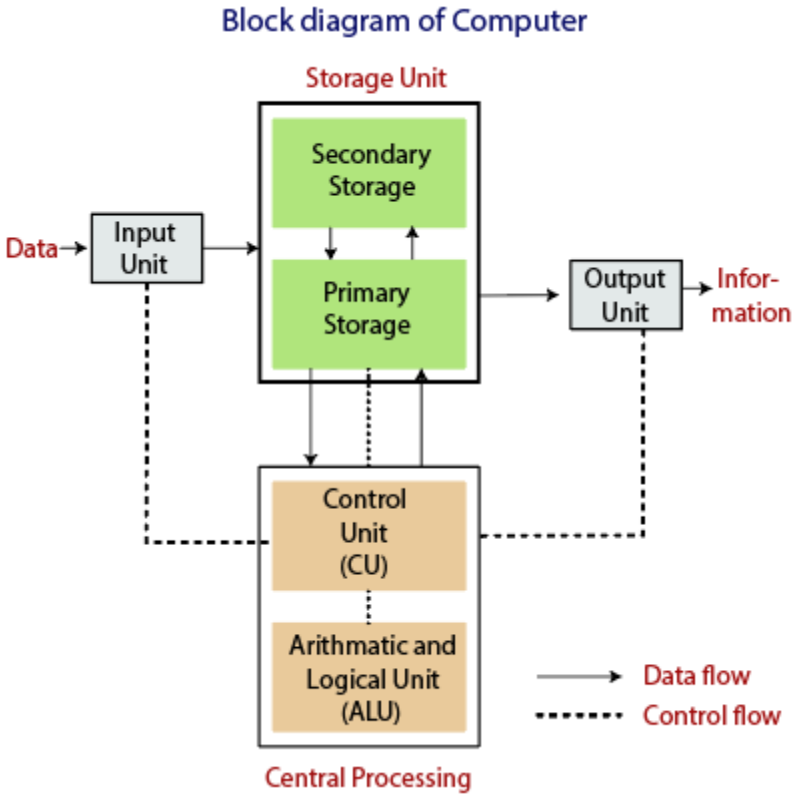
Block Diagram Of computer



In the following way, the computer processes the information.

- In the input unit, the user's data is passed, then it is converted into the machine-readable form, and then this data is stored in the computer's memory unit.
- From the memory, this data is passed to the CPU of the computer system, and in the CPU the ALU does all the necessary arithmetic operations on it with the central processor.
- Now, the processed data is stored in the computer's main memory and then the memory will decide when to output this data.
- From the main memory, this data is passed to the output unit of the computer system and the user gets it.
- All this travelling of data throughout the whole computer system is controlled by the Control Unit of the CPU.

Input Unit

All the data received by the computer goes through the input unit. The input unit comprises different devices. Like a mouse, keyboard, scanner, etc. In other words, each of these devices acts as a mediator between the users and the computer.

The 3 major functions of the input unit are-

- Take the data to be processed by the user.
- Convert the given data into machine-readable form.
- And then, transmit the converted data into the main memory of the computer.

The Processor Unit (CPU)

It is the brain of a computer system.

All major calculation and comparisons are made inside the CPU and it is also responsible for activation and controlling the operation of other unit.

This unit consists of two major components, that are arithmetic logic unit (ALU) and control unit (CU).

Arithmetic Logic Unit (ALU)

Here arithmetic logic unit performs all arithmetic operations such as addition, subtraction, multiplication and division. It also uses logic operation for comparison.

Control Unit (CU)

And the control unit of a CPU controls the entire operation of a computer. It also controls all devices such as memory, input/output devices connected to the CPU.

CU fetches instructions from memory, decodes the instruction, interprets the instruction to know what the task are to be performed and sends suitable control signals to the other components to perform for the necessary steps to executes the instruction.

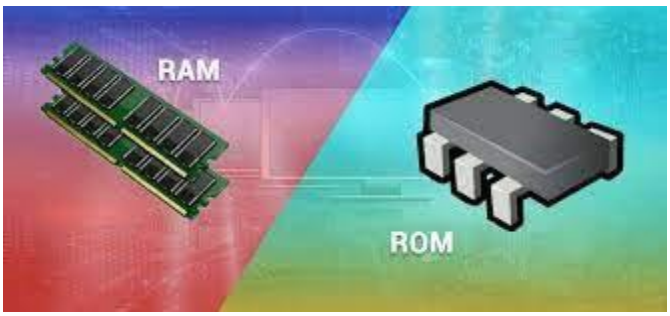
Storage Unit

The raw data from the Input unit is saved in the Storage Unit. It is the place where the data that is to be processed and processed data is stored. The Storage Unit is further classified into two parts.

- Primary Storage
- Secondary Storage

Primary Storage

This storage is also known as the main memory of the computer system. This part of the storage unit holds the data, programs, and instructions that are currently in use. This storage part resides in the motherboard. Primary storage contains the ROM and RAM of the computer system.



Secondary Storage

It is a non-volatile and permanent data storage device. It is the place where the data is stored for a short or a long time. The secondary storage supports the primary storage. This device is also known as the hard drive of the computer. It is primarily used as a backup device.

Output Unit

The output unit is the place through which the computer system outputs the data. The output unit is always hardware. The computer screen, speakers, printer, etc. are the output devices because from these devices users get their processed data.

Hardware

Hardware simply refers to all the tangible and physical components of a computer. This includes all the components that can be seen or touched.
Hardware and software are complementary, a computer system isn't complete unless there's also software.
There are many different kinds of hardware that can be installed inside, and connected to the outside, of a computer. Computer hardware can be categorized as

- Internal hardware components
- external hardware components

Internal hardware components

Internal components collectively process or store the instructions delivered by the program or operating system (OS).These are located inside the computer. These include the following:
MotherBoard, CPU, RAM, Hard Drive, Heat Sink, power supplies, transistors and chips,

External hardware components

External hardware components, also called *peripheral components*.

They are externally connected to the computer to control either input or output functions. These hardware devices are designed to either provide instructions to the software (input) or render results from its execution (output).
Common external hardware components include the following:
mouse ,keyboard ,microphone , camera , touchpad

Software

Software is a set of programs used to operate computers and execute specific tasks and well defined functions

Software programmers write the software program in various human-readable languages such as Java, Python, C, etc. and later use the source code.

Types of Software

Software's are broadly classified into two types

- **System Software**
- **Application Software**

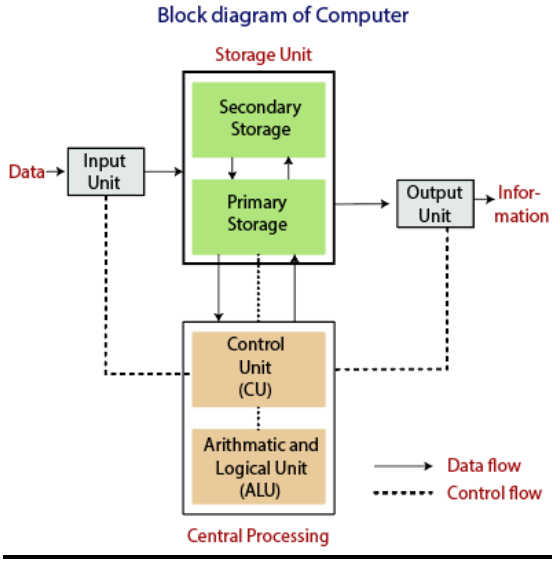
1. System Software

System software is a computer program that helps the user to run computer hardware or software and manages the interaction between them. Essentially, it is software that constantly runs in the computer background, maintaining the computer hardware and computer's basic functionalities, including the operating system, utility software, and interface.

2. Application Software

Application programs or software applications are end-user computer programs developed primarily to provide specific functionality to the user. The applications programs assist the user in accomplishing numerous tasks such as doing online research, completing notes, designing graphics, managing the finances, watching a movie, writing documents, playing games, and many more.

Functional Blocks of CPU



CPU(Central Processing Unit)

It is the brain of a computer system.

It is also called as heart of a computer system.

All major calculation and comparisons are made inside the CPU and it is also responsible for activation and controlling the operation of other unit.

This unit consists of two major components, that are arithmetic logic unit (ALU) and control unit (CU).

Arithmetic Logic Unit (ALU)

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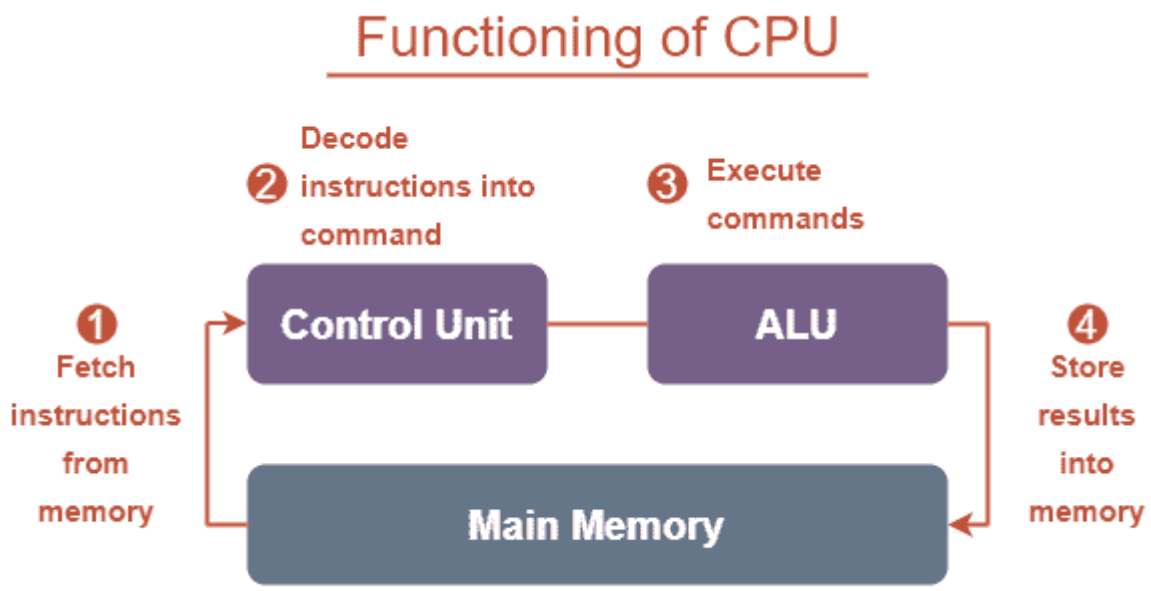
Functions of CPU



The CPU processes instructions it receives in the process of decoding data. In processing this data, the CPU performs four basic steps:

1. **Fetch:** Each instruction is stored in memory and has its own address. The processor takes this address number from the program counter, which is responsible for tracking which instructions the CPU should execute next.

2. **Decode:** All programs to be executed are translated into binary instructions, which are understandable to your CPU. This step is called decoding.
3. **Execute:** While executing instructions, the CPU can do one of three things: Do calculations with its ALU, move data from one memory location to another, or jump to a different address.
4. **Store:** The CPU must give feedback after executing an instruction, and the output data is written to the memory.

Functions of Memory

The data and instructions that are entered into the computer system through input units have to be stored inside the computer before actual processing starts. Also the results produced after processing must be kept somewhere inside the computer before being passed on to the output unit. Moreover the intermediate results produced by the computer must also be preserved for on-going procession. The memory of a computer system is designed to cater all these needs. It provides space for storing instructions and data, space for intermediate results and space for final results.

The functions of memory are as follows:

(i) Stores the data and instructions to be processed.
(ii) Stores intermediate results of processing
(iii) Stores the final results of processing before these are released to an output device.
(iv) Stores data for future use
(v) Supplies information to other units of computer where need

Difference Between RAM & ROM

Difference	RAM(Random Access Memory)	ROM(Read Only Memory)
Data retention	RAM is a volatile memory which could store the data as long as the power is supplied.	ROM is a non-volatile memory which could retain the data even when power is turned off.
Working type	Data stored in RAM can be retrieved and altered.	Data stored in ROM can only be read.
Use	Used to store the data that has to be currently processed by CPU temporarily.	It stores the instructions required during bootstrap of the computer.
Speed	It is a high-speed memory.	It is much slower than the RAM.
CPU	The CPU can access the data stored on it.	The CPU can not access the data stored

Difference	RAM(Random Access Memory)	ROM(Read Only Memory)
Interaction		on it unless the data is stored in RAM.
Size and Capacity	Large size with higher capacity, with respect to ROM	Small size with less capacity, with respect to RAM
Used as/in	CPU Cache, Primary memory.	Firmware, Micro-controllers
Accessibility	The data stored is easily accessible	The data stored is not as easily accessible as in RAM
Cost	Costlier	cheaper than RAM.
Storage	A RAM chip can store only a few gigabytes (GB) of data.	A ROM chip can store multiple megabytes (MB) of data.

Difference Between SRAM & DRAM

SRAM(Static RAM)	DRAM(Dynamic RAM)
It stores information as long as the power is supplied.	It stores information as long as the power is supplied or a few milliseconds when power is switched off.
Transistors are used to store information in SRAM.	Capacitors are used to store data in DRAM.
Capacitors are not used hence no refreshing is required.	To store information for a longer time, contents of the capacitor need to be refreshed periodically.
SRAM is faster compared to DRAM.	DRAM provides slow access speeds.
It does not have a refreshing unit.	It has a refreshing unit.
These are expensive.	These are cheaper.
SRAMs are low-density devices.	DRAMs are high-density devices.
In this bits are stored in voltage form.	In this bits are stored in the form of electric energy.

SRAM(Static RAM)	DRAM(Dynamic RAM)
These are used in cache memories.	These are used in main memories.
Consumes less power and generates less heat.	Uses more power and generates more heat.

Rom & its Types

ROM (Read Only Memory): It is a non-volatile memory. Non-volatile memory stores information even when there is a power supply failed/ interrupted/stopped. ROM is used to store information that is used to operate the system. As its name refers to read-only memory, we can only read the programs and data that is stored on it. It contains some electronic fuses that can be programmed for a piece of specific information. The information stored in the ROM in binary format. It is also known as permanent memory. ROM is of four types:

- **MROM(Masked ROM):** Hard-wired devices with a pre-programmed collection of data or instructions were the first ROMs. Masked ROMs are a type of low-cost ROM that works in this way.
- **PROM (Programmable Read Only Memory):** This read-only memory is modifiable once by the user. The user purchases a blank PROM and uses a PROM program to put the required contents into the PROM. Its content can't be erased once written.
- **EPROM (Erasable Programmable Read Only Memory):** It is an extension to PROM where you can erase the content of ROM by exposing it to Ultraviolet rays for nearly 40 minutes.
- **EEPROM (Electrically Erasable Programmable Read Only Memory):** Here the written contents can be erased electrically. You can delete and reprogramme EEPROM up to 10,000 times. Erasing and programming take very little time, i.e., nearly 4 -10 ms(milliseconds). Any area in an EEPROM can be wiped and programmed selectively.

RAM & its Types

RAM (Random Access Memory): It is a volatile memory. Volatile memory stores information based on the power supply. If the power supply fails/ interrupted/stopped, all the data & information on this memory will be lost. RAM is used for booting up or start the computer. It temporarily stores programs/ data which has to be executed by the processor. RAM is of two types:

- SRAM
- DRAM

- **S RAM (Static RAM):** It uses transistors and the circuits of this memory are capable of retaining their state as long as the power is applied. This memory consists of the number of flip flops with each flip flop storing 1 bit. It has less access time and hence, it is faster.
- **D RAM (Dynamic RAM):** It uses capacitors and transistors and stores the data as a charge on the capacitors. They contain thousands of memory cells. It needs refreshing of charge on capacitor after a few milliseconds. This memory is slower than S RAM.

Memory

Computer memory is just like the human brain. It is used to store data/information and instructions. It is a data storage unit or a data storage device where data is to be processed and instructions required for processing are stored. It can store both the input and output can be stored here.

In general, memory is of three types:

- Primary memory
- Secondary memory
- Cache memory

Now we discuss each type of memory one by one in detail:

1. Primary Memory: It is also known as the main memory of the computer system. It is used to store data and programs or instructions during computer operations. It uses semiconductor technology and hence is commonly called semiconductor memory. Primary memory is of two types:

- RAM
- ROM

(i) RAM (Random Access Memory): It is a volatile memory. Volatile memory stores information based on the power supply. If the power supply fails/ interrupted/stopped, all the data & information on this memory will be lost. RAM is used for booting up or start the computer. It temporarily stores programs/ data which has to be executed by the processor. RAM is of two types:

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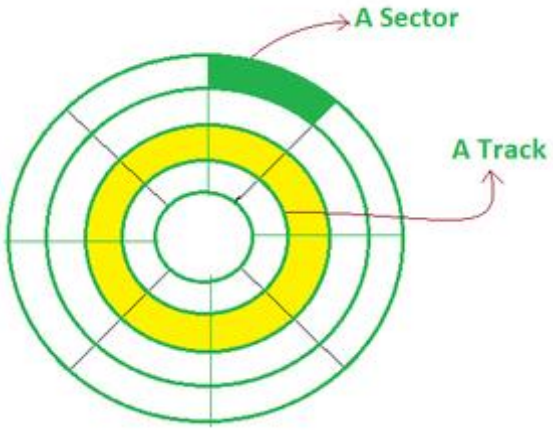
2. Secondary Memory: It is also known as auxiliary memory and backup memory. It is a non-volatile memory and used to store a large amount of data or information. The data or information stored in secondary memory is permanent, and it is slower than primary memory. A CPU cannot access

secondary memory directly. The data/information from the auxiliary memory is first transferred to the main memory, and then the CPU can access it.

Types of secondary memory:
(i) Magnetic Tapes: Magnetic tape is a long, narrow strip of plastic film with a thin, magnetic coating on it that is used for magnetic recording. Bits are recorded on tape as magnetic patches called RECORDS that run along many tracks. Typically, 7 or 9 bits are recorded concurrently. Each track has one read/write head, which allows data to be recorded and read as a sequence of characters. It can be stopped, started moving forward or backward, or rewound.
(ii) Magnetic Disks: A magnetic disc is a circular metal or a plastic plate and these plates are coated with magnetic material. The disc is used on both sides. Bits are stored in magnetized surfaces in locations called tracks that run in concentric rings. Sectors are typically used to break tracks into pieces.



Hard discs are discs that are permanently attached and cannot be removed by a single user.

(iii) Optical Disks: It's a laser-based storage medium that can be written to and read. It is reasonably priced and has a long lifespan. The optical disc can be taken out of the computer by occasional users.
Types of Optical Disks :

3. Cache Memory: It is a type of high-speed semiconductor memory that can help the CPU run faster. Between the CPU and the main memory, it serves as a buffer. It is used to store the data and programs that the CPU uses the most frequently.
Advantages of cache memory:

- It is faster than the main memory.
- When compared to the main memory, it takes less time to access it.
- It keeps the programs that can be run in a short amount of time.
- It stores data in temporary use.

Generations of Computers

- **First Generation Computers (1940-1956)**
- **Second Generation Computers (1956-1963)**
- **Third Generation Computers (1964-1971)**
- **Fourth Generation Computers (1971-Present)**
- **Fifth Generation Computers (Present and Beyond)**

First Generation Computers: Vacuum Tubes (1940-1956)

The first electronic computer used vacuum tubes as a serious piece of technology that was ENIAC, which stands for Electronic Numeric Integrated And Calculator, vacuum tubes were widely employed in computers. The first-generation computers were very large in size and took up much space in the room because vacuum tubes were larger components used in the computers.

Main first generation computers are:

- **ENIAC:** Electronic Numerical Integrator and Computer, built by J. Presper Eckert and John V. Mauchly was a general-purpose computer. It had been very heavy, large, and contained 18,000 vacuum tubes.
- **EDVAC:** Electronic Discrete Variable Automatic Computer was designed by von Neumann. It could store data also as instruction and thus the speed was enhanced.
- **UNIVAC:** Universal Automatic Computer was developed in 1952 by Eckert and Mauchly.

Main characteristics of first generation computers are:

Main electronic component	Vacuum tube.
Programming language	Machine language.
Main memory	Magnetic tapes and magnetic drums.
Input/output devices	Paper tape and punched cards.
Speed and size	Very slow and very large in size (often taking up entire room).
Examples of the first generation	IBM 650, IBM 701, ENIAC, UNIVAC1, etc.

Second Generation Computers: Transistors (1956-1963)

Second-generation computers used the technology of transistors rather than bulky vacuum tubes. Another feature was the core storage. A transistor may be a device composed of semiconductor material that amplifies a sign or opens or closes a circuit.

The use of transistors made it possible to perform powerfully and with due speed. It reduced the dimensions and price and thankfully the warmth too, which was generated by vacuum tubes.

Main characteristics of second generation computers are:-

Main electronic component	Transistor.
Programming language	Machine language and assembly language.

Memory	Magnetic core and magnetic tape/disk.
Input/output devices	Magnetic tape and punched cards.
Power and size	Smaller in size, low power consumption, and generated less heat (in comparison with the first generation computers).
Examples of second generation	PDP-8, IBM1400 series, IBM 7090 and 7094, UNIVAC 1107, CDC 3600 etc.

Third Generation Computers: Integrated Circuits. (1964-1971)

During the third generation, technology envisaged a shift from huge transistors to integrated circuits, also referred to as IC. Here a variety of transistors were placed on silicon chips, called semiconductors. The most feature of this era's computer was the speed and reliability. IC was made from silicon and also called silicon chips.

A single IC, has many transistors, registers, and capacitors built on one thin slice of silicon. The value size was reduced and memory space and dealing efficiency were increased during this generation.

Main characteristics of third generation computers are:

Main electronic component	Integrated circuits (ICs)
Programming language	High-level language
Memory	Large magnetic core, magnetic tape/disk
Input / output devices	Magnetic tape, monitor, keyboard, printer, etc.
Examples of third generation	IBM 360, IBM 370, PDP-11, NCR 395, B6500, UNIVAC 1108, etc.

Fourth Generation Computers: Micro-processors (1971-Present)

In 1971 First microprocessors were used, the large scale of integration LSI circuits built on one chip called microprocessors. The most advantage of this technology is that one microprocessor can contain all the circuits required to perform arithmetic, logic, and control functions on one chip.

The computers using microchips were called microcomputers. This generation provided the even smaller size of computers, with larger capacities. That's not enough, then Very Large Scale Integrated (VLSI) circuits replaced LSI circuits.

Main characteristics of fourth generation computers are:

Main electronic component	Very large-scale integration (VLSI) and the microprocessor (VLSI has thousands of transistors on a single microchip).
Memory	semiconductor memory (such as RAM, ROM, etc.)
Input/output devices	pointing devices, optical scanning, keyboard, monitor, printer, etc.
Examples of fourth generation	IBM PC, STAR 1000, APPLE II, Apple Macintosh, Alter 8800, etc.

Fifth Generation Computers

The technology behind the fifth generation of computers is AI(Artificial Intelligence). It allows computers to behave like humans. It is often seen in programs like voice recognition, area of medicines, and entertainment.

The speed is highest, size is that the smallest and area of use has remarkably increased within the fifth generation computers

Main characteristics of fifth generation computers are:

Main electronic component	Based on artificial intelligence, uses the Ultra Large-Scale Integration (ULSI) technology and parallel processing method (ULSI has millions of transistors on a single microchip and Parallel processing method use two or more microprocessors to run tasks simultaneously).
Language	Understand natural language (human language).
Size	Portable and small in size.
Input / output device	Trackpad (or touchpad), touchscreen, pen, speech input (recognize voice/speech), light scanner, printer, keyboard, monitor, mouse, etc.
Example of fifth generation	Desktops, laptops, tablets, smartphones, etc.