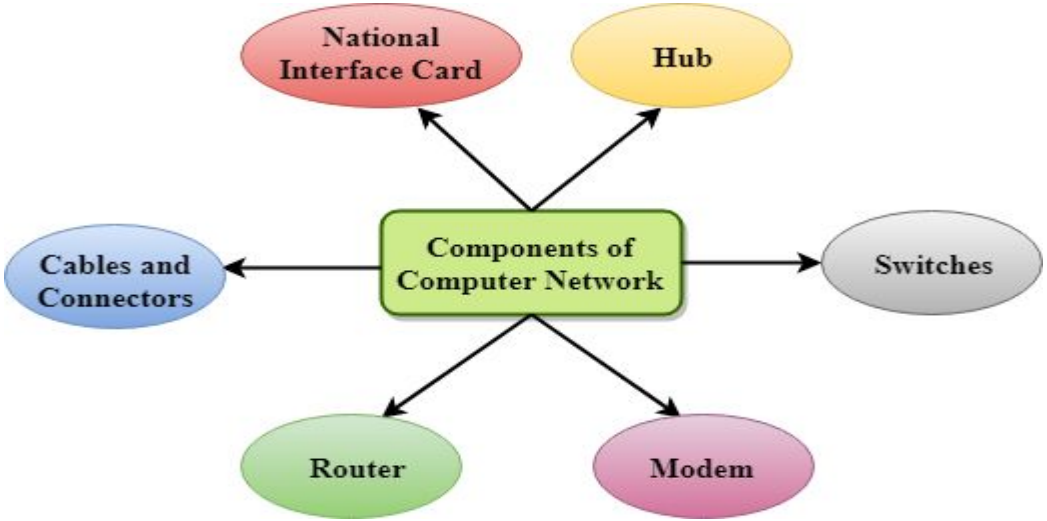
Data Communication and Computer Network

What is Computer Network?

A computer network is a set of devices connected through links. A node can be computer, printer, or any other device capable of sending or receiving the data. The links connecting the nodes are known as communication channels.

Computer Network uses distributed processing in which task is divided among several computers. Instead, a single computer handles an entire task, each separate computer handles a subset.

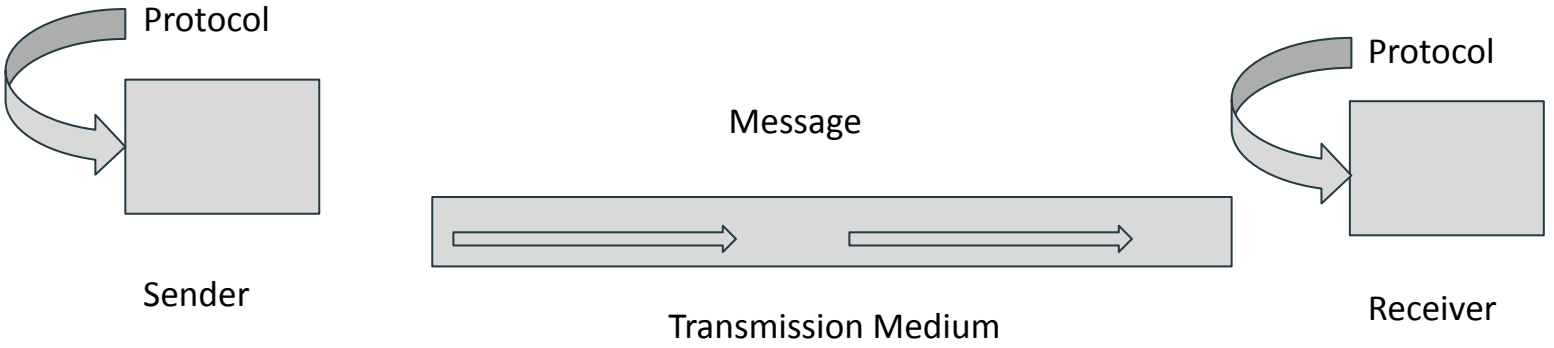


Definition of Data Communication ?

Data Communication is defined as the exchange of information (in the form of 0's and 1's) between two digital devices via some form of transmission medium.

The transfer or exchange of information from one computer to another is known as data communication.

The data communication process is made up of five components namely message sender,receiver,transmission medium and protocol.



Function of each component in data communication

1. The **message** is the information in the form of data to be communicated .It can consist of text,numbers,pictures,sound,video or any combination of these.
2. The **sender** is the device that sends the data message.It can be computer,workstations,telephone and so on.
3. The **receiver** is the device that receive the message.It can be computer,workstations,telephone and so on.
4. The **transmission medium** is the physical path by which a message travel from sender to receiver.It can consist of twisted pair wire,coaxial cable,fibre-optic cable ,laser or radio waves.
5. A **protocol** is refers to a set of rules that coordinate the exchange of information.without the protocol the sender and receiver cannot communicate. Both sender and receiver should follow the same protocol to communicate with each other.

Component of Data Communication

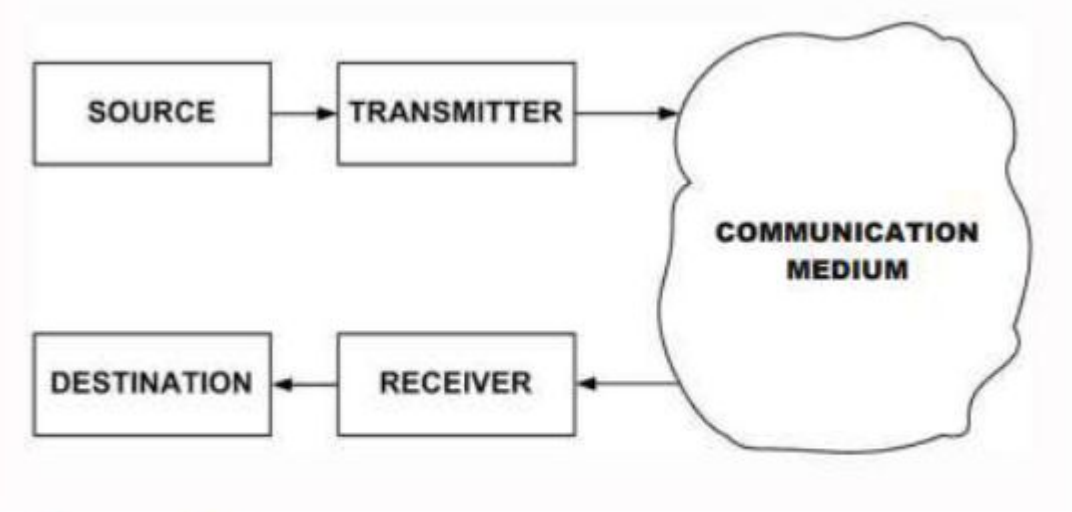


Figure 2.1.1 *Simplified model of a data communication system*

Component of data communication systems are as follows:

1.**Source**:- source generates the data which is to be transmitted. Example of source include telephone terminal, personal computer etc.

2.**Transmitter**:-The transmitter also known as the sender is the device that originates the information transfer. Data from the source are not transmitted in the same from which are generated by source, transmitter converts and encode the data so as to produce electromagnetic signals. Modem is used to convert incoming data stream into analog signals that can be handled by telephone network.

3.**Transmission System**:- It is a single transmission line or network connecting source and destination . Example includes cabling, microwave,fibre optics ,radio waves and so on.

4.**Receiver** :- The Receiver also known as the sink that receives the information transfer. The receiver is to accept the information from transmission line or network and converting it into digital data in the form of stream so that destination can handle the data.

5.**Destination**:-Destination is a device like computer that receives the data.

The efficiency of data communication systems depend on following basic characteristics

1. **Delivery**- the system must deliver data to the correct intended destination.

2. **Accuracy**- the communication system should be delivered data accurately ie without any error.

3.**Timeless**-the communication system must deliver data on time as required. Delay in data delivery my trended data useless for the receiver.

4. **Jitter** - It is the variation in the packet arrival time. Uneven jitter may affect the timeliness of data being transmitted

5.**Transmission system utilization**- it is a measure of use of Transmission facilities that are shared among the number of communicating device various multiplexing techniques are used to share total capacity of transmission medium with number of users

The efficiency of data communication systems depend on following basic characteristics

6.Synchronization- receiver must be able to detect when transmission begins and When It Ends. Synchronization between receiver and transmission should be achieved using handshaking signals

7. Error detection and correction- transmitted signal May get distorted when it travels long distance through medium. For example a file from one computer can be transmitted to other should be accompanied by error detection code.

8.Message formatting- two party should have same agreement about format of data to exchange a transmitted. By the record for characters is to be adopted in universally.

Protocol standards and standard organizations

Protocol :- A protocol is a set of rules and conventions. In other words a protocol is a set of rules that governs data communication.

A protocol is one of the components of data communication system.Without protocol communication cannot occur. For successful communication to occur the sender and receiver must agree upon certain rules in relation with the data such rules called as protocol

Element of protocols

1 syntax-The syntax of protocol defines the structure or format of data.This mean that the order in which it is to be sent is decided. A protocol could define that the first 16 bit of a data transmission must always contain the receiver's address

2.**Semantics**-Protocol semantics defines the interpretation of the data that is being sent. For example the semantics could define that if the last two bits of the receiver's address field contain a 00, it means that the sender and the receiver are on the same network.

3.**Timing**- Timing refers to an agreement the sender and the receiver about the transmission rate and duration.

Function of Protocols

- Protocol defines data Sequencing rule.
- Protocols define data routing rules which the most efficient path between the source and the destination .
- Protocols define data formatting rules which group of bits or characters within packet constitute data, control,addressing,or other information.
- Protocols define flow control of information or data.
- It defines error control rules are designed to detect error in message and to ensure transmission of correct message.
- Protocols defines connection establishment and termination rules that define how connections are established, maintain and terminated when two nodes of a network want to communicate with each other.

Common Protocols

- Ethernet- The protocol is by far the most widely used.Ethernet uses an access method called CSMA / CD(Carrier sense multiple access/Collision Detection.)The Ethernet protocol allow for linear bus,star or tree topologies.
- ATM- Asynchronous transfer mode (ATM) is a network protocol that transmits data at a speed of 155 mbps and higher.
- TCP(Transmission Control Protocol) - It is a connection-oriented transport protocol. Connection -oriented protocol provide reliable transport, in that if a segment is dropped,the sender can detect that drop and retransmit that dropped segment.
- FTP(File transfer protocol)- It provides the uploading and downloading of file from a remote host running ftp server software.
- SMTP(Simple Mail Transfer Protocol)-It defines how mail message are sent between hosts.
- HTTp(Hypertext Transfer Protocol)- It enables text,graphics,multimedia and other material to be downloaded from an http server.

- **Protocol Standard**
- **International Standard Organization(ISO)**-Iso is well known multi-national standard body.Open Systems Interconnection (OSI) model as a networking protocol is a major contribution of the ISO to the data communication World.ISO created in 1947,the iso is a non-profitable standard creation organization. Members from over eight developed nations actively represent the ISO
- **Institute of Electrical and Electronics Engineers(IEEE)-** IEEE is the biggest professional engineering body in the world. IEEE focus area are development in the areas of electric and electronic engineering and radio sciences. IEEE also covers the development and adoption of international computer and communication standards.
- **American National standards Institute(ANSI):-** ANSI is a private non-profit organization that does not have any direct ties with the us federal government.
- **Telecommunications Industry Association:-**TIA is the leading trade association in the communications and information technology industry. It facilitates business development opportunities through market development, trade promotion, trade shows, and standard development.

Bandwidth, Data Transmission Rate, Baud Rate and BIts per second

Bandwidth is a range within a band of frequencies or wavelengths.Bandwidth is also the amount of data that can be transmitted in a fixed amount of time.

For Digital devices the bandwidth is usually expressed in bits per second (bps) or bytes per second.

For analog devices, the bandwidth is expressed in cycle per second, or hertz(Hz).

Bit Rate :- Bit Rate is simply the number of bits (ie 0’s and1’s) transmitted per unit time.

Bit rate is the number of bits transmitted in one second. It is expressed as bits per second bps.

Baud Rate:- Baud rate is the number of signals units transmitted per unit time that is needed to represent those bits.

Different Connecting devices used in computer network

1) **Hub:-** It is also known as multiport repeater.It is normally used for connecting stations in a physical star topology.

   It is the broadcasting device.It sends packets to all nodes in the network.

2) **Repeater :-** It is used to take the distorted,weak and corrupt input signal and regenerate this signal at its output.

   It ensures that the signal are not distorted or weak before it reaches the destination.

   It recreates the bit pattern of the signal, and puts this regenerated signal back on the transmission medium.

   It work in the physical layer with no intelligent function.

Different Connecting devices used in computer network

3) Switch :- It is used to connect multiple computers in which it can direct a transmission to its specific destination.

It is uncasting device. It avoids unnecessary network traffic. It operates in both the physical and the data link layer.

4)**Router:-** It is a device that helps in determining the best and shortest path out of the available paths, for a particular transmission.

Routers use logical and physical addressing to connect two or more logically separate networks.

It works at physical, Data link and network layer of OSI model

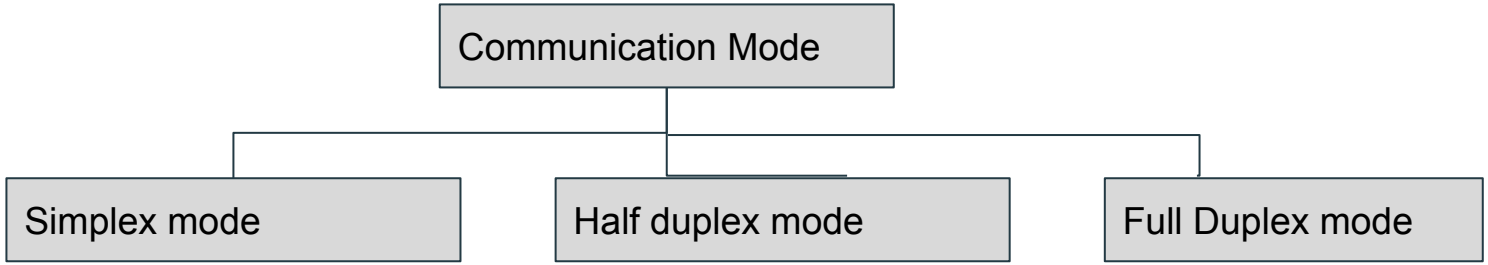
Router read complex network address in packet and efficiently direct packets from one network to another, reducing excessive traffic.

Modes of Communication.

The direction of data flow between two linked devices is called mode of communication.

There are three types of direction of data flow namely simplex mode , half-duplex mode and full duplex mode.

There are 3 types of transmission modes which are given below: Simplex mode, Half duplex mode, and Full-duplex mode. These are explained below.



Modes of Communication.

Simplex mode: In simplex mode, Sender can send the data but the sender can't receive the data. It is a unidirectional communication

In simplex mode communication mode, the communication can take place in only one direction ie data can be sent only in one direction.

Example of simplex mode are radio and TV transmissions. In computer system, the keyboard, monitor and printer are examples of simplex devices.

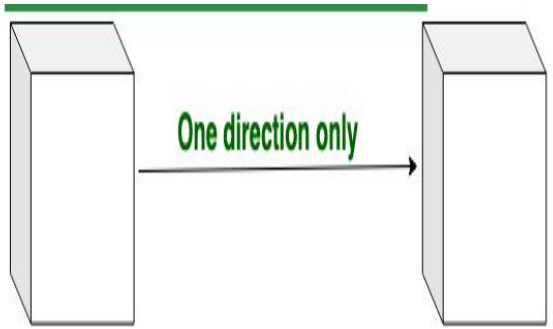
Advantages:- 1) Very Simple and easy communication

Method. 2)Cheaper in cost.

Disadvantages:-1)Only allow for communication in one

Direction. 2) Simplex transmission are not often used

Because it is not possible to send back error to the transmit end



Simplex mode

Modes of Communication.

Half-duplex mode: In half-duplex mode, Sender can send the data and also can receive the data one at a time. It is two-way directional communication but one at a time

-In half duplex communication mode, the communication can take

place in both the directions ,but only in one direction at a time .

-In this mode data is send and received alternatively.

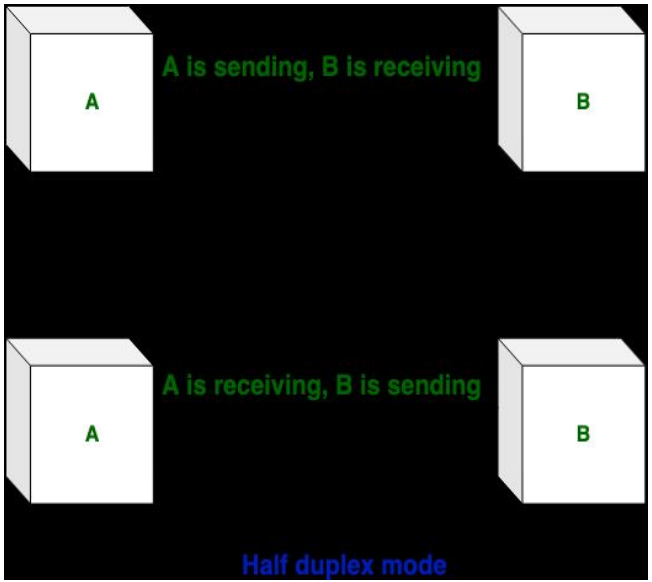
Example -Walkie -talkie.

Advantages:-1) Enables to two way communication.

2) Low cost than full duplex communication mode.

Disadvantages:- 1) Only one device can transmit at a time.

2) high cost than simplex mode.



Modes of Communication.

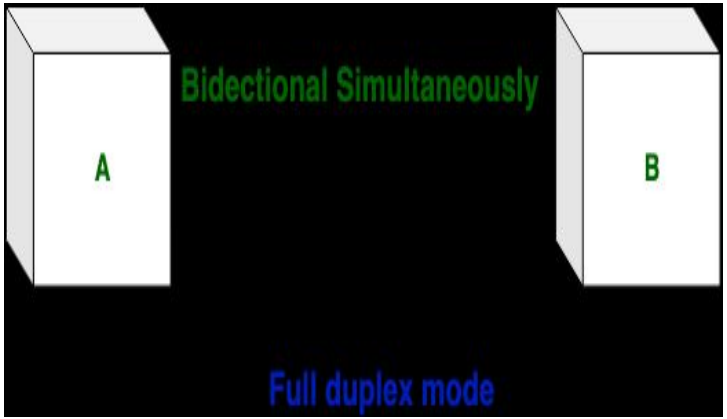
Full duplex mode: In full-duplex mode, Sender can send the data and also can receive the data simultaneously. It is two-way directional communication simultaneously.

Full duplex mode is the fastest directional mode of

Communication.

The Telephone communication system is an example of

Full duplex mode.



Advantages:- 1) Enables two-way communication

Simultaneously

2)Fastest method of data communication

Disadvantages:- 1)More Expensive and complex method.2) the bandwidth channels is required for data transmission.