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Computer Fundamentals

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COMPUTER FUNDAMENTALS

What is a computer?

Definition: - a computer is an electronic device which accepts input, processes it according to a set of instruction provided and generates the desire outputs.

It is like a super calculator which can perform many more complex function. It can perform operations on numbers, text, graphics etc.

A computer system is a combination of different elements which is as follows:

- a) Hardware: hardware is the term which refers to all physical devices that the computer is made of (electronic circuits, cables etc.)
- b) Software: software is the term used to describe the instructions that tell the hardware how to perform a task.
- c) Data: data are individual facts like first name, price, and quantity order.
- d) Information: data which has been massaged into a useful form, like a complete mailing address

History of Computers

The history of computer can traced back thousands of years, to a device still used in many villages and sometimes, to teach children to count. It was Abacus, which was probably developed between 5000 BC and 2000 BC in Asia. It was used extensively in china and japan, and consist of beads strung on wires or thin rods to aid counting. Expert abacus users can perform stupendous calculations with the abacus, which explains why it remained virtually unchanged for thousands of year. In historical terms, it is probably the most robust and most scalable version of the computer.

In 1614, John Napier developed a system of multiplication and division using addition and subtraction. These were the famous Log Table, a tabular representation of numbers that could be used to perform calculations like multiplication and division on large numbers quickly. Using the system of log tables, Napier devised a simple calculation tool called Napier's Bones in 1617, which consisted of specially marked rods that, when placed side by side in specific combination, could give the quotients of large numbers.

Using these system of logarithms or log tables, + developed the Slide Rule in the 1620's. The Slide Rule consisted of two movable rulers that could be adjusted to perform calculations. The Side Rule made a handy pocket calculator that was used into the 1960's until the development of small electronic calculators.

In the seventeenth century, two significant developments took place on the computing scene. In 1647, Blaise Pascal developed a machine calculator to help his father, a tax collector. The calculator used gears and cogs that could be rotated to perform simple addition. In 1694, Gottfried Leibnitz developed a better calculator that could perform multiplication and division as well. These mechanical devices, while very useful, required precision engineering and therefore could not be produced on a mass scale at those times.

In 1821, Charles Babbage developed the Difference Engine and in 1832, the Analytical engine. These were significant development in computing and the analytical engine is considered a milestone signifying the start of the computer age. To input data into the machine, Babbage used a system of punch cards initially developed by Joseph Jacquard as a means of automating weaving.

The same input system was used by Herman Hollerith in his own tabulating machine, developed in 1883. He entered the machine into a competition to determine the best way to analyze data in the 1819 US census and won top spot in the competition. He began to develop the machine for commercial use. Putting his company through a series of mergers with other companies. The company created by Herman Hollerith ultimately became International Business Machines, better known as IBM.

Generation in computer terminology is a change in technology a computer is/was being used. Initially, the generation term was used to distinguish between varying hardware technologies. Nowadays, generation includes both hardware and software, which together make up an entire computer system.

There are five computer generations known till date. Each generation has been discussed in detail along with their time period and characteristics. In the following table, approximate dates against each generation has been mentioned, which are normally accepted.

Following are the main five generations of computers: -

| S.No | Generation & Description |
|------|---|
| 1 | <p>First Generation: Vacuum Tubes (1940-1956)</p> <p>The first computers used vacuum tubes for circuitry and magnetic drums for memory, and were often enormous, taking up entire rooms. The UNIVAC and ENIAC computers are examples of first-generation computing devices. The UNIVAC was the first commercial computer delivered to a business client, the U.S. Census Bureau in 1951.</p> |
| 2 | <p>Second Generation: Transistors (1956-1963)</p> <p>The world would see transistors replace vacuum tubes in the second generation of computers. The transistor was invented at Bell Labs in 1947 but did not see widespread use in computers until the late 1950s. Second-generation computers moved from cryptic binary machine language to symbolic, or assembly, languages, which allowed programmers to specify instructions in words. High-level programming languages were also being developed at this time, such as early versions of COBOL and FORTRAN. The first computers of this generation were developed for the atomic energy industry.</p> |
| 3 | <p>Third Generation: Integrated Circuits (1964-1971)</p> <p>The development of the integrated circuit was the hallmark of the third generation of computers. Transistors were miniaturized and placed on silicon chips, called semiconductors, which drastically increased the speed and efficiency of computers. Instead of punched cards and printouts, users interacted with third generation computers through keyboards and monitors and interfaced with an operating system, which allowed the device to run many different applications at one time with a central</p> |
| | <p>program that monitored the memory.</p> |

| | |
|---|---|
| 4 | <p>Fourth Generation: Microprocessors (1971-1980)</p> <p>The microprocessor brought the fourth generation of computers, as thousands of integrated circuits were built onto a single silicon chip. What in the first generation filled an entire room could now fit in the palm of the hand. The Intel 4004 chip, developed in 1971. In 1981 IBM introduced its first computer for the home user, and in 1984 Apple introduced the Macintosh. As these small computers became more powerful, they could be linked together to form networks, which eventually led to the development of the Internet. Fourth generation computers also saw the development of GUIs, the mouse and handheld devices.</p> |
| 5 | <p>Fifth Generation: Artificial Intelligence (1981-Present and Beyond)</p> <p>Fifth generation computing devices, based on artificial intelligence, are still in development, though there are some applications, such as voice recognition, that are being used today. The use of parallel processing and superconductors is helping to make artificial intelligence a reality. Quantum computation and molecular and nanotechnology will radically change the face of computers in years to come. The goal of fifth-generation computing is to develop devices that respond to natural language input and are capable of learning and selforganization.</p> |

Computers can be broadly classified by their speed and computing power.

| Sr. | Type | Specifications |
|-----|------------------------|---|
| 1 | PC (Personal Computer) | It is a single user computer system having moderately powerful microprocessor |
| 2 | Workstation | It is also a single user computer system, similar to personal computer however it has a more powerful microprocessor. |
| 3 | Mini Computer | It is a multi-user computer system, capable of supporting hundreds of users simultaneously. |
| 4 | Main Frame | It is a multi-user computer system, capable of supporting hundreds of users simultaneously. Software technology is different from minicomputer. |
| 5 | Supercomputer | It is an extremely fast computer, which can execute hundreds of millions of instructions per second. |

PC (Personal Computer)



A PC can be defined as a small, relatively inexpensive computer designed for an individual user. PCs are based on the microprocessor technology that enables manufacturers to put an entire CPU on one chip. Businesses use personal computers for word processing, accounting, desktop publishing, and for running spreadsheet and database management applications. At home, the most popular use for personal computers is playing games and surfing the Internet.

Although personal computers are designed as single-user systems, these systems are normally linked together to form a network. In terms of power, now-a-days high-end models of the Macintosh and PC offer the same computing power and graphics capability as low-end workstations by Sun Microsystems, Hewlett-Packard, and Dell.

Workstation



Workstation is a computer used for engineering applications (CAD/CAM), desktop publishing, software development, and other such types of applications which require a moderate amount of computing power and relatively high quality graphics capabilities.

Workstations generally come with a large, high-resolution graphics screen, large amount of RAM, inbuilt network support, and a graphical user interface. Most workstations also have mass storage device such as a disk drive, but a special type of workstation, called diskless workstation, comes without a disk drive.

Common operating systems for workstations are UNIX and Windows NT. Like PC, workstations are also single-user computers like PC but are typically linked together to form a local-area network, although they can also be used as stand-alone systems.

Minicomputer

It is a midsize multi-processing system capable of supporting up to 250 users simultaneously.



Mainframe

Mainframe is very large in size and is an expensive computer capable of supporting hundreds or even thousands of users simultaneously. Mainframe executes many programs concurrently and supports many simultaneous execution of programs.



Supercomputer

Supercomputers are one of the fastest computers currently available. Supercomputers are very expensive and are employed for specialized applications that require immense amount of mathematical calculations (number crunching).

For example, weather forecasting, scientific simulations, (animated) graphics, fluid dynamic calculations, nuclear energy research, electronic design, and analysis of geological data (e.g. in petrochemical prospecting).



All types of computers follow the same basic logical structure and perform the following five basic operations for converting raw input data into information useful to their users.

| S.No. | Operation | Description |
|-------|----------------------|--|
| 1 | Take Input | The process of entering data and instructions into the computer system. |
| 2 | Store Data | Saving data and instructions so that they are available for processing as and when required. |
| 3 | Processing Data | Performing arithmetic, and logical operations on data in order to convert them into useful information. |
| 4 | Output Information | The process of producing useful information or results for the user, such as a printed report or visual display. |
| 5 | Control the workflow | Directs the manner and sequence in which all of the above operations are performed. |

1.1 Features of Computer System

Computers are unique when compared to other machines due to their multitasking capabilities. The characteristics or advantages of computers are as follows:

High Speed

- Computer is a very fast device.
- It is capable of performing calculation of very large amount of data.
- The computer has units of speed in microsecond, nanosecond, and even the picosecond.
- It can perform millions of calculations in a few seconds as compared to man who will spend many months to perform the same task.

Accuracy

- In addition to being very fast, computers are very accurate.
- The calculations are 100% error free.
- Computers perform all jobs with 100% accuracy provided that the input is correct.

Storage Capability

- Memory is a very important characteristic of computers.
- A computer has much more storage capacity than human beings.
- It can store large amount of data.
- It can store any type of data such as images, videos, text, audio, etc.

Diligence

- Unlike human beings, a computer is free from monotony, tiredness, and lack of concentration.
- It can work continuously without any error and boredom.
- It can perform repeated tasks with the same speed and accuracy.

Versatility

- A computer is a very versatile machine.
- A computer is very flexible in performing the jobs to be done.
- This machine can be used to solve the problems related to various fields.
- At one instance, it may be solving a complex scientific problem and the very next moment it may be playing a card game.

Reliability

- A computer is a reliable machine.
- Modern electronic components have long lives.
- Computers are designed to make maintenance easy.

Automation

- Computer is an automatic machine.
- Automation is the ability to perform a given task automatically. Once the computer receives a program i.e., the program is stored in the computer memory, then the program and instruction can control the program execution without human interaction.

Reduction in Paper Work and Cost

- The use of computers for data processing in an organization leads to reduction in paper work and results in speeding up the process.
- As data in electronic files can be retrieved as and when required, the problem of maintenance of large number of paper files gets reduced.
- Though the initial investment for installing a computer is high, it substantially reduces the cost of each of its transaction.

Programmability

- A computer is programmable.
- List of instructions informing the computer what is must to do. □ Programs can be written as per the specific needs

Cost-effectiveness

- Computers help in reduction of manual work and hence, lower labor costs.
- The cost involved is a one-time investment of buying a system while the running cost are negligible.

Disadvantages of Computers

Following are certain disadvantages of computers: - No

I.Q.

- A computer is a machine that has no intelligence to perform any task.
- Each instruction has to be given to the computer.
- A computer cannot take any decision on its own.

Dependency

- It functions as per the user's instruction, thus it is fully dependent on humans.

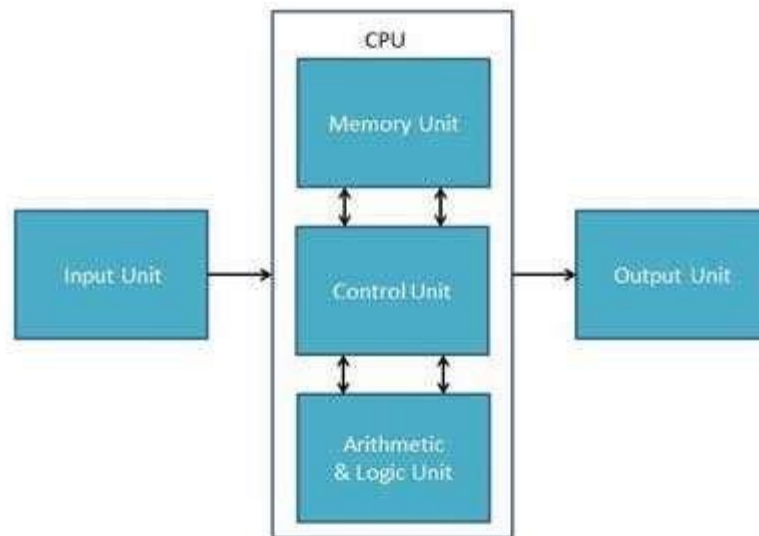
Environment

- The operating environment of the computer should be dust free and suitable.

No Feeling

- Computers have no feelings or emotions.
- It cannot make judgment based on feeling, taste, experience, and knowledge unlike humans.

1.2 Block Diagram



Input cycle: in this phase, data is prepared in a convenient form and on a medium most suitable for data entry into a processing machine. We input the data through various input devices. The input devices translate the information into a form understandable by the computer.

Processing Cycle: in this phase, the primary memory of the computer system can manipulate or combine the input data as per instructions. Processing is done automatically in accordance with a series of instructions called a program, which is stored in the primary memory in the computer system.

Output Cycle: once the data is processed, the results need to be produced in the most suitable form for the user. A user can view the result of the processed data with the help of the output device desired.

Central Processing Unit

CPU itself has following three components: -

- Memory or Storage Unit
- Control Unit
- ALU(Arithmetic Logic Unit)

Memory or Storage Unit

This unit can store instructions, data, and intermediate results. This unit supplies information to other units of the computer when needed. It is also known as internal storage unit or the main memory or the primary storage or Random Access Memory (RAM).

Its size affects speed, power, and capability. Primary memory and secondary memory are two types of memories in the computer. Functions of the memory unit are – □ It stores all the data and the instructions required for processing.

- It stores intermediate results of processing.

- It stores the final results of processing before these results are released to an output device.
- All inputs and outputs are transmitted through the main memory.

Control Unit

This unit controls the operations of all parts of the computer but does not carry out any actual data processing operations. Functions of this unit are –

- It is responsible for controlling the transfer of data and instructions among other units of a computer.
- It manages and coordinates all the units of the computer.
- It obtains the instructions from the memory, interprets them, and directs the operation of the computer.
- It communicates with Input/Output devices for transfer of data or results from storage.
- It does not process or store data.

ALU (Arithmetic Logic Unit)

This unit consists of two subsections namely,

- ☐ Arithmetic Section
- ☐ Logic Section

1.3 Hardware Input and Output Devices

An input unit is an electromechanical device that accepts data from the user and translates it into a computer or machine-understandable language.

Keyboard: the most commonly used keyboard layout is QWERTY (so named because the letters on the keyboards are arranged in that sequence),

Which allows data entry into computer system by pressing the set of keys.



Keyboards are of two sizes 84 keys or 101/102 keys, but now keyboards with 104 keys or 108 keys are also available for Windows and Internet.

The keys on the keyboard are as follows –

| Sr. | Keys & Description |
|-----|--|
| 1 | Typing Keys These keys include the letter keys (A-Z) and digit keys (0-9) which generally give the same layout as that of typewriters. |
| 2 | Numeric Keypad It is used to enter the numeric data or cursor movement. Generally, it consists of a set of 17 keys that are laid out in the same configuration used by most adding machines and calculators. |
| 3 | Function Keys The twelve function keys are present on the keyboard which are arranged in a row at the top of the keyboard. Each function key has a unique meaning and is used for some specific purpose. |
| 4 | Control keys These keys provide cursor and screen control. It includes four directional arrow keys. Control keys also include Home, End, Insert, Delete, Page Up, Page Down, Control(Ctrl), Alternate(Alt), Escape(Esc). |
| 5 | Special Purpose Keys Keyboard also contains some special purpose keys such as Enter, Shift, Caps Lock, Num Lock, Space bar, Tab, and Print Screen. |

Point-and-draw-device: the mouse, the electronic pen, joystick, and touch screen are examples of point-and-draw- devices.

Mouse: it is a small hand- held point-and-draw device and the most popular. The movements of the mouse are reproduced by the graphic cursor on the screen.

Generally, it has two buttons called the left and the right button and a wheel is present between the buttons. A mouse can be used to control the position of the cursor on the screen, but it cannot be used to enter text into the computer.



Joystick: in most joystick, a button is provided on the top to select the option pointed to by the cursor. The button is clicked to make a selection. Joysticks are mainly used in video games, flight simulations, training simulators, industrial cranes and remote controls.



Electronic pen: a user can use an electronic pen to point at a make a selection from displayed menu or set of icons. It can also be used for drawing graphics by directly on the screen.



Touch screen: a touch screen is the simplest user friendly input device that helps the users choose from available options or icons displayed on the computer screen by using a finger. It is often used as an information kiosk at various public places for people to access stored information. For e.g. at airports and railway station, kiosks provide information to passengers on lodging, distance to reach the place for lodging, tourist spots, and ticket booking, besides automatic check in of hotel guest and ordering of food using electronic menu cards.



Data scanning devices: data scanning devices are used for directly entering data from source documents into computer system. They are of many types the most commonly used ones are:

Image scanner: an image scanner converts paper document (typed text, pictures, graphics or hand written material) into an electronic form that can be stored in a computer. Image scanner are available in different shapes and sizes. This includes flatbed scanners and hand-held-scanners. A flatbed scanners is just like a copier machine and consist of a box with a glass plate on the top and a lid that covers the glass plate. Hand-held-scanner has a set of light emitting diodes within a small case that can be held conveniently in hand. They are usually used when the volume of documents to be scanned is low.



Optical character recognition device: it is an optical scanner that is capable of detecting alphanumeric characters typed or printed in paper using an optical character recognition (OCR) font. OCR devices are used for voluminous works such as printing computerized bills, reading ZIP codes or pin codes in postal services and reading passenger tickets.



Optical barcode reader: an optical barcode reader (OBR) can scan a set of vertical bars of different widths representing specific data. It is used for reading tags in merchandise goods stores, medical stores, book stores and libraries.



Optical mark reader: an optical reader (OMR) is a special scanner use to recognize a type of mark made by a pen or pencil, and is specially used for checking answer sheets in examinations having multiple choice question.



Magnetic ink character recognition device: a magnetic ink character recognition (MICR) device is generally used by the banking industry to directly read account numbers on cheques.



Digitizer: A digitizer is used for converting (digitizing) graphics, maps, pictures, and drawings into digital data form, which can be stored in random access memory (RAM), and then displayed on the monitor. It can store data as x and y coordinates of a picture or drawing. It is used in computer-aided designed (CAD) and geographical information systems (GIS).



Electronic card-based device: Electronic cards are small plastic cards having encoded data appropriate for a particular application. These are often issued by banks to customers to be used in automatic teller machines (ATM).



Speech recognition device: speech recognition devices are input devices that allow an individual to input data into a computer system by speaking to it.



Vision-based device: a vision based device allows a computer to accept input by viewing an object. In this case, the input data is an objects shape and features in the form of an image. An example of a vision based device is a computer with a digital camera.



An output device is an electromechanical device that accepts the data from the computer and translates it into a form that is fit to be used by users. Output devices produce output that are of two types:

a) Soft copy output

A soft copy output cannot be retrieved if not saved. Content displayed on a monitor, words spoken by a voice response system, word document, excel sheets, and PPTs are example of soft copy output.

b) Hard copy output

A hard copy output is permanent as it is reproduced on paper or a tangible material that can be easily stored. It can thus be moved around. The output produced on paper by printer or plotter is output of hard copy output.

Monitor - It is the most popular output device for soft copy output. The output is displayed on a television-like screen. A monitor and a keyboard are usually linked with each other to form a video display terminal (VDT). The two different type of monitor are cathode ray tube (CRT) and liquid crystal display (LCD) flat-panel. CRT monitors operate like television screens and are usually used in non-portable computer systems. LCD flat-panel monitors are thinner, lighter, and are used in desktops and portable computer systems.



Printer- This is a popular device for producing a hard copy output from a computer system. Based on their working principals, printers are classified as impact and non-impact printers. Impact printer have the mechanical contact with the printer head and paper, while non-impact printers print by spraying very small droplets of ink on paper with the help of nozzle. The classifications of printers are as follows:

Dot-matrix printer- a dot matrix printer is the character printer that forms characters and images as patterns of dots. It is an impact printer as it prints by hammering pins on an inked ribbon to leave an impression on the [paper. It is considerably noisy and has slow printing speed (about 30-600 characters per second).



Inkjet printer- Inkjet printer are character printer that forms characters and images by spraying drops of ink on the paper. They are non-impact printers as they print by spraying ink on the paper. They are less noisy than impact printers.



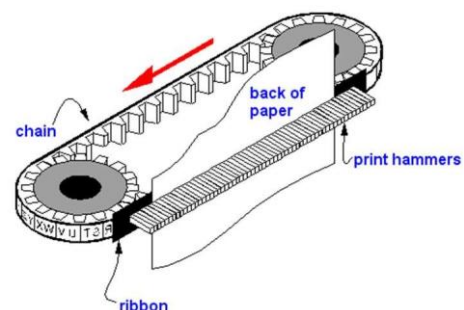
Line Printers

Line printers are the printers which print one line at a time. (Drum & Chain)



Drum printer- A drum printer consist of a cylindrical drum with characters embossed on its surface in form of circular bands. It is an impact printer as it prints by hammering on a paper and an inked ribbon against the characters embossed on the drum. It is noisy and the printing speed is 300-200 line per minute.

Chain/band printer- a line printer prints one line at a time. The chain/band printers have a set of hammers embossed in front of the chain/band in such a way that an inked ribbon and paper can be placed between the chain/band. It consist of metallic chain/band based on which all the characters of the character set supported by the printer are embossed.





Laser printer- It is a page printer which produces a high quality prints by forming characters and images with very tiny ink particles. It is non-impact printer that is quite in operation. Its printing speed and print quality are better than other printers however, laser printer are more expensive than the aforementioned types of printers.

Plotter- plotters are output devices specially used by professional's, architects, engineers, city planners, and those who need to generate high precision, hard copy graphic output widely varying in size. Plotters are particularly suited when the output consist of complex graphics such as charts, maps, and even 3D figures.



Screen image projector- It is output device used to project information from a computer into a large screen so that it can be viewed by a group of people. It provides a temporary, soft copy output similar to a monitor.



Voice response system- In the section on input devices, we talked about a speech recognition system allows a user to talk to computer. On the other hand the voice response system enables the computer to talk to a user. A voice response system has an audio response device that produces audio output. The audio output is temporary and a soft copy output. They are of two types:

- Voice reproduction system
- Speech synthesizer



1.4 Memory of Computer (CPU, RAM ROM)

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. The memory is divided into large number of small parts called cells. Each location or cell has a unique address, which varies from zero to memory size minus one. For example, if the computer has 64k words, then this memory unit has $64 * 1024 = 65536$ memory locations. The address of these locations varies from 0 to 65535. Memory is primarily of three types –

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

Cache Memory

Cache memory is a very high speed semiconductor memory which can speed up the CPU. It acts as a buffer between the CPU and the main memory. 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.



Primary Memory (Main Memory)

Primary memory holds only those data and instructions on which the computer is currently working. It has a limited capacity and data is lost when power is switched off. It is generally made up of semiconductor device. These memories are not as fast as registers. The data and instruction required to be processed resides in the main memory.

The primary storage memory is of two types: random access memory (RAM) and real only memory (ROM).

Random Access Memory (RAM): the primary memory is built with volatile RAM chips. Volatile, here, means that it loses its contents as and when the power is switched off. It is also the main memory of the computer system, which stores the data temporarily, and can be accessed in any sequence.



Real Only Memory (ROM): this type of memory is permanently stored in the pc circuit and is non-volatile (i.e. it retains data even after the computer system has been switched off.). All machine-level instructions

are stored in the ROM and it is provided by the manufacturer. Data can be read from this memory but cannot be changed. In addition, the data has to be accessed sequentially, unlike RAM.

Characteristics of Main Memory

- These are semiconductor memories.
- It is known as the main memory.
- Usually volatile memory.
- Data is lost in case power is switched off.
- It is the working memory of the computer.
- Faster than secondary memories.
- A computer cannot run without the primary memory.

Secondary Memory - secondary storage devices have programs, instruction, data, and information pertaining to task that the computer system is current storage device- secondary storage devices have programs, instruction, data, and information pertaining to task that the computer system is currently not working on but may require for processing later. Hard disks and DVD/CD-ROMs are the most commonly used secondary storage devices currently. Magnetic disk- it is a type of storage device that has layer of magnetic substance coated on a rigid or flexible surface. The drive is usually equipped with a read-write assembly that can transfer data, represent in the form of 0s and 1s, and convert it into a magnetic signal which can be later stored on a medium.



Optical disk- It is the most popular secondary storage device that can store a larger amount of data within a restricted space. In this type of storage, signals are stored in form of light. Binary digit 0 and 1 are converted into light information and stored in read-write head assembly of the driver.

Other memory storage devices- we will now discuss other popular memory storage devices. Flash drive (pen drive): a flash drive is a compact device the size if pen (from which the name has derived) that comes in various shapes and stylish designs. Now a day's pen drives are smarter than pens. A pen drive is the most common way of transferring data from one computer to another. It is a plug-and-play device that can simply be plugged into a universal serial bus (USB) port of a computer.

Memory Card



Secure Digital card (SD)



MiniSD



Compact Flash



Memory Stick



MultiMedia card



XD-Picture card



Memory card reader

Motherboard

The motherboard serves as a single platform to connect all of the parts of a computer together. It connects the CPU, memory, hard drives, optical drives, video card, sound card, and other ports and expansion cards directly or via cables. It can be considered as the backbone of a computer.



Features of Motherboard

A motherboard comes with following features –

- Motherboard varies greatly in supporting various types of components.
- Motherboard supports a single type of CPU and few types of memories.
- Video cards, hard disks, sound cards have to be compatible with the motherboard to function properly.
- Motherboards, cases, and power supplies must be compatible to work properly together.

Popular Manufacturers

Following are the popular manufacturers of the motherboard.

- Intel
- ASUS
- AOpen
- ABIT
- Biostar
- Gigabyte
- MSI

Description of Motherboard

The motherboard is mounted inside the case and is securely attached via small screws through pre-drilled holes. Motherboard contains ports to connect all of the internal components. It provides a single socket for CPU, whereas for memory, normally one or more slots are available. Motherboards provide ports to attach the floppy drive, hard drive, and optical drives via ribbon cables. Motherboard carries fans and a special port designed for power supply. There is a peripheral card slot in front of the motherboard using which video cards, sound cards, and other expansion cards can be connected to the motherboard.

On the left side, motherboards carry a number of ports to connect the monitor, printer, mouse, keyboard, speaker, and network cables. Motherboards also provide USB ports, which allow compatible devices to be connected in plug-in/plug-out fashion. For example, pen drive, digital cameras, etc.

Memory unit is the amount of data that can be stored in the storage unit. This storage capacity is expressed in terms of Bytes.

The following table explains the main memory storage units –

| S.No. | Unit & Description |
|-------|---|
| 1 | Bit (Binary Digit) A binary digit is logical 0 and 1 representing a passive or an active state of a component in an electric circuit. |
| 2 | Nibble A group of 4 bits is called nibble. |
| 3 | Byte A group of 8 bits is called byte. A byte is the smallest unit, which can represent a data item or a character. |
| 4 | Word A computer word, like a byte, is a group of fixed number of bits processed as a unit, which varies from computer to computer but is fixed for each computer. The length of a computer word is called word-size or word length. It may be as small as 8 bits or may be as long as 96 bits. A computer stores the information in the form of computer words. |

The following table lists some higher storage units –

| Sr. | Unit & Description | |
|-----|--------------------|-------------------|
| 1 | Kilobyte (KB) | 1 KB = 1024 Bytes |
| 2 | Megabyte (MB) | 1 MB = 1024 KB |
| 3 | Gigabyte (GB) | 1 GB = 1024 MB |
| 4 | Terabyte (TB) | 1 TB = 1024 GB |
| 5 | Petabyte (PB) | 1 PB = 1024 TB |
| 6 | Exabyte (EB) | 1 EB = 1024 PB |
| 7 | Zettabyte (ZB) | 1 ZB = 1024 EB |
| 8 | Yottabyte (YB) | 1 YB = 1024 ZB |

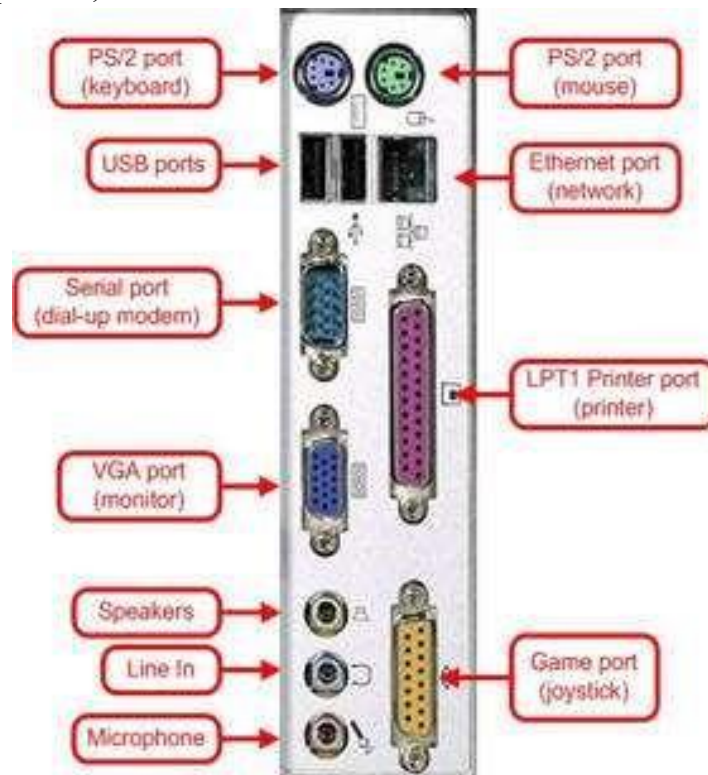
Port

A port is a physical docking point using which an external device can be connected to the computer. It can also be programmatic docking point through which information flows from a program to the computer or over the Internet.

Characteristics of Ports

A port has the following characteristics –

- External devices are connected to a computer using cables and ports.
- Ports are slots on the motherboard into which a cable of external device is plugged in.
- Examples of external devices attached via ports are the mouse, keyboard, monitor, microphone, speakers, etc.



Let us now discuss a few important types of ports –

Serial Port

- Used for external modems and older computer mouse
- Two versions: 9 pin, 25 pin model
- Data travels at 115 kilobits per second

Parallel Port

- Used for scanners and printers
- Also called printer port
- 25 pin model
- IEEE 1284-compliant Centronics port

PS/2 Port

- Used for old computer keyboard and mouse
- Also called mouse port
- Most of the old computers provide two PS/2 port, each for the mouse and keyboard
- IEEE 1284-compliant Centronics port

Universal Serial Bus (or USB) Port

- It can connect all kinds of external USB devices such as external hard disk, printer, scanner, mouse, keyboard, etc.
- It was introduced in 1997.
- Most of the computers provide two USB ports as minimum.
- Data travels at 12 megabits per seconds.
- USB compliant devices can get power from a USB port.

VGA Port

- Connects monitor to a computer's video card.
- It has 15 holes.
- Similar to the serial port connector. However, serial port connector has pins, VGA port has holes.
- Three-pronged plug.
- Connects to the computer's power cable that plugs into a power bar or wall socket.

Fire wire Port

- Transfers large amount of data at very fast speed.
- Connects camcorders and video equipment to the computer.
- Data travels at 400 to 800 megabits per seconds.
- Invented by Apple.
- It has three variants: 4-Pin FireWire 400 connector, 6-Pin FireWire 400 connector, and 9Pin FireWire 800 connector.

Modem Port

- Connects a PC's modem to the telephone network.

Ethernet Port

- Connects to a network and high speed Internet.
- Connects the network cable to a computer.
- This port resides on an Ethernet Card.
- Data travels at 10 megabits to 1000 megabits per seconds depending upon the network bandwidth.
- Game Port
- Connect a joystick to a PC
- Now replaced by USB

Digital Video Interface, DVI port

- Connects Flat panel LCD monitor to the computer's high-end video graphic cards.
- Very popular among video card manufacturers.

Sockets

- Sockets connect the microphone and speakers to the sound card of the computer.

1.5 Software – System Software, Application Software

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

The system software is a collection of programs designed to operate, control, and extend the processing capabilities of the computer itself. System software is generally prepared by the computer manufacturers. These software products comprise of programs written in low-level languages, which interact with the hardware at a very basic level. System software serves as the interface between the hardware and the end users.

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



Here is a list of some of the most prominent features of a system software –

- Close to the system
- Fast in speed
- Difficult to design
- Difficult to understand
- Less interactive
- Smaller in size
- Difficult to manipulate

- Generally written in low-level language

Application Software

Application software products are designed to satisfy a particular need of a particular environment. All software applications prepared in the computer lab can come under the category of Application software.

Application software is a software that instructs the computer to perform a special set of tasks. There are application software to meet the needs of users. To make a computer operational, application software has to be installed along with the operating system.

Examples of application software: the most frequently used application software is of two types:

- General-purpose application software (data based management packages, word processors, spreadsheets, etc.)
- Special- purpose application software (accounting, inventory, production management, property management system, etc.)

User-written Software: an organisation may develop customized software, depending on its needs.

Readymade software: Different kinds of software that can be used for accounting or management of hotels are available in the market.

Examples of Application software are the following –

- Payroll Software
- Student Record Software
- Inventory Management Software
- Income Tax Software
- Railways Reservation Software
- Microsoft Office Suite Software
- Microsoft Word
- Microsoft Excel
- Microsoft PowerPoint

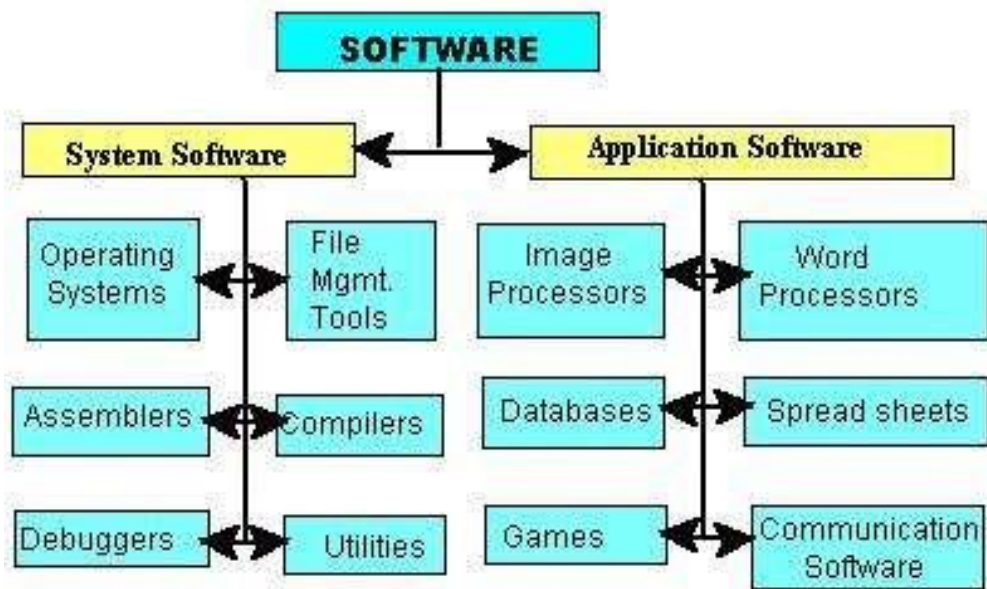


Features of application software are as follows –

- Close to the user □ Easy to design
- More interactive
- Slow in speed
- Generally written in high-level language
- Easy to understand
- Easy to manipulate and use
- Bigger in size and requires large storage space

Difference between System software and Application software:

Good system software allow application packages to be run on computer with very little effort. If there is no system software application packages cannot be run. The making of software system is a complex task that requires extensive knowledge and specialized training in computer science. System software consists of programs that are designed to control different operations of a computer. It controls the activities of the computer hardware and interacts with the application software to perform a particular task.



1.6 Networks – LAN, MAN, WAN, Topologies

Classification of networks

Networks can be broadly classified into two types: local area network (LAN) and wide area network (WAN). WANs are also side to be long-haul networks.

Local Area Network (LAN)

A LAN refers to a group of computers in a localized area. It consists of two or more computers directly link within a small, well-defined area such as a hotel, room, office building or campus.

Characteristics of LAN: -

- **Geographical Distribution:** A LAN is restricted to a limited geographical coverage of a few kilometers.
- **Data Transmission rate:** Data transmission rates are higher in LAN when compared to other network transmissions. The data transmission rates in ALANs usually range from 10 megabits per second (Mbps) to 1 gigabit per second (GBPS).
- **Error rate:** LANs usually have only a few errors during data transmission over a communication or network connection.
- **Communication link:** the most common communication links used in LANs are twisted pairs, coaxial cables, and a fiber optics because the nodes are physically distributed over a small geographical area.
- **Ownership:** A LAN is usually owned by a single organization because of its limited geographical coverage.
- **Communication cost:** the cost of transmitting data in a LAN is negligible since the transmission medium is owned by the user's organization.

Wide Area Network (WAN)

A Wide Area Network (WAN) consists of two or more geographically dispersed computers, linked by communication facilities such as telecommunication or microwave links. A WAN is a computer network covering a relatively large geographical area such as large organization and government agencies. We will now discuss the characteristics of WANs:

Geographical distribution: A WAN may extend over several thousand kilometers and may operate nationwide or even worldwide.

Data transmission rate: Data transmission rates usually range from 1200 bits per second to 2MBPS. With advancement in technology, data transmission rates are being increased continuously.

Error Rate: the error rate in WAN is high when compared to LANs.

Communication links: typical communication links used in WANs are telephone lines, microwave links and satellite channels since the nodes are physically distributed over a large geographical area.

Ownership: A WAN is usually formed by interconnecting multiple LANs that may belong to a different area.

Communication cost: with a WAN the cost involved is very high as the transmission medium used are leased lines or public communication systems such as telephone lines, microwave links, and satellite channels.

Metropolitan Area Network (MAN)

A network that shares some of the characteristics of both LANs and WANs is sometimes referred to as Metropolitan Area Network (MAN). MANs generally cover a wider geographical area (up to 50km in diameter) than LANs, and frequently operate at speeds very close to those of LANs. The main objective of MANs is to interconnect LANs located in an entire city or Metropolitan Area. The communication links used for WANs are coaxial cables or microwave links.

Characteristics of MAN: -

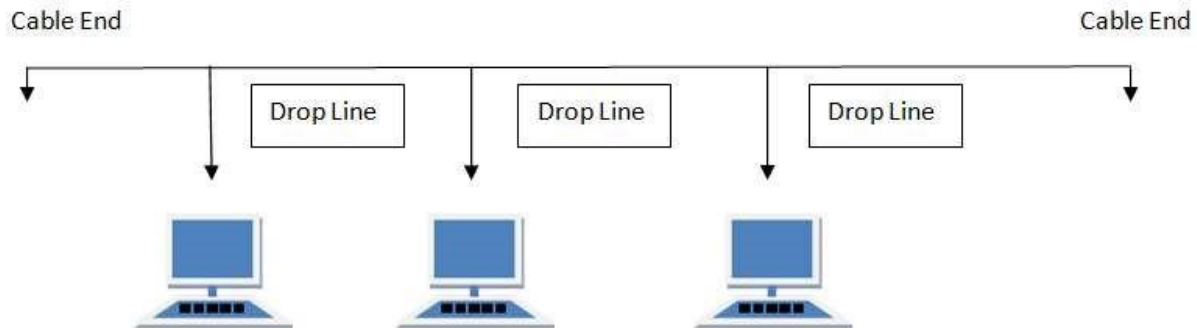
- Geographical Distribution: A WAN is spread out with a geographical coverage upto a diameter of around 50 kilometers.
- Data Transmission rate: Data transmission rates are slightly above LAN when compared to other network transmissions.
- Error rate: MANs usually have only a more errors during data transmission over a communication or network connection than LANs but less than WANs □ Communication link: they use links as used for LANs and WANs.
- Ownership: A MAN is not owned by a single organization because of its larger geographical coverage.
- Communication cost: the cost of transmitting data in a MAN is slightly higher as compared to LAN but lower than Wan.

Types of Network Topology

Network Topology is the schematic description of a network arrangement, connecting various nodes (sender and receiver) through lines of connection.

BUS Topology

Bus topology is a network type in which every computer and network device is connected to single cable. When it has exactly two endpoints, then it is called Linear Bus topology.



Features of Bus Topology

1. It transmits data only in one direction.
2. Every device is connected to a single cable

Advantages of Bus Topology

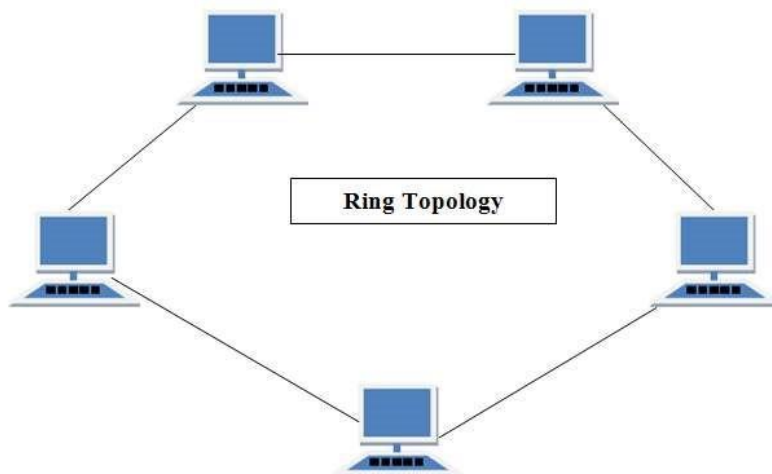
1. It is cost effective.
2. Cable required is least compared to other network topology.
3. Used in small networks.
4. It is easy to understand.
5. Easy to expand joining two cables together.

Disadvantages of Bus Topology

1. Cables fails then whole network fails.
2. If network traffic is heavy or nodes are more the performance of the network decreases.
3. Cable has a limited length.
4. It is slower than the ring topology.

RING Topology

It is called ring topology because it forms a ring as each computer is connected to another computer, with the last one connected to the first. Exactly two neighbors for each device.



Features of Ring Topology

1. A number of repeaters are used for Ring topology with large number of nodes, because if someone wants to send some data to the last node in the ring topology with 100 nodes, then

the data will have to pass through 99 nodes to reach the 100th node. Hence to prevent data loss repeaters are used in the network.

2. The transmission is unidirectional, but it can be made bidirectional by having 2 connections between each Network Node, it is called Dual Ring Topology.
3. In Dual Ring Topology, two ring networks are formed, and data flow is in opposite direction in them. Also, if one ring fails, the second ring can act as a backup, to keep the network up.
4. Data is transferred in a sequential manner that is bit by bit. Data transmitted, has to pass through each node of the network, till the destination node.

Advantages of Ring Topology

1. Transmitting network is not affected by high traffic or by adding more nodes, as only the nodes having tokens can transmit data.
2. Cheap to install and expand

Disadvantages of Ring Topology

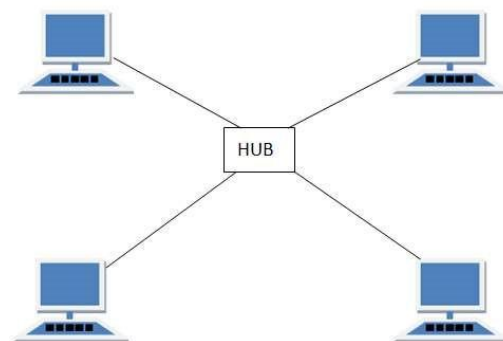
1. Troubleshooting is difficult in ring topology.
2. Adding or deleting the computers disturbs the network activity.
3. Failure of one computer disturbs the whole network.

STAR Topology

In this type of topology all the computers are connected to a single hub through a cable. This hub is the central node and all others nodes are connected to the central node.

Features of Star Topology

1. Every node has its own dedicated connection to the hub.
2. Hub acts as a repeater for data flow.
3. Can be used with twisted pair, Optical Fibre or coaxial cable.



Advantages of Star Topology

1. Fast performance with few nodes and low network traffic.
2. Hub can be upgraded easily.
3. Easy to troubleshoot.
4. Easy to setup and modify.
5. Only that node is affected which has failed, rest of the nodes can work smoothly.

Disadvantages of Star Topology

1. Cost of installation is high.
2. Expensive to use.
3. If the hub fails then the whole network is stopped because all the nodes depend on the hub.
4. Performance is based on the hub that is it depends on its capacity

MESH Topology

It is a point-to-point connection to other nodes or devices. All the network nodes are connected to each other.

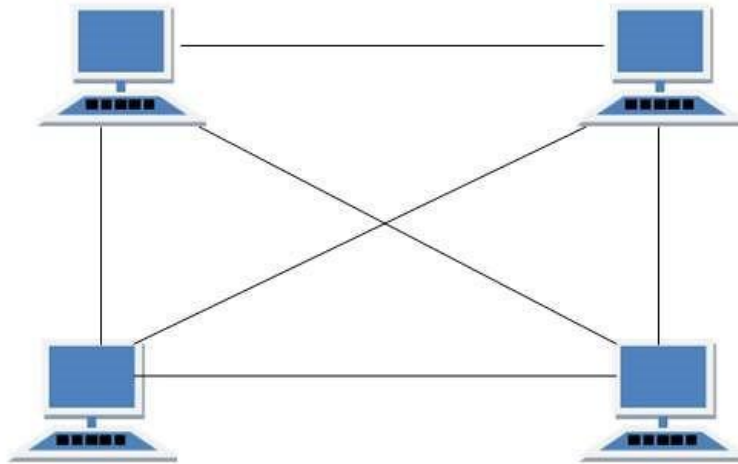
There are two techniques to transmit data over the Mesh topology, they are :

1. Routing
2. Flooding Routing

In routing, the nodes have a routing logic, as per the network requirements. Like routing logic to direct the data to reach the destination using the shortest distance. Or, routing logic which has information about the broken links, and it avoids those node etc. We can even have routing logic, to re-configure the failed nodes.

Flooding

In flooding, the same data is transmitted to all the network nodes, hence no routing logic is required. The network is robust, and the its very unlikely to lose the data. But it leads to unwanted load over the network.



Types of Mesh Topology

1. Partial Mesh Topology : In this topology some of the systems are connected in the same fashion as mesh topology but some devices are only connected to two or three devices.
2. Full Mesh Topology : Each and every nodes or devices are connected to each other.

Features of Mesh Topology

1. Fully connected.
2. Robust.
3. Not flexible.

Advantages of Mesh Topology

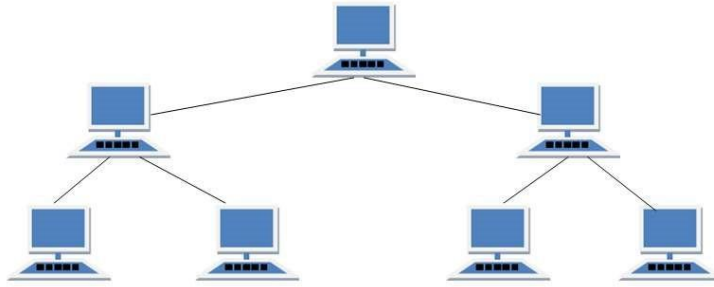
1. Each connection can carry its own data load.
2. It is robust.
3. Fault is diagnosed easily.
4. Provides security and privacy.

Disadvantages of Mesh Topology

1. Installation and configuration is difficult.
2. Cabling cost is more.
3. Bulk wiring is required.

TREE Topology

It has a root node and all other nodes are connected to it forming a hierarchy. It is also called hierarchical topology. It should at least have three levels to the hierarchy.



Features of Tree Topology

1. Ideal if workstations are located in groups.
2. Used in Wide Area Network.

Advantages of Tree Topology

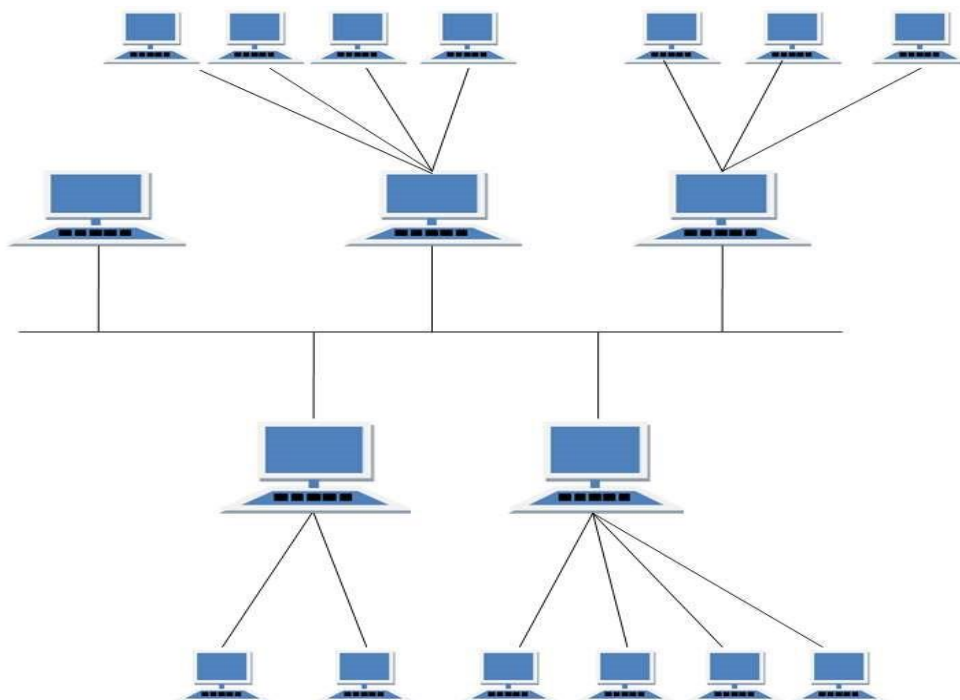
1. Extension of bus and star topologies.
2. Expansion of nodes is possible and easy.
3. Easily managed and maintained.
4. Error detection is easily done.

Disadvantages of Tree Topology

1. Heavily cabled.
2. Costly.
3. If more nodes are added maintenance is difficult.
4. Central hub fails, network fails.

HYBRID Topology

It is two different types of topologies which is a mixture of two or more topologies. For example if in an office in one department ring topology is used and in another star topology is used, connecting these topologies will result in Hybrid Topology (ring topology and star topology).



Features of Hybrid Topology

1. It is a combination of two or topologies

2. Inherits the advantages and disadvantages of the topologies included

Advantages of Hybrid Topology

1. Reliable as Error detecting and troubleshooting is easy.
2. Effective.
3. Scalable as size can be increased easily.
4. Flexible.

Disadvantages of Hybrid Topology

1. Complex in design.
2. Costly.

1.7 Viruses – Types, Precautions

“Virus is a program that reproduces its own code by attaching itself to other executable files in such a way that the virus code is executed when the infected executable file is executed.”

Other definitions: -

Viruses: A virus is a small piece of software that piggybacks on real programs. For example, a virus might attach itself to a program such as a spreadsheet program. Each time the spreadsheet program runs, the virus runs too, and it has the chance to reproduce (by attaching to other program) or wreak havoc.

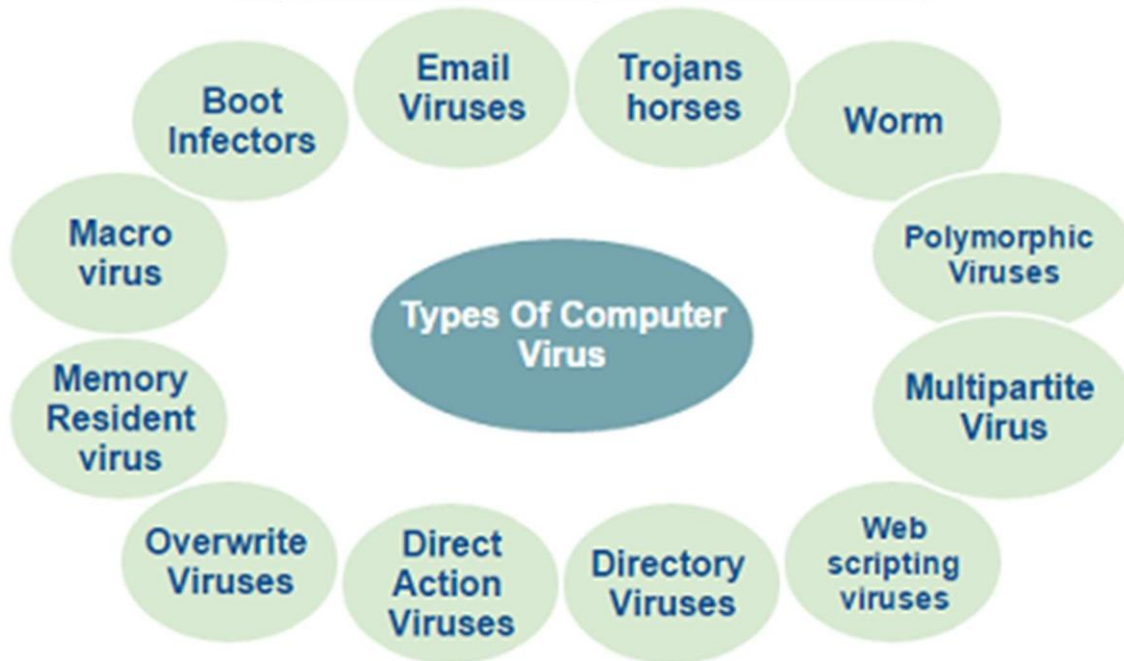
Computer viruses: Computer viruses are called viruses because they share some of the traits of biological viruses. A computer virus passes from computer to computer like a biological virus passes from person to person

Features of Virus: -

A computer virus shares some of these traits. A computer virus must piggyback on top of some other program or document in order to get executed. Once it is running, it is then able to infect other program or document in order to get executed. Obviously, the analogy between computer and biological viruses stretches things a bit, but there are enough similarities that the name sticks.

Viruses often perform some type of harmful activity on infected host computers, such as acquisition of hard disk space or central processing unit (CPU) time, accessing private information (e.g., credit card numbers), corrupting data, displaying political or humorous messages on the user's screen, spamming their e-mail contacts, logging their keystrokes, or even rendering the computer useless. However, not all viruses carry a destructive.

Types of Computer Viruses



Types of Computer Virus: -

Boot Sector Virus

From a user perspective, boot sector viruses are some of the most dangerous. Because they infect the master boot record, they are notoriously difficult to remove, often requiring a full system format. This is especially true if the virus has encrypted the boot sector or excessively damaged the code. They typically spread via removable media. They reached a peak in the 1990s when floppy disks were the norm, but you can still find them on USB drives and in email attachments. Luckily, improvements in BIOS architecture have reduced their prevalence in the last few years.

Direct Action Virus

A direct action virus is one of the two main types of file infector viruses (the other being a resident virus). The virus is considered “non-resident”; it doesn’t install itself or remain hidden in your computer’s memory.

It works by attaching itself to a particular type of file (typically EXE or COM files). When someone executes the file, it springs into life, looking for similar files in the directory for it to spread to.

On a positive note, the virus does not typically delete files nor hinder your system’s performance. Aside from some files becoming inaccessible, it has a minimal impact on a user and can be easily removed with an anti-virus program.

Resident Virus

Resident viruses are the other primary type of file infectors. Unlike direct action viruses, they install themselves on a computer. It allows them to work even when the original source of the infection has been eradicated. As such, experts consider them to be more dangerous than their direct action cousin.

Depending on the programming of the virus, they can be tricky to spot and even trickier to remove. You can split resident viruses into two areas; fast infectors and slow infectors. Fast infectors cause as much damage as quickly as possible and are thus easier to spot; slow infectors are harder to recognize because their symptoms develop slowly.

In a worst-case scenario, they can even attach themselves to your anti-virus software, infecting every file the software scans. You often need a unique tool – such as an operating system patch – for their total removal.

Multipartite Virus

While some viruses are happy to spread via one method or deliver a single payload, Multipartite viruses want it all. A virus of this type may spread in multiple ways, and it may take different actions on an infected computer depending on variables, such as the operating system installed or the existence of certain files.

They can simultaneously infect both the boot sector and executable files, allowing them to act quickly and spread rapidly.

The two-pronged attack makes them tough to remove. Even if you clean a machine's program files, if the virus remains in the boot sector, it will immediately reproduce once you turn on the computer again.

Polymorphic Virus

According to Symantec, polymorphic viruses are one of the most difficult to detect for an antivirus program. It claims anti-virus firms need to “spend days or months creating the detection routines needed to catch a single polymorphic”.

But why are they so hard to protect against? The clue is in the name. Anti-virus software can only blacklist one variant of a virus – but a polymorphic virus changes its signature (binary pattern) every time it replicates. To an anti-virus program, it looks like an entirely different piece of software, and can, therefore, elude the blacklist.

Overwrite Virus

To an end-user, an overwrite virus is one of the most frustrating, even if it's not particularly dangerous for your system as a whole. That's because it will delete the contents of any file which it infects; the only way to remove the virus is to delete the file, and consequently, lose its contents. It can infect both standalone files and entire pieces of software.

Overwrite viruses typically have low visibility and are spread via email, making them hard to identify for an average PC user. They enjoyed a heyday in the early 2000s with Windows 2000 and Windows NT, but you can still find them in the wild.

Spacefiller Virus

Also known as “Cavity Viruses”, spacefiller viruses are more intelligent than most of their counterparts. A typical modus operandi for a virus is to simply attach itself to a file, but spacefiller try to get into the empty space which can sometimes be found within the file itself. This method allows it to infect a program without damaging the code or increasing its size, thus enabling it to bypass the need for the stealthy anti-detection techniques other viruses rely on. Luckily, this type of virus is relatively rare, though the growth of Windows Portable Executable files is giving them a new lease of life.

E-mail Viruses: An E-mail virus moves around in e-mail messages, and usually replicates itself by automatically mailing itself to dozens of people in the victim's e-mail address book.

Worms: a worm is a small piece of software that uses computer networks and security holes to replicate itself. A copy of the worm scans the network for another machine that has a specific security hole. It copies itself to the new machine using the security hole, and then starts replicating from there, as well.

Trojan horses: A Trojan horse is simply a computer program. The program claims to do one thing (it may claim to be a game) but instead does damage when you run it (it may erase your hard disk). Trojan horses have no way to replicate automatically.

Macro Virus

Macro viruses infect files that are created using certain applications or programs that contain macros. These mini-programs make it possible to automate series of operations so that they are performed as a single action, thereby saving the user from having to carry them out one by one.

Directory Virus

Directory viruses change the paths that indicate the location of a file. By executing a program (file with the extension .EXE or .COM) which has been infected by a virus, you are unknowingly running the virus program, while the original file and program have been previously moved by the virus. Once infected it becomes impossible to locate the original files.

Web Scripting Virus

A web scripting virus is a type computer security vulnerability through websites that breaches your web browser security. This allowed the attackers to inject client-side scripting into the web page. It can bypass access controls, steal your information from your web browser.

Precautions:

Install quality antivirus

Many computer users believe free antivirus applications, such as those included with an Internet service provider's bundled service offering, are sufficient to protect a computer from virus or spyware infection. However, such free anti-malware programs typically don't provide adequate protection from the ever-growing list of threats.

Instead, all Windows users should install professional, business-grade antivirus software on their PCs. Pro-grade antivirus programs update more frequently throughout the day (thereby providing timely protection against fast-emerging vulnerabilities), protect against a wider range of threats (such as rootkits), and enable additional protective features (such as custom scans).

Install real-time anti-spyware protection

Many computer users mistakenly believe that a single antivirus program with integrated spyware protection provides sufficient safeguards from adware and spyware. Others think free anti-spyware applications, combined with an antivirus utility, deliver capable protection from the skyrocketing number of spyware threats.

Unfortunately, that's just not the case. Most free anti-spyware programs do not provide real-time, or active, protection from adware, Trojan, and other spyware infections. While many free programs can detect spyware threats once they've infected a system, typically

professional (or fully paid and licensed) anti-spyware programs are required to prevent infections and fully remove those infections already present.

Keep anti-malware applications current

Antivirus and anti-spyware programs require regular signature and database updates. Without these critical updates, anti-malware programs are unable to protect PCs from the latest threats.

Computer users must keep their antivirus and anti-spyware applications up to date. All Windows users must take measures to prevent license expiration, thereby ensuring that their anti-malware programs stay current and continue providing protection against the most recent threats. Those threats now spread with alarming speed, thanks to the popularity of such social media sites as Twitter, Facebook, and My Space.

Perform daily scans

Occasionally, virus and spyware threats escape a system's active protective engines and infect a system. The sheer number and volume of potential and new threats make it inevitable that particularly inventive infections will outsmart security software. In other cases, users may inadvertently instruct anti-malware software to allow a virus or spyware program to run.

Regardless of the infection source, enabling complete, daily scans of a system's entire hard drive adds another layer of protection. These daily scans can be invaluable in detecting, isolating, and removing infections that initially escape security software's attention.

Disable autorun

Many viruses work by attaching themselves to a drive and automatically installing themselves on any other media connected to the system. As a result, connecting any network drives, external hard disks, or even thumb drives to a system can result in the automatic propagation of such threats.

Computer users can disable the Windows autorun feature by following Microsoft's recommendations, which differ by operating system.

Disable image previews in Outlook

Simply receiving an infected Outlook e-mail message, one in which graphics code is used to enable the virus' execution, can result in a virus infection. Prevent against automatic infection by disabling image previews in Outlook.

By default, newer versions of Microsoft Outlook do not automatically display images. But if you or another user has changed the default security settings, you can switch them back (using Outlook 2007) by going to Tools | Trust Center, highlighting the Automatic Download option, and selecting Don't Download Pictures Automatically In HTML E-Mail Messages Or RSS.

Don't click on email links or attachments – Think before you click

It's a mantra most every Windows user has heard repeatedly: Don't click on email links or attachments. Yet users frequently fail to heed the warning.

Whether distracted, trustful of friends or colleagues they know, or simply fooled by a crafty email message, many users forget to be wary of links and attachments included within

email messages, regardless of the source. Simply clicking on an email link or attachment can, within minutes, corrupt Windows, infect other machines, and destroy critical data. Users should never click on email attachments without at least first scanning them for viruses using a business-class anti-malware application. As for clicking on links, users should access Web sites by opening a browser and manually navigating to the sites in question.

Surf smart

Many business-class anti-malware applications include browser plug-ins that help protect against drive-by infections, phishing attacks (in which pages purport to serve one function when in fact they try to steal personal, financial, or other sensitive information), and similar exploits. Still others provide "link protection," in which Web links are checked against databases for bad pages.

Whenever possible, these preventive features should be deployed and enabled. Unless the plug-ins interfere with normal Web browsing, users should leave them enabled. The same is true for automatic pop-up blockers, such as are included in Internet Explorer 8, Google's toolbar, and other popular browser toolbars.

Regardless, users should never enter user account, personal, financial, or other sensitive information on any Web page at which they haven't manually arrived. They should instead open a Web browser, enter the address of the page they need to reach, and enter their information that way, instead of clicking on a hyperlink and assuming the link has directed them to the proper URL. Hyperlinks contained within an e-mail message often redirect users to fraudulent, fake, or unauthorized Web sites. By entering Web addresses manually, users can help ensure that they arrive at the actual page they intend.

But even manual entry isn't foolproof. Hence Deploy DNS protection.

Use a hardware-based firewall

Technology professionals and others argue the benefits of software- versus hardwarebased firewalls. Often, users encounter trouble trying to share printers, access network resources, and perform other tasks when deploying third-party software-based firewalls. As a result, I've seen many cases where firewalls have simply been disabled altogether.

But a reliable firewall is indispensable, as it protects computers from a wide variety of exploits, malicious network traffic, viruses, worms, and other vulnerabilities. Unfortunately, by itself, the software-based firewall included with Windows isn't sufficient to protect systems from the myriad robotic attacks affecting all Internetconnected systems. For this reason, all PCs connected to the Internet should be secured behind a capable hardware-based firewall.

Deploy DNS protection

Internet access introduces a wide variety of security risks. Among the most disconcerting may be drive-by infections, in which users only need to visit a compromised Web page to infect their own PCs (and potentially begin infecting those of customers, colleagues, and other staff).

Another worry is Web sites that distribute infected programs, applications, and Trojan files. Still another threat exists in the form of poisoned DNS attacks, whereby a compromised DNS server directs you to an unauthorized Web server. These compromised DNS servers are typically your ISP's systems, which usually translate friendly URLs such as yahoo.com

to numeric IP addresses like 69.147.114.224. Users can protect themselves from all these threats by changing the way their computers process DNS services. While a computer professional may be required to implement the switch, Open DNS offers free DNS services to protect users against common phishing, spyware, and other Web-based hazards.

Use Complex and Secure Passwords:

The first line of defense in maintaining system security is to have strong and complex passwords. Complex passwords are difficult for the hackers to find. Use a password that is at least 8 characters in length and include a combination of numbers, letters that are both upper and lower case and a special character. Hackers use certain tools to break easy passwords in few minutes. One recent study showed that a 6 character password with all lower case letters can be broken in under 6 minutes!

Back Up Your Files. The best thing you can do is back up your files—all of them. Ideally you will have your files (your data) in at least three places: the place where you work on them, on a separate storage device, and off-site. Keep your files on your computer, back them up to an external hard drive, then back them up in a different location. You can use a backup service or simply get two external hard drives and keep one at work, at a friend's house, at a family member's house, or in a safe deposit box.

Don't Use Open Wi-Fi. When you are at the local coffee shop, library, and especially the airport, don't use the "free" open (non-password, non-encrypted) Wi-Fi. Think about it. If you can access it with no issues, what can a trained malicious individual do?

Keep Your Personal Information Safe. This is likely the most difficult thing to do on the Internet. Many hackers will access your files not by brute force, but through social engineering. They will get enough of your information to gain access to your online accounts and will glean more of your personal data. They will continue from account to account until they have enough of your info that they can access your banking data or just steal your identity altogether. Be cautious on message boards and social media. Lock down all of your privacy settings, and avoid using your real name or identity on discussion boards.