

Introduction to Computer System

The word 'Computer' literally means to 'Compute' or to 'Calculate'. Stated simply, it is an electronic device which processes information based on the instructions provided, to generate the desired output. It, therefore, requires two types of input – raw data, and the set of instructions to process or act upon the data. These are

- 1) It accepts data or instructions by way of input,
- 2) It stores data,
- 3) It can process data as required by the user,
- 4) It gives results in the form of output, and
- 5) It controls all operations inside a computer.

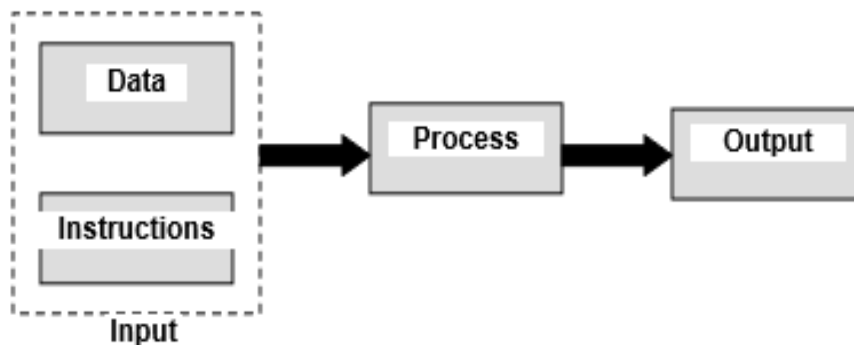


Figure 1.1: Processing Information

Data can be of any type – text, numeric, alpha-numeric, image, picture, sound etc. The instructions that act upon this data are also called the program or software in computer terminology.

Characteristics of Computer

The characteristics of computers that have made them so powerful and universally useful are speed, accuracy, diligence, versatility and storage capacity.

1. Speed

Computers work at an incredible speed. The speed with which it performs is way beyond human capabilities. As a comparison, it can do in one minute what a human being would probably take a lifetime. When we refer to the speed of computers, we now talk in terms of milliseconds (hundredth of a second), microseconds (millionth of a second), nanoseconds (billionth of a second), and even picoseconds (trillionth of a second). A powerful computer is capable of performing about 3-4 million simple instructions per second.

2. Accuracy

In addition to being fast, computers are also accurate. The degree of accuracy of computer is very high and every calculation is performed with the same accuracy. The errors in computer are due to human and inaccurate data.

3. Diligence

A computer is free from tiredness, lack of concentration, fatigue, etc. It can work for hours without creating any error. If millions of calculations are to be performed, a computer will perform every calculation with the same accuracy. Due to this capability it overpowers human being in routine type of work.

4. Versatility

Computers are versatile machines and are capable of performing any task as long as it can be broken down into a series of logical steps. This means that their capability is, once again, limited only by human intelligence. It means the capacity to perform completely different type of work. The presence of computers can be seen in every sphere – Railway/Air reservation, Banks, Hotels, Weather forecasting and many more.

5. Storage Capacity

Today's computers can store volumes of data. The Computer has an in-built memory where it can store a large amount of data. You can also store data in secondary storage devices such as hard disk, which can be kept outside your computer and can be carried to other computers.

6. Reliability

The reliability of results processed by a computer is very high. If a program is executed any number of times with the same set of data, every time the results would be the same.

7. Power of Remembering

Computer has the power of storing any amount of information or data. Any information can be stored and recalled as long as you require it, for any numbers of years. It depends entirely upon you how much data you want to store in a computer and when to lose or retrieve these data.

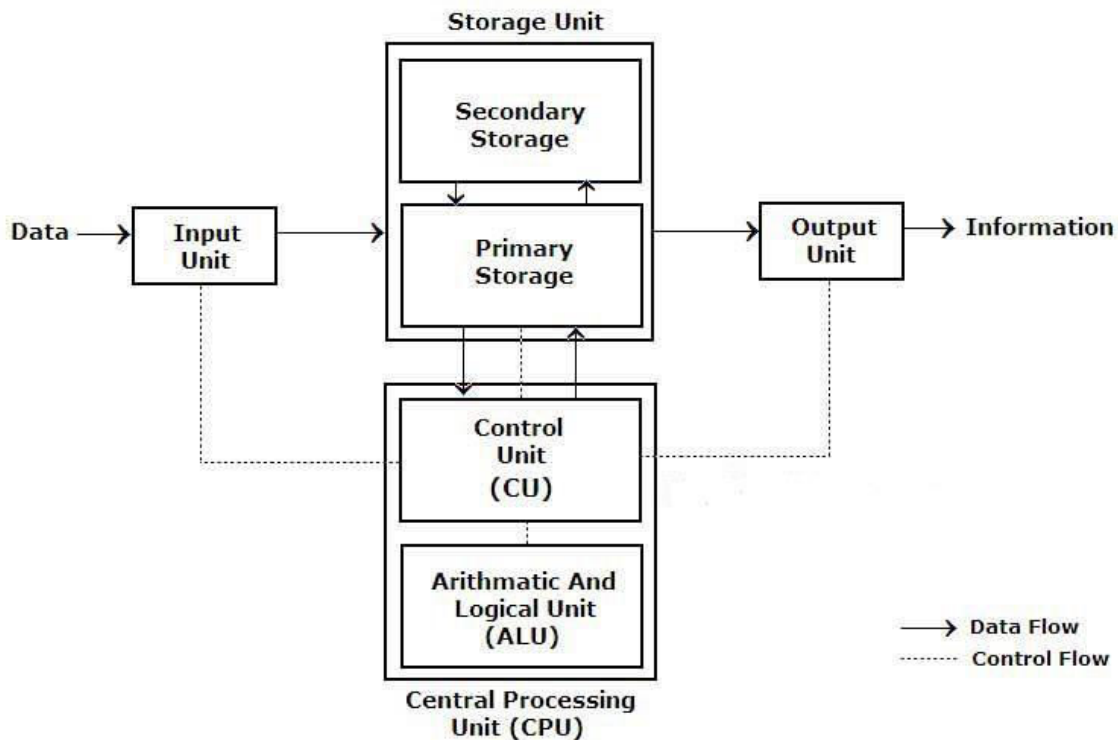
8. No IQ

Computer is a dumb machine and it cannot do any work without instruction from the user. It performs the instructions at tremendous speed and with accuracy. It is you to decide what you want to do and in what sequence. So a computer cannot take its own decision as you can.

9. No Feeling

It does not have feelings or emotion, taste, knowledge and experience. Thus it does not get tired even after long hours of work. It does not distinguish between users.

Block Diagram of Computer and its Various Components



Block Diagram of Computer and its components

1. **Input:** This is the process of entering data and programs into the computer system. You should know that a computer is an electronic machine like any other machine which takes as inputs raw data and performs some processing giving out processed data. Therefore, the input unit takes data from us to the computer in an organized manner for processing.

2. **Storage:** The process of saving data and instructions permanently is known as storage. Data has to be fed into the system before the actual processing starts. It is because the processing speed of the Central Processing Unit (CPU) is so fast that the data has to be provided to the CPU with the same speed. Therefore, the data is first stored in the storage unit for faster access and processing. This storage unit or the primary storage of the computer system is designed to do the above functionality. It provides space for storing data and instructions.

The storage unit performs the following major functions:

- All data and instructions are stored here before and after processing.
- Intermediate results of processing are also stored here.

3. **Processing:** The task of performing operations like arithmetic and logical operations is called processing. The Central Processing Unit (CPU) takes data and instructions from the storage unit and makes all sorts of calculations based on the instructions given and the type of data provided. It is then sent back to the storage unit.

4. **Output:** This is the process of producing results from the data for getting useful information. Similarly the output produced by the computer after processing must also be kept somewhere inside the computer before being given to you in human readable form. Again the output is also stored inside the computer for further processing.

5. **Control Unit:** The manner how instructions are executed and the above operations are performed. Controlling of all operations like input, processing and output are performed by control unit. It takes care of step by step processing of all operations inside the computer.

Functional Units

In order to carry out the operations mentioned in the previous section the computer allocates the task between its various functional units. The computer system is divided into three separate units for its operation. They are:

Arithmetic Logical Unit (ALU)

After you enter data through the input device it is stored in the primary storage unit. The actual processing of the data and instruction are performed by Arithmetic Logical Unit. The major operations performed by the ALU are addition, subtraction, multiplication, division, logic and comparison. Data is transferred to ALU from storage unit when required. After processing the output is returned back to storage unit for further processing or getting stored.

Control Unit (CU)

The next component of computer is the Control Unit, which acts like the supervisor seeing that things are done in proper fashion. Control Unit is responsible for co coordinating various operations using time signal. The control unit determines the sequence in which computer programs and instructions are executed. Things like processing of programs stored in the main memory, interpretation of the instructions and issuing of signals for other units of the computer to execute them. It also acts as a switch board operator when several users access the computer simultaneously. Thereby it coordinates the activities of computer's peripheral equipment as they perform the input and output.

Central Processing Unit (CPU)

The ALU and the CU of a computer system are jointly known as the central processing unit. You may call CPU as the brain of any computer system. It is just like brain that takes all major decisions, makes all sorts of calculations and directs different parts of the computer functions by activating and controlling the operations.

Computer Memory

Memory is the best essential element of a computer. A memory is just like a human brain. It is used to store data and instructions. Computer memory is the storage space in the computer, where data is to be processed and instructions required for processing are stored.

Memory is primarily of three types –

- **Primary Memory/Main Memory**
- **Secondary Memory**
- **Cache Memory**

Primary Memory/Main Memory

Primary memory is also known as main memory or may also refer to "Internal memory." and primary storage. It is used for immediate access of data by the processor. All those types of computer memories that are directly accessed by the processor using data bus are called primary memory. Primary memory holds only those data and instructions on which the computer is currently working. It has a limited capacity. It is costly and hence is not largely used for data storage. It is generally made up of semiconductor device. These memories are not as fast as registers. It is divided into two subcategories RAM and ROM.

1. Random Access Memory (RAM)

- It is also called as *read write memory* or the *main memory* or the *primary memory*.
- The programs and data that the CPU requires during execution of a program are stored in this memory.
- It is a volatile memory as the data loses when the power is turned off.
- RAM is further classified into two types- *SRAM (Static Random Access Memory)* and *DRAM (Dynamic Random Access Memory)*.

DRAM	SRAM
1. Constructed of tiny capacitors that leak electricity.	1. Constructed of circuits similar to D flip-flops.
2. Requires a recharge every few milliseconds to maintain its data.	2. Holds its contents as long as power is available.
3. Inexpensive.	3. Expensive.
4. Slower than SRAM.	4. Faster than DRAM.
5. Can store many bits per chip.	5. Can not store many bits per chip.
6. Uses less power.	6. Uses more power.
7. Generates less heat.	7. Generates more heat.
8. Used for main memory.	8. Used for cache.

Difference between SRAM and DRAM

2. Read Only Memory (ROM)

- Stores crucial information essential to operate the system, like the program essential to boot the computer.
- It is not volatile.
- Always retains its data.
- Used in embedded systems or where the programming needs no change.
- Used in calculators and peripheral devices.
- ROM is further classified into 4 types - *ROM*, *PROM*, *EPROM*, and *EEPROM*.
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Types of Read Only Memory (ROM)

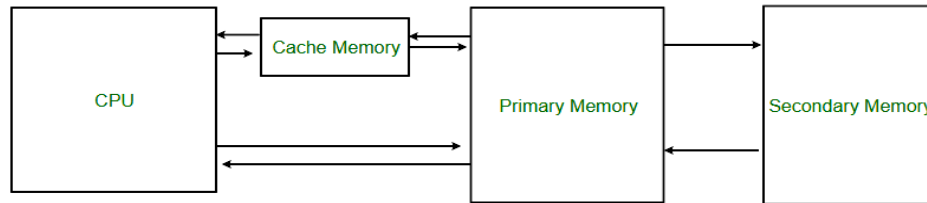
1. **PROM (Programmable read-only memory)** – It can be programmed by user. Once programmed, the data and instructions in it cannot be changed.
2. **EPROM (Erasable Programmable read only memory)** – It can be reprogrammed. To erase data from it, expose it to ultra violet light. To reprogram it, erase all the previous data.
3. **EEPROM (Electrically erasable programmable read only memory)** – The data can be erased by applying electric field, no need of ultra violet light. We can erase only portions of the chip.

RAM	ROM
1. Temporary Storage.	1. Permanent storage.
2. Store data in MBs.	2. Store data in GBs.
3. Volatile.	3. Non-volatile.
4. Used in normal operations.	4. Used for startup process of computer.
5. Writing data is faster.	5. Writing data is slower.

Difference between RAM and ROM

Cache Memory

Cache memory is a very high speed memory that is placed between the CPU and main memory, to operate at the speed of the CPU. It acts as a buffer between the CPU and the main memory. Cache memory is made of fast speed SRAMs. It is used to hold those parts of data and program which are most frequently used by the CPU. The parts of data and programs are transferred from the disk to cache memory by the operating system, from where the CPU can access them.



Advantages

The advantages of cache memory are as follows –

- Cache memory is faster than main memory.
- It consumes less access time as compared to main memory.
- It stores the program that can be executed within a short period of time.
- It stores data for temporary use.

Disadvantages

The disadvantages of cache memory are as follows –

- Cache memory has limited capacity.
- It is very expensive.

Secondary Memory / Auxiliary Memory/External Memory

A Secondary Memory also referred to as auxiliary storage and external storage. If we need to store large amount of data or programs permanently, we need a cheaper and permanent memory. Such memory is called **secondary memory**. Secondary memory (or secondary storage) is the slowest and cheapest form of memory. It cannot be processed directly by the CPU. It must first be copied into primary storage (also known as RAM).

Secondary memory devices include magnetic disks like hard drives and floppy disks ; optical disks such as CDs and CDRoms ; and magnetic tapes, which were the first forms of secondary memory.

Characteristics of Secondary Memory

These are some characteristics of secondary memory, which distinguish it from primary memory –

- It is non-volatile, i.e. it retains data when power is switched off
- It is large capacities to the tune of terabytes
- It is cheaper as compared to primary memory

Depending on whether secondary memory device is part of CPU or not, there are two types of secondary memory – fixed and removable.

Primary memory	Secondary memory
Fast Expensive Low capacity Works directly with the processor	Slow Cheap Large capacity Not connected directly to the processor

Hard Disk Drive

Hard disk drive is made up of a series of circular disks called **platters** arranged one over the other almost $\frac{1}{2}$ inches apart around a **spindle**. Disks are made of non-magnetic material like aluminum alloy and coated with 10-20 nm of magnetic material.



Standard diameter of these disks is 14 inches and they rotate with speeds varying from 4200 rpm (rotations per minute) for personal computers to 15000 rpm for servers. Data is stored by magnetizing or demagnetizing the magnetic coating. A magnetic reader arm is used to read data from and write data to the disks. A typical modern HDD has capacity in terabytes (TB).

Floppy Disk

The floppy disk memory technique uses a thin plastic-coated film covered with magnetic material. It is covered with a protective plastic cover. A floppy disk is a magnetic storage medium for computer systems. In order to read and write data from a floppy disk, a computer system must have a floppy disk drive (FDD). A floppy disk is also referred to simply as a floppy. Since the early days of personal computing, floppy disks were widely used to distribute software, transfer files, and create back-up copies of data. When hard drives were still very expensive, floppy disks were also used to store the operating system of a computer. It was invented in 1967 by a team at IBM and was one of the first types of hardware storage that could read/write a portable device. It came in three sizes.

1. 8" Floppy Disk (1971)
2. 5.25" Floppy Disk (1976)
3. 3.5" Floppy Disk (1984)

CD Drive

CD stands for **Compact Disk**. CDs are circular disks that use optical rays, usually lasers, to read and write data. They are very cheap as you can get 700 MB of storage space for less than a dollar. CDs are inserted in CD drives built into CPU cabinet. They are portable as you can eject the drive, remove the CD and carry it with you. There are three types of CDs –

- **CD-ROM (Compact Disk – Read Only Memory)** – The data on these CDs are recorded by the manufacturer. Proprietary Software, audio or video are released on CD-ROMs.
- **CD-R (Compact Disk – Recordable)** – Data can be written by the user once on the CD-R. It cannot be deleted or modified later.
- **CD-RW (Compact Disk – Rewritable)** – Data can be written and deleted on these optical disks again and again.

DVDDrive

DVD stands for **Digital Video Disk**. DVD are optical devices that can store 15 times the data held by CDs. They are usually used to store rich multimedia files that need high storage capacity. DVDs also come in three varieties – read only, recordable and rewritable. As a result, the DVD specification provided a storage capacity of **4.7 GB** for a single-layered, single-sided disc and **8.5 GB** for a dual-layered, single-sided disc.



Pen Drive/USB Drive

Pen drive is a portable memory device that uses solid state memory rather than magnetic fields or lasers to record data. It uses a technology similar to RAM, except that it is nonvolatile. It is also called USB drive, key drive or flash memory.



Blu Ray Disk

Blu Ray Disk (BD) is an optical storage media used to store high definition (HD) video and other multimedia file. BD uses shorter wavelength laser as compared to CD/DVD. This enables writing arm to focus more tightly on the disk and hence pack in more data. BDs can store up to 128 GB data.

Input Devices

The devices which are used to give data and instructions to the computer are called Input Devices. It allows you to interact with computer and control it. Central processing unit of computer receives the input and processes it to produce output. Various types of input devices can be used with the computer depending upon the type of data you want to enter in the computer, e.g., keyboard, mouse, joystick, light pen, etc. The most commonly used or primary input devices on a computer are the keyboard and mouse.

Some of the popular input devices are:

1. Keyboard
2. Mouse
3. Scanner
4. Joystick
5. Light Pen
6. Track ball
7. Digitizer
8. Microphone
9. Magnetic Ink Character Recognition (MICR)
10. Optical Character Reader (OCR)

Keyboard

It is the most commonly used input device. It is used to enter data and instructions directly into the computer. Keyboards allow you to input letters, numbers, and other symbols into a computer that can serve as commands or be used to type text.

There are 104 buttons on the keyboard which are called keys.



Mouse

Mouse is another input device which is commonly found connected with the computers. It is basically a pointing device which works on the principle of Point and Click. When the mouse is moved on the mouse pad, a light beam underneath reflect to give motion to the pointer on the screen. The mouse is used in windows based programs, where the user can run the commands by pointing the objects with the help of pointer and clicking the buttons on the mouse. We also use mouse for drawing in paint and kid pix.

Most of the latest mouse, these days, includes a wheel in the middle of two buttons that help us to scroll through documents more easily. We use our forefinger to move the wheel to scroll up or down in a document. Optical mouse uses red light to track the movement of mouse for moving the pointer on the computer screen. This type of mouse is more accurate and reliable than the traditional mouse.



Nowadays cordless mouse is very popular. it does not have wires. it either uses Bluetooth technology to sends the data through the air to a receiver, usually plugged in USB port of the computer.

Joystick and Game-pad

Joystick and game-pad are also input devices which are also input devices which are used to control the movement of object on the screen. Just like mouse, these are also pointing devices. Mostly they are used for playing games on the computer. The joystick has a vertical stick with a track ball at its bottom. While playing the games on the computer, the user needs to move the objects quickly on the screen. With the movement of this vertical stick the objects can be moved in all the directions easily.

A game-pad is a type of game controller held in two hands, where the fingers (especially thumbs) are used to provide input by pressing buttons on it. It is also known as Control Pad.



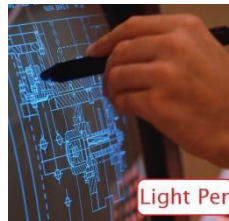
Joystick



Gamepad

Light Pen

Light pen is another pointing type input device. It is a pen shaped device which can be used by directly pointing the objects on the screen. It can also be used for making drawings directly on the monitor screen.



Scanner

We can store pictures, photographs, diagrams into the computer with the help of scanner. The scanner reads the image and saves it in the computer as a file. Scanner is an input device, which works more like a photocopy machine. Scanner captures images from the source which are then converted into a digital form that can be stored on the disk. These images can be edited before they are printed.



Touchscreen

Touchscreen is a special computer screen that takes the input by sensing the touch of a human finger, gloved hand, stylus, pen or any other pointing device. The user gives instructions to the computer just by touching the screen.



Digitizer

A digitizer tablet (also known as a digitizer or graphics tablet) is a tool used to convert hand-drawn images into a format suitable for computer processing. Images are usually drawn onto a flat surface with a stylus and then appear on a computer monitor or screen. Digitizer tablets can also be used as an input

device, receiving information represented in drawings and sending output to a CAD (computer aided design) application and PC-based software like AutoCAD.



Microphone

This is an input device which is used to record sound or voice into the computer system. You can store voice data in the computer by speaking in front of this device.



Trackball

A trackball is similar to a mouse but is mounted in a fixed position. The user spins the ball with fingers to move the pointer on the screen.

A Trackball technology was used in earlier laptop computer which is now replaced with track-pad.



Magnetic Ink Card Reader (MICR)

MICR input device is generally used in banks as there are large number of cheques to be processed every day. The bank's code number and cheque number are printed on the cheques with a special type of ink that contains particles of magnetic material that are machine readable. This reading process is called

Magnetic Ink Character Recognition (MICR). The main advantages of MICR are that it is fast and less error prone.



Optical Character Reader (OCR)

OCR is an input device used to read a printed text.

OCR scans the text optically, character by character, converts them into a machine readable code, and stores the text on the system memory.



Optical Mark Reader (OMR)

OMR is a special type of optical scanner used to recognize the type of mark made by pen or pencil. It is used where one out of a few alternatives is to be selected and marked. It is specially used for checking the answer sheets of examinations having multiple choice questions.



Bar Code Readers

Bar Code Reader is a device used for reading bar coded data (data in the form of light and dark lines). Bar coded data is generally used in labeling goods, numbering the books, etc. It may be a handheld scanner or may be embedded in a stationary scanner.



Output Devices

The devices which are used to display the results or information are called Output Devices. You can view the output on the monitor or you can print it on a paper using a printer. Monitor and the printer are the commonly used output devices.

Monitor

This is the most common output device connected with the computer to display the processed information. It looks like a TV and is also known as VDU (Visual Display Unit). Pictures are displayed by using a large number of very small dots on screen called pixels. The number of pixels that a monitor can show on its screen is referred to as the resolution of the screen.



LCD Monitor



CRT Monitor

The two commonly used monitor types are:

1. Cathode Ray Tube (CRT) Monitor
2. Liquid crystal Display (LCD) Monitor

LCD uses very small amount of electricity as compared to CRT.

The output produced on the screen is called Soft Copy Output because it cannot be retained for a long time.

Nowadays LCD monitors are more popular as their sharp picture quality. They are light weighted and flat screen monitors.

Printer

This is an important output device of the computer system. It gives a printed output of the results that appears on the monitor screen. Printed output is also called Hard Copy output because unlike monitor, this output can be preserved even if the computer is switched off.

Printers are of different types. On the basis of their printing techniques, printers are grouped as follows:

- 1.Character printer
- 2.Line printer
- 3.Page printer



Character Printer

Character printer prints one character at a time; it prints at the speed of around 30 to 600 characters per second.

Dot Matrix printer is an example of a character printer.

Dot Matrix Printer

This type of printer works like a typewriter. It creates an impression on the paper by pressing the end of pins fixed in its print heads, against an inked ribbon. This printer is noisy with a low print quality. Its speed is measured in CPS(Character Per Second).

Line Printer

This is high speed printer that prints one line at a time. It is used when large quantity of output is required as it produces the quick output. Examples of a Line printer are Drum printer and the Chain printer. The noise level of these printers is high and speed ranges from 200 to 2000 LPM(Lines Per Minute).

Page Printer

Page Printer prints a whole page at a time. Examples of these printers are inkjet printer or a Line printer because it has to store each page in memory before printing it.

Inkjet Printer

This type of printer prints by spraying tiny ink droplets on the paper. It can print in both, color as well as black and white. The print quality of this printer is better than that of Dot Matrix Printer and it prints without making any noise. Its speed is measured in PPM(Pages Per Minute).

The most commonly used printers are: Dot matrix, inkjet and Laser printers.

Laser printer

In this type of printer, laser beam technology is used to print the text or graphics on the paper. The speed of this printer is very fast and it gives out very fine quality prints. It's speed is also measured in PPM.

Speaker

Speakers are categorized as output devices. These are used to listen to the music and sounds played by the computer. Normally they come in a pair and have different shapes and sizes.



Plotter

We can get the print of a photograph, drawing, image stored in the computer, by using a plotter. It is an output device which provides a high quality of printed output. It is generally used by engineers and architects.



Software

As you know computer cannot do anything without instruction from the user. In order to do any specific job you have to give a sequence of instructions to the computer. This set of instructions is called a computer program. Software refers to the set of computer programs.

Software is a set of programs, which is designed to perform a well-defined function. A program is a sequence of instructions written to solve a particular problem.

There are two types of software –

- System Software
- Application Software

System Software

System software is a type of computer program that is designed to run a computer's hardware and application programs. System software acts as **interface** between hardware and user applications. It helps run the computer hardware and computer system itself.

If we think of the computer system as a layered model, the system software is the interface between the hardware and user applications.

The operating system (OS) is the best-known example of system software. The OS manages all the other programs in a computer.

Some examples of system software are Operating System, Compilers, Interpreter, Assemblers, etc.

- The BIOS (basic input/output system) gets the computer system started after you turn it on and manages the data flow between the operating system and attached devices such as the hard disk, video adapter, keyboard, mouse, and printer.
- The boot program loads the operating system into the computer's main memory or random access memory (RAM).
- An assembler takes basic computer instructions and converts them into a pattern of bits that the computer's processor can use to perform its basic operations.
- A device driver controls a particular type of device that is attached to your computer, such as a keyboard or a mouse. The driver program converts the more general input/output instructions of the operating system to messages that the device type can understand.
- According to some definitions, system software also includes system utilities, such as the disk defragmenter and System Restore, and development tools such as compilers and debuggers.

Utility Program

A program that performs a specific task related to the management of computer functions, resources, or files, as password protection, memory management, virus protection, and file compression.

Utility program helps to manage, maintain and control computer resources.

Examples of utility programs are antivirus software, backup software and disk tools.

Antivirus

Antivirus software helps to protect a computer system from viruses and other harmful programs. A computer virus is a computer program that can cause damage to a computer's software, hardware or data.

It is referred to as a virus because it has the capability to replicate itself and hide inside other computer files.

One of the most common ways to get a virus is to download a file from the Internet. Antivirus software scans your online activity to make sure you are not downloading infected files. New viruses are coming out all the time, so antivirus software needs to be updated very frequently.

Example: AVG, Avast, Quick Heal, eScan, Net Protector etc.

Disk Cleaner

These are the programs in-built in operating system to find and delete unwanted files from the computer to free the disk space. It could be temporary files or folders automatically created during internet surfing session on the computer.

Disk Defragmenter

Disk Defragmenter is a utility in Microsoft Windows designed to increase access speed by rearranging files stored on a disk to occupy contiguous storage locations, a technique called defragmentation. Disk defragmenter is a disk management utility that increases file access speeds by rearranging fragmented files on contiguous locations. Large files are broken down into fragments and may be stores in non-contiguous locations if contiguous ones are not available. When such files are accessed by the user, access speed is slow due to fragmentation. Defragmenting a disk minimizes head travel, which reduces the time it takes to read files from and write files to the disk.

Compression and Decompression Tools

Storage space is always at a premium in computer systems. So operating systems are always looking at ways to minimize amount of storage space taken by files. Compression tools are utilities that assist operating systems in shortening files so that they take less space. After compression files are stored in a different format and cannot be read or edited directly. It needs to be uncompressed before it can be accessed for further use. Some of the popular compression tools are **WinRAR, PeaZip, The Unarchiver**, etc. In order to use a compressed file, you must first decompress it. The software used to decompress depends on how the file was compressed in the first place. To decompress a .zip file you need software, such as WinZip. To decompress a .sit file, you need the Stuffit Expander program. WinZip does not decompress .sit files, but one version of Stuffit Expander can decompress both .zip and .sit files.

Application Software

An application is any program, or group of programs, that is designed for the end user. A software which is developed to help the user to perform specific tasks is called application software.

Application software is a term which is used for software created for a specific purpose. It is generally a program or collection of programs used by end users. It can be called an application or simply an app.

In fact all the software other than system software and programming software are application software.

Various Examples Of Application Software Are:

- Word processing software
- Database programs
- Entertainment software
- Business software
- Educational software
- Computer-aided design(CAD) software
- Spreadsheet software etc.

Word Processing

Word processing software is used to manipulate a text document, such as a resume or a report. You typically enter text by typing, and the software provides tools for copying, deleting and various types of formatting. Some of the functions of word processing software include:

- Creating, editing, saving and printing documents.
- Copying, pasting, moving and deleting text within a document.
- Formatting text, such as font type, bolding, underlining or italicizing.
- Creating and editing tables.
- Inserting elements from other software, such as illustrations or photographs.
- Correcting spelling and grammar.

Word processing includes a number of tools to format your pages. For example, you can organize your text into columns, add page numbers, insert illustrations, etc. However, word processing does not give you complete control over the look and feel of your document. When design becomes important, you may need to use desktop publishing software to give you more control over the layout of your pages.

Word processing software typically also contains features to make it easier for you to perform repetitive tasks. For example, let's say you need to send a letter to all your customers regarding a new policy. The letter is the same for all customers except for the name and address at the top of the letter. A mail merge function allows you to produce all the letters using one template document and a table with customer names and addresses in the database.

Spreadsheet Program

Spreadsheet software is a software application capable of organizing, storing and analyzing data in tabular form. The application can provide digital simulation of paper accounting worksheets. They can also have multiple interacting sheets with data represented in text, numeric or in graphic form. With these capabilities, spreadsheet software has replaced many paper-based systems, especially in the business world. Originally developed as an aid for accounting and bookkeeping tasks, spreadsheets are

now widely used in other contexts where tabular lists can be used, modified and collaborated.

Spreadsheet software is also known as a spreadsheet program or spreadsheet application. A programming language is a set of commands, instructions, and other syntax use to create a software program.

Programming Language

To communicate with a person, you need a language. Same if you need to communicate with the computer, you need a programming language. Without any programming language you cannot communicate with the computer.

Thus, programming language is the medium of communication between you (a person) and a computer system. It is the set of some instructions written in a specific style (coding) to instruct the computer to do some specific task. A programming language is a set of commands, instructions, and other syntax use to create a software program. Each programming language has a unique set of keywords and a special syntax for organizing program instructions. Programs are created through programming languages to control the behavior and output of a machine through accurate algorithms, similar to the human communication process.

Types of Programming Languages

There are three types of programming languages, which can be categorized into the following ways:

1. Low level language

- a) Machine language (1GL)
- b) Assembly language (2GL)

2. High level language

- a) Procedural-Oriented language (3GL)
- b) Problem-Oriented language (4GL)
- c) Natural language (5GL)

3. Middle Level Language

1. Low level language

These are machine dependent programming languages such as Binary (Machine code) and Assembly language.

This language is the most understandable language used by computer to perform its operations. It can be further categorized into:

a) Machine Language (1GL)

Machine language consists of strings of binary numbers (i.e. 0s and 1s) and it is the only one language, the processor directly understands. Machine language has very fast execution speed and efficient use of primary memory.

Merits:

- It is directly understood by the processor so has faster execution time since the programs written in this language need not to be translated.
- It doesn't need larger memory.

Demerits:

- It is very difficult to program using 1GL since all the instructions are to be represented by 0s and 1s.
- Use of this language makes programming time consuming.
- It is difficult to find error and to debug.
- It can be used by experts only.

b) Assembly Language

Assembly language is also known as low-level language because to design a program programmer requires detailed knowledge of hardware specification. This language uses mnemonics code (symbolic operation code like 'ADD' for addition) in place of 0s and 1s. The program is converted into machine code by assembler. The resulting program is referred to as an object code.

Merits:

- It makes programming easier than 1GL since it uses mnemonics code for programming. Eg: ADD for addition, SUB for subtraction, DIV for division, etc.
- It makes programming process faster.
- Error can be identified much easily compared to 1GL.
- It is easier to debug than machine language.

Demerits:

- Programs written in this language is not directly understandable by computer so translators should be used.
- It is hardware dependent language so programmers are forced to think in terms of computer's architecture rather than to the problem being solved.

- Being machine dependent language, programs written in this language are very less or not portable.
- Programmers must know its mnemonics codes to perform any task.

2. High level language

Instructions of this language closely resemble to human language. or English like words. It uses mathematical notations to perform the task. The high level language is easier to learn. It requires less time to write and is easier to maintain the errors. The high level language is converted into machine language by one of the two different languages translator programs; interpreter or compiler.

High level language can be further categorized as:

a) Procedural-Oriented language (3GL)

A procedural language is a type of computer programming language that specifies a series of well-structured steps and procedures within its programming context to compose a program. It contains a systematic order of statements, functions and commands to complete a computational task or program. These languages are designed to express the logic and the procedure of a problem to be solved. It includes languages such as Pascal, COBOL, C, FORTAN, etc.

Merits:

- Because of their flexibility, procedural languages are able to solve a variety of problems.
- Programmer does not need to think in term of computer architecture which makes them focused on the problem.
- Programs written in this language are portable.

Demerits:

- It is easier but needs higher processor and larger memory.
- It needs to be translated therefore its execution time is more.

b) Problem-Oriented language (4GL)

Problem-oriented languages designed to solve specific problems or develop specific applications by enabling us to describe what we want rather than step-by-step procedures for getting there. . This is one step ahead from 3GL. These are result oriented and include database query language.

Eg: Visual Basic, C#, PHP, etc.

The objectives of 4GL are to:

- Increase the speed of developing programs.
- Minimize user's effort to obtain information from computer.
- Reduce errors while writing programs.

Merits:

- Programmer need not to think about the procedure of the program. So, programming is much easier.

Demerits:

- It is easier but needs higher processor and larger memory.
- It needs to be translated therefore its execution time is more.

c) Natural language (5GL)

Natural languages are still in developing stage where we could write statements that would look like normal sentences.

Merits:

- Easy to program.
- Since, the program uses normal sentences, they are easy to understand.
- The programs designed using 5GL will have artificial intelligence (AI).
- The programs would be much more interactive and interesting.
- Demerits:
- It is slower than previous generation language as it should be completely translated into binary code which is a tedious task.
- Highly advanced and expensive electronic devices are required to run programs developed in 5GL. Therefore, it is an expensive approach.

Middle level Language

Languages that have the features of both low level languages and high level languages are called middle level language.

C is called middle-level language because it is actually binding the gap between a machine level language and high-level languages. User can use c language to do System Programming (for writing operating system) as well as Application Programming (for generate menu driven customer billing system).

A program written in high-level language is called as source code. To convert the source code into machine code, translators are needed.

Translator

A translator takes a program written in source language as input and converts it into a program in target language as output.

It also detects and reports the error during translation.

Roles of translator are:

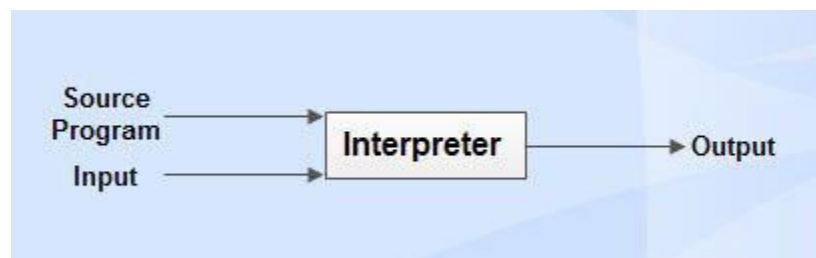
- Translating the high-level language program input into an equivalent machine language program.
- Providing diagnostic messages wherever the programmer violates specification of the high-level language program.

Different type of translators

The different types of translator are as follows:

Compiler

Compiler is a translator which is used to convert programs in high-level language to low-level language. It translates the entire program and also reports the errors in source program encountered during the translation.

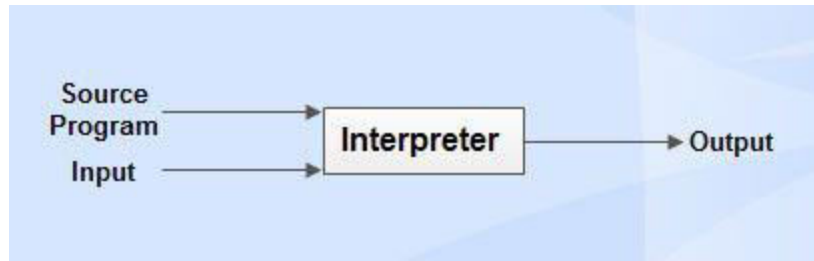


Interpreter

Interpreter is a translator which is used to convert programs in high-level language to low-level language. Interpreter translates line by line and reports the error once it encountered during the translation process.

It directly executes the operations specified in the source program when the input is given by the user.

It gives better error diagnostics than a compiler.



Assembler

Assembler is a computer program which is used to translate program written in Assembly Language in to machine language. The translated program is called as object program. Assembler checks each instruction for its correctness and generates diagnostic messages, if there are mistakes in the program.

Once assembled, the program file can be used again and again without re-assembly.

Difference between Compiler and Interpreter

S. No.	Compiler	Interpreter
1	Performs the translation of a program as a whole.	Performs statement by statement translation.
2	Execution is faster.	Execution is slower.
3	Requires more memory as linking is needed for the generated intermediate object code.	Memory usage is efficient as no intermediate object code is generated.
4	Debugging is hard as the error messages are generated after scanning the entire program only.	It stops translation when the first error is met. Hence, debugging is easy.
5	Programming languages like C, C++ uses compilers.	Programming languages like Python, BASIC, and Ruby uses interpreters.