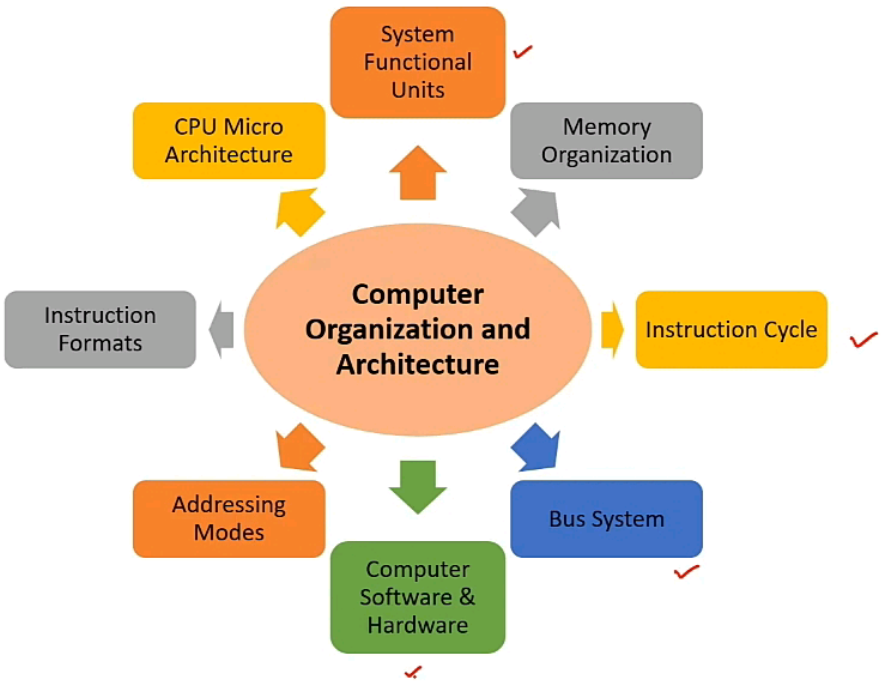
# The COA Important Topics

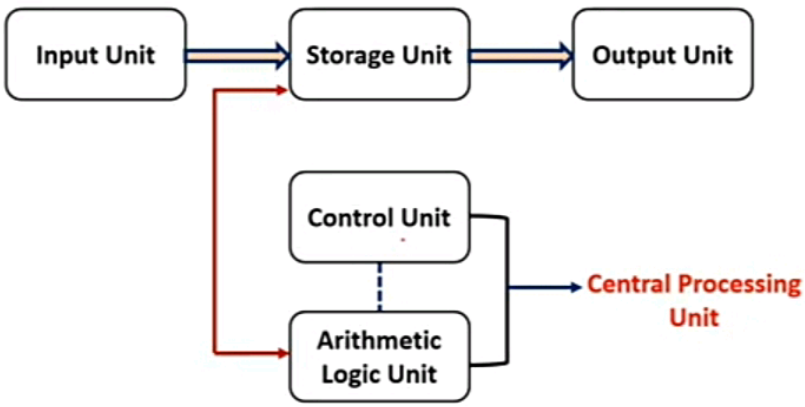


# Functional Units of Digital System

- A **general purpose computer** system is the **best known example** of a digital system
- **Other examples** include telephone switching exchanges, digital voltmeters, digital counters, electronic calculators and digital displays etc.

A computer consists of five main components :

- Input
- Output
- Memory
- Arithmetic and Logical Unit
- Control Unit




Functional Units of a Computer System

# Functional Units of Digital System

## Input Unit

- It is **used by the computer** to **read the data**
- The most **commonly used** input devices are keyboards, mouse, joysticks, trackballs, microphones, etc.
- Whenever a key is pressed, the corresponding letter or digit is automatically translated into its corresponding binary code and transmitted over a cable to either the memory or the processor.

## Control Unit

- It is a component of a computer's CPU that coordinates the operation of the processor
- It coordinates the operation of the processor. It tells the computer's memory, arithmetic/logic unit and input and output devices how to respond to a program's instructions
- The control unit is also known as the nerve center of a computer system

## Central Processing Unit

- It is commonly known as CPU can be referred as an electronic circuitry within a computer
- It carries out the instructions given by a computer program by performing the basic arithmetic, logical, control and input/output (I/O) operations specified by the instructions

# UNIT-1

## Memory Unit

- It is referred as the storage area in which programs are kept which are running, and that contains data needed by the running programs
- The **Memory unit** can be **categorized** as: **primary memory** and **secondary memory**

### Primary Memory

- Also known as the volatile form of memory, means when the computer is shut down, anything contained in RAM is lost
- Examples are: RAM and ROM

### Secondary Memory

- It is used when a large amount of data and programs have to be stored for a long-term basis
- Also known as the Non-volatile memory form i.e. data is stored permanently irrespective of shut down.
- Examples are: magnetic disks, magnetic tapes, and optical disks.

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# Functional Units of Digital System

## Arithmetic and Logical Unit

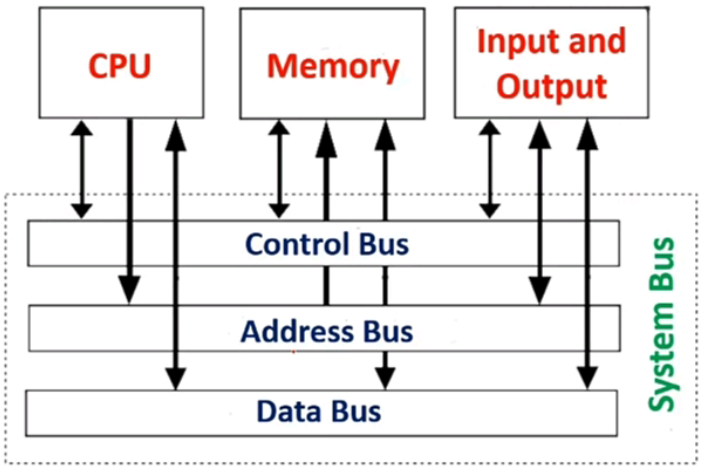
- Most of all the arithmetic and logical operations of a computer are executed in the ALU (Arithmetic and Logical Unit) of the processor
- It performs arithmetic operations like addition, subtraction, multiplication, division and also the logical operations like AND, OR, NOT operations

## Output Unit

- Output devices display information in a way that the user can understand
- These devices display information that has been held or generated within a computer
- The most common example of an output device is a monitor

# Interconnection Between Functional Components

- The major parts of microcomputers are central processing unit (CPU), memory, and input and output unit
- To connect these parts together through three sets of parallel lines, called buses
- Three types of buses are:
  - Address Bus
  - Data Bus
  - Control Bus




Functional Units and their Interconnections

# Introduction to Bus

- **Bus** is a **subsystem** that is used to **transfer data** and **other information** between devices
- Various devices in computer such as Memory, CPU, I/O etc. are communicate with each other through buses

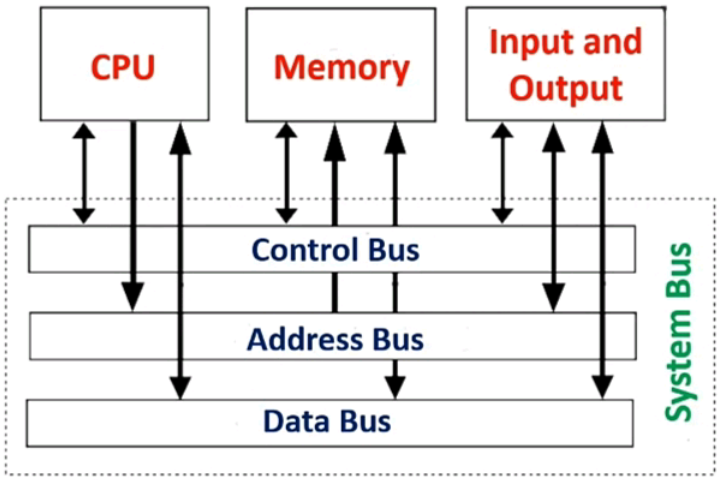
- In general, a bus is said to be as the **communication pathway** connecting two or more devices
- A **key characteristics** of a bus is that it is a **shared transmission medium** because multiple devices are attached to a bus

# Introduction to Bus

- A bus consists of multiple communication Pathways or lines which are either in the form of wires or metal lines etched in a card or board(Printed Circuit Board)
- Each line is capable of transmitting binary 1 and binary 0
- Computer System Contains a number of different buses that provide pathways between components at various levels of computer system hierarchy

**Three types of buses are:**

- Address Bus
- Data Bus
- Control Bus




8, 16, 32, 64

# Operation of Bus

**The Operation of Bus is as follows:**


If One module **wishes to send data** to another, it must do two things:

- ❑ Obtain the use of module Bus
- ❑ Transfer for data to the Bus

If one module **wishes to request data** from another module, it must:

- ❑ Obtain the use of Bus
- ❑ Transfer a request to other module over the appropriate control and address lines, and then it must wait for that second module to send the data

# Types of Bus

**There are variety of Buses, but some of widely used buses are:**

## System Bus

- A Bus that connects major computer components (Processor, Memory, I/O) is called a System Bus
- It is a single computer bus among all Buses that connects all these components of a computer system
- It is the only Bus, in which data lines, address, control lines all are present, it is also Known as "front side " Bus
- It is faster than peripheral Bus (PCI, ISA, etc.) but slower than backside Bus

# Types of Bus

## Peripheral Bus (I/O Bus or External Bus)

- Peripheral Bus also known as "I/O Bus“
- It is data pathway that connects peripheral devices to the CPU
- Or in computing, a peripheral bus is a computer bus designed to support computer peripheral like printers, hard drives
- The PCI and USB buses are commonly used Peripheral Buses, and are today used in commonly many PCs

**PCI (Peripheral Component Interconnect)**

- PCI Bus connects the CPU and expansion boards such as modem cards ,network cards and sound cards
- These expansion boards are normally plugged into expansion slots on the motherboard
- That's why PCI bus is also known as expansion bus or external Bus

# Types of Bus

**Local Bus**

Local Bus are the traditional I/O(Peripheral) buses such as ISA,MCA, or EISA Buses

**ISA (Industry Standard Architecture Bus)**

- The ISA Bus permit bus mastering i.e., it enabled peripheral connected directly to the bus to communicate directly with other peripherals without going through the processor
- One of the consequences of bus mastering is Direct Memory Access
- Up to end of 1990s almost all PCs computers were equipped with ISA Bus, but it was progressively replaced by the PCI Bus, which offer a better performance

**MCA (Micro Channel Architecture)**

- It is an improved proprietary bus designed by IBM in 1987 to be used in their PS/2 lines of computers
- This 16 to 32 bit bus was incompatible with the ISA bus and could reach a throughput of 20 Mbps

**EISA(Extended Industry Standard Architecture)**

- It was developed in 1988 by a consortium of companies
- The EISA Bus use connectors that were same size as the ISA connectors but with 4 rows of contacts instead of 2 for 32 bit addressing

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# Types of Bus

## High Speed Bus

- High Speed Bus are specifically designed to support high capacity I/O devices
- High Speed Bus brings high demand devices into closer integration with the processor
- This Bus supports connection to high speed LANs, such as Fast Ethernet at 100 Mbps, video and graphic workstation, firewire etc.

# Introduction to Bus

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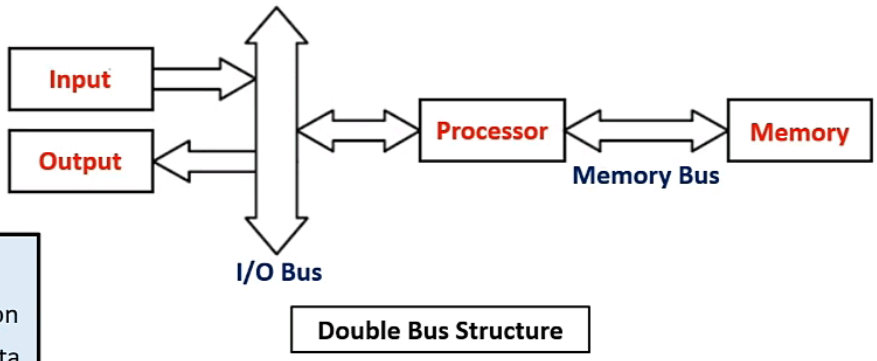
**Types of Bus Structures:**

- Single Bus Structure
- Double Bus Structure
- Multiple Bus Structure

# Double Bus Structure

Double bus structure is used to overcome the bottleneck of single bus structure




Double Bus Structure

- It uses two buses:
  - one bus is used to fetch instruction
  - other is used to fetch data, required for execution

- In the first configuration, the processor is placed between the I/O unit and the memory unit
- The processor is responsible for any data transfer between the I/O unit and the memory unit
- The processor acts as a “messenger”

# Single Bus Structure vs Double Bus Structure

| Single Bus Structure | Double Bus Structure |
|---|---|
| One common bus is used for communication between peripherals and processor | Two buses are used, one for communication from peripherals and other for processor |
| Instructions and data both are transferred in same bus | Instructions and data both are transferred in different buses |
| Its performance is low | Its performance is high |
| Cost of single bus structure is low | Cost of double bus structure is high |
| Number of cycles for execution is more | Number of cycles for execution is less |
| Execution of process is slow | Execution of process is fast |
| Number of registers associated are less | Number of registers associated are more |
| At a time single operand can be read from bus | At a time two operands can be read |

# Multiple Bus Structure