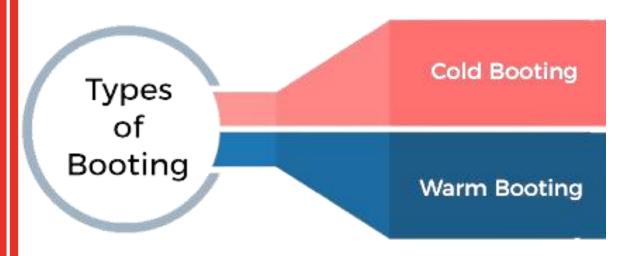
 The bootsector loads & runs the bootloader from its filesystem.



#### **Cold booting**

Also known as hard booting, this is when a computer is started from a powered-off state. The system performs a power-on self-test (POST) to initialize hardware devices and load the operating system into RAM





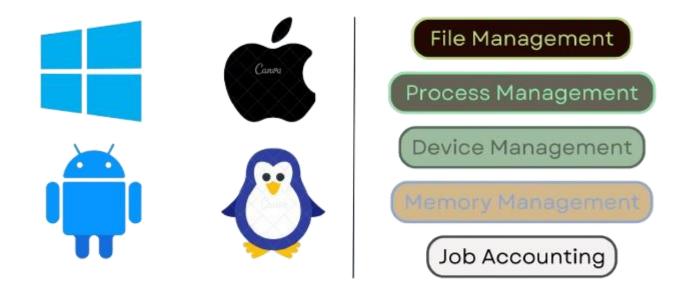
#### Warm booting

Also known as soft booting, this is when a computer is restarted without being completely powered off. Warm booting is typically used to recover from crashes, apply software updates, or refresh the system.

It's faster than cold booting because it skips the initial POST checks. You can perform a warm boot by using the "Restart" option in your operating system or pressing Ctrl + Alt + Delete

# Operating system (OS)

• "The operating system (OS) is a fundamental software platform that efficiently manages hardware and software resources, provides vital services for programs, and facilitates seamless interaction between users and computer hardware



# Functions of an Operating System

#### Resource Management:

Manages hardware resources like CPU, memory, storage, and I/O devices, allocating them efficiently to applications and users.

#### Process Management:

Handles the creation, scheduling, and termination of processes (programs in execution). Ensures proper synchronization and communication between processes.

#### Memory Management:

Allocates and tracks memory usage for applications and processes. Includes virtual memory management to extend physical memory with disk space.

#### • File System Management:

Provides a way to store, organize, retrieve, and manipulate data files on storage devices like hard drives and SSDs.

#### User Interface:

Offers interfaces for interaction, such as command-line interfaces (CLI) or graphical user interfaces (GUI).

#### Security and Access Control:

Protects system resources and data from unauthorized access and ensures secure execution of processes.

#### Networking:

Manages communication and resource sharing between computers over networks.

#### Device Management:

Provides drivers to interact with peripheral devices such as printers, keyboards, and network cards.

## **BOOT.INI**

BOOT.INI is a configuration file used in older versions of Microsoft Windows (specifically Windows NT-based systems like Windows NT, 2000, and XP) to manage the boot process. It contains settings that determine which operating systems or boot options are displayed when the computer starts.

#### Purpose of BOOT.INI

- •Directs the system to the partition or drive where the operating system resides.
- •Allows users to configure multiple operating systems in a dual-boot or multiboot setup.
- •Provides advanced boot options like safe mode or debug mode.

#### Location

The BOOT.INI file is typically found in the root directory of the system partition, usually C:\.

It is a hidden and system file.

## Master Boot Record (MBR)

• The Master Boot Record (MBR) is a special type of boot sector located at the beginning of storage devices like hard drives and USB drives. It is crucial for booting traditional BIOS-based systems and managing partitions on the disk.

The MBR is 512 bytes in size and contains the following components:

#### 1.Boot Code (446 bytes):

- Contains machine code instructions to initiate the boot process.
- •Directs the system to the operating system's bootloader.

#### 2.Partition Table (64 bytes):

- •Holds information about up to four primary partitions on the disk.
- Each entry is 16 bytes and includes details like partition type, size, and starting location.

#### 3.Boot Signature (2 bytes):

•A marker (0x55AA) indicating that the sector is an MBR. This helps the BIOS identify it as bootable.

# STORAGE

## **STORAGE**

• Computers have many types of storage devices, including:

 Random access memory (RAM): The primary storage for a computer, RAM is used to temporarily store data while you work on a file. RAM is volatile, meaning it can't hold onto information after the computer turns off. • Solid-state drives (SSDs): SSDs use flash memory instead of magnets and disks, making them faster and more durable than hard disk drives (HDDs). SSDs are also more appropriate for portable devices because they require less power.



• **USB flash drives**: These small, portable devices are a popular choice for extra storage.

• Optical storage devices: These include CDs, DVDs, and Blu-Ray discs. Binary data is stored as microscopic pits and bumps on the disc's surface, which are scanned by a laser.

# R.A.I.D

## Redundant Array of Independent Disks

 RAID (Redundant Array of Independent Disks) is a data storage technology that combines multiple physical disks into a single logical unit, providing improved data reliability, performance, and capacity.

> Redundant Array of Independent Drives



### **Features**

#### **Performance:**

Distributes data across multiple drives to increase read/write speeds.

#### **Redundancy:**

Protects against data loss in case of drive failure by storing duplicate or parity data.

#### **Capacity:**

Combines storage space from multiple drives into one logical volume.

## Common RAID Levels:

- 1. RAID 0: Striping (data is split across multiple disks) for improved performance, but no redundancy.
- 2. RAID 1: Mirroring (data is duplicated on two disks) for improved reliability, but no increase in capacity.
- 3. RAID 5: Striping with parity (data is split across multiple disks with parity information) for improved performance and reliability.

• 4. RAID 6: Striping with dual parity (data is split across multiple disks with two sets of parity information) for improved performance and reliability.

• 5. RAID 10: Combination of mirroring and striping for improved performance and reliability.

