

UNIT-1

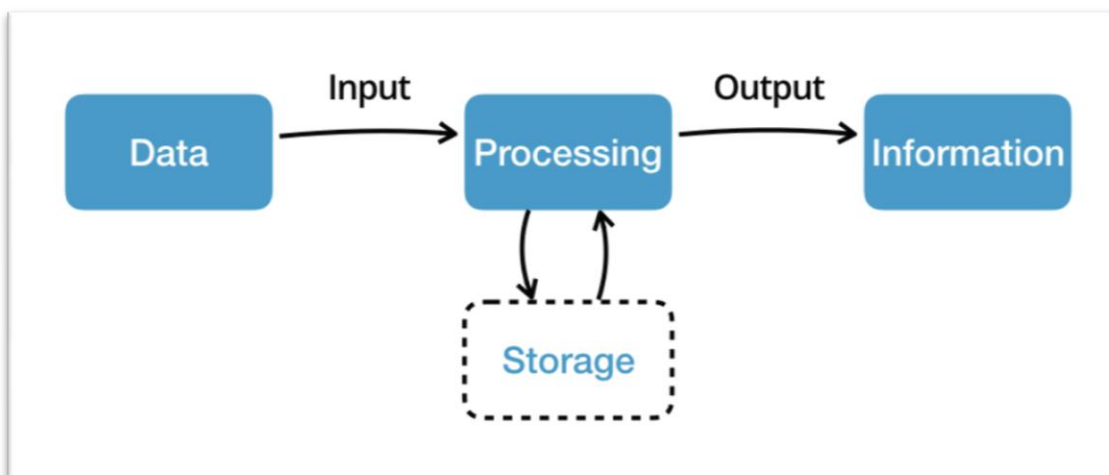
Introduction to Computer

- Computer is derived from a Latin word "Computare" which means "**to calculate**" "**to count**" or , "**to sum up**". So, more precisely the word computer means a "device that performs computation".
- In simple, computer is an electronic device which takes input from the user with the help of input devices, process it using CPU and then gives meaningful output from the output devices.
- A computer may be defined as a machine that can solve problems by accepting data, performing certain operations, and presenting results of those operations in sequential instructions. Such a set of sequenced instructions, which cause a computer program to perform particular operations is called program.

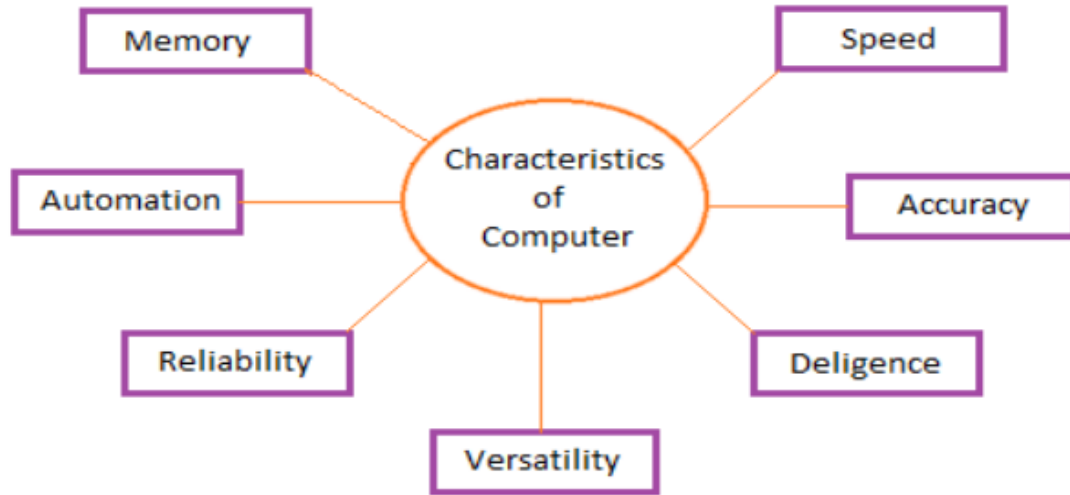
Main functions of computer

- Takes data as input
- Stores the data/instructions in its memory and use them when required
- Processes the data and converts it into useful information
- Generates the output
- Controls all the above activities

Functions of computer



Features/characteristics of computer



Speed:

A computer works with much higher speed and accuracy compared to humans while performing mathematical calculations. Computers can process millions (1,000,000) of instructions per second. The time taken by computers for their operations is microseconds and nanoseconds.

Accuracy:

Computers perform calculations with 100% accuracy. Errors may occur due to data inconsistency or inaccuracy.

Diligence:

A computer can perform millions of tasks or calculations with the same consistency and accuracy. It doesn't feel any bored or tired.

Versatility:

Versatility refers to the capability of a computer to perform different kinds of works with same accuracy and efficiency.

Reliability:

A computer is reliable as it gives consistent result for similar set of data i.e., If we give same set of input any number of times, we will get the same result.

Automation:

Computer performs all the tasks automatically, just we need to give instructions.

Memory:

In computer we can store large amount of data in memory for future use. We can store either temporarily or permanently.

Applications of Computer:



Advantages of computer:

- We can perform any task within a fraction of second.
- We can store large amount of data or information for long term purpose.
- We can communicate with others.
- Computer preforms calculations with 100 % accuracy.
- We can perform multiple tasks at the same time.
- It is versatile.

Limitations/Disadvantages of computer:

- Requires initial cost
- Computer depends of user's input
- We need to give instruction to perform any task
- Computer have no imagination or memory power to remember about past
- Requires technically skilled persons to handle computer
- There might be health problem because of continuous use of computer
- Computer makes people dull, machine dependent, addict

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Types of computer:

Computers are classified on the basis of working principle, on the basis of size, on the basis of model and on the basis of brand.

On the basis of Size:

1. Super Computer
2. Mainframe Computer
3. Mini Computer
4. Micro Computer

On the basis of working principle(Function)

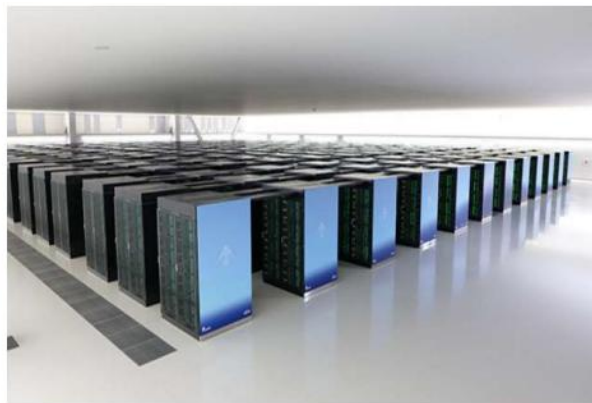
1. Analog Computer
2. Digital Computer
3. Hybrid Computer

1. Super Computer:

A super computer is the fastest type of computer which performs a task with very high rate of speed. So that they are incredibly fast, sophisticated and powerful. Super computers are multi-user and multiprocessor large computer of very high efficiency and storing capacity. Super computers are able to solve very difficult and complex problem within a Nano seconds. **Example: CRAY X-MAP/24, NEC-500, PARAM, ANURAG etc.**

Some Applications:

- Weather forecasting, military research and defense systems, automobile, aircraft, space craft designing, nuclear research, scientific research etc.



2. Mainframe Computers:

It is the largest computer on the basis of size. It is powerful multi-user computer used in large organizations such as business, industries, defense etc. It can response any numbers of request at a time. It uses several CPU for data processing. More than 100 users can use at a time because it works on time sharing mode. It is general purpose computing system designed for large scale data processing. Examples: IBM 1401, ICL 2950/10, ICL 39, CYBER 170 etc.

Applications: Industries, Banking, Insurance companies, Airlines, Air Traffic Control etc.

Mainframe Computers



Mainframe Computer



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3. Mini Computers:

Minicomputers are computers that are somewhere in between a microcomputer and a mainframe computer. For this reason, a minicomputer is often called a **midrange computer**. This computer is useful for medium sized business organizations, industries, universities and banks due to cheap and easy to operate than mainframe computers. They are also multi-user computer and supports more than 40 users at a time. It is costly than micro computers. It is also used in scientific research, engineering analysis and industrial process monitoring and control.

Examples: Prime 9755, VAX 7500, HCL, PDA-I, MAGNUM etc.



4. Micro Computer:

A computer which is based on a microprocessor is called a microcomputer. It is a small, low cost digital computer. It requires small space, can be placed on a table. This computer has a central processing unit on a single chip. A microcomputer is a small sized personal computer that is designed for an individual use. It is mainly used in office, house, school, shop and store etc.

Examples: laptop, notebook, palmtop, desktop, workstation, Tablet PC, PDA(Personal Digital Assistant) etc.



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Difference between Micro Computer and Super Computer

Micro Computer	Super Computer
1. It is a less powerful computer.	1. It is a more powerful computer.
2. It is a slower computer in terms of processing.	2. It is a faster computer in terms of processing.
3. It is a general purpose computer.	3. It is a special purpose computer.
4. It is the smallest computer on the basis of size.	4. It is larger in size.
5. It can be portable as well as non-portable.	5. It is non-portable computer.
6. It is cheaper.	6. It is the most expensive computer.
7. It can be handled by only one person.	7. It requires numbers of experts or users to operate.
8. It has less memory and storage capacity.	8. It usually contains larger memory and storage capacity.
9. It is the most popular computer among all.	9. It is a rarely used for some specific tasks.
10. It is used in office, house.	10. It used in weather forecasting, scientific research.
11. Example: Desktop, PC, Laptop, Tablet PC etc.	11. Example: CRAY X-MP/24, NEC-500, PARAM etc.

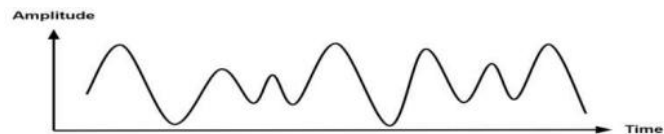
Types of computer based on working principle (Function):

1. Analog Computer:

The computer which can process analog quantities (continuous data) is called an analog computer. Analog computer operates by measuring rather than counting. It is a special purpose computer and is mainly used in scientific work and not for commercial or personal purpose. Generally, it has less storage capacity and its accuracy is poor as compared to digital computers. It is specially designed to compute physical forces such as temperature, pressure.

The wave form of an analog computer is:

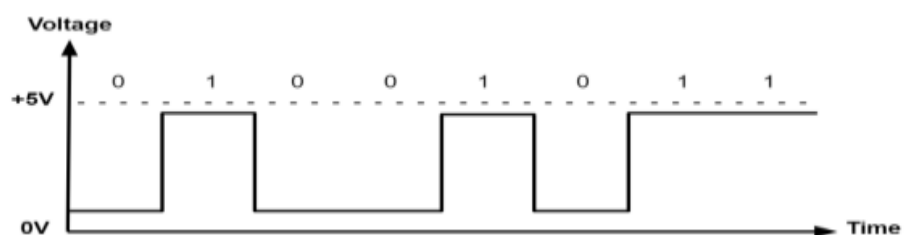
Example: Thermometer, barometer, speedometer, ammeter etc.



2. Digital Computer:

The computer which works on discrete data (discontinuous data, binary systems or 0 and 1) is known as a digital computer. The binary system is such a system of numbering in which only two digits are used (0 and 1) where 0 represents off and 1 as on. So, the basic principle of these computers is either presence or absence of an electric pulse in the signals. It is multipurpose and programmable. It is high cost, fast processing, more accurate and has larger memory capacity. It is usually a general purpose computer.

The wave form of digital computer is:



Example: IBM PC, IBM Compatible, Apple/Macintosh computer etc.

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3. Hybrid Computer:

A computer which has a combined features of both analog and digital computers is called hybrid computer. These type of computer can process both continuous and discrete data and has the capability to convert one type of data into another. Hybrid computers are the special purpose computer. It is mostly used in airplane, radar communication, rocket launching, weather forecasting, hospital systems such as CT scan, heart valve analysis, automated industry control etc. It usually has high cost compared to analog and digital computers.

Difference between analog and digital computer:

Digital Computer	Analog Computer
1. These computer work with digits.	1. These computer works with natural or physical values.
2. It works upon discrete data.	2. It works upon continuous data.
3. It operates by counting and adding i.e. calculates.	3. It operates by measuring and comparing.
4. It's accuracy is high.	4. It's accuracy is low.
5. Results are obtained after complete computation.	5. The output is continuous.
6. It is general purpose computer.	6. It is a special purpose computer.
7. Larger storage capacity.	7. Smaller storage capacity.
8. Higher cost as compared to analog computer.	8. Lower cost as compared to digital computers.
9. It can be reprogrammed.	9. Generally, it can not be reprogrammed.
10. Example: Laptop, Desktop, Tablet etc.	10. Example: Thermometer, Speedometer etc.

Mobile Computing:

- Mobile Computing is a technology that allows transmission of data, voice and video via a computer or any other wireless enabled device without having to be connected to a fixed physical link.
- Mobile computing is the idea that users can process data or perform digital tasks on mobile devices.
- Mobile computing involves mobile communication, mobile hardware, and mobile software.
- Goal of Mobile Computing: "People and their machines should be able to access information and communicate with each other easily and securely, in any medium or combination of media – voice, data, image, video, or multimedia – any time, anywhere, in a timely, cost-effective way."

Features of Mobile Computing:

- It is a portable device that can be used during mobility.
- It has limited processing and storage capacity.
- It includes mobile communication, mobile hardware and mobile software.
- It usually contains a touch screen for providing input.
- It contains camera, speaker and microphone.
- Most of the mobile computing devices contain a memory card slot to expand the storage capacity.
- It has wireless connectivity such as Bluetooth, Wi-Fi to connect the Internet or with other computing devices as well as a wired connection through the USB port.
- It uses different a mobile computing operating system such as Android, IOS, Windows Mobile etc.

Advantages of Mobile Computing:

- It enables users to work from any location at any time.
- It saves time for accessing data and information.
- It helps to increase the productivity of users reducing the time and cost.
- It has made research easier.
- It is portable.
- It is one of the major handheld sources of entertainment of users at present.
- Nowadays, Business processes are easily available through secured mobile connections.
- It provides remote access to the organizational data from any location.

Disadvantages of Mobile Computing:

- Mobile technology requires faster and quality connectivity services like need either Wi-Fi or 3G or 4G connectivity.
- It has security concern, most wireless connectivity is unsafe.
- Large power consumption due to low battery backup.
- Might get credential verification problem.
- Extensive use of mobile devices results in health problem.

Computer System:

• A computer along with additional hardware and software together is called a computer system. A computer system primarily comprises a central processing unit (CPU), memory, input/output devices and storage devices. All these components function together as a single unit to deliver the desired output.

• **Computer Architecture** is a functional description of requirements and design implementation for the various parts of computer. It deals with functional behavior of computer system. It comes before the computer organization while designing a computer. Architecture describes what the computer does.

• **Computer Organization** comes after the decide of Computer Architecture first. Computer Organization is how operational attribute are linked together and contribute to realize the architectural specification. Computer Organization deals with structural relationship. • Organization describes how it does it.

Block Diagram of Computer System:

A computer system or block diagram of computer system consists of the following components:

1. **Input Unit**
2. **Central Processing Unit**
3. **Output Unit**
4. **Memory Unit(Main Memory, Auxiliary Storage)**

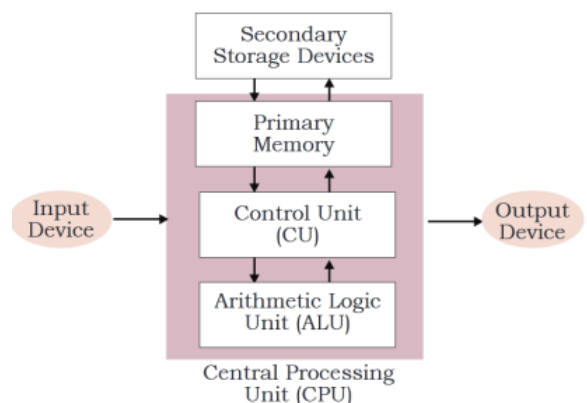


Figure 1.1: Components of a Computer System

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1. Input Unit:

The input unit provides an interface between user and machine for providing input data and instructions into the computer memory. Input unit accepts input, convert it into a machine readable format and provides it for processing and storage. Input unit consists of many input devices such as mouse, keyboard, scanner, microphone etc.

2. Central processing unit (CPU):

The CPU is the brain of a computer that organizes and executes the instructions. Its primary function is to execute the instruction. Besides executing the instructions, the CPU controls the operation of all other components such as memory, input and output devices.

The functions of CPU(processor) are:

- To carry out the processing.
- To give commands to all parts of the computer system.
- To control the sequence of operation.
- To control the storage of data or instructions.
- To perform arithmetic calculations such as addition, subtraction.

Different parts of the CPU are:

- *Arithmetic Logic Unit (ALU)*
- *Control Unit (CU)*
- *Register*

Arithmetic Logic Unit (ALU):

Arithmetic logic unit is used to perform arithmetic operations such as addition, subtraction, multiplication etc. and logical operations such as comparing greater than, smaller than, equal to etc.

Control Unit:

- The control unit of the CPU controls the entire operations of the computer.
- Control unit also controls all other devices such as memory, input and output devices connected to the CPU.
- It directs the movement of electronic signals among main memory and ALU and input devices.
 - The control unit gives instructions or commands to other devices to perform operations.
- It also controls the flow of data from input devices to memory and from memory to output devices.

Register:

- Registers are small amounts of high-speed memory contained within the CPU. They are used by the processor to store small amounts of data that are needed during processing.
- The register within CPU are special purpose temporary storage location.
- The storage capacity of registers is small.

3. Output Unit:

The output unit provides the result after completing the processing task to the user. It convert the output into a user understandable format through output devices. Output unit consists of many output devices such as monitor, printer, speaker etc.

4. Memory Unit:

The memory unit is responsible for storing data and instructions either for a short or longer period of time. We can store data and output in the memory either temporarily or permanently.

There are two type of memory:

1. Primary Memory (Main Memory)



2. Secondary Memory (Auxiliary Memory)

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Primary Memory:

- It is the main memory of the computer.
- It is used for storing data and instructions during processing.
- It is the only memory, which is directly accessible to CPU.
- It is usually expensive, faster of read/write operation and used in small storage capacity.
- Example: RAM, ROM and Cache Memory

Secondary Memory:

- It is the additional memory of the computer and used for storing large amount of data permanently.
- It is also used for transferring data from one computer to another.
- It is usually cheaper, slower, and used in larger storage capacity.
- It is not directly accessible to CPU and it requires primary memory for its operations.
- Example: Hard Disk, CD, DVD, Pen Drive etc.

Microprocessor:

- *A microprocessor is a multipurpose, programmable, clock-driven, register based electronic component/chip(Integrated Circuit) capable of performing Arithmetic and Logical Unit(ALU) operations and communicating with the other component connected to it.*
- *It is a general purpose device, which may be applied to a wide range of applications.*
- *It reads binary instructions from an input device or primary memory, accepts binary data as inputs, and processes data according to those instructions and provides results as output.*
- *In the large computer systems such as supercomputer and mainframe computer, processing tasks may be handled by multiple numbers of processors. In the average microcomputer, the entire CPU is a single unit called a microprocessor.*
- *The first microprocessor called Intel 4004 was developed by American Intel Corporation in 1971.*
- *A microprocessor controls all functions of the CPU of a computer or other digital device.*
- *The microprocessor consists of mainly three components namely ALU, CU and Registers.*

Functions of the Microprocessor:

- The microprocessor is responsible to carry out processing instructions in and out from the main memory.
- It gives commands to all parts of the computer system.
- It controls the sequence of operations.
- It controls the storage of data or instructions.
- It also performs arithmetic calculations such as addition, subtraction.
- It will also supervise and control the I/O devices in addition to execution.

Bus System:

- In computer architecture, a bus is a collection of wires, chips and slots inside the computer through which data, memory address and control signals are transmitted from one part to another part of the computer.

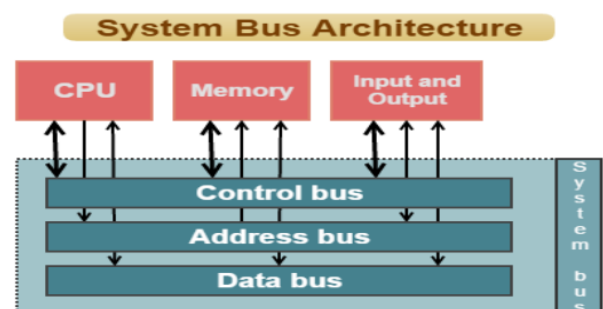
Functions of bus:

1. It carries information from one component to another component.
2. It carries data, address or control signals.
3. Different components of computer are interacted by bus.

Types of Bus:

There are three types of Bus:

1. Address Bus
2. Data Bus
3. Control Bus



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1. Address Bus:

- Address bus carries memory addresses from the processor to other components such as primary storage and input/output devices.
- In a computer system, each peripheral or memory location is identified by a numerical value called an address and the address bus is used to carry this numerical value as well as it also contains a few control lines to carry control commands.
- The address bus is unidirectional that means bits flow in one direction, from the processor to peripherals.
- The capacity of the address bus might be different in different system such as 8 bits, 16 bits, 20 bits etc.

2. Data Bus:

- Data bus is used to transfer data from one location to another location across the computer.
- The meaningful data which is to be sent or retrieved from a device is placed on these lines.
- The CPU uses a data bus to transfer data and it may be of 16-bit or 32 bit.
- It is an electrical path that connects the CPU, memory and other hardware devices on the motherboard.
- These lines are bidirectional that means data flow in both direction between the processor and memory and peripheral devices

3. Control Bus:

- The control bus carries the control signal.
- The control signal is used for controlling and coordinating of the various activities across the computer.
- The control unit generates a specific control signal for every operation such as memory read or write or input/output operation.

Input and Output Devices

The input devices are the hardware that allows the user and other applications to input data into a computer for processing and enable us to provide the means of communication between the computer and user.

Most common examples of input devices are:

1. Keyboard
2. Mouse
3. Joy Stick
4. Light pen
5. Track Ball
6. Scanner
7. Graphic Tablet
8. Microphone
9. Magnetic Ink Card Reader(MICR)
10. Optical Character Reader(OCR)
11. Bar Code Reader
12. Optical Mark Reader(OMR)

1. Keyboard:

- Keyboard is the most common and very popular input device which helps to input data to the computer.
- The layout of the keyboard is like that of traditional typewriter, although there are some additional keys provided for performing additional functions.
- 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.



2. Mouse:

- Mouse is the most popular pointing device.
- It is a very famous cursor-control device having a small palm size box with a round ball at its base, which senses the movement of the mouse and sends corresponding signals to the CPU when the mouse buttons are pressed.
- 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.



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3. Scanner:

- Scanner is an input device, which works more like a photocopy machine.
- It is used when some information is available on paper and it is to be transferred to the hard disk of the computer for further manipulation.
- Scanner captures images from the source which are then converted into a digital form that can be stored on the disk.
- These images can be edited before they are printed.



4. Digitizer:

- Digitizer is an input device which converts analog information into digital form.
- Digitizer can convert a signal from the television or camera into a series of numbers that could be stored in a computer.
- They can be used by the computer to create a picture of whatever the camera had been pointed at.
- Digitizer is also known as Tablet or Graphics Tablet as it converts graphics and pictorial data into binary inputs.
- A graphic tablet as digitizer is used for fine works of drawing and image manipulation applications.



5. Microphone:

- Microphone is an input device to input sound that is then stored in a digital form.
- The microphone is used for various applications such as adding sound to a multimedia presentation or for mixing music.



6. Light Pen:

- Light pen is a pointing device similar to a pen.
- It is used to select a displayed menu item or draw pictures on the monitor screen.
- It consists of a photocell and an optical system placed in a small tube.
- When the tip of a light pen is moved over the monitor screen and the pen button is pressed, its photocell sensing element detects the screen location and sends the corresponding signal to the CPU



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Output Device:

- Output devices are hardware equipment used to generate output.
- Output devices provide output to the users, which is generated after processing the input data.
- The output data could be text, graphics, audio or video.

Most common output devices are:

1. Monitors
2. Graphic Plotter
3. Printer
4. Speaker

1. Monitor:

- Monitors, commonly called as Visual Display Unit (VDU), are the main output device of a computer.
- It forms images from tiny dots, called pixels that are arranged in a rectangular form.
- The sharpness of the image depends upon the number of pixels.

Types of Monitors.

- i. Cathode-Ray Tube (CRT) Monitor
- ii. Liquid Crystal Display (LCD) Monitors

<u>CRT</u>	<u>LCD</u>
1. CRT stands for Cathode Ray Tube.	1. LCD stands for Liquid Crystal Display.
2. It is the monitor based on cathode ray tube technology.	2. It is the monitor based on liquid crystal display technology.
3. Vacuum Tube and electron gun used as functional components.	3. Liquid crystal used as functional component.
4. It is less expensive.	4. It is quite expensive.
5. CRT monitors are big and bulky.	5. LCD monitors are thin and light.
6. It emits radiation.	6. It does not emits radiation.
7. Harmful for human eyes.	7. Less harmful for human eyes.
8. CRT have lower response time.	8. LCD have greater response time.

- iii. Light-Emitting Diodes (LED) Monitors

2. Printers:

- A printer is basically an output device which prints a hard copy of the electronic data that is stored in the computer or any other devices.
- The electronic data may include documents, text, images or even the combination of all three.
- Printer is an output device, which is used to print information on paper.

Types of Printer:

1. Impact Printer
2. Non-Impact Printer

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Impact printer / Dot-matrix Printer

1. It prints characters or images by striking print hammer or wheel against an inked ribbon.
2. Its speed is slower.
3. Its printing quality is lower.
4. It normally uses continuous paper sheet.
5. It generates noise during printing.
6. It uses inked ribbon for printing.
7. It is less expensive.
8. Dot matrix is an impact printer.

Non impact Printer / Laser Printer

1. It prints characters and images without striking the papers.
2. Its speed is faster.
3. Its printing quality is higher.
4. Its normally uses individual paper sheet.
5. It does not generate noise during printing.
6. It uses toner or cartridge for painting.
7. It is more expensive.
8. Laser printer is a non-impact printer.

3. Plotter:

- A plotter is a printer that interprets commands from a computer to make line drawings on paper with one or more automated pens.
- Plotters were the first type of printer that could print with color and render graphics and full-size engineering drawings.
- As a rule, plotters are much more expensive than printers.



4. Speaker:

- Speakers are used to connect to a computer to generate sound, which are one of the most common output devices.
- With the computer speaker, the computer's sound card creates a signal that is used to produce sound.
- The primary objective of speakers is to offer audio output for the listener.



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Interfaces or Ports:

- Interface or port refers to the point or a connector through which data is transferred between two hardware devices, between a user and a program etc.
- Interface defines how two different types of device can be connected and communication and data flow can occur between them.
- In computer there are different types of interfaces like hardware interface, software interface and user interface.

Types of hardware interfaces:

There are different types of interface or ports for connection different devices in computer system where data flow in and out through these ports:

1. Parallel Ports
2. Serial Ports
3. USB Ports
4. HDMI
5. IEEE 1394 (Fire Wire)

1. Parallel Ports:

- A parallel port allows the transfer of all the bits of word simultaneously such as printer.
- In parallel interface, there are multiple lines to connect to the peripheral to the port (i.e. parallel interface is a connection of eight or more wires through bits can flow simultaneously).
- This port normally has 25 pins.
- A parallel interface is used to transfer data at faster rate for high speed peripherals such as disk and tape.



2. Serial Ports:

- A serial port allows serial data transfer.
- In serial data transfer, one bit of data is transmitted at a time.
- With serial interface, data bits are transmitted one bit at a time through single wire, however the interface include additional wires for the bits that control the flow of data.
- It is used to connect to either a telephone line through modem.
- This port normally has 9 pins.



3. USB Ports:

- USB Stands for Universal Serial Bus.
- It is a high speed serial bus.
- A USB port is a standard cable connection interface for personal computers and consumer electronics devices.
- Its data transfer rate is higher than that of serial port.
- USB ports allow USB devices to be connected to each other with and transfer digital data over USB cables.



4. HDMI:

- HDMI Stands for High Definition Multimedia Interface.
- It is a connector and cable which is capable of transmitting high quality and high-bandwidth streams of audio and video between devices.
- HDMI technology is used with devices such as HDTV, Projector, DVD player etc.
- Different versions of HDMI have been developed and newer version gave an improvement in audio and video capacity, performance, resolution and color space.



5. IEEE 1394:

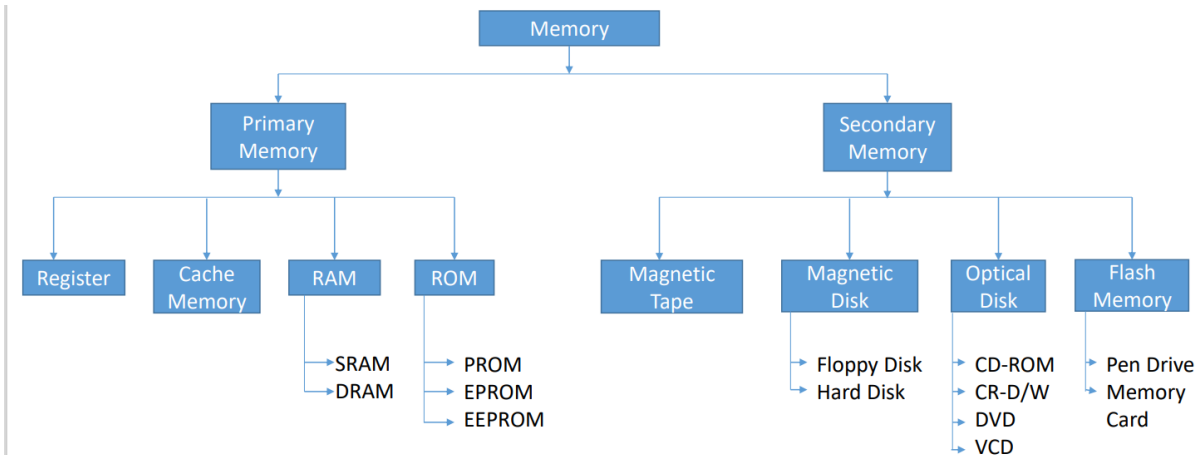
- IEEE Stands for "Institute of electrical and electronic engineers".
- The IEEE 1394 port is a serial bus interface standard for high speed communication for digital audio, digital video.
- This is also know as Fire Wire.
- It is faster than USB 1.1 but slower than USB 2.0.
- Its data transfer rate is 400 MBPS.
- It uses four wires: two for power supply and two for sending data.



Memory

Introduction to Memory:

- **Computer memory, device that is used to store data or programs (sequences of instructions) on a temporary or permanent basis for use in an electronic digital computer.**



Primary Memory:

- The primary memory of computer is also known as main memory of computer.
- It is fast and less capacity memory of the computer.
- The primary memories of computer are ROM, RAM, Cache Memory and Registers etc.
- Primary memory are mainly used to store data and instructions during a time of processing.
- These memories have great effect on processing speed of computer.

Types of primary memory are :

1. Random Access Memory (RAM)
2. Read Only Memory (ROM)
3. Cache Memory
4. Register

1. Random Access Memory:

- Random Access Memory is abbreviated as RAM.
- RAM gives applications a place to store and access data on a shortterm basis.
- It stores the information when your computer is actively using so that it can be accessed quickly.
- Computer random access memory (RAM) is one of the most important components in determining your system's performance.
- It is a volatile memory that means the information is lost after the power is switched off.

Types of RAM:

- i. Dynamic Random Access Memory (DRAM):

In DRAM, the stored data will be lost after a few milliseconds even if the computer is in ON state. So, to prevent data loss, a refreshing circuit is required. It is cheaper but slower to read/write than SRAM. It stores data in the form of charge. It is popularly used at present.

- ii. Static Random Access Memory (SRAM):

SRAM stores data and programs as long as the computer is ON state. It is expensive but faster to read/write than DRAM. It stores data in the form of voltage. It is rarely used at present due to expensive costs and limited storage capacity.

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Differentiate between DRAM and SRAM:

<u>SRAM</u>	<u>DRAM</u>
1. SRAM has lower access time, so it is faster compared to DRAM.	1. DRAM has higher access time, so it is slower than SRAM.
2. SRAM is costlier than DRAM.	2. DRAM costs less compared to SRAM.
3. SRAM requires constant power supply, which means this type of memory consumes more power.	3. DRAM offers reduced power consumption, due to the fact that the information is stored in the capacitor.
4. Due to complex internal circuitry, less storage capacity is available compared to the same physical size of DRAM memory chip.	4. Due to the small internal circuitry in the one-bit memory cell of DRAM, the large storage capacity is available.
5. SRAM has low packaging density.	5. DRAM has high packaging density.

2. Read Only Memory:

- Read Only Memory is abbreviated as ROM.
- It can be used only to perform the read operation, it does not have writing capabilities.
- It is non-volatile memory that means the information stored in it is permanent and is not lost even if the power supply is cut down.
- It is used for permanent storage of programs.
- ROM is cheaper than RAM.

Types of ROM are:

i. **Programmable Read Only Memory (PROM):**

PROM is a programmable ROM. It is once programmable i.e. the user can write data in a PROM only once. User can store permanent programs, data or any kind of information in a PROM. Special equipment called ROM Programmer or ROM burner is available for storing data in PROM.

ii. **Erasable Programmable Read Only Memory (EPROM):**

The data stored in EPROM can be erased by exposing it to ultraviolet (UV) light. When an EPROM is exposed to UV light, the entire data are erased. It is used to store programs, which are permanent but need frequent updating. It is usually reprogrammed without removing it from the circuit board. It is far more economical than PROM as it can be reused.

iii. **Electrical Erasable Programmable Read Only Memory (EEPROM):**

It can be erased and reprogrammed on the byte by byte basis. Either a single byte or the entire chip can be erased in an operation. It requires a much shorter time, a few milliseconds for erasing as compared to EPROM. It need not be removed from the circuit board for erasing as EPROM.

RAM	ROM
1. Random Access Memory.	1. Read Only Memory.
2. It is a Read-Write memory.	2. It is a read only memory.
3. It is a Volatile memory.	3. It is a non-Volatile memory.
4. Data in RAM can be modified.	4. Data in ROM can not be modified.
5. RAM sizes from 64MB to 16GB.	5. ROM is comparatively smaller than RAM.
6. Types of RAM are Static RAM and Dynamic RAM.	6. Types of ROM are PROM, EPROM and EEPROM.
7. RAM is costlier memory.	7. ROM is comparatively cheaper than RAM.
8. Temporary storage.	8. Permanent storage.
9. Used in normal operations.	9. Used for startup process of computer.

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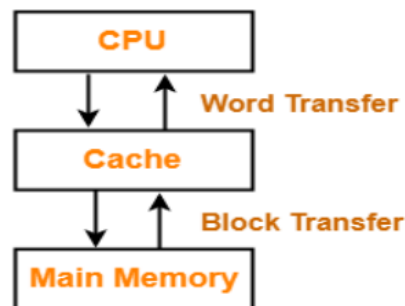
3. Cache Memory:

Cache memory, also called cache, supplementary memory system that temporarily stores frequently used instructions and data for quicker processing by the central processing unit (CPU) of a computer. Cache holds a copy of only the most frequently used information or program codes stored in the main memory.

Features of Cache Memory:

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

Block Diagram of Cache Memory:



Cache and Main Memory

4. Register:

- Registers are small amounts of high-speed memory contained within the CPU. They are used by the processor to store small amounts of data that are needed during processing.
- The register within CPU are special purpose temporary storage location.
- The storage capacity of registers is small.

Secondary Memory:

- Secondary memory is also termed as external memory and refers to the various storage media on which a computer can store data and programs.
- The Secondary storage media can be fixed or removable.
- Fixed Storage media is an internal storage medium like hard disk that is fixed inside the computer.
- Secondary memory are used to store data permanently.

1.Magnetic Tape:

- Magnetic tape is a medium for magnetic recording, made of a thin, magnetic coating on a long, narrow strip of plastic film.
- It was developed in Germany in 1928, based on magnetic wire recording.
- Devices that record and playback audio and video using magnetic tape are tape recorders and video tape recorders respectively.
- A device that stores computer data on magnetic tape is known as a tape drive.



2.Magnetic Disk :

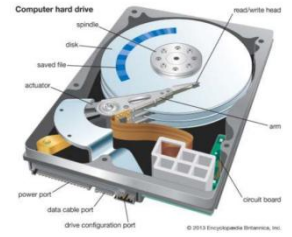
- A magnetic disk is a storage device that uses a magnetization process to write, rewrite and access data.
- It is covered with a magnetic coating and stores data in the form of tracks, spots and sectors.
- Hard disks, zip disks and floppy disks are common examples of magnetic disks.



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2.1 Floppy Disk:

- A floppy disk or floppy diskette is a type of disk storage composed of a thin and flexible disk of a magnetic storage medium in a square or nearly square plastic enclosure lined with a fabric that removes dust particles from the spinning disk.
- Floppy disks are read from and written to by a floppy disk drive.



2.2 Hard Disk:

- Hard disk, also called hard disk drive or hard drive, magnetic storage medium for a computer.
- Hard disks are flat circular plates made of aluminum or glass and coated with a magnetic material.
- Hard Disks are usually fixed into a computer and are used to store data permanently.
- Hard Disks vary in capacity but new versions allow for huge amounts of storage.
- Hard disks for personal computers can store terabytes (trillions of bytes) of information.



3. Optical Disk:

- An optical disk is any computer disk that uses optical storage techniques and technology to read and write data.
- It is a computer storage disk that stores data digitally and uses laser beams (transmitted from a laser head mounted on an optical disk drive) to read and write data.
- Examples: CD-ROM, DVD, VCD etc.



3.1 CD-ROM:

- CD-ROM, abbreviation of compact disc read-only memory, type of computer memory in the form of a compact disc that is read by optical means.
- A CD-ROM drive uses a low-power laser beam to read digitized (binary) data that has been encoded in the form of tiny pits on an optical disk.



3.2 DVD:

- DVD stands for Digital Versatile Disc.
- It is commonly known as Digital Video Disc.
- It is a digital optical disc storage format used to store high capacity data like high quality videos and movies.
- It is also used to store operating system.
- DVDs are widely used for storing and viewing movies and other data.



3.3 VCD:

- VCD is short for "Video Compact Disc".
- A VCD is basically a CD that contains digital video and audio files on it.
- Both the video file and audio track are in MPEG-1 quality.
- SVCD stands for Super Video CD and is similar to a VCD in that it holds digital video and audio files on a CD.



4. Flash Memory:

- Flash memory is an electronic non-volatile computer memory storage medium that can be electrically erased and reprogrammed.
- A kind of memory that retains data in the absence of a power supply.
- Example: Pen drive, Memory Card

4.1 Pen Drive:

- A pen drive, or a USB flash drive, is a portable data-storage device. Pen drives have replaced the floppy drives of old and have become the most popular data-storage devices among consumers.
- Micro, lightweight and handy, a pen drive can be easily carried from place to place by students, professionals, academicians and independent tech consultants.
- Currently available pen drives with storage capacities ranging from 8GB and 32GB can be used to store graphics-heavy documents, photos, music files and video clips.



4.2 Memory Card:

- A memory card is a type of storage device that is used for storing media and data files.
- It provides a permanent and nonvolatile medium to store data and files from the attached device.
- Memory cards are commonly used in small, portable devices, such as cameras and phones.
- A memory card is also known as a flash card.



Interface:

- Interface or port refers to the point or a connector through which data is transferred between two hardware devices, between a user and a program etc.
- An interface is a shared boundary across which two or more separate components of a computer system exchange information
- The exchange can be between software, computer hardware, peripheral devices, humans, and combinations of these.
- In computing the term interface can have various meanings, but all relate to the interaction between one object and another.
- Interface defines how two different types of device can be connected and communication and data flow can occur between them.
- In computer there are different types of interfaces like hardware interface, software interface and user interface.

Hardware Interface:

- Hardware interface is a physical device, port, or connection that interacts with the computer or other hardware device.
- Hardware interfaces refer to the connection and communication of different devices.
- For example, a printer being connected to a USB port is actually connected to the USB interface of the system. Another example of a hardware interface is a graphics card plugged into a PCI slot, which is using the PCI(Peripheral Component Interconnect) interface to connect and communicate.

Software Interface:

- Software interface is a program that allows a user to interact computers in person or over a network.
- A software interface is used to allow either two pieces of software to communicate with each other (software-software interface), or to allow software to communicate with a hardware device (software-hardware interface).
- One of the best examples of an interface is a GUI (Graphical User Interface).

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Software:



- Program is a sequence of instructions.
- An instruction is a command given to the computer to perform the certain specified operation on given data.
- Set of programs written for a computer to perform a particular task is a "Software".
- The logical components or set of procedures to routines or instructions are called software.
- Software is the interface between the computer and the user.

Types of Software:

1. System Software:

- Operating System
- Language Processor
- Utility Software
- Device Driver

2. Application Software:

- Customized or Tailored Software - Packaged Software

1. System Software:

- System Software is the group of programs that directs the internal operations of computer system.
- The purpose of the system software is to make the use of computer more efficient and easier.
- It is used to control and coordinate computer hardware and software.
- System software is usually supplied by the computer manufacturer with computers.
- System software is responsible for resource management, memory management, file management, task scheduling etc.

i. Operating System:

- An operating system is an integrated set of programs that is used to manage the various resources and overall operation of the computer system.
- It acts as an interface between the user of a computer and computer hardware.
- Examples: Windows OS, Apple's Mac OS, Linux, Android etc.

ii. Language Processor:

- It is also known as language translator.
- Language processor is a set of programs that translates statement written in one language into statement in another language.
- Types of language processor are:
 1. Assembler
 2. Compiler
 3. Interpreter

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iii. Utility Software:

- Utility programs is also called System Support Software or Service Program.
- It is a type of s/w designed to help, analyze, configure, optimize or maintain a computer.
- Utility software provides useful services to the user of the computer.
- Utility programs enhance or extend the operating system's capabilities and improve the system performance.
- Example: Antivirus Programs, Backup Utility, Disk Cleaner, Data Compression Software, Firewall etc.

iv. Device Driver:

- A device driver is a program that lets the operating system communicate with specific computer hardware.
- A device driver is a computer program and provides a software interface to hardware devices that operates or controls a particular type of device that is attached to a computer or automaton.
- Many parts of a computer need drivers, and common examples are:
 - ♣ Computer printers.
 - ♣ Graphic cards.
 - ♣ Modems.
 - ♣ Network cards.
 - ♣ Sound cards.

2.Application Software:

- Application software is user oriented software.
- It is used to solve the particular problems of the user and make the user's task easier.
- There must be system software to run application software.

Types:

a) **Tailored or Customized Software :**

- It is a specific purpose software.
- It is software developed according to the need of a particular user or organization.
- This type of software are designed for some specific purpose, for solving specific problem of the particular user and organization.
- It is easier to modify or change the features of software according the requirements.
- Example: Result Publishing Software, Hotel Reservation Software, e-Payment Software, Billing Software etc.

b) **Packaged Software:**

- It is a general purpose software.
- It is a generalized set of programs designed and developed for general purpose.
- It is generally large sized, bug free, advanced and standard software for special work.
- It is well tested and more user friendly.
- It is more reliable and easy to access.
- Examples: Microsoft Office Package, Database Software, Web Designing Software etc.

Programs v/s Software:

On the basis of	Program	Software
Definition	A computer program is a set of instructions that is used as a process of creating a software program by using programming language.	Software is a set of programs that enables the hardware to perform a specific task.
Types	Programs do not have further categorization.	The software can be of two types: system software and application software.
User Interface	A program does not have a user interface.	Every software has a user interface that may be in graphical format or in the form of a command prompt.
Size	Programs are smaller in size, and their size exists between Kilobyte (Kb) to a megabyte (Mb).	Software's are larger in size, and their size exists between megabytes (Mb) to gigabytes (Gb).
Time taken	A program takes less time to be developed.	Whereas software requires more time to be developed.

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On the basis of	Program	Software
Features and functionality	A program includes fewer features and limited functionalities.	It has more features and functionalities.
Development approach	The development approach of a program is unorganized, unplanned, and unprocedural.	The development approach of software is well planned, organized, and systematic.
Documentation	There is a lack of documentation in the program.	Software are properly documented.

Computer Virus:

- Computer virus is a type of self replicating computer program which causes the normal functioning of computer system.
- A computer virus is a malicious piece of computer code designed to spread from device to device and which destroys data, application programs and even the operating system.
- Computer viruses aim to disrupt systems, cause major operational issues, and result in data loss and leakage.

Symptoms of Computer Virus:

- Sometime computer may not boot and hang quickly.
- Viruses shows error message on the screen.
- Changes to your homepage.
- Mass emails being sent from your email account.
- Reduce system performance.
- Unnecessary message, link, figure and picture can be seen on the screen.
- It takes long time to load the program.
- Unknown programs that start up when you turn on your computer.
- Sometimes it changes the size and extension of the files.

Preventive measures for Computer Virus:

- Do not use pirated software.
- Install and upgrade regular antivirus software.
- Scan the mail or unknown file of internet before using or opening it.
- Backup your system on regular basis.
- Use the user password to avoid unauthorized users.

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Types of Computer Virus:

- 1. Message Carrying Virus:** It does not infect the programs and files but sometimes it produces unnecessary messages or pictures on the screen which disturb the computer.
- 2. Boot Sector Virus:** It infects the information system during the startup process.
- 3. System Infector:** It infects the various parts of operating system. It infects the .com, .exe or .sys file in the computer system.
- 4. Multipartite Viruses:** It infects both file and boot sector. This virus is comparatively more infectious and more difficult to remove.
- 5. Polymorphic Virus:** Spread through spam and infected websites, the polymorphic virus are file infectors which are complex and are tough to detect.
- 6. File Infector Virus:** As the name suggests, it first infects a single file and then later spreads itself to other executable files and programs.
- 7. Worm:** This type of virus do not destroy data as such but get into the computer memory and slow down the operation of the computer.
- 8. Macro Virus:** It contains inside file including Microsoft Excel and Word. Because they target software rather than systems, macro viruses can infect any operating system
- 9. Trojan Horse:** It attaches themselves to program but do not replicate and mostly they are used in computer network.

Antivirus:

- Antivirus is a software programs that can protect the device from viruses and eliminate viruses so that the computer system runs smoothly.
- Antivirus software, or antivirus software (abbreviated to AV software), also known as anti-malware, is a computer program used to prevent, detect, and remove malware.

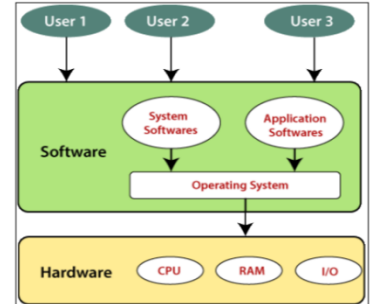
Commonly used Antivirus Software are:

- **Norton Antivirus**
- **F-Secure Antivirus**
- **Kaspersky Antivirus**
- **AVAST Antivirus**
- **Comodo Antivirus**
- **McAfee Antivirus**

UNIT-3

Operating System

- An Operating System (OS) is an interface (communication bridge) between a computer user and computer hardware.
- Operating system is the system software that controls and coordinates the overall function of the computer system and provides as an interface to the user.
- It also controls the resources (hardware and software) of the computer system.
- It also enhances the capability of the computer system.
- The purpose of an operating system is to provide a platform on which a user can execute programs in a convenient and efficient manner.



→ *An operating system is a program that acts as an interface between the user and the computer hardware and controls the execution of all kinds of programs.*

Functions of Operating System:

1. Input-Output Management
2. File Management
3. Memory Management
4. Security Management
5. Process Management
6. Interrupt Handling
7. Deadlock Prevention
8. Command Interpreter
9. Device Management
10. Job scheduling

1. Input-Output Management:

- Operating system allows the computer to interact and control access with peripheral devices such as keyboard, mouse, speaker, modem, monitor and printer etc.
- Input-Output management refers to the transformation of data between input and output devices of the computer system.
- Operating System also manages the input to and output from computer system.
- Operating system handles the speed, functions and design of different attached input/output devices.

2. File Management:

- File management is defined as the process of manipulating files in a computer system, which includes the process of creating, modifying, and deleting the files.
- OS manages files with their different extensions and directories.
- Related to files, Operating system is responsible for:

- Creation and deletion of files.
- Helps in easily and quickly locating these files.
- Access to files for reading and writing.
- Protect files against system failure.
- Saving of files among various users.
- Support for manipulation of files and folders.

3. Memory Management:

- Operating system manages all memory devices on the computer system.
- Operating system handles allocation and de-allocation of memory space as required by various programs.
- Operating system checks how much memory is to be allocated to processes and decides which process will get memory at what time.
- OS keep tracks which memory segment is being used by the processor and which memory segment is free.

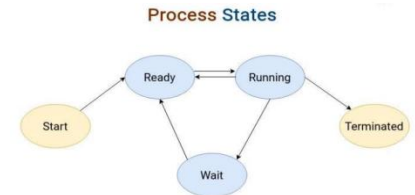
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4. Security Management:

- The protection is the process of securing the data or information or other resources from unauthorized access.
- Related to protection and security, an operating system is responsible for:
 - Protection and security of files and folders.
 - Preventing theft, corruption and loss of data.
 - Hiding the system files and folders from unwanted modification.

5. Process Management:

- A process is an execution of sequence of instruction or program by the CPU.
- Process management is responsible for assigning the processor to the different process so that the resources are utilized in a proper and efficient manner.



6. Interrupt Handling:

- Interrupt is an even that alters the normal processing of computer.
- Interrupt allows the current program to be suspended while higher priority program is execute.
- When interrupts occurs, OS suspends the running process, saves its all states in process control back and run the higher priority program and after its completion, resumes the suspended program.

7. Deadlock Prevention:

- Deadlock is a situation in computer system in which no any process can progress due to endless wait of resources.
- OS ensures that the above situation does not hold, and thus prevents if from deadlock.
 - It takes suitable action by careful allocation of resources such as defining timestamp for each process so that deadlock can be avoided.

8. Command Interpreter:

- Every operating system must provide a command interpreter for its operation.
- Command interpreter can have direct access to the functions of the operating system.
- The command interpreter reads and executes the commands that a user types at a terminal or keyboard, interprets them and translated them into a detailed set of instructions, which computer hardware can understand.

9. Device Management:

- An operating system manages all device communication using their respective device-drivers.
- The device-driver is associated with an OS for their proper work, installed and configured on the computer.
- Operating system performs the task of allocation and de-allocation of the device.

10. Job Scheduling:

- Job scheduling is the process of allocating system resources to many different tasks by an operating system (OS).
- Operating system handles prioritized job queues that are awaiting CPU time and it should determine which job to be taken from which queue and the amount of time to be allocated for the job.

Database Management System

Prepared By: Chiranjeevi Budha

Data:

- ❖ Data is a collection of facts, such as numbers, words, measurements, observations or just descriptions of things. (NWMOD)
- ❖ Data can be manipulated to produce output.
- ❖ Data are the raw facts from which we start to get information.
- ❖ Data can be in any form- numerical, textual, graphical, image, sound, video etc.
- ❖ Example: 5, Kiran, Nepal, House etc.

Information:

- ❖ Information is the processed data i.e. after processing the data we get the information.
- ❖ Information is always meaningful.
- ❖ This information may be in the form of text documents, images, audio clips, software programs, or other types of data.

Example:

Information of students		
S.N.	Name	Address
1.	Sandesh	Dang
2.	Dipendra	Kathmandu

Database:

A database is a collection of related data about a subject organized in a useful manner that provides a meaningful information.

Example: Banking record of the customers, result sheet, records of students, a database of employee etc.

Database Systems:

A database systems consists of a collection of interrelated data and a set of applications programs to access, update and manage the data.

Major Uses of Database Application Software:

- Storing Data
- Accessing data when it is required
- Updating/modifying data
- Deleting or removing data
- Providing securing on the data so that it can be used only by the authorized persons.
- Sharing of data for concurrent access
- Maintaining accuracy of data.
- Reducing data redundancy
- Providing timely and accurate information.
- Maintaining standards or rules to access the data.

Database Management System (DBMS)

- A Database Management System is a set of programs that manages the database files.
- The DBMS allows accessing the files, updating the records, and retrieving data as requested.
- DBMS acts as an interface between the applications programs and the data in the database.
- Example: Microsoft Access, Oracle, MySQL, SQL Server, dBase, FoxPro etc.

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File Processing Systems:

- File Processing System (FPS) is a way of storing, retrieving and manipulating data which is present in various files. Files are used to store various documents.
- A file processing system is a collection of programs that store and manage files in computer hard-disk.
- All files are grouped based on their categories.

Advantages of File Processing Systems:

1. Low Cost
2. Easy to use
3. High Scalability

Disadvantages of File Processing Systems:

- **Slow access time :**

Direct access of files is very difficult and one needs to know the entire hierarchy of folders to get to a specific file. This involves a lot of time.

- **Presence of redundant data:**

The same data can be present in two or more files which takes up more disc space.

- **Inconsistent Data:**

Due to data redundancy, same data stored at different places might not match to each other.

- **Data Integrity Problems:**

The data present in the database should be consistent and correct. To achieve this, the data should must satisfy certain constraints.

- **Difficulty in recovery of corrupt data:**

Recovery or backup of lost and corrupt data is nearly impossible in case of File Processing System.

- **Problem in Concurrent Access :**

When a number of users operates on a common data in database at the same time then anomalies arise, due to lack of concurrency control.

Objectives or Goals of DBMS:

1. To provide a storage area for the mass amount of relevant data.
2. To make access to the data easy for the end-user.
3. To provide response to the user's request for data.
4. To make the latest modification to the database available immediately.
5. To eliminate data redundancy (duplication of data).
6. To allow multiple users to be active at one time.
7. To allow the growth of the database.
8. To protect the data from the physical harm and unauthorized access.

Advantages of DBMS:

1. Data Sharing
2. Reduce data redundancy
3. Integrity can be maintained
4. Data Independence
5. Data Availability
6. Standard can be improved
7. Inconsistency can be avoided
8. Security can be improved
9. Providing multiple user interface
10. Concurrent access of data (data can be shared).

Unit-4

Disadvantages of DBMS:

1. The initial investment is high for implementing DBMS.
2. Proper training is required for staff to work properly in the database system.
3. It is complex to understand and implement.
4. When some fault occurs in one part of the database it affects the other parts as well.
5. The overhead cost of providing security, recovery, and integrity functions.
6. The problem arises if the database is not properly designed or if the database applications systems is not properly implemented.

Field, Record and File:

Field:

- Set of one or more related characters.
- Field name must be unique and meaningful.
- Example: Student_ID, Student_Name, Phone_No

Record:

- Record is a collection of fields treated as a single unit.
- Represents a different entity.

File:

- Collection of related records treated as a single unit.

Student's Record

Student_ID	Student_Name	Phone_No
101	Ram	9803344558
102	Krishhna	9876543212

Database Model:

- The database model describes the structure of a database.
- It is a collection of conceptual tools for describing data, relationships etc.
- It defines how the data are stored and accessed.

Types of database model:

1. Hierarchical Database Model
2. Network Database Model
3. Relational Database Model
4. Object Oriented Model

1. Hierarchical Database Model

-A hierarchical database model is a data model in which the data are organized into a tree-like structure.

- All records in the hierarchy are called nodes.
- Each node is related to the others in a parent-child relationships.
- Each parent record may have one or more child records, each can have only one parent.
- The top-level record in the hierarchy is called the root record.

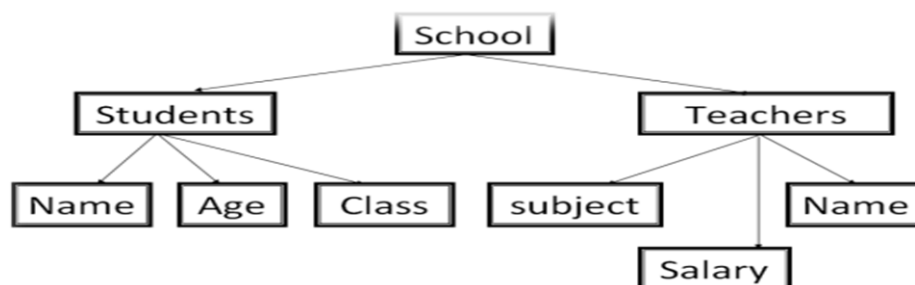


Fig: Hierarchical Database Model

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Advantages of Hierarchical Database Model:

- It is the easiest model of the database.
- Searching is fast and easy if the parent is known.
- It is very efficient in handling one-to-many relationship.
- It helps to build complex system from simple components.

Disadvantages of Hierarchical Database Model:

- It old-fashioned, outdated database model.
- It is not flexible database model.
- It can't handle many-to-many relationships.
- It increases data redundancy as same data can be saved in different places.
- When a parent node is deleted, all the children nodes is deleted automatically.

2. Network Database Model:

- Network database model is a modified version of the hierarchical database.
- In network database structure each node may have several parents.
- A network database model views all records in sets.
- The network database model has a higher level of flexibility than hierarchical mode.
- It is easier to restructure the information stored in this structure.
- A network model is a database model that is designed as a flexible approach to representing objects and their relationships.

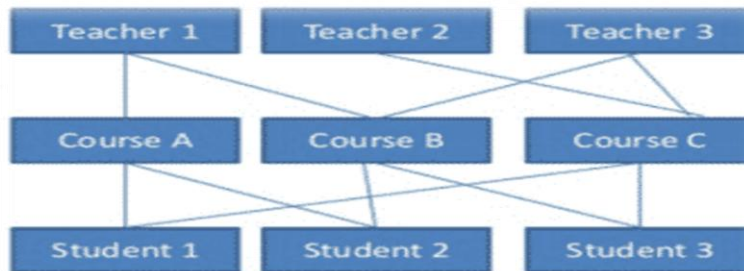


Fig:- Network Database Model

Advantages of Network Database Model:

- It is more flexible than hierarchical model because it accepts many to many relationship.
- It reduces redundancy because data shouldn't be repeated if same data is needed.
- Searching is fast because of multidirectional pointers.

Disadvantages of Network Database Model:

- It is one of the complex database model.
- It needs larger programs to handle the relationships.
- Pointers needed in this model increase the over head of storage.
- It is less secure compared to the hierarchical model, as it is open to all.

3.Relational Database Model:

- Relational database model is a type of database model where data are arranged in two-dimensional table, which are easy for a user to develop and understand.
- In Relational database model, each table represents a relation, and each row of the table corresponds to a single record of the database.
- It is highly flexible to program and retrieve data.
- A relational database consists of a collection of tables, each of which is assigned a unique name.

Example:-

Student

Roll_Number	Name	DOB	Class	Year
101	Ram	1991-03-23	A	I
102	Kiran	1994-02-10	B	II

Unit-4

Course

Course_ID	CName	Duration	Day
C201	Computer	3 Months	Sunday
C202	DBMS	4 Months	Tuesday

Different Features of a relation:

Attribute: Attribute is the name of a column in a relation.

Example: Roll_Number, Name, DOB, Class and Year

Domain: Domain defines the set of all values that an attribute takes on.

The set of all possible values that an attribute takes is called the domain of the attributes.

For Example: The domain of Roll_Number is the set of all Roll_Number in the class.

Null Value: Null Value indicates nothing. An attribute used as the primary key shouldn't have a Null Value.

Tuple: Every row of a relation is called a tuple. Hence relation is a set of tuples. A tuple is also called as a record and there cannot be two identical tuples in a relation.

Advantages of Relational Database Model:

1. Since one table is linked with other, some common fields and rules implemented on one table can easily be implemented to another.
2. It is very less data redundancy.
3. Normalization of the database is possible.
4. Rapid processing of database is possible.
5. Easy to add new data.

Disadvantages of Relational Database Model:

1. It is more complex than other models.
2. Too many rules make database non-user-friendly.

4. Object Oriented Model:

- This model is used to model data in terms of objects and their interactions.
- Data are modeled and created as objects.
- Each object is an independent application or program, assigned to perform a specific task.
- This model can store complex data such as images, audio, video etc.

Relational Database Management System (RDBMS):

- A relational database management system (RDBMS) is a program that allows you to create, update, and delete a relational database.
- RDBMS is used to access and manipulate multiple table at a time.
- In relational database management system, the database is made up of a set of tables.
- The data of one table is related to other tables through a common field.
- Most relational database management systems use the SQL language to access the database.

Advantages of Database System compared to the flatfile system:

- The database system is easier to access, update, manage and retrieve data than the flat-file system.
- Data redundancy is low in a database system.
- Data sharing is easier in a database system.
- Searching and sharing of data are easier than the flat-file system.
- A database system is secured and integrity can be maintained very well.
- A database system is excessively fast execution data than the flat-file system.

Entity, Attribute and Relationship:

Entity: An entity is a name of 'thing' or 'person' or 'object' in the real world that is distinguishable from all other objects.

Example: student, employee, book, loan, account etc.

Entity set is a set of entities of the same type that share the same properties or attributes. For example: the set loan might represent the set of all loans (house loan, car loan, personal loan) provided by a particular bank.

Attribute:

The properties that characterize an entity set are called its attribute. For example: the possible attributes of the customer entity can be Customer_ID, Customer_Name, Customer_address, Customer_telno and Customer_email.

Unit-4

Relationship:

The association between entities is called relationship.

For example, the student takes a class, a professor teaches a class, and a department employs a professor and so on.

For a binary relationship set R between entity sets A and B, the relationship may be:

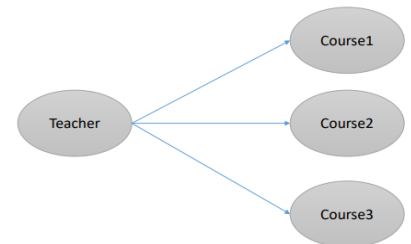
1. One-to-one
2. One-to-many
3. Many-to-many

1. One-to-one: An entity in A is associated with at most one entity in B and an entity in B is associated with at most one entity in A.

For example, in a school database, each student has only one student ID, and each student ID is assigned to only one person.



2. One-to-many: An entity in A is associated with any number of entities in B but an entity in B can be associated with at most one entity in A. **For example:** Relationship between teacher and course.



3. Many-to-one: An entity in A is associated with at most one entity in B but an entity in B can be associated with any number of entities in A.

For example:



Many to One Relationship

4. Many-to-many: An entity in A is associated with any number of entities in B and an entity in B is associated with any number of entities in A.

For example: Relationship between student and course.



Database Design:

- Database design is the organization of data according to a database model. The database designer determines what data must be stored and how the data elements interrelate and fit the data to the database model.
- Database design involves classifying data and identifying interrelationships.
- Properly designed database are easy to maintain and improves data consistency.
- The main objectives of database design in DBMS are to produce logical and physical designs models of the proposed database system.
- Database designs also include ER (entity-relationship model) diagrams. An ER diagram is a diagram that helps to design databases in an efficient way.

A design process includes:

- 1. Determine the purpose of the database** - This helps prepare for the remaining steps.
- 2. Find and organize the information required** - Gather all of the types of information to record in the database, such as product name and order number.
- 3. Divide the information into tables** - Divide information items into major entities or subjects, such as Products or Orders. Each subject then becomes a table.
- 4. Turn information items into columns** - Decide what information needs to be stored in each table. Each item becomes a field, and is displayed as a column in the table. For example, an Employees table might include fields such as Last Name and Hire Date.
- 5. Specify primary keys** - Choose each table's primary key. The primary key is a column, or a set of columns, that is used to uniquely identify each row. An example might be Product ID or Order ID.

Unit-4

6. Set up the table relationships - Look at each table and decide how the data in one table is related to the data in other tables. Add fields to tables or create new tables to clarify the relationships, as necessary.

7. Refine the design - Analyze the design for errors. Create tables and add a few records of sample data. Check if results come from the tables as expected. Make adjustments to the design, as needed.

8. Apply the normalization rules - Apply the data normalization rules to see if tables are structured correctly. Make adjustments to the tables, as needed.

E-R Diagram:

-Entity Relationship Diagram

E-R diagram is a graphical representation of different entities and their relationship.

E-R diagram is used to express graphically overall logical structure of a database.

We use different components to make a E-R diagram:

Rectangle  - It represents the entity. It contains objects used in relational database.

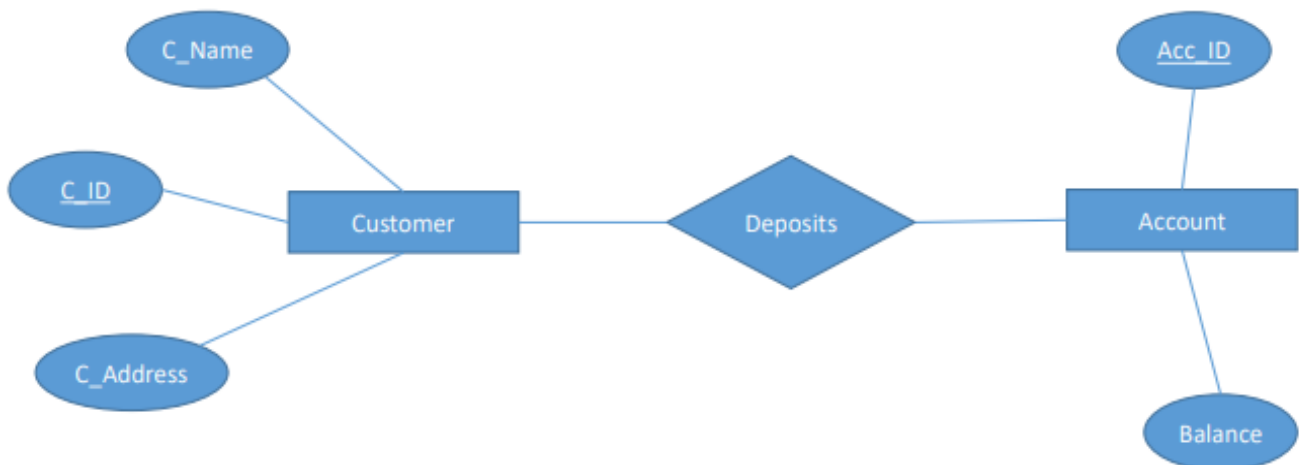
Oval or Ellipse  - It represents attributes of entities.

Diamond  - It represents the relationship among entities.

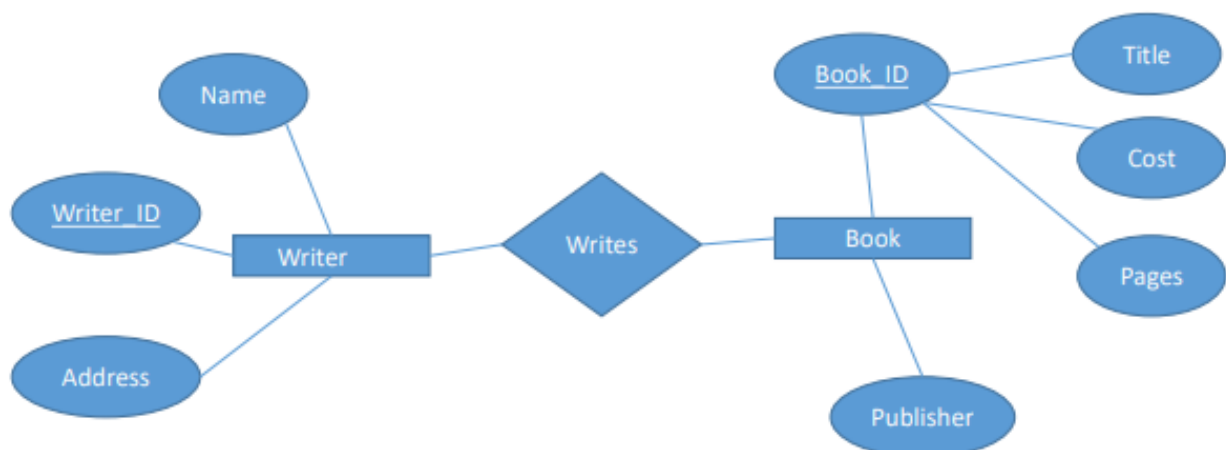
Line  It is used to link attributes to entity sets and entity set to the relationship and vice versa.

Example of E-R Diagram:

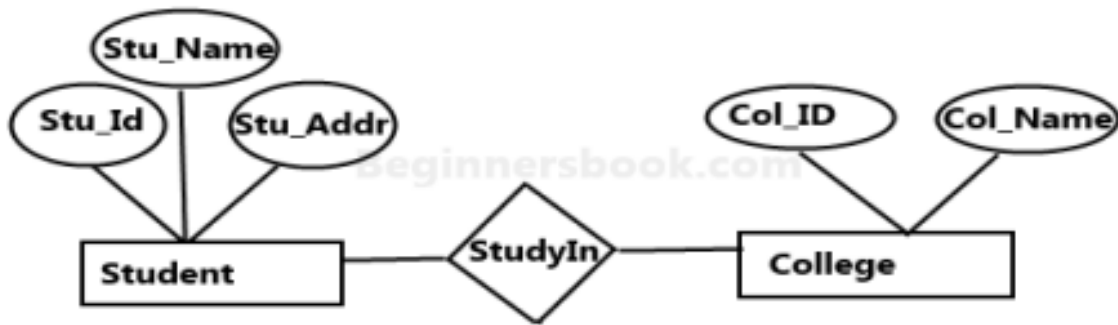
An E-R diagram for relation customer deposits amount in his account.



An E-R diagram for the relationship writer writes book:



Unit-4



Sample E-R Diagram

Advantages of E-R Diagram:

- It provides a visual representation of the database design.
- It is simpler and easier to understand.
- It allows designers for effective communication about the features of the database.
- It is highly flexible to use as additional relationship can be added as per need.
- It supports in physical database design.
- It provides a higher level description of the system.

Database Security:

- Database security refers to the collective measures used to protect and secure database and database files.
- Database security is the method of securing database from unauthorized access and accidental threats.
- Unauthorized access may include leaking or theft of information, unauthorized modification of data in database and destruction of data.
- Database security is designed to protect the confidentiality, integrity and availability of data in the database.

Importance of Database Security:

- To protect data from the threats.
- To protect from the unauthorized access.
- To maintain the quality of database.
- It's expensive and complicated to fix.

Structured Query Language (SQL):

- SQL is used to communicate with a database.
- SQL is a standard language for accessing and manipulating databases.
- According to ANSI (American National Standards Institute), it is the standard language for relational database management systems.
- SQL statements are used to perform tasks such as update data on a database, or retrieve data from a database.

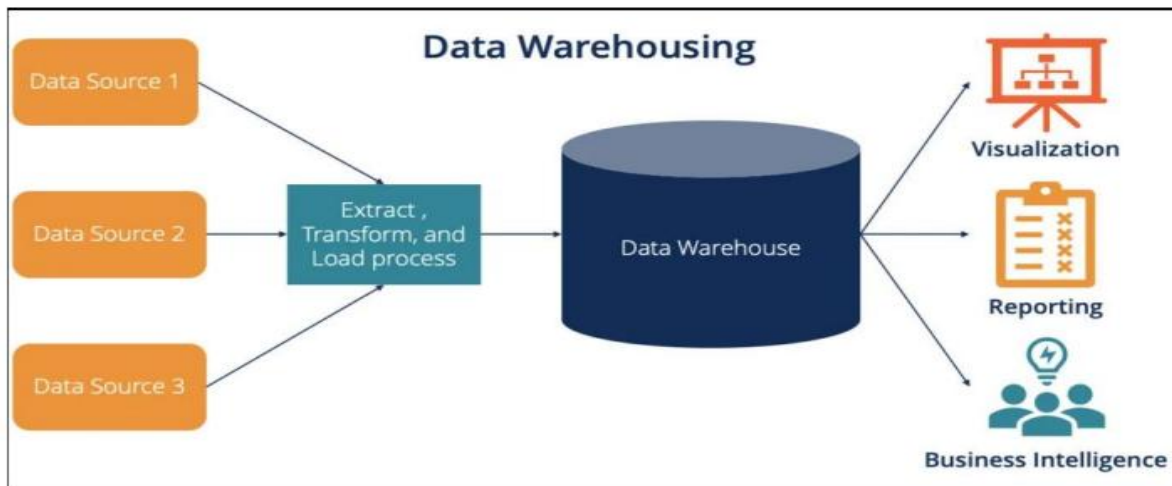
SQL Commands are grouped into:

1. Data Definition Language (DDL)
2. Data Manipulation Language (DML)
3. Data Control Language (DCL)

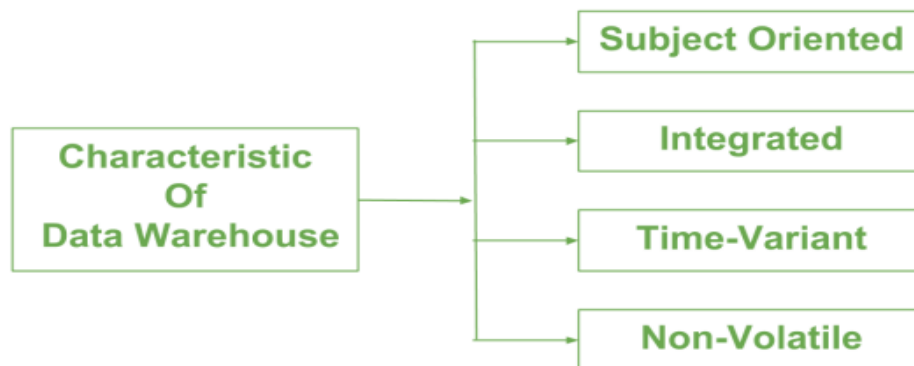
Unit-4

Data Warehouse:

- Data Warehousing is the process of collecting, organizing, and managing data from disparate data sources to provide meaningful business insights and forecasts to respective users.
- A Data Warehouse (DW) is a relational database that is designed for query and analysis rather than transaction processing.
- It includes historical data derived from transaction data from single and multiple sources.
- A Data Warehouse is a group of data specific to the entire organization, not only to a particular group of users.
- A Data Warehouse provides integrated, enterprise-wide, historical data and focuses on providing support for decision-makers for data modeling and analysis.
- It is not used for daily operations and transaction processing but used for making decisions.



Characteristics of Data Warehouse:



Benefits of Data Warehouse:

- Saves Time.
- Improves Data Quality.
- Improves Business Intelligence.
- Leads to Data Standardization and Consistency.
- Enhances Return on Investment (ROI)
- Stores Historical Data.
- Increases Data Security.

Applications of Data Warehouses:

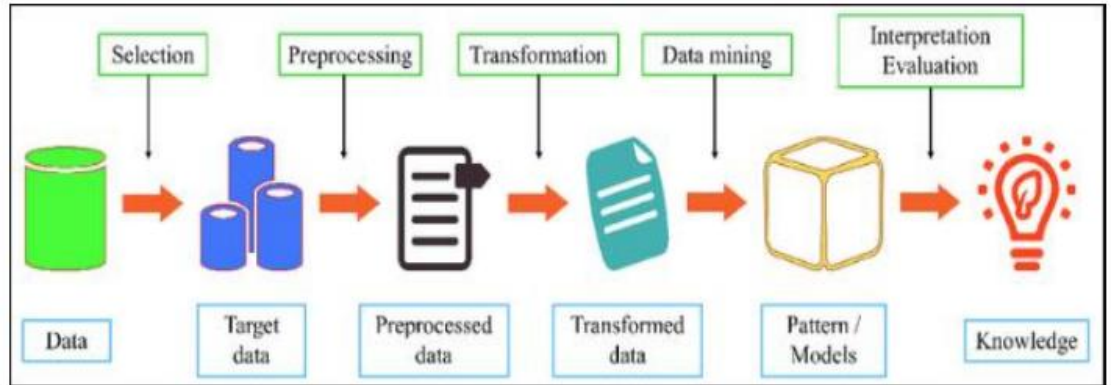
- Consumer goods
- Banking services
- Financial services
- Manufacturing
- Retail sectors

Unit-4

Data Mining:

- Data mining is the process of extracting useful information from the large set of data.
- Data mining is also known as KDD (Knowledge Discovery from Data).
- The process of extracting information to identify patterns, trends, and useful data that would allow the business to take the data-driven decision from huge sets of data is called Data Mining.
- Data Mining is a process used by organizations to extract specific data from huge databases to solve business problems.

Data Mining Process:



Features of Data Mining:

- It is good with large databases and datasets
- It predicts future results
- It creates actionable insights
- It utilizes the automated discovery of patterns

Advantages of Data Mining:

- Market Analysis
- Fraud Detection
- Trend Analysis
- Risk Management
- Market Basket Analysis
- Future Prediction

Database Administrator (DBA):

- A Database Administrator (DBA) is individual or person responsible for controlling, maintenance, coordinating, and operation of database management system. Managing, securing, and taking care of database system is prime responsibility.
- DBA makes the strategy and policy decisions regarding the database.
- A database administrator (DBA) is a specialized computer systems administrator who maintains a successful database environment by directing or performing all related activities to keep the data secure.

Roles and Duties of DBA:

- Defining the internal schema of database.
- Defining the external schema of database.
- Installing and upgrading the database server and application tools.
- Defining security and integrity rules.
- Defining backup and recovery procedures.
- Monitoring performance and responding to the changing requirements.
- Supporting database design, creation, and testing activities.
- Identifying the problems and presenting the solutions.
- Allocating system storage and planning future storage requirements for the database system.
- Controlling and monitoring user access to the database.

Introduction to Communication

- The word “ Communication ” is derived from the Latin word “Communicare” which means “to share”.
- Communication is the process of sharing messages from one point to another point. OR Communication is the transfer of information from one or more people to other people.
- **Example**: “Conversation between two persons”.

Telecommunication:

- Telecommunication is the transmission of messages, over significant distance, for the purpose of communication.
- Telecommunication enables people to communicate over long distances.
- **Examples:** Mobile Phones, Landlines, Satellite, Radio, Television etc.

Data Communication:

- Data communication means sharing of data in various forms like text, images, audio, videos etc.
- It is the transmission of data or information between a source and a receiver where source transmits the data and the receiver receives the data.
- **Examples:** E-mails, instant messages, digital phone calls, chatting etc.

Elements of Data Communication:

1. Sender
 2. Medium
 3. Receiver
 4. Protocols
-

1. Sender :

The person, computer or device that is used for sending data is called sender, source or transmitter. In modern digital communication system, the source is usually a computer.

2. Medium:

Medium means through which data flows from one location to another is called transmission medium. Wired or wireless mediums are used to connect receiver and sender.

3. Receiver:

The device or computer that receives that receives the data is called receiver. The receiver can be a computer, printer or photocopy machine.

4. Protocols:

The set of rules and formats under which data transmission takes place between sender and receiver is called protocols.

The data communication software are used to transfer data from one computer to another. The software that follows the same communication protocols can communicate and exchange data.

Block Diagram of Communication System:

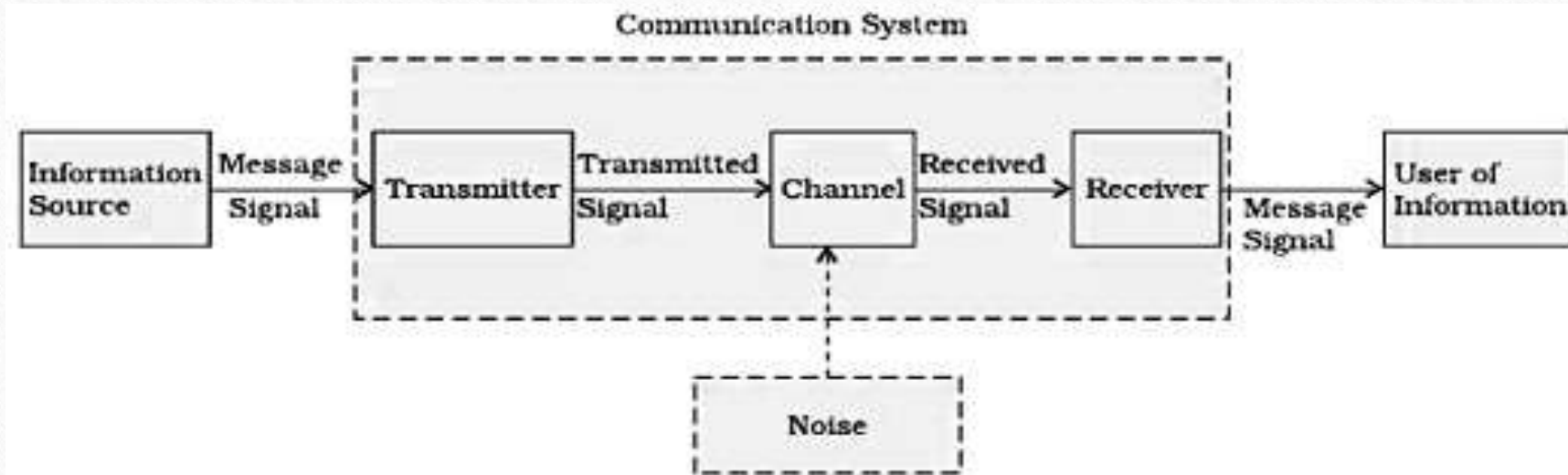


FIGURE 15.1 Block diagram of a generalised communication system.

Modes of Data Transmission:

- The way in which data is transmitted from one location to another location is called data transmission mode.

1. Simplex Mode

2. Duplex Mode

1. Simplex Mode:

- In simplex mode, data is transmitted in only one direction on the data communication medium.

Continue of Simplex mode.....

- In simplex mode, a terminal can only send data but can not receive it OR it can only receive the data but can not send.
- It is not possible to confirm successful transmission of data in simplex mode.
- It is the cheapest communication method.
- **Examples**: Radio, Television, Newspaper etc.

2. Duplex Mode:

- In duplex mode, data is transmitted in both direction.
- In this mode, receiver is not a passive who can response to the sender.

i. Half Duplex Mode

ii. Full Duplex Mode

i. Half Duplex Mode:

- In half duplex mode, data can be transmitted in both direction but only in one direction at a time.
- Data transmission rate is slow.
- In half duplex modes, transmission of data can be confirmed.
- **Examples:** Walkie- Talkie, Fax machine etc.

ii. Full Duplex Mode:

- In full duplex mode, data can be transmitted in both directions simultaneously.
- It is a faster mode for data transmission because there is no time wastes in switching directions.
- **Example:** Telephone, Router etc.

Analog and Digital Signals:

Analog Signals	Digital Signals
1. Analog Signals are continuous signals.	1. Digital Signals are discrete signals.
2. Analog signal uses continuous values for representing the information.	2. A digital signal uses discrete values for representing the information.
3. Analog signals can be affected by the noise during the transmission.	3. Digital signals cannot be affected by the noise during transmission.
4. Analog signal are stored in the form of continuous wave form.	4. Digital signals are stored in the form of binary bits “0” and “1”.
5. Examples: Weather temperature, Humidity, Human Voice, Heart Beat etc.	5. Examples: digital transmission,

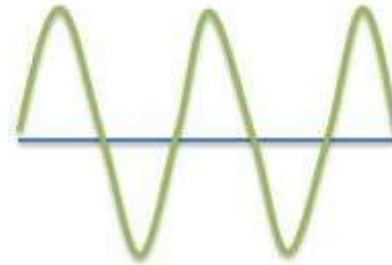
Analog and Digital Signals:



Analog Signal



Digital Signal



Analog
Signal

Vs

0100111101

Digital
Signal

Representation of Signals

Modem:

- Modem stands for “ **Modulator and Demodulator**”.
- It is an electronic device, which allows the computer to send and receive data through telephone lines.
- The main purpose of modem is to convert analog signals into digital signals and vice versa.
- Modem can be either wired or wireless.

Bit:

- Bit stands for “**B**inary **d**igit”.
- It is the smallest data measuring unit in communication system.
- The transmission of data in computer takes place in terms of bits.
- Each bit of binary digit is 0 or 1.

Bandwidth:

- Bandwidth is the amount of data that can be transmitted through a communication channel during a specified period of time.
- It is the data handling capacity of a communication system.
- The Bandwidth of digital signal is measured in bits per second (bps).
- The Bandwidth of analog signal is measured in cycle per second (cycle/sec) or Hertz.
- The Bandwidth of modem is measured in bits per second (bps).

Introduction to Computer Network

- Computer network is the interconnection of several computers so that they can communicate, share resources and transfer data and information.
- In the computer network many computers of the same location or different locations are connected with each other by means of wired or wireless media.

Advantages of Computer Network:

- In the computer network we can easily share the information with the other computer.
- Computer connected to the network can share peripherals devices like printer, hard disk etc.
- It can share software between member workstations which saves money for not buying multiple copies of system or programs.
- Network helps to keep information reliable and up-to- date.
- Networking also provides the function of backup.

Disadvantages of Computer Network:

- Computer virus spreads mostly through network.
- Fear of misappropriation of data.
- The initial setup cost is very high.
- Cyber crime may be occurred.

Types of Computer Network:

-  1. Local Area Network (LAN)
-  2. Metropolitan Area Network (MAN)
-  3. Wide Area Network (WAN)

1. Local Area Network (LAN):

Features of Local Area Network:

- It covers small area such as a room, a building or a school or an organization etc.
- It offers a high speed data transfer rate about 10 to 100 Mbps (Mega bits per second).
- It is normally owned by a single organizations.
- It uses guided transmission media.
- It is unaffected by any environment factors.

2. Metropolitan Area Network (MAN):

Features of Metropolitan Area Network:

- It covers a larger geographical area than LAN such as an university, an entire city, a valley , a district or a zone and connects larger number of computers.
- It uses cable or wireless communication media to connect computers.
- It connects multiple LANs in different locations by using Ethernet Technology.
- It owned by a single or multiple organizations.
- It offers a number of network services compatible with bandwidth form 128kbps to 1Gbps.

3. Wide Area Network (WAN):

Features of Wide Area Network:

- It is not restricted to a geographical locations such as Internet. It covers whole world.
- It uses satellite links or microwave systems to connect several LANs and MANs.
- It is owned by multiple organizations.
- This technology is very expensive to setup.
- Data Transmission in WANs is slower than LANs and WANs.

LAN Topologies

Network Topology/ LAN Topologies:

- A network topology is the physical and logical arrangement of computers, cables and other components on a network.
- Topology defines the structure of the network of how all the components are interconnected to each other.
- Network topology is the logical way of explaining how computers are connected each other and shows physically how they are linked.
- There are two different aspects to the network topology, one is **physical topology** that describes the actual physical layout or pattern of cabling that connect the nodes and another is **logical topology** which describes the path that takes signals as they flow through the network.

Network Topology:

- Network topologies are often represented as a graph.
- The type of network topology differs depending on how the network needs to be arranged.

Types of Network Topology:

1. Bus Topology
2. Ring Topology
3. Star Topology
4. Mesh Topology
5. Hybrid Topology
6. Tree Topology

1. Bus Topology:

- A bus topology has one single long cable(called bus) acts as backbone to connect all the devices in the network.
- Topology in which all the computer are connected to same link(bus) is called bus topology.

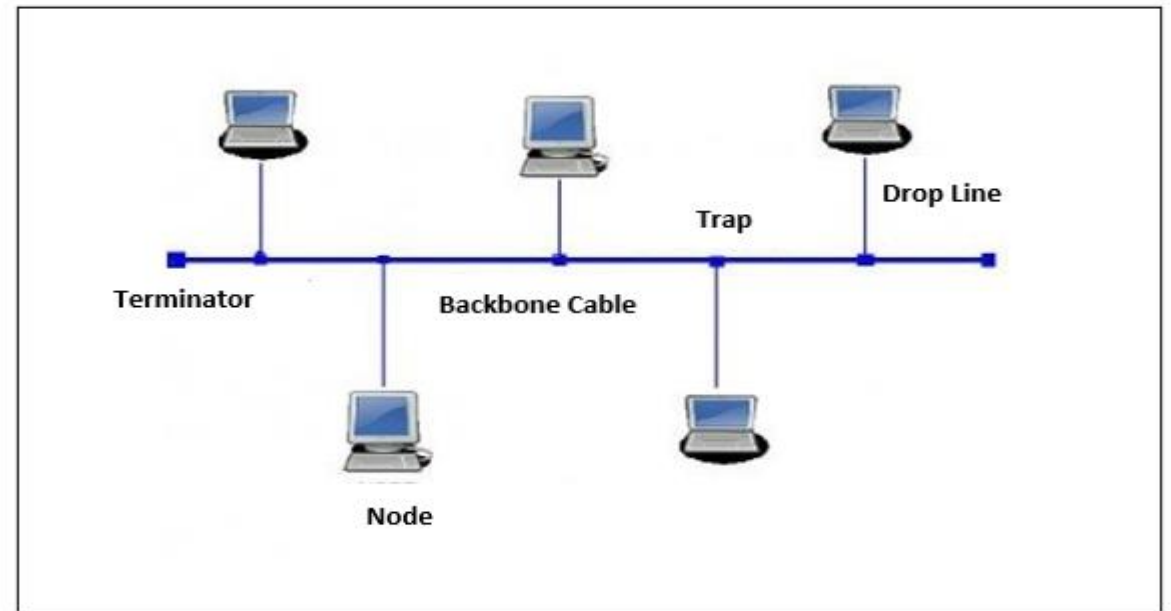


Figure 1: Bus Topology

1. Bus Topology:

- Nodes are connected to the bus cable by drop line and drop lines are connection running between the device and the main cable.
- Bus topology is that topology that used multipoint connection.
- Message can transmit in both direction in bus.
- Co-axial cables are mostly used.
- It consists of the main cable with terminators at both ends.
- The data signal is available to all computers connected to the bus.
- The data signal carries the address of the destination computer.
- It is good for connecting 15-20 computers.

Advantages of Bus Topology:

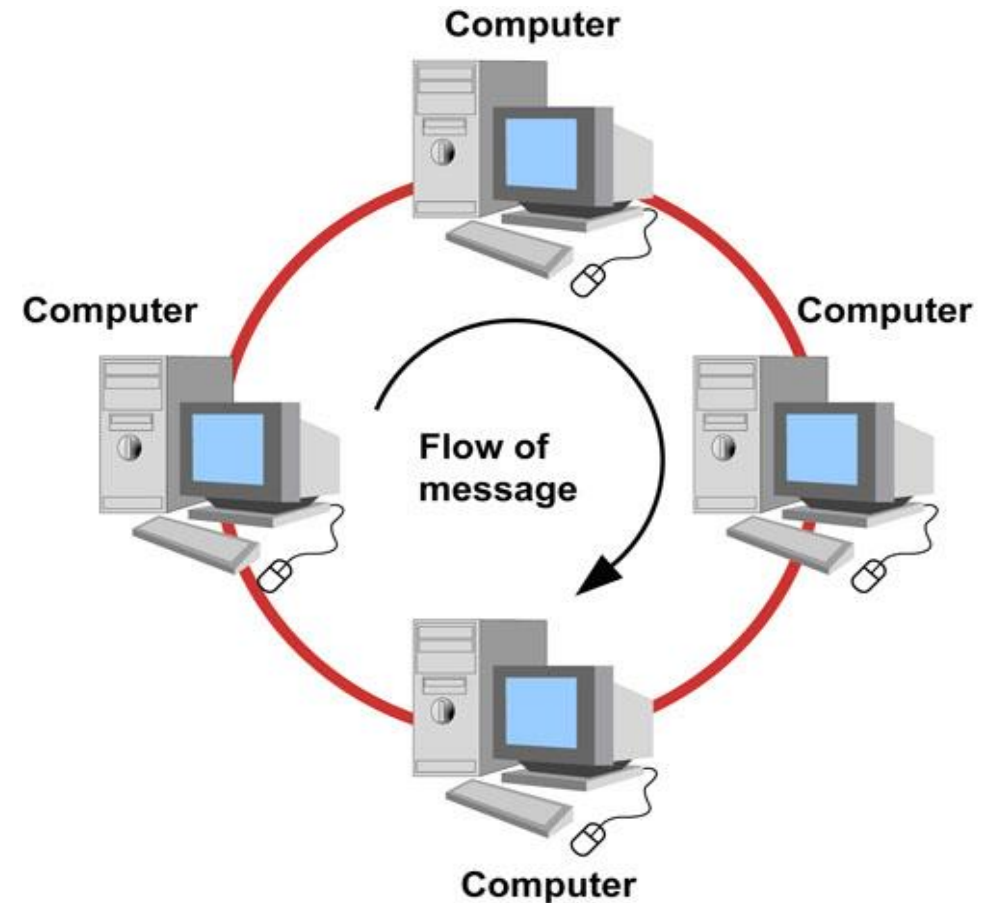
- It is simple, reliable, easy to use and easy to understand.
- New computer can be added to the network easily.
- Less cable required.
- Failure of one computer does not affect other.
- It works well when you have a small network.

Disadvantages of Bus Topology:

- When the backbone cable fails, whole network fails.
- Difficult in identification of the error cause.
- Adding new devices may require modification or replacement of backbone.
- Terminators are required for both ends of the main cable.
- There is a risk of data collision since many devices share the same bus for transfer data.

2. Ring Topology:

- In ring topology, each node is exactly connected to two other nodes on either side of it and finally form a closed loop.
- A signal is passed along the ring in one direction, from device to device until it reaches the destination.
- Each node in the topology share a ring by passing a token that specifies whose turn it is.
- Ring network does not have terminated ends, thus data signals travel in a circle.
- The protocols used to implement ring topology are Token Ring.



Advantages of Ring Topology:

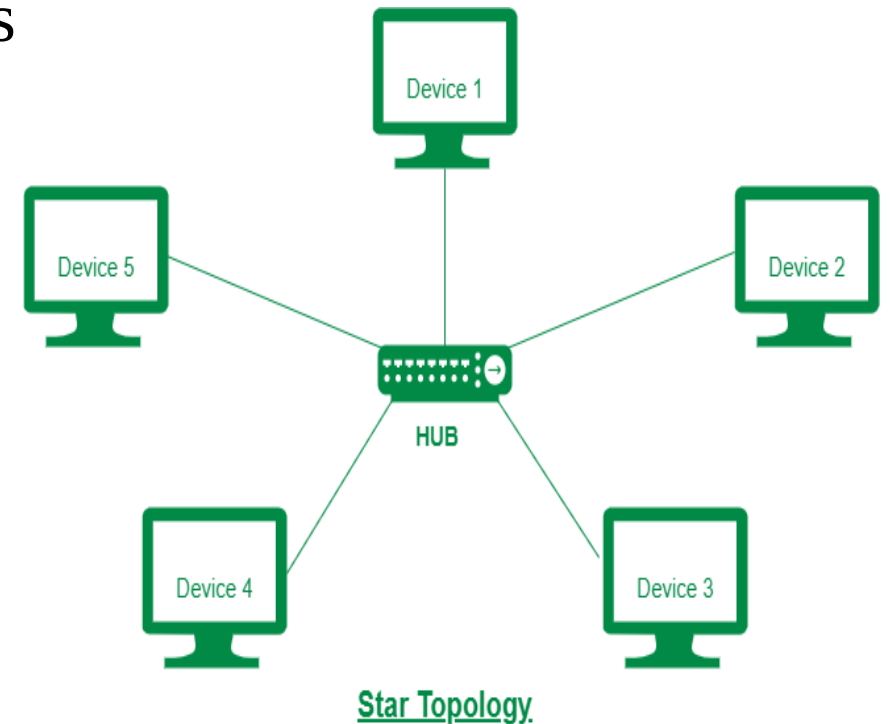
- All data flows in one direction, reducing the chance of packet collisions.
- Data can transfer between workstation at high speeds.
- Fault isolation is simplified.
- Less expensive than star and mesh topology.
- Additional workstations can be added without impacting performance of the network.

Disadvantages of Ring Topology:

- If at any point the cable breaks the entire network stop functioning.
- Failure of one node causes the failure of whole network.
- More cabling is needed than a bus topology.
- There is delay in communication between the nodes if there are large numbers of nodes in the network.

3. Star Topology:

- A network topology in which each of the devices and computers on a network connect to a central hub is called star topology.
- All devices are connected through a central link forming a star-like structure.
- The computers are connected to the central hub using twisted pair cables, coaxial cables or optic fibers.
- Star topology is the most popular topology to connect computer and devices in network.
- The signal is transmitted from the source computer to the destination computer via the central hub.



Advantages of Star Topology:

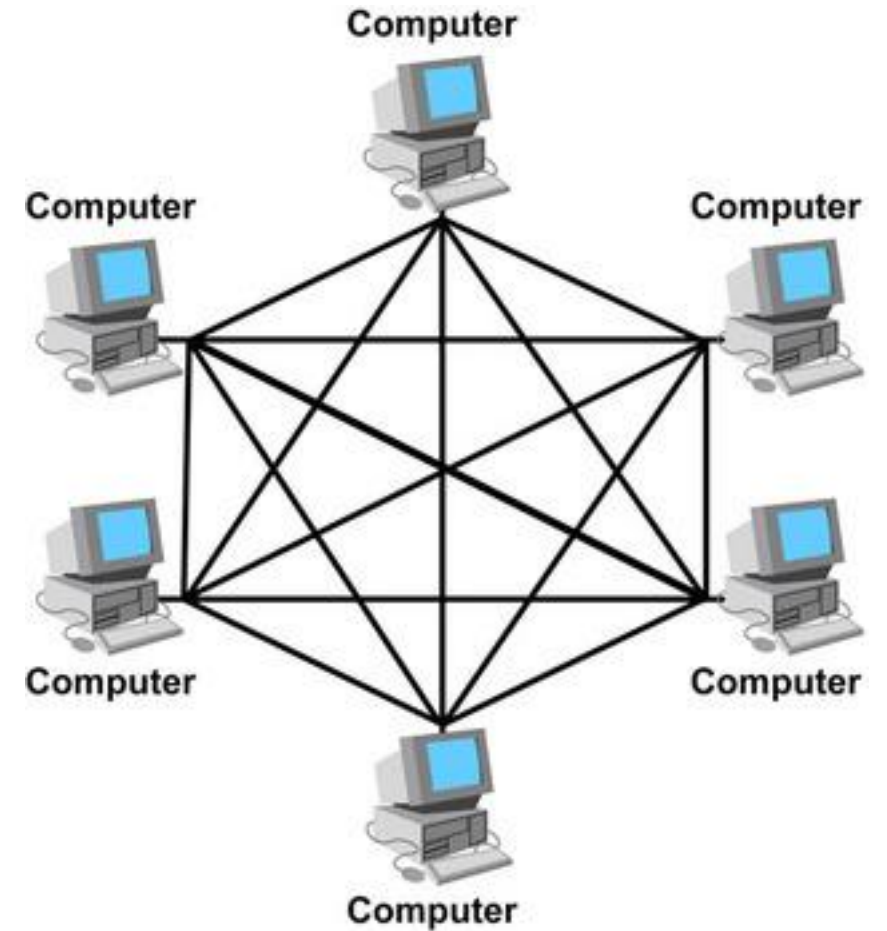
- Easy to install and reconfigure.
- It is easy to remove and add new computers to star topology without disturbing the rest of the network.
- Failure of one node does not affect the whole network.
- Centralized control.
- Higher Security

Disadvantages of Star Topology:

- If the central hub fails, the whole network fails or stops.
- Data collision rate is high.
- It requires extra device.
- It is expensive than bus and ring topology as require more cable than bus and ring and need of hub.

4. Mesh Topology:

- In a mesh topology each node (device) has a dedicated point to point link to every other node(device). The term dedicated means that the link carries data only between the two devices it connect.
- A fully connected mesh network has $\frac{n(n-1)}{2}$ physical channels (paths) to link n devices and every device in the network must have $(n-1)$ input/output ports.



Advantages of Mesh Topology:

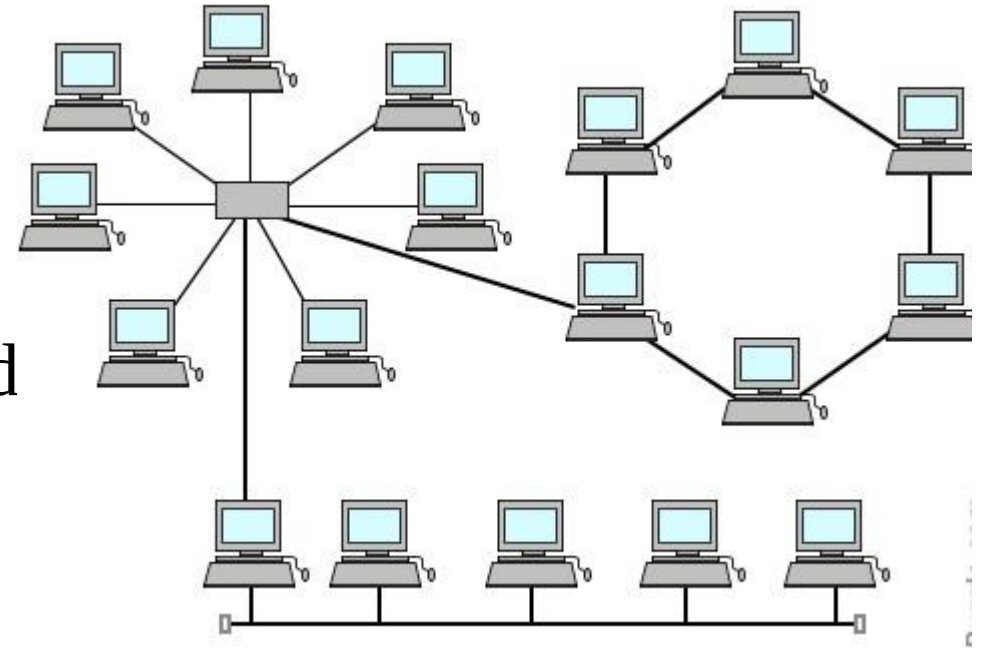
- Due to dedicated link there is no traffic problem.
- If one link fail it does not affect the whole network.
- High security and privacy due to dedicated link only the intended recipient sees it, other can not access it.
- Fault identification and isolation easy due to point to point link.

Disadvantages of Mesh Topology:

- Expensive- it requires huge amount of cable and large number of i/o ports.
- Difficult to add and remove nodes.
- Impractical for most workspace environments.

5. Hybrid Topology:

- Hybrid topology is a topology with two or more topologies are combined.
- These topologies can include a mix of bus, mesh, ring, star and tree topologies.
- Two common technologies used in hybrid topologies are:
 - Star-Ring Hybrid Technology
 - Star-Bus Hybrid Technology



Advantages of Hybrid Topology:

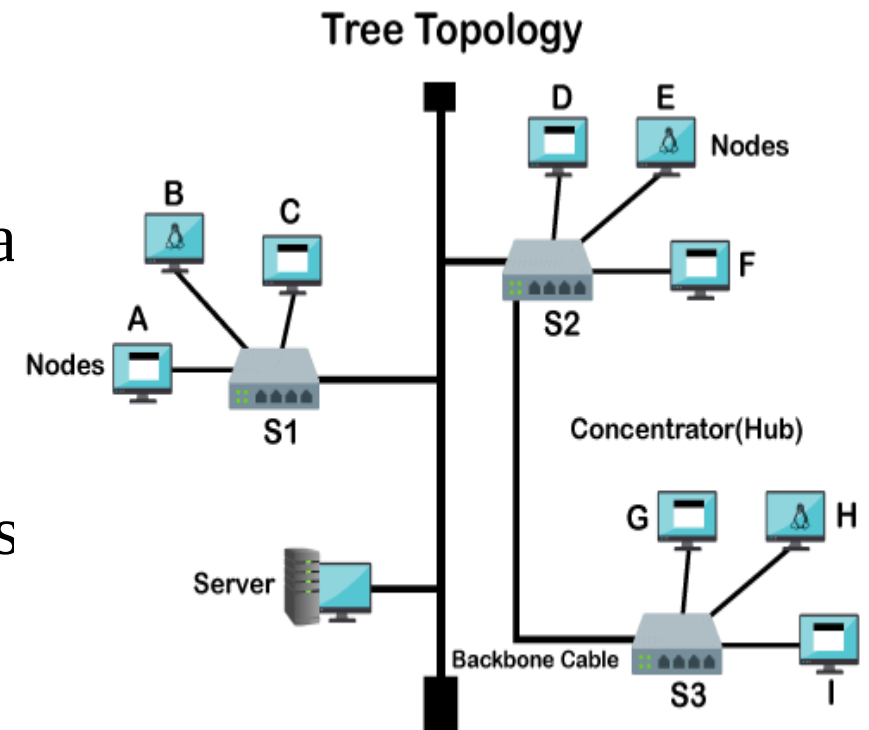
- **Scalable** – It is easy to increase the size of network by adding new components.
- Hybrid network is developed as per need of the small and large organization.
- It have the strength of all the topologies combined.

Disadvantages of Hybrid Topology:

- Expensive due to additional networking devices.
- Difficult to design and implement.

6. Tree Topology:

- Tree Topology is a topology which is having a tree structure in which all the computers are connected like the branches which are connected with the tree.
- In Computer Network, tree topology is called a combination of a Bus and Star network topology.
- Tree network topology is considered to be the simplest topology in all the topologies which is having only one route between any two nodes on the network.
- Tree topology is one of the most popular among the five network topologies.



Advantages of Tree Topology:

- It provides high scalability as leaf nodes can add more nodes in the hierarchical chain.
- Failure of a node does not affect the entire network.
- Easier to find the fault nodes or hubs in the network.

Disadvantages of Tree Topology:

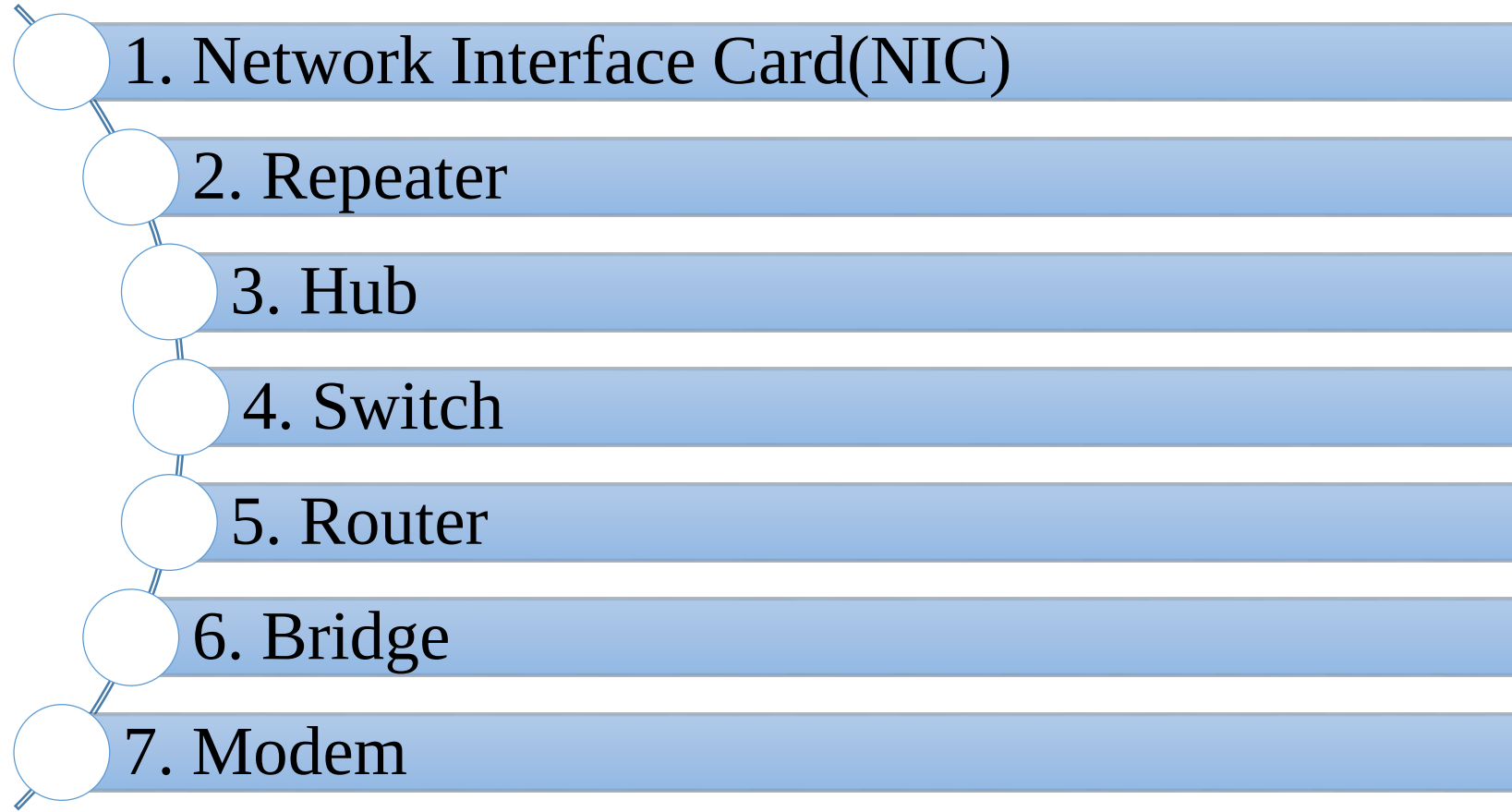
- Expensive as it require large number of cables and networking devices.
- Failure of root nodes (or backbone cable) causes the failure of entire network.
- Difficult to configure than other topologies.

Network Devices

Network Devices:

- The devices having two or more ports to which the computers and other devices can be connected in the network are called network devices.
- Network devices has two main functions:
 1. it amplifies the signal to restore the original strength of the signal.
 2. it provides an interface to connect multiple computers and devices in a network.

Network Devices:

- 
1. Network Interface Card(NIC)
 2. Repeater
 3. Hub
 4. Switch
 5. Router
 6. Bridge
 7. Modem

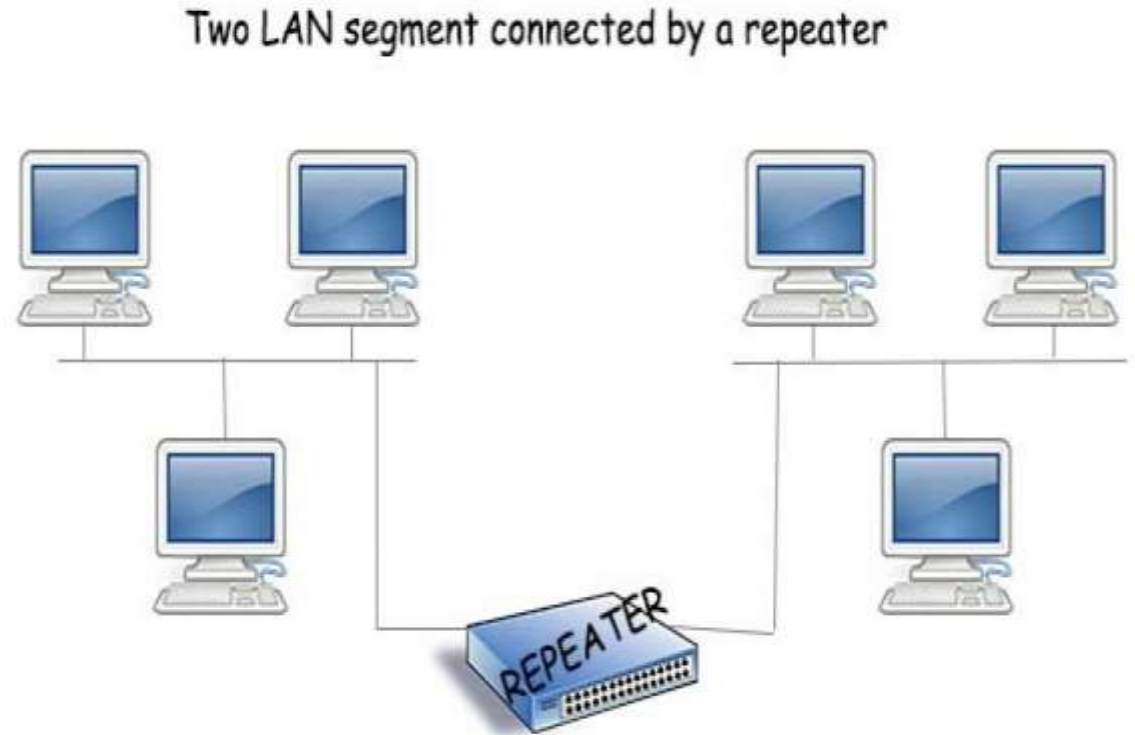
1. Network Interface Card(NIC):

- Network Interface Card is also known as Network Adapter or Network Cards or LAN card.
- A NIC is a hardware device through which the computer connects to a network.
- It is inserted in the slot on the motherboard and provides the physical connection between the network cable and computer.
- NIC has a permanent media access control (MAC) address.
- NIC work at both the data link layer and physical layer of the OSI reference model.



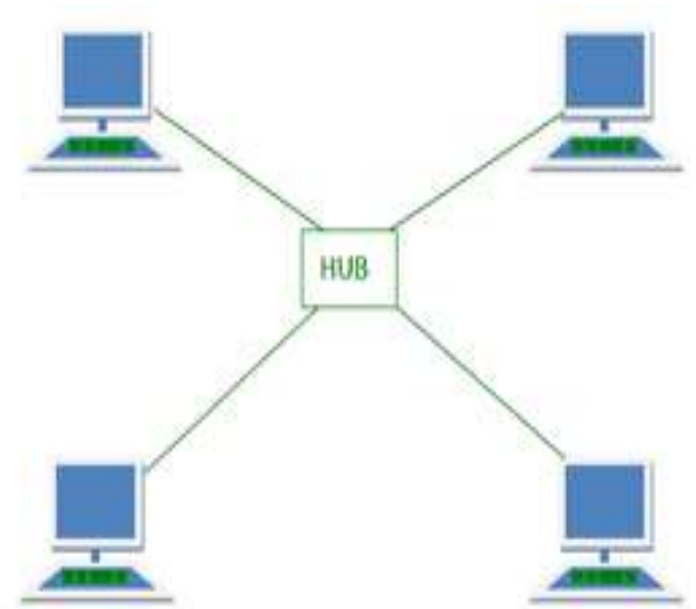
2. Repeater:

- Repeater are used to regenerate an incoming signal before retransmitting it.
- Repeater works at the physical layer of the OSI reference model.
- Repeaters are used to extend LAN. It has only two ports and can connect only two segments of a network.
- They are incorporated in networks to expand its coverage area.



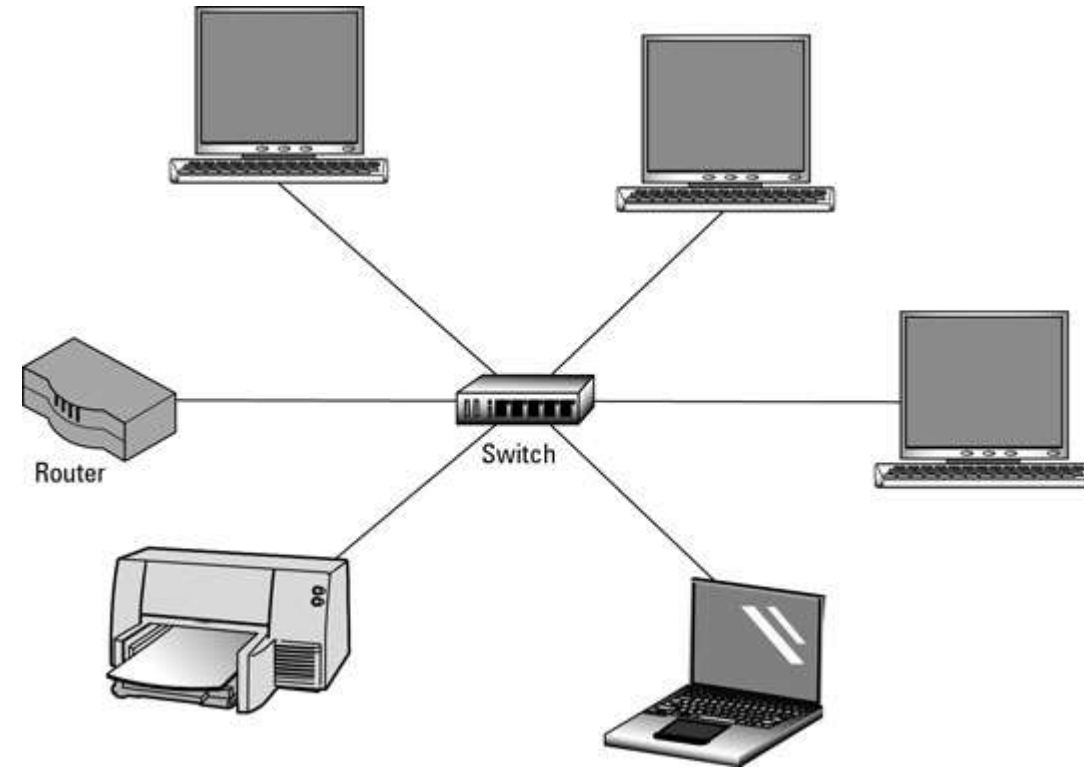
3. Hub:

- Hub is a multiport networking device which divides the network connection among multiple devices.
- Hub will broadcast the message to all the connected devices in the network. The all the devices will check whether the message belongs to them or not. If not, the message will be dropped.
- Hubs do not perform packet filtering or addressing functions; they just send data packets to all connected devices.
- Hubs operate at the Physical layer of the Open Systems Interconnection (OSI) model.
- There is more network traffic in the Hub.
- It is like a repeater with multiple ports but hub does not amplify the incoming signal.



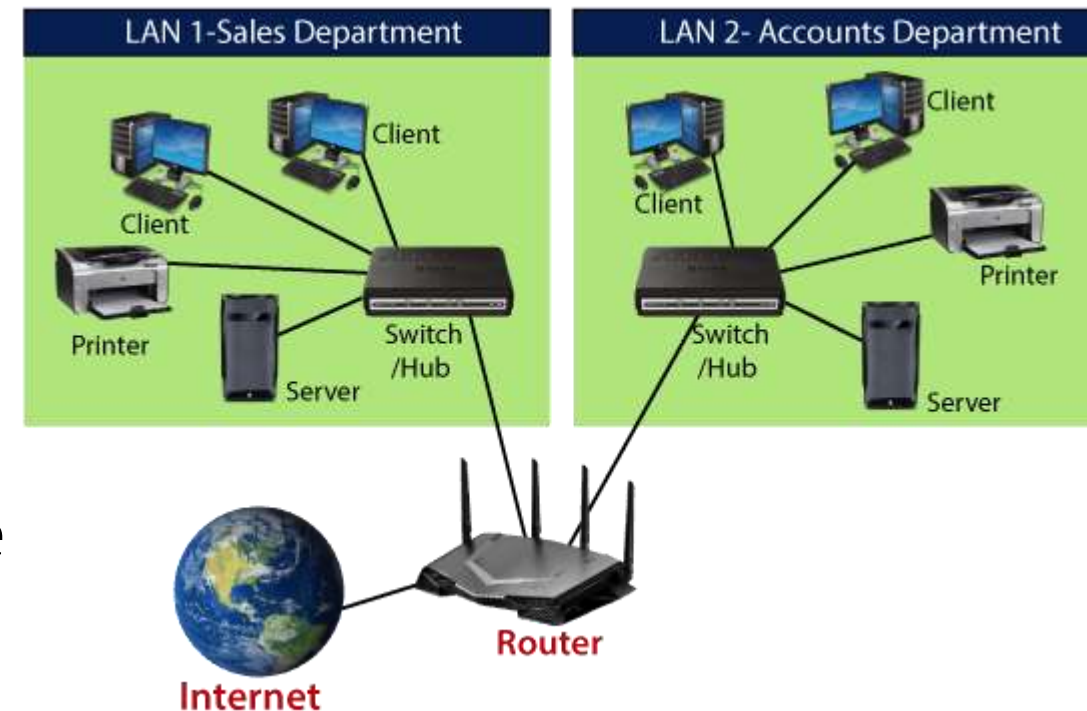
4. Switch:

- A switch is a hardware device that connects multiple devices on a computer network.
- The switch contains the updated table that decides where the data is transmitted or not.
- Switch delivers the message to the correct destination based on the physical address present in the incoming message.
- A switch does not broadcast the message to the entire network like Hub.
- It is more intelligent than Hub.
- Switch works at the data link layer of an OSI reference model.



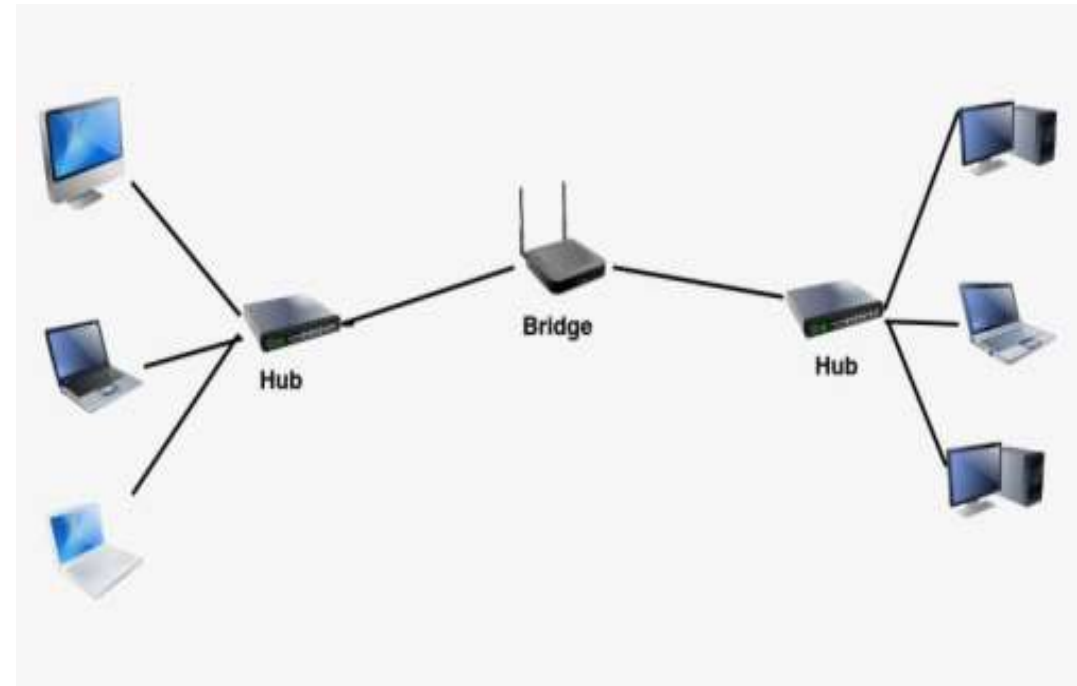
5. Router:

- Router is a networking device used to connect two different network that are running on two different protocols.
- Routes data from one network to another based on their IP address.
- A router works at the network layer of OSI model.
- A router forwards the packet based on the information available in the routing table.
- It determines the best path from the available paths for the transmission of the packet.
- A router has a processor, memory and i/o interface for each network to which it connects.



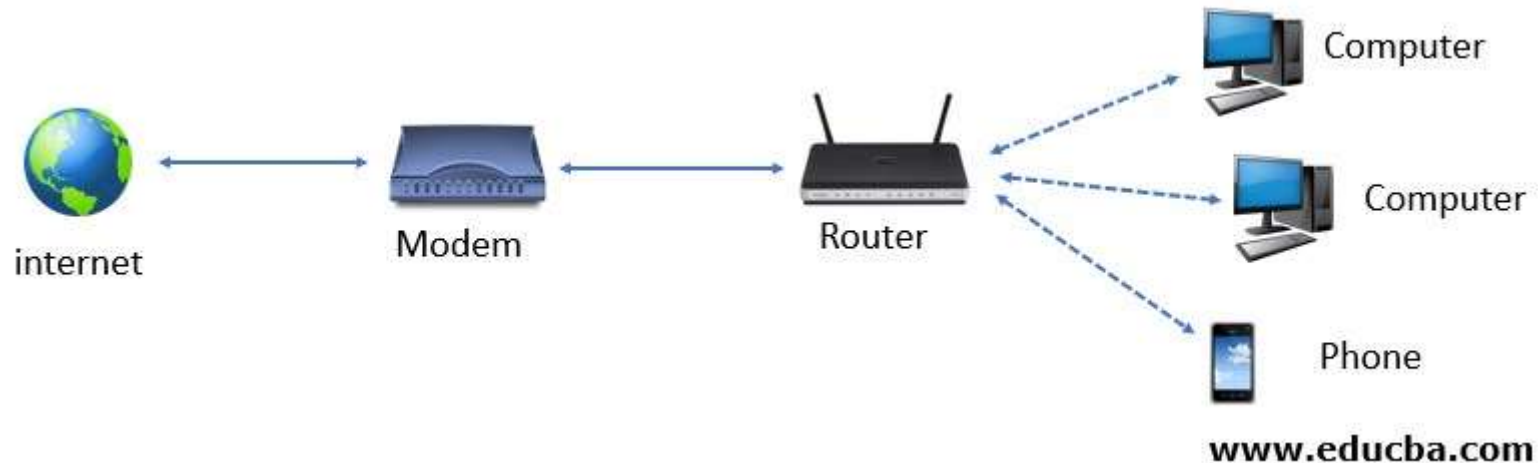
6. Bridge:

- Bridge is used to connect two LAN segments like a repeater but has an additional functionality of reading the MAC address.
- Bridge works at the data link layer of OSI model.
- It is also used for interconnecting two LANs on the same protocol.
- Bridge is also two connecting port device.
- The working principle of a bridge is that it blocks or forwards the data depending on the destination MAC address and this address is written into every data frame.



7. Modem:

- The word “MODEM” stands for Modulator-Demodulator.
- The modem is a device that converts digital information to analog by modulating it on the sending end and demodulating the analog information into digital information at the receiving end.
- The modem is a peripheral device for computers, which allows digital computer to communicate over standard analog phone lines.

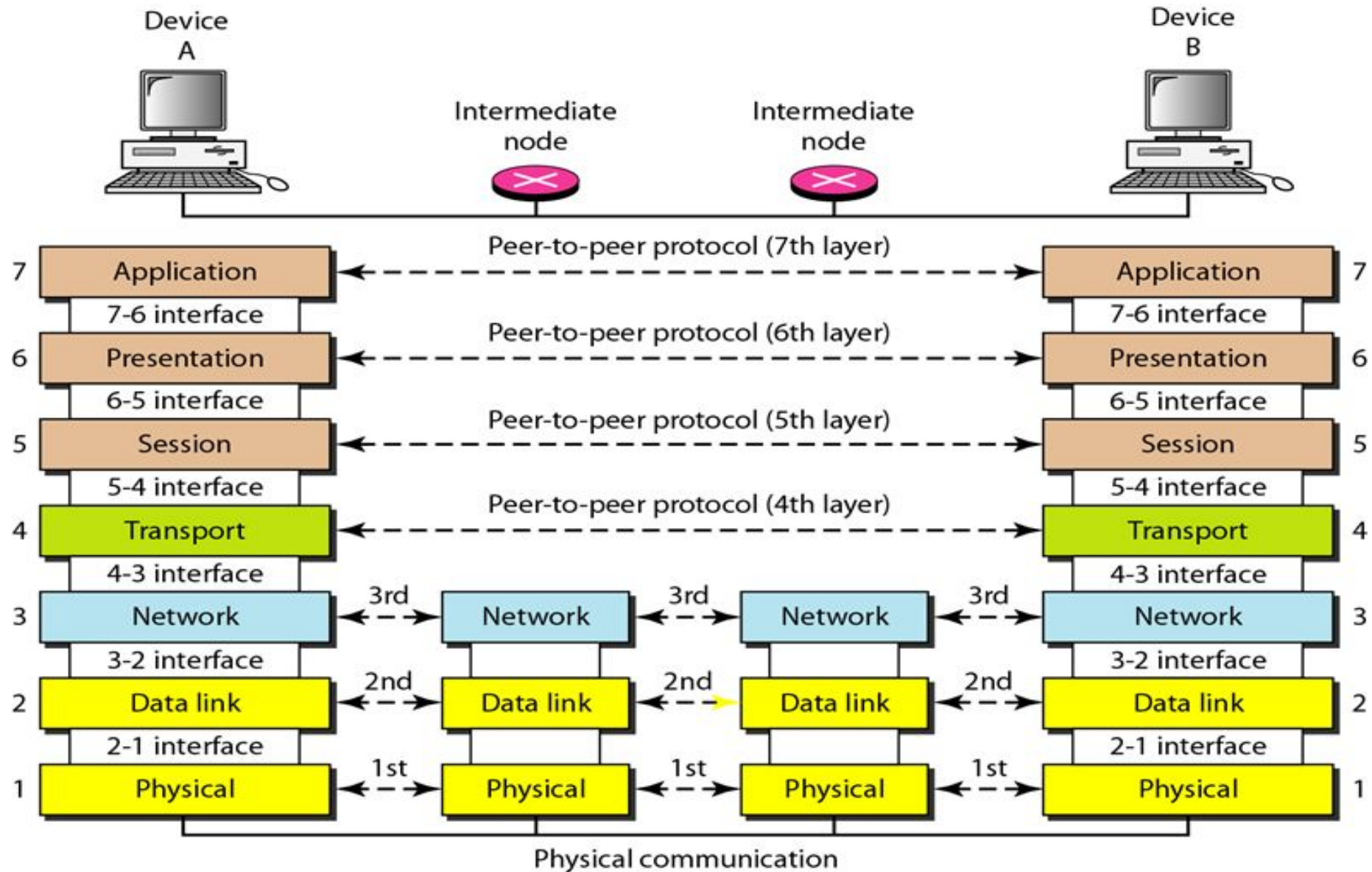


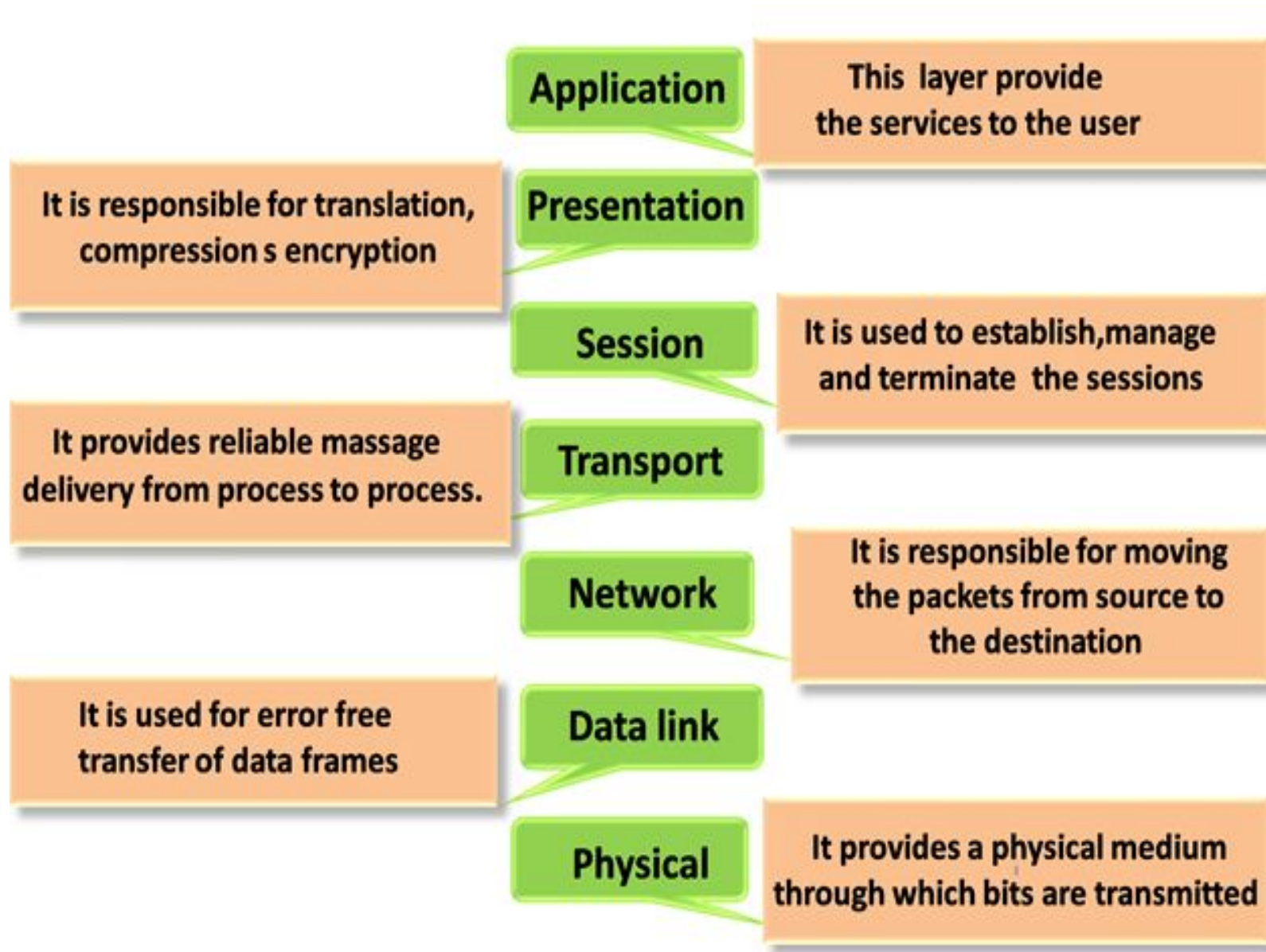
OSI Model

OSI Model:

- OSI stands for “Open System Interconnection”.
- OSI reference model is based on a proposal developed by International Standards Organization in late 1970s.
- The purpose of OSI model is to open communication between different system without requiring changes to the logic of underlying hardware and software.
- OSI reference model is a conceptual that describes how information from a software application in one computer moves through a physical medium to the software application in another computer.
- OSI consists of seven layers, and each layer performs a particular network function.
- OSI model divides the whole task into seven smaller and manageable tasks. Each layer is assigned a particular task.
- Each layer is self-contained, so that task assigned to each layer can be performed independently.

OSI Reference Model:





Application Layer:

- It enables the users to access to the network resources.
- This layer provides the network services to the end-users.
- This layer contains the variety of protocols that are needed by users.

Functions of Application layer:

File transfer, access, and management (FTAM): An application layer allows a user to access the files in a remote computer, to retrieve the files from a computer and to manage the files in a remote computer.

Mail services: An application layer provides the facility for email forwarding and storage.

Directory services: An application provides the distributed database sources and is used to provide that global information about various objects.

Presentation Layer:

- A Presentation layer is mainly concerned with the syntax and semantics of the information exchanged between the two systems.
- It acts as a data translator for a network.
- This layer is a part of the operating system that converts the data from one presentation format to another format.
- The Presentation layer is also known as the syntax layer.

Functions:

- Translation
- Encryption/Decryption
- Data Compression

Session Layer:

- The Session layer is used to establish, maintain and synchronizes the interaction between communicating devices.

Functions:

- Dialog Control
- Synchronization

Transport Layer:

- The Transport layer is a Layer 4 ensures that messages are transmitted in the order in which they are sent and there is no duplication of data.
- The main responsibility of the transport layer is to transfer the data completely.
- It receives the data from the upper layer and converts them into smaller units known as segments.
- This layer can be termed as an end-to-end layer as it provides a point-to-point connection between source and destination to deliver the data reliably.
- This layer uses Transmission Control Protocol(TCP) and User Datagram Protocol(UDP).

Functions/Services:

- Port Addressing
- Segmentation and Reassembly
- Connection Control
- End-to-End flow control
- Error Control

Network Layer:

- It is responsible for delivery of data from the original source to the destination network.
- The protocols used to route the network traffic are known as Network layer protocols. Examples of protocols are IP and Ipv6.

Functions of Network Layer:

- Internetworking: An internetworking is the main responsibility of the network layer. It provides a logical connection between different devices.
- Addressing: A Network layer adds the source and destination address to the header of the frame. Addressing is used to identify the device on the internet.
- Routing: Routing is the major component of the network layer, and it determines the best optimal path out of the multiple paths from source to the destination.
- Packetizing: A Network Layer receives the packets from the upper layer and converts them into packets. This process is known as Packetizing. It is achieved by internet protocol (IP).

Data Link Layer:

- It is responsible for moving data (frames) from one node to another node.

Functions:

Framing: The data link layer translates the physical's raw bit stream into packets known as Frames. The Data link layer adds the header and trailer to the frame. The header which is added to the frame contains the hardware destination and source address.



Data Link Layer:

Functions:

- **Physical Addressing**: The Data link layer adds a header to the frame that contains a destination address. The frame is transmitted to the destination address mentioned in the header.
- **Flow Control**
- **Error Control**
- **Access Control**: When two or more devices are connected to the same communication channel, then the data link layer protocols are used to determine which device has control over the link at a given time.

Physical Layer:

- The main functionality of the physical layer is to transmit the individual bits from one node to another node.
- It establishes, maintains and deactivates the physical connection.

Functions of a Physical layer:

Line Configuration: It defines the way how two or more devices can be connected physically.

Data Transmission: It defines the transmission mode whether it is simplex, half-duplex or full-duplex mode between the two devices on the network.

Topology: It defines the way how network devices are arranged.

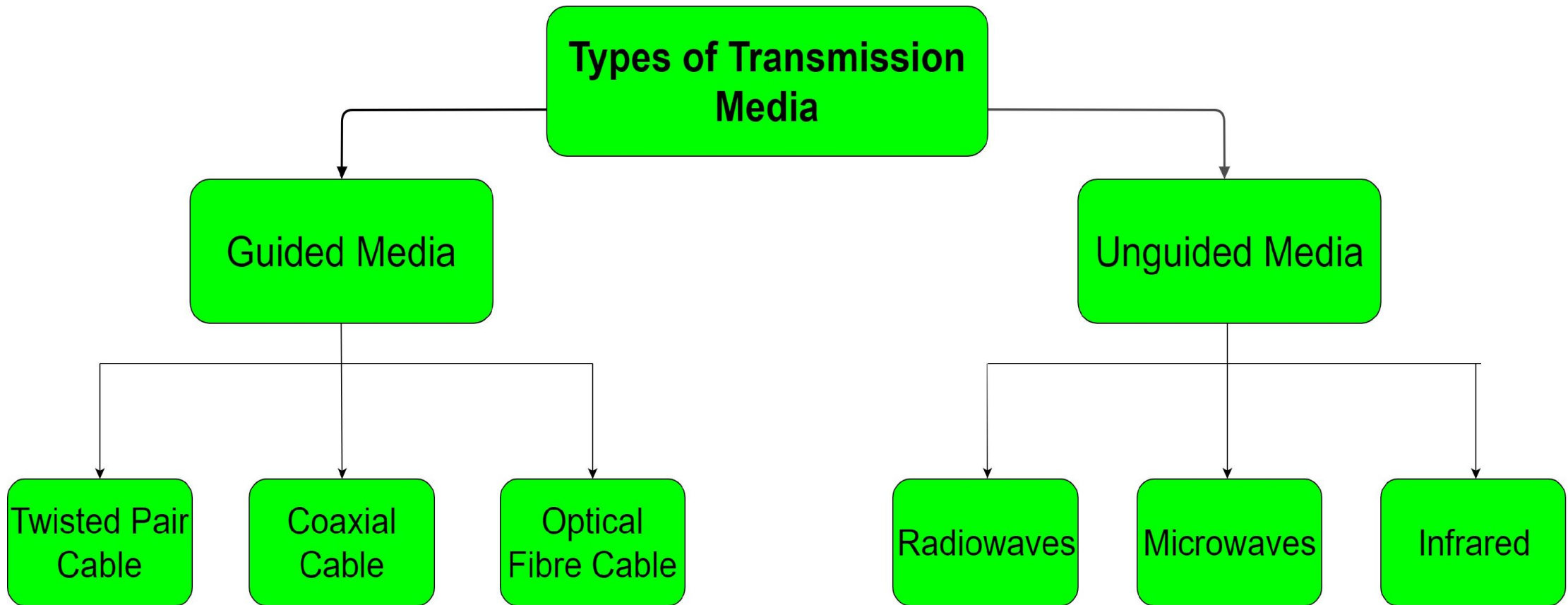
Signals: It determines the type of the signal used for transmitting the information.

Transmission Media

Transmission Media:

- Transmission media is a communication channel that carries the information from the sender to the receiver.
- Data is transmitted through the electromagnetic signals.
- The main functionality of the transmission media is to carry the information in the form of bits through LAN(Local Area Network).
- It is a physical path between transmitter and receiver in data communication.
- The characteristics and quality of data transmission are determined by the characteristics of medium and signal.
- In OSI(Open System Interconnection) model, transmission media supports the Layer 1 (Physical Layer).

Types of Transmission Media:



1. Guided Media:

- Guided Media is also known as Wired Transmission Media or Bounded Transmission Media.
- Type of communication media which use physical cable or wire for data transmission is known as guided media.
- It is mainly suited for point to point line configuration system.
- Guided media transmits signal by sending electricity or light over a cable or wire.
- It uses a cabling system that guides the data signals along a specific path.

Features:

- High Speed
- Secure
- Used for comparatively shorter distances

Types of Guided Media:

1. Twisted Pair Cable
2. Co-axial Cable
3. Fiber-optic Cable

1. Twisted-pair Cable:

- Twisted pair cable is the most common guided transmission medium consists of pair of copper conductors, each conductor covered with its own colored plastic insulation.
- Colors are used both to identify the specific conductors in a cable and to indicate which wires belong in pairs and how they are relate to other pair in a large bundle.
- A twisted pair cable is cheap as compared to other transmission media.
- Installation of the twisted pair cable is easy, and it is a lightweight cable.
- The frequency range for twisted pair cable is from 0 to 3.5KHz.

Types of Twisted-Pair Cable:

1. Unshielded Twisted Pair(UTP)
2. Shielded Twisted Pair(STP)

1. Unshielded Twisted Pair(UTP):

- UTP cable consists of a number of twisted pairs of wires with a simple plastic casing.
- An unshielded twisted pair is widely used in telecommunication.
- Following are the categories of the unshielded twisted pair cable:

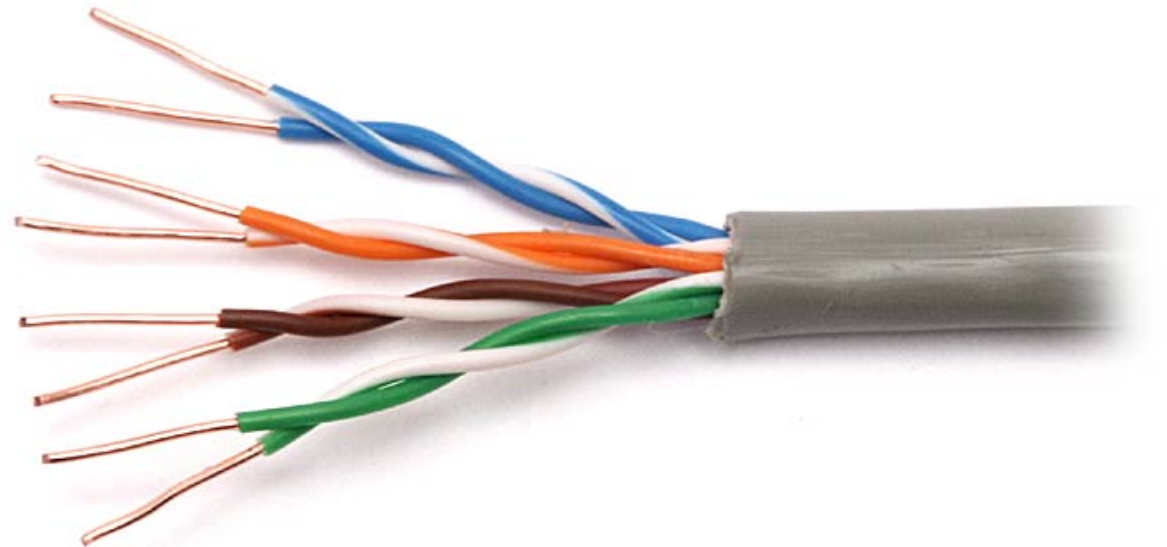
Category 1: Category 1 is used for telephone lines that have low-speed data.

Category 2: It can support up to 4Mbps.

Category 3: It can support up to 16Mbps.

Category 4: It can support up to 20Mbps. Therefore, it can be used for long-distance communication.

Category 5: It can support up to 200Mbps

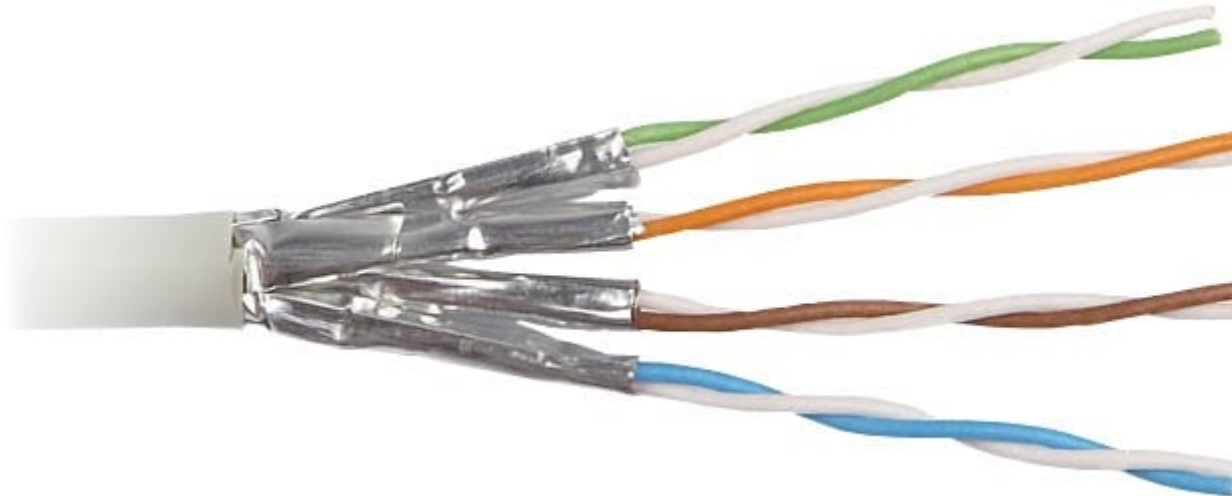


2. Unshielded Twisted Pair:

- A shielded twisted pair is a cable that contains the mesh surrounding the wire that allows the higher transmission rate.

Characteristics Of Shielded Twisted Pair:

- The cost of the shielded twisted pair cable is more expensive than UTP.
- Comparatively difficult to install and manufacture.
- It has higher capacity as compared to unshielded twisted pair cable.
- It is shielded that provides the higher data transmission rate.



2. Co-axial Cable:

- Coaxial cable is very commonly used transmission media, for example, TV wire is usually a coaxial cable.
- Coaxial cable, sometimes known as coax cable, is an electrical cable that transmits radio frequency (RF) signals from one point to another.
- The name of the cable is coaxial as it contains two conductors parallel to each other.
- It has a higher frequency as compared to Twisted pair cable.
- The inner conductor of the coaxial cable is made up of copper, and the outer conductor is made up of copper mesh. The middle core is made up of non-conductive cover that separates the inner conductor from the outer conductor and the outer conductor is covered in protective plastic sheath.
- The middle core is responsible for the data transferring whereas the copper mesh prevents from the **EMI**(Electromagnetic interference).

Coaxial cable

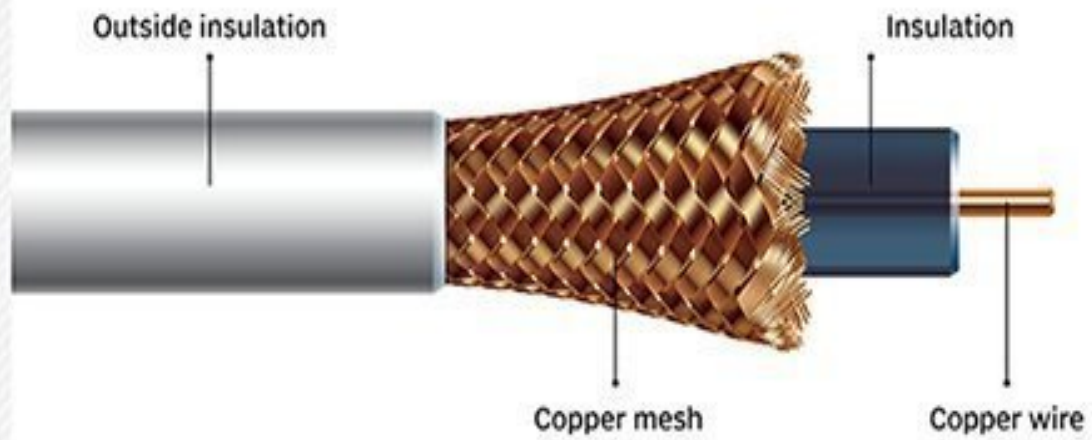


ILLUSTRATION: SHUTTERSTOCK/STOCK

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Advantages Of Coaxial cable:

- The data can be transmitted at high speed.
- It has better shielding as compared to twisted pair cable.
- It provides higher bandwidth.

Disadvantages Of Coaxial cable:

- It is more expensive as compared to twisted pair cable.
- If any fault occurs in the cable causes the failure in the entire network.

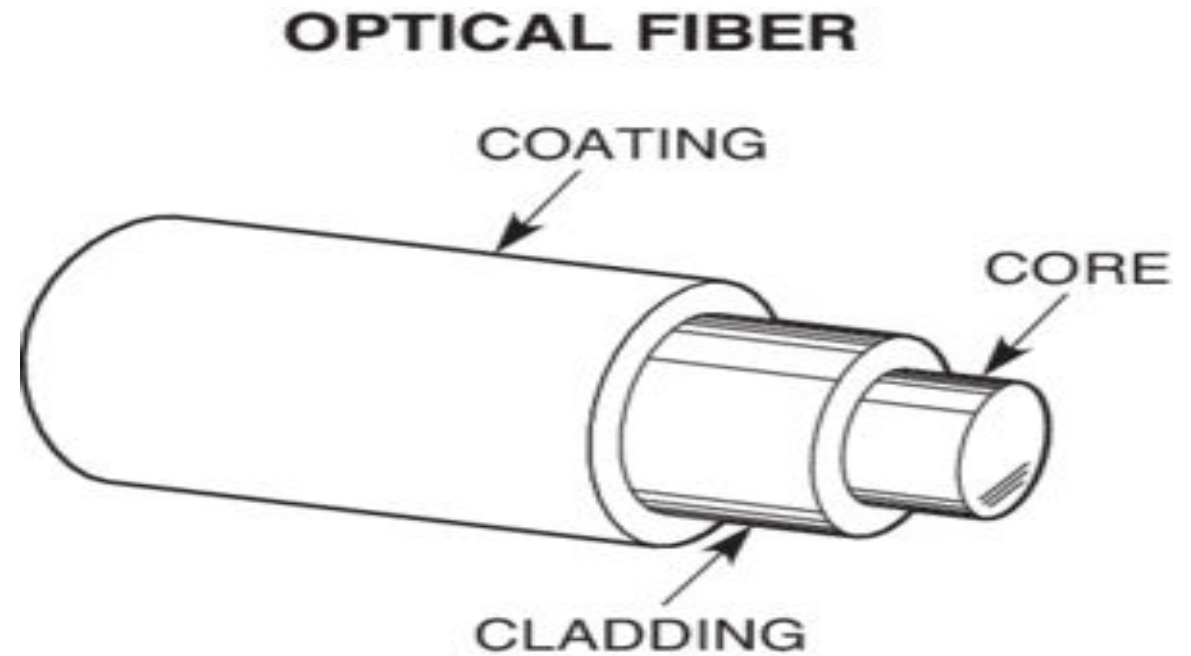
3. Fiber-optic Cable:

- A fiber optic cable is made of glass and plastic and transmits signals in the form of light.
- The plastic coating protects the optical fibers from heat, cold, electromagnetic interference from other types of wiring.
- Fiber optics provide faster data transmission than copper wires.
- Three basic elements of fiber optic cable are:
 1. Core
 2. Cladding
 3. Jacket

Core: The inner narrow strand up of glass or plastic is called core. It is the light transmission area of fiber.

Cladding: The concentric layer of glass surrounding core is called cladding.

Jacket: The protective coating consisting of plastic is known as a jacket.



Advantages:

- Greater Bandwidth
- Faster Speed
- Thinner and Lighter
- Better Reliability
- Longer Distance

Disadvantages:

- Expensive
- Difficult to install and split
- More fragile than metal cable

2. Unguided Media:

- Unguided Media is also known as Wireless Transmission Media or unbounded Transmission Media.
- An unguided transmission transmits the electromagnetic waves without using any physical medium. Therefore it is also known as wireless transmission.
- Unbounded media transmit the data through air.

Types of Unguided Media:

1. Radio Waves
2. Micro Waves
3. Infrared Waves

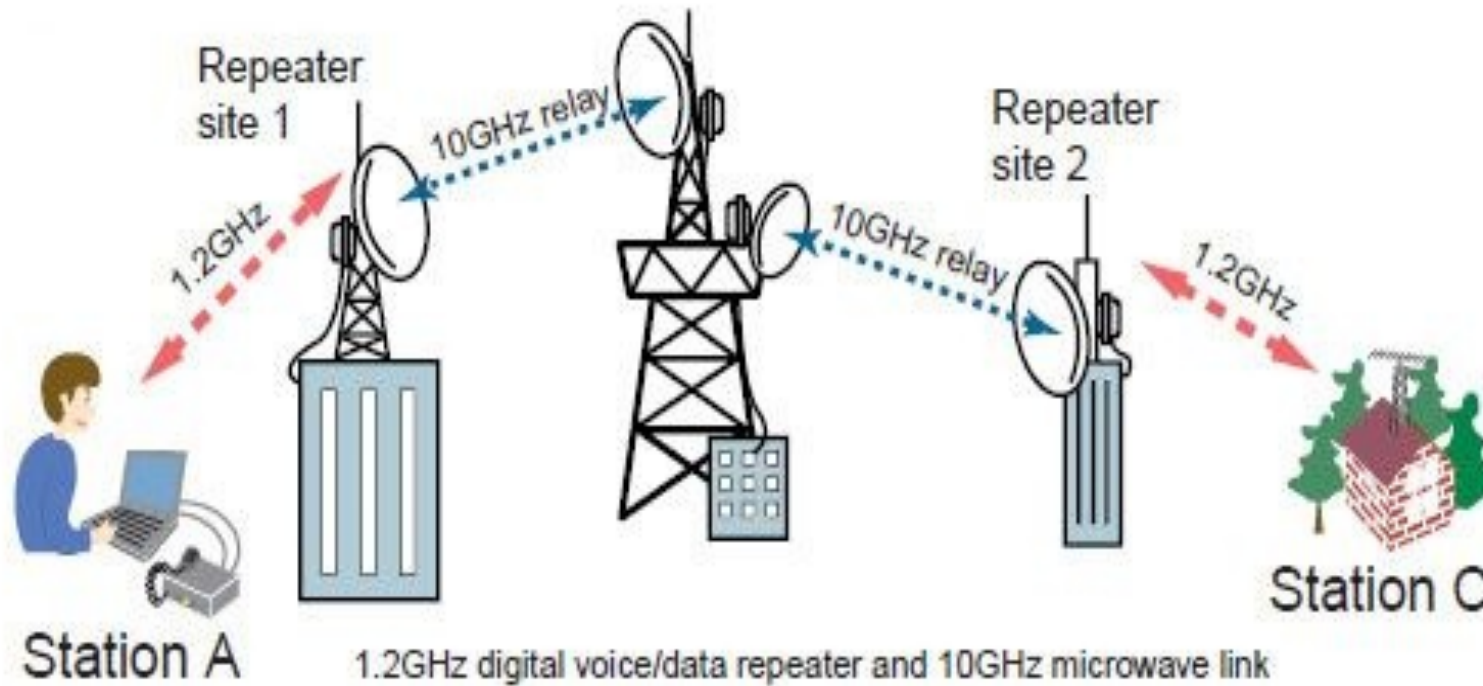
1. Radio Waves:

- Electromagnetic waves ranging in frequencies between 3KHz and 1 GHz are normally called radio waves.
- Radio waves are easy to generate and can travel long distance and can penetrate the obstacle.
- Radio waves are widely used for communication both indoors and outdoors.
- Radio waves are omnidirectional that means they can travel in all direction from the source.
- So, the sending and receiving antennas do not have to be aligned. A sending antenna send waves that can be received by any receiving antenna.
- AM, FM radio, televisions, cordless phones used radio waves for transmission.

2. Micro Waves:

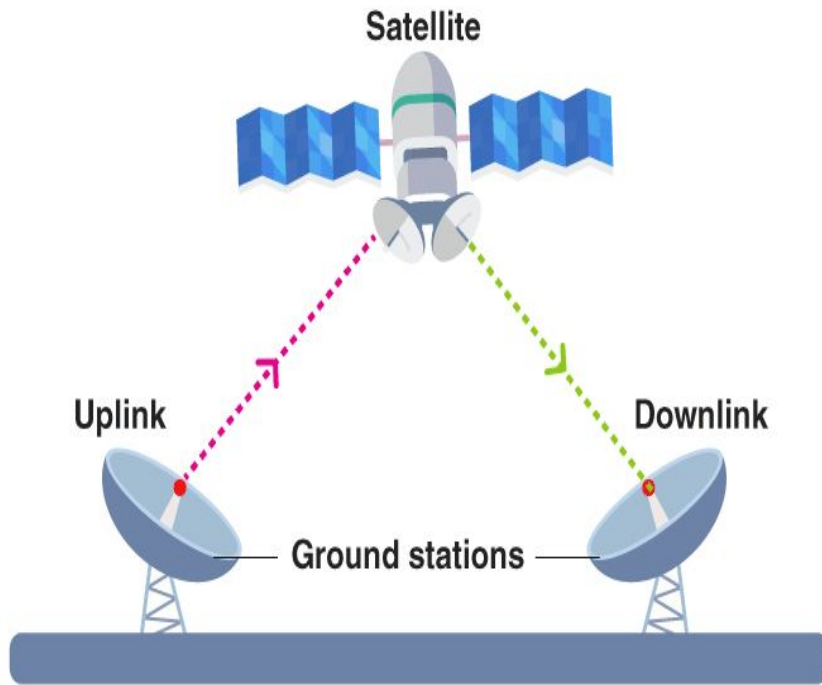
- Electromagnetic wave having frequencies between 1 and 300 GHz are called microwaves.
- Microwave system uses high frequency (high speed) radio signals to transmit data through space.
- It is a line of sight transmission i.e. the sending and receiving antennas need to be properly aligned with each other.
- The distance covered by the signal is directly proportional to the height of the antenna.
- Microwaves signals propagate in one direction at a time, hence two frequencies are needed for two way communication.
- These are majorly used for mobile phone communication and television distribution.

Micro Wave System:



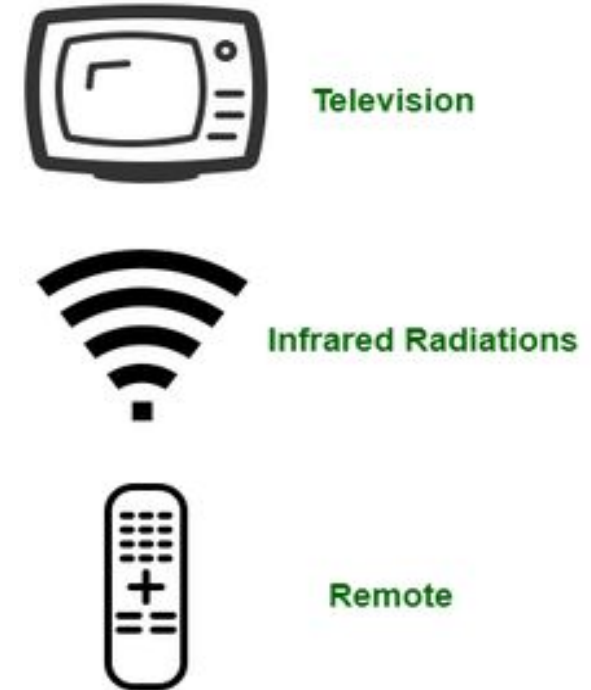
Communication Satellite:

- A satellite is a physical object that revolves around the earth at a known height.
- Satellite communication is more reliable nowadays as it offers more flexibility than cable and fiber optic systems.
- We can communicate with any point on the globe by using satellite communication.
- The satellite accepts the signal that is transmitted from the earth station, and it amplifies the signal. The amplified signal is retransmitted to another earth station.
- Satellite communication is used in mobile and wireless communication applications.
- It is used in a wide variety of applications such as weather forecasting, radio/TV signal broadcasting, mobile communication, etc.



3. Infrared Waves:

- Infrared waves are used for very short distance communication.
- They cannot penetrate through obstacles.
- This prevents interference between systems.
- Frequency Range: 300GHz – 400THz.
- It is used in TV remotes, wireless mouse, keyboard, printer, etc.

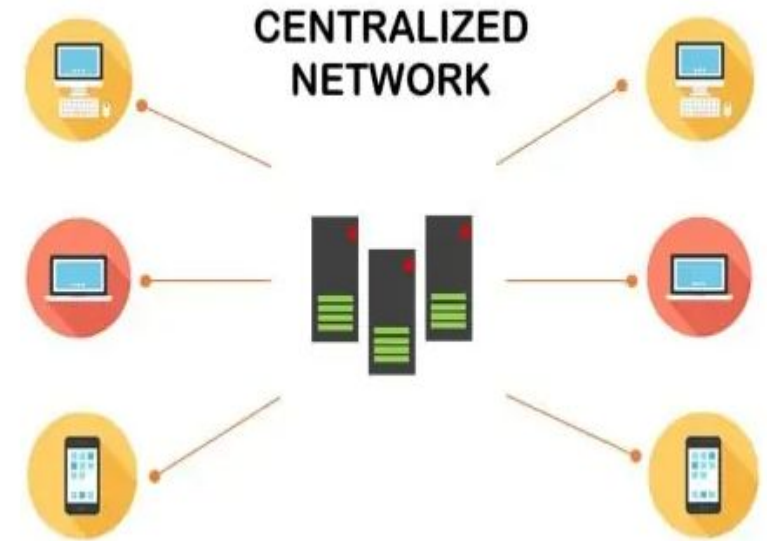


Communication Protocol:

- Communication protocol is the set of rules that governs the data communication.
- The main function of these protocols is to exchange messages from one computer system to another.
- A communication protocol is a system of rules that allows two or more entities of a communications system to transmit information via any kind of variation of a physical quantity.
- The protocol defines the rules, syntax, semantics and synchronization of communication and possible error recovery methods.

Centralized Network System:

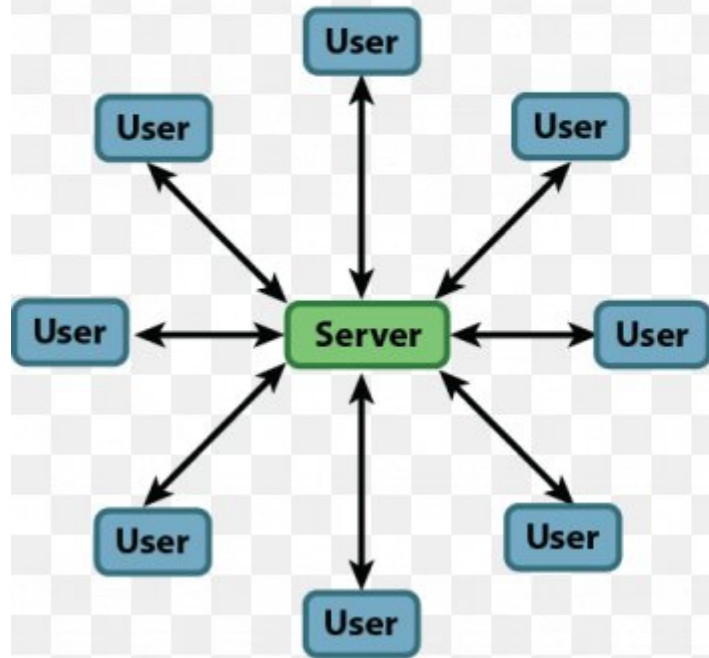
- A centralized network is built around a single, central server that handles all major management and data processing functions.
- Workstation connect to the server and send their requests to the central server for processing rather than doing them directly.
- Client systems and users cannot directly access resources or services on different servers without first going through the centralized master server.
- If the central server goes down, the entire network goes down with it.



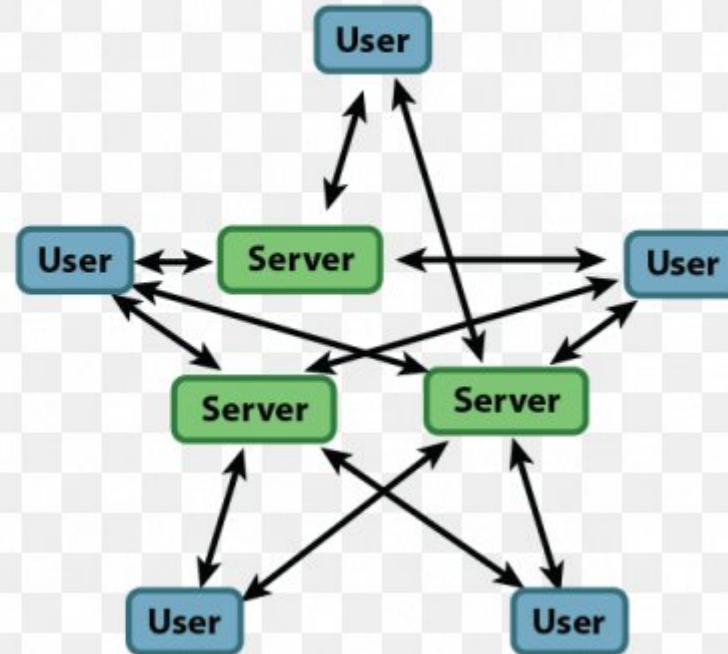
Distributed Network System:

- A distributed network is a type of computer network that is spread over different networks.
- In a distributed network, all network services and coordination tasks are split evenly among many equal servers across the entire enterprise network.
- Distributed network does not rely on a single central server.
- A distributed network doesn't use a single central server or a cluster of domain controllers—all data processing, computational resources, and network management functions are shared by nodes distributed geographically and logically across the whole enterprise network.

Centralized network



Distributed network



Assignment:

1. Difference between centralized and distributed network system.
2. Write down the advantages and disadvantages of centralized and distributed network system.

MS-DOS

MS-DOS:

- MS-DOS stands for Microsoft Disk Operating System.
- MS-DOS was the main operating system for IBM PC compatible personal computers during the 1980s by Microsoft Company.
- DOS is CUI(Character User Interface) based operating system.
- MS-DOS is a single user, single tasking operating system.
- MS-DOS is the collection of huge number of files.
- We can use command prompt to execute MS-DOS commands.

Parts of DOS:

- The DOS OS is a set of programs which are stored on some secondary storage device normally floppy disk. It is then loaded into RAM when required.
- The DOS software is divided into three parts stored in three different files on a disk.
- The disk which contains these three files is called a Bootable Disk.

These three files are:

IO.SYS □ Input and Output Device Handler

MSDOS.SYS □ Kernel of DOS for all responses

COMMAND.COM □ User Interface for commands

File:

The systematic collection of related data or information or program instructions is known as file. A unique name is given for each file to identify. Such unique name is known as a file name. A file name contains name and extension. The name helps to identify the file and extension helps to identify the type of file.

Directory:

Directory is the location to store files and sub-directories. Files on the hard disk are divided into various segments called directories. A directory can store any number of files. It helps to organize our files in an efficient manner.

DOS Commands:

- Command is the set of instruction given to the computer to perform the specific task. It will execute and do the appropriate action.

There are mainly two types of commands:

1. Internal Commands
2. External Commands

1. Internal Commands:

- Internal commands are those commands that are loaded automatically in the memory when DOS is loaded into memory during booting process.
- These commands are easier to learn and use.
- They do not require any external file support as like external commands.
- These commands are used for performing basic operations on files and directories.
- **Some command examples of Internal Commands are:**

cls, copy con, copy, cd or chdir, date, color, time, del, dir, exit, md or mkdir, ren, prompt, rd or rmdir, type ,ver, vol,start, title etc.

CLS:

- It is basically used to clear all the information from the display screen without deleting the information.
- Syntax: CLS

COPY CON:

- This command is basically used to create a file.
- The only disadvantages of this command is that the file created by this command can not be modified.
- Syntax: COPY CON filename.extension

DIR:

- DIR stands for directory listing. It is used to display all the files and sub directories stored in the directory along with their size in bytes, the date and time when they were created.
- Syntax: DIR
- Syntax: DIR E: (It will display list of directories and files in drive E)

TYPE:

- This command is used to display the content of a file on the screen.
- Syntax: TYPE filename

REN:

- This command is used to rename of a file.
- Syntax: REN oldfilename newfilename

COPY:

- This command is used to copy the contents of one or more specified files to another disk or same disk with same or different file name.
- Syntax: COPY source_file_name destination_file_name
- Syntax: COPY source_file_name D:\ destination_file_name
- This command is also used to combine the contents of two different file into one file.
- Syntax: COPY filename1+filename2 Newfilename

DEL or ERASE:

- This command is used to delete a file from the disk.
- Syntax: DEL/ERASE filename
- Syntax: DEL/ERASE E:\filename

COLOR:

- This command is used to change foreground and background color of command prompt.
- Syntax: COLOR attribute (Example: COLOR 5)
- Example: COLOR 24 (for background and text)

DATE:

- This command is used to view the system date as maintained by the DOS. It is also used to change the current date to that entered by the user.
- Syntax: DATE

TIME:

- This command is used to view the system time as maintained by the DOS. It is also used to change the current time to that entered by the user.
- Syntax: TIME

EXIT:

- This command is used to close the command prompt.
- Syntax: EXIT

COMP:

- This command is used to compare two different files.
- Syntax: COMP filename1 filename2

MD or MKDIR:

- This command is used to make directory or subdirectory.
- Syntax: MD directory_name

CD or CHDIR:

- This command is used to change directory.
- It is used to find out the location of the file in the directory structure or it can also move us from one location in the directory structure to another.
- C:\> CD directoryname
- C:\> CD.. (It moves one level back to the present directory)
- C:\> CD\ (It moves to the root directory directly from any logged subdirectory)

RD or RMDIR:

- This command is used to delete a particular directory or subdirectory from a disk. Only an empty directory or subdirectory can be removed.
- Syntax: RD directory_name

PROMPT:

- This command is used to change the MS-DOS command prompt.
- Syntax: PROMPT newname
- Syntax: PROMPT \$P\$G (back)

VER:

- This command is used to see the current version of DOS.
- Syntax: VER

VOL:

- This command is used to see the volume label name and serial number.
- Syntax: VOL

TITLE:

- This command is used to change the title name of command prompt.
- Syntax: TITLE name

START:

- This command is used to open new command prompt.
- Syntax: START

2. External Commands:

- These external commands are for performing advanced tasks and they do need some external file support as they are not stored in COMMAND.COM
- The external commands are used less frequently and are stored in some external files which are stored in some secondary storage device.
- Whenever an external command is to be executed then the external file in which that particular command is stored is transferred from the secondary storage disk to main memory (RAM).

External Commands:

- LABEL
- CHKDSK
- FC
- ATTRIB
- SORT
- FIND
- TREE
- XCOPY
- MOVE

LABEL:

- This command is used to change or see the drive label of the disk.
- Syntax: LABEL

CHKDSK:

- This command is used to check the disk.
- Syntax: CHKDSK

FC:

- This command is used to compare two files.
- Syntax: FC filename1 filename2

ATTRIB:

- This command is used to show or hide the file and directory.
- Syntax: ATTRIB +H file/directory name (To Hide)
- Syntax: ATTRIB -H file/directory name (To Show)

SORT:

- This command is used to show the content of file in ascending or descending order.
- Syntax: SORT filename (Ascending Order)
- Syntax: SORT/R filename (Descending Order)

TREE:

- This command is used to show the root of directory.
- Syntax: TREE directory name

XCOPY:

- This command is used to copy the file from one directory to another directory.
- Syntax: XCOPY <source> <destination>

MOVE:

- This command is used to move the file from one directory to another directory.
- Syntax: MOVE <source> <destination>

Unit-6

Internet and WWW

Internet:

- Internet is the network of network or simply it is the largest form of computer network.
- Internet is a system connecting computers around the world using TCP/IP (Transmission Control Protocol/Internet Protocol) a set of standards for transmitting and receiving digital data.
- Internet is defined as an interconnection of networks scattered all over the globe by means of exchanging information worldwide.
- The internet employs a set of standardized protocols which allow for the sharing of resources among different kinds of computers that communicate with each other on the network.

Uses of Internet:

Internet is used for different purposes by different people. Some uses of the Internet are listed below:

- E-Commerce (auction, buying, selling products etc.)
- Research (on-line journals, magazines, information etc.)
- Education (e-learning courses, virtual classroom, distance learning)
- E-Governance (online filing of application (Income Tax), on-line application forms etc.)
- On-line ticket booking (airplane tickets, rail tickets, cinema hall tickets etc.)
- On-line payments (credit card payments etc.)
- Video conferencing (exchange of views, music, files, mails, folders, data, information etc.)
- Outsourcing jobs (work flow software)
- Social networking (sites like Facebook, Instagram, Twitter)
- E-Telephony (sites like Skype)

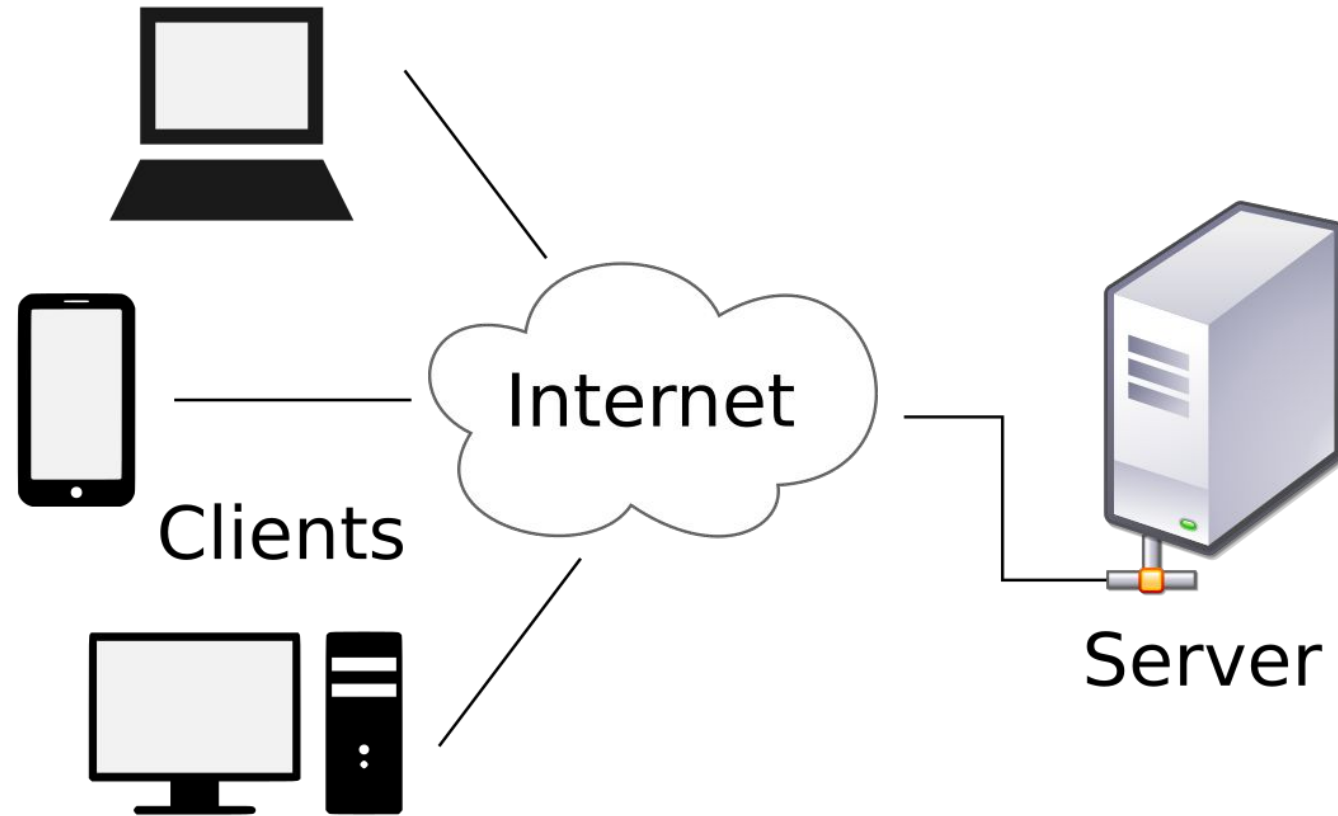
Applications of Internet:

- Business
- Education
- Communication
- Entertainment
- Government
- Health and Medicine
- Stock Market
- Research

Client-Server Technology:

- Client-Server architecture style describes network architecture that involve a separate client and server system and connecting network.
- It is a network architecture in which each computer or process on the network is either a client or a server where each client request for the service and server provides the services to the client.
- Servers are powerful computers or process dedicated to managing disk drives(file servers), printers(print servers), or network traffic(network servers).
- Clients are PCs or workstations on which users run applications.
- This model involves a server application that is accessed directly by multiple clients, referred to as 2-tier architecture style.
- It is a model where the system is organized as a set of services and associated servers and clients that access and use it.

Client-Server Technology:



Advantages:

- The data is centralized within the system that is maintained in a single place.
- The model is efficient in delivering resources to the client and also requires low-cost maintenance.
- It is easy to manage, and the data can be easily delivered to the client.
- As the data is centralized, this system is more secure and serves added security to the data.
- Within this type of model, more clients and servers can be embedded into the server, which makes the performance outstanding and increases the model's overall flexibility.

Disadvantages:

- Clients' systems can get a virus or any malicious scripts if any are running on the server.
- Extra security must be added so that the data does not get spoofed in between the transmission.
- The main problem can be server down. When the server is down, the client loses its connection and will not access the data.

E-mail(Electronic Mail):

- Electronic mail (e-mail) is a method of exchanging messages between people using electronic devices.
- Electronic mail is the method of creating, transmitting, or storing primarily text-based human communication with digital communication systems.
- A worldwide e-mail network allows people to exchange e-mail messages very quickly.
- A method of exchanging messages instantly from one system to another with the help of the internet is called an **Email**.
- To use e-mail, a user must have an email address.

Features of Email:

- Email can be sent to one person or more than one person at the same time.
- Email is location independent i.e. user can access it anywhere.
- Email is faster than postal mail since it is transmitted electronically.
- Email messages can be sent at any time of the day.
- A copy of e-mail message that the sender has sent is available on the senders computer for later reference.
- Email is an ideal method for sending documents already of the computer as attachments.

Video Conferencing:

- Video conferencing is a type of online meeting where two or more people engage in a live audio-visual call from different locations.
- Video conferencing is defined as the live connection between people in separate locations for the purpose of communication usually involving audio and video as well.
- There are many ways to utilize video conferencing technology, such as company meetings, job training sessions, or addressing board members.
- The stability and quality of the video conference may fluctuate with the speed and reliability of the data connection.

Advantages of Video Conferencing:

- Effective Communication
- Build Meaningful Relationships
- Cost-Efficient
- Saves Time
- Reliable and Streamlined Communication
- Increases Efficiency
- Improved Productivity
- Quick and Easy Meeting Scheduling
- Accurate and Consistent Records
- Set Up Live & Virtual Events
- Better Engagement Than Audio Conferencing
- Connects Remote Team and Builds Culture
- Creates Effective Meetings
- Recording and Playback Options

Disadvantages of Video Conference:

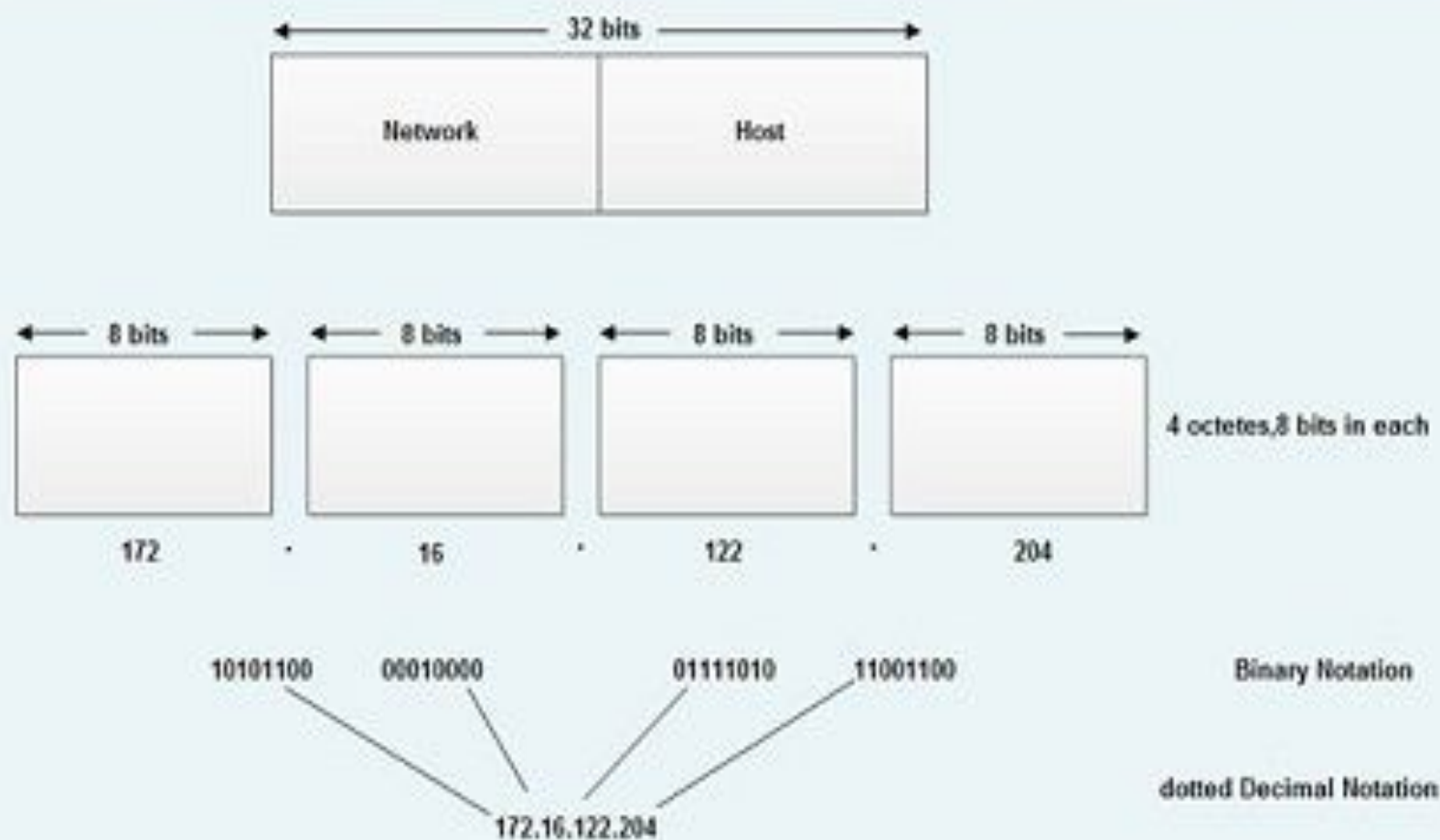
- Lack of Personal Interaction
- Working With Teams in Different Time zones
- Technical Difficulties
- High Setup Cost

Internet Service Provider (ISP):

- ISP is a company that provides internet access to the customer. So, this is also known as “Internet Access Provider”.
- ISP connects to its customers using different data transmission technology such as Modem, Cable, Ethernet, Dial-up, Wi-Fi etc.
- An Internet service provider (ISP) is an organization that provides services for accessing, using, or participating in the Internet.
- Internet services typically provided by ISPs can include Internet access, Internet transit, domain name registration, web hosting, Usenet service etc.
- An ISP typically serves as the access point or the gateway that provides a user access to everything available on the Internet.

Internet Address:

- Internet Address is also called IP Address.
- An IP address is a unique address that identifies a device on the internet or a local network.
- IP stands for "Internet Protocol," which is the set of rules governing the format of data sent via the internet or local network.
- An Internet Protocol address (IP address) is a numerical label such as 192.0.2.1 that is connected to a computer network that uses the Internet Protocol for communication.
- IP address serves two main functions: network interface identification and location addressing.



IP Address Format

Domain Name:

- A domain name refers to your website address. This is what users type in a browser's search bar to directly access your website.
- A domain name is unique and cannot be shared between different sites. For example: www.google.com
- Each website is identified by a unique set of numbers, called an IP address. where the website data is located. When visitors enter a domain name in their search bar, it sends a request to a set of Domain Name System (DNS) servers. The DNS then responds with the IP address of the website's hosting server, making it accessible.
- Domain names were created because IP addresses are too complicated to remember. So, for internet users to access a website, it needs to be given a name.

Structure of a Domain Name:

For example: www.google.com

- **www:** this refers to the third-level domain (World Wide Web).
- **google:** refers to the second-level domain; this is the name of the site.
- **.com:** this is the top-level domain (TLD), also known as a domain name extension.

Examples of some of the popular TLDs include:

.com .org .net .gov .edu

Domain Name System (DNS):

- DNS is also called “Domain Name Server” or “Domain Name Service”.
- DNS is an automatic process that converts the domain name to its corresponding IP address so that web browser can understand which web page is going to access on the internet.
- Most Uniform Resource Locators (URLs) are built around the domain name of the web server that takes client requests.

How DNS works ?

- DNS servers convert URLs and domain names into IP addresses that computers can understand and use. They translate what a user types into a browser into something the machine can use to find a webpage. This process of translation and lookup is called DNS resolution.

Protocol:

- Protocol is a “set of rules and standards” which are used in digital communication to connect network devices and exchange information among them.

Types:

1. TCP/IP
2. HTTP
3. FTP
4. SMTP
5. POP
6. Telnet
7. Gopher
8. WAIS

TCP/IP:

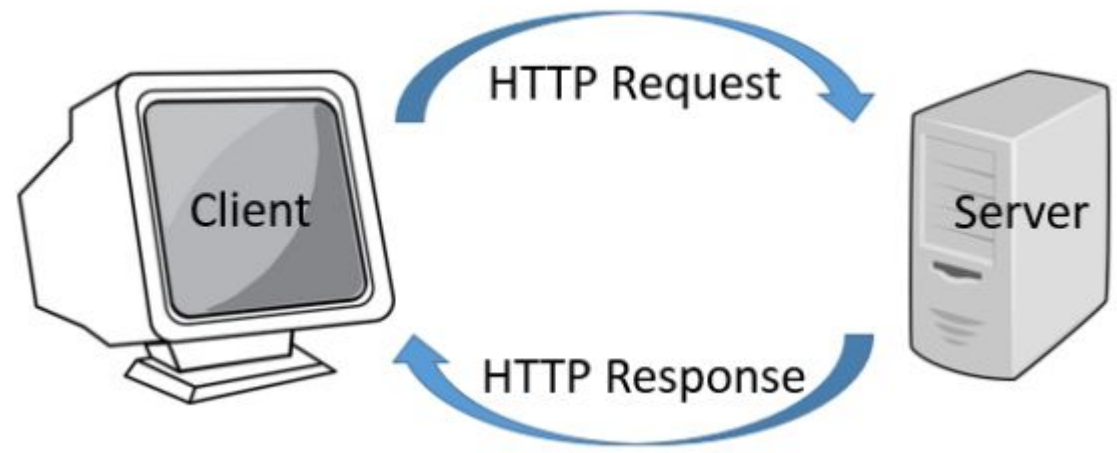
- TCP stands for Transmission Control Protocol a communications standard that enables application programs and computing devices to exchange messages over a network. It is designed to send packets across the internet and ensure the successful delivery of data and messages over networks.
- TCP organizes data so that it can be transmitted between a server and a client.
- The Internet Protocol (IP) is the method for sending data from one device to another across the internet. Every device has an IP address that uniquely identifies it and enables it to communicate with and exchange data with other devices connected to the internet.

TCP/IP:

- TCP and IP are separate protocols that work together to ensure data is delivered to its intended destination within a network. IP obtains and defines the address—the IP address—of the application or device the data must be sent to. TCP is then responsible for transporting and routing data through the network architecture and ensuring it gets delivered to the destination application or device that IP has defined.

HTTP:

- The Hypertext Transfer Protocol (HTTP) is an application-level protocol.
- It is a protocol used to access the data on the World Wide Web (www).
- The HTTP protocol can be used to transfer the data in the form of plain text, image, audio or video.

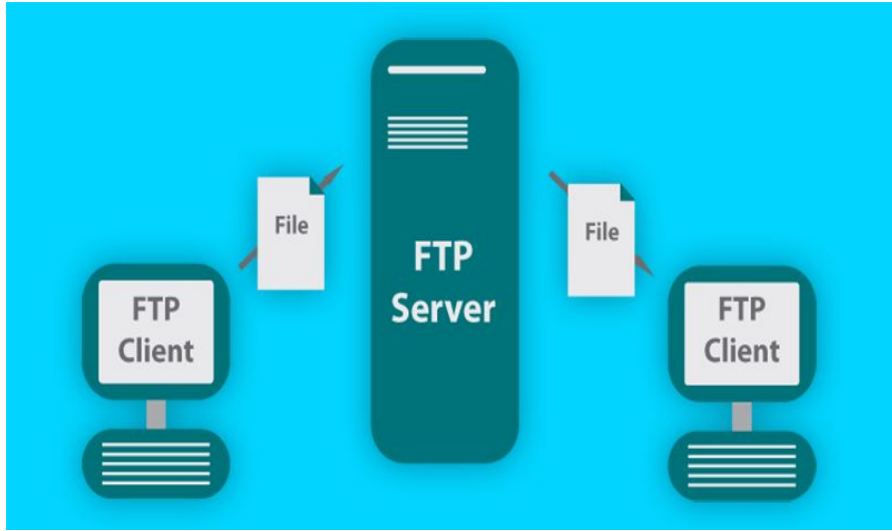


Features of HTTP Protocol:

- **Connectionless protocol**: HTTP is a connectionless protocol. HTTP client initiates a HTTP and after a request is made, the client disconnects from the server and waits for a response. The server processes the request and re-establishes the connection with the client and sent response back. The connection between client and server exist only during the current request and response time only.
- **Media independent**: HTTP protocol is a media independent as any type of data can be sent as long as both the client and server know how to handle the data content.
- **Stateless**: HTTP is a stateless protocol as both the client and server know each other only during the current request. Due to this nature of the protocol, both the client and server do not retain the information between various requests of the web pages.

FTP:

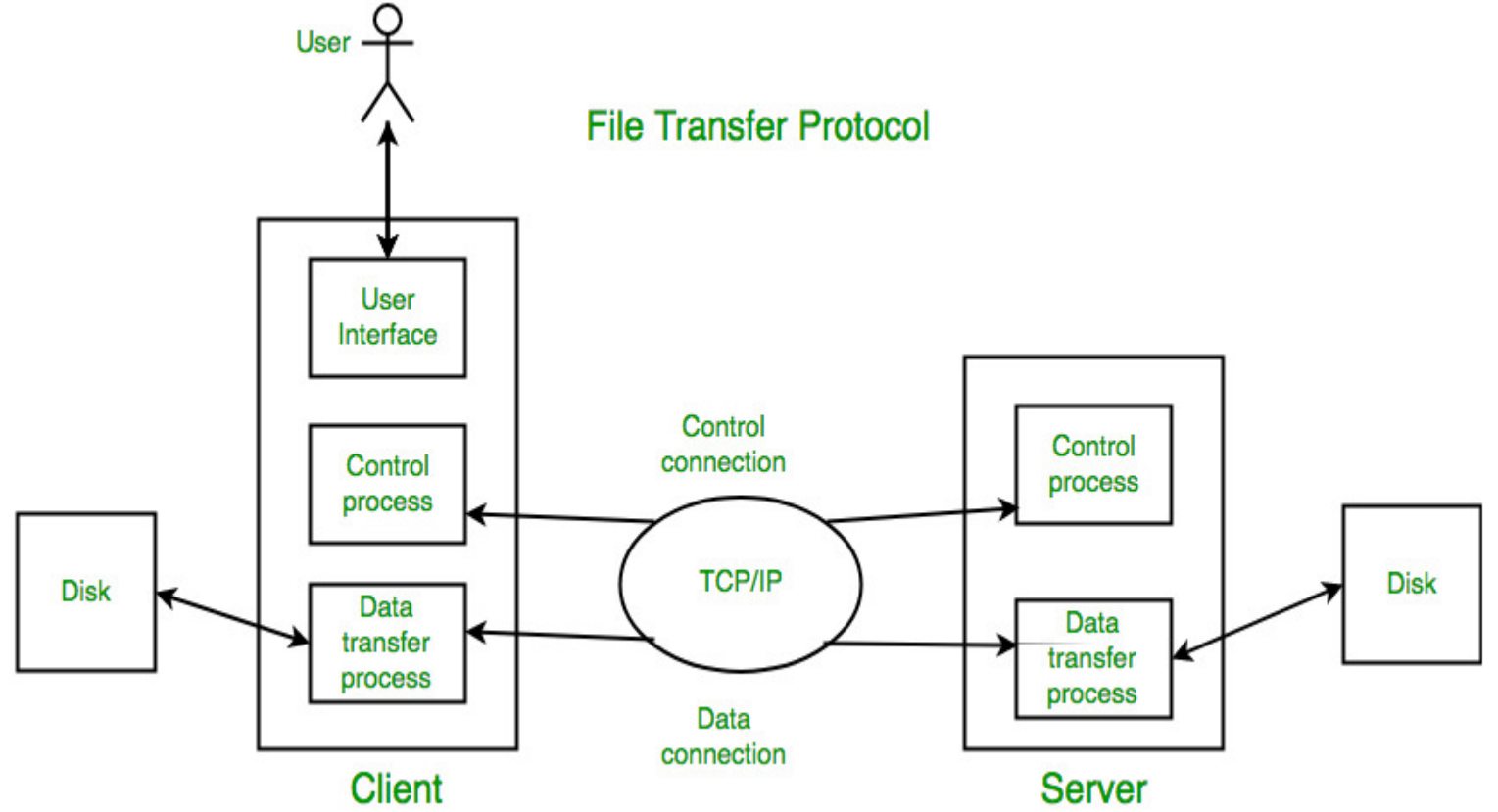
- FTP stands for File transfer protocol.
- FTP is a standard internet protocol provided by TCP/IP used for transmitting the files from one host to another.
- It is mainly used for transferring the web page files from their creator to the computer that acts as a server for other computers on the internet.
- It is also used for downloading the files to computer from other servers.
- There are couple of ways to transfer files using FTP
 - Using Browser
 - Using FTP Client

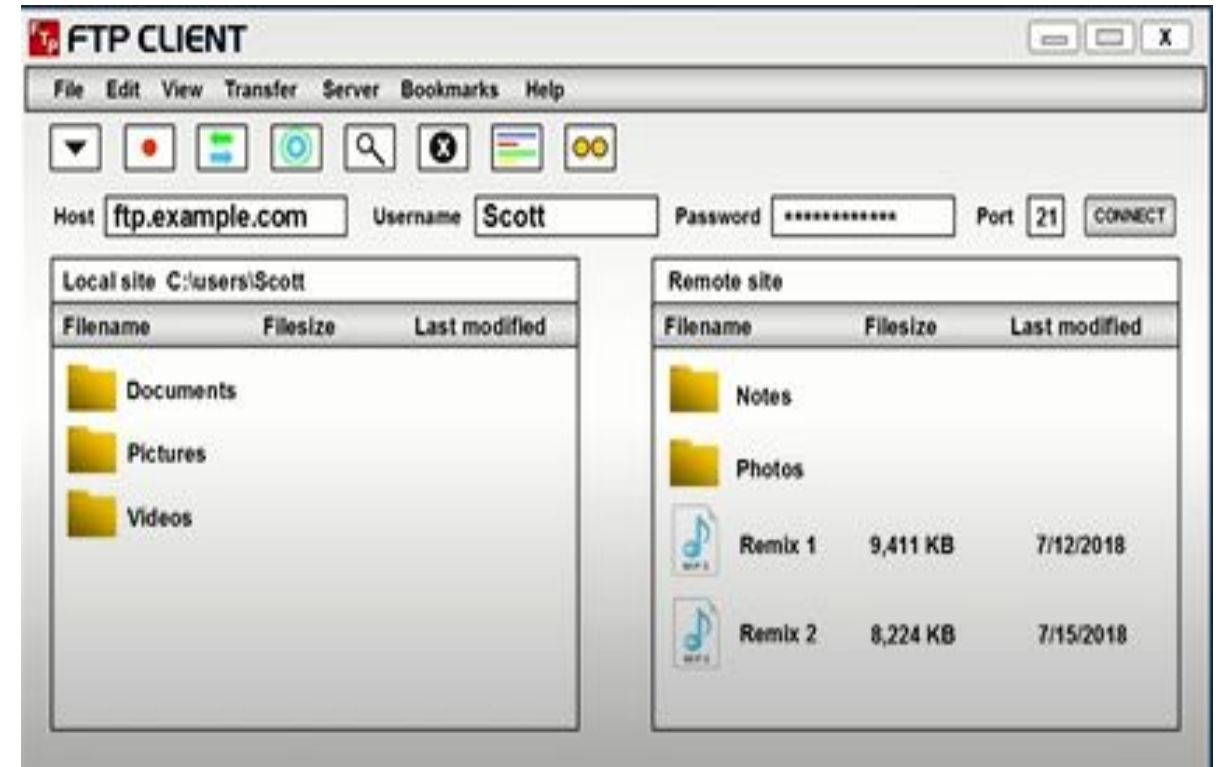


ftp.example.com

Index of /

	Name	Size	Date Modified
	Notes		3/25/2017
	Photos		6/28/2017
	Remix 1	9,411 KB	7/12/2018
	Remix 2	8,224 KB	7/15/2018





FTP is not secured.

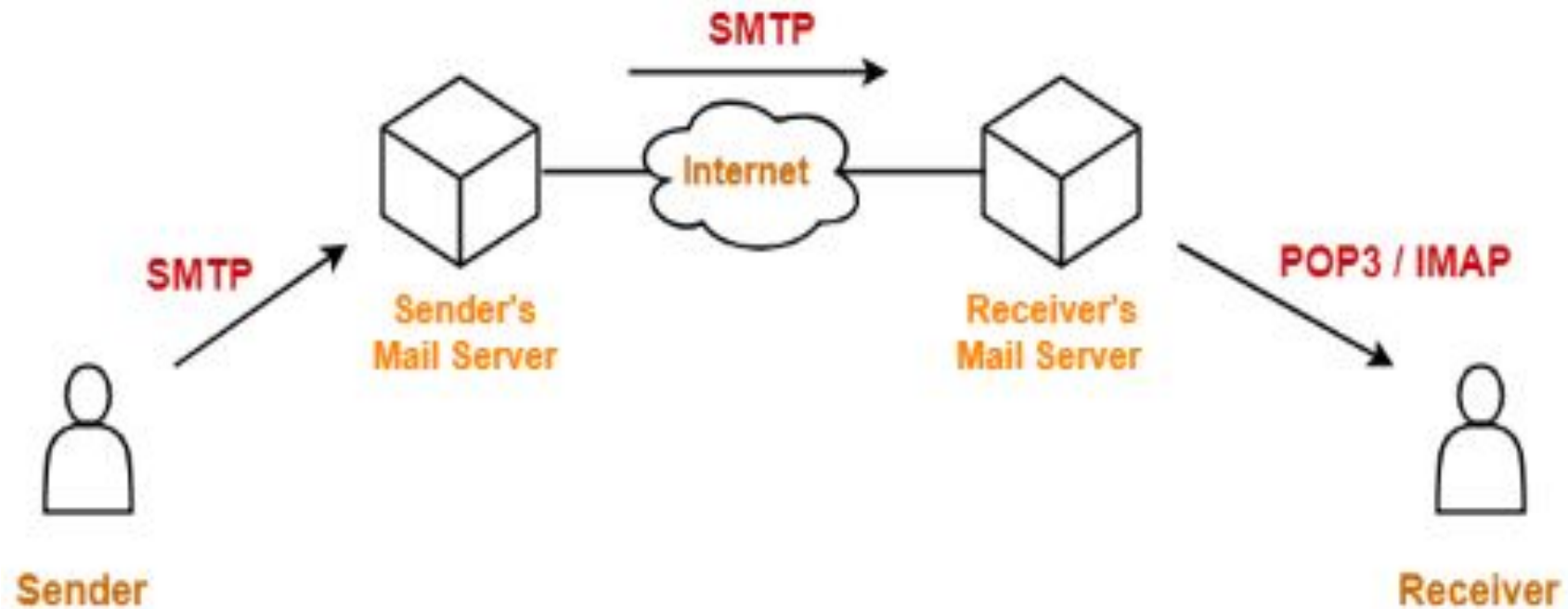
SFTP (Secured File Transfer Protocol) ---Transfer the encrypted file.

TFTP (Trivial File Transfer Protocol)—Only used with in the LAN.

SMTP:

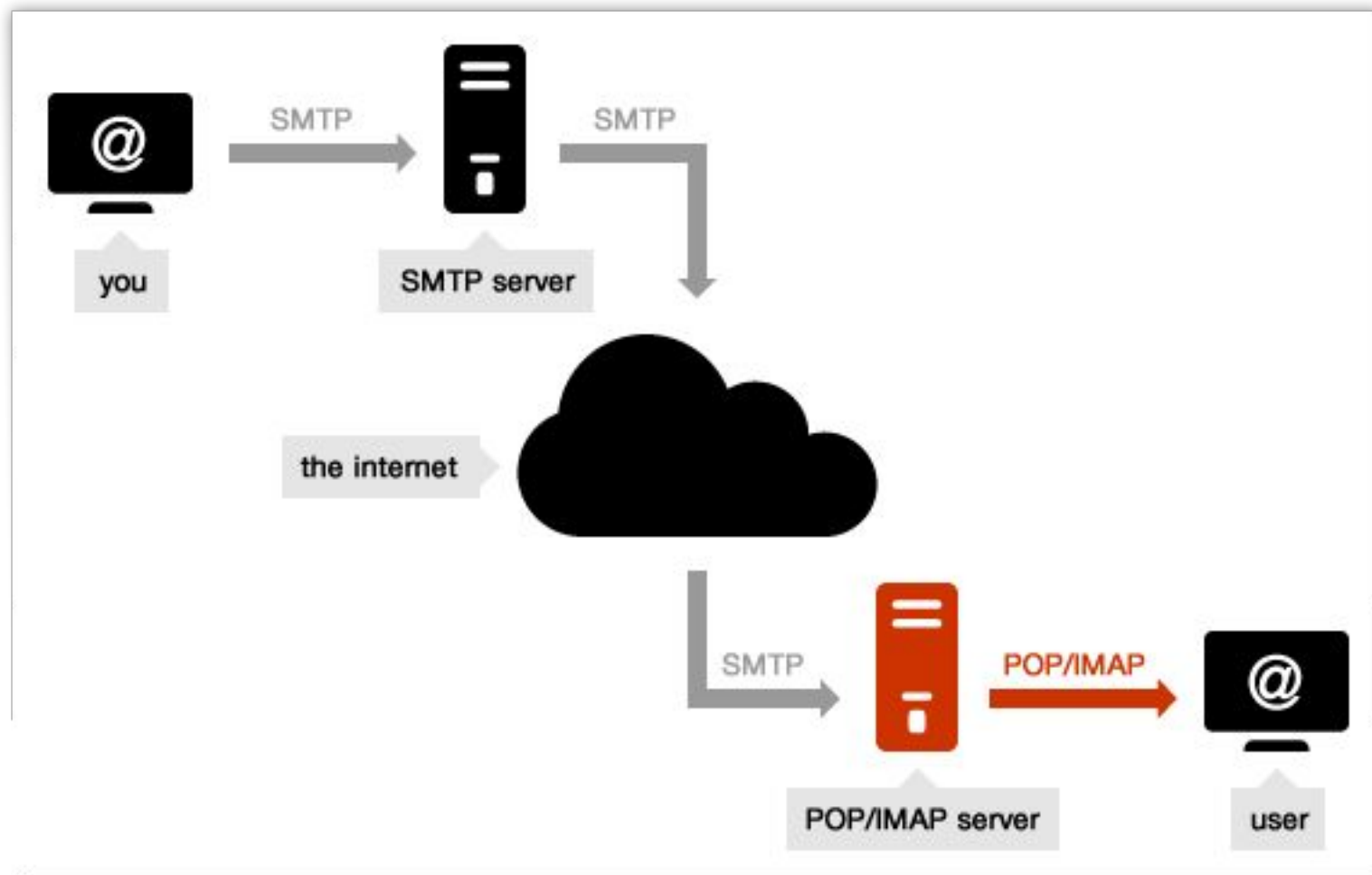
- SMTP stands for Simple Mail Transfer Protocol.
- SMTP is a set of communication guidelines that allow software to transmit an electronic mail over the internet is called Simple Mail Transfer Protocol.
- It is a program used for sending messages to other computer users based on e-mail addresses.
- It provides a mail exchange between users on the same or different computers, and it also supports:
 - It can send a single message to one or more recipients.
 - Sending message can include text, voice, video or graphics.
 - It can also send the messages on networks outside the internet.

- The main purpose of SMTP is used to set up communication rules between servers. The servers have a way of identifying themselves and announcing what kind of communication they are trying to perform. They also have a way of handling the errors such as incorrect email address.



POP:

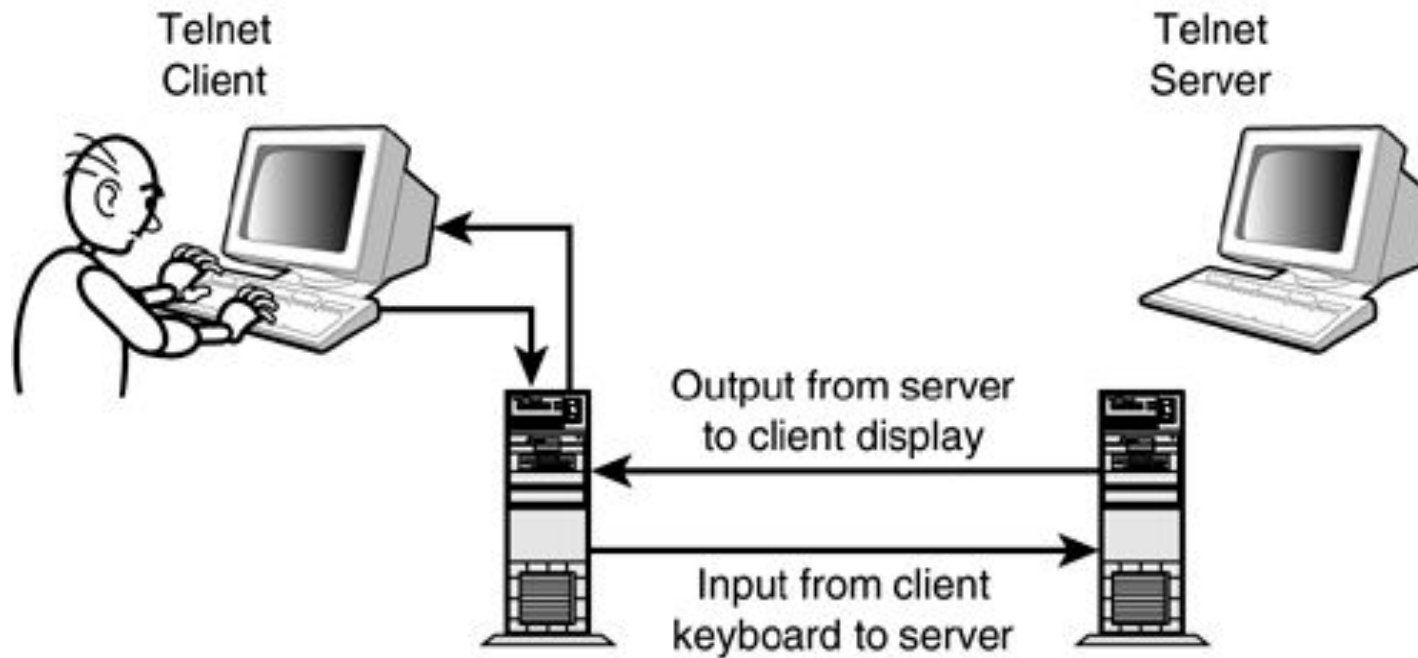
- POP stands for Post Office Protocol.
- POP is an application layer protocol of OSI reference model.
- POP is used by clients for retrieving emails from the mail server.
- POP allows downloading message from your inbox to your local computers.
- As we know that SMTP is used as a message transfer agent. When the message is sent, then SMTP is used to deliver the message from the client to the server and then to the recipient server. But the message is sent from the recipient server to the actual server with the help of the Message Access Agent. The Message Access Agent contains two types of protocols (POP3 and IMAP).



Telnet:

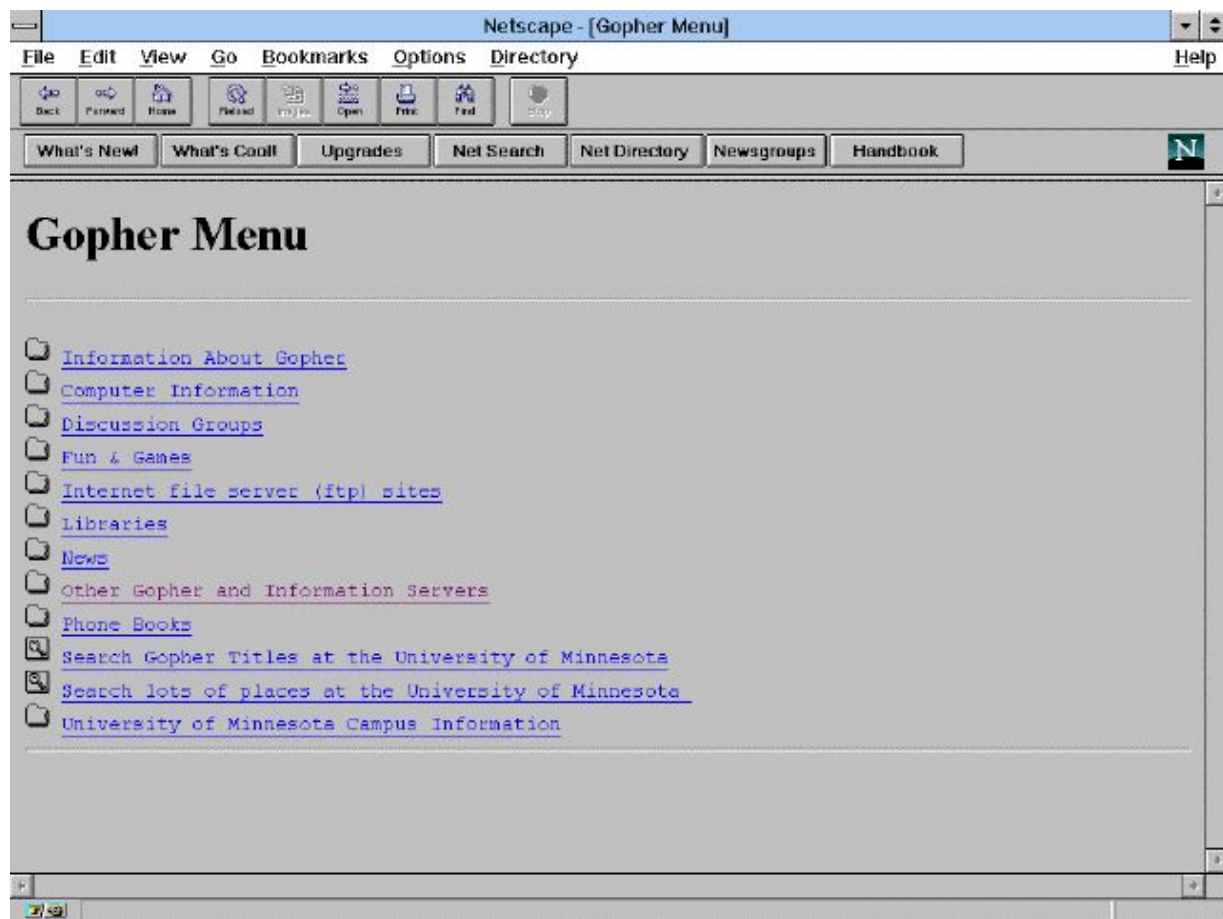
- TELNET stands for Terminal Network.
- It is a type of protocol that enables one computer to connect to local computer.
- It is used as a standard TCP/IP protocol for virtual terminal service which is given by ISO(**International Organization for Standardization**).
- Computer which starts connection known as the local computer.
- Computer which is being connected to i.e. which accepts the connection known as remote computer.
- When the connection is established between local and remote computer. During telnet operation whatever that is being performed on the remote computer will be displayed by local computer. Telnet operates on client/server principle.
- Local computer uses telnet client program and the remote computers uses telnet server program.

-Telnet is a command line tool that runs on your computer and it will allow you to send command remotely to a server to access the services like run programs, create folders, delete files, create files, transfer files, start/stop services etc.



Gopher:

- Gopher is an application-layer protocol that provides the ability to extract and view Web documents stored on remote Web servers.
- Gopher was conceived in 1991 as one of the Internet's first data/file access protocols to run on top of a TCP/IP network.
- Gopher is an Internet application that allows you to browse many different kinds of resources by looking at menus or listings of information available.
- Its function is easy to remember because of its name: you use Gopher to "go fer" information that is on other computers all over the world.
- The menus in the Gopher system allow you to see what information is there; the Gopher client on your system then brings the information you want to your computer screen.
- The Gopher servers of the world are all interconnected and have been compared to a large library full of resources.



WAIS:

- Wide Area Information Server (WAIS) is a client–server text searching system that uses the ANSI Standard Z39.50 Information Retrieval Service Definition and Protocol Specifications for Library Applications" (Z39.50:1988) to search index databases on remote computers.
- WAIS (Wide Area Information Servers) is an Internet system in which specialized subject databases are created at multiple server locations, kept track of by a directory of servers at one location, and made accessible for searching by users with WAIS client programs.