INTRODUCTION TO COMPUTER NETWORKS

WHAT IS NETWORK

A network is a collection of NODES connected to one another in order to fulfill some task.
examples
    COMPUTER NETWORK
    FAMILY NETWORK
    and so on ....

WHAT IS COMPUTER NETWORK

- **A Computer Network consists of two or more computers that are Connected with each other in order to:**

    - ❖ **Share resources (such as printers and CD-   ROMs),**
    - ❖ **Exchange files, or**
    - ❖ **Allow electronic communications**

NETWORK CLASSIFICATION ....

BASED ON GEOGRAPHICAL AREA :
        Local Area Network – LAN
        Metropolitan Area Network – MAN
        Wide Area Network – WAN
BASED ON ROLE MODEL :
        CLIENT SERVER NETWORK
        PEER TO PEER NETWORK
BASED ON PURPOSE :
        Storage area network, or SAN
        Enterprise private network, or EPN
        Virtual private network, or VPN

NETWORK CLASSIFICATION .... BASED OF GEOGRAPHICAL AREA

LAN :

A local area network, or LAN, consists of a computer network at a single site, typically an individual office building.

A LAN is very useful for sharing resources, such as data storage and printers.

LANs can be built with relatively inexpensive hardware, such as hubs, network adapters and Ethernet cables.

If a local area network, or LAN, is entirely wireless, it is referred to as a wireless local area network, or WLAN.

NETWORK CLASSIFICATION .... BASED OF GEOGRAPHICAL AREA

MAN :

A metropolitan area network, or MAN, consists of a computer network across an entire city, college campus or small region.

A MAN is larger than a LAN, which is typically limited to a single building or site.

Depending on the configuration, this type of network can cover an area from several miles to tens of miles.

A MAN is often used to connect several LANs together to form a bigger network.

NETWORK CLASSIFICATION .... BASED OF GEOGRAPHICAL AREA

WAN :
A wide area network, or WAN, occupies a very large area, such as an entire country or the entire world. A WAN can contain multiple smaller networks, such as LANs or MANs.
The Internet is the best-known example of a public WAN.

LAN

WAN

Metropolitan-area Network MAN

LAN

Basic Network LAN MAN WAN

LAN
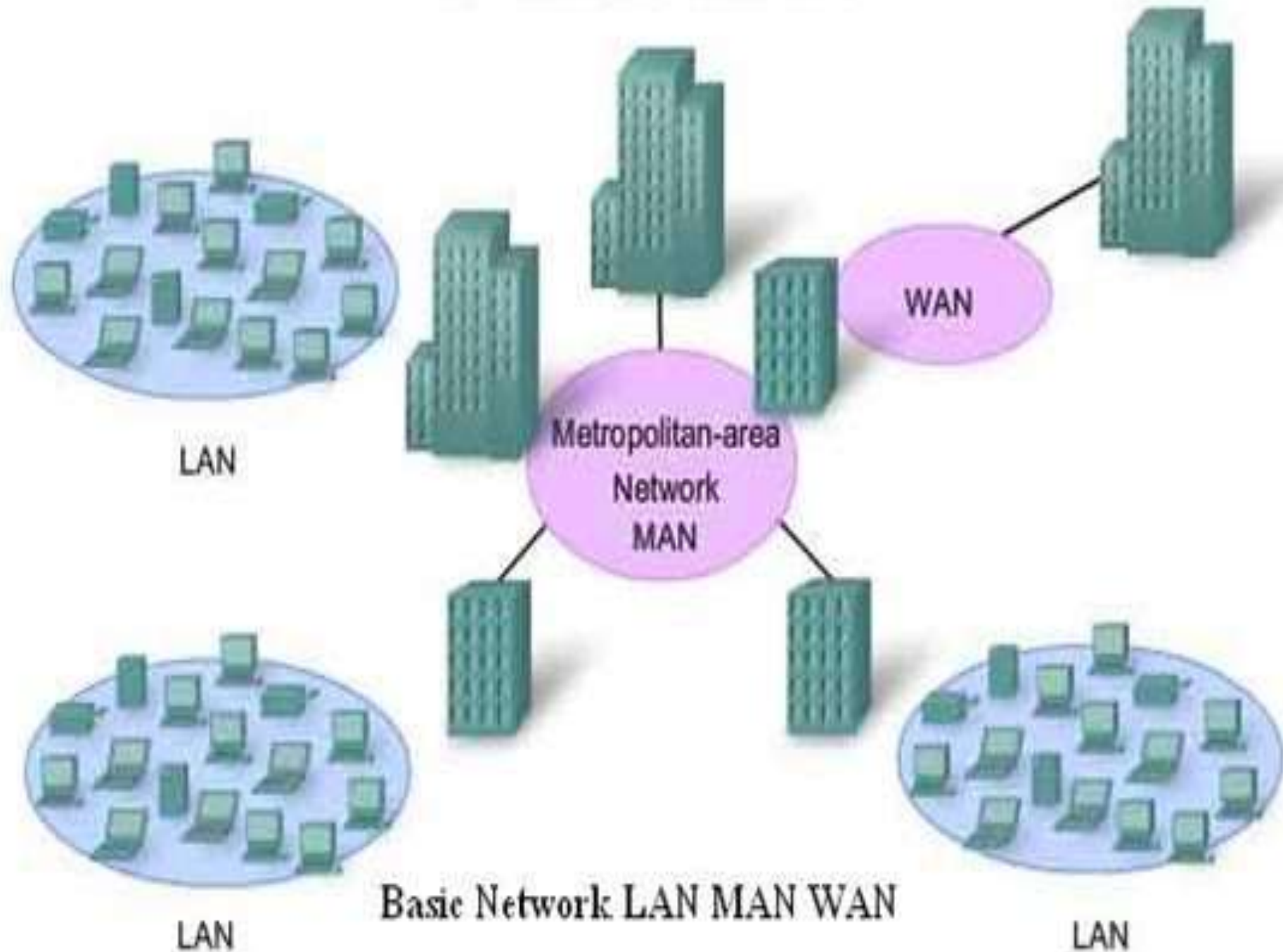
NETWORK CLASSIFICATION .... BASED ON ROLE MODEL

CLIENT SERVER SYSTEM
PEER TO PEER SYSTEM

NETWORK DEVICES

Repeater
Hub
Switch
Bridge
Router
Gate Way
Modem

REPEATER

Functioning at Physical Layer.
A repeater is an electronic device that receives a signal and retransmits it at a higher level and/or higher power, or onto the other side, so that the signal can cover longer distances.
Repeater have two ports ,so cannot be use to connect for more than two devices.

REPEATER

HUB

An Ethernet hub, active hub, network hub, repeater hub, hub or concentrator.
It is a device for connecting multiple twisted pair or fiber optic Ethernet devices together and making them act as a single network segment.
Hubs work at the physical layer of the OSI model.
The device is a form of multiport repeater.

HUB

SWITCH

A network switch or switching hub is a computer networking device that connects network segments.

It is Commonly refers to a network bridge.

It processes and routes data at the data link layer (layer 2) of the OSI model.

Switches that additionally process data at the network layer (layer 3 and above) are often referred to as Layer 3 switches or multilayer switches.

nw1

switch

nw2
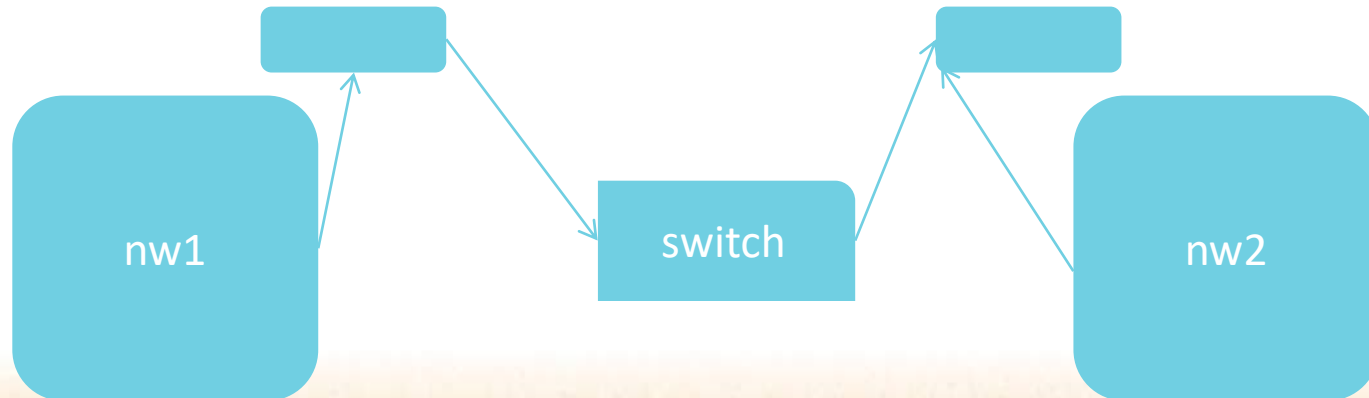
SWITCH

BRIDGE

A network bridge connects multiple network segments at the data link layer (Layer 2) of the OSI model.

In Ethernet networks, the term bridge formally means a device that behaves according to the IEEE 802.1D standard.

A bridge and switch are very much alike; a switch being a bridge with numerous ports.

Switch or Layer 2 switch is often used interchangeably with bridge.

Bridges can analyze incoming data packets to determine if the bridge is able to send the given packet to another segment of the network.

ROUTER

A router is an electronic device that interconnects two or more computer networks, and selectively interchanges packets of data between them.

Each data packet contains address information that a router can use to determine if the source and destination are on the same network, or if the data packet must be transferred from one network to another.

Where multiple routers are used in a large collection of interconnected networks, the routers exchange information about target system addresses, so that each router can build up a table showing the preferred paths between any two systems on the interconnected networks.

GATEWAY

In a communications network, a network node equipped for interfacing with another network that uses different protocols.

A gateway may contain devices such as protocol translators, impedance matching devices, rate converters, fault isolators, or signal translators as necessary to provide system interoperability.

It also requires the establishment of mutually acceptable administrative procedures between both networks.

A protocol translation/mapping gateway interconnects networks with different network protocol technologies by performing the required
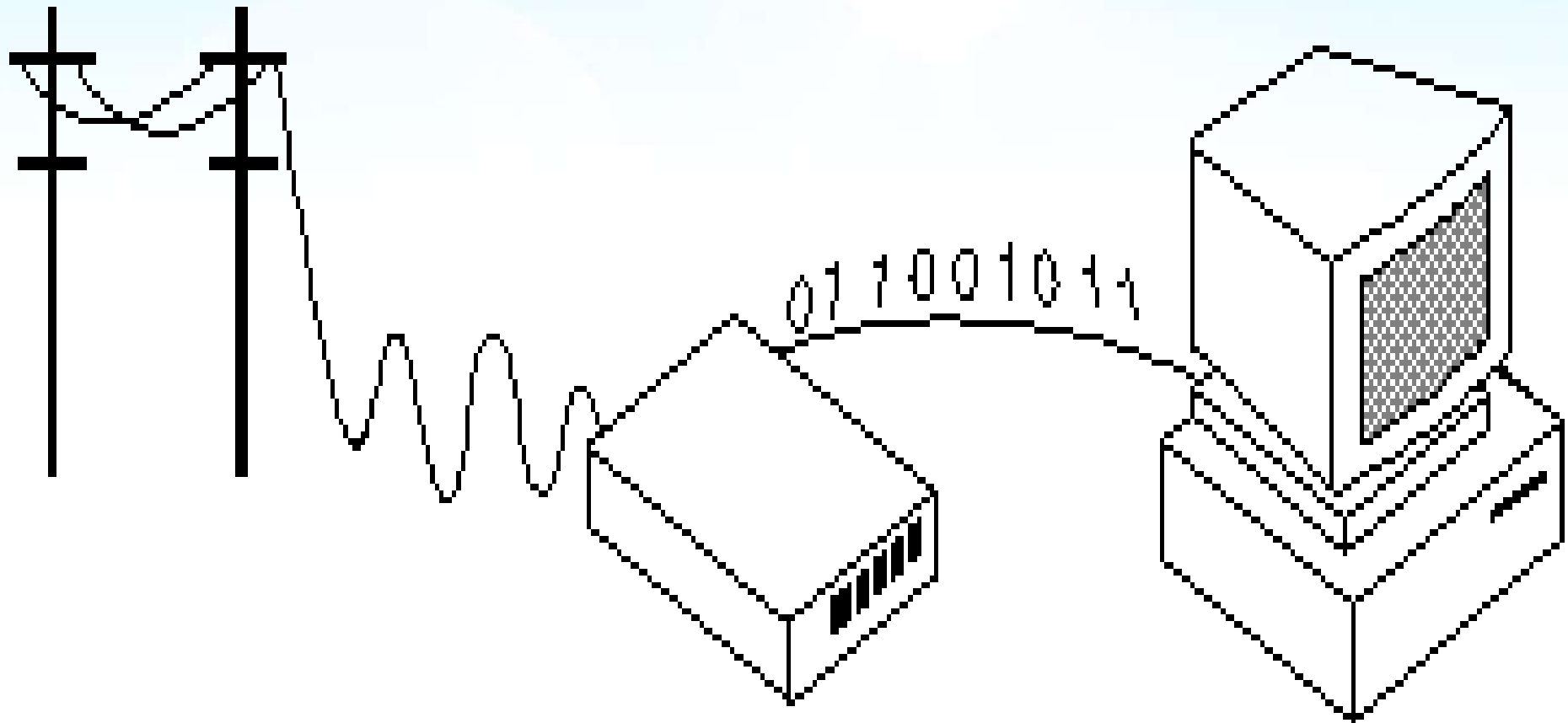
GATEWAY
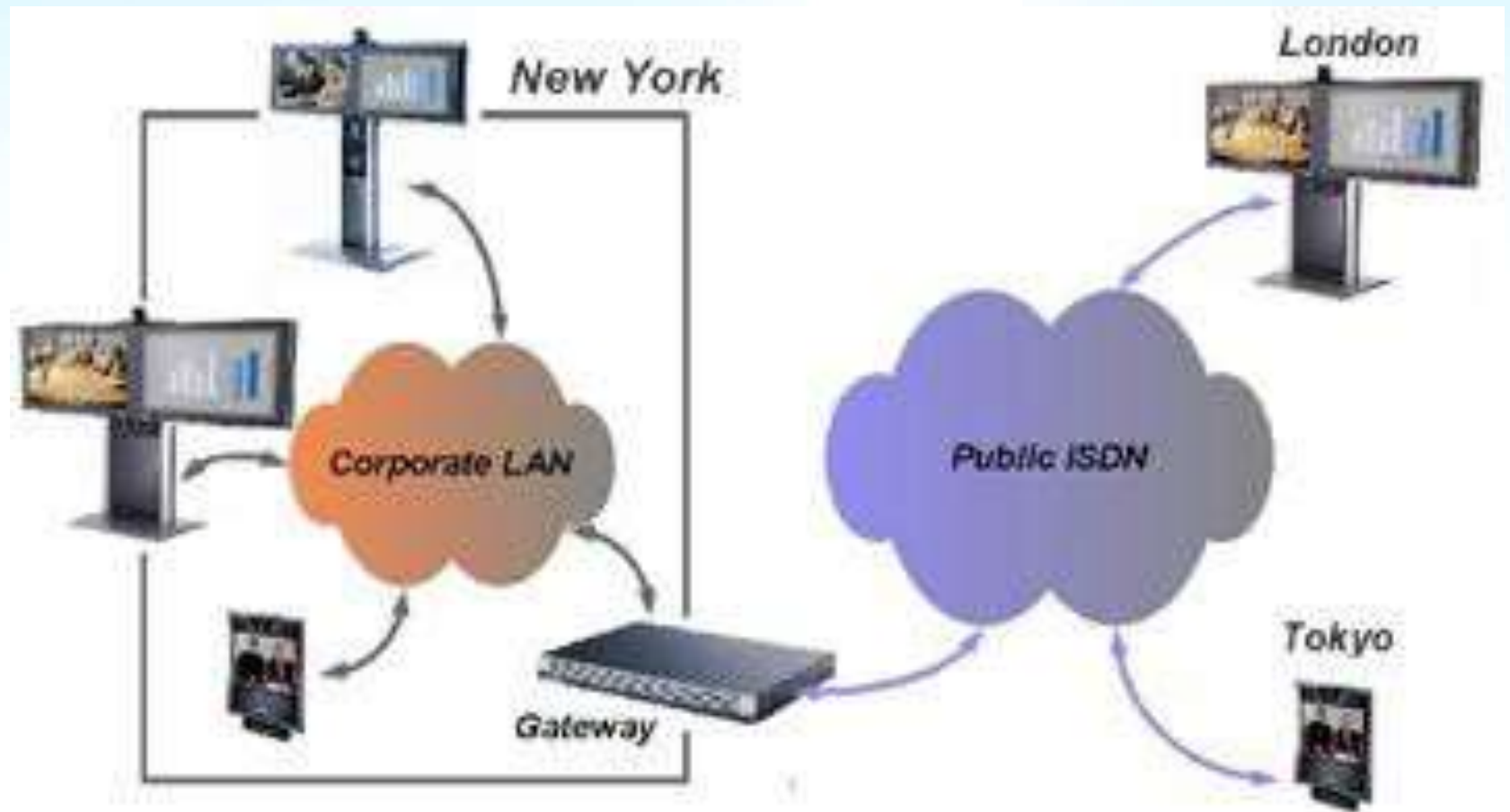
MODEM

Short for MODulator-DEModulator.
A modem is a device or program that enables a computer to transmit data over, for example, telephone or cable lines. Computer information is stored digitally, whereas information transmitted over telephone lines is transmitted in the form of analog waves.
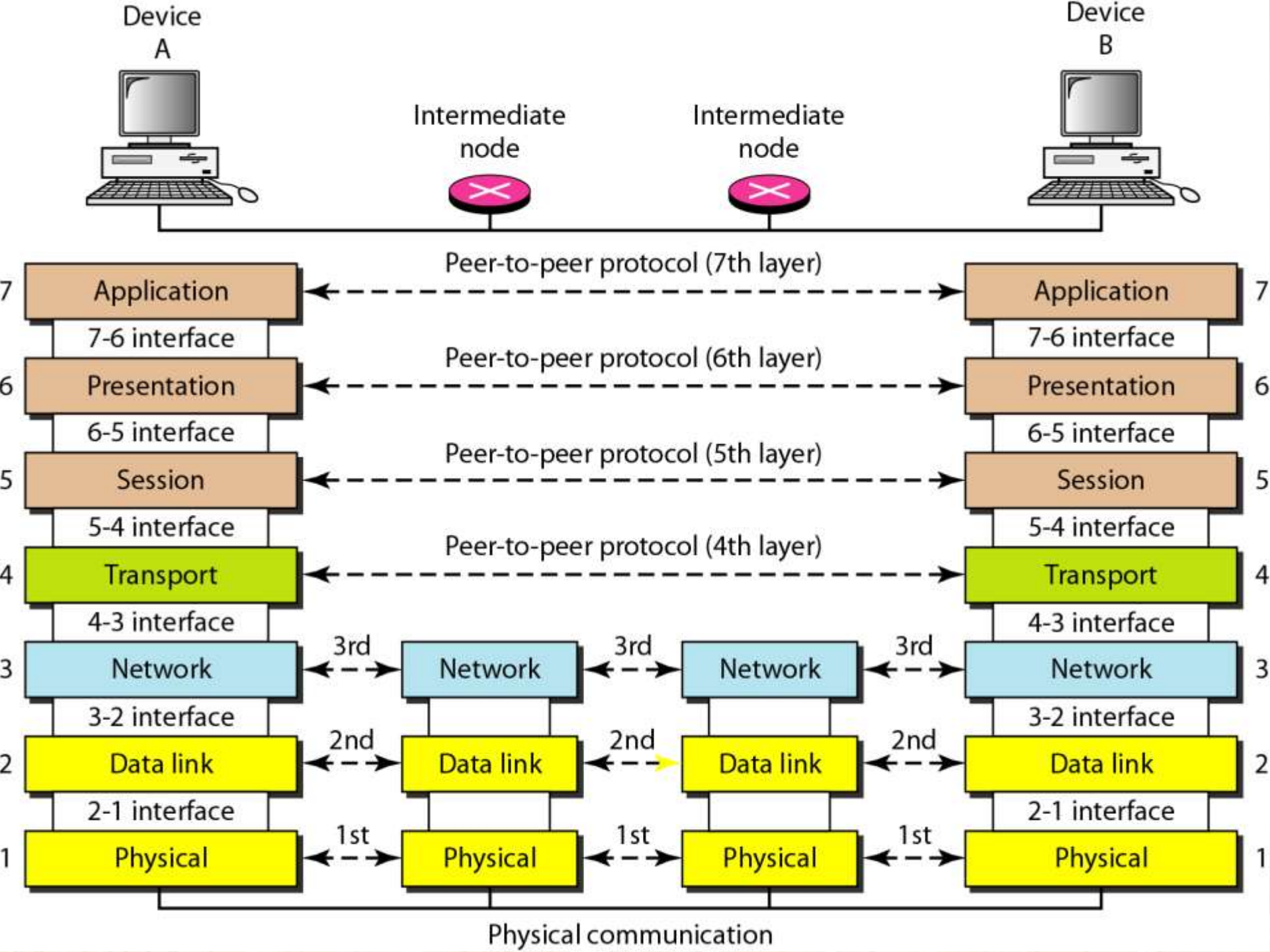A modem converts between these two forms.

MODEM

01100101

Modem

OSI REFERENCE MODEL

The Open System Interconnection (OSI) model defines a networking framework to implement protocols in seven layers.
The OSI model doesn't perform any functions in the networking process.
It is a conceptual framework so we can better understand complex interactions that are happening.

	Device A			Intermediate node		Intermediate node		Device B	

Peer-to-peer protocol (7th layer)

7	Application	← − − − − − − − − − − − − − − − − − − →	Application	7

7-6 interface

Peer-to-peer protocol (6th layer)

6	Presentation	← − − − − − − − − − − − − − − − − − − →	Presentation	6

6-5 interface

Peer-to-peer protocol (5th layer)

5	Session	← − − − − − − − − − − − − − − − − − − →	Session	5

5-4 interface

Peer-to-peer protocol (4th layer)

4	Transport	← − − − − − − − − − − − − − − − − − − →	Transport	4

4-3 interface

3	Network	←3rd→ Network ←3rd→ Network ←3rd→	Network	3

3-2 interface

2	Data link	←2nd→ Data link ←2nd→ Data link ←2nd→	Data link	2

2-1 interface

1	Physical	←1st→ Physical ←1st→ Physical ←1st→	Physical	1

Physical communication

Who Developed the OSI?

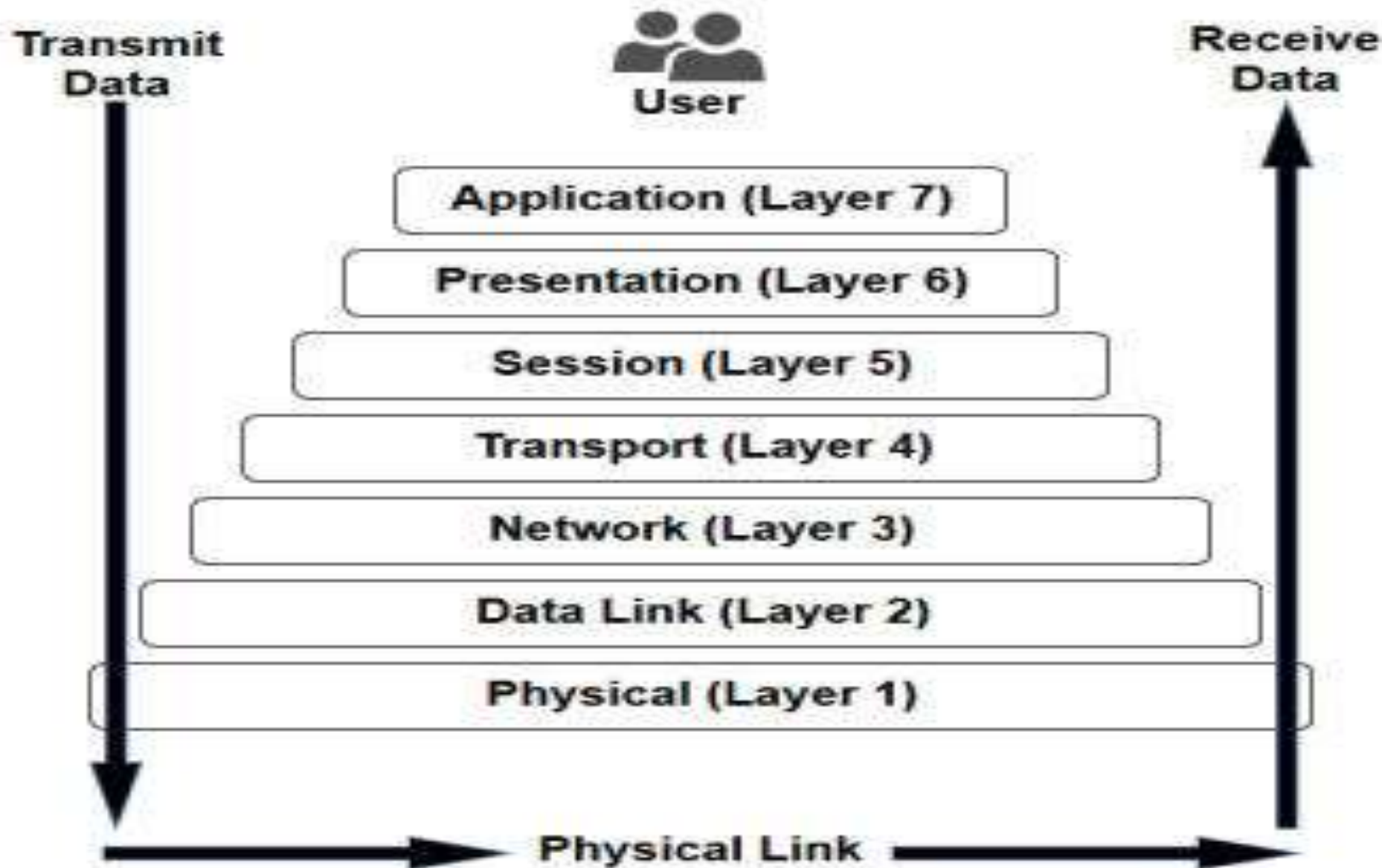The International Standards Organization (ISO) developed the Open Systems Interconnection (OSI) model.

It divides network communication into seven layers.

Layers 1-4 are considered the lower layers, and mostly concern themselves with moving data around.

Layers 5-7, the upper layers, contain application-level data.

Networks operate on one basic principle: "pass it on." Each layer takes care of a very specific job, and then passes the data onto the next layer.

The 7 Layers of OSI

Transmit Data

User

Receive Data

Application (Layer 7)

Presentation (Layer 6)

Session (Layer 5)

Transport (Layer 4)

Network (Layer 3)

Data Link (Layer 2)

Physical (Layer 1)

Physical Link

PHYSICAL LAYER

FIrst Layer of OSI

It converts the data into bits

data transferred from one mc to another by medium

establish the communication between ....

Functions :

Define Data Rate

Synchronization

Signal into bits and vice versa

The physical layer is responsible for movements of individual bits from one hop (node) to the next.
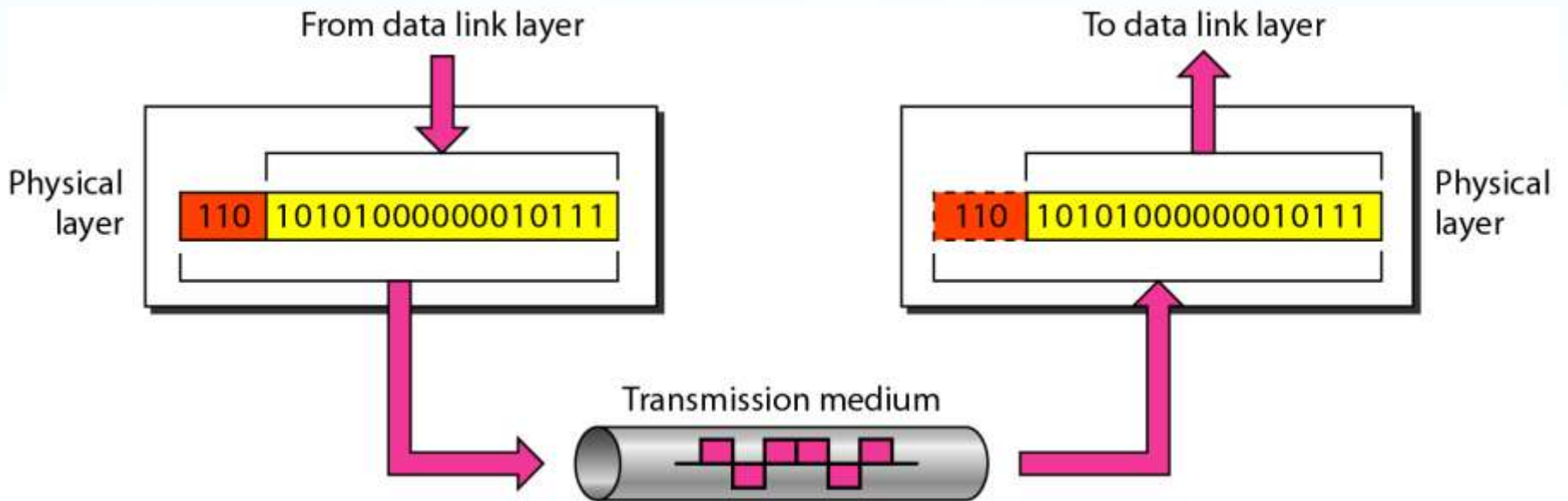
DATA LINK LAYER

At OSI Model, It is Layer 2

The data link layer is divided into two sub layers: The Media Access Control (MAC) layer and the Logical Link Control (LLC) layer.

MAC : It controls the access of physical medium.

LLC : It establish the link between physical layer and all other layer.

This Layer packs the data into frames.

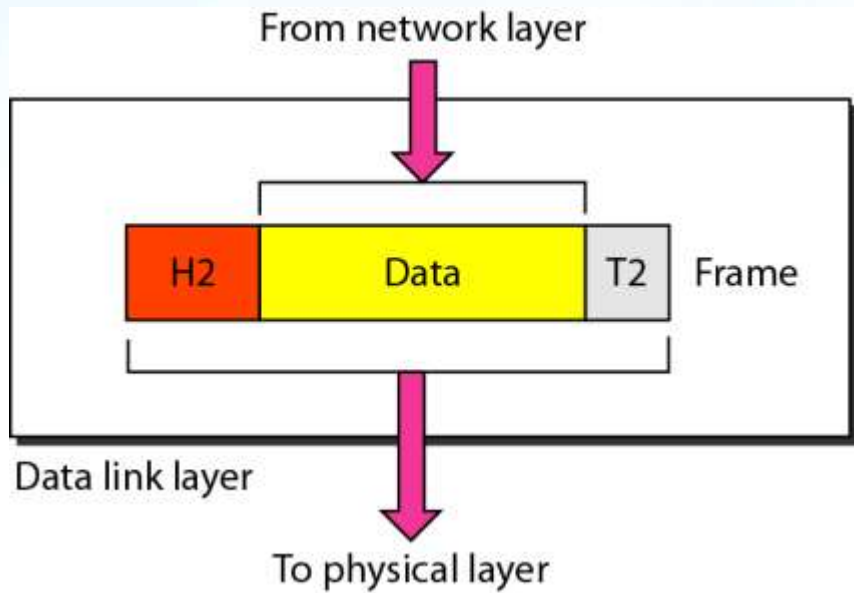converting data into frames is called FRAMING.

frame contain hw address of SENDER and RECEIVER.

Ethernet address is MAC Address

The data link layer is responsible for moving frames from one hop (node) to the next.
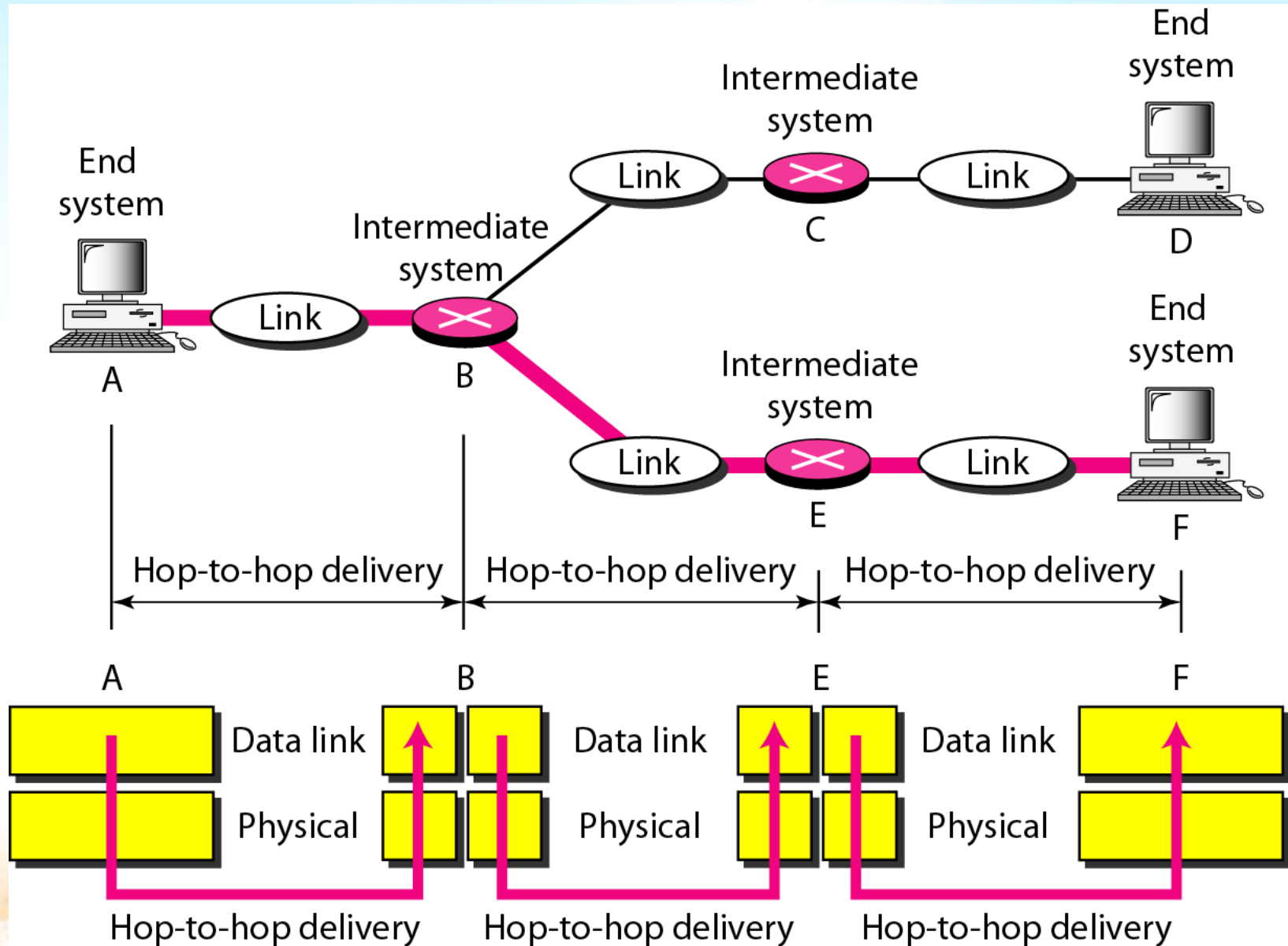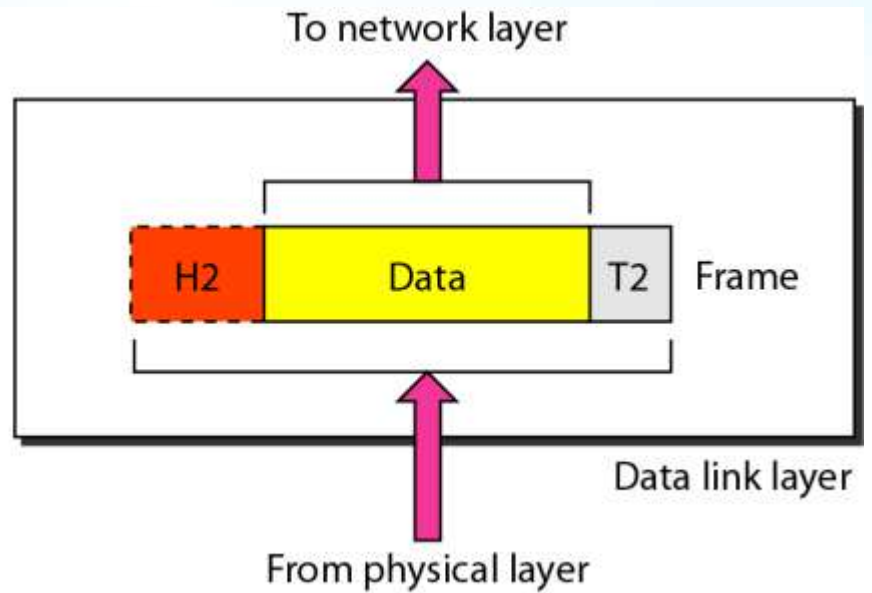
NETWORK LAYER

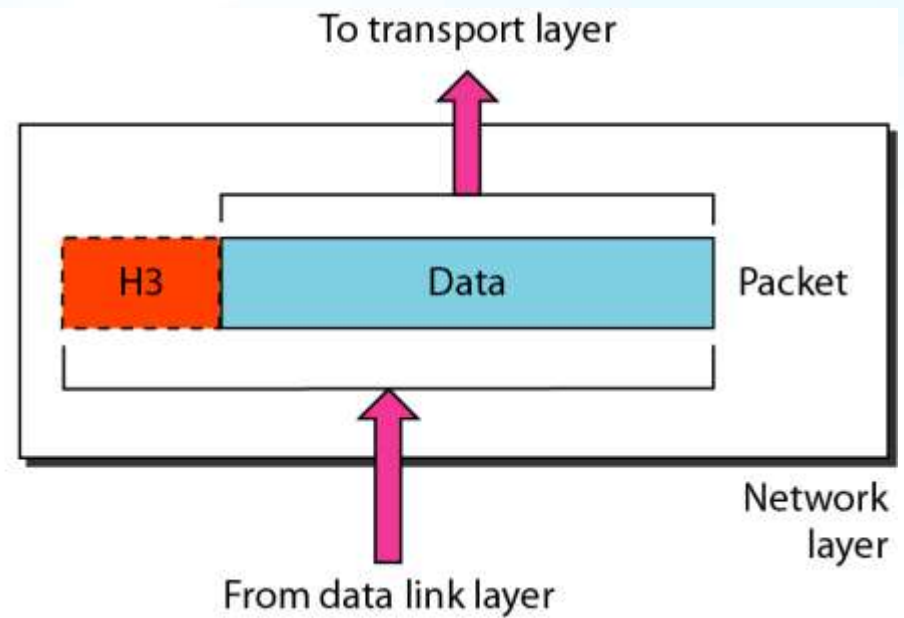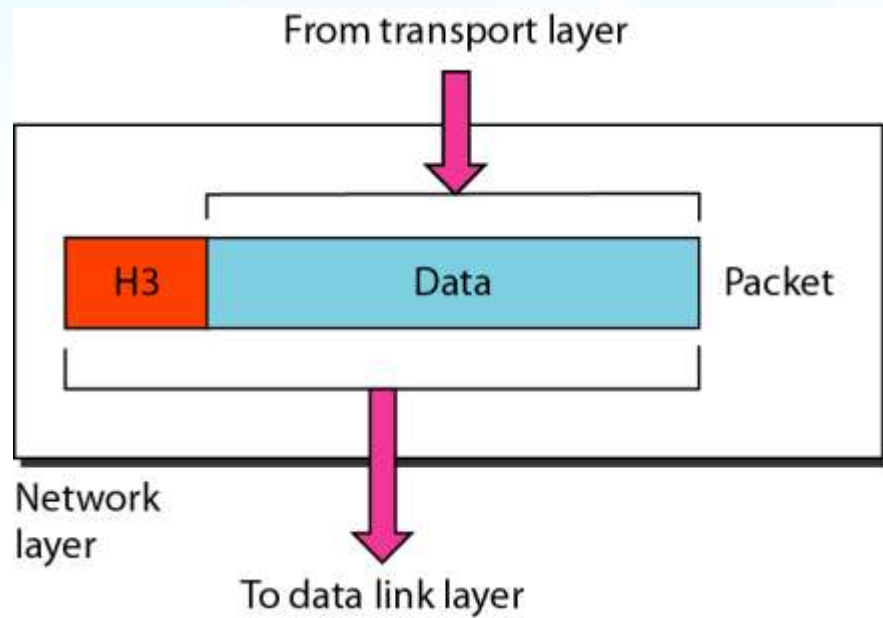**3rd Layer of OSI**
Responsible for Network COmmunication.
2 major functions
LOGICAL ADDRESSING : nw layer provide IP address to travel the packet in nw. and the address is responsible to reach the data at destination.
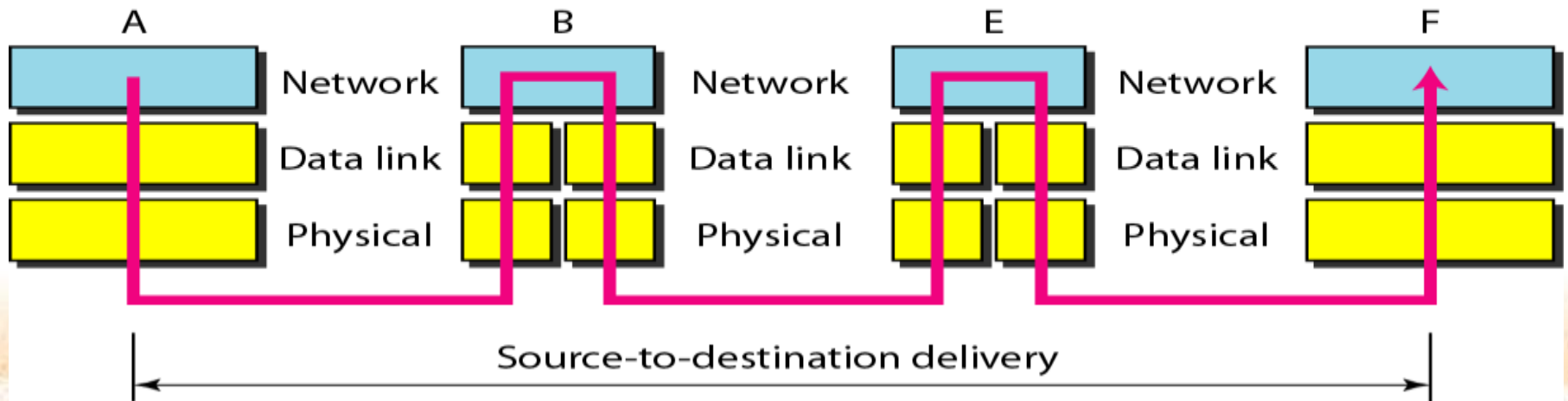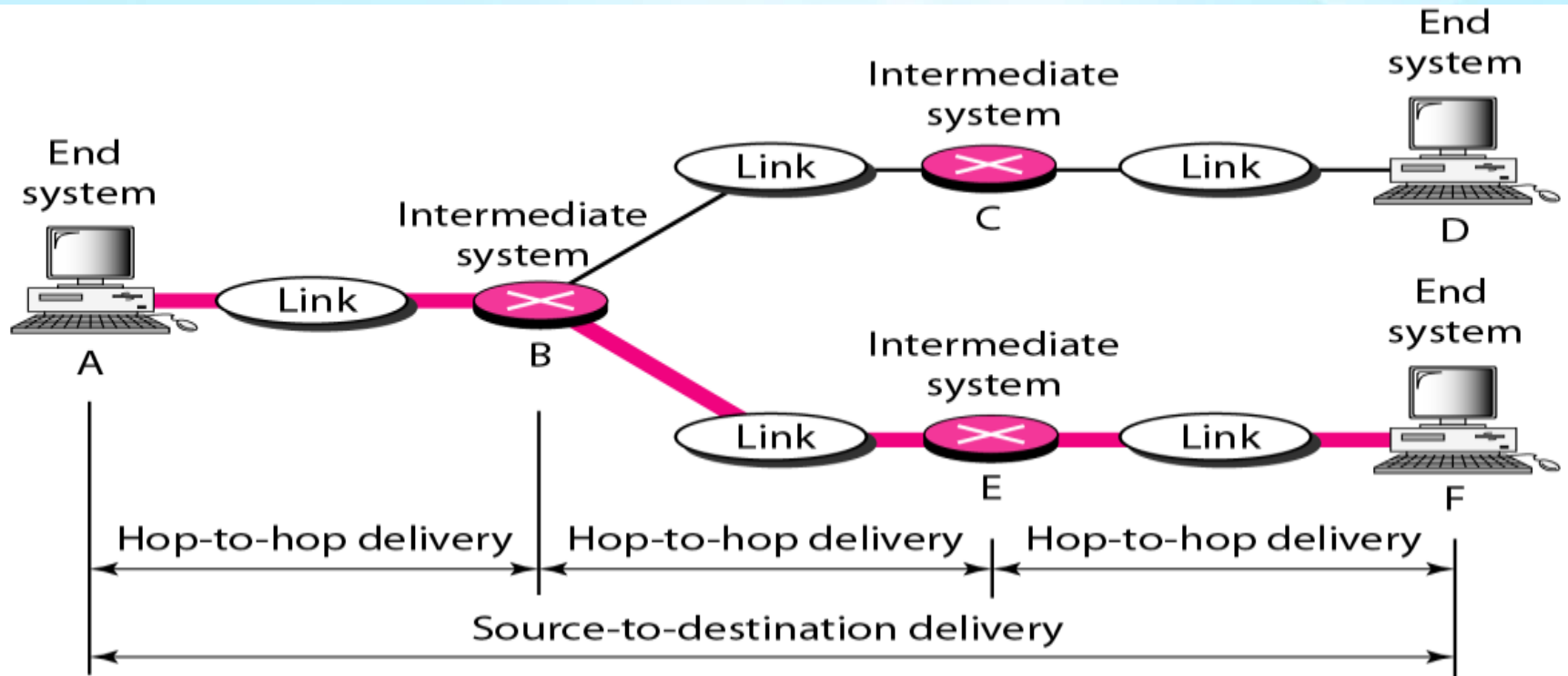**ROUTING : It is the responsibility of this layer to transfer the data from one network to another network (if required).**
IP ADDRESS IS USED IN THIS LAYER

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

SOURCE TO DESTINATION DELIVERY

TRANSPORT LAYER

4th layer of OSI
responsible for reliable data transport
also data must be in <u>sequence</u> and <u>error free</u>.
**TRANSPORT LAYER communicate in 2 ways**

       <u>Connection oriented</u> : ack, slow, reliable, error free
       <u>Connection less</u> : no ack, fast, not reliable, error*

SERVICES

1. **Segmentation** : data is converted into segment before sending.

2. **Sequencing** : each segment is given a sequence number

3. **Connection establishment** : before sending conn is to be established

4. **Acknowledgment** : ack is given by receiver to sender

5. **Flow control** : it confirms the transfer rate of data
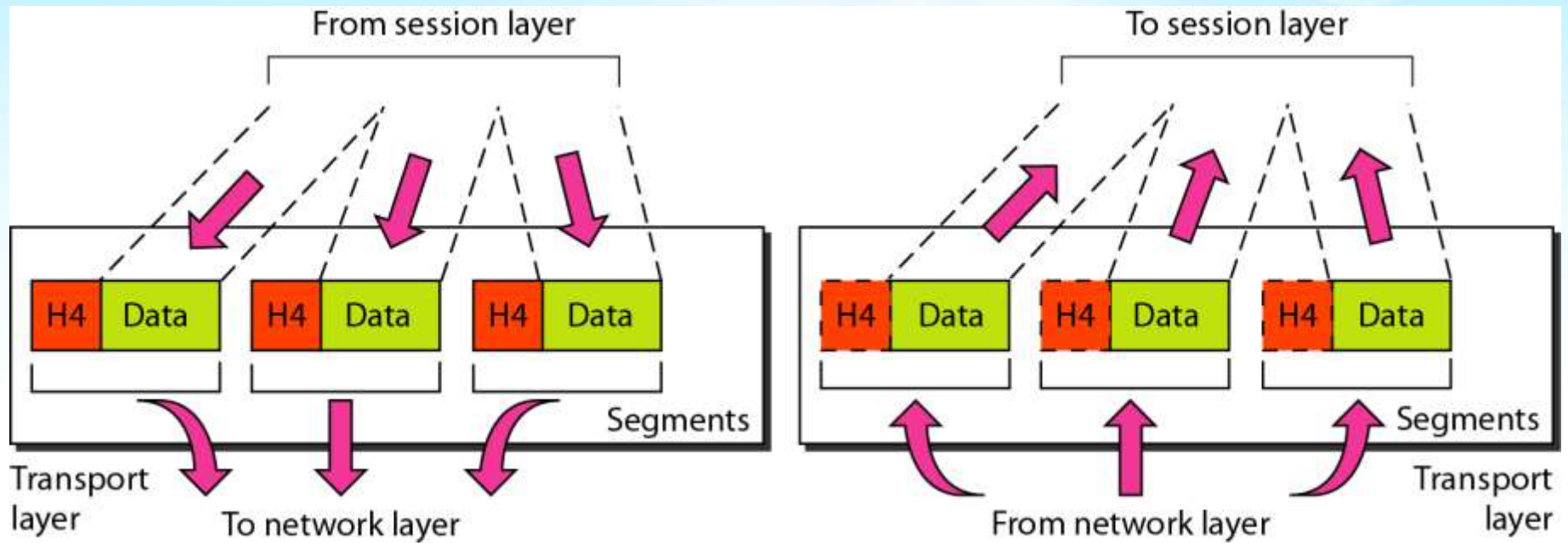
The transport layer is responsible for the delivery of a message from one process to another.

SEGMENTATION : process of dividing a data packet into smaller units for transmission over the network.

SESSION LAYER

5th layer
establish the session between SEN and REC
maintain the session until communication completes
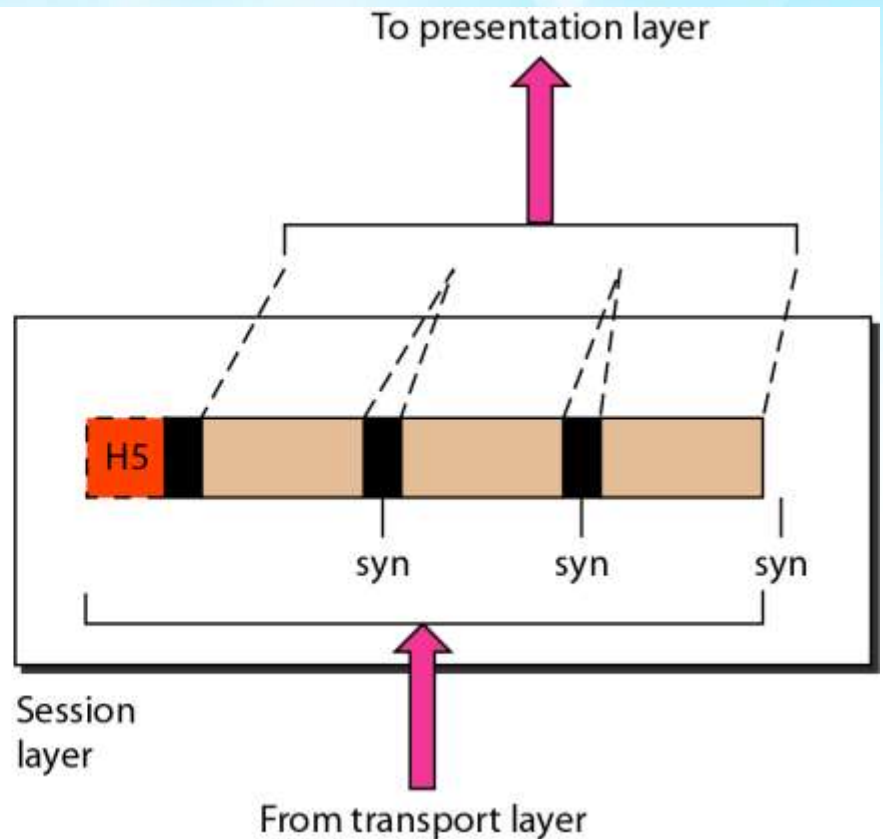after completion it terminate the session
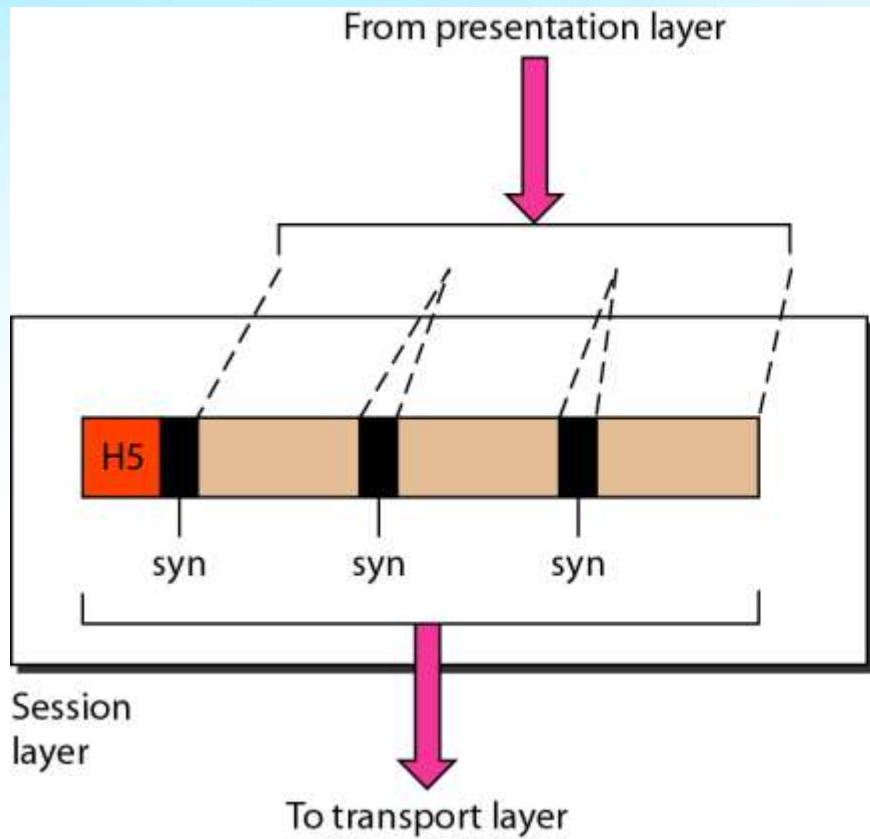if session breaks in between then recovery is done by it
responsible for data synchronization.
FUNCTIONS :
>
> A. ESTABLISH THE CONN
> B. MAINTAIN THE CONN
> C. TERMINATE THE CONN

The session layer is responsible for dialog control and synchronization.

PRESENTATION LAYER

6th layer
responsible for data representation
it also verifies that data forwarded by sender must be understood by receiver
for this S and R must follows some standard
      TEXT - RTF, ASCII
      IMAGES - JPG, GIF
      AUDIO - MP3, WAV
      VIDEO - AVI, MPEG
this layer also does some formatting in order to present to upper layer.
so it is up to presentation layer how to present the data.

PRESENTATION LAYER

FUNCTIONS :

TRANSLATION : converts the data in compatible format

COMPRESSION : reducing the number of bits requiring transmission, which improves the data throughput. **[Throughput is a measure of how many units of information a system can process in a given amount of time.].**

ENCRYPTION :Encryption is needed for security purposes when sending data across networks.
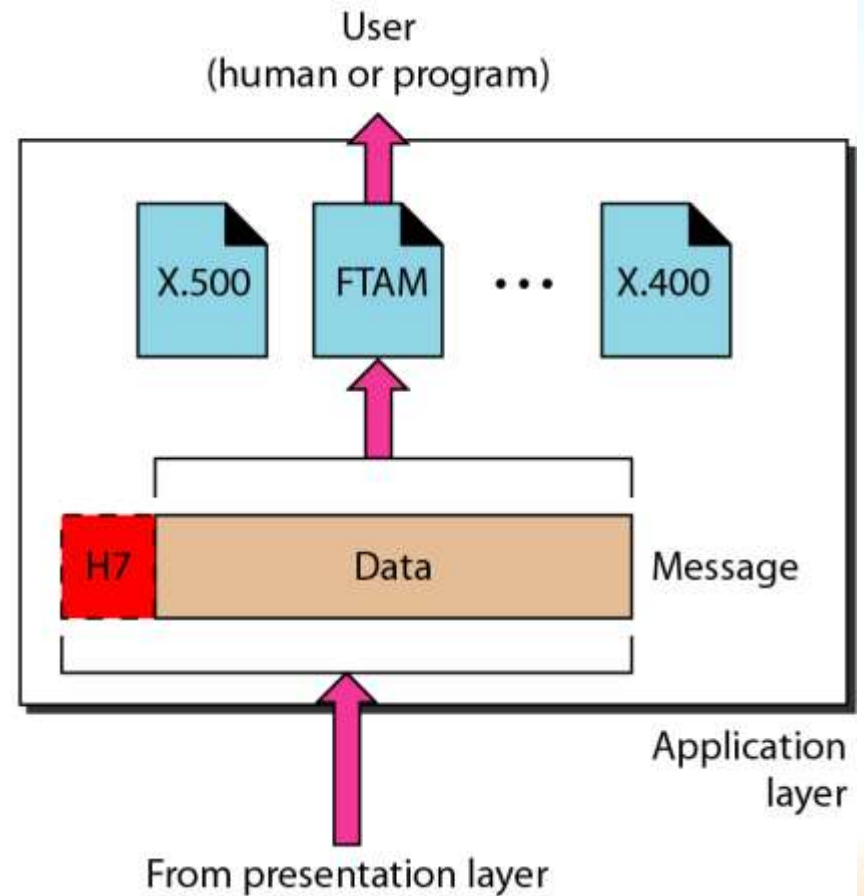
APPLICATION LAYER

7th layer
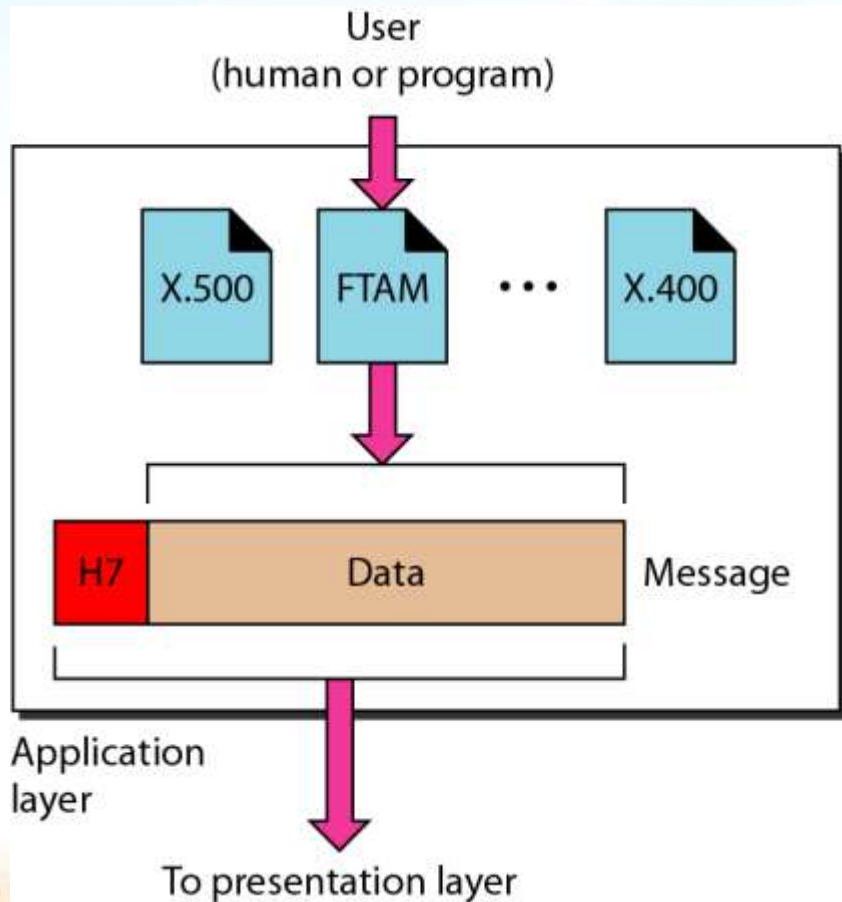it provide interface between user application and network.   e.g. Mozila [browser], gmail, outlook [email client]
from above application we can interact on internet.
various protocol are used ------- HTTP, POP, POP3, FTP, SMTP
FUNCTIONS :
       1. it identifies communicating parties
       2. keep track the availiblity of data
       3. sync the communication
       4. provide basic services : email, file transfer

SUMMARY OF OSI LAYERS

	Layer	
	Application	To allow access to network resources
To translate, encrypt, and compress data	**Presentation**	
	Session	To establish, manage, and terminate sessions
To provide reliable process-to-process message delivery and error recovery	**Transport**	
	Network	To move packets from source to destination; to provide internetworking
To organize bits into frames; to provide hop-to-hop delivery	**Data link**	
	Physical	To transmit bits over a medium; to provide mechanical and electrical specifications