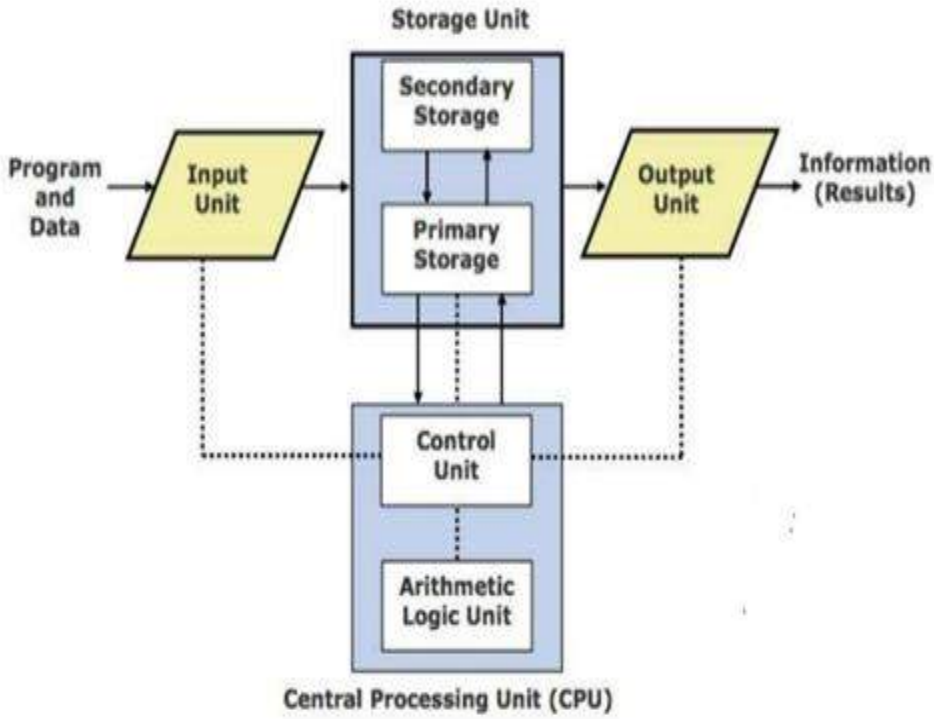
Basic Computer Organization and Data processing Cycle

The Basic Diagram of the Computer consists of Input Unit, Output Unit and Central Processing Unit.



Input Unit

The input unit is used for giving instructions and data by using input devices. It converts these instructions and data to the computer acceptable format and it supplies the converted instructions and data to the computer system for further processing.

Central Processing Unit

The central processing unit (CPU) performs most of the processing inside a computer. CPUs have been constructed on a single integrated circuit called a microprocessor. It consists of the control unit, the Arithmetic Logic Unit (ALU), and the memory unit.

(1) Control Unit

The control unit manages the computer's various components. It reads and interprets (decodes) the program instructions, transforming them into control signals that activate other parts of the computer.

(2) Arithmetic Logic Unit

The ALU can perform arithmetic and logical operations. The set of arithmetic operations that an ALU supports to addition, subtraction and more complex mathematical operations. Logic operations involve Boolean logic like AND, OR, XOR, and NOT. These can be useful for creating complicated conditional statements.

(3) Memory Unit

Computer main memory consists of primary and secondary memory.

- **Primary Memory**

Primary memory holds only those data and instructions on which computer is currently working. It has limited capacity and data is lost when power is switched off. It is generally made up of the semiconductor device. It is a volatile memory. The two types of primary memory are Random Access Memory (RAM) & Read Only Memory (ROM).

- **RAM (Random Access Memory)** - RAM is the internal memory of the CPU for storing data, program and result of the program. It is read/write memory which stores data till the machine is working. Some types of RAMs are Dynamic RAM (DRAM), Static RAM (SRAM) and Synchronous Dynamic RAM (SDRAM), etc.
    - **Dynamic Random-Access Memory (DRAM)** – Dynamic memory must be constantly refreshed, or it loses its contents. This type of memory is more economical.
    - **Static Random-Access Memory** – SRAM is faster and less volatile than DRAM but requires more power and is more expensive. It does not need to be refreshed like a DRAM.
    - **Synchronous Dynamic Random-Access Memory** - A type of DRAM that can run at much higher clock speeds.
    - **ROM (Read Only Memory)** - ROM stores data permanently on personal computers (PCs) and other electronic devices. It performs major input/output tasks and holds programs or software instructions. It is non-volatile.
    - **MROM (Masked ROM)** - The very first ROMs were hard-wired devices that contained a pre-programmed set of data or instructions. These kinds of ROMs are known as masked ROMs which are inexpensive.
    - **PROM (Programmable Read Only Memory)** - PROM can be modified only once by a user. The user can buy a blank PROM and enter the desired contents using a PROM program.
    - **EPROM (Erasable and Programmable Read Only Memory)** - The EPROM can be erased by exposing it to ultra-violet light. EPROMs have a Quartz window in the package to expose the chip to UV light. They were widely used as the BIOS (Basic Input Output System) chips in computer motherboards.
    - **EEPROM (Electrically Erasable and Programmable Read Only Memory)** - The EEPROM is programmed and erased electrically. It can be erased and reprogrammed about ten thousand times. Both erasing and programming take about 4 to 10 milliseconds. They were also used as BIOS chips.

- **Secondary Memory**

Secondary memory stores data on a long-term basis. It cannot be processed directly by the CPU. It must first be copied into primary storage. Secondary memory devices include magnetic disks like hard drives and floppy disks, optical disks such as CDs and CDROMs, and magnetic tapes, USB Flash drives.

- **Hard drive** – It is a non-removable storage device containing magnetic disks or platters rotating at high speeds. The hard drives store data in segments of concentric circles. It may spin at 5,400 to 15,000 RPM.
- **Floppy Disk** - Floppy disk is composed of a thin, flexible magnetic disk sealed in a square plastic carrier. Floppy disks were widely used to distribute software, transfer files, and create backup copies of data. To read and write data from a floppy disk, a computer system must have a floppy disk drive (FDD).
- **Compact Disc (CD)** - A compact disc is a portable storage medium that can be used to record, store data in digital form. They are fragile and prone to scratches.
- **Compact disc read-only memory (CD-ROM)** - It is a storage device that can be read but can't change or delete it.
- **Digital Video Disc (DVD)** - A device currently used to store data in large amounts and accepts

high definition material. A two-layered DVD can hold approximately 17 gigabytes of video, sound, or other data.

- **Blue-ray Disc** – The upgraded version of CD and DVD discs and drives are the Blu-ray discs. It is commonly known as BD-ROM. The Maximum capacity of BD disc is 25GB if single layer and 50 GB if dual layer.
- **Holographic Versatile Disc (HVD)** – It is a holographic storage format and has a maximum capacity of 3.9 terabytes.
- **Flash Drives** – Flash drives are small, ultra-portable storage device. They connect to computers and other devices via a built-in USB plug. They are often referred to as pen drives, thumb drives, or jump drives. Mostly they have a storage capacity from 8 GB to 64 GB.
- **Zip Disks** – An advanced version of the floppy disk is known as Zip Disks. It was developed by Iomega. Zip disks are available in 100 and 250-MB and 750 MB capacities and they are used to store, share and back up large amounts of data.
- **Cache Memory** - It is a very high-speed semiconductor memory which can speed up the CPU. It acts as a buffer between the CPU and main memory. Example: Registers
- **Virtual Memory** - Virtual memory permits software to use additional memory by utilizing the hard disk drive (HDD) as temporary storage.

Quick Revision

Types	Examples
Semiconductor Memory	RAM, ROM
Optical Memory	CD-ROM, CD-R, DVD, HVD, Blu-ray Disc
Magnetic Memory	Hard Disk Drive (HDD), Floppy Disk Drive (FDD)
Flash Memory	Pen drive, Memory card etc (EEPROM Technology devices)

Output Unit

The output unit provides the information from the computer to an external device. It presents a soft/ hard copy of the information which can be readable by the users.

Computer Peripheral

A peripheral device links to a computer system to enhance the functionality of the computer. It is not part of the core computer architecture. Input devices, output devices, and storage devices are the types of peripheral devices.

Input Devices

Input devices serve as a link between a user and the computer. It allows users to feed instructions and data to computers for processing, display, storage and/or transmission. Some input devices are:

1. **Keyboard** – It is used to enter data into the computer in both alpha and numeric forms. Some important keys in a keyboard are:
2. **Toggle Keys** - It is used to change the input mode of a group of keys on a keyboard. Caps Lock, Num Lock, Scroll Lock are toggle keys.
   - **Caps Lock** – Capitalizes all letters.
   - **Num Lock** – Makes sure numbers are inputs from the keypad.
   - **Scroll Lock** - Allows the arrow keys to scroll through the contents of a window.
3. **Modifier Keys** - It is a special key (key combination) that temporarily modifies the normal action of another key when pressed together. Shift, Alt, Ctrl, Fn are modifier keys.

- **Shift** - used for capitalizing letters and entering different types of symbols.
- **Function** (Fn) - Other functions such as brightness and volume control.
- **Control** (Ctrl) - used for entering keyboard shortcuts, such as Ctrl+S, Ctrl+P etc.
- **Alt** - used in combination with the numeric keys and the Control key for entering keyboard shortcuts.

4. **Function Keys** - A key on a computer keyboard, distinct from the main alphanumeric keys, to which software can assign a function. F1 - F12 keys are known as function keys and each key performs a different function. It may be used as single key commands (e.g., F5) or combined with one or more modifier keys (e.g., Alt+F4).
5. **Escape Key** – It is located in the upper left corner of a computer keyboard. It is often used to quit, cancel, or abort a process which is running on a computer.
6. **Mouse** - It is a pointing and cursor-control device. A round ball at its base senses the movement of a mouse and sends corresponding signals to CPU when the mouse buttons are pressed. A mouse has two or three buttons called Left, Right, and Middle button.
7. **Joy Stick** – It is used to move the cursor position on a monitor screen. It is mainly used in Computer Aided Design (CAD) and playing games on the computer. It can also be helpful as an input device for people with movement disabilities.
8. **Track Ball** – It is mostly used in notebooks or laptops. It is a ball which is half inserted and by moving fingers on the ball, the pointer can be moved.
9. **Scanner** – It captures images from printed material and converts it into a digital format that can be stored within the PC. Flatbed Scanners, Hand Scanners, Sheetfed Scanner are some types of scanner.
10. **Barcode Reader** – It is an electronic device for reading printed barcodes. A light sensor in the barcode reader can read the barcode and translates optical impulses into electrical impulses to store the data into the computer. It is an important tool for warehouse management and operations.
11. **Magnetic Ink Character Recognition (MICR)** – It is a character recognition system that uses special ink and characters. It is used to verify the legitimacy or originality of paper documents, especially cheques. Information can be encoded in the magnetic characters. It provides a secure, high-speed method of scanning and processing information
12. **Optical Character Recognition (OCR)** - It is a technology that recognizes text within a digital image. It converts the document to an editable text file.
13. **Optical Mark Recognition (OMR)** – It is an electronic method that scans the document and reads the data from the marked fields and results can be transmitted into the computer.
14. **Digitizer** – It allows users to draw and manipulate graphics on the screen. It is also known as a graphics tablet. These kinds of tablets typically designed for CAD/CAM professionals.
15. **Touch Screen** - It is a computer display screen that serves as an input device. A touchscreen can be touched by a finger or stylus. Touchscreen records the event and sends it to a controller for processing.
16. **Microphone** – Microphone translates sound vibrations in the air into electronic signals. It enables many types of audio recording devices for purposes including communications, music and speech recording.
17. **Web Camera** – It captures and stores images in digital form. The stored images can be can be archived on a photographic compact disc or external hard disk.
18. **Light Pen** - It is a light-sensitive input device, used to select text, draw pictures and interact with user interface elements on a computer screen or monitor.

Output Devices

The Output devices are used to send data from a computer to another device. Examples are monitors, projectors, speakers, plotters, and printers etc.

1. **Monitors** – Monitors are the main output device of a computer. It forms images from tiny dots that are arranged in a rectangular form. The sharpness of the image depends on the number of pixels. There are two kinds of viewing screens used for monitors.
   - **Cathode-Ray Tube (CRT)** - The CRT display is made up of small picture elements called pixels.

CRT tube creates an image on the screen using a beam of electrons.

- **Flat- Panel Display** - The flat-panel display refers to a class of video devices that have reduced volume, weight and power requirement in comparison to the CRT.
- **Liquid Crystal Display (LCD) Monitor** - LCD monitors use compact fluorescent tubes to illuminate and brighten the image on the screen and produce good image quality, resolution and contrast levels.
- **Light Emitting Diode (LED) Monitor** - LED monitors use new backlighting technology to improve picture quality. The LED monitor is more lifelike and accurate due to the improved contrastratios and color saturation over LCD.
- **Organic Light Emitting Diode (OLED) Monitor** – This type of monitor made up of some organic material (containing carbon, like wood, plastic or polymers) that is used to convert the electric current into light. They are directly used to produce the correct colour and there is no needfor backlight which saves power and space.

2. **Printers** – Printers are output devices that prints information in the form of text/images on a paper. Impact Printers and Non-impact printers are the two types of printers.

(i) **Impact Printers** - The impact printers print the characters by striking them on the ribbon which is then pressed on the paper. Examples: Dot-Matrix Printers, Line Printers, Daisy wheel printer, Drum printer, Chain printer, Band printer.

- **Dot-Matrix Printers** – It prints characters as a combination of dots. They have a matrix of pins on the print head of the printer which form the character. They generally have 9-24 pins. Their speed is measured in cps (Character per second).
- **Line Printers** - A line printer is an impact printer which can print one line of text at a time. It is also known as a bar printer.

(ii) **Non-Impact Printers** - Non-impact printers print the characters on the paper without using ribbon. These printers print a complete page at a time, so they are also called as page printers. Examples - Laser Printers, Inkjet Printers etc.

- **Laser Printers** - A laser printer is a popular type of personal computer printer that uses a non-impact photocopier technology. The type of ink used in a laser printer is dry. It gives high-quality output. The resolution of laser printers is measured in dpi (dots-per-inch).
- **Inkjet Printers** - Inkjet printers work by spraying ink on a sheet of paper. The type of ink used in an inkjet printer is wet.

(iii) Other Types

- **Solid Ink Printer** - It is a type of color printer. It works by melting the solid ink that applies the images to the paper. It is non-toxic and convenient to handle.
- **LED Printer** - This type of printer uses a light emitting diode instead of a laser. It starts by creating a line-by-line image of the page.

3. **Plotters** - A plotter is an output device used to produce hard copies of large graphs and designs on paper, such as construction drawings, architectural plans, and business charts. Drum plotters and Flatbed plotters are the types of plotters.

(i) **Drum plotter** – It is a pen plotter that wraps the paper around a drum with a pin feed attachment. The drum then rotates the paper as pens move across it and draw the image. Itis used to produce continuous output, such as plotting of earthquake activity. It is also known as Roller Plotter.

(ii) **Flatbed plotter** - It plots on paper that is spread and fixed over a rectangular flatbed table. Itis used in the design of cars, ships, aircrafts, buildings, highways etc. It is also known as Table Plotter.

4. **Speaker** - Speakers are one of the output devices used with computers. They aretransducers that convert electromagnetic waves into sound waves.

5. **Digital Projectors** – Projector is a device that connects with a computer and projects theoutput onto a white screen or wall.