Data Communication

STUDY NOTES

- **Data Communications:** Data communications are the exchange of data between two devices via some form of transmission medium such as a wire cable.
- **Characteristics of Data Communication:** Data communication has four critical characteristics that are as follows:
- **Delivery:** Data must be sent in the correct order from the source device to the correct destination.
- **Accuracy:** The information must be supplied without errors. The data should be retransmitted if there is any inaccuracy during transmission.
- **Timeliness:** Data must be given within the time frame provided. The data that was given late has become unusable.
- **Jitter:** Jitter is caused by an uneven or unexpected delay in the packet arrival time.
- **Types Of Data Communications:** Data communication between different devices are broadly categorised into 3 types: Simplex communication, Half- duplex communication and Full-duplex communication.
- **Simplex Mode:** A simplex communication system sends a message in only one direction.
- The message source (sender) works as the transmitter.
- It sends the message over the data channel to the receiver.
- **Half Duplex:** Half-duplex data communication system provides messages in both directions but only allows transfer in one direction at a time.
  - ❖ In this process, once a party begins sending a transmission, the receiver must wait until the signal stops before responding.
- **Full Duplex:**
  - ❖ A full-duplex is that type of data communication that works both ways at the same time.
  - ❖ Full-duplex mode is basically a set of two simplex channels, one works as a forward channel and the other as a reserve channel.
  - ❖ The two channels link together at some point in a full-duplex system.
- **Switching Techniques:**
  - ❖ Switching Techniques are the techniques that are used and applied on a large network.
  - ❖ Switching technique comes into picture when these large network needs to transfer the packet from source to destination i.e. from sender to receiver.
  - ❖ There are two types of popular switching techniques like circuit switching and packet switching with their own significance.
  - ❖ **Circuit Switiching:** The Circuit Switching technique establishes a dedicated path or channel between the sender and receiver for data transmission.
    - ■ Once a dedicated path is established then it does not terminate it until and unless the connection between the two data transmission point terminates.
    - ■ If circuit switching technique is applied and then any user wants to send the data for transmission and data can be any video, request or voice then that video is sent to destination receiver and then acknowledgement is provided to the user who sends the data.

- ❖ In circuit-switching technique only fixed set of data can be transferred and proper path from source to destination should be available.
- ❖ Communication switching technique involves three main stages:
  - (i) Circuit connection establishment
  - (ii) Transfer of data
  - (iii) Disconnection of circuit
- ❖ We can say that it operates in a similar manner in which a telephonic network operates when you call someone, then a dedicated communication channel or path is established between you two, which remains open till you disconnect the phone call.

- **Message Switching:**
  - ❖ In packet switching, data is broken down into small packets with each packet having source and destination addresses, travelling from one router to the next router.
  - ❖ Packets try to cover the shortest path available across the entire travel network.
  - ❖ In Message switching, there is no specific continuous path between source and destination i.e. receiver.
- **Communication Media Wired Technologies:**
  - ❖ In a wired network, data is transmitted over a physical medium.
  - ❖ There are three types of physical cables used in a wired network.
- **Twisted Pair of cables:**
  - ❖ It is a popular media for LAN (Local Area Network) and a telephone network.
  - ❖ It contains multiple pairs of cables twisted with each other.
  - ❖ The cables are twisted to minimize interference between each other.
  - ❖ **Features of twisted pair cable are as follows:** A twisted pair cable is two insulated copper wires twisted together loosely to form a cable. They are cheaper, lighter and easier to work with than coaxial cables.
  - ❖ **Advantages of twisted pair cable:**
    - ■ It is the least expensive media of transmission.
    - ■ It is relatively easy for implementation and termination.
    - ■ If a portion of a twisted pair cable is broken it doesn't affect the whole network.
- **Coaxial cable:**
  - ❖ Coaxial cable is commonly used for broadband connections and cable TV networks.
  - ❖ It is appropriate for contacting computers in MAN(Metropolitan Area Network).
  - ❖ It consists of a single copper wires covered by a plastic layer and aluminium foil.
  - ❖ It requires a BNC connector to connect the cable with the computer.
  - ❖ **Features of coaxial cable are as follows:**
    - ■ Cost is relatively inexpensive of coaxial cable.
    - ■ Its installation is relatively simple.
  - ❖ **Advantages of coaxial cable:**
    - ■ It is easy to install and maintain coaxial cable.
    - ■ It supports high bandwidth levels 400 to 600Mhz.
  - ❖ **Disadvantages of coaxial cable:**
    - ■ It needs to be grounded to limit interference.
    - ■ It is expensive as compared to a twisted pair cable.
- **Fibre optics cable:**
  - ❖ It is the fastest transmission media at present.
  - ❖ Fibre optics cable is popularly used for long-distance communication, telecommunications network.
  - ❖ It transmits data in the form of a light signal. It contains multiple hair-like fibres made of glass or plastic.

- ❖ **Features of fibre optics cable are as follow:**
  - ■ It is more expensive than copper cable.
  - ■ The types of equipment can be much higher.
  - ■ The data rates in the range of 100Mbps to 2Gbps.
- ❖ **Advantages of fibre optical cable:**
  - ■ It is the fastest transmission medium at present.
  - ■ It can transmit a large volume of data at the same time.
- ❖ **Disadvantages of fibre optical cable:**
  - ■ It is expensive and difficult to install.
  - ■ It can be easily broken.
  - ■ It has a limited physical arc of cables.

- **Ethernet cable:**
  - ❖ Typically, Ethernet cables are used to provide an internet connection, connect devices to a local network.
  - ❖ They plug into Ethernet ports on a variety of devices.
  - ❖ An Ethernet cable is used for faster speeds.
  - ❖ An Ethernet cable is a common type of network cable used with wired networks.
- **Wireless Technologies:** Wireless technology provides the ability to communicate between two or more entities over distances without the use of wires or cables of any sort.
  - ❖ **Bluetooth:** Bluetooth is a wireless communication technology that can be used for close-range data transmission from one digital device to another.
  - ❖ **WLAN:**
    - ■ Wireless LAN stands for Wireless Local Area Network.
    - ■ It is also called LAWN (Local Area Wireless Network).
    - ■ WLAN is one in which a mobile user can connect to a Local Area Network (LAN) through a wireless connection.
  - ❖ **Infrared:**
    - ■ Infrared (IR) is a wireless mobile technology used for device communication over short ranges.
    - ■ IR communication has major limitations because it requires line-of-sight, has a short transmission range and is unable to penetrate walls.
  - ❖ **Microwave:** Microwave is a line-of-sight wireless communication technology that uses high frequency beams of radio waves to provide high speed wireless connections that can send and receive voice, video, and data information.
- **Advantages of Microwaves:**
  - ❖ Supports larger bandwidth and hence more information is transmitted.
  - ❖ More antenna gain is possible.
  - ❖ Higher data rates are transmitted as the bandwidth is more.
- **Network Protocols:**
  - ❖ A network protocol is an established set of rules that determine how data is transmitted between different devices in the same network.
  - ❖ Essentially, it allows connected devices to communicate with each other, regardless of any differences in their internal processes, structure or design.
- **Need for Protocol:** Network protocols are needed because it includes mechanisms for devices to identify and make connections with each other, as well as formatting rules that specify how data is packaged into messages sent and received.
- **Types of Protocols:** There are various types of protocols that support a major and comprehensive role in communicating with different devices across the network. These are:

- **HTTP:**
  - ❖ Hypertext Transfer Protocol (HTTP) is an application-layer protocol for transmitting hypermedia documents, such as HTML.
  - ❖ It was designed for communication between web browsers and web servers, but it can also be used for other purposes.
- **FTP:**
  - ❖ FTP (File Transfer Protocol) is a network protocol for transmitting files between computers over Transmission Control Protocol/Internet Protocol (TCP/IP) connections.
  - ❖ Within the TCP/IP suite, FTP is considered an application layer protocol.
  - ❖ In an FTP transaction, the end user's computer is typically called the local host.
- **IP:**
  - ❖ IP stands for "Internet Protocol," which is the set of rules governing the format of data sent via the internet, or local network.
  - ❖ In essence, IP addresses are the identifier that allows information to be sent between devices on a network: they contain location information and make devices accessible for communication.
- **PPP:**
  - ❖ Point-to-Point Protocol (PPP) is a TCP/IP protocol that is used to connect one computer system to another.
  - ❖ Computers use PPP to communicate over the telephone network or the Internet.
  - ❖ A PPP connection exists when two systems physically connect through a telephone line.
- **Electronic mail protocol:** Email protocol is a standard method for exchanging information between email clients like Thunderbird, Apple Mail, or Mailbird and email provider's servers like Gmail, Outlook, Yahoo, and vice versa.
- **Concept of Channel:**
  - ❖ Communication channels are mediums through which you can send a message to its intended audience.
  - ❖ **For example**, phone calls, text messages, emails, video, radio, and social media are all types of communication channels.
- **Bandwidth:**
  - ❖ The maximum amount of data transmitted over an internet connection in a given amount of time.
  - ❖ Bandwidth refers to a network's capacity to transfer data between devices or the internet within a particular span of time.
- **Data Transfer Rate:**
  - ❖ The Data Transfer Rate (DTR) is the amount of digital data that is moved from one place to another in a given time.
  - ❖ The data transfer rate can be viewed as the speed of travel of a given amount of data from one place to another. In general, the greater the bandwidth of a given path, the higher the data transfer rate.