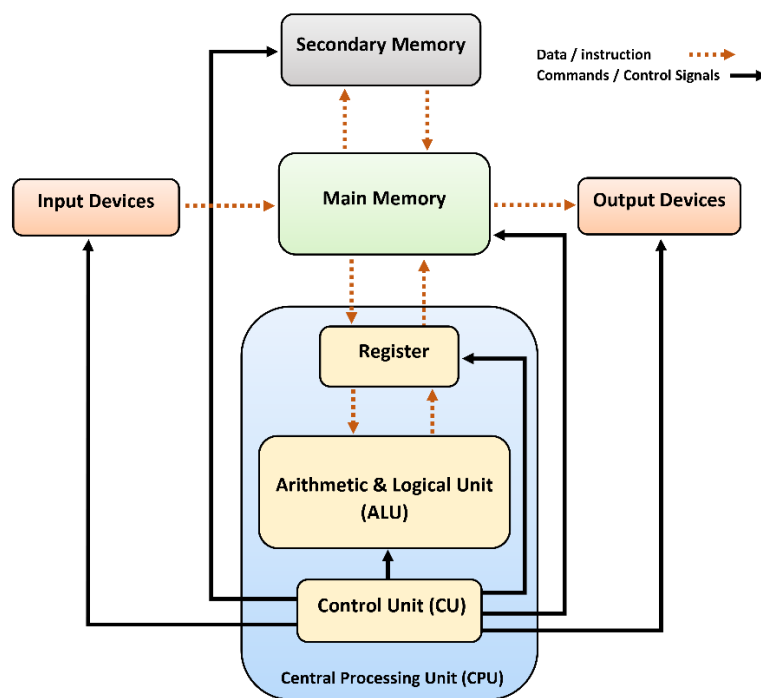


Computer Architecture of Hardware

Question 1. Explanation of Computer Architecture ?:-

The **architecture of a computer** refers to the conceptual design and fundamental operational structure of a computer system. It defines how various components interact and work together to perform computations.



Components of Computer Architecture

1. Central Processing Unit (CPU):

- The brain of the computer responsible for executing instructions.
- Components of CPU:
 - **Control Unit (CU):** Directs operations within the computer by interpreting instructions from programs.
 - **Arithmetic Logic Unit (ALU):** Performs mathematical calculations and logical operations.
 - **Registers:** Small storage locations for immediate access during processing.

2. Memory:

- Stores data and instructions required for processing.
- Types:

- **Primary Memory:**
 - **RAM (Random Access Memory):** Temporary, volatile memory for currently used data.
 - **ROM (Read-Only Memory):** Non-volatile, stores essential data like the BIOS.
- **Secondary Memory:**
 - Storage devices like HDDs, SSDs, and optical drives for long-term data storage.

3. **Input Devices:**

- Tools to input data into the computer (e.g., keyboard, mouse, scanner).

4. **Output Devices:**

- Devices that display or output the results of computations (e.g., monitor, printer).

5. **Storage Devices:**

- **Primary Storage:** RAM for temporary data storage.
- **Secondary Storage:** HDDs and SSDs for permanent data storage.

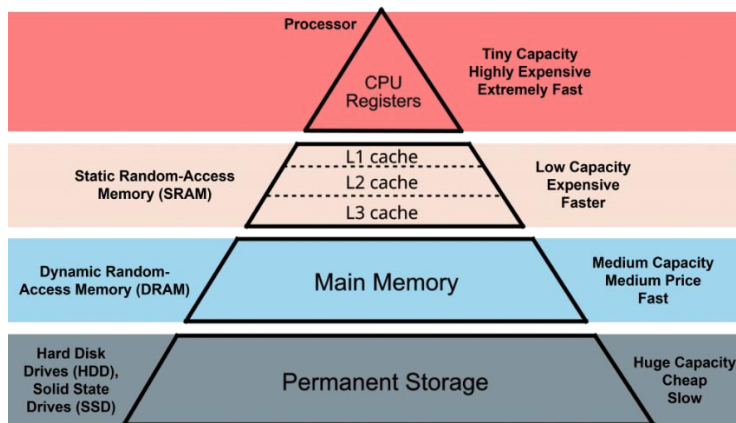
6. **System Bus:**

- Communication pathways for data transfer between components.
- Types:
 - **Data Bus:** Transfers data.
 - **Address Bus:** Transfers memory locations.
 - **Control Bus:** Transfers control signals.

7. **I/O Interface:**

- Manages communication between the CPU and peripheral devices.

Question 2. Explanation of Memory Hierarchy:-



Levels of Memory Hierarchy

The memory hierarchy is generally divided into the following levels:

1. Registers:

- Closest to the CPU.
- Smallest and fastest memory in the hierarchy.
- Stores data that the CPU is currently processing.

2. Cache Memory:

- Faster than main memory but slower than registers.
- Stores frequently accessed data and instructions.
- Typically divided into levels:
 - L1 Cache: Closest to the CPU, very fast but small.
 - L2 Cache: Larger than L1 but slower.
 - L3 Cache: Shared among CPU cores, larger and slower than L2.

3. Main Memory (RAM):

- Primary memory used for executing applications.
- Volatile: Data is lost when power is off.
- Slower and cheaper than cache.

4. Secondary Storage:

- Non-volatile storage such as HDDs and SSDs.
- Stores data permanently but is slower than RAM.

5. Tertiary Storage:

- Backup or archival storage (e.g., magnetic tapes, optical discs).

- Very large capacity but extremely slow.

6. Cloud Storage:

- Data stored on remote servers accessed over the Internet.
- Relatively slower due to network latency but offers virtually unlimited storage.

Characteristics of the Memory Hierarchy

Level	Speed	Cost	Capacity	Volatility
Registers	Fastest	Highest	Smallest	Volatile
Cache (L1, L2, L3)	Very Fast	Very High	Small	Volatile
Main Memory (RAM)	Fast	High	Moderate	Volatile
Secondary Storage	Slow	Low	Large	Non-volatile
Tertiary Storage	Very Slow	Very Low	Very Large	Non-volatile
Cloud Storage	Slowest	Variable	Virtually Unlimited	Non-volatile