

Name : G.Nithish

Reg no : 19BCS0012

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Network topology :

Network

* A network is a set of devices (often referred to as nodes) connected by communication links.

* A node can be a computer, printer, or any other device capable of sending and/or receiving data generated by other nodes on the network.

* Network topology refers to the manner in which the links and nodes of a network are arranged to relate to each other.

Star topology :-

- ★ In Star topology each device in the network is connected to central device called hub.
- ★ Unlike mesh topology, Star topology doesn't communicate directly between devices, a device must have to communicate through hub. If one device wants to send data to other device, it has to first send the data to hub and then hub transmit that data to the designated device.

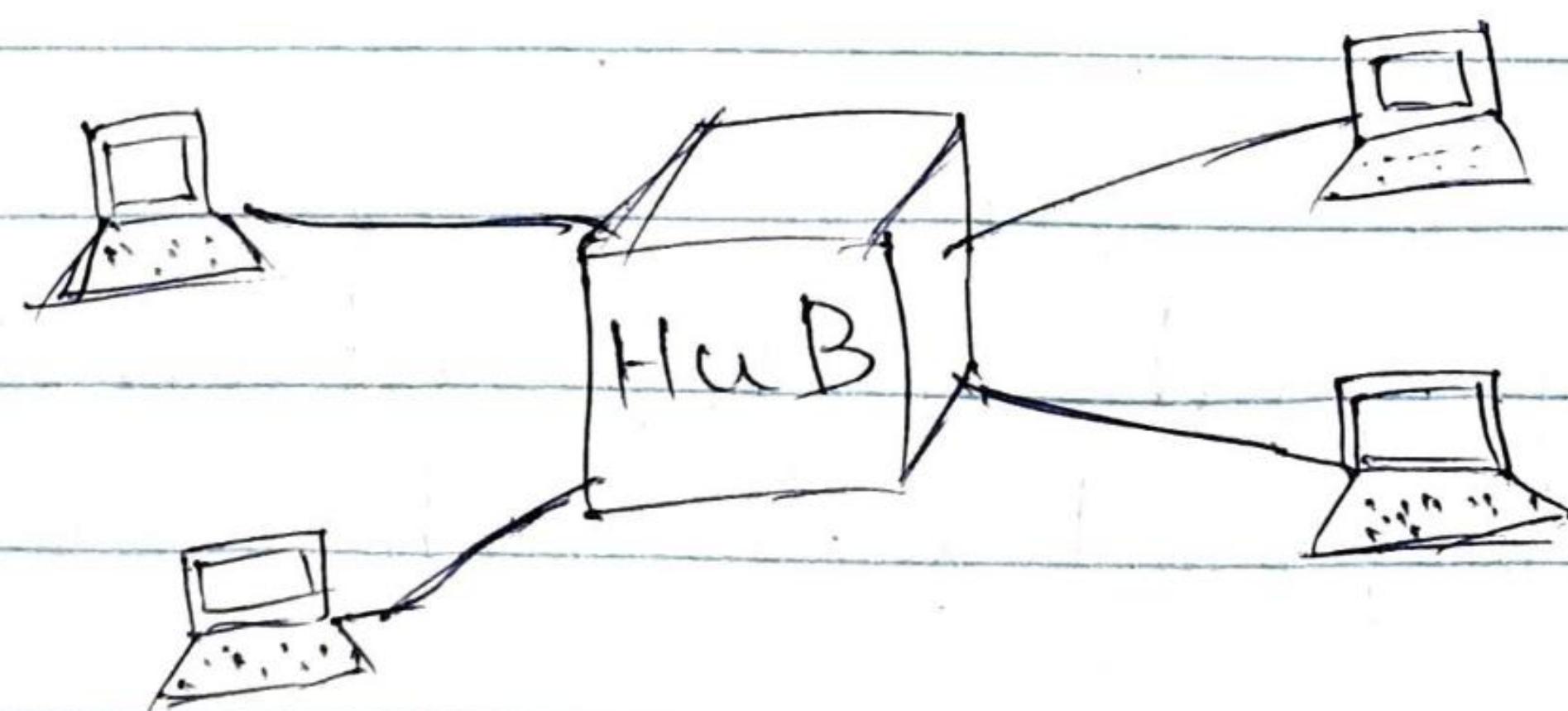
Advantages of Star topology :-

- ★ Less expensive because each device only need one I/O port and to be connected with hub with one link.
- ★ Easier to install.
- ★ Robust, if one link fails, other links will just fine.

Disadvantages of Star topology:-

- A) If hub goes down everything goes down, none of the device can work without hub.
- B) Hub requires more resources and regular maintenance because it is the central system of star topology.

Example of Star topology:-



Bus topology:-

* Data network with the bus topology has a linear transmission cable, usually Coaxial, to which many network devices and workstations are attached along the length and all devices are connected to this main cable through drop lines.

* There is a device called tap that connects the drop line to the main cable. Since all the data transmitted over the main cable, there is a limit of drop lines and the distance a main cable can have.

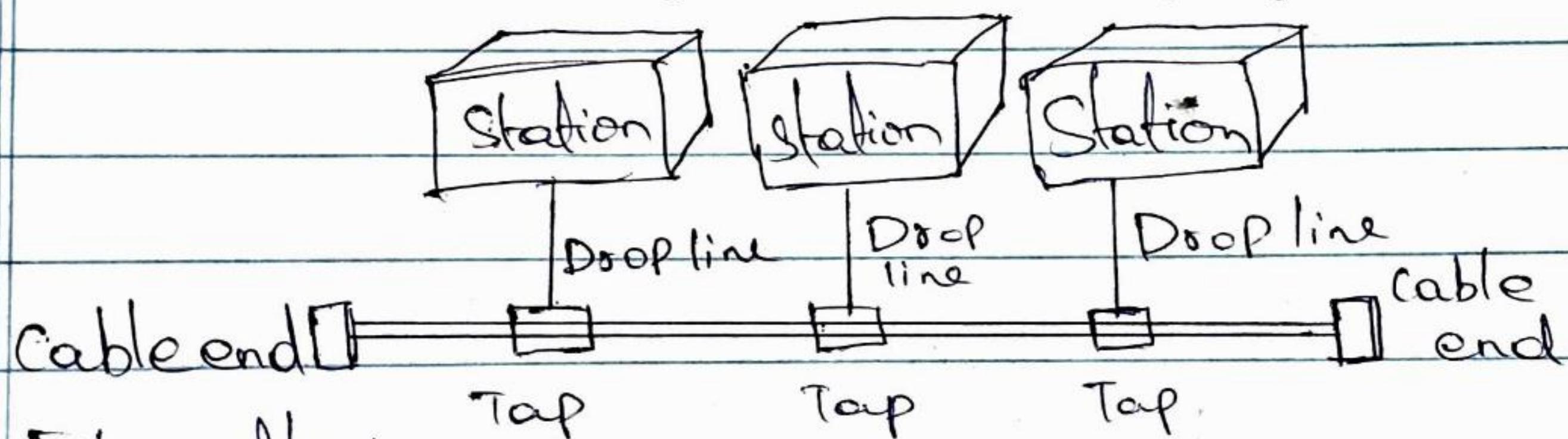
Advantages of Bus topology:-

- * Easy to install and maintain
- * Can be extended easily
- * Very reliable because of single transmission line.

Disadvantages of Bus topology:

- ★ Troubleshooting is difficult as there is no single point of control.
- ★ One faulty node can bring the whole network down.
- ★ Dumb terminals can't be connected to the bus.

Given below Diagram is an eg of Bus topology.



Example:

- ★ An eg of Bus topology is connecting two floors through a single line.

★ Ethernet networks also use a bus topology.

★ In bus topology, one computer in the network works as a server and other computers behave as client. The purpose of the server is to exchange data between client computers.

Ring topology:-

- *) In ring topology each terminal is connected to exactly two nodes, giving the network a circular shape.
 - *) Data travels in only one pre-determined direction.
 - *) When a terminal has to send data, it transmits it to the neighboring node which transmits it to next one. Before further transmission data may be amplified. In this way data reverses.
 - *) Each device in ring topology has a repeater; if the received data is intended for other device then repeater forwards this data until the intended device receives it.

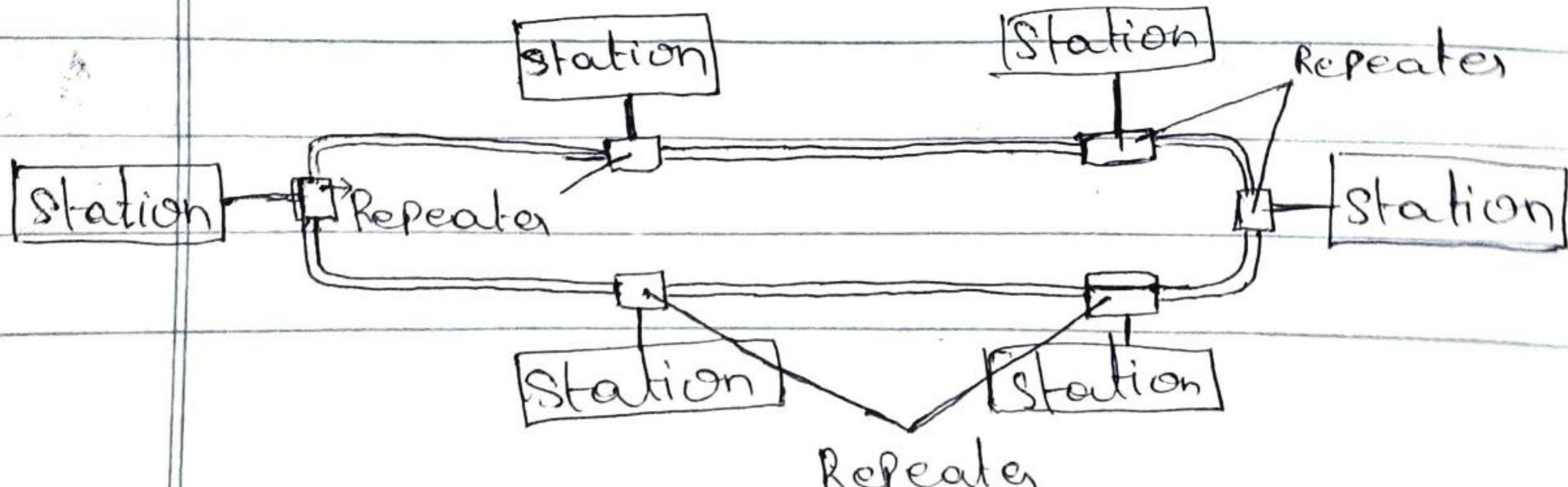
Advantages of Ring topology:-

- ★ Small cables segments are needed to connect two nodes.
- ★ Ideal for Optical fibres as data travels in only one direction.
- ★ Very high transmission speeds possible.

Disadvantages of Ring topology:-

- ★ Failure of single node brings down the whole network.
- ★ Troubleshooting is difficult as many nodes may have to be inspected before faulty one is identified.
- ★ Difficult to remove one or more node while keeping the rest of network intact.

Given diagram is an eg of Ring topology:-



Hybrid topology:-

* Hybrid topology is a combination of more than two topologies. In computer networking, a network structure that contains more than two topologies is known as hybrid topology.

* It includes a mix of bus topology, mesh topology, ring topology, star topology and tree topology. The combination of topology depends on the need of a company.

Advantages:-

- * Hybrid network combines the benefits types of topologies.
- * Can be modified as per requirement.
- * It is extremely flexible and very reliable and is easily scalable.

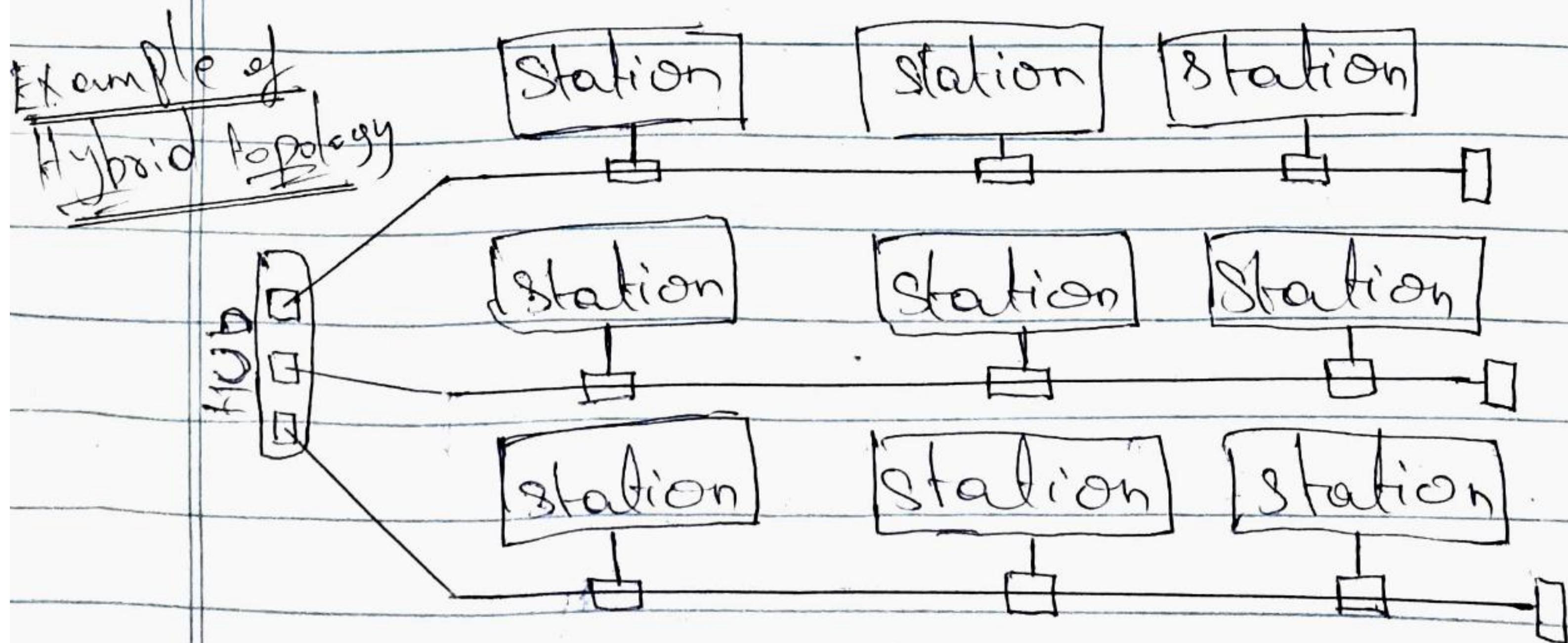
disadvantages:-

- ★ It is expensive
- ★ The design of a hybrid network is complex.
- ★ Hardware changes are required in order to connect topology to another topology.

for example:

If there is a mesh topology in one office department while a Ring topology in another Department, connecting these two with bus topology will result in Hybrid topology.

★ Combination of Star-Ring and Star-Bus network are common example.



2.

OSI reference model

* OSI model established in 1984,
the International Standards Organization
(ISO) is a multinational body dedicated
to world wide organization, agreement
on international standards. An ISO
Standard that covers all aspects of
network communications is OSI model.

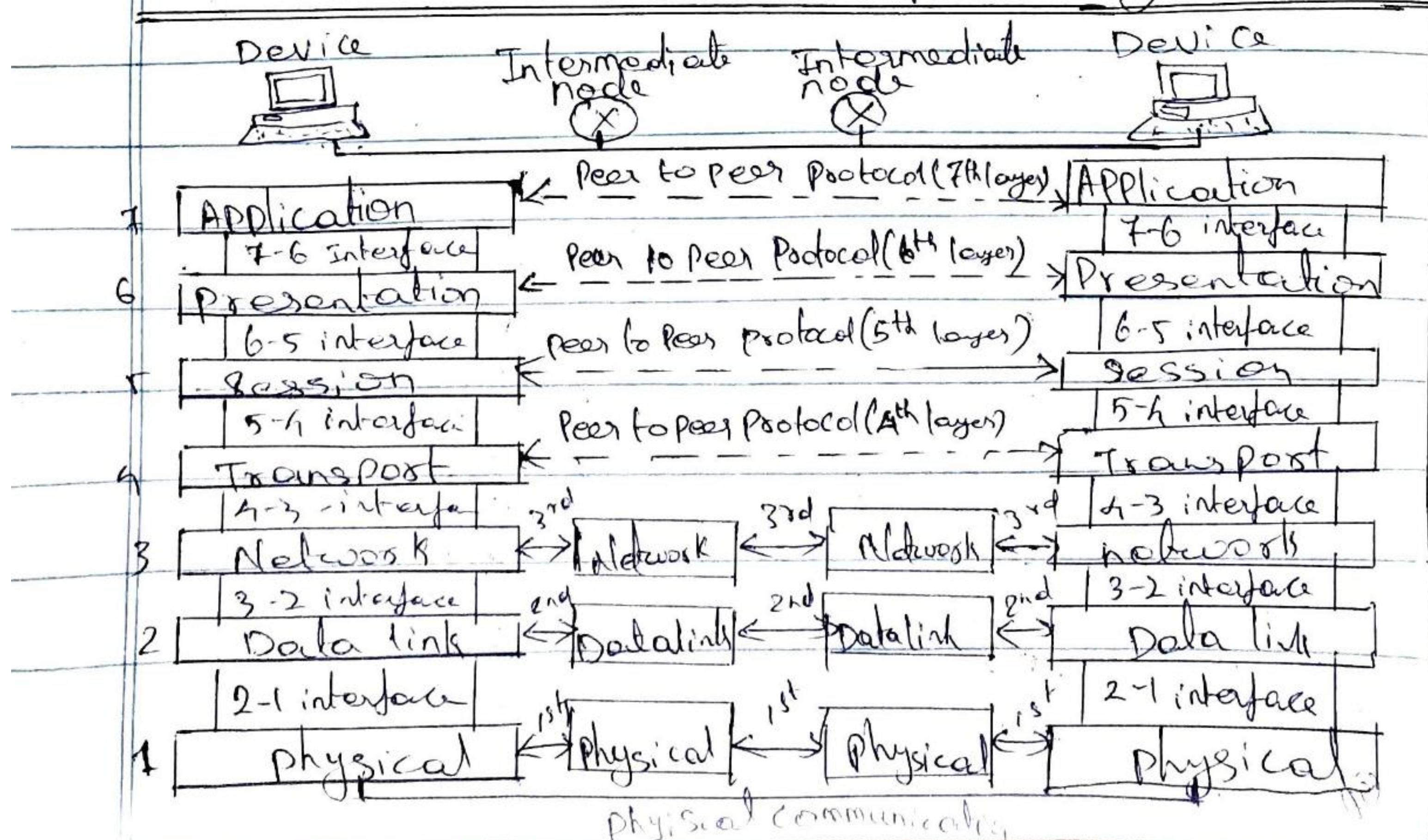
OSI reference model specifies standards
for describing "Open System Interconnection"
with the term 'open' chosen to emphasise
the fact that by using these international
standards.

Seven layers of OSI

Application	7
Presentation	6
Session	5
Transport	4
Network	3
Data link	2
Physical	1

The seven layers can be thought of as belonging to three subgroups.

- ↳ Layer 1, 2, 3 → Physical, data link & network
are the network support layers; they deal with the physical aspects of moving data from one device to another
- ↳ Layer 5, 6, 7 → Session, Presentation & application can be thought of as the user support layers;
- ↳ Layer 4 → the transport layer links the two subgroups and ensures that what the lower layers have transmitted in a form that the upper layer can use.

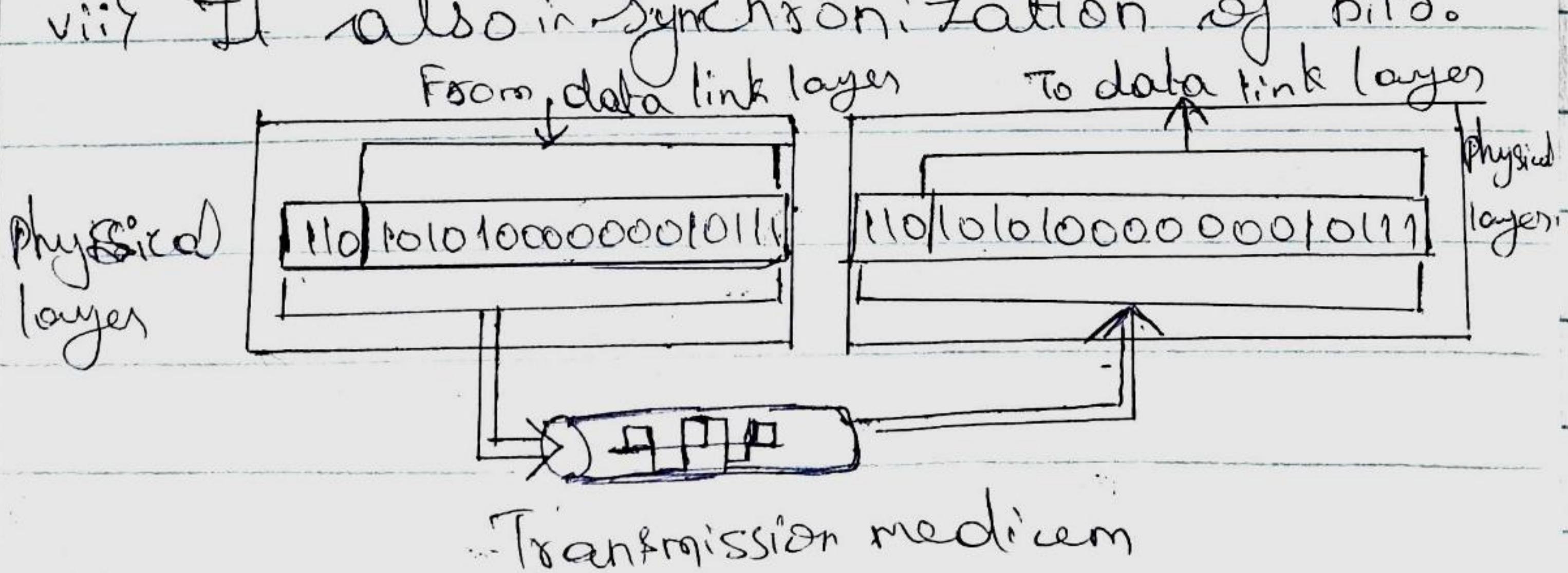


1st Physical Layer :-

Responsible for movements of individual bits from one hop/node to another next.

Functions :-

- i) To active, maintain and deactivate the physical connection.
- ii) To define voltages and data rates needed for transmission.
- iii) To convert digital bits into electrical signal.
- iv) To decide whether the transmission is Simplex, half duplex or full duplex.
- v) A physical layer is concerned with the connections of devices to the media.
- vi) It also defines the physical topology.
- vii) It also in synchronization of bits.



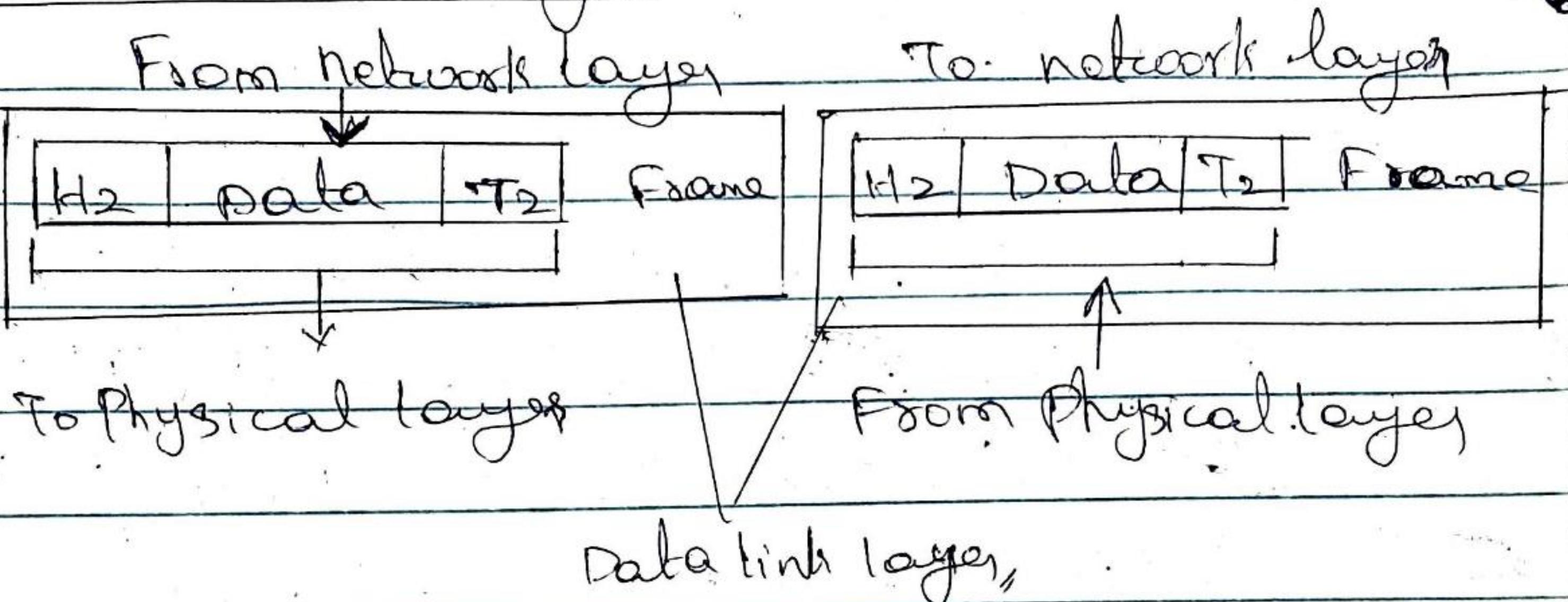
Services

* Physical Characteristics of medium

 i) Data Rate ii) Line configuration

* Physical topology ii) Representation of bits

Data link layer:-



Functions:

* It transforms the Physical layer's raw transmission facility to a reliable link.

* It is responsible for moving frames from one hop(node) to the next.
(i.e.) Hop-to-Hop delivery.

Services:

i) Framing: The layer divides the stream of bits received from the network layer into manageable data units called frames.

14, 5, b

Physical addressing:-

→ It adds a header to the frame to define the Physical address of the sender and/or receiver of the frame:

Flow control:

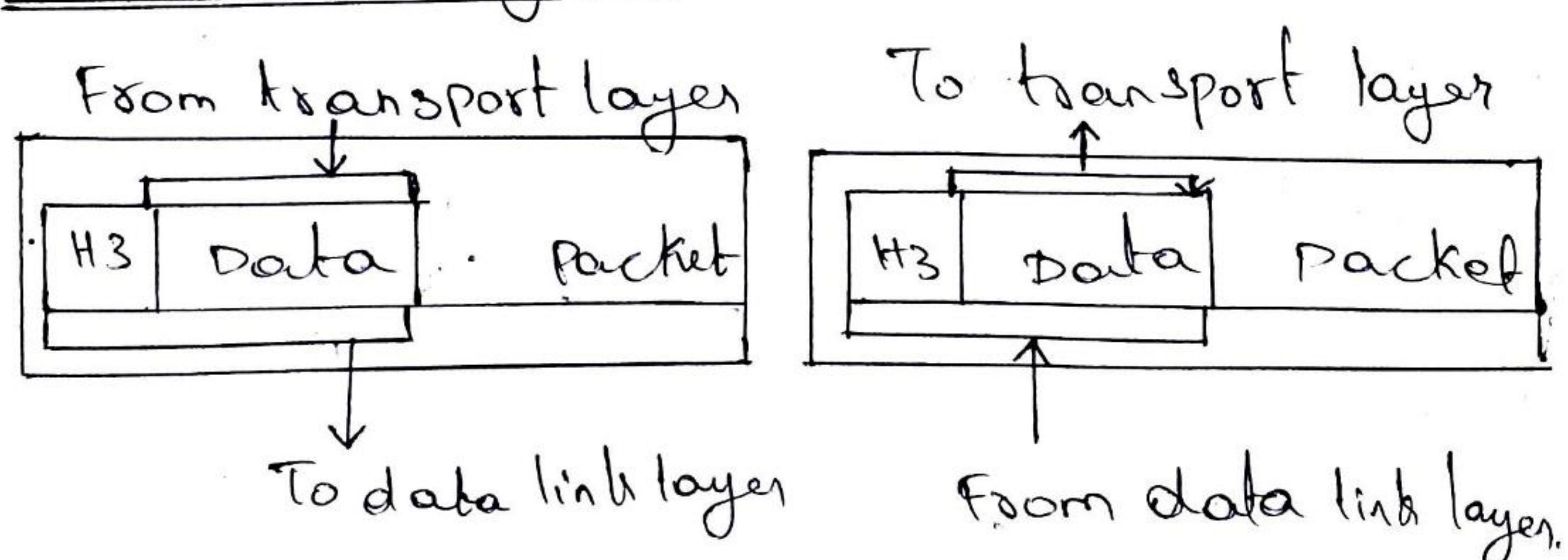
It provides a flow control mechanism to avoid a fast transmitter from overrunning a slow receiver by buffering extra bits:

* Error control

* Physical Addressing

* Access control

Network layer:- → ③



Function:

The network layer is responsible for the delivery of individual packets from the source host to the destination host.

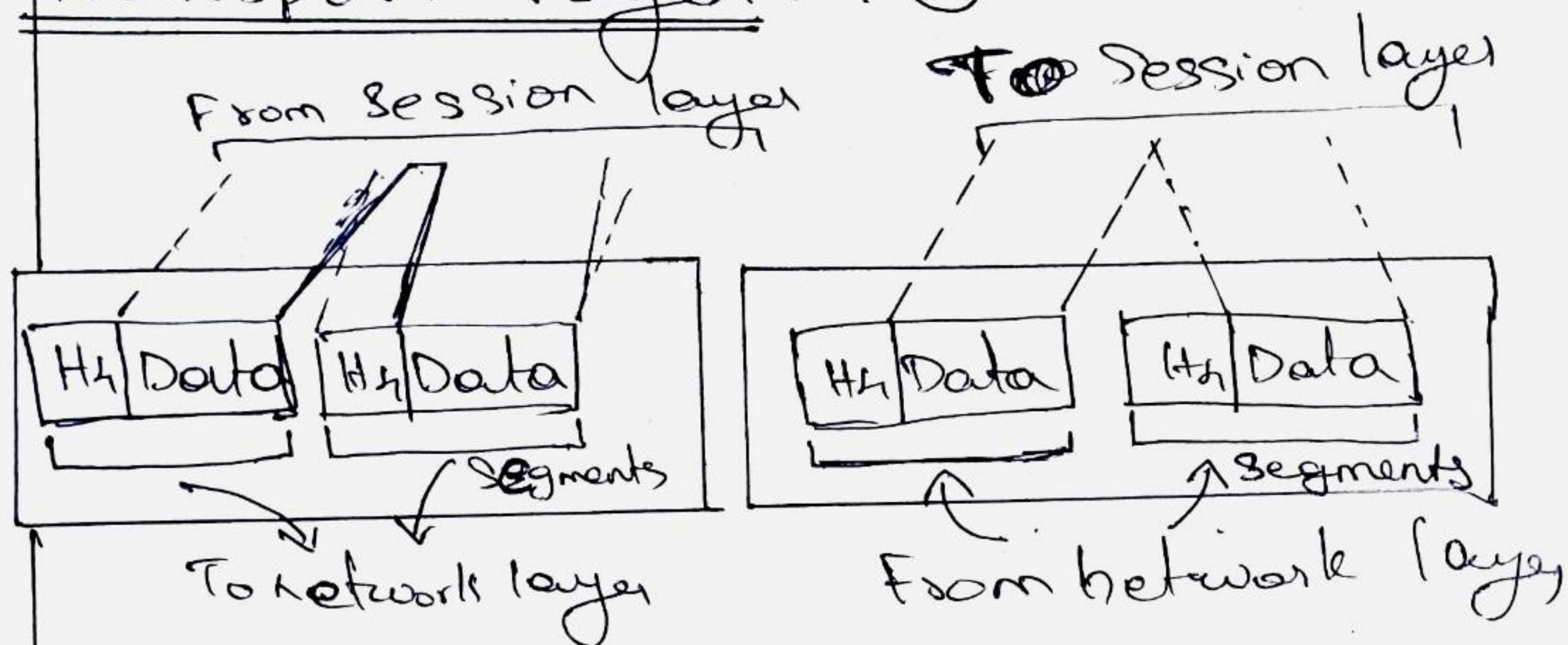
Services Provided

* Logical Addressing:-

It translates logical network address into physical machine address.

* Routing:

Transport Layer → ④



Function:

It is responsible for process to process delivery of the entire message i.e. Source to destination delivery of the entire message.

It ensures that the whole message arrives intact and in order, ensuring both error control and flow control at source destination level.

Services Provided by the Transport layer.

- * Port addressing
- * Segmentation & Reassembly
- * Connection control.
- * End to End flow control
- * Error control.

Session layer: → ⑤

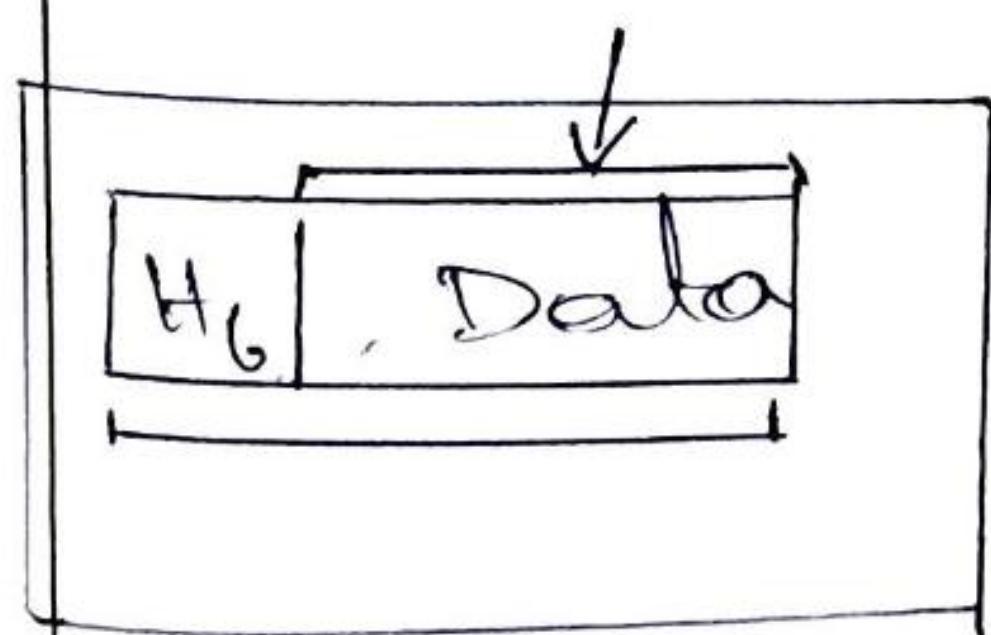
It is responsible for dialog control and synchronization i.e. it is network dialog controller. It establishes maintains and synchronizes the interaction among communicating system.

Services:-

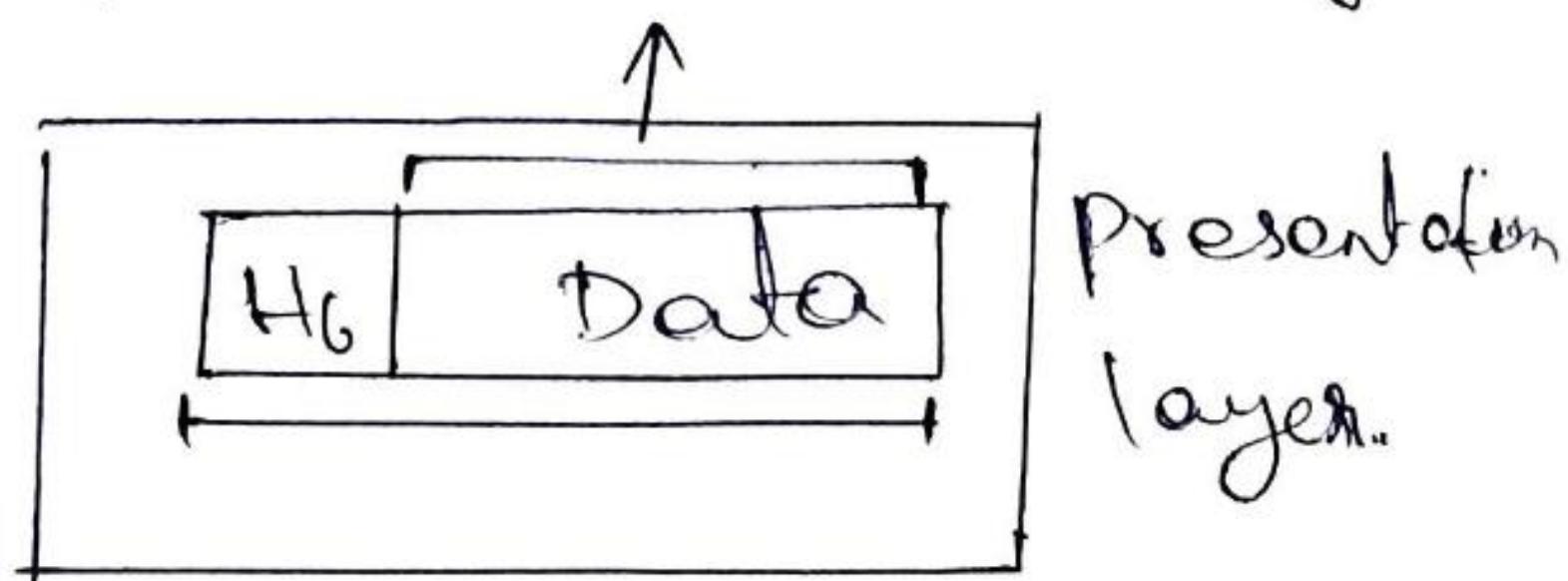
- * Synchronization
- * Dialog Control.

Presentation layer: → ⑥

From Application layer To Application layer.



To session
layer



From session
layer

Presentation
layer.

functions

It is responsible for translation, compression and encryption. It is concerned with the syntax and semantics of the information exchanged between two systems.

7.4 Application layer:

It is responsible for providing services to the user. It provides services that directly support user applications such as database access, e-mail, file transfer.

Services

* File Transfer and Access Management (FTAM)

- (*) Mail Services
- (*) Directory Services.

