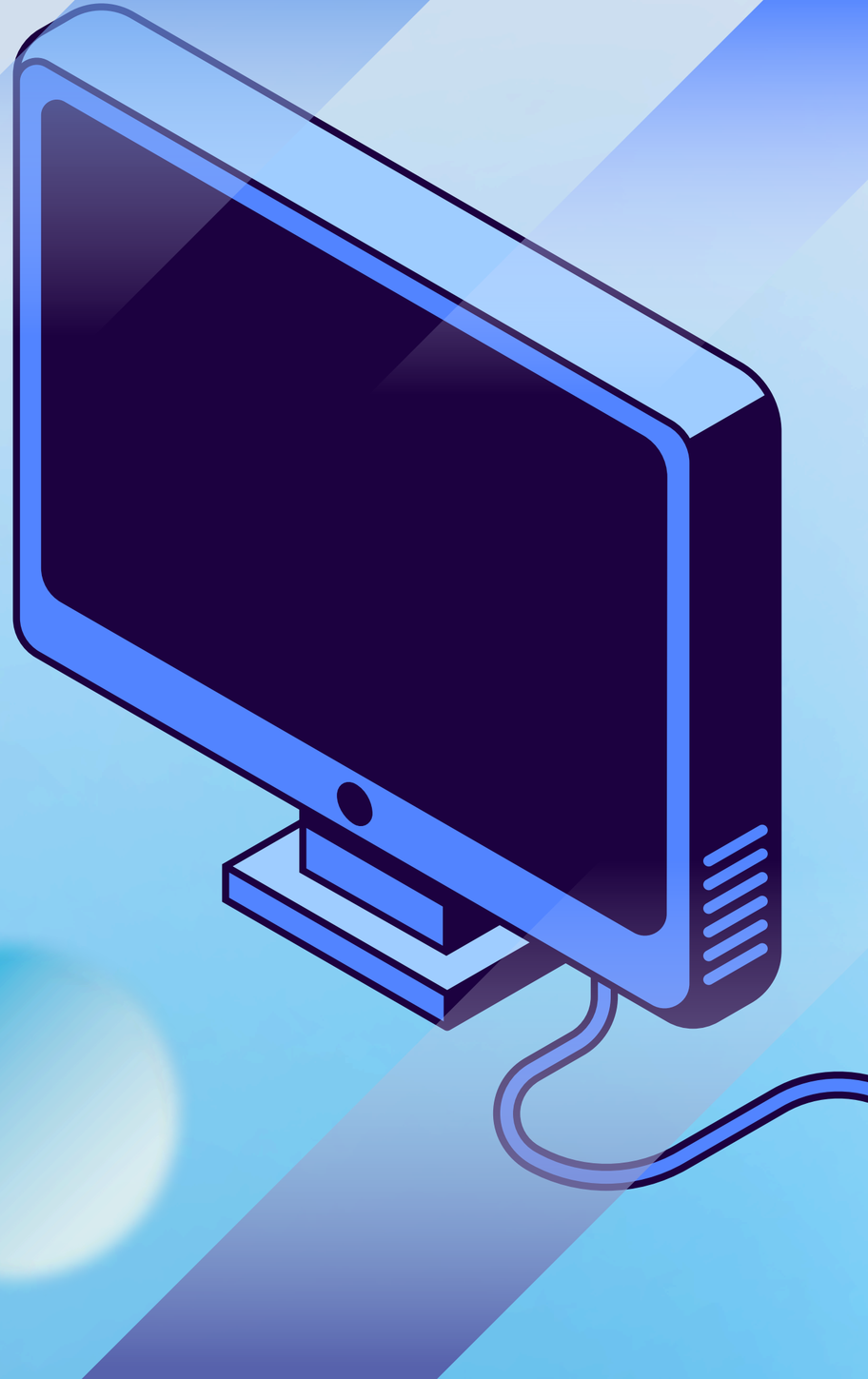
BIOS, Boot Processing, and Operating System Fundamentals



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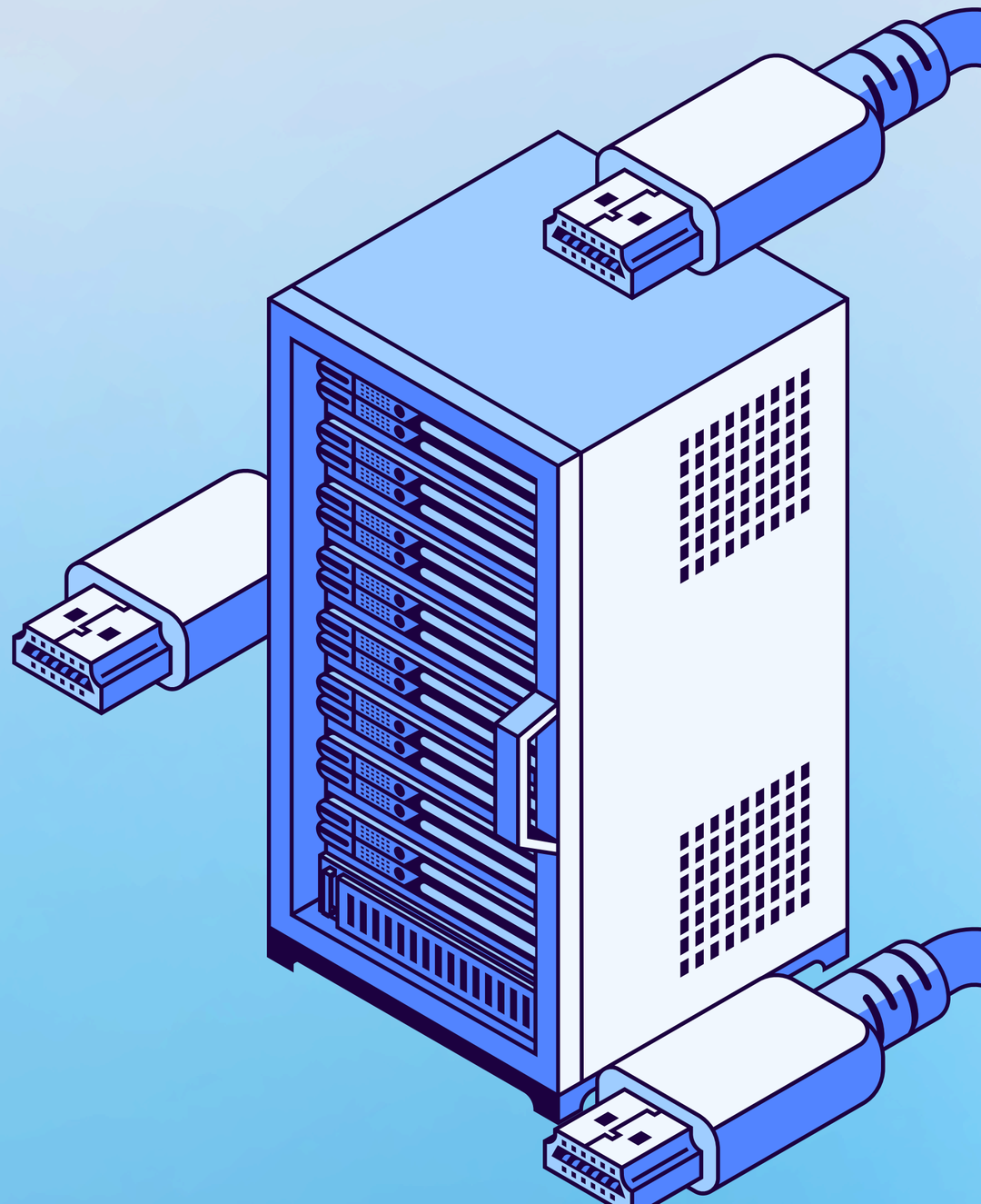
Introduction

- Briefly introduce the concept of BIOS, boot processes, and operating system fundamentals.
- Explain the importance of understanding these components in modern computing.

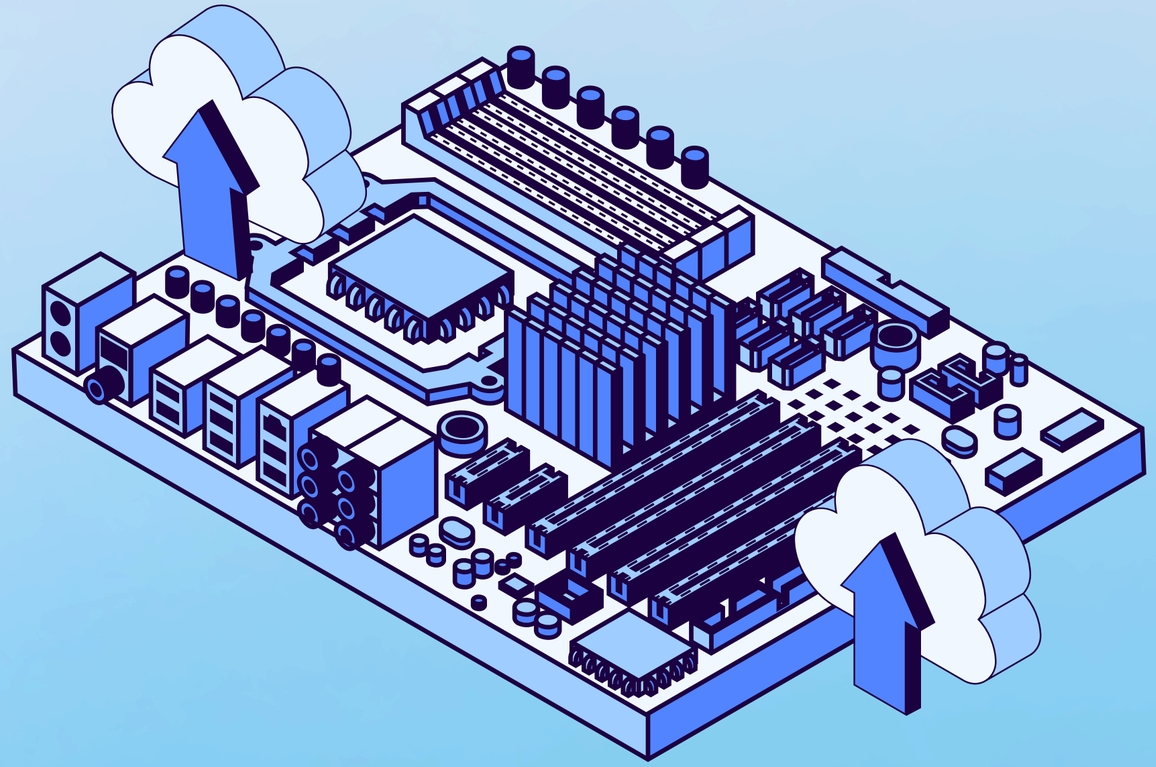
What is BIOS?

Definition: Basic Input/Output System (BIOS) is firmware that initializes hardware during the boot process before handing control over to the operating system.

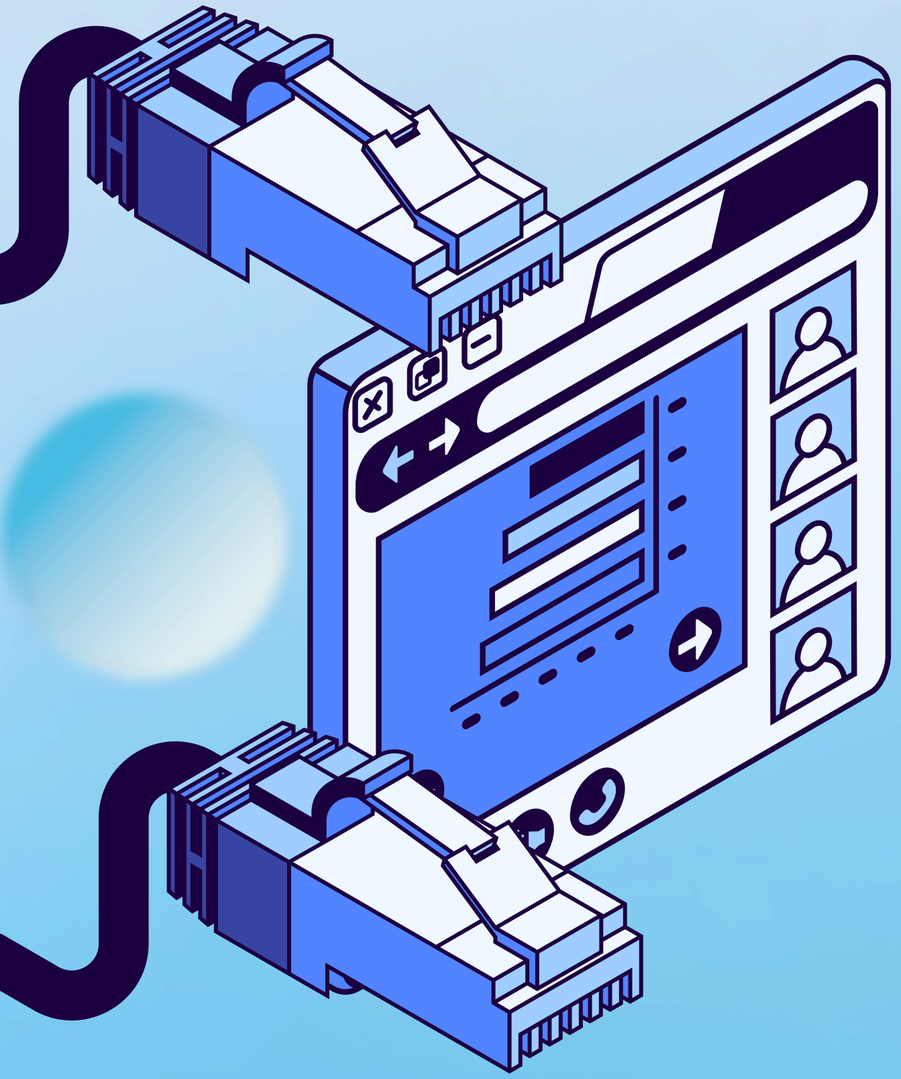
Role in Boot Process: BIOS performs POST (Power-On Self-Test) and locates the operating system.



BIOS Components



- **CMOS** (Complementary Metal-Oxide-Semiconductor): Stores BIOS settings.
- **BIOS ROM** (Read-Only Memory): Non-volatile storage of BIOS code.
- **Firmware***: Software permanently programmed into hardware.



BIOS Key Functions

- **POST:** BIOS performs diagnostics to ensure that essential hardware (CPU, RAM, storage) is working.
- **Bootstrap Loader:** BIOS finds and loads the bootloader from the specified boot device.
- **Hardware Configuration:** BIOS configures CPU, memory, and connected devices like hard drives and peripherals.

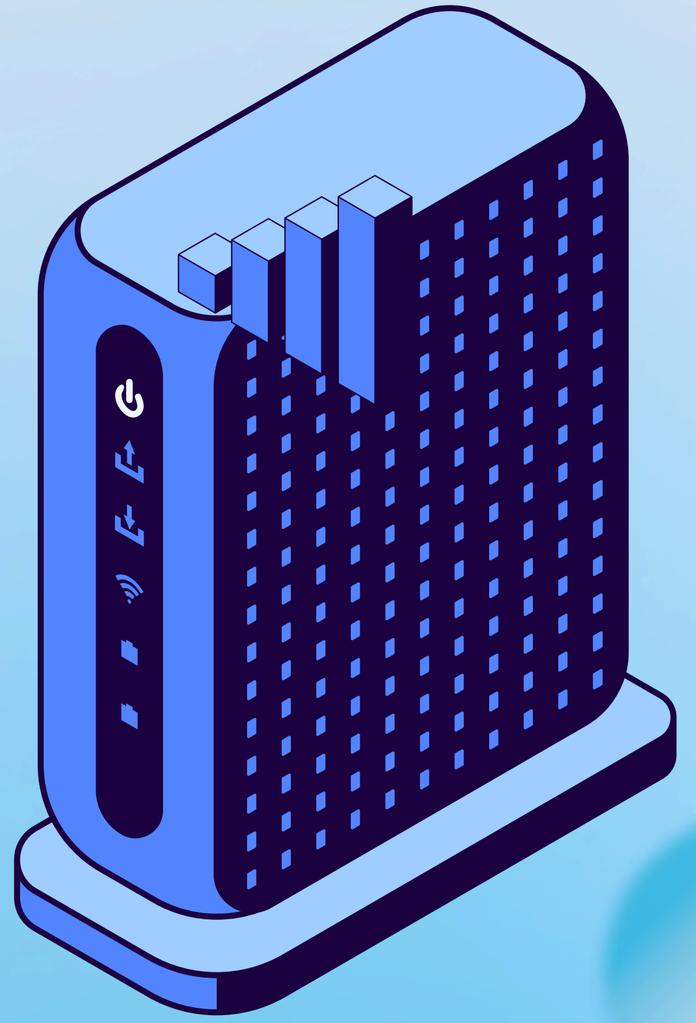
BIOS vs UEFI:

- **BIOS:** Legacy firmware, 16-bit, supports MBR (Master Boot Record) partitioning, limited to 2TB disk size.

UEFI: Modern firmware, supports GPT (GUID Partition Table) for larger disks, graphical interface, secure boot, and faster boot times.

- Comparison:

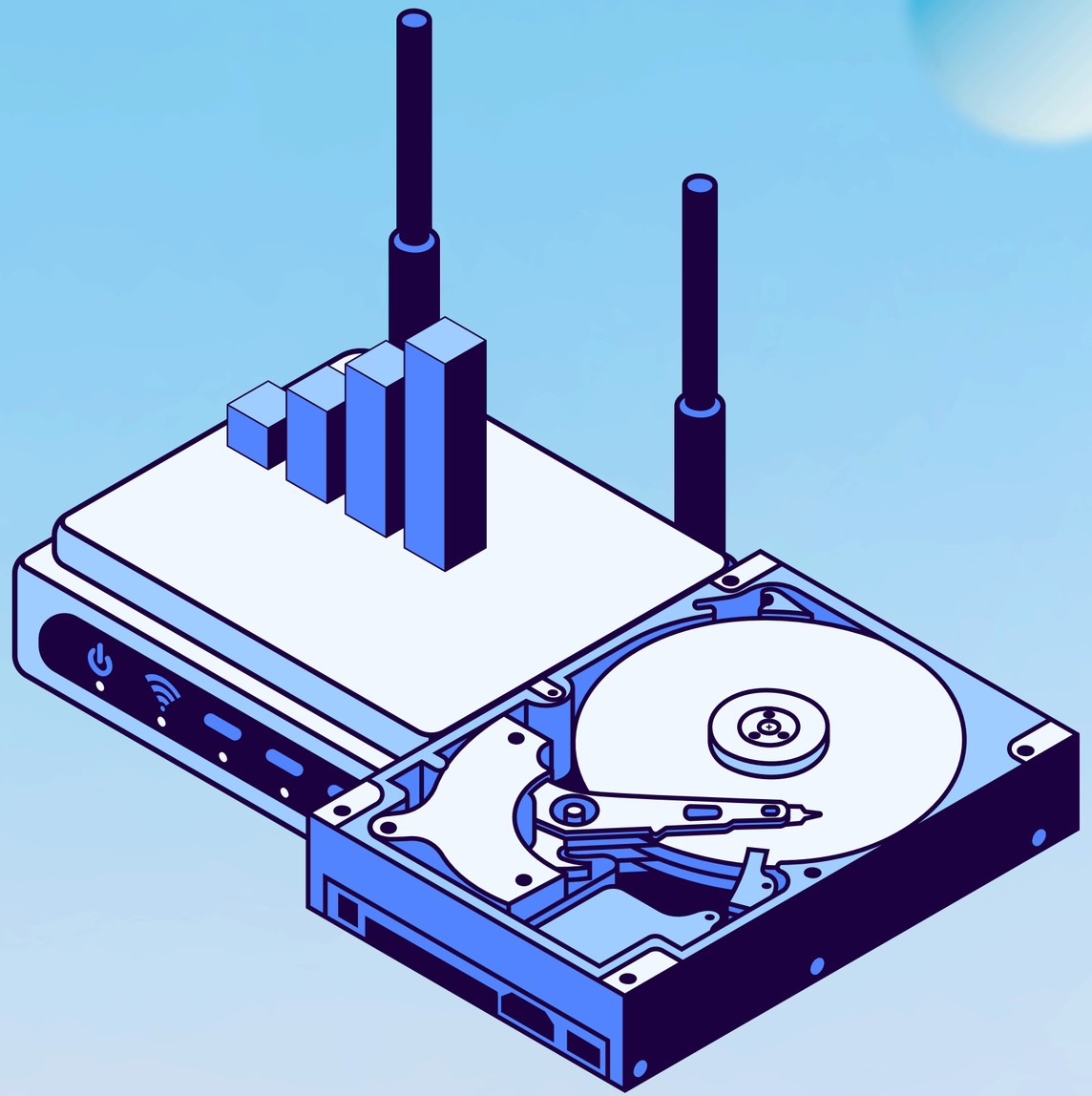
- UEFI is faster, more flexible, and supports advanced features like Secure Boot and larger disks.

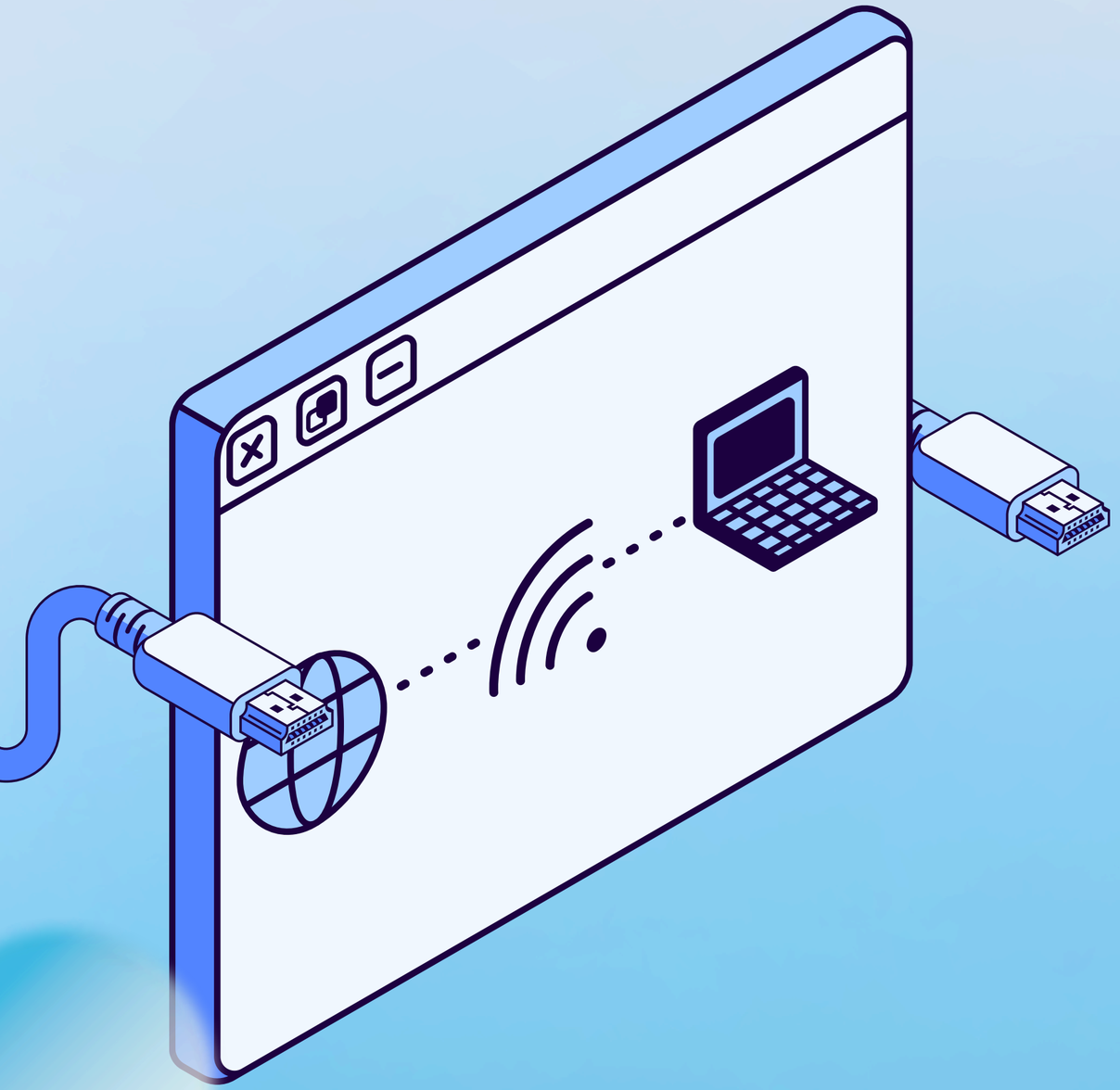


What is the Boot Process?

- **Boot Process:** The sequence of steps the system undergoes to start up and load the operating system.

- **Key Stages:**
  1.Power-on
  2. BIOS initialization
  3. POST
  4. Bootloader execution.
  5. Operating System Kernel loading





Step-by-Step Boot Process

1. Power is supplied to the motherboard.
2. BIOS performs POST.
3. BIOS loads bootloader
4. Bootloader loads the operating system kernel
5. OS initialization (drivers, services, login).

BIOS POST Process

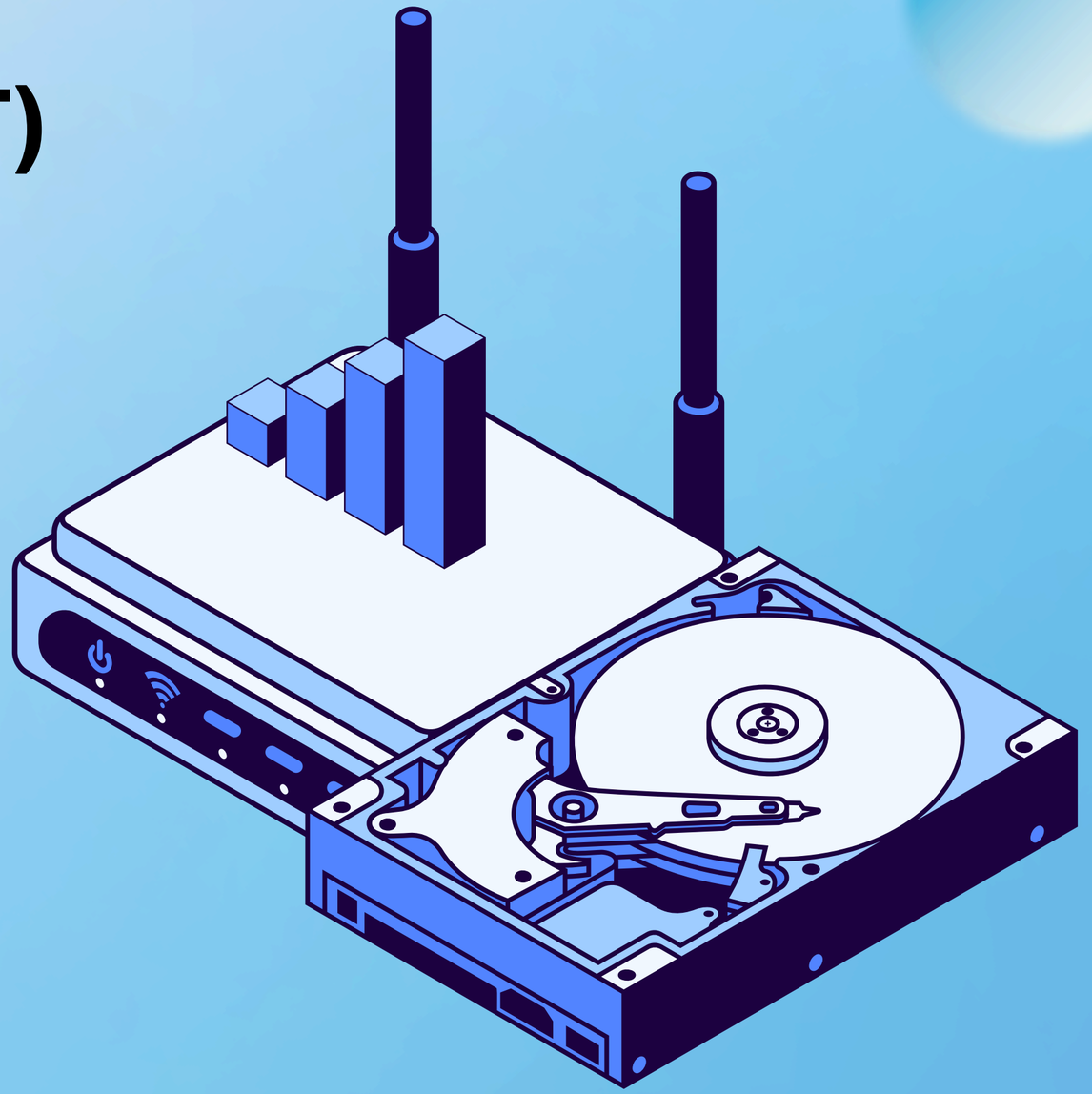
The POST checks:

- **CPU:** Functionality and presence.
- **Memory (RAM):** Integrity and capacity.
- **Peripheral Devices:** Keyboard, Mouse, Storage.

- If POST passes, BIOS proceeds to boot the OS.

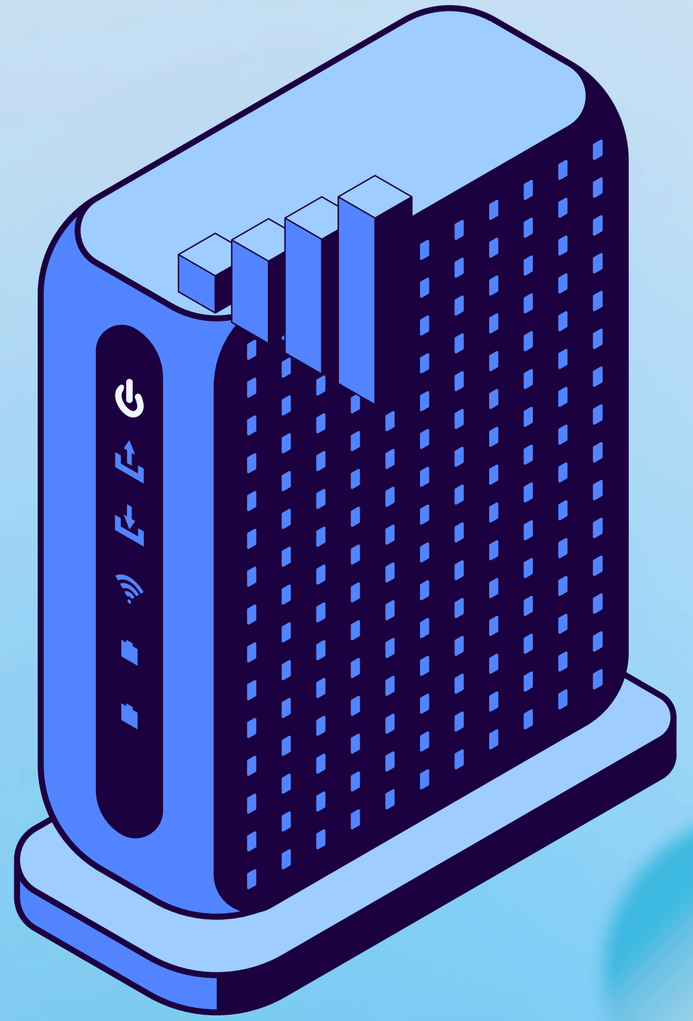
Bootloader: (MBR vs GPT)

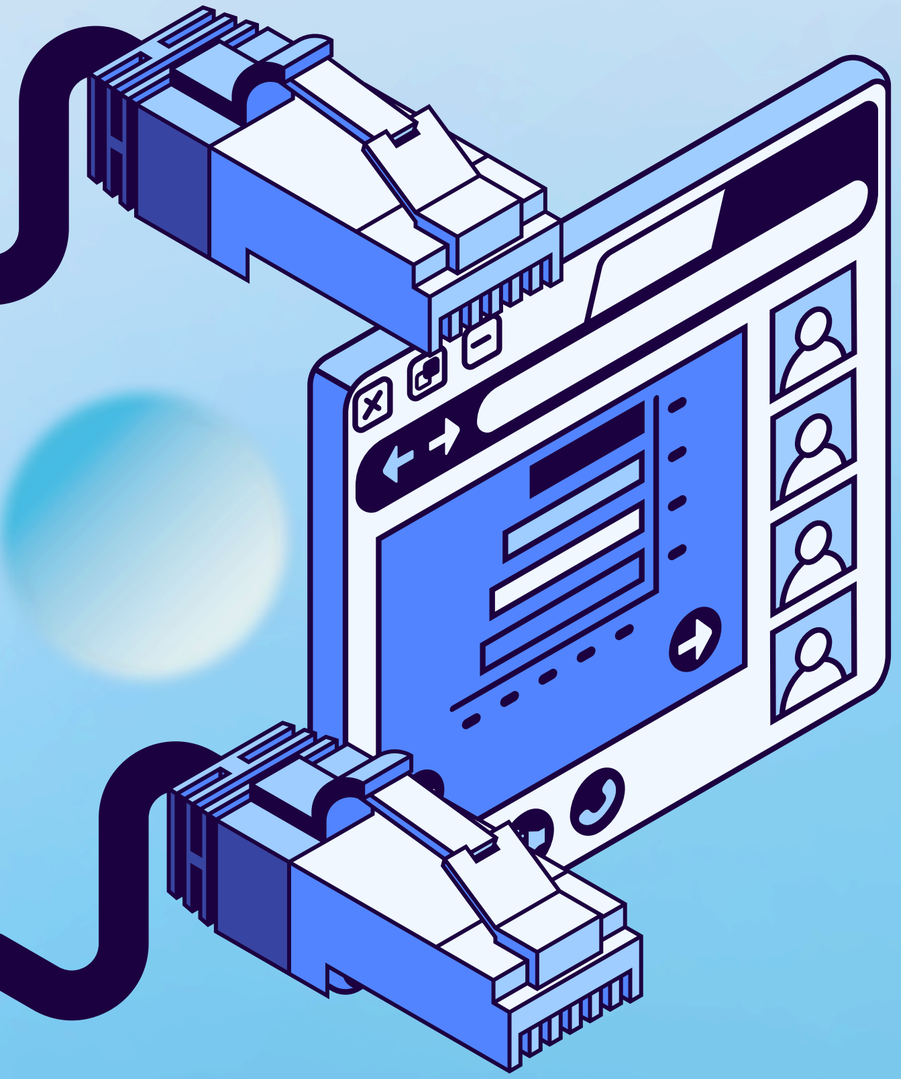
- **MBR (Master Boot Record):** Older partitioning scheme, limited to 2TB disks
- **GPT (GUID Partition Table):** Modern partitioning scheme, supports larger disks and more partitions.



Boot Process Flow

1. BIOS/UEFI Initialization.
2. POST (Power-On Self-Test):
3. Bootloader Execution.
4. Loading OS kernel
5. Operating System Boot-up.





Role of the Operating System

- **What is an OS?:** The software that manages hardware resources and provides services for application programs.
- **Kernel:** Manages hardware and system resources.
- **Shell:** Interface for user commands.
- **Drivers:** Enable communication between hardware and software.

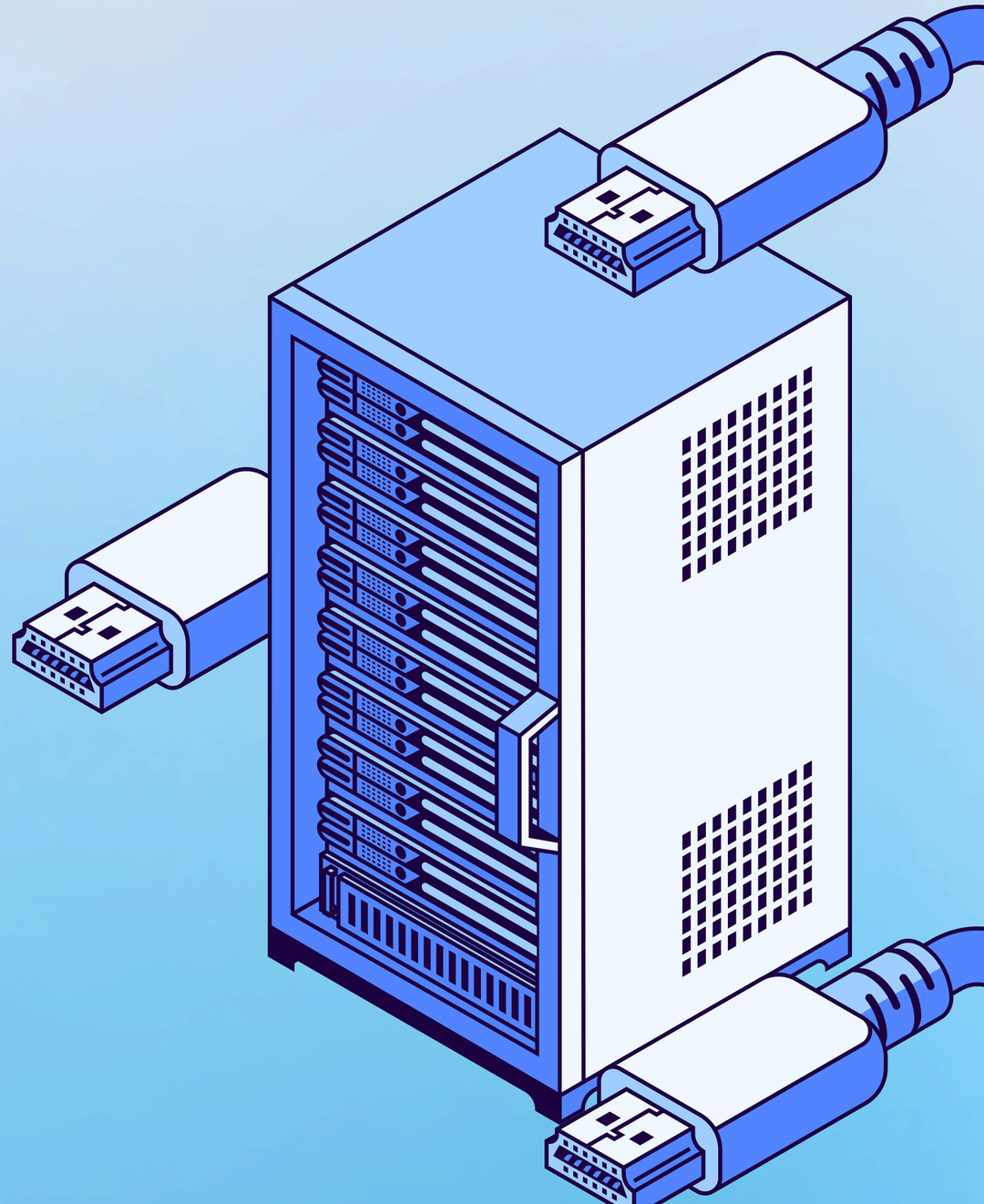
Operating System Boot Process

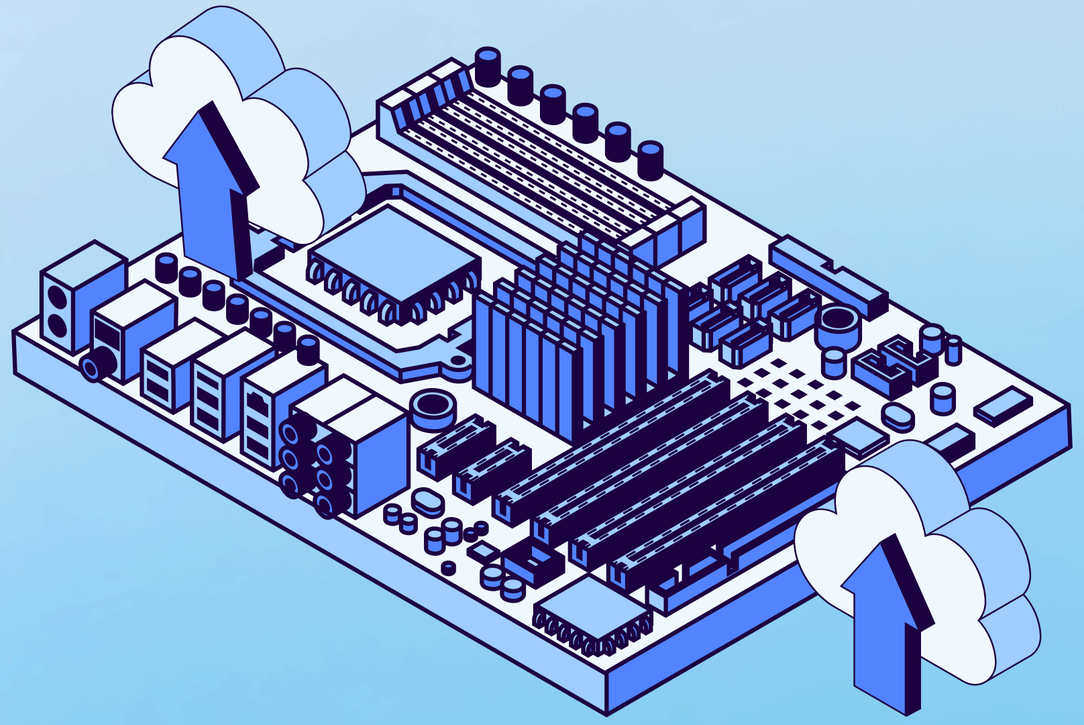
- **The OS kernel is loaded into memory by the bootloader.**
  - **Kernel Initialization:**

- Detects hardware devices.
- Loads device drivers.
- Initializes system services (e.g., network, file system).

BIOS/UEFI and OS Interaction

- **BIOS/UEFI:** handles the initial hardware configuration and loading of bootloaders.
- **Operating System:** takes over for further hardware management and user interaction.





Key Differences Between BIOS and OS

BIOS: Basic firmware for hardware initialization.

Operating System: Manages system resources and provides user environment.

Key distinction: BIOS runs first; OS takes over after BIOS completes.

Understanding BIOS and boot processes is crucial for managing system startup, optimizing settings, and troubleshooting boot issues. Proper configuration and maintenance can prevent many common problems.

Thank You!