

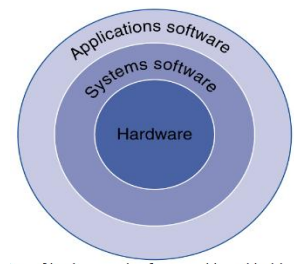


## KEY COMPONENTS OF A COMPUTER

MODULE 3 | DEEPA MATHEWS

### Components of a Computer

- A computer is an electronic device that accepts digitize information from the user, processes it according to a sequence of instruction and provides the processor information to the user.
- Every Computer is composed of two basic components: **hardware and software**.
- **Hardware** refers to the physical and visible components of the system such as a monitor, CPU, keyboard and mouse.
- **Software**, refers to a set of instructions which enable the hardware to perform a specific set of tasks. It includes the features that is responsible for directing the work to the hardware. Software can be divided into **Application Software and System Software**.



# Software Components of a Computer

**Application Software:** Allows to perform specific task on a computer using capabilities of computer. Different application software are needed to perform different tasks.

**System Software:** System software operates directly on hardware devices of computer. It provides a platform to run an application. It provides and supports user functionality. System software includes editor, assemblers, linker, loader, compilers, interpreters, debuggers and operating system.

- Compiler: A program that translates high level language statements into assembly language statements.
- Assembler: A program that translates a symbolic version of instructions into the binary version
- An operating system interfaces between a user's program and the hardware and provides a variety of services and supervisory functions. It is used for handling basic input and output operations, allocating storage and memory etc. Examples : Linux, iOS, and Windows



Hardware	Software
Hardware is further divided into four main categories: <ul style="list-style-type: none"> <li>• Input Devices</li> <li>• Output Devices</li> <li>• Secondary Storage Devices</li> <li>• Internal Components</li> </ul>	Software is further divided into two main categories: <ul style="list-style-type: none"> <li>• Application Software</li> <li>• System Software</li> </ul>
Developed using electronic and other materials	Developed writing using instructions using a programming language
When damaged, it can be replaced with a new component	When damaged it can be installed once more using a backup copy
Hardware is physical in nature and hence one can touch and see hardware	The software cannot be physically touched but still can be used and seen
Hardware cannot be infected by Viruses	The software can be infected by Viruses
Hardware will physically wear out over time	Software does not wear out but it can be affected by bugs and glitches
An example of Hardware is hard drives, monitors, CPU, scanners, printers etc.	An example of software is Windows 10, Adobe Photoshop, Google Chrome etc.

# Levels of Program Code

## High-level language

- Level of abstraction closer to problem domain
- Provides for productivity and portability

## Assembly language

- Textual representation of instructions

## Hardware representation

- Binary digits (bits)
- Encoded instructions and data

High-level  
language  
program  
(in C)

```
swap(int v[], int k)
{
    int temp;
    temp = v[k];
    v[k] = v[k+1];
    v[k+1] = temp;
}
```

↓  
**Compiler**

Assembly  
language  
program  
(for MIPS)

```
swap:
    multi $2, $5, 4
    add $2, $4, $2
    lw $15, 0($2)
    lw $16, 4($2)
    sw $16, 0($2)
    sw $15, 4($2)
    jr $31
```

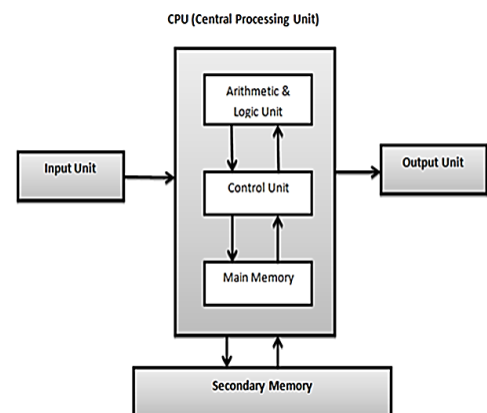
↓  
**Assembler**

Binary machine  
language  
program  
(for MIPS)

```
000000001010001000000000100011000
00000000100000100001000000100001
10001101111000100000000000000000
10001110000100100000000000000100
10101110000100100000000000000000
10101101111000100000000000000100
000000111110000000000000001000
```

# Five Key Components of a Computer

- The five classic components of a computer are **input**, **output**, **memory**, **datapath**, and **control**, with the last two sometimes combined and called the processor.
- The processor gets instructions and data from memory. Input writes data to memory, and output reads data from memory. Control sends the signals that determine the operations of the datapath, memory, input, and output. The datapath is the component of the processor that performs arithmetic operations



# Input Unit

- Input unit is used to provide data, information and instructions to the computer so that it can perform processing on data/information according to the instructions given by the user.
- **They are electromagnetic devices that accept data from the user and translate it into machine understandable code which is understood by the computer.**
- The type of data entered in the computer depends upon the device used by the user.
- It is through input unit that the user communicates with the computer. In this way it serves as a link between user and computer.

# Input Unit

A computer accepts data in two ways, either manually or directly.

Key board is used to enter data manually by the user and scanner is an example to enter data directly into the computer.

Other examples are Joysticks, trackballs, mouse, scanners etc are other input devices.



# Output Unit

Output devices are used to display the result of the processing done by CPU on the input provided by the user.

**The output generated by the CPU is in coded form and cannot be understood by the user. It translates the coded output from machine language to human understandable language.**

The output may be displayed on the monitor or printed on a paper or listened through speakers.

# Output Unit

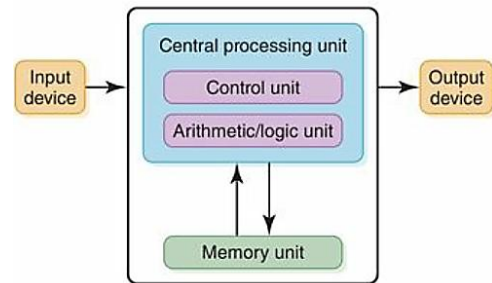
Examples of output devices are monitor, printer, plotter, speaker etc.

- **Liquid Crystal Display:** A display technology using a thin layer of liquid polymers that can be used to transmit or block light according to whether a charge is applied.
- **Active matrix display:** A liquid crystal display using a transistor to control the transmission of light at each individual pixel.



# Central Processing Unit (CPU)

- CPU is the key component of a computer system, which contains the circuitry necessary to interpret and execute program instructions. It performs fundamental arithmetic logic, input and output operations, control circuits that follow the program fed in the computer.
- The **Common CPU components are**
  - **Control Unit (CU),**
  - **Arithmetic Logic Unit (ALU),**
  - **Registers, cache, buses and clock.**



# Central Processing Unit (CPU)

- The leading manufacturers of CPU are AMD and Intel.
- Major types of CPU are classified as
  - single-core,
  - dual-core (single CPU that comprises of two strong cores and functions like dual CPU acting like one. ),
  - Quad-core (design with four cores on a single CPU, it divides the workload in between the cores, and enables for effective multitasking.),
  - Hexa core, Octa-core, and Deca core processor



# Control Unit

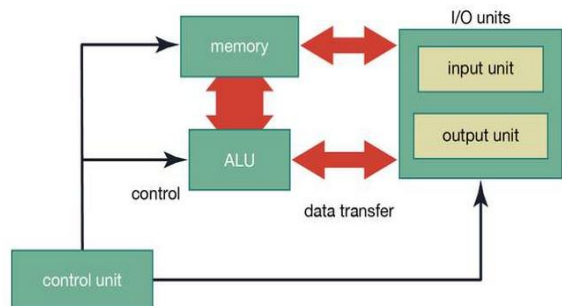
Control unit is responsible for interpreting the instructions provided by the user and directing the sequence of operations accordingly.

It uses electronic signals to direct the entire computer system to carry out or execute stored programs and instructions.

CPU does not perform actual processing on data rather it controls and coordinates the overall functioning of the computer system.

# Control Unit

- It first instructs the input unit to transfer raw data and instructions to memory unit;
- Secondly, sends it to ALU for processing;
- Thirdly processed data is sent back to memory unit for temporary storage;
- Lastly displays the result of processing to the user through output unit.



In this way it ensures that the required information is transferred between memory unit, ALU, input/output devices in desired sequence.

## Arithmetic Logic Unit

The Arithmetic and Logical unit is where actual processing on data takes place. It performs arithmetic and logical operations on the data. It also controls the speed of these operations.

It performs

- four basic mathematical operations i.e., addition, subtraction, multiplication and division,
- three comparative or logical operations i.e., 'greater than', 'less than', 'equals to' to compare numbers, letters or special characters between data items.
- logical Boolean operations such as 'AND', 'NOT', 'OR'.

These operations are carried out at a very high speed

## Memory Unit

The memory is where the programs are kept when they are running; it also contains the data needed by the running programs. It is basically of two types - Primary memory and Secondary memory

### **Primary Memory (main memory or internal memory. )**

It holds instructions and data currently being processed by the CPU, the intermediate results produced during the course of calculations and recently processed data. While the instructions and data remain in primary memory, the CPU can access them directly and quickly. The memory is built from DRAM (Dynamic Random Access Memory) chips. Multiple DRAMs are used together to contain the instructions and data of a program.

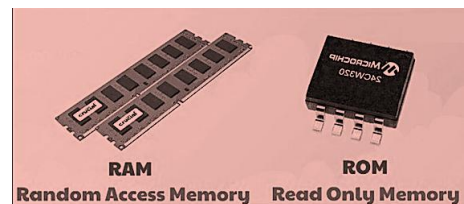


# Primary Memory

Functions of main memory include:

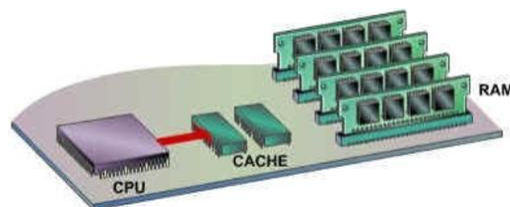
- (a) holding data & instructions for the task assigned by input device before processing,
- (b) holding intermediate results while processing,
- (c) holding data & information after processing unless they are transferred to output unit,
- (d) holding programs and instructions from secondary storage device, and
- (e) holding complex programs like operating system.

It is of two kinds: Random Access Memory (RAM) & Read Only Memory (ROM).



# Cache Memory

**Cache Memory** is a special very high-speed memory which stores frequently requested data so that they are immediately available to the CPU when needed. It is used to speed up and synchronizing with high-speed CPU. Cache memory is costlier than main memory or disk memory but economical than CPU registers. Cache memory is an extremely fast memory type that acts as a buffer between RAM and the CPU.



## Secondary Storage Unit

Secondary memory is also known as external memory or auxiliary memory.

It is required to supplement the limited capacity and volatile characteristics of primary memory.

It is a non-volatile memory which is used to store instructions and data permanently unless erased by the user or the till the damage of the storage device. They are used to maintain a backup of important files and data. This memory is less expensive and has much larger storage capacity than primary memory.

## Secondary Storage Unit

Secondary memory devices includes: hard disk, pen drives, CD (Compact disks), DVD's (Digital Versatile Disc) etc.





THANK YOU

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