Module-1
Introduction to Computers

What is computer?

The term *computer* is derived from the Latin word *compute*, which means calculate.

"A computer is an advanced electronic computing device that takes raw data as **input** from the users, **processes** and generates desired result as an **output**. If necessary input and output can be stored in computer's secondary memory for future use."
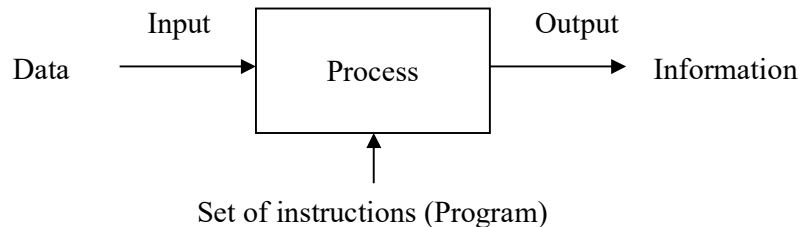

Figure 1. Input-process-output concept

Components of a computer system

A computer consists of various components as integrated system to perform different computational tasks. These components are mainly classified into following three functional units as follow.

1. Input Unit: Keyboard and mouse are the most commonly used input devices used by users to give an input to a system.

2. System / Processing Unit: The CPU (Central Processing Unit) is the brain of the computer that is responsible for controlling and executing program instructions.

3. Output Unit: Monitor is the most commonly used output device to display the result in visual form on the screen.

Features or Characteristics of a computer system

Some of the key characteristics of a modern digital computer as follow.

1) **Speed:** Computer is a fast electronic device. It can solve large and complex problems in fraction of seconds. The speed of a computer is measured in milliseconds(10^{-3} or 1/1000 or 0.001), microseconds(10^{-6} or 1/1000000 or 0.000001) , nanoseconds(10^{-9} or 1/1000000000 or 0.000000001) and picoseconds(10^{-12}). The speed of a computer depends upon its hardware configuration that is in terms of MIPS (Millions of instructions (clock pules) per second), BIPS (Billions of instructions (clock pulse) per second) and even more speed.

2) **High Storage Capacity:** A computer can store huge amount of data in many different formats. The computer's memory is generally classified into two types as main memory and secondary memory. The unit of computer memory is bytes. (Bytes, KB, MB, GB, TB, PB, etc.)

3) **Accuracy:** A computer carries all the calculations with great accuracy. The accuracy given by the computer depends upon the written program (set of instructions) and its hardware configuration.

4) **Reliability:** A computer produces consistent correct results with no errors. Most of the computer generated errors due to incorrect instructions given by the programmer. Therefore, computers are trustworthy machines.

5) **Versatility:** Computers are versatile machine. They can perform variety of tasks in many fields. These are used in all most all the fields like engineering, medical, scientific, commercial, entertainment and teaching aid, etc.

6) **Diligence:** Computers can perform repetitive calculations any number of times without any error with the same accuracy. That is, computers do not suffer from human traits such as tiredness, fatigue, lack of concentrations, etc.

7) **Programmability:** Programmers can write the programs by using high level programming languages like C to develop application and system software's.

Limitations or disadvantages of a computer system
1. GIGO (Garbage in Garbage Out): An incorrect input data would result in incorrect result.
2. Lack of common sense.
3. High investment for software as compare to hardware.

Applications or uses of a computer system
Some of the key application areas of computers are as follow.
1. Engineering - Computers are used by engineers to design and implement new designs by using different application software like Solid Edge, AutoCAD, ANSYS, PRO-E, CAD/CAM software etc.
2. Science and Research - Computers are actively used by scientists and researchers for the purpose of research and development. For example, weather monitoring and forecasting.
3. Medical - Computers are used by doctors to diagnose various diseases.
4. Education - Computers facilitates the students to get knowledge through different websites, undertake e-learning courses and to face on line examinations.
5. Business Environment - Computers are used to store large amount of information in database for further use, to conduct business meeting through web conferencing, and to buy and sell the goods though the use of online e-commerce websites.
6. Communication - Internet facility can be used to send and receive e-mail.
7. Entertainment
8. Agricultural
9. Banking - Computers are used for online banking facility.
10. Health etc.

Early History or Evolution of computers
In ancient times, people used different mechanical devices and methods for performing computing operations. Before the invention of any type of calculating device, people carried out the simple arithmetic calculations such as addition and subtraction on their fingers and toes. In ancient times, people also used stones for representing numbers and to carry out simple calculations such as Stonehenge.
1. Neolithic computer (Stonehenge)
2. Abacus
3. Pascaline
4. Difference and Analytical Engine
5. ENIAC & EDVAC

1. **Neolithic computer** (3500 years ago): A huge stone carved structure spread in a circular pattern over the huge ground and used to perform astronomical calculations by considering the positions of sun rays and called it as Stonehenge.
2. **Abacus** (2500 BC): Abacus was the first recorded computer introduced by Chinese in 2500 BC to perform arithmetical calculations like addition, subtractions, multiplication and division. In this device, the wooden frame consists of many wires with beads sliding on them. The user of abacus can perform arithmetic operations by sliding beads on the wires by hand. The abacus is also called as a counting frame. It is used by Greeks, Romans and Japanese.
3. **Pascaline** (1642) : Pascaline was a calculator developed by Blaise Pascal in 1642 to help his father. He was the son of tax collector, who was doing lot of additions and subtractions. The Pascaline was also known as a numerical wheel calculator. The wheels of the machine moved only clock wise and were designed to perform additions and subtractions.

4. **Difference and Analytical Engine** (1822 & 1832):

In 1822, a professor of mathematics at the Cambridge University, Charles Babbage invented Differential Engine. This was a hand operated machine built with wheels, levers and mechanical linkages. It was used to calculate various mathematical functions. It was so designed that once the initial values were set, it would produce the next few thousand values without mistakes. So, it called Differential Engine.

In 1833, Charles Babbage developed Analytical Engine. This machine consisted of five functional units such as input unit, memory unit, arithmetic unit, control unit and output unit. The architecture of modern digital computer resembles the analytical. The real beginning of a computer as we know today started with the efforts of mathematics professor Charles Babbage, because of his contribution in the filed of computers, he is called as today's *father of computer*. These are the mechanical computers.

5. **ENIAC , EDVAC and UNIVAC-I (1946, 1950,1951)**

ENIAC (Electronic Numerical Integrator and Calculator): It was the first electronic computer and developed by American Scientists John Presper and John W Mauchly in 1946 by using semiconductors. It was having the capability to perform 5000 additions, subtractions or 350 multiplications and divisions in a second. It had a short memory and various components had to be manually operated in different ways to perform different computations. Its size was 80 feet long with nearly 30 ton of weight. This machine could be reset to perform other types of calculations by changing switch settings and plugs and socket connections. It is used by American Govt. to calculate the trajectories (path) of bombs and shells. The biggest problem with this computer was that all the instructions were hardwired within the computer. Thus making modifications in instructions was a very difficult task. This problem was solved by EDVAC.

EDVAC (Electronic Discrete Variable Automatic Computer) : It was introduced by John Von Neumann in 1950 with a new concept of storage information in a large internal memory i.e to overcome the disadvantage of ENIAC. It was capable read data and instructions from external resources through the punched cards. Thus, problem of ENIVAC was solved by it.

UNIVAC (Universal Automatic Computer-I) was developed in 1951. It was developed for both scientific and commercial applications. It also had a compiler to translate programs to machine code.

John Von Neumann Architecture:
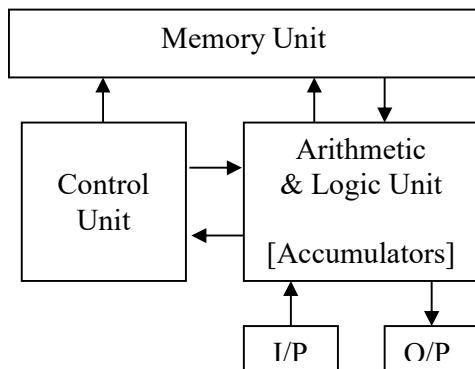
The John Von Neumann architecture is a design model for a stored-program digital computer that uses a central processing unit (CPU) and a single storage structure called **memory** to hold both instructions and data with a new concept of storage information in a large internal memory i.e. to overcome the disadvantage of ENIAC. It is named after the mathematician and early computer scientist John von Neumann.
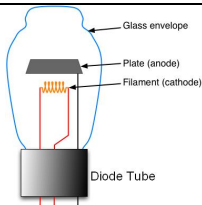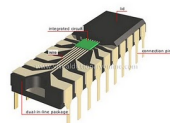
Memory Unit: It is used to store both data and instructions.

Control Unit: The control unit was used to control all other units of a computer system. It sends control and timing signals to other units to do specific task. It helps to fetch data and instructions from memory to send signals to ALU to perform specific task.

ALU (Arithmetic and Logic Unit): It performs arithmetical and logical calculations on data as per the given instructions by the programmer.

**Generations of Computer:** There are five generations of computers as follow.

Generations	First Generation	Second Generation	Third Generation	Fourth Generation	Fifth Generation
Year	1940- 56	1957- 63	1964- 75	1976 –1989	1990 – till date
Technology	**Vacuum Tubes** * Vacuum tube was a fragile glass device that could control and amplify electronic signals. * The circuits were constructed using vacuum tubes. * The magnetic drums were used for storing memory.	**Transistors** * Transistors are solid state semiconductor devices. * Used magnetic disks as primary memory. *Small size & minimal weight, allowing the development of miniaturized electronic devices. 1 Transistor=40 Vaccum Tubes	**ICs (Integrated Circuit)** * An integrated circuit (IC), sometimes called a chip or microchip, It is a semiconductor wafer on which thousands or millions of tiny resistors, capacitors, and transistors are fabricated. * 1 IC= 10 to 100 transistors * I.C's s were developed by Jack Kilby in 1958	**LSI** * Large Scale Integrated Semiconductor Circuit * 1 LSI= 100 to 1000 transistors. * It has large primary and secondary memory in comparison to third generation.	VLSI & ULSI (Very Large Scale Integrated Circuit & Ultra Large Scale Integrated Circuit) 1 VLSI= millions of transistors
Speed	Milliseconds 10^{-3}	Microseconds 10^{-6}	Nanoseconds 10^{-9}	Picoseconds 10^{-12}	10^{-15}
Memory	10K to 20K	Upto 64K	Upto 4000K	Upto 32000K	Billions of characters
Programming Language	Machine Language	Assembly Language	High Level Language	4th GLs like C, C++ & Java	5th GLs
Examples	ENIAC & UNIVAC	IBM 1401, IBM 1820	IBM system 1360 Honeywell-6000	HP, Dell, HCL & All modern PCs	Robots & Natural languages.
Disadvantages	-Extremely large in size. -Generation of lot of heat -Air conditioning was needed	Required air conditioning	Complex technology to manufacture CPU and other components	Complex technology	Complex technology

Basic parts and structure of a computer

A computer system comprises of various hardware and software components. The set of instructions give to a machine to perform particular task is called software. The physical devices connected to a computer system are called hardware components. Software is the component that makes the hardware components to perform operations. i.e. software directs and controls the working of hardware.

Basic Structure of a computer:

The major four functions of a computer system are **reading**, **processing**, **displaying** and **storing** the input and result. These functions a computer system can be carried out by using the three units namely input unit, system unit and output unit as shown below.
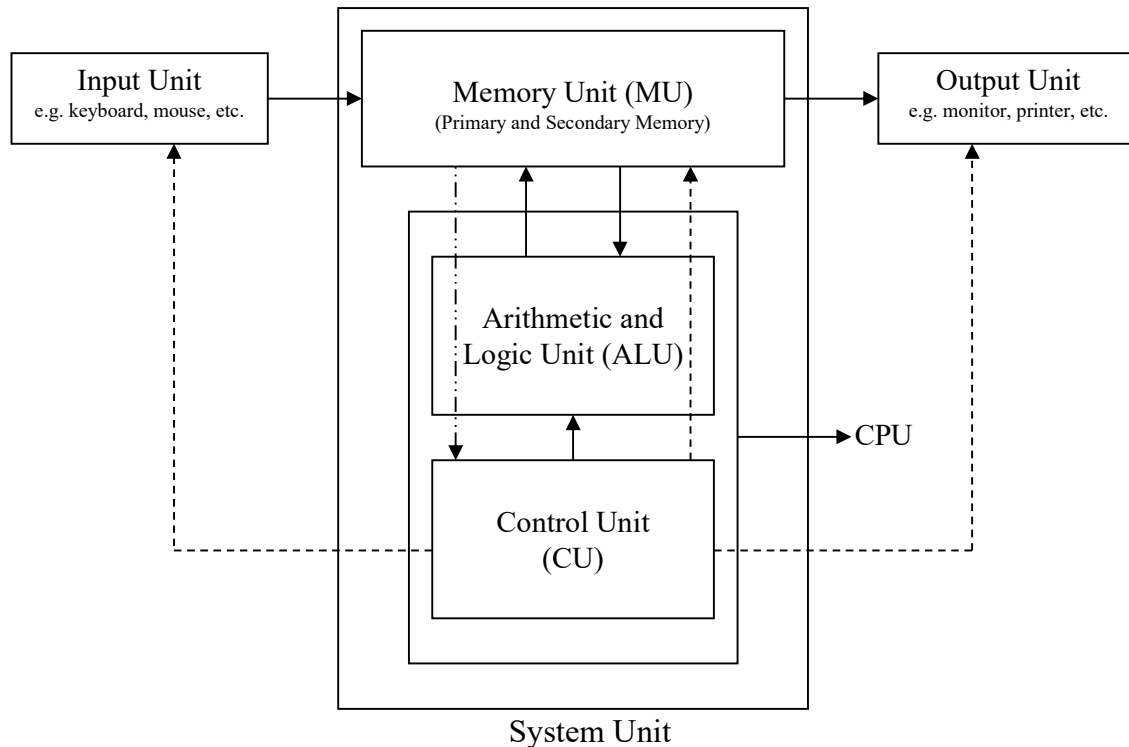
Data and results flow ———————

Control instructions to other units from control unit - - - - - - - - - - -

Instructions from memory unit to control unit — ·· — ·· — ·· — ·· —

1) Input unit:

The input unit helps to enter (feed) data and information into a computer. The devices like keyboard, mouse and scanner are commonly used as input devices. A keyboard is used to enter alphanumeric characters and symbols. The mouse is used to pick or select a command from the monitor screen. A scanner is used to scan an image or to read a barcode and so on.

2) System or Central Processing Unit:

The processing unit comprises a processor, which interprets the program instructions in memory, controls the flow of data and performs arithmetic and logical operations. The program instructions are processed one at a time along with the necessary data. The results are sent to memory and the next instruction is processed. This method is repeated until the program is executed.

The CPU consists of sub units to perform different operations namely ALU, CU and MU.

a) Arithmetic and Logic Unit:

The arithmetic-logic unit (ALU) is the unit of the computer that performs arithmetic and logical operations on the data. This section of the machine can be relatively small consisting of circuits and registers which perform arithmetic (+, -, *, /) and logic (>,<,<=,>=,etc) operations. Arithmetic-logic units which can add and subtract and perform logical operations form the backbone for the arithmetic and control operations in computers. To perform scientific calculations the floating-point number system is used.

b) Control unit:

The control unit controls the overall activities of the components of the computer. It is mainly used to coordinate the activities among other units. It will send commands signals and controls the sequence of instructions to be executed. The control unit may be defined as "the parts that effect the retrieval of instructions in proper sequence and application of the proper signals to the arithmetic unit and the other parts".

The function of the control circuitry in a general purpose computer is to interpret the instruction words and then sequence the necessary signals to those sections of the computer that will cause it to perform the instructions.

Functions of control unit

1. Accessing data and instructions from memory unit
2. Interpretation of instructions
3. Controlling input and output units
4. Overall supervision of a computer system

c) Memory Unit: The memory unit is the unit where all the input data and results are stored. The computer's memory can classified into following two types.

- Primary memory : RAM and ROM
  Random Access Memory (RAM) is a semiconductor chip. It is also called as volatile memory because stored information will be lost as soon as power is switched off.
  Read Only Memory (ROM) contains instructions for the microcomputers as a read only.
- Secondary memory: Hard Disk Drives (HDDs), Floppy Disks, Compact Disks (CDs), etc.
  The unit of computer's memory is bytes or bits. A bit is a binary digit, which represents one's (1) and zero's (0)

8 bits	= 1 byte
1024 bytes	= 1 Kilobyte (KB)
1024 Kilobytes	= 1 Megabyte (MB)
1024 Megabytes	= 1 Gigabyte (GB)
1024 Gigabytes	= 1 Terabyte (TB)
1024 Terabytes	= 1 Petabyte (PB)

Difference between Primary and Seconday Memory

Sl.No	Primary Memory	Secondary Memory
1	This memory is also called internal or main memory	This memory is also called external memory
2	Reading data will be much faster	Reading data will be much slower
3	Temporary storage	Permanent Storage
4	Expensive	Less Expensive
5	Storage devices are semiconductors	Storage devices are magnetic disk or optical disk
6	Examples: ROM (Read Only Memory) RAM (Random Access Memory)	Examples: HDD (Hard Disk Drive) CD (Compact Disk), Floppy Disk, etc.

Difference between ROM and RAM

Sl.No	ROM	RAM
1	Read Only Memory	Random Access Memory
2	The stored data can be read only.	The data can be read and rewritten
3	Permanent memory or non-volatile memory	Temporary memory or volatile memory
4	Used by machine	Used by programmer and machine both
5	Data is available after the power cut off	No data is available after the power cut off

3) Output Unit:

The output device is used to display or print result from a computer. Monitor, printer and plotter are commonly used output devices. A monitor is used to display the result in the form of text and graphics. The printer is used to print the result. A plotter is used to plot or print graphical result from a computer. Note that a result displayed in a monitor is temporary and it disappears when the next result is displayed, whereas the output printed using a printer or a plotter is permanent and these printouts can be used for any business correspondence or documentation. Normally soft copy is referred to information that is stored on the storage device. A hard copy refers to a print out showing the information. Monitors and printers are the god examples for output devices.

Input Devices

Input devices are electromagnetic devices that are used to provide data to a computer for storing and further processing. The basic task of an input device is to take the input from the user, translate it into the machine readable form and then transmits to processing unit for processing.

Input devices

1. Keyboard
2. Pointing devices
   - Mouse
   - Trackball (Socket contains a ball, which can be rolled manual to move cursor on the screen. It is used as a game controller)
   - Light Pen
   - Joystick
   - Touch screen

3. Scanning devices
   - Image Scanners
   - OCR devices
   - OMR devices
   - MICR devices and
   - Bar code reader
4. Digital camera
5. Media input devices (Microphone, Webcam, Graphics Tablet)

Output Devices

1) Display monitors
2) Printers
3) Plotters: Plotter is a device used to print high quality graphics and images. It uses one or more pens to produce a high quality drawing. These will use four basic colors namely cyan, magenta, yellow and black.
4) Voice output systems
5) Projectors

1. Keyboard - Keyboard is the most commonly used input device. A standard keyboard includes alphanumeric keys, functions, modifier keys, cursor movement keys, space bar, escape key, numeric keypad and some special keys, such as page Up, Page Down, Home, Insert, Delete and End. The alphanumeric keys include the number keys and the alphabet keys. The function keys fromF1 to F12 helps to perform a specific task such as searching a file or refreshing a web page. The modifier keys such as Shift and Control keys modify the casing style of a character or symbol. The cursor movement keys include Up, Down, Left and Right keys. They are used to modify the direction of the cursor on the screen. The spacebar key shifts the cursor to the right by one position. The numeric keypad uses separate keypads for numbers and mathematical operators. The keyboard that is used in common is called 'QWERTY' keyboard.

2. Pointing Devices

These are generally used for moving the cursor to a particular location to point and select an object on the screen. These are helpful to select icons, menu options and windows on the GUI (Graphical User Interface).

Some of the commonly used pointing devices are as follow.

1. Mouse
2. Trackball (Socket contains a ball, which can be rolled manual to move cursor on the screen. It is used as a game controller)
3. Light Pen
4. Joystick
5. Touch screen

1. Mouse:

This is a small hand held pointing device connected to CPU through a cable. It helps to select elements on the screen such as tools, icons and command buttons by pointing and clicking them. It has two buttons and one scroll button at the top. The mouse can be categorized into following two types depending on the technology used to design it.

Mechanical mouse – The distance and the speed of the ball inside the mouse determine how far the mouse cursor moves on the screen.

Optical Mouse – It uses a light emitting diode (LED) or photodiode to detect the underlying surface to move the mouse cursor on the screen.

2. Trackball:

Trackball is another pointing device. While operating the trackball, you don't move the whole device. You move the ball with your finger or palm. As the ball moves, pointer on the screen also moves. They occupy less space for their operation as compare to mouse. It is used as a game controller.

3. Light Pen

Light pen looks like an ordinary pen. It helps to write on the screen. The special handwriting recognition software is developed to read the text written by light pen. The light pen also used to select items from the screen. Light pen is also called as stylus. It is useful to fill the application forms by selecting the options displayed on the screen.

4. Joystick

The joy stick is used as a game controller. It helps to control playable character or object. It provides input to a computer game.

5. Touch screen

Touch screens are special screens, which are touch sensitive. When you touch a part of the screen, they are able to generate information that the screen has been touched and on particular locations. It helps to capture the information generated on touch screen and to act accordingly. Many ATM machines make use of touch screens.

SCANNING DEVICES

These are the optical input devices used to capture the text and images and convert them into computer readable form (digital form). They are as below.

1. Image Scanners
2. OCR devices
3. OMR devices
4. MICR devices and
5. Bar code reader

Image Scanners:

Scanner is an input device that can electronically capture the text or images such as photographs, drawings, artwork etc. It will scan the input in graphical form to convert into digital form (0's and 1's) so that scanned image can be stored in computer memory.

OCR devices (Optical Character Recognition):

The OCR technology helps to read and convert the printed document and text image into equivalent ASCII character that cab understood by the computer. It will distinguish the dark area from light area. If a document is scanned through OCR then it can be converted into document file as a .doc or .txt file.

OMR devices (Optical Mark Recognition):

The OMR will convert the human marked data from various paper documents such as tests, exams and various surveys using an optical device. These are used to obtain data from the marked fields. These are popularly used to scan documents having multiple choices in the question papers.

MICR devices (Magnetic Ink Character Recognition):

These are used to recognize the characters written by using magnetic ink consisting of iron oxide particles. These are developed for the banking operation. i.e. to check details on bank cheques, identify numeric characters and store the data on disk. Use of MICR is quite popular in banks

Bar code reader:

A bar code reader is a handheld input device. It is used to read bar coded data to capture the information of a product. A bar code consists of a series of parallel adjacent vertical bars with various thicknesses. A bar code reader scans a bar code present on a product to convert into ASCII values understood by a computer.

Microphone

It is an input device used to read audio from the user. It converts audio into digital data. To use microphone, PC should have a sound card i.e. hardware unit which translates analog audio signals obtained from microphone into a digital form. The microphone is usually used with speakers for the following.

- to make calls using PCs
- in the audio/video conferencing over the internet.
- We can record our voice by using audio recording software.

OUTPUT DEVICES

The devices which are used to display or print results are called output devices. The main task of an output device is to convert machine readable information into human readable form which may be text, graphics, audio or video, etc.

Categories of output devices:

6) Display monitors
7) Printers
8) Plotters: Plotter is a device used to print high quality graphics and images. It uses one or more pens to produce a high quality drawing. These will use four basic colors namely cyan, magenta, yellow and black.
9) Voice output systems
10) Projectors

Display Monitors or Visual Display Units (VDUs)

Minitor is the most commonly used output device. It helps to display results generated by computer on screen.

Types of monitors:

1. Cathode Ray Tube Monitor
2. Liquid Crystal Display Monitor

1. Cathode Ray Tube (CRT)

The CRT monitor is a TV like display attached to the computer on which the output is displayed. The major components of the CRT monitor are as follow.

Electron gun: An electron gun situated at the back of the monitor generates a beam of electrons. In colour monitor, 3 electron guns are used to emit very high temperature electron beams and help to produce three different RGB colours Red, Green and Blue.
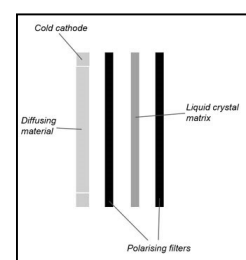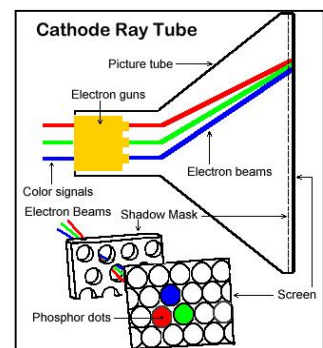
Advantages:

1. They provide bright and clear pictures.

Disadvantage: Occupies more desktop space, more weight & they require more power.

2. LCD Monitors

LCD technology is modern technology. It was continuously used in laptop display systems. It makes the use of liquid crystal substance. The characteristic of liquid crystal substance is that light passes through them and they appear transparent. But, when electric charge is applied to them, then crystals get polarized and they become opaque. The liquid crystal matrix is used between the two polarizing filters which are perpendicular to each other.

Advantages
1. Occupies less space.
2. Less weight
3. Easily moveable
4. Require less power and run on battery power

PRINTERS
The printer is another nost commonly used output device, which is used to get hard copy of the text displayed on the screen.
Types of Printers:
1) Impact Printers   : e.g. **Dot Matrix Printers**
2) Non-Impact Printers   : e.g. Inkjet Printers and Laser Printers

Difference between Impact and Non-impact printers

	Impact Printers	Non-Impact Printers
1	Impact printers are those printers in which a physical contact is established between the print head, ribbon (cartridge) and paper.	No physical contact
2	Output is generated with moving physical component such as revolving print chains or wheels	There is no physical moving component
3	Less expensive	These are expensive
4	The quality of output is less	The quality of output is high
5	Generates much noise while printing	Generates less noise while printing
6	It can print multiple copies at a time (carbon copies)	It can print single copy at a time
7	Example: Dot matrix printer	Examples: Laser printer & Inkjet printer

Difference between dot matrix, inkjet and laser printers.

	Dot Matrix Printer	Inkjet Printer	Laser Printer
1	Impact Printer	Non-impact Printer	Non-impact printer
2	It uses metal pins in its head to create text and graphics in the form of dots.	Its print head does not have metal pins, instead it has several tiny nozzles that spray ink onto the paper. Each nozzle is thinner than hair.	The laser printer uses a beam of laser for printing.
3	The process of printing involves striking a pin against a ribbon to produce its output.	The ink cartridges are attached to the printer head that moves horizontally from left to right.	The printer uses a cylindrical drum, a toner and the laser beam.
4	Printing speed is slower than laser printer,	Printing speed is slower than laser dot matrix.	Printing speed is higher than both.
5	Character by character printing	Line by line printing	It is a page printer
6	Low quality printing	High quality printing	High quality printing
7	Less expensive	High expensive	High expensive
8	Generates much noise while printing	Generates less noise while printing	No noise
9	Speed is measured in DPI (Dots Per Inch)	Speed is measured in CPI (Characters Per Inch)	Speed is measured in PPM (Pages Per Minute)
10	Monochrome (Black & White) Printers	Color printer	Monochrome and color printer

DATA PROJECTORS

The data project is a special device used to display the output obtained from the computers on the large screen or a wall. They are portable and can be taken to any place. These are classified into following two types namely LCD and DLP projectors based on technology used.

LCD Projectors	DLP Projectors
Uses Liquid Crystal Display technology	Uses Digital Light Processing technology
It uses its own light source to display output on screen	It uses mirrors to reflect the light
Used in darkened place	Used in both darkened and brightened place
Blur images are produced in normal lighting conditions.	Clear image are produced in normal lighting conditions.

TYPES OF COMPUTERS OR CATEGORIZING COMPUTERS

Computers can be classified on the basis of the following two concepts.

- On the basis of principle of working
- On the basisi of size and storage capacity

Types of Computers

On the basis of Principle of Working	On the basis of Size and Capacity	
	Computers for Individuals	**Computers for Multiusers (Organisations)**
1) Analog computers	1) Desktop Computers	1) Super Computers
	2) Workstations	
2) Digital Computers	3) Notebook Computers	2) Mainframe Computers
	4) Tablet PCs	
3) Hybrid Computers	5) Handheld PCs	3) Mini Computers
	6) Smart Phones	

i) On the basis of principle of working :

Analog Computers	Digital Computers	Hybrid Computers
1) Process the data in analog form by means of electrical signals	1) Process the data in digital form by means of electrical signals	1) Process the digital data by using analog signals
2) Analog signals have two parameters i.e amplitude and frequency	2) Digital signals use two binary digits (bits) 1 & 0 [ON/OFF]	2) Uses both the processing techniques
3) Process the input data which is in continuous form like pressure and temperature.	3) Process the input data like letters and numbers	3) Process both the type of data
4) Process the data by measuring	4) Process the data by counting	4) Process the data by both the techniques
5) less accurate	5) highly accurate	5) highly accurate
6) limited storage capacity	6) high storage capacity	6) mediums storage capacity
7) requires less memory	7) requires high memory	7) requires less memory
8) Used in engineering and scientific applications.	8) Now a day used in every field	8) Used in hospitals to measure heart beats of a patient

On the basis of size and capacity

i) Computers for individuals:

| Types	Definition	Use	Advantages	Disadvantages	Examples
1) Desktop computers	Independent personal computer	Used in home and office	less cost, easy maintenance	Occupy more space	Dell, HP, HCL, etc,
2) Workstations	A workstation is also a personal computer. But, it has more powerful microprocessor	Used by professional for specific work i.e to run CAD/CAM softwares, 3D graphics and animations, etc.	powerful machine, high resolution graphics	Costly, Not portable	Manufactured by Sun Microsystems like Hewlett Packard & IBM
3) Notebook Computers [laptops]	A small moveable personal computer weighing from 1 to 3 kg	Used in temporary space within airlines, trains and in meetings etc.	less space, portable, less power consumption	Costlier than desktop, More expensive to repair	Dell laptop, SONY laptop, HP laptop etc.
4) Tablet Computers	A tablet PC is a personal computer and looks like a standard slate. User can write on the screen by using digital pen called stylus	It has the features of laptop	Light weight, Portable	Costlier, Deligate	
5) Handheld PCs	These are mobile computing device and small enough to hold in your hand	Used to manage appointments, contact numbers, addresses etc.	Acts as PDA (Personal Digital Assistant)	Limited memory	
6) Smart Phones [cellular phones]	A smart phone is an electronic hand held device.	It can be connected to internet Used to listen music	Less cost, Portable	Less memory, delicate	

ii. Computers for multiusers (organizations):

Super Computers	Mainframe Computers	Mini Computers
1) These are most **powerful**, very **expensive** & **fastest** computers.	1) These are **less powerful** as compare to **super** computers	1) **Medium size** computers as compare to both.
2) Speed is measured in **Nanosecond**. i.e. GIGAFLOP (1 Billion Floating Point Arithmetic Operations Per Second)	2) Speed is measured in **MEGAFOPS** (Millions of Floating Point Arithmetic Operations Per Second)	2) Less speed as compared to both.
3) Used in **defense**, **aircraft** design, **weather report**, **chemical** & **petrol** industry.	3) Used in **airline booking**, railway reservation and network banking.	3) Used in **small private business environments**.
4) More number of terminals can be connected to it. i.e. up to 10,000 terminals	4) More number of terminals can be connected to it. i.e. up to 1000 terminals	4) Middle range as compare to both
5) Examples for super computers are **CRAY3**, Cyber 205, NEC SX-3, & **PARAM** from India.	5) Examples for mainframe computers are IBM 3000, VAX 8000 and CDC 6600	5) Examples for mini computers are PDP 11, VAX 7500 etc.

Computer Network

Introduction to Computer Network:

We need a computer network to overcome the limitations of a stand alone computer (autonomous computer) like sharing the data and peripheral devices. As we know, in today's information technology, communication and sharing of resources is very much essential. The good example is Internet (global computer network) through which we can share the information and other resources too.
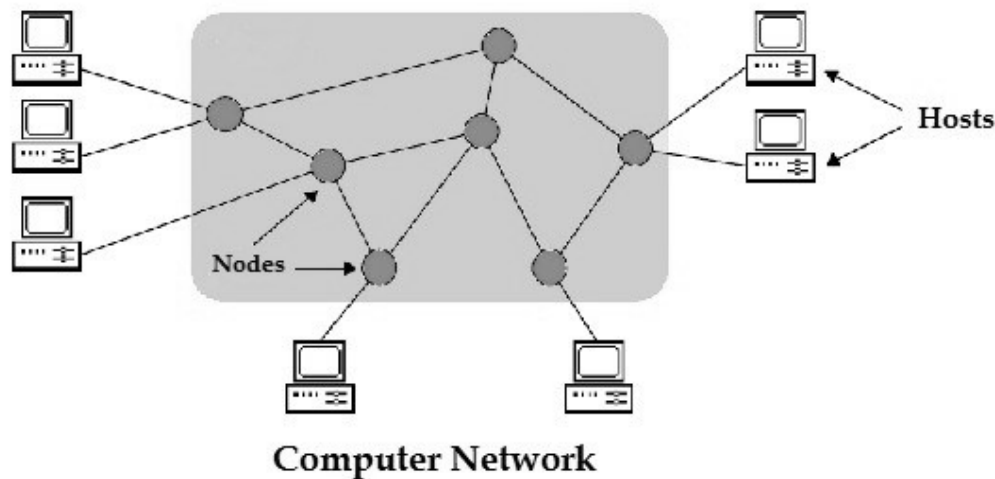
Computer Network

What is computer network?

Definition:

"An interconnection of autonomous (independent) computers to one another to share the available resources"

or

"An arrangement in which two or more computers are connected to each other to share the data and other resources"

Computers in a network can be connected by using telephone lines, cables, satellite links, etc. Wireless network will use radio signals to exchange the information.

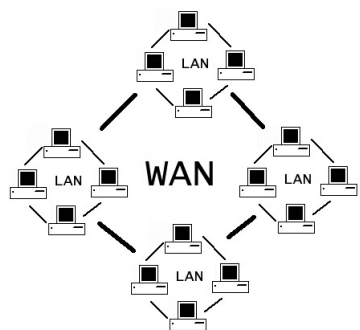**Advantages of Networking [Uses or Need]:**
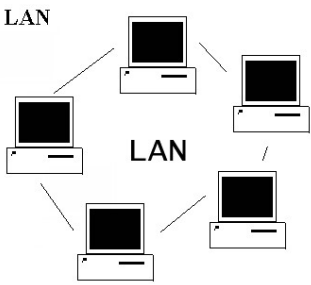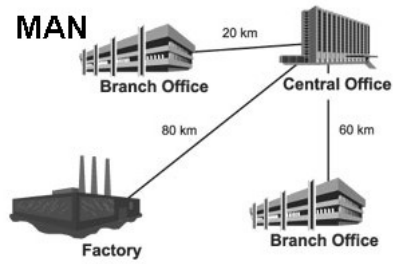
1. **Sharing of data:** It provides the facility to exchange the frequently required data between the two or more computers. i.e. interaction between the different departments in an organization.
2. **Sharing of resources:** Sharing of resources like printer, fax and scanner by all the terminals connected within a network.
3. **Personal communication:** Communicate the other people by using e.mail facity, audior or video conferencing.
4. **Easier data backup:** Storing the data within a server by the terminals connected to it.
5. **Load sharing of employees:** Work load of the employees can be distributed on different terminals.
6. **E-Commerce:** People can sell or purchase the good from anywhere in the world through the internet facility.
7. E-Learning, E-Business, E-Education, E-Intelligence, etc.

Types of Networks

The computer networks are mainly classified into following 3 types.
1. LAN   [Local Area Network]
2. MAN   [Metropolitan Area Network]
3. WAN   [Wide Area Network]

| LAN	MAN	WAN
Local Area Network	Metropolitan Area Network	Wide Area Network
A group of computers that are connected in a small area such as building, home, office etc i.e. within a small campus	A network which covers large area like a city	A network which covers a large area like a state, country or across a continent.
Distance covered by this network is less than 1 KM	Distance covered by this network is 5 to 50 KM.	Distance covered by this network is 100 to 1000 KM
Used within a single building like home or office	Used by private organization like cable television in our city.	Used all over the world. i.e good example is internet
Computers are connected through the twisted pair cables and co axial cables.	A network device called router is used to connect the LANs together	It uses fiber optics, cables and even satellite signals as a transmission media.
Transmitting data is cheaper	Transmitting data is costlier	Transmitting data is more costlier
Transmission data is generally error free	Transmission data is generally error prone	Transmission data is generally error free

Network Topologies: [important]
       A network topology is defined as the layout or structure of computers, cables and other devices that are connected to each other in a network. It consists of nodes and links. A node is the end point of each computer. A link is a communication path between two nodes.

Types of Network Topologies: These are mainly classified into following 4 types.
1. Bus Topology
2. Ring Topology
3. Star Topology
4. Mesh Topology

1. Bus Topology:
       In this network structure, a single cable runs in a building or campus. All the nodes (terminals / computers) are connected to this single cable. It is suitable for Local Area Network.

Note: Only for class room circulation, Prepared by Mr. C. S. Kusur CSE
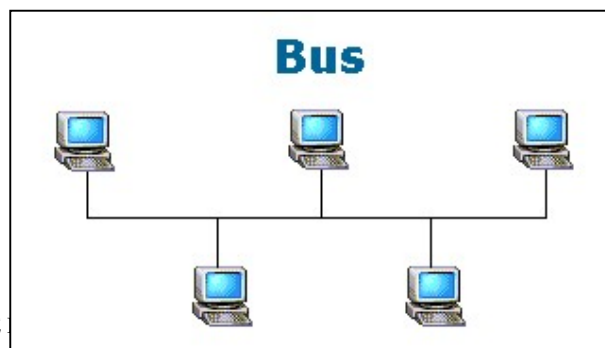
Advantages:
1. Failure of one node will not affect the whole network.
2. Well suited for quick setup
3. Easy to install and expand
4. High rate of data transmission as compare to star and ring topology

Disadvantages:
1. A cable break can disable the entire network
2. Trouble shouting is very difficult
3. Only a single message can travel at a time

2. Ring Topology:

In this network structure, all the computers are connected to each other in the form of a ring. i.e. first node is connected to second, second to third and so on. Finally last node is connected to first one.

Advantages:
1. All the nodes have equal chance to transfer the data
2. These are easily extensible
3. It can span longer distance than other type of networks

Disadvantages:
1. Difficult to install
2. Expensive
3. Difficult to troubleshoot
4. Adding or removing computer can disturb the the entire network
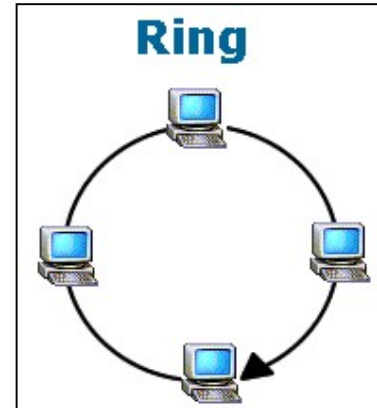
3. Star Topology:

In this network structure, all the computers are connected to with a central system called server. The central computer is also called a hub. To transmit information from one node to another node, it should be transmitted through a central hub. The central hub manages and controls all the functions of network.

Advantages:
1. Easy to install and expand.
2. Addition or deletion of a node is easier.
3. Failure of one node will not affect the entire network.
4. Well suited for quick setup
5. Easier to debug network problems through a hub

Disadvantages:
1. Failure of a central system i.e. hub will affect the whole network
2. Cost of hub is expensive
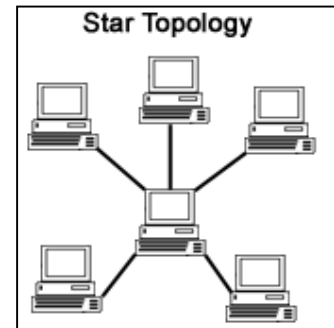
4. Mesh Topology

In this network structure, all the computers and network devices are interconnected with one another like a mesh. Every node has a connection to every other node in the network. This topology is not commonly used for most computer networks because of its installation difficulty and expensive.

Advantages:
1. Failure of a single node will not affect the entire network
2. Data transfer rate is very fast because all the nodes are connected to each other.

Disadvantages:
1. Installation and re configuration is very difficult
2. Costlier
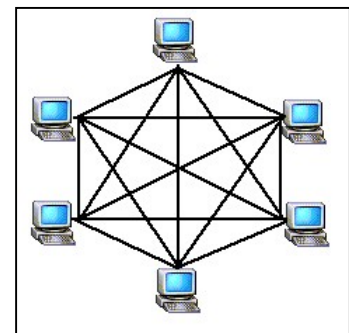
Network Components or Network Hardware

The network devices are mainly classified into following two types.

1. NIC (Network Interface Cards)
2. Network Linking Devices (imp)
   a. Hubs
   b. Bridges
   c. Switches
   d. Routers
   e. Gateways

1. **Network Interface Cards (NICs)** : This is the important hardware component, which connects the machine to the computer network. This will be fixed into one of the free slot on the mother board. It has one port for the connection of a network cable.

2. **Network Linking Devices**: These are the external devices , that are used to link various devices in the network. They are as follow.

a) **Hub:** It is a small box to which other various devices are connected so that they can communicate with each other. The main functions are gathering the signals from other networks and amplification of signals.
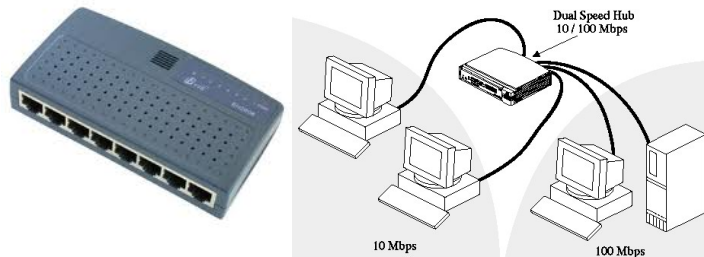

b) **Bridges:** A bridge is a device that connects two or more LANs. It will regenerate the signal and then forward the data from one LAN to another LAN.
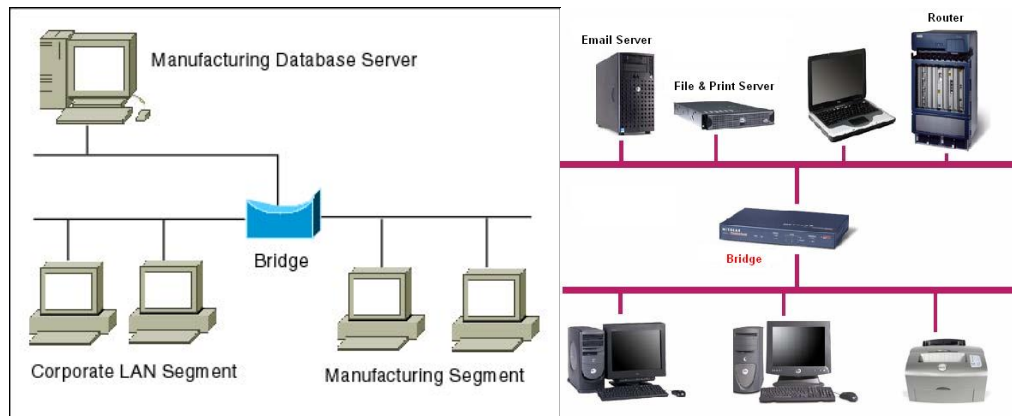

c) **Switches:** A switch is similar to a hub, where all the devices are connected at one point so that they can communicate. But, a switch is more intelligent than a hub.

Functions:
   i) Inspect the incoming signals
   ii) Determines the address of both the source and destination data
   iii) Based on the destination address, it will forward the data.
   iv) It is the responsibility of a switch to send data to appropriate device.
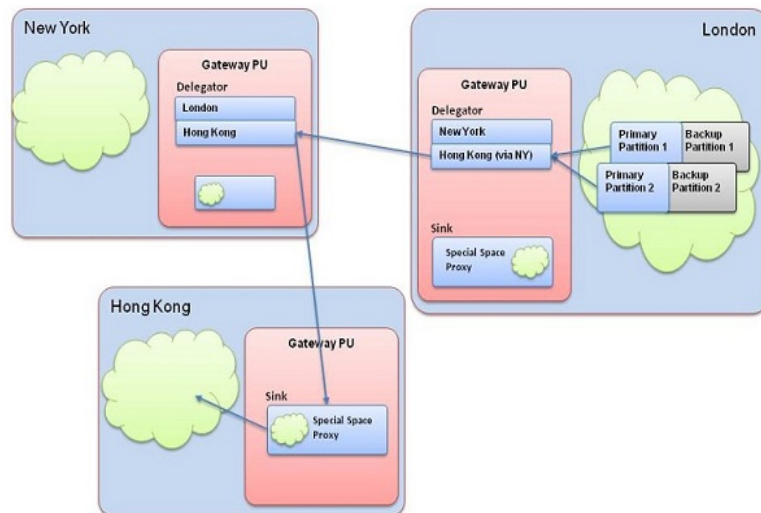
A basic Local Area Network

Teach-ICT.com
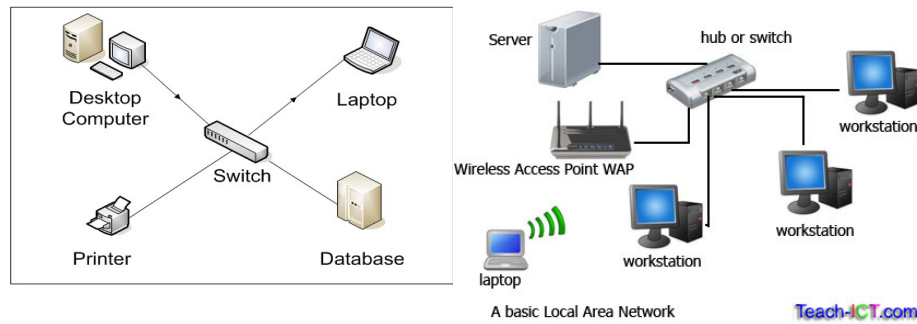
d) **Routers:** A router is a complicated device that will store the routing information for the networks. Its responsibility is to select best path for fast data transmission. If the network traffic changes, then the router will re direct the data into less longest routers. Router are expensive and difficult to maintain.
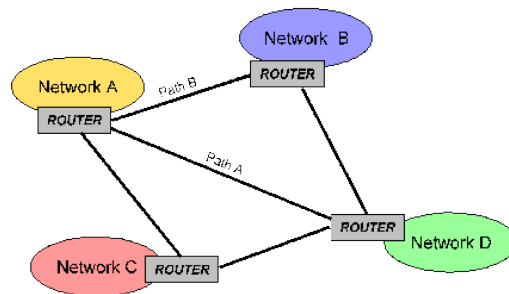
e) **Gateway:** To create a communication between types of networks, we need a gateway device. The protocols of one network will be converted into protocols of another network. Hence, gateways are also called protocol converters.

Functions:

i) Convert the data into format of another network

ii) Converting protocols of network into protocol of another network

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YouTube Channel: https://www.youtube.com/channel/UChfntyymbl_LduCpRAbqmmQ

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