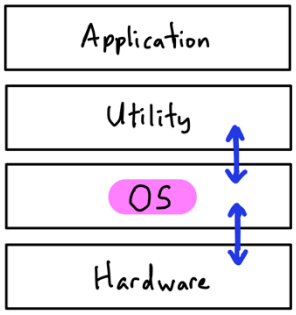
Operating Systems: A Brief Overview

What is an Operating System (OS)?
An operating system (OS) is installed above the hardware layer to enable users to control and coordinate the hardware among various application programs.

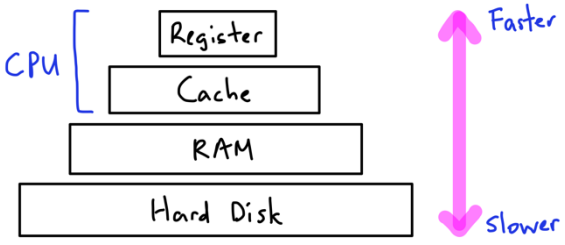


Purpose of the OS and Hardware
The hardware managed by the OS serves to:

- Increase throughput
- Shorten turnaround time
- Enhance availability
- Improve reliability

Core Components of the Computer System

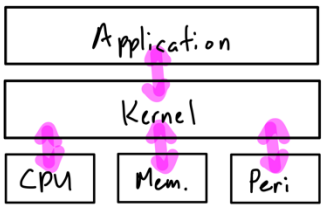
1. **Central Processing Unit (CPU)**
    - The CPU is the "brain" of the computer, responsible for computations and executing programs.
    - It is also referred to as the processor.
2. **Memory**
    - Memory serves as storage for data and instructions.
    - Two main types:
        - **Volatile main memory** (e.g., RAM)
        - **Non-volatile secondary memory** (e.g., HDD and SSD)
3. **The Memory Hierarchy**



Processes and Scheduling

- When a program is executed, the OS loads it from secondary memory into main memory.
- **Process:** A program in main memory, ready for execution.
- The CPU can handle only one process at a time. In multi-process systems, the OS schedules processes based on specific algorithms.

The Kernel



- The kernel is the core component of the OS, responsible for:
  - Managing hardware
  - Ensuring security
  - Allocating resources
  - Performing critical operations like CPU scheduling, memory management, I/O handling, and managing file systems.

User Mode vs. Kernel Mode

- **Kernel Mode:** Provides unrestricted access to hardware.
- **User Mode:** Restricts hardware access for security and stability.
- To access hardware or resources from user mode, processes make **system calls**.

System Calls

- System calls act as functions that transition a process from user mode to kernel mode.
- Common system calls:
  - **fork():** Creates a new process.
  - **wait():** Suspends execution until a child process completes.