# OPERATING SYSTEM STUDY NOTES

## Operating System (OS) and Types

Operating system is system software that manages computer hardware and software resources and provides a user interface. It enables communication between users and the hardware.

### Functions

- **Process Management:** Manages program execution and multitasking.
- **Memory Management:** Allocates and tracks memory use.
- **File System Management:** Organizes and controls file storage.
- **Device Management:** Manages I/O devices and peripheral access.

- **User Interface:** Provides a way for users to interact with the computer.

## Types of Operating Systems:

- **Batch OS:** Executes a series of jobs without user interaction, suitable for tasks that can be processed in bulk.

- **Time-Sharing OS:** Allows multiple users to share system resources simultaneously, dividing time among tasks.

- **Distributed OS:** Manages a network of computers, making them appear as a single system and sharing tasks and resources.

- **Real-Time OS (RTOS):** Processes data in real-time, essential for applications where timing is crucial (e.g., medical and industrial systems).

- **Mobile OS:** Designed for mobile devices (e.g., Android, IOS), optimized for touchscreen interfaces and power efficiency.

## Computer System Architecture

- **Von Neumann Architecture:** Consists of a single pathway for both instructions and data, including the Control Unit, Arithmetic Logic Unit (ALU), Memory, and Input / Output devices.

- **Harvard Architecture:** Separates pathways and storage for instructions and data, often used in embedded systems.

- **Single Processor System:** A single CPU processes all instructions sequentially.

- **Multiprocessor System:** Multiple CPUs work in parallel to improve processing power.

- **Clustered System:** A group of linked computers working together often used in high-performance computing environments.

## Components of a Computer System

- **Hardware:** Physical components that perform computing tasks (e.g., CPU, RAM, motherboard, storage).

- **Software:** Programs and applications that run on hardware, categorized into system software and application software.

- **User:** Interacts with the system, utilizing both software and hardware for tasks.

## Hardware and Devices

- **Central Processing Unit (CPU):** Known as the "brain" of the computer; executes instructions and processes data. Key parts:

- **Control Unit (CU):** Directs the flow of data and instructions within the CPU.

-**Arithmetic Logic Unit (ALU):** Performs arithmetic and logical operations.

- **Motherboard:** The primary circuit board that connects all components, containing slots for CPU, RAM, and storage.

- **RAM (Random Access Memory):** A form of volatile memory that temporarily holds data for quick access by the CPU.

- **Storage Devices:** Include hard disk drives (HDD), solid-state drives (SSD), and optical drives, used for long-term data storage.

## Input / Output Devices

- **Input Devices:** Allow users to send data to the computer (e.g., keyboard, mouse and scanner).

- **Output Devices:** Display or output data from the computer (e.g., monitor, printer).

## Software and Types

- **System Software:** Software that manages and supports a computer's resources (e.g., operating systems, drivers).

- **Application Software:** Programs designed for specific tasks (e.g., Microsoft Word, Excel, games).

- **Utility Software:** Supports system performance and maintenance (e.g., antivirus, file managers).

- **Programming Software:** Tools for developers to write and test code (e.g., compilers, IDEs).

# Internal Working of a Computer

- **Input:** Data is entered via input devices (e.g., keyboard, mouse) and then processed by the CPU.

- **Processing:** The CPU processes data according to instructions from software. This process includes:

- **Fetch-Decode-Execute Cycle:** The CPU fetches an instruction from memory, decodes it, and executes it.

- **Storing:** Temporary data is held in RAM, while permanent data is stored on a storage device.

- **Output:** Processed data is sent to output devices (e.g., monitor, printer) for display or further use.

- **Bus System:** Transfers data among CPU, memory, and I/O devices; includes data, address, and control buses.

## CPU, Motherboard, and RAM

- **CPU:** Executes instructions and processes data; has cores that allow parallel processing.

- **Motherboard:** Hosts the CPU, RAM, storage, and other components, providing connectivity and communication pathways.

- **RAM:** Temporary, high-speed memory that stores data currently in use by the CPU; more RAM allows for better multitasking.

## Memory Management

The OS manages memory allocation and de-allocation to ensure efficient use of resources and avoid conflicts.

### Types of Memory

- **Primary Memory:** Fast, volatile memory like RAM that is directly accessible by the CPU.

- **Secondary Memory:** Persistent storage (e.g., HDD, SSD) used for long-term storage.

- Memory Management Techniques:

- **Paging:** Divides memory into fixed-size pages, allowing processes to be loaded as needed.

- **Segmentation:** Divides memory based on logical units, like functions or data blocks.

- **Virtual Memory:** Extends available memory by using part of the disk storage as extra RAM, managed by the OS.

## File Management

The OS controls how data is stored, organized, and accessed on storage devices.

- **File System Types:** Defines how data is stored and organized, with common types including FAT32, NTFS, ext4.

- **File Operations:** Basic file operations include creating, reading, writing, deleting, and organizing files within directories.

- **Directory Structure:** Organizes files in a hierarchical manner, often resembling a tree structure for easier navigation.

# Importance of File Management

- **Efficient Retrieval:** Well-organized files make it easier to find, share, and work with documents.

- **Space Management:** Helps optimize storage space by eliminating redundant or unnecessary files.

- **Collaboration:** Enables teams to work together by sharing, versioning, and tracking files.

- **Security:** Protects sensitive data through permissions, encryption, and backups.

- **Backup and Recovery:** Regular backups ensure files can be recovered in case of loss due to accidents or disasters.