



Chapter 1

Computer and its Components

Learning Objectives

By the end of this chapter, learner will be able to:

- List five computer applications which are used on the daily basis.
- Identify the different Input / Output devices.
- Describe the process of changing data from input to output (The IPO cycle).
- Explain the connectivity of devices through different kinds of ports.
- Differentiate between primary and secondary memory.
- State the purpose of different softwares.
- Tabulate the difference between different types of computers according to their size and processing capabilities.

INTRODUCTION

The computer is just a dead collection of plastic, silicon and metal until you press the 'Power' button. One little burst of electricity and it starts a string of events that puts life and power into the machine. But, even at this stage, the computer is unaware of the potential that it holds within itself. The computer, today, is a fundamental part of the information age.

Initially, computers were developed to perform mathematical operations, but later on, they were used to store the result of those operations, which with the time leads to the storage of other data or information.

As we are talking about data and information, now we will learn what data is and what is called as information?

Data is a collection of unprocessed facts, figures, and symbols.

e.g. Ram, age, 32, years, old

Information is a processed form of data. It is organized, meaningful, and useful.

e.g. Ram is 32 years old.

Or

Ram's age is 32 years.

A computer can be defined as an advanced electronic device that takes raw data as input from the user. It uses a set of instructions (called program) to process the data and give the result (output). The result can be used immediately or saved for future use.

1. HARDWARE AND SOFTWARE

In the process of converting data to information, a computer uses hardware and software. At the simplest level, all computers consist of these two basic components; the hardware and the software.

Hardware is any part of the computer that has a physical structure that can be seen and touched, though some may be so tiny that they are invisible to the naked eye.

Software is the instruction set that tells the computer how to perform tasks. Software is intangible i.e., that cannot be seen and touched, but its effect is clearly defined.

Input devices, output devices, a system unit, storage devices, and communication devices are all components of computer hardware.

1.1 Hardware components are classified into following categories

I. Input Devices

Input devices are the devices that allow a user to enter data and instructions into a computer such as keyboard, mouse, microphone, scanner, trackball, joystick, graphics tablet and digital camera.

The various functions of input devices are:

- ❖ They accept data and instructions from the user.
- ❖ They convert these instructions and data from human readable form to machine readable form.
- ❖ They supply the converted instructions and data to the CPU for further processing.

			
Mouse	Keyboard	Microphone	Scanner
			
Trackball	Joystick	Graphics Tablet	Digital Camera

II. Output Devices

Output devices are used to display the result or information to the user through monitor or VDUs, LCDs, printers, plotters and speakers.

Functions of output devices can be summed up as follows:

- ❖ It accepts the results produced by the computer which is in the coded form or machine readable form.
- ❖ It converts these coded results into human readable form.
- ❖ It supplies the converted results to the user.



Monitor or VDU



Printers



Plotters

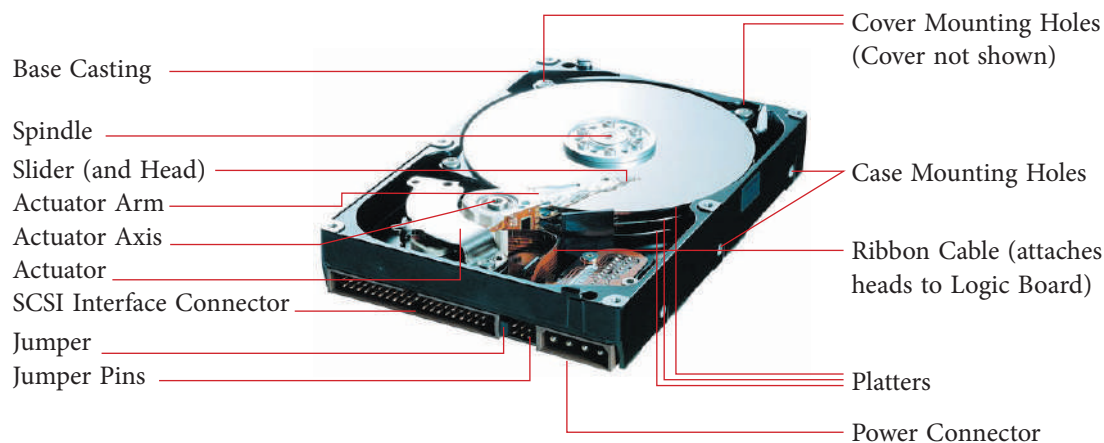


Speaker

III. Storage devices

Storage devices are the devices which are used to retrieved from and saved to the data and information such as hard drives, memory sticks (pen drives), compact discs, DVDs and tape drives.

1. **Floppy disks** were developed in late 1960s. A floppy disk is made up of a circular thin plastic jacket coated with magnetic material. Its outer cover which is a hard plastic protects this plastic disk. It can hold 1.44 MB data. Nowadays, these disks are outdated.
2. **Hard Disk** is made up of a metal disk and coated with a metal oxide used to store bulk of data. These disks can store more information than floppy disks, up to tens or hundreds of gigabytes.



3. **Compact Disk – Read Only Memory** or CD-ROM is a read only or read-write disk. It can store large amount of data which can be distributed to large number of users. It is inexpensive and fast, but its access time is longer than that of magnetic disk.

There are two types of CDs: CD-R and CD-RW.

CD-R stands for Compact Disk – Recordable which can store 700 MB of data, but only once.

CD-RW stands for Compact Disk – ReWriteable which can read, write and erase data as many times.



4. **DVD**, short for Digital Versatile Disc, is an optical storage disc similar to CD-ROM, as this is double sided with dual layer disc and can hold 4.7 GB of data.



5. **Blue-Ray Disks** are used to store more than 25 GB of data with a very high speed in less amount of time. A single layer of BD can store 13 hours of video where as double layer BD can store more than 20 hours of video.

6. **USB** stands for Universal Serial Bus. It is a portable memory device which is used to store data that needs to be transferred to the other device using USB port of the system.



7. **Memory Card** or flash memory card is a memory device. It is used as an easy, fast and reliable medium to store and transfer data from one device to the other. It is used in digital cameras, game consoles, mobile phones etc.



1.2. CPU (Central Processing Unit)

The **system unit** is the box that protects the internal electronic components from damage. It contains the central processing unit (CPU) and memory. The **CPU** interprets and carries out the basic instructions that operate the computer. **Memory** is where data and instructions are held.

The heart of the computer system is the processor unit. It consists of the **Arithmetic and Logic Unit (ALU)** which executes most computer operations (arithmetic and logical) and the **Control Unit** which acts as the nerve centre that sends control signal to all other units.

The control unit and ALU are usually many times faster than other devices connected to a computer system. This enables a single processor to control a number of external devices such as video terminals, magnetic tapes, disk memories, sensors, displays and mechanical controllers, since they are much slower than the processor.

1.3. Memory

There are two categories of memory, primary memory and secondary memory (or external memory).

Primary Memory is very fast as data and programs must be in the primary memory for execution. Random Access Memory (RAM) and Read Only Memory (ROM) are both primary memory.

Random Access Memory refers to memory that can be selected and used randomly. The information stored here disappears the very moment the machine is turned off. It is also referred to as volatile memory.

Read Only Memory is permanently built into the computer at the time of production. The information from this memory can only be read and it is not possible to write fresh

information into it. It permanently stores a set of instructions which instructs the computer how to work. After we switch on the computer, it uses instructions stored here to carry out a series of tasks automatically, before we can actually use the computer.

Secondary Memory or Auxiliary Memory: The content on the RAM is erased when electric power is switched off. So, it becomes necessary to store this data for future use, somewhere else. Since, primary storage is expensive too; we need a relatively cheaper form of backup storage which can store vast quantities of information. Thus, **Secondary Memory** devices become an important part of the computer.

1.3.1 Units of Memory

Memory, storage, files and folder sizes are all measured in bytes. Computers work in the base 2 system, also called binary number system, using only the digits 0 and 1. A single numeric value using either 0 or 1 is called a **bit**. A sequence of 'bits' make a **byte**. Usually eight bits make a byte (sometimes it could be sixteen, thirty two or even sixty four). Bits are grouped into bytes to increase the efficiency of the computer. To describe large capacities, the terms Kilobyte (KB), megabyte (MB), gigabyte (GB), terabyte (TB) and Petabyte (PB) are used.

1 nibble = 4 bits

1 byte = 8 bits

1 KB = 1024 bytes

1 MB = 1024 KB

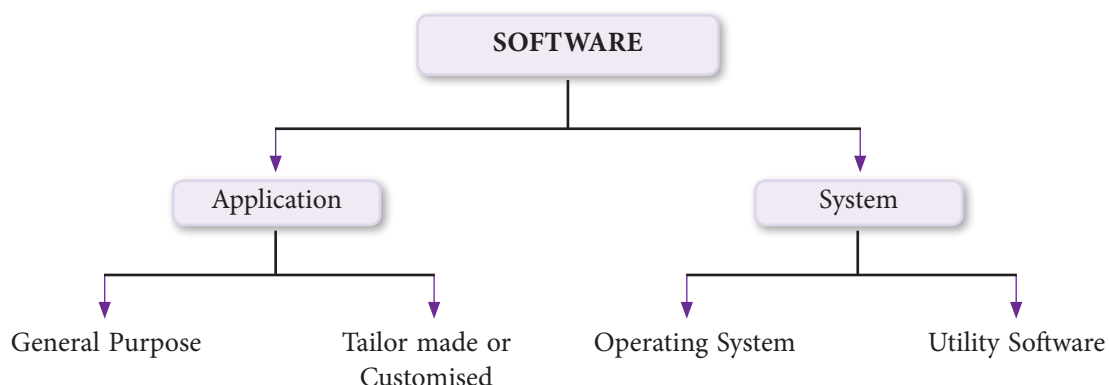
1 GB = 1024 MB

1 TB = 1024 GB

1 PB = 1024 TB

2. SOFTWARE

A computer system's hardware must have software to function. There are two primary types of softwares: Application software and Systems software.



2.1 Application software

It includes programs that direct the computer to carry out specific tasks. Often, multiple programs are integrated to create an application. For example: To write error free documents, Word Processors are used such as OpenOffice.org Writer, MS Word etc. For calculations, Spreadsheets are used such as OpenOffice.org Spreadsheet, Ms Excel etc. For making presentations, Presentation Softwares are used such as OpenOffice.org Impress, MS PowerPoint etc. For designing images, Desktop publishing softwares are used such as Gimp, Adobe Photoshop, Corel Draw, Picasa etc.

Whereas, at the same time, there are application softwares that are created to address specific needs of a group of specialized users and are, therefore, known as tailored or customized software to perform the required tasks in a specific manner. There are many packaged softwares available, addressing specific needs of small or big groups of users. You have a 'Tally' or a 'QuickBooks' to address a small businessman's accounting needs, but it can also serve a large multinational company.

2.2 System software

System software includes the programs that enable the computer's hardware to work with and run the application software. System software is the interface between user and the other programs and the computer's hardware.

2.2.1 There are two categories of system software: operating systems and system utilities.

The operating system, also referred to as the OS, is a computer program that manages all the other programs on your computer, stores files in an organized manner, and coordinates the use of the computer hardware such as the keyboard and mouse. The operating system frees one from having to interact directly with the hardware— other than clicking the mouse button or pressing keys on the keyboard— to complete tasks.

Utility software is a form of system software. It is used to analyze, configure, optimize or maintain the computer. This software performs all the housekeeping functions.

The utility softwares are categorised into the following categories:

1. **Text Editors** facilitate the creation of flawless text documents. WordPad and Notepad are the commonly used text editors.
2. **Compression Utilities** are used to compress the selected files. It helps to save the space on the disk and to transfer heavy files on a network.

3. **Disk Fragmentation** utility helps the user to arrange used and free space on the hard disk which in turn increases the processing speed of the disk.
4. **Scan Disk** utility checks for the problems on the hard disk such as bad sectors, viruses etc.
5. **Encryption or Decryption** utility is used to hide the data for secured transmission. At the source, data is encrypted and at the destination device, data is decrypted to reveal the original message. Decryption requires a secret key or password.

3. COMPUTERS CHARACTERISTICS

Speed: A computer computes problems much faster than a human being.

Accuracy: With the high computation speed, computers are able to produce accurate results. If the input is valid, only then correct output will be produced as computers follows GIGO i.e. Garbage In Garbage Out principle.

No IQ: It is programmed to carry out tasks and performs exactly as instructed, since it has no intelligence of its own.

Diligence: It can carry out tasks over and over again with exactly the same result every time, and it does so without tiring.

Data Storage: Using different kinds of storage devices, it can store huge quantities of data over long periods of time.

No Heuristics: As computer is a dumb machine, thus it never ever learns from its past experiences.

4. GENERATIONS OF COMPUTERS

The first electronic computer was designed and built at the University of Pennsylvania based on vacuum tube technology.

Computers have been divided into five generations according to the development of technologies used to fabricate the processors, memories and I/O units.

- ❖ **I Generation (1945 – 55)** Bulky, vacuum based and costly, used assembly language which was translated to machine level language for execution. These computers were used mainly for scientific calculations. *Examples:* ENIAC, EDSAC, EDVAC, UNIVAC.

- ❖ **II Generation (1955 – 65)** Smaller than vacuum based computers, but better performance-wise, used transistors instead of vacuum tubes. High level languages such as FORTRAN and COBOL were used. Punched cards continued to be used during this period. Computers, then, were used increasingly in business, industry and commercial organizations. *Examples:* IBM 7030, Honeywell 400.
- ❖ **III Generation (1965 – 75)** Small Scale Integration and Medium Scale Integration technology were implemented in CPU, I/O processors etc. Faster processors with magnetic core memories that were later replaced by RAM and ROM. This is when microprogramming was introduced as were operating system software. Database management, multi-user application, online systems like closed loop process control, airline reservation, interactive query systems, automatic industrial control, etc. emerged during this period. *Examples:* System 360 Mainframe from IBM, PDP-8 Mini Computer from Digital Equipment Corporation.
- ❖ **IV Generation (1975 – 89)** Microprocessors were introduced where complete processors and large section of main memory could be implemented in a single chip. CRT screen, laser & ink jet printers, scanners etc. were developed and so were LAN and WANS. C and UNIX were used. *Examples:* Intel's 8088,80286,80386,80486 .., Motorola's 68000, 68030, 68040, Apple II, CRAY I/2/X/MP etc.
- ❖ **V Generation: 1989 to present** Computers use extensive parallel processing, multiple pipelines, multiple processors etc. Portable notebook computers introduced. They also started using object oriented languages such as JAVA. Quantum mechanism and nanotechnology available here will radically change computers for all times. *Examples:* IBM notebooks, Pentium PCs-Pentium 1/2/3/4/Dual core/Quad core. SUN work stations, Origin 2000, PARAM 10000, IBM SP/2.

5. CATEGORIES OF COMPUTERS

Computers are classified into many categories depending upon their size, functioning and processing capabilities.

5.1 According to how it functions, computers can be classified into three categories

Analog: According to the Merriam Webster Dictionary, computers in which continuously variable physical quantities, such as electrical potential, fluid pressure, or mechanical motion, are used to represent (analogously) the quantities in the problem to be solved are called analog computers.

Digital: These computers deal with data in the form of numbers. They mainly operate by counting and performing arithmetic & logical operations on numeric data. Such computers are 'many problems' oriented.

Hybrid: Digital computers could not deal with very large numbers and so, a computer with characteristics of both analog and digital was created which was known as Hybrid computer.

5.2 According to the size, computers are classified into the following categories

Palmtop, better known as Personal Digital Assistants (PDAs), are small, lightweight and tightly integrated computers which usually do not have keyboards but rely on touch screen technology for user-input.

Laptops and Notebooks are portable computers. They include a battery that provides electrical backup for a period of time.

Personal computer (PC) is small in size and is designed for general use by a single person.

Desktop computer is typically set up in a permanent location and is a PC that is not portable. A desktop computer is a PC built for high performance and heavy workload. It helps in faster rendering of complex graphics, provides power for computer intensive applications and memory for large tasks. They are more reliable and have less downtime.

Micro-computers came into being with the invention of the micro-processor. They are not so expensive. The personal computer is a micro-computer.

Mini computers provide more power than micro computers in terms of speed and storage capacity. They are also less expensive. Their performance is also lower than that of mainframes.

Mainframe computers can also process data at very high speeds, but less than that of super computers. Normally, they are used in banking, airlines and railways etc. for their applications.

A **supercomputer** is the fastest type of computer. They are employed for specialized applications that require large amounts of mathematical calculations. A supercomputer channels all its power into executing a few programs at great speed, whereas a mainframe uses its power to execute many programs at the same time. These computers are used to solve problems involving quantum mechanical physics, weather forecasting, climate research, molecular modelling such as computing the structures and properties of chemical compounds, simulations, cryptanalysis, and many others.

6. APPLICATIONS OF COMPUTERS

Computers are used in almost all walks of life today. In medicine and health care, in education and business, in the manufacturing and service industries, for science and research; computers are the most important tool used by human beings.

7. INPUT → PROCESS → OUTPUT (IPO)

Input-Process-Output cycle or IPO refers to the stages that a set of instructions undergo to achieve the desired result. The computer is not a magic box where things get done automatically. The information, through various input devices, is fed into the system to be processed by the CPU. The information is then received as output in the **desired** format and presented in human readable form.

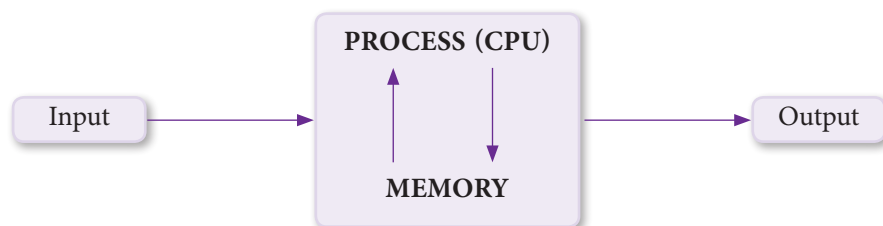
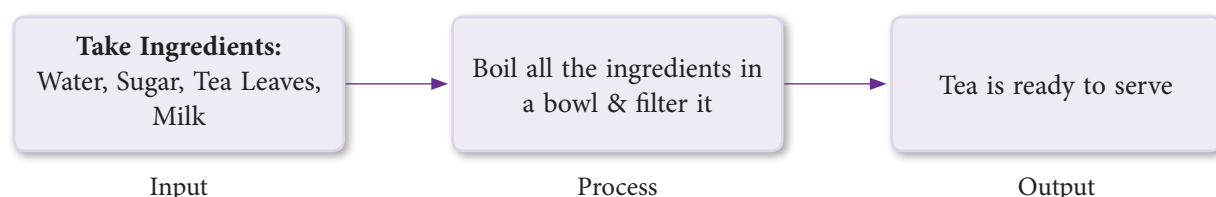


Diagram of a computer of IPO

e.g. To make a Cup of Tea:



8. COMPUTER PORTS AND CABLES

8.1 PS/2 Ports

The PS/2 Ports are simple, 6-pin, low-speed serial connections commonly used to connect a keyboard and mouse. If you select to use a USB keyboard and mouse, you can disable the PS/2 ports in the system's CMOS setup and free the PS/2 system resources for other devices.



8.2 VGA Monitor Port

Video Graphics Array is used to connect the monitor to the computer. VGA offers images at higher resolutions. The standard VGA can produce as many as 256 colors at a time from a palette of 262,144 colors. The original VGA, though, had to be at a 320x400 resolution to display this amount of color. At the standard 640x480 resolution, it was only capable of 16 colors at a time. It uses color summing to translate color graphics into graphics using 64 different shades of grey. This, in effect, simulates color on a monochrome monitor. VGA requires a VGA monitor, or one capable of accepting the analog output of a VGA card.



8.3 Parallel Port

Printers and other devices are said to be either parallel or serial. Parallel means the device is capable of receiving more than one bit at a time (that is, it receives several bits in parallel). Most modern printers are parallel.



8.4 Ethernet Port

There is a built in Ethernet port on most computers to connect it to a wired network. Ethernet ports are also found on all popular broadband routers.



8.5 S-Video Port

Short for Super-Video, a technology for transmitting video signals over a cable by dividing the video information into two separate signals: one for color (chrominance), and the other for brightness (luminance). When sent to a television, this produces sharper images than composite video, where the video information is transmitted as a single signal over one wire. This is because televisions are designed to display separate Luminance (Y) and Chrominance (C) signals. (The terms Y/C video and S-Video are the same.)



Computer monitors, on the other hand, are designed for RGB signals. Most digital video devices, such as digital cameras and game machines, produce video in RGB format. Therefore, the images look best when output is on a computer monitor. When output is on a television, however, they look better in S-Video format than in composite format.

To use S-Video, the device sending the signals must support S-Video output and the device receiving the signals must have an S-Video input jack. Then, you need a special S-Video cable to connect the two devices.

8.6 USB Port

Universal Serial Bus, a protocol for transferring data to and from digital devices. Many digital cameras and memory card readers connect to the USB port on a computer. USB card readers are typically faster than cameras or readers that connect to the serial port, but slower than those that connect via FireWire which is an external bus standard that supports data transfer rates of 12 Mbps. A single USB port can be used to connect up to 127 peripheral devices, such as mouse, modems, and keyboards. USB also supports Plug-and-Play installation and hot plugging.



8.7 FireWire IEEE 1394 Port

FireWire is a cabling technology for transferring data to and from digital devices at high speeds. Some professional digital cameras and memory card readers connect to the computer over FireWire. FireWire card readers are typically faster than



those that connect via USB. Also known as IEEE 1394, FireWire was invented by Apple Computer, but is now commonly used with Windows-based PCs as well.

8.8 Mini Audio Jack

Audio connectors are used to affix cables to other audio equipment, providing electronic signal transference and grounding protection. Connectors may be plugs, jacks, or combinations, and may have an integral switch. Plug type audio connectors are a plug, or male, connector includes pins that can be inserted into a socket. Jack type audio connectors are a jack, or female, connector consists of sockets that are aligned to mesh with a pin-type connector. Combination plug and jack connectors are also available.



Summary

1. Data is a collection of unprocessed facts, figures and symbols.
2. Information is a data that is organised, meaningful and useful. It helps in decision making processes.
3. Hardware refers to the components that can be seen or touched. It comprises of input devices, output devices, system units, storage devices and a communication devices.
4. Software is a set of instructions that tells the computer to perform the task.
5. Primary memory helps in the fast execution of the program and it compromises of RAM and ROM.
6. Secondary memory is also known as Auxiliary Memory. It helps to store the data permanently using available storage devices such as Hard Disk, DVD, USB, etc.
7. Operating system is a computer program that manages all other programs stored on the computer.
8. IPO refers to input-process-output cycle which is followed by the computer system to achieve the desired result.
9. Most keyboards attach to the PC via PS/2 connector or USB port.
10. Pointing device such as mouse is connected to the PC via a serial port, PS/2 mouse port or USB port.
11. The process of decoding data that has been encrypted into secret format is called decryption.