

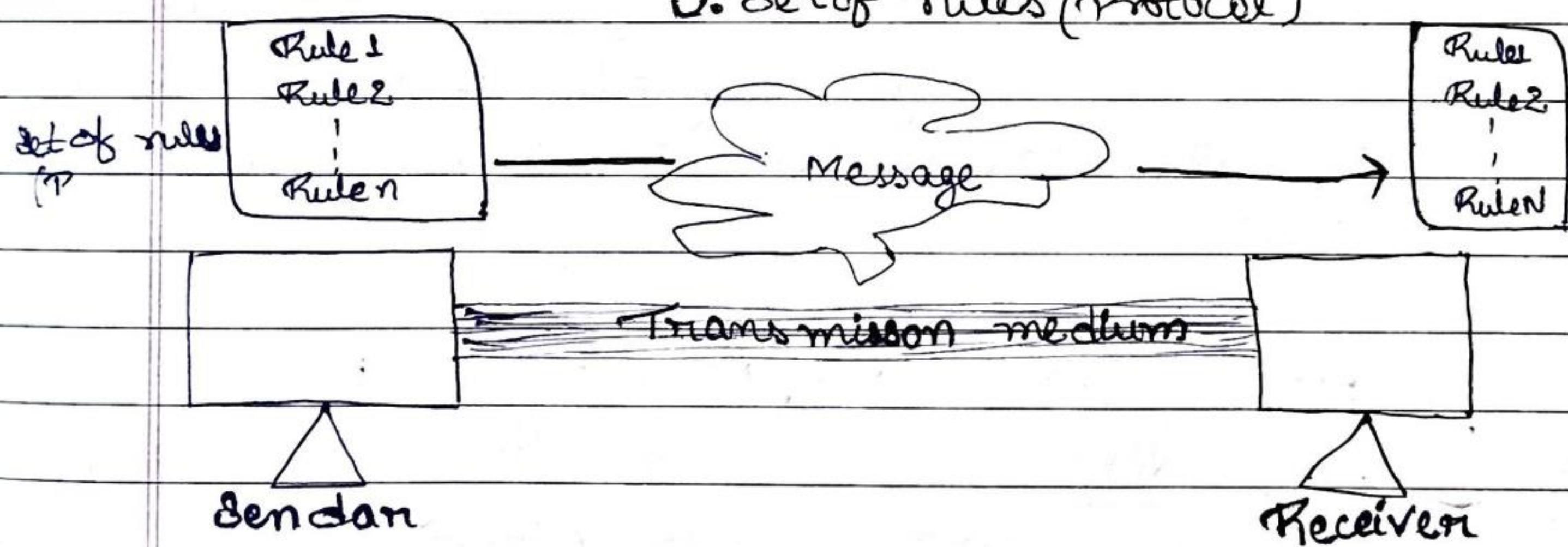
M=1] Data communication components: Representation of Data and its flow Networks, various connections Topology, Protocols & standards, OSI Model, Transmission Modes. 28/05/22

* Data communication is defined as exchange of Data between two devices via some form of transmission media such as a ~~capable~~ cable, wire or it can be air or vacuum also.

For occurrence of Data comm., communicating devices must be a part of communication system made up of a combination of hardware or software device and programs.

⇒ There are Mainly five components of Data commun. System :-

1. Message
2. Sender
3. Receiver
4. Transmission medium
5. Set of rules (Protocol)



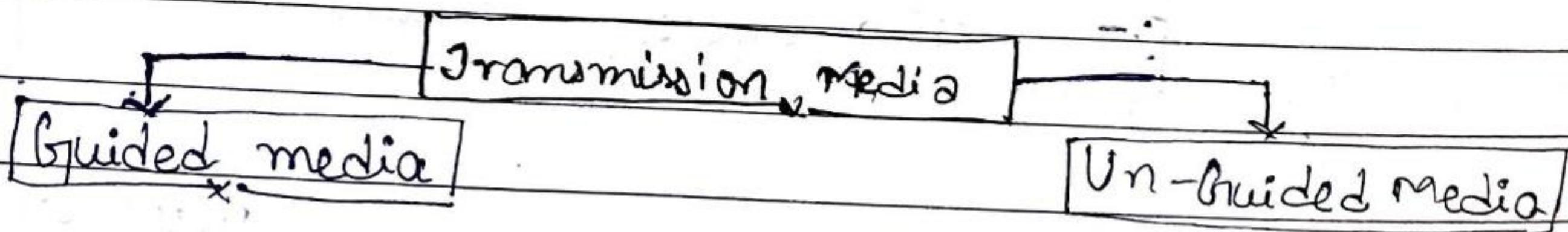
* Message:- This is most useful asset of a data communication system. The message simply refers to data or piece of information which is to be communicated. A message could be in any form like text, Audio, video.

* Assets:- ~~संपत्ति~~

- * Sender :- To transfer message from source to destination. Someone must be there who will play role of a source. Sender plays part of source in Data communication system.
* It is simple a device that sends data msg.
Eg:- Mobile, Telephone, Laptop etc.

- * Receiver :- It is destination where finally message sent by source has arrived. It is a device that receives message same as sender.
Eg:- Mobile, Laptop, Telephone, walkie-talkie

- * Transmission Medium :- A transmission medium is a physical path b/w the transmitter and the receiver i.e. it is the channel through which data is sent from one place to another.



- * Set of rules (Protocol) :- To govern Data communication various sets of rules had been already designed by the designers of communication system.
It is a kind of agreement b/w communicating devices.

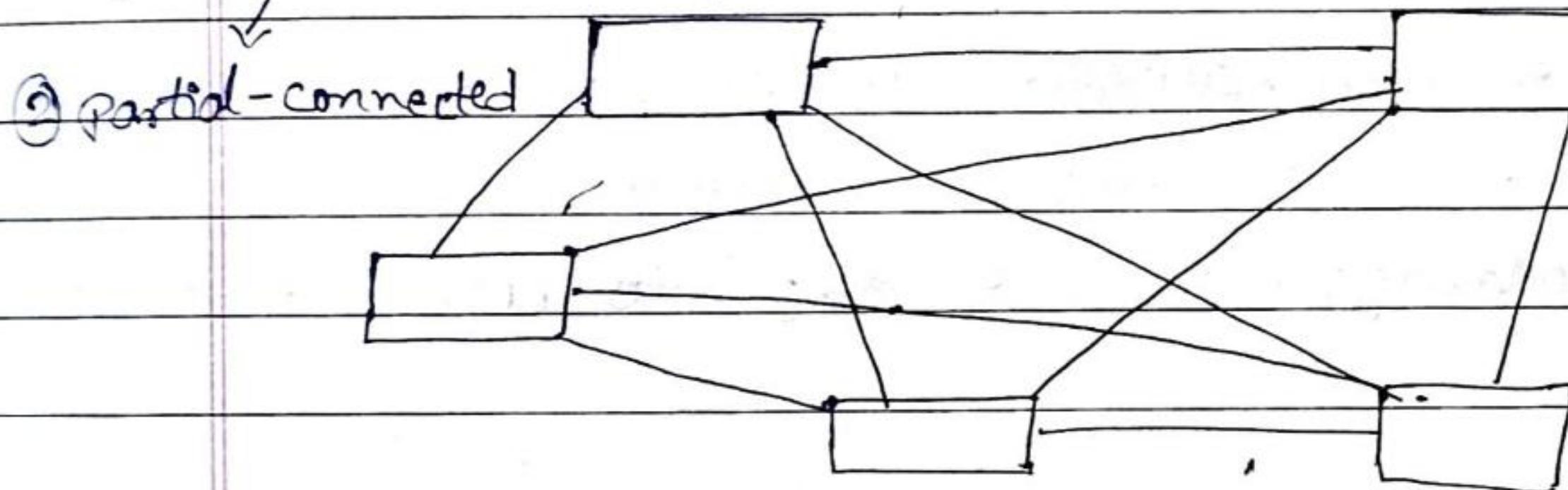
Connection topology

- * A Network connection topology is the physical and logical arrangement of nodes and connections in a network.
 - Nodes usually include devices such as switches, routers etc.

* Types of Topology

1. Mesh Topology :- In a mesh topology, every device is connected to another

- ① Fully-connected Devices via a particular channel.



- Every node connected to every other nodes.

⇒ ADVNG. :- • It is Robust • Scalability

- Provides security and privacy.
- The fault is diagnosed easily. Data is reliable because data is transferred among the devices through dedicated channels or links.

⇒ Problem in ADVNG. :- • The cost of maintenance is high.

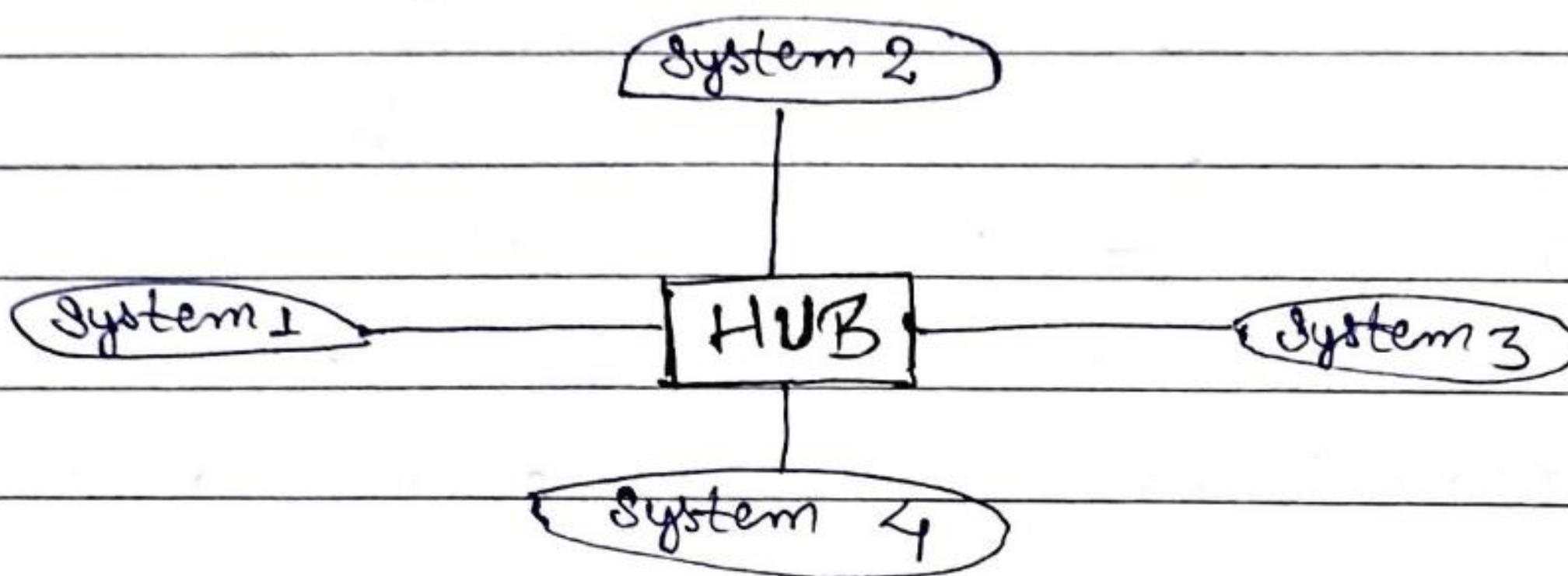
- Installation & config. are difficult.

- The cable's cost is high as bulk wiring

new!!

* Diagonised - निलंबन/पहारन

2. Star Topology :- In this, All the devices are connected to one single hub through a cable. The hub is central node. The hub can be passive in nature i.e. Not an intelligent hub such as broadcasting devices.



⇒ ADVNG :-

- Centralized Network
- User-friendly
- Very reliable
- Highly efficient
- Easily Manageable
- Safe to use.
- Robust

⇒ DAVNG :-

- Requires more cable than a linear bus.
- Performance is dependent on central / HUB.
- Extra Hardware Required like hub/switches.
- High cost
- prone to damage

3. BUS Topology :- It is a Network type in which every computer & network device is connected to a single cable. It's transmit Data from one end to another in a single cable. Not bi-directional feature in this.

ADVNG :-

⇒

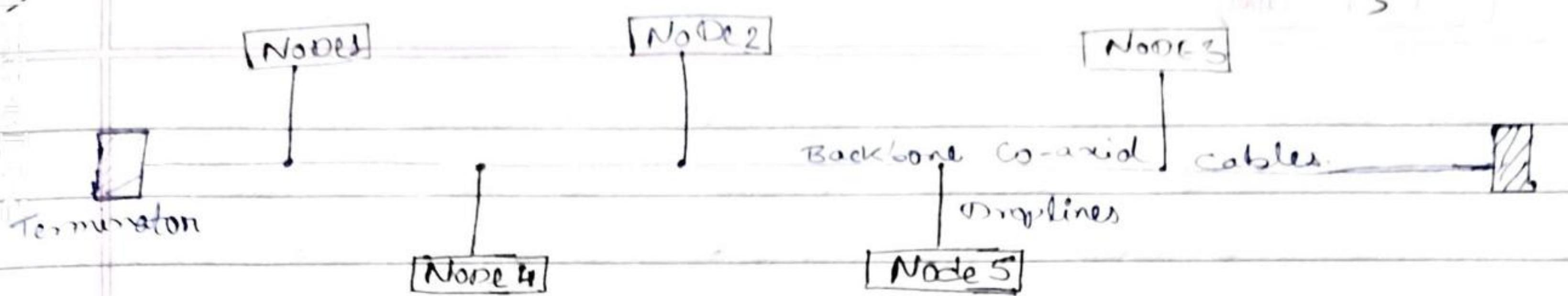
- Cable cost is low than other topology.
- Easy to connect a new node.
- cost efficient
- No need of hub or switch
- Easy to extension

Network

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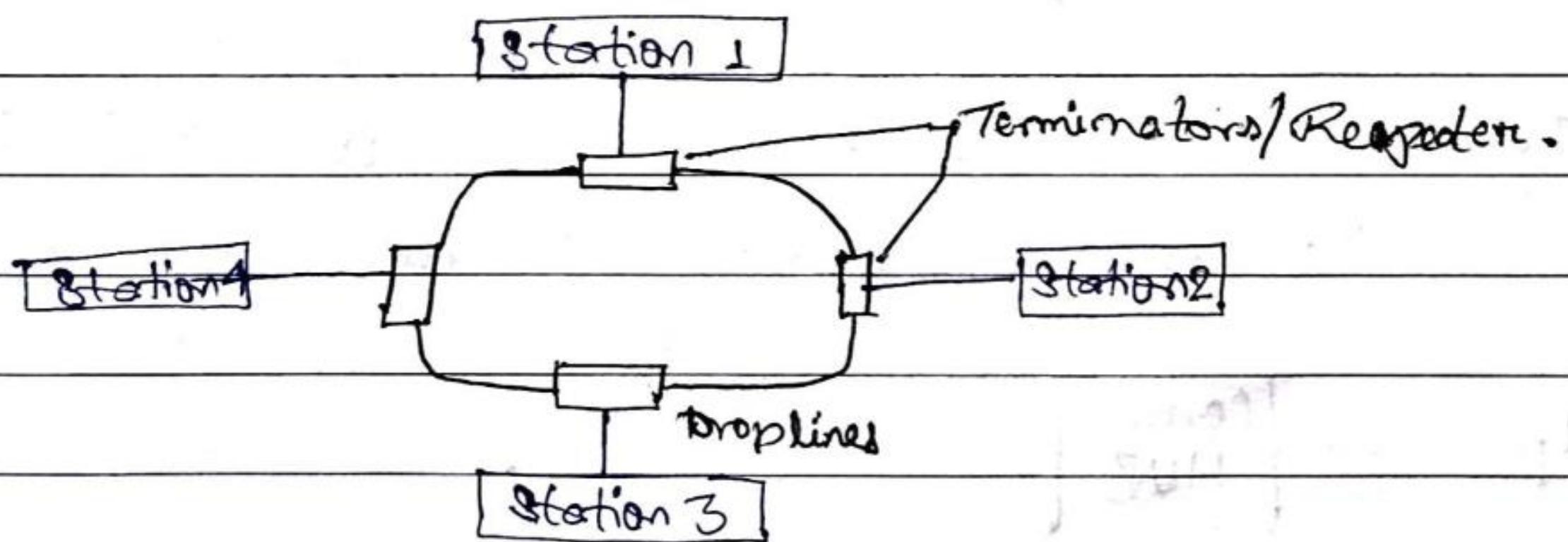
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- ⇒ DAVING :-
- ADDitional Devices slow the Network
 - Size limitation (^{It depend on} size of cable) • Not good for
 - packet loss is high • Troubleshooting is Hard ^{large net}

4. Ring Topology :- It forms a ring connecting devices with its exactly two neighboring devices. A No. of repeaters are used for Ring topology with a large No. of nodes.

- Transmission is Uni-directional. But it can be ^{2^{node}} b/w each network node is called in Dual - Ring Topology



* The following operations take place in ring topology one :-

1. one station is known as a monitor station which takes all the responsibility to perform the operation.
2. when No station is transmitting the data, then it the token will circulate in the Ring.

4. There are two token release techniques:-
 ① Early token release it releases the token just after transmitting the data.
 ② Delay token releases after the acknowledgement is received from the receiver.

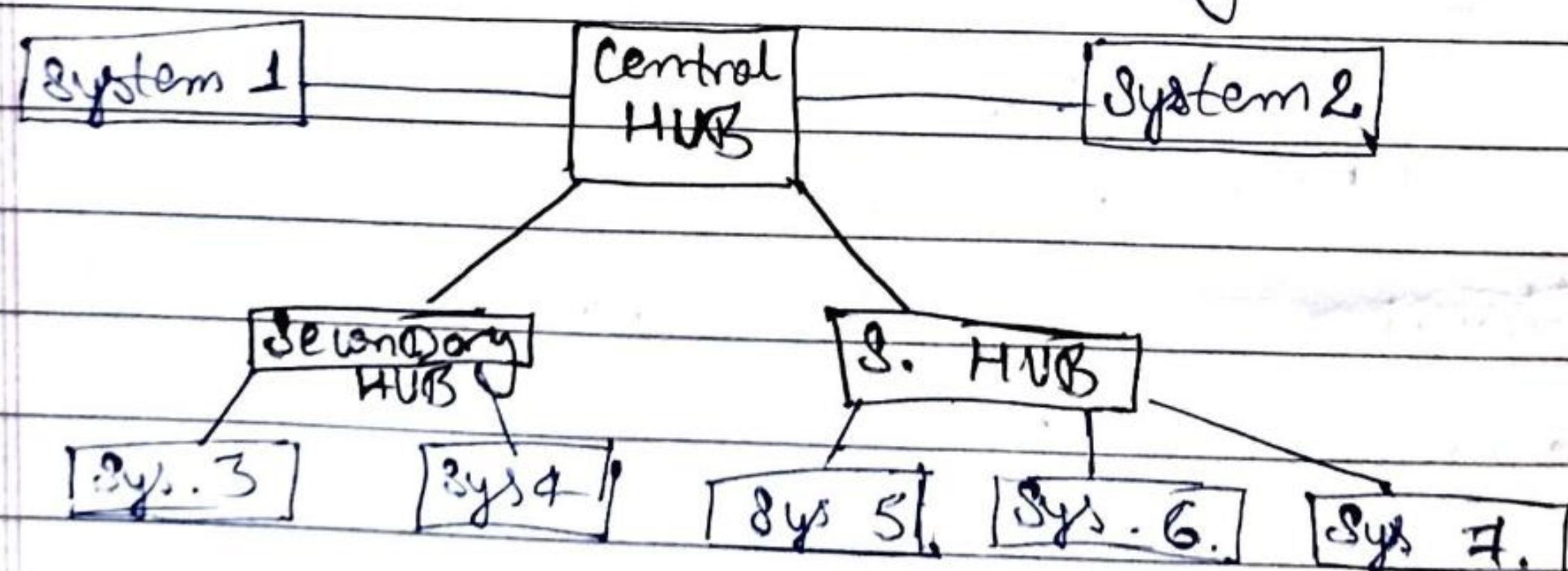
⇒ ADVANTAGES :-

- The possibility of collision is minimum in this type of Topo.
- Low collision
- Equal access to the resources.
- cheap to install
- Data transfer speed is high
- No need of server.

⇒ DISADVANTAGES :-

- Due to Uni-directional, a data packet (Token) must have pass all nodes.
- Slower than Bus.
- Dependent on the cable.
- Expensive
- Not Scalable
- Difficult to Troubleshoot

5. TREE - Topology :- In this, It is Variation of Star - topology; hierarchy flow of data



- Also known as BUS - STAR - Topology
 It is a network that is not commonly used
 But when a combination of scalability or hierarchy setup is required b/w two Networks.

⇒ ADVANTAGES :- • Detection of errors .

- Sturdiness • Easy Expansion • Device Support
- Low-cable require • Used in WAN

⇒ DISADVANTAGES :- • Installing tree topology • Cost
 • Maintenance • Security • Reliability

* 6. Hybrid Topology :- The combination of various different topologies.

Eg:- In ICICI Branch 1 has Bus - topo. & Branch 2 has Ring topo. , connecting these two topo. will result
HyB

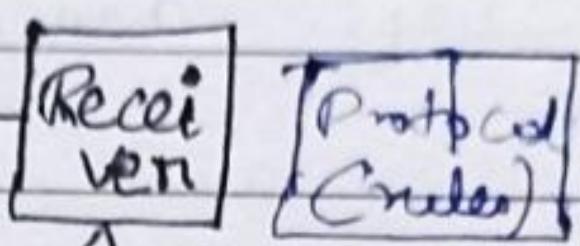
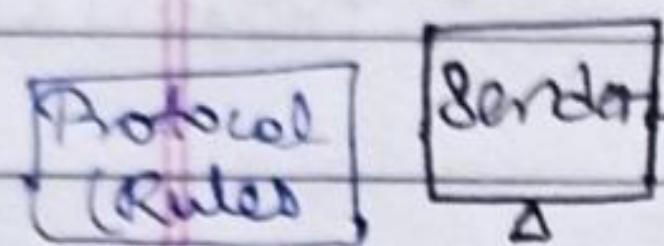
⇒ ADVANTAGES :- • Reliable • Flexible • Effective • Scalable .

⇒ DISADVANTAGES :- • Costly HUB • Complex Design • costly Infra

Protocols & STANDARD

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- ▲ **Protocol** :- In order to make communication successful b/w devices, some rules of procedures should be agreed upon at sending & receiving end of the system. Rules & procedures are called as protocols.



- Without protocol communication is not possible.

- # Key elements:-
- Syntax (संरचना)
 - Semantic (कार्य)
 - Timing

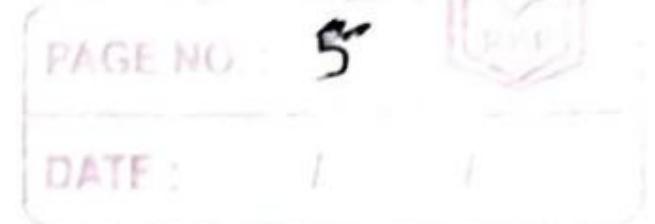
- **Standards** :- It is the set of rules for data communication that are needed for exchange of info. among devices.

▲ It mainly used to provide guidelines to manufacturers, agencies, vendors and also to other service providers in order to ensure the kind of interconnectivity.

- * **Data Communication**, STANDARDS mainly fall into two
- **de facto** (It means "By fact"/"by convention") Those standards have not been approved by an organized body but have been adopted as standards through widespread use. Also, sometimes, there, standards are often established by manufac.

Eg:- Apple & google are two company which established own rules on their products. which are differ.

STANDARD



2. • De jure Standard :- The meaning of the word "De jure" is "By law" or "By Regulation". Thus, These are the standards that have been approved by officially recognized body like ANSI, ISO, IEEE etc. * These are the standard which are important to follow if it is required or needed.

Eg:- All the Data communication standard protocols like - EIA, SMTP, TCP, IP, UDP etc. are important to follow.

ISO :- International Organization of Standardization

IEEE :- Institute of Electrical & electronics Engineers.

ANSI :- American National Standards Institute

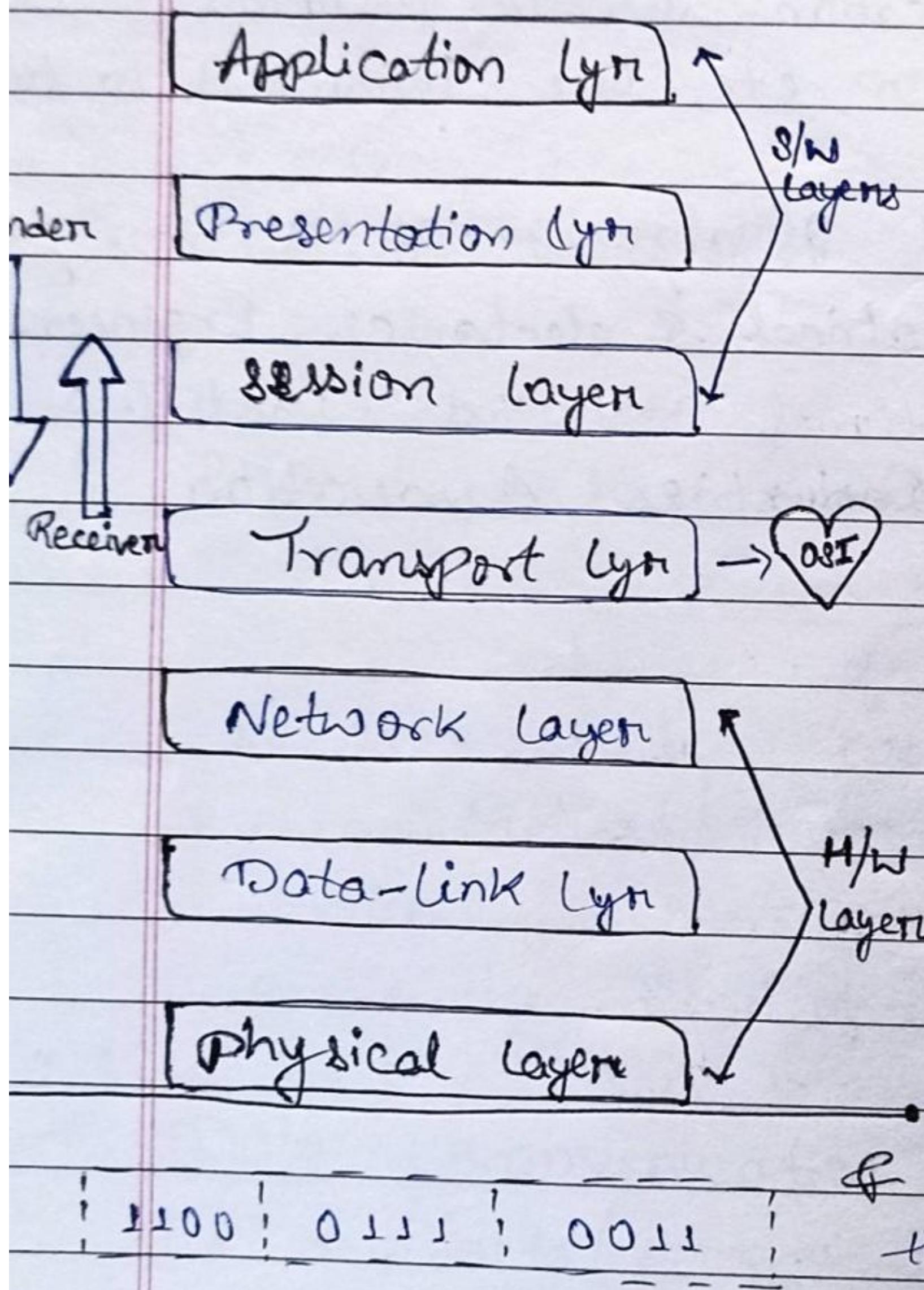
EIA :- Electronic Industries Association.

Open System Interconnection MODEL

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- * The OSI is a conceptual Model that describes the Universal Standard of Communication functions of a telecommunication system or computer system.
- * This is 7 layer architecture with each layer having specific functionality to perform.



1. Physical Layer :- The lowest layer of the OSI Reference model is the physical layer. It is responsible for the actual physical connection b/w the devices. The physical connection ~~contain~~ info in the form of Bits.

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

- When receiving data, this layer will get the signal received & convert it into 0s & 1s & send them to the Data-link.

* Functions of P. Layer:

1. Bit synchronization
2. Bit rate control

3. physical Topologies

4. transmission M

Note: HUB, REPEATER, MODEM, Cables are Physical layer device

2. Data-link:- It 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 Data-link layer to transmit it to the Host using its MAC Address.

- * Data link divided into
 1. Logical link Control (LLC)
 2. Media Access control (MAC)
- * Functions of D.L.:-
 1. Framing
 2. Physical Address
 3. Error control
 4. Flow & Access control

Note :- Packet referred in D.L. to as FRAME.

↳ DL Handled by the NIC | Switch/Bridge are ^{DL}Device

3. Network-layer:- It 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 the No. of routes available. Sender & Receiver IP add. are placed in the header by N-Layer

- * Functions of N.L.:-
 - Routing
 - Logical Add.

Note :- Segment in N. Layer is referred to as Packet.
 ↳ ^{NL} Its implemented by such as Routers.

4. Transport Layer :- This provides services to the application layer & takes services from the N. Layer. The Data in the transport layer is referred to as segments. It is responsible for the end-to-end delivery of the successful Data transmission & re-transmits the Data if an error is found.

* Functions of T. L :-
1. Segmentation & Reassembly
2. Service Point Addressing

* Services of T. L :-
1. Connection-oriented
2. Connectionless.

NOTE :- Data in TL is called segments.
It is operated by OS.

5. Session Layer :- This layer is responsible for the establishment of connection, maintenance of sessions, authentication, & also ensures security.

* Function S. Layer :-
1. Session establishment, maintain & termination
2. Synchronization
3. Dialog Control.

Note :- All the below 3 layers are integrated in TCP/IP as App. by

Computer Network

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6. Presentation layer :- It 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 network.

* Functions of P. layer :- 1. Translation (eg:- ASCII to EBCDIC)
2. Encryption/Decryption 3. Compression.

7. Application layer :- At the very top of the OSI Reference Model stack of layers, we find the App. 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 app. services to access the network & for the displaying the received information to the user.

Eg:- Browsers, skype, etc. /* also called as desktop layer
Functions of A. L :- 1. Mail ser. 2. Directory service
3. Network virtual terminal 4. FTAM

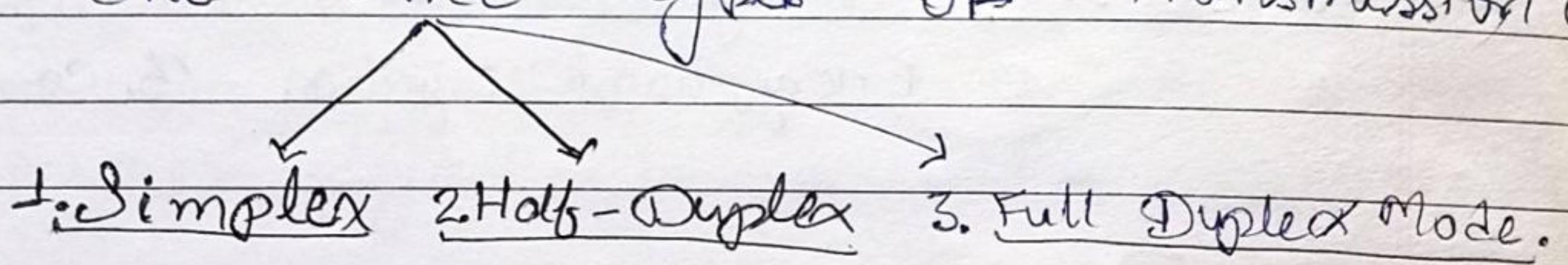
IP | OSI Model act as reference Model Not in use / current using Model is TCP/IP Model.

Transmission Modes

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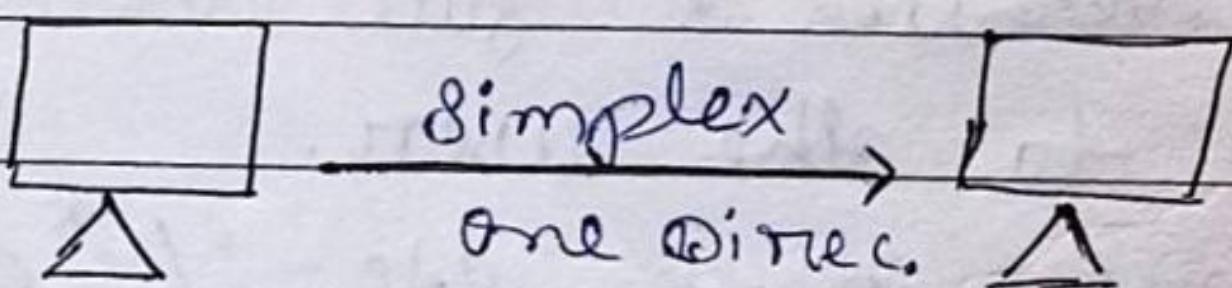
→ It means transferring Data b/w two devices. It is also known as a "Communication Modes"

▲ There are Three types of Transmission m.



1). Simplex :- In this mode, the communication is Unidirectional, as on a one-way street. Only one of the two devices on a link can transmit, the other can only receive. It uses the entire capacity of the channel to send data in to one direction.

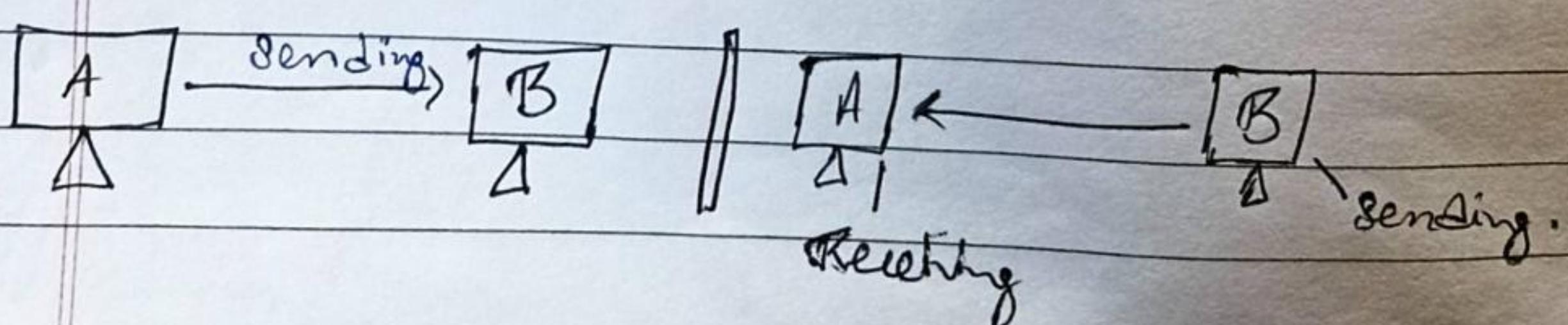
Eg:- Keyboard, Monitors.



2). Half-Duplex :- In this mode, Each station can both transmit & receive, But not at the same time. When one device is sending, the other can only receive & "vice versa"

Eg:- Walkie-talkie

$$\text{Channel capacity} = \text{Bandwidth} * \text{Propagation Delay}$$



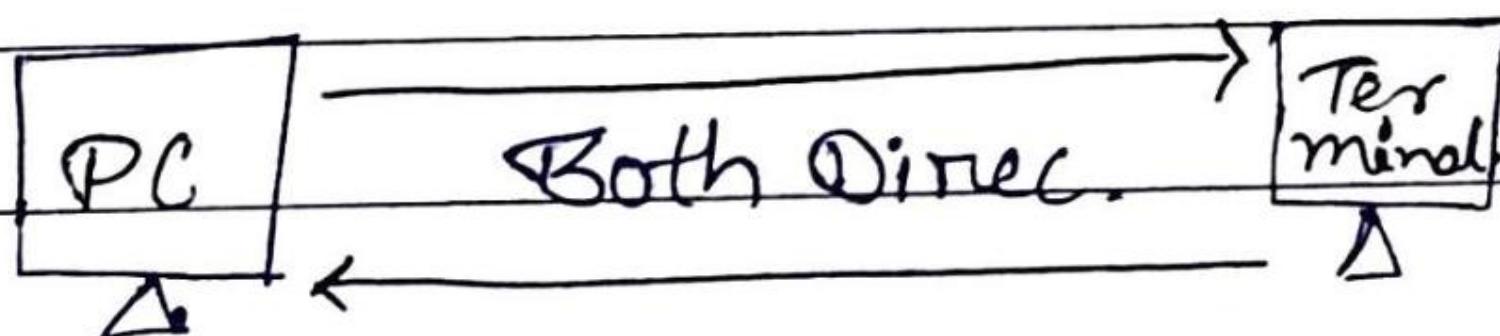
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3. Full-Duplex :- In full-Duplex mode, Both stations can transmit and receive simultaneously. In full-duplex, signals going in one direction share the capacity of the link with signals going in another direction, this sharing can occur in two ways.

- Full - Duplex Mode is used when communication in both directions is required all the time.

Eg:- Telephone, Mobile

$$\text{Channel capacity} = 2 * \text{Bandwidth} * \text{propagation delay}$$



* Key Points