First Stage
Lecture -3

COMPUTER ORGANIZATION

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Computer System Components

■ *Computer Components : All the different pieces of electrical hardware that join together to make up the complete computer system.*

■ *Computer system has two main components which when both combined makes the computer system . These are :*

► Hardware .

► Software .

Computer System Components

- *Hardware* *is the physical parts of the computer system, these parts can you touch and see. A motherboard, CPU, keyboard and a monitor are all items of hardware. Hardware is useless without software to run on it.*

- *Software* *is a collection of instructions that can be run on the computer. These instructions tell the computer hardware what to do. Software is useless unless there is hardware to run it on.*

Computer System Components

Software   Hardware

System

Aplication

Computer System Components

■ **Computer system** is the combination of hardware and software. A typical of computer system has memory and a set of states that define the relationship between the system's inputs and outputs.

Internal Hardware Computer Components

Internal computer components are designed to fit INSIDE the computer system and they all carry out important roles. We will discuss the following:

Motherboard

Processor (Central Processing Unit / CPU)

Internal Memory (RAM and ROM)

Video Card (graphics card)

Sound Card

*Secondary Storage (*Internal Hard Disk Drive*)*

1 Motherboard

- *The motherboard is central to any computer system.*
- *Also known as the system board, the backplane, or the main board.*
- *All components plug into the motherboard either directly (straight into the circuit board) or indirectly (via USB ports).*
- *Once connected to the motherboard, the components can work together to form the computer system.*

Mother Board
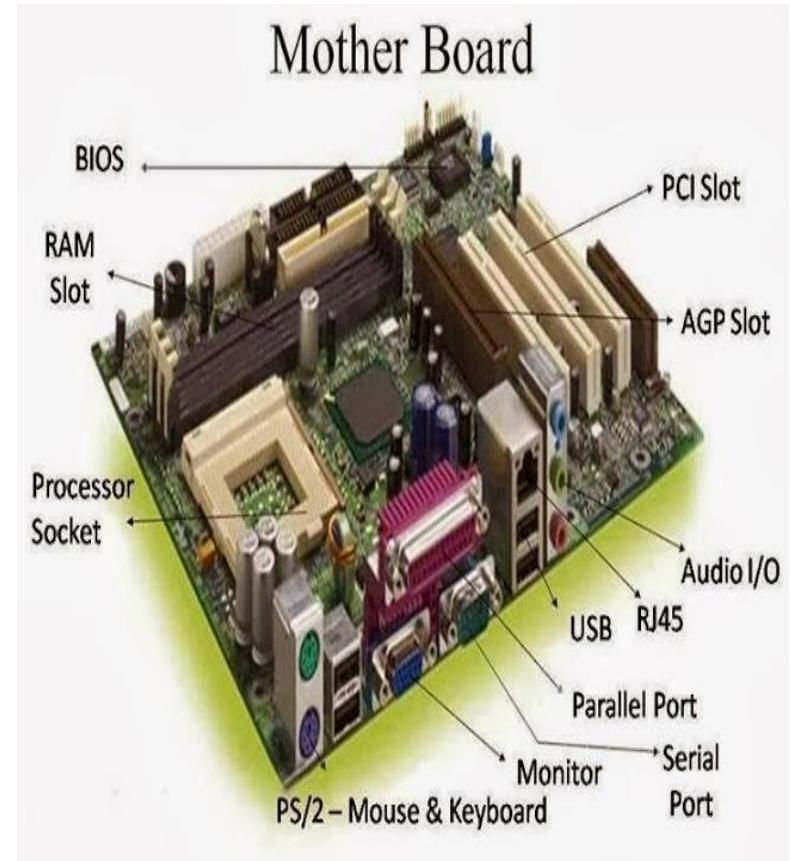
2Processor (**Central Processing Unit / CPU**)

● *The Central Processing Unit (CPU) is the brain of the computer.*

● *The CPU 'controls' what the computer does and is responsible for performing calculations and data processing. It also handles the movement of data to and from system memory.*

● *CPU itself has following components.*

➢ *Control Unit (CU).*
➢ *Arithmetic logic unit (ALU)*
➢ *Registers.*

➢ *Cache.*
➢ *Buses.*
➢ *Clock*

CPU Location

Image 1

CPU Slot

CPU

Image 2

CPU

Image 1 shows where the CPU is installed on a motherboard.

The CPU has a bunch of pins which fit into the CPU Slot on the motherboard.

Image 2 shows a cooling fan which is installed directly above the CPU to pull heat away.

Processor Components

◆ ***CU (Control Unit) :*** *It reads and interprets instructions from memory and transforms them into a series of signals to activate other parts of the computer.*

The CU provides several functions:

- *It fetches, decodes and executes instructions*

- *It issues control signals that control hardware*

- *It moves data around the system*

Processor Components

◆ ***ALU (Arithmetic Logic Unit) :*** *performs simple arithmetic and logical operations.*

The ALU has two main functions:

* *It performs arithmetic and logical operations (decisions). The ALU is where calculations are done and where decisions are made.*

* *It acts as a gateway between primary memory and secondary storage . Data transferred between them passes through the ALU.*

Processor Components

◆ ***Registers :*** are devices capable of storing information, receiving data from other areas within the computer and transferring information as directed by the control unit, it is used for temporary storage of data or instruction and the most important register are :

■ **Program counter (PC):** it contains the address of the next instruction to be executed.

■ **Instruction register (IR):** it contains the instruction being executed.

■ **Address register (AR) :** holds the address of memory location.

Registers : are small amounts of high-speed memory contained within the CPU. They are used by the processor to store small amounts of data that are needed during processing, such as:

- The address of the next instruction to be executed
- The current instruction being decoded
- The results of calculations

Processor Components

◆ *Cache:* is a small amount of high-speed random access memory (RAM) built directly within the processor. It is used to temporarily hold data and instructions that the processor is likely to reuse. This allows for faster processing as the processor does not have to wait for the data and instructions to be fetched from the RAM.

◆ *Buses:* A bus is a high-speed internal connection. Buses are used to send control signals and data between the processor and other components.

- Three types of bus are used:

- Address bus - carries memory addresses from the processor to other components such as primary memory and input/output devices.

- Data bus - carries the actual data between the processor and other components.

- Control bus - carries control signals from the processor to other components. The control bus also carries the clock's pulses.

Processor Components

◈ ***Clock:*** The CPU contains a clock which is used to coordinate all of the computer's components. The clock sends out a regular electrical pulse which synchronizes (keeps in time) all the components.

- The frequency of the pulses is known as the clock speed. Clock speed is measured in hertz. The higher the frequency, the more instructions can be performed in any given moment of time.

- In the 1980s, processors commonly ran at a rate of between 3 megahertz (MHz) to 5 MHz, which is 3 million to 5 million pulses or cycles per second. Today, processors commonly run at a rate of 3 gigahertz (GHz) to 5 GHz, which is 3 billion to 5 billion pulses or cycles per second.

CPU functions and components Diagram