* Modes of communication -

- The way in which data is transmitted from one device to another device is known as transmission mode.
- The transmission mode is also known as the communication mode.
- Each communication channel has a direction associated with it, and transmission media provide the direction.
- The transmission mode is also known as a directional mode.
- The transmission mode is defined in the physical layer.

- Transmission mode -

- Simplex mode.
- Half-Duplex mode.
- Full-Duplex mode.

- Simplex mode -

- In simplex mode, the communication is unidirectional, i.e., the data flow in one direction.

- A device can only send the data but cannot receive it or it can receive the data but cannot send the data.

- The transmission mode is not very popular as mainly communications require the two-way exchange of data.
- The simplex mode is used in the business field as in sales that do not require any corresponding reply.

- The radio station is a simplex channel as it transmits the signal to the listeners but never allows them to transmit back.

- Advantage of simplex mode:

In simplex mode, the station can utilize the entire bandwidth of the communication

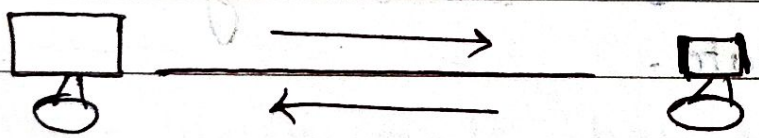
channel, so that more data can be transmitted at a time.

- Disadvantage of simplex mode -

Communication is unidirectional, so it has no inter-communication between devices.

- Half-Duplex mode -

- In a half-duplex channel, direction can be reversed, i.e., the station can transmit and receive the data as well.



- Transmission in either direction, but not simultaneously.

- Messages flow in both the directions, but not at the same time.

- The entire bandwidth of the communication channel is utilized in one direction at a time.

- A Walkie-talkie is an example of the Half-duplex mode. In walkie-talkie, one party speakes, and another party listens. After a pause, the other speakes and first party listens. speaking simultaneously will create the distorted sound which cannot be understand.

- Advantages of Half-duplex mode-

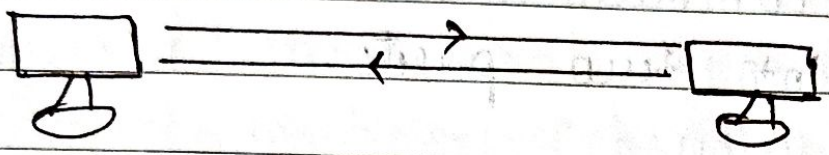
In half-duplex mode, both the devices can send and receive the data and also can utilize the entire bandwidth of the communication channel during the transmission of data.

- Disadvantages of Half-Duplex mode-

In half-duplex mode, when one device is sending the data, then another has to wait, this causes the delay in sending the data at the right time.

- **Full - duplex mode -**

- The communication is bi-directional, i.e., the data flow in both the directions.



Transmission in both the directions simultaneously

- Both the stations can send and receive the message simultaneously.

- The Full-duplex mode is the fastest mode of communication between devices.

- Full-duplex mode has two simplex channels. One channel has traffic moving in one direction, and another channel has traffic flowing in the opposite direction.

- Advantage of Full-duplex mode -

Both the stations can send and receive the data at the same time.

- Disadvantage of Full - duplex mode -

If there is no dedicated path exists between the devices, then the capacity of the communication channel is divided into two parts.

→ Bit Rate (BR) -

- Bit rate refers to the rate at which data is processed or transferred.
- It is usually measured in seconds, ranging from bps for smaller values to Kbps and mbps.
- Bit rate is also known as bitrate or data rate.
- In networking and digital telecommunications, bit rate refers to the per-second measurement of data that passes through a communications network.

- In this context, bit rate is synonymous with data transfer rate (DTR).
- For multimedia encoding, bit rate refers to the number of bits used per unit of playback time, such as video or audio after compression (encoding).
- Multimedia size and output quality often depend on the bit rate used during encoding.

Therefore, in both cases:

$BR = D \div T$

where:
BR = Bit Rate
D = Amount of Data
T = Time (usually second).

- In telecommunications and computing, "bit rate" is the number of bits communicated or processed per unit of time.

- Bit rate is measured in bits per second (symbol: bit/s) and is commonly prefixed with a SI prefix like kilo, mega, Giga, or Tera.

- The non-standard term "bps" is sometimes used instead of the conventional sign "bit/s". Therefore, 1 Mbps stands for one million bits per second.

- one byte per second (1 B/s) equates to 8 bit per second in most computer and digital communication contexts.

→ Baud Rate -

- A baud is the number of signaling elements per second sent by a communications device such as a modem. In theory, a modem with a high baud rate means fast transmission.

- The baud rate is therefore equal to the bit rate only if each signal element represents one bit of information.

classmate
Date
Page

- A "baud" is a standard symbol rate measuring unit. It is one of the components that determine the speed of transmission across a data channel.

- In pulses per second, symbols per second, it is the unit for symbol rate or modulation rate.

- The term "baud" refers to the gross bit rate, which is measured in bits per second

→ Network bandwidth -

- Network bandwidth is a measurement indicating the max^m capacity of a wired or wireless communications link to transmit data over a network connection in a given amount of time.

- Typically, bandwidth is represented in the number of bits, Kilobits, megabits or gigabits that can be transmitted in 1 second.

- synonymous with capacity, bandwidth describes data transfer rate. Bandwidth is not a measure of network speed -- a common misconception.

→ How does bandwidth work?

- The more bandwidth a data connection has, the more data it can send and receive at one time.
- In this concept, bandwidth can be compared to the volume of water that can flow through a pipe.
- The wider the pipe's diameter, the more water can flow through it at one time.
- The higher the capacity of the communication link, the more data can flow through it per second.
- The cost of a network connection goes up as bandwidth increases.

→ Attenuation in Networking -

- Attenuation in computer networking is the loss of communication signal strength that is measured in decibels (dB).

- As the rate of attenuation increases, the transmission, such as an email a user is trying to send or a phone call, become more distorted.

- Attenuation occurs on computer networks because of:

- Range - Over longer distances both wired and wireless transmissions gradually dissipate in strength.

- Interference - Radio interference or physical obstructions, such as walls, dampen communication signals on wireless networks.

- Wire size - Thinner wires suffer from more attenuation than thicker wires on wired networks.

UNIT-02

→ Reference Models (Network Architecture)

The two most important reference models are as follows -

- The OSI reference model
- The TCP/IP reference model.

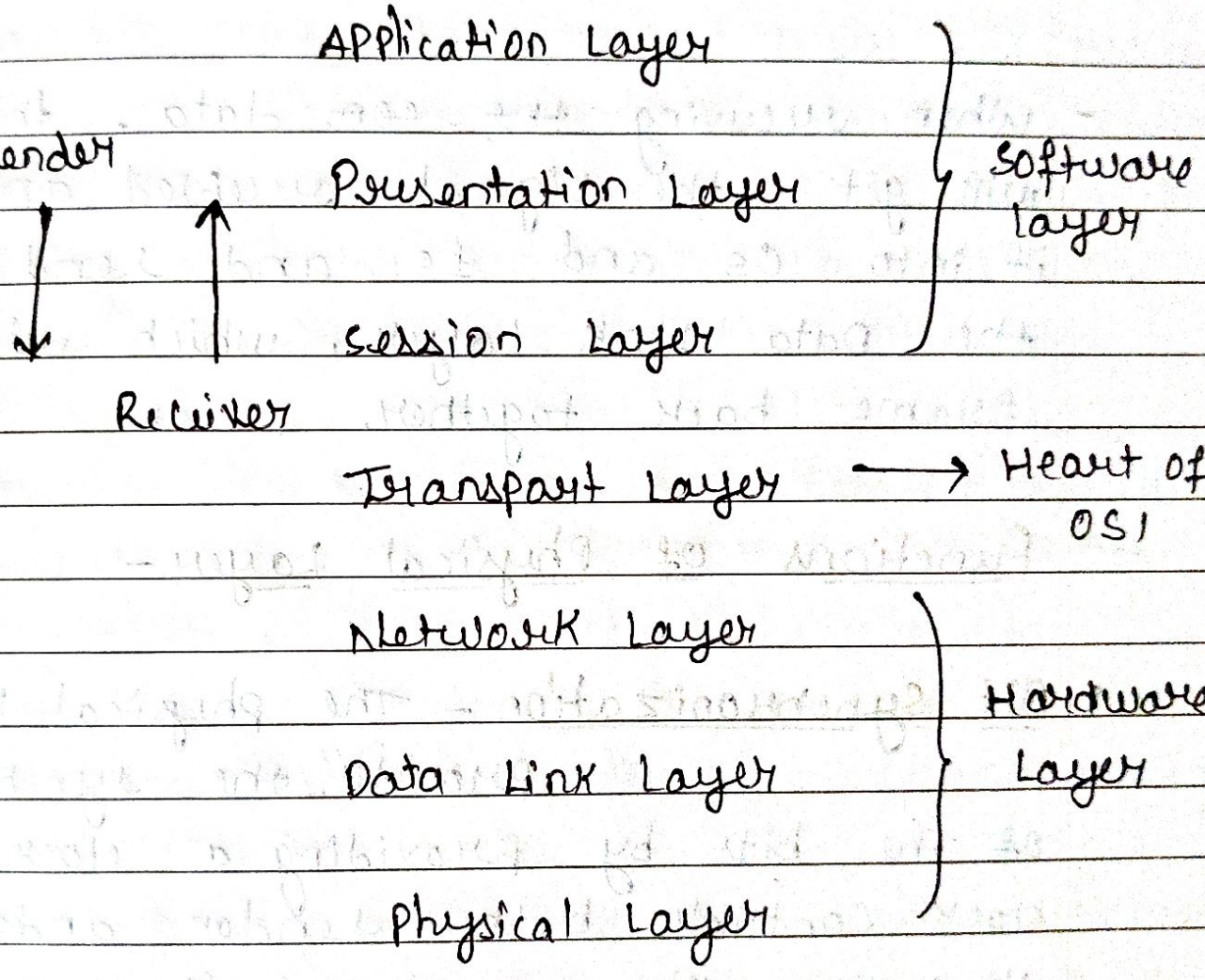
- **Introduction to OSI Model -**

- The users of a computer network are located over a wide physical range i.e. all over the world.

- Therefore, to ensure that nationwide and worldwide data communication systems can be developed and are compatible to each other, an international group of standards has been developed.

- These standards will fit into a framework which has been developed by the International organization of standardization (ISO).

- This ~~form~~ framework is called as Model for open system interconnection (OSI) and it is normally referred to as OSI reference model.



1. Physical Layer :-

- The lowest layer of the OSI reference model
- It is responsible for the actual physical connection between the devices.

- The physical layer contains information in the form of bits.

- It is responsible for transmitting individual bits from one node to the next.

- When receiving the ~~the~~ data, this layer will get the signal received and convert it into 0s and 1s and send them to the Data Link Layer, which will put the frame back together.

→ Functions of Physical Layer -

- Bit Synchronization - The physical layer provides the synchronization of the bits by providing a clock. This clock controls both sender and receiver thus providing synchronization at bit level.

- Bit rate Control - The physical layer also defines the transmission rate i.e. the number of bits send per second.

- Physical topologies - Physical layer specifies the way in which the different devices / nodes are arranged in a network i.e. bus, star, or mesh topology.

- Transmission mode - Physical layer also defines the way in which the data flows between the 2 connected devices. The various transmission modes possible are Simplex, half-duplex and full-duplex.

2. Data Link Layer - * Packets in Data link layer is referred to as Frame.

- The data link layer is responsible for the node-to-node delivery of the message.

- The main function of this layer is to make sure data transfer is error-free from one node to another, over the physical layer.

- When a packet arrives in a network, it is the responsibility of DDL to transmit it to the Host using its MAC address.

- Data Link Layer is divided into 2 sublayers
  i. Logical Link control (LLC)
  ii. Media Access control (MAC)

- The Packet received from the Network layer is further divided into frames depending on the frame size of NIC (Network Interface card).

- DLL also encapsulates sender and Receiver's MAC address in the header.

→ Functions of Data Link Layer -

- Framing - Framing is a function of the data link layer. It provides a way for a sender to transmit a set of bits that are meaningful to the receiver. This can be accomplished by attaching special bit patterns to the beginning and end of the frame.

- Physical addressing - After creating frames, the mechanism of error control in which it detects &

- Physical addressing - After creating frames, the Data Link layer adds physical address (MAC address) of the sender and/or receiver in the header of each frame.

- Error control - Data link layer provides the mechanism of error control in which it detects and retransmits damaged or lost frames.

- Flow control - The data rate must be constant on both sides else the data may get corrupted thus, flow control coordinates the amount of data that can be sent before receiving acknowledgement.

- Access control - When a single communication channel is shared by multiple devices, the MAC sub-layer of the data link layer helps to determine which device has control over the channel at a given time.

3. Network Layer -

- The network layer works for the transmission of data from one host to the other located in different networks.

- It also takes care of packet routing i.e. selection of the shortest path to transmit the packet, from number of routes available.

- The sender & receiver's IP address are placed in the header by the n/w layer.

→ Functions of Network layer -

- Routing - The network layer protocols determine which route is suitable from source to destination. The function of the network layer is known as routing.

- Logical Addressing - In order to identify each device on internetwork uniquely, the n/w layer defines an addressing scheme. The sender & receiver's IP addresses

ata in the transport layer is called as segments.
Transport layer is operated by the OS.
Transport layer is called as Heart of osi model.
t is a part of the OS & communicates with the appli^n layer by making system calls.

placed in the header by the n/w layer. such an address distinguishes each device uniquely and universally.

4. Transport Layer-

- The transport layer provides services to the application layer and takes service from the network layer.
- The data in the transport layer is referred to as segments.
- It is responsible for the End to End Delivery of the complete message.
- The transport layer also provides the acknowledgment of the sucessful data transmission and re-transmits the data if an error is found.
- At sender's side-
  - Transport layer receives the formatted data from the upper layers, performs

segmentation, and also implements flow & Error control to ensure proper data transmission.

- It also adds source and destination port number in its header and forward the segmented data to the Network layer.

Note- The sender needs to know the port number associated with the reciver's application.

- Generally, this distination port number is configured, either by default or manually.

- At reciver's side-

- Transport layer reads the port number from its header and forwards the data which it has recived to the respective application.

- It also performs sequencing and reassembling the segmented data.

→ Functions of transport layer-

- Segmentation and Reassembly- This layer accepts the message from the (session) layer, and breaks the message into smaller units. Each of the segments produced has a header associated with it. The transport layer at the destination station reassemble the message.

- Service Point Addressing- In order to deliver the message to the correct process, the transport layer header includes a type of address called service point address or port address. This by specifying this address, the transport layer makes sure that the message is delivered to the correct process.

- The services provided by the transport layer -

i) Connection-Oriented service - It is a three-phase process that includes

- Connection Establishment
- Data Transfer
- Termination / disconnection

In this type of transmission, the receiving device sends an acknowledgement back to the source after a packet or group of packets is received. This transmission is reliable and secure.

ii) Connectionless service -

- It is a one-phase process and includes Data Transfer.
- In this type of transmission, the receiver does not acknowledge receipt of a packet.
- This approach allows for much faster communication between devices.
- Connection-oriented service is more reliable than connectionless service

5. Session Layer-

- This layer is responsible for the establishment of connection, maintenance of sessions, authentication, and also ensures security.

→ funtions of session layer-

- Session establishment, maintenance, & termination- This layer allows the two processes to establish, use and terminate a connection.

- Synchronization- This layer allows a process to add checkpoints which are considered synchronization points into the data. These synchronization points help to identify the error so that the data is re-synchronized properly, and ends of the messages are not cut prematurely and data loss is avoided.

- Dialog controller- The session layer allows two systems to start communication with each other in half-duplex or full duplex.

6. Presentation layer-

- The presentation layer is also called the Translation layer.
- The data from the application layer is extracted here and manipulated as per the required format to transmit over the n/w.

→ Functions of Presentation layer-

- Translation- For ex - ASCII to EBCDIC
- Encryption/Decryption- Data encryption translates the data into another form or code. The encrypted data is known as the cipher text and the decrypted data is known as plain text. A key value is used for encryption as well as decrypting data.
- Compression- Reduces the number of bits that need to be transmitted on the n/w

7. Application Layer -

- At the very top of the OSI reference Model stack of layer, we find appli^n layer which is implemented by the network applications.

- These applications produce the data, which has to be transferred over the network.

- This layer also serves as a window for the application services to access the network and for displaying the received inf^n to the user.

Ex- Browsers, Skype Messenger, etc.

→ Functions of Application layer -

- Network virtual Terminal.
- FTAM - File transfer access and management.
- Mail services.
- Directory services.

07/04/22

TCP/IP

- TCP/IP reference model is a four-layered suite of communication protocols.
- It was developed by the DoD (Department of Defence) in the 1960s.
- It is named after the two main protocols that are used in the model, namely, TCP and IP.
- TCP stands for Transmission control protocol and IP stands for Internet protocol.
- The four layers in the TCP/IP protocol suite are-

- **Host-to-Network Layer-**

It is the lowest layer that is connected with the physical transmission of data.

TCP/IP does not specifically define any protocol here but supports all the standard protocols.

- Internet Layer -

It defines the protocols for logical transmission of data over the n/w.

The main protocol in this layer is internet Protocol (IP) and it is supported by the protocols ICMP, IGMP, RARP, and ARP.

- Transport Layer -

It is responsible for error-free end-to-end delivery of data.

The protocols defined here are Transmission control Protocol (TCP) and user Datagram protocol (UDP).

- Application Layer -

This is the topmost layer and defines the interface of host programs with the transport layer services.

This layer includes all high-level protocols like Telnet, DNS, HTTP, FTP, SMTP, etc.

The following diagram shows the layers and the protocols in each of the layers -

Application Layer	TELNET	DNS	HTTP	.....
Transport Layer	TCP	UDP	SCTP	
Internet Layer	IP	ICMP IGMP	RARP ARP	
HOST-to-Network Layer	ETHERNET	FRAME RELAY	TOKEN RING	ATM