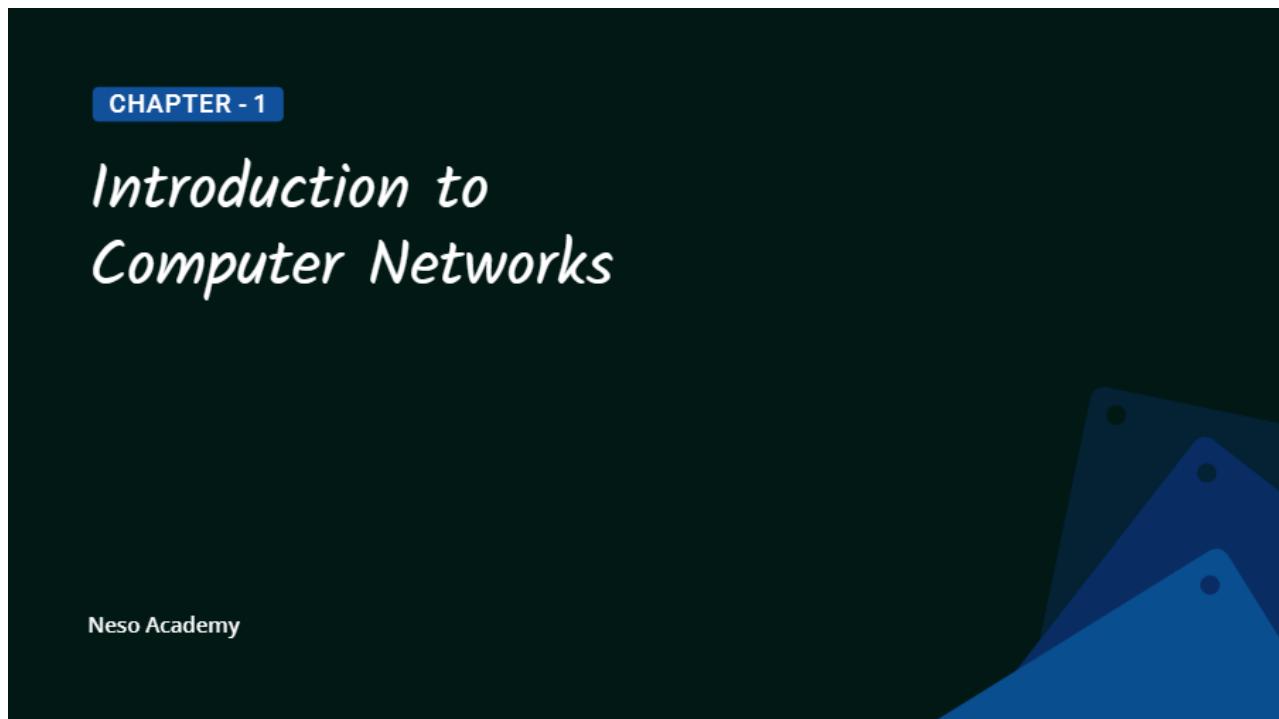


# Introduction to Computer Networks | Neso Academy

 [nesoacademy.org/cs/06-computer-networks/ppts/01-introductiontocomputernetworks](https://nesoacademy.org/cs/06-computer-networks/ppts/01-introductiontocomputernetworks)



Introduction to Computer Networks Neso Academy CHAPTER- 1

The image shows a slide with a dark blue background. In the center, there is a circular watermark-like graphic containing the text "NESO ACADEMY" in a stylized font, with a crosshair design overlaid. To the left of the watermark, there is a target icon consisting of concentric circles with an arrow pointing towards the center. Next to the icon, the text "Target Audience" is written in a yellow, sans-serif font. Below this, there is a bulleted list of five items, each preceded by a yellow star icon:

- ★ Undergraduate students
- ★ Preparing for GATE
- ★ Preparing for networking interview
- ★ Prerequisite to CCNA international certification course
- ★ Demystify networking technologies and jargons

★★★★★

## Scope

- Ⓐ Networking is everywhere.
- Ⓐ Networks support the way we learn.
- Ⓐ Networks support the way we communicate.
- Ⓐ Networks support the way we work.
- Ⓐ Networks support the way we play.

## PEDAGOGY



Lecture



Problem Solving



Simulation using Cisco packet tracer

Pedagogy

## SYLLABUS

- ★ Chapter 1: Fundamentals
- ★ Chapter 2: Data Link Layer
- ★ Chapter 3: Network Layer
- ★ Chapter 4: Transport Layer
- ★ Chapter 5: Application Layer
- ★ Chapter 6: Network Security

★★★★★Syllabus

## OUTCOMES

Upon the completion of this lecture, the learner will be able to:

- ★ Understand “What is computer network?”.
- ★ Identify end devices and intermediary devices.

★★Outcomes

## DEFINITION – COMPUTER NETWORK

A computer network is a set of nodes connected by communication links.

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

Example for nodes:	Computer
	Server
	Printer
	Security Camera
	Many more (Switches, Bridges, Routers etc.,)

Definition -Computer Network

## DEFINITION – COMPUTER NETWORK

A computer network is a set of nodes connected by communication links.

A communication link can be a wired link or wireless link.

The link carries the information.



Wired Link



Wireless Link

Definition -Computer Network

## DEFINITION – COMPUTER NETWORK

A computer network is a set of nodes connected by communication links.

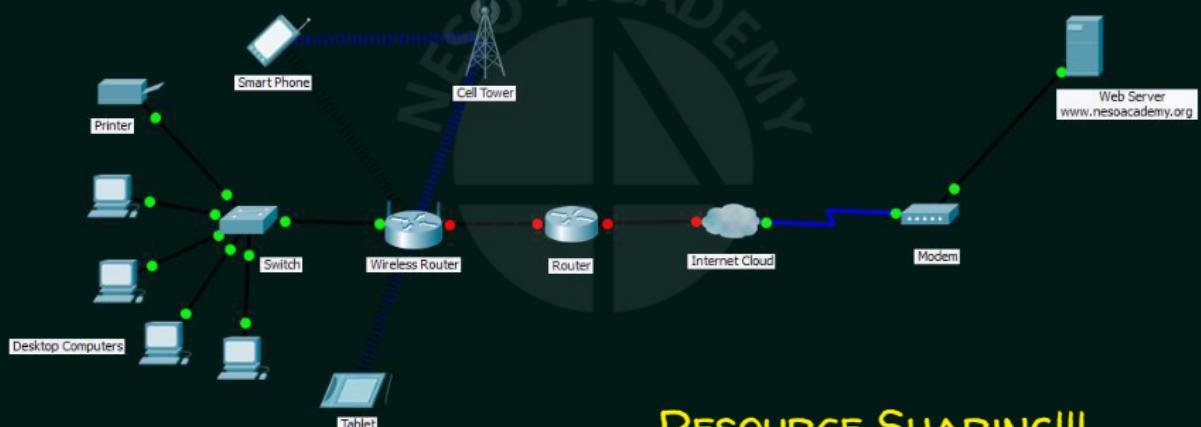
A communication link can be a wired link or wireless link.

The link carries the information.

Links (Medium)	Wired: Cable
	Wireless: Air

Definition -Computer Network

## AN EXAMPLE COMPUTER NETWORK



An example computer network Resource Sharing!!!



## ACTIVITY TIME

Find out the end nodes (end devices) and intermediary nodes depicted in the scenario and place them rightly.

END DEVICES	INTERMEDIARY NODES
PC	Router
Printer	Wireless Router
Server	Cell Tower
Tablet	Modem
Smart Phone	Internet Cloud

## Activity Time

## OUTCOMES

Upon the completion of this session, the learner will be able to

- ★ Understand the need for fault tolerant networks.
- ★ Understand the need for scalable networks.
- ★ Understand Quality of Service (QoS).
- ★ Know the importance of security in computer networks.

Outcomes★★★★

## BASIC CHARACTERISTICS OF COMPUTER NETWORK

- ★ Fault Tolerance
- ★ Scalability
- ★ Quality of Service (QoS)
- ★ Security

Basic characteristics of computer network★★★★

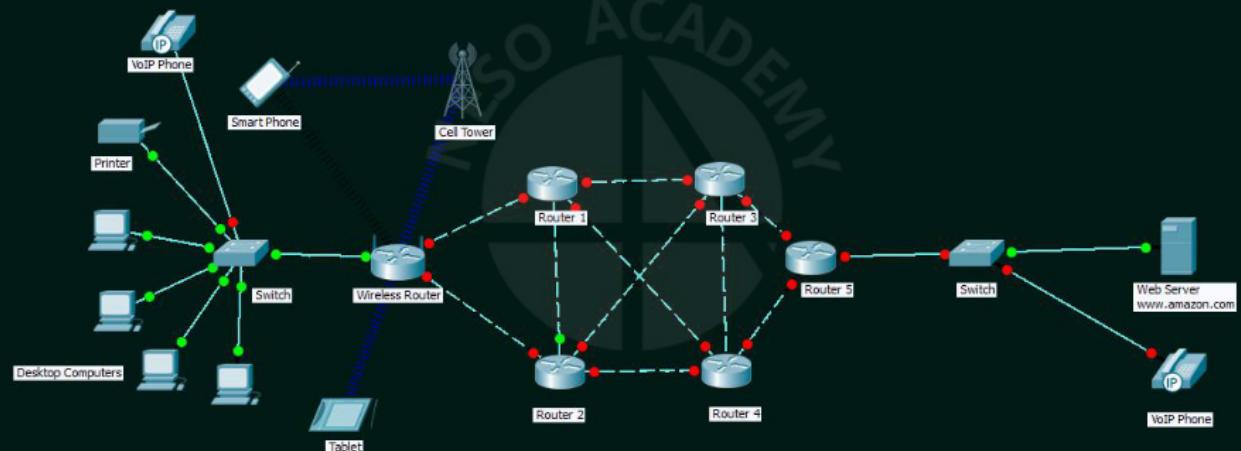
### FAULT TOLERANCE

The ability to :

1. Continue working despite failures
2. Ensure no loss of service

Fault Tolerance

## AN EXAMPLE COMPUTER NETWORK



An example computer network

## SCALABILITY

The ability to :

1. Grow based on the needs
2. Have good performance after growth

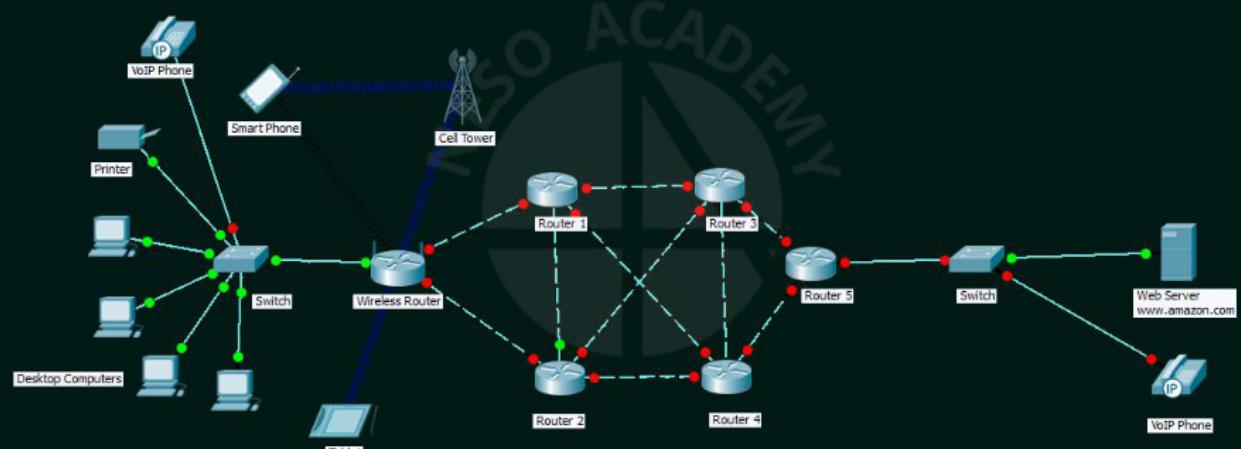
Scalability

## SCALABLE NETWORK – THE INTERNET



Scalable Network -The Internet

## AN EXAMPLE COMPUTER NETWORK



An example computer network

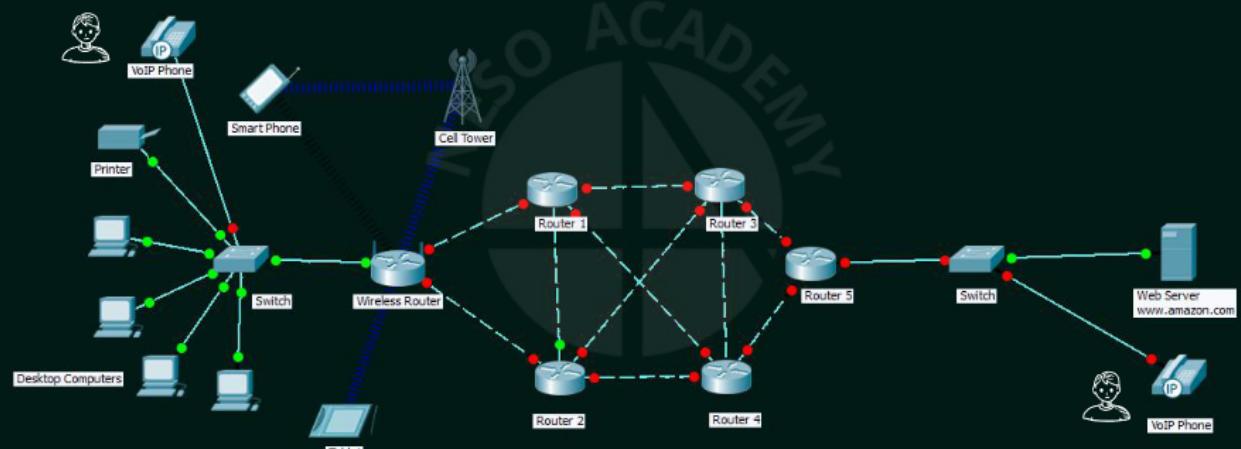
## QUALITY OF SERVICE (QoS)

The ability to :

1. Set Priorities
2. Manage data traffic to reduce data loss, delay etc.,

### Quality of Service (QoS)

#### AN EXAMPLE COMPUTER NETWORK



An example computer network

## QUALITY OF SERVICE (QoS)

The ability to :

1. Set Priorities
2. Manage data traffic to reduce data loss, delay etc.,

Quality of Service (QoS)

## SECURITY

The ability to prevent:

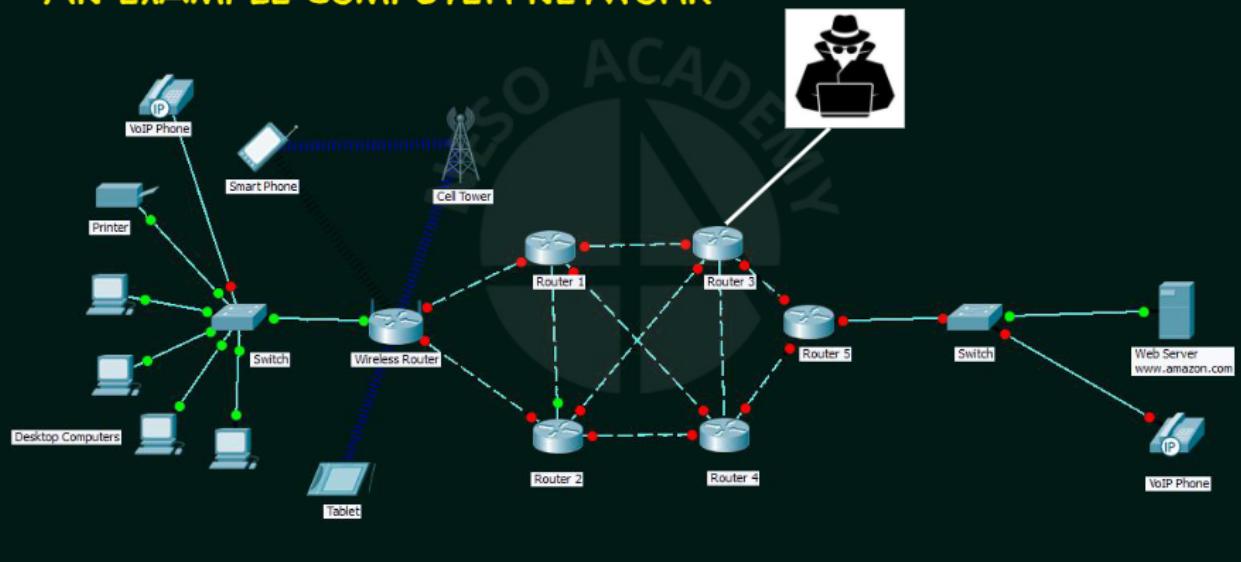
- ★ Unauthorized access
- ★ Misuse
- ★ Forgery

The ability to provide:

- ★ Confidentiality
- ★ Integrity
- ★ Availability

Security★★★★★

## AN EXAMPLE COMPUTER NETWORK



An example computer network

## SECURITY

The ability to prevent:

- ★ Unauthorized access
- ★ Misuse
- ★ Forgery

The ability to provide:

- ★ Confidentiality
- ★ Integrity
- ★ Availability

Security ★★★★★★

## BASIC CHARACTERISTICS OF COMPUTER NETWORK

- ★ Fault Tolerance
- ★ Scalability
- ★ Quality of Service (QoS)
- ★ Security

Basic characteristics of computer network★★★★

## OUTCOMES

Upon the completion of this session, the learner will be able to

- ★ Know “What is Data Communication?”.
- ★ Understand data flow.
- ★ Understand the importance of protocols in computer network.
- ★ Know the elements of protocol.

Outcomes★★★★

## DATA COMMUNICATION

- ★ Data communications are the exchange of data between two nodes via some form of link (transmission medium) such as a cable.



Data Communication★

## DATA FLOW

- ★ Simplex.
- ★ Half Duplex.
- ★ Full Duplex.

Data flow★★★

## **DATA FLOW – SIMPLEX**

Communication is always unidirectional.

One device can transmit and the other device will receive.

Example : Keyboards, Traditional monitors.

Data flow -Simplex

## **DATA FLOW – HALF DUPLEX**

Communication is in both directions but not at the same time.

If one device is sending, the other can only receive, and vice versa.

Example : Walkie-Talkies.

Data flow -Half Duplex

## DATA FLOW – DUPLEX OR FULL DUPLEX

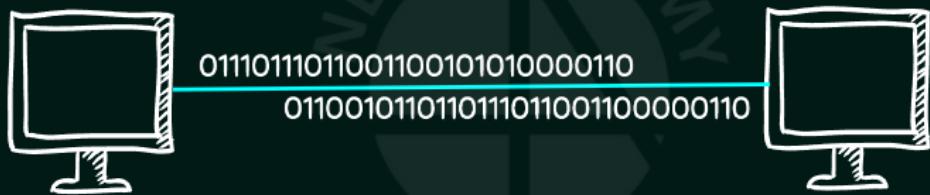
Communication is in both directions simultaneously.

Device can send and receive at the same time.

Example : Telephone line.

Data flow -Duplex or Full Duplex

### DATA FLOW



Data flow

## PROTOCOLS

All communication schemes will have the following things in common:

- ★ Source or sender
- ★ Destination or receiver
- ★ Channel or media

Rules or protocols govern all methods of communication.

Protocols★★★

IF THERE ARE NO PROTOCOLS...



if there are no protocols...

## PROTOCOLS

Protocol = Rule.

It is a set of rules that govern data communication.

Protocol determines:

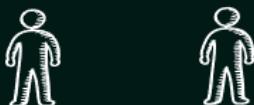
- What is communicated?
- How it is communicated?
- When it is communicated?

Protocols 

## PROTOCOLS – HUMAN COMMUNICATION

Protocols are necessary for human communication and include:

- ★ An identified sender and receiver
- ★ Common language and grammar
- ★ Speed and timing of delivery
- ★ Confirmation or acknowledgment requirements



Protocols -Human Communication ★★★★

## PROTOCOLS – NETWORK COMMUNICATION

Protocols used in network communications also define:

- ★ Message encoding
- ★ Message formatting and encapsulation
- ★ Message timing
- ★ Message size
- ★ Message delivery options



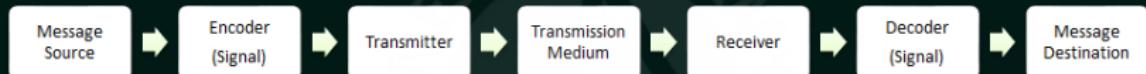
Protocols -Network Communication★★★★★

## ELEMENTS OF A PROTOCOL

1. Message encoding
2. Message formatting and encapsulation
3. Message timing
4. Message size
5. Message delivery options

Elements of a Protocol

## 1. MESSAGE ENCODING



## 1. Message Encoding

## 2. MESSAGE FORMATTING AND ENCAPSULATION

Agreed format.

Encapsulate the information to identify the sender and the receiver rightly.

## 2. Message Formatting and Encapsulation

### 3. MESSAGE SIZE

Humans break long messages into smaller parts or sentences.

Long messages must also be broken into smaller pieces to travel across a network.



### 3. Message Size

### 4. MESSAGE TIMING

Flow Control.

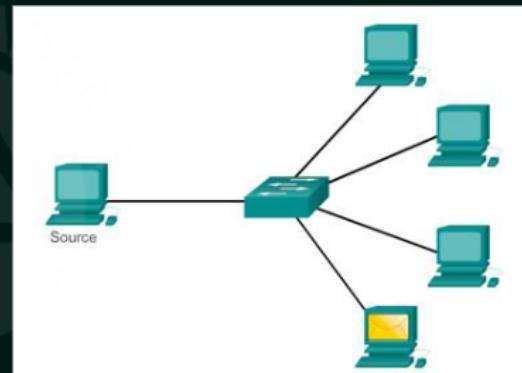
Response Timeout.



### 4. Message Timing

## 5. MESSAGE DELIVERY OPTIONS

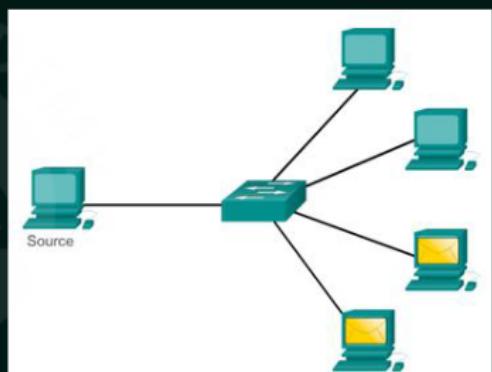
- ★ Unicast
- ★ Multicast
- ★ Broadcast



5. Message Delivery Options★★★

## 5. MESSAGE DELIVERY OPTIONS

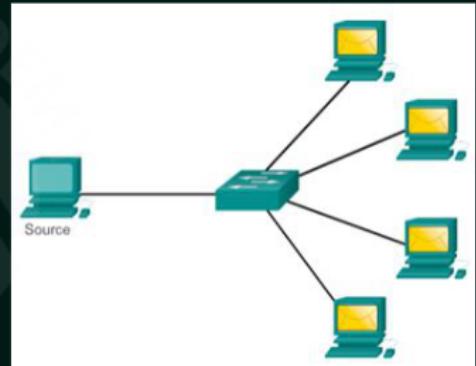
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5. Message Delivery Options★★★

## 5. MESSAGE DELIVERY OPTIONS

- ★ Unicast
- ★ Multicast
- ★ Broadcast



5. Message Delivery Options★★★

## OUTCOMES

Upon the completion of this session, the learner will be able to

- ★ Understand protocols and its role in computer networks.
- ★ Understand Peer-to-Peer networks and Client-Server networks.

Outcomes ★★

## PROTOCOLS

Protocol = Rule.

It is a set of rules that govern data communication.

Protocol determines:

- What is communicated?
- How it is communicated?
- When it is communicated?

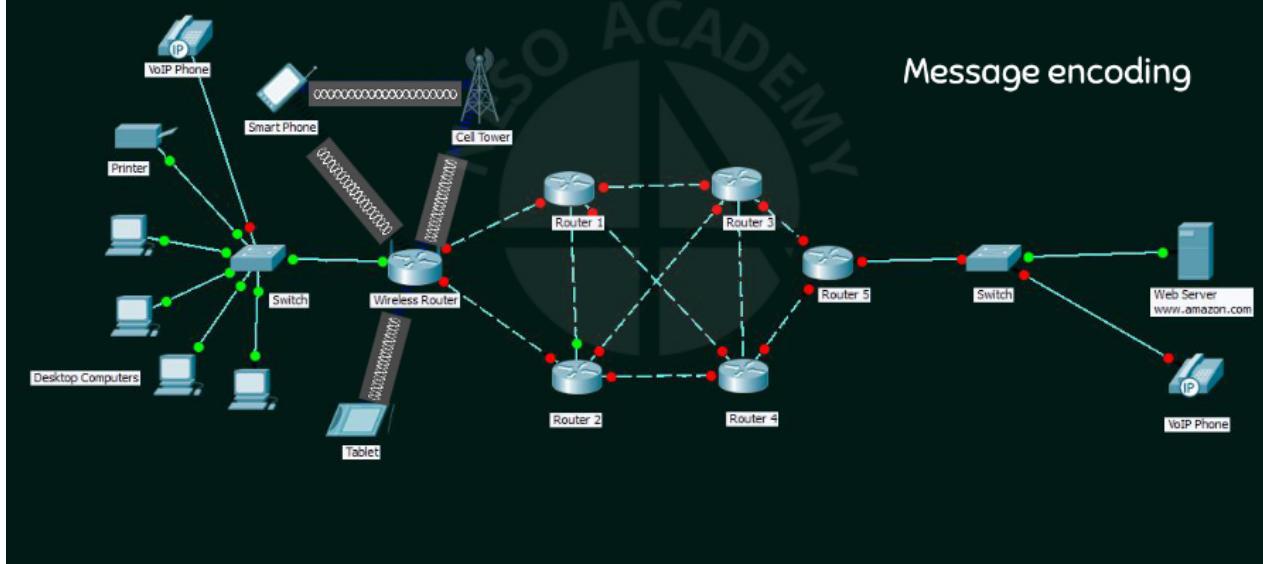
Protocols □ □ □

## ELEMENTS OF A PROTOCOL

1. Message encoding
2. Message formatting and encapsulation
3. Message timing
4. Message size
5. Message delivery options

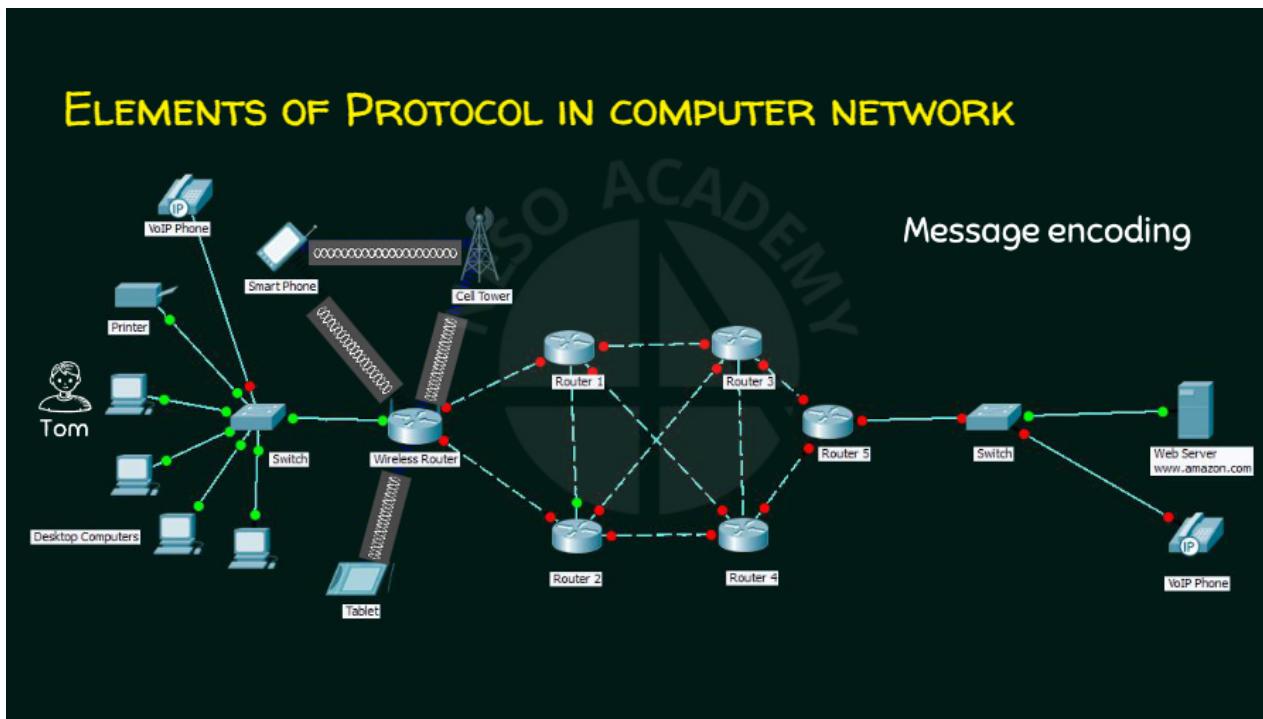
Elements of a Protocol

## ELEMENTS OF PROTOCOL IN COMPUTER NETWORK



Message encoding

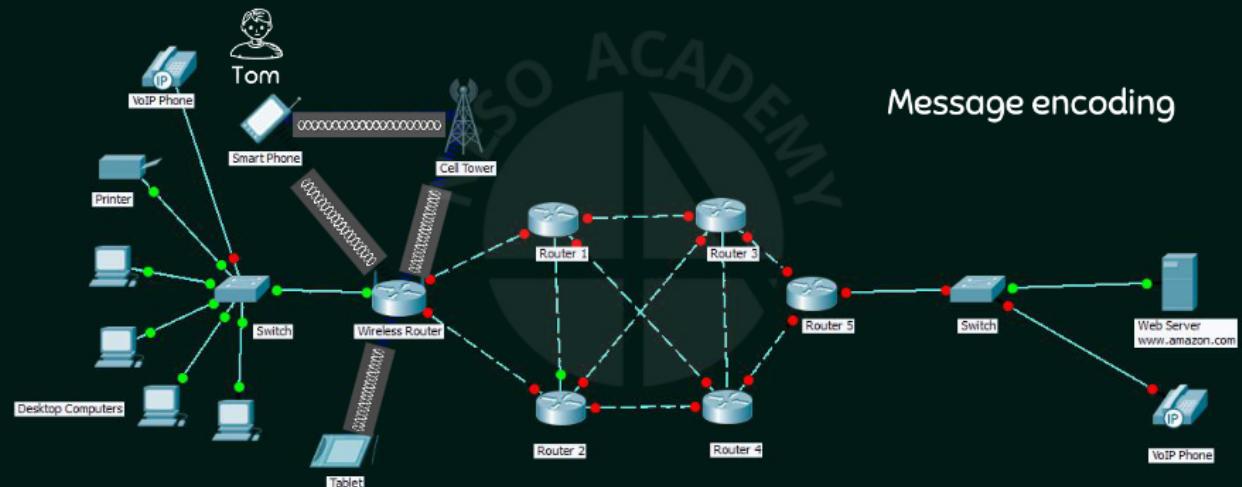
Elements of Protocol in computer network



Message encoding

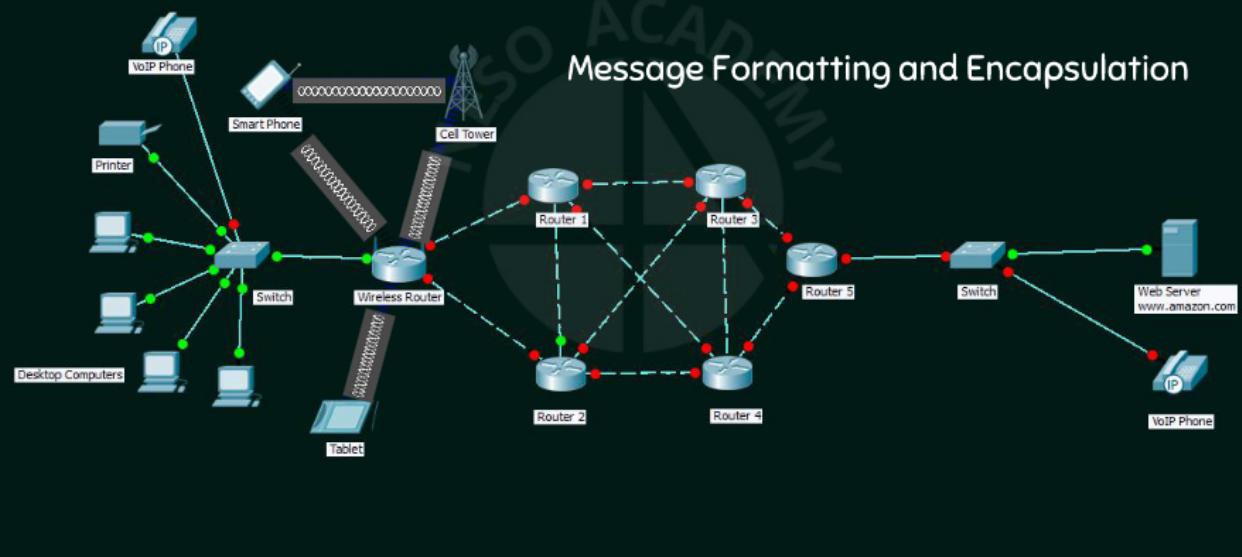
Elements of Protocol in computer network

## ELEMENTS OF PROTOCOL IN COMPUTER NETWORK



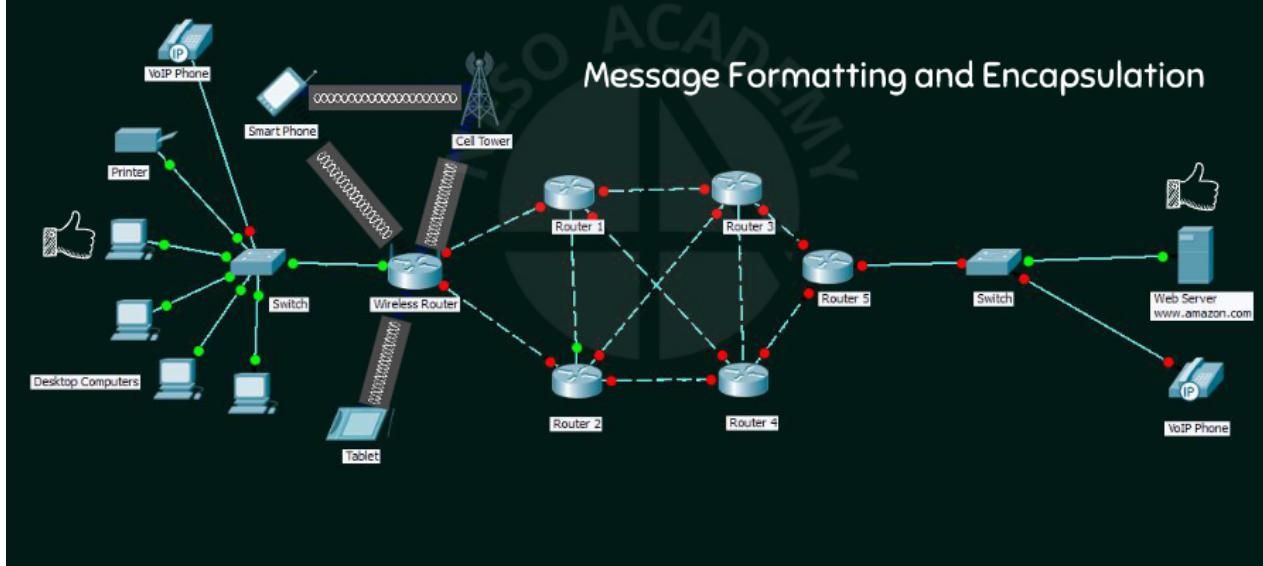
Elements of Protocol in computer network

## ELEMENTS OF PROTOCOL IN COMPUTER NETWORK

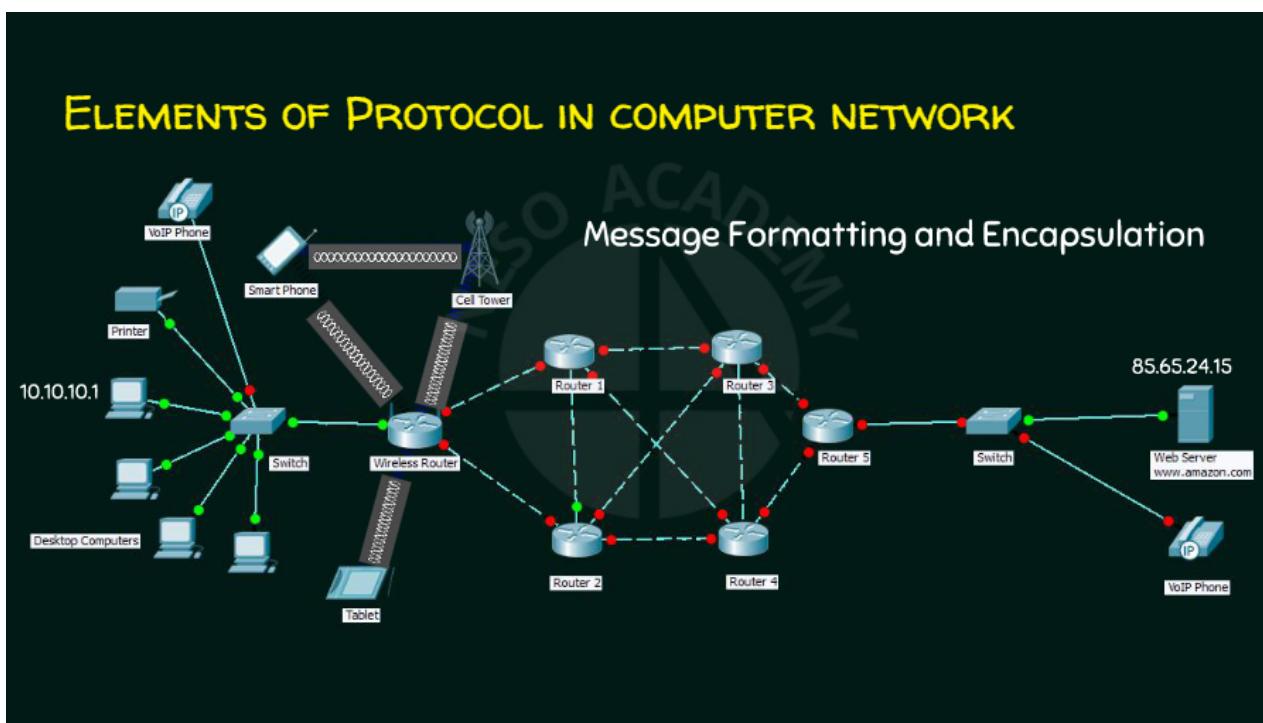


Elements of Protocol in computer network

## ELEMENTS OF PROTOCOL IN COMPUTER NETWORK



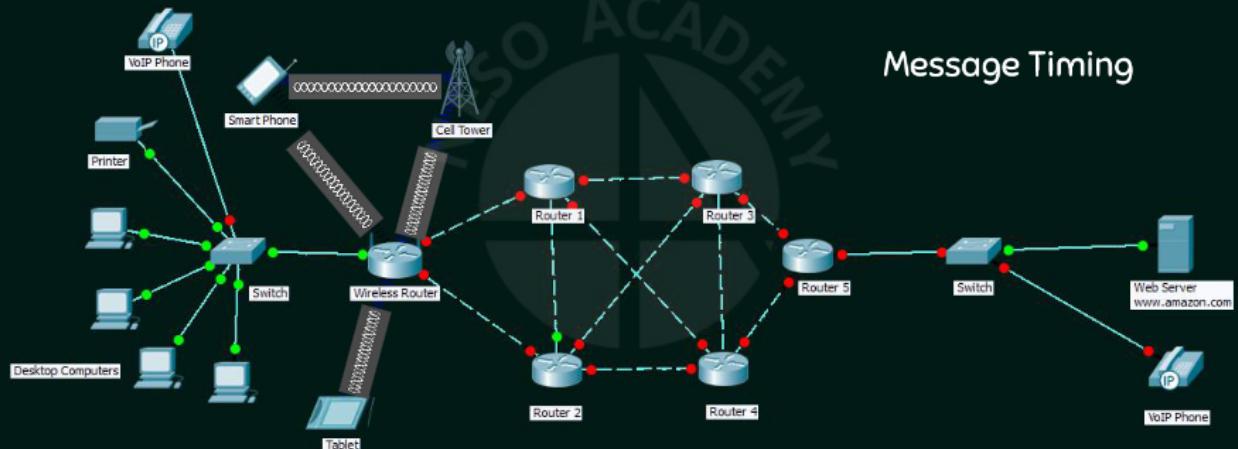
Elements of Protocol in computer network



Elements of Protocol in computer network

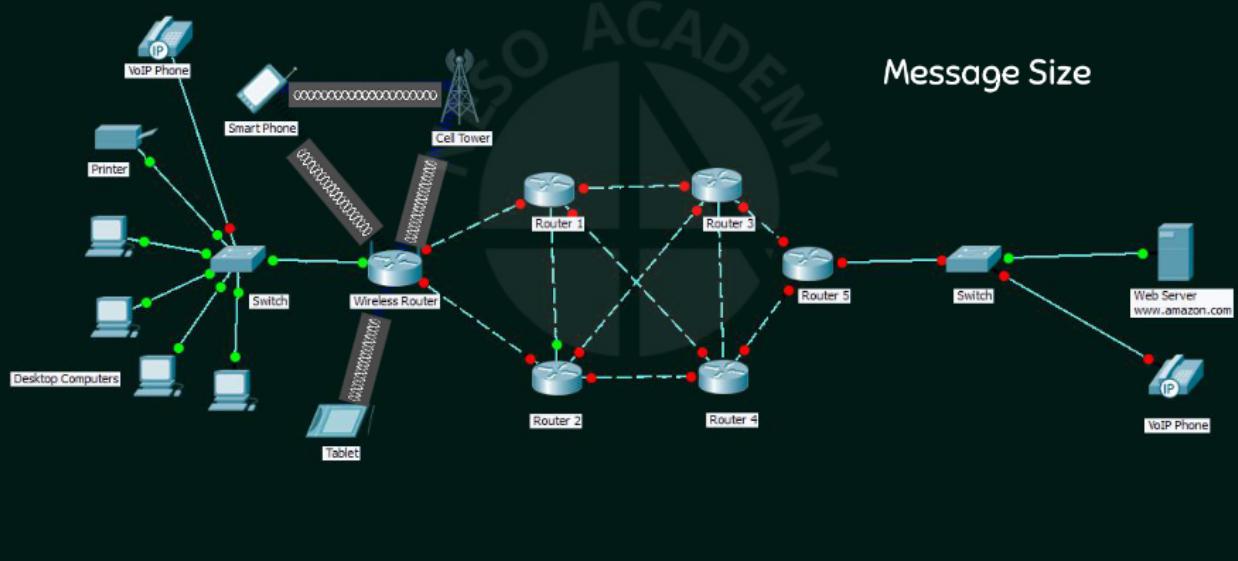
## ELEMENTS OF PROTOCOL IN COMPUTER NETWORK

Message Timing



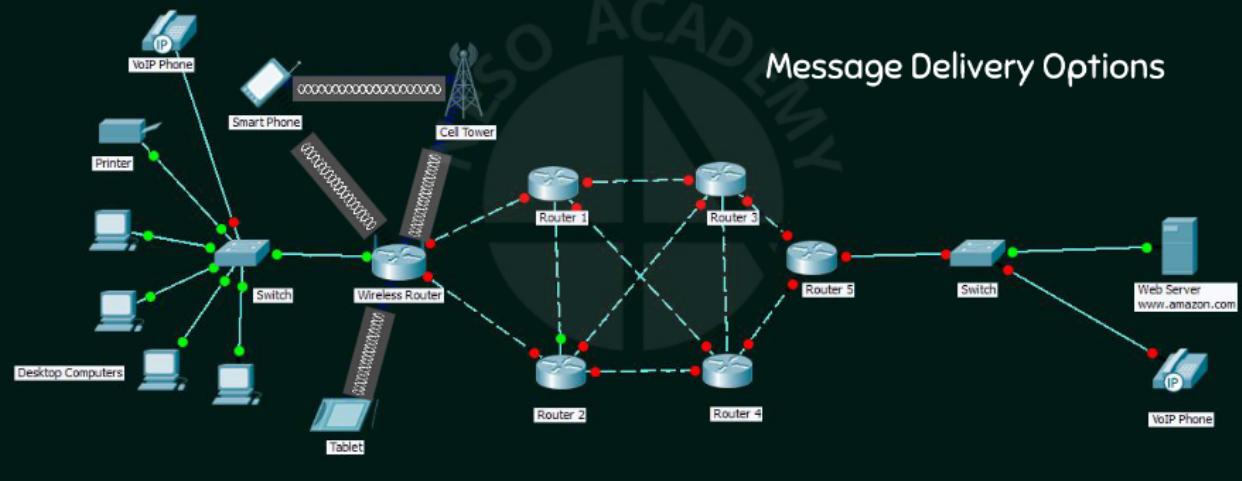
Elements of Protocol in computer network

Message Size



Elements of Protocol in computer network

## ELEMENTS OF PROTOCOL IN COMPUTER NETWORK



Elements of Protocol in computer network

## PEER-TO-PEER NETWORK

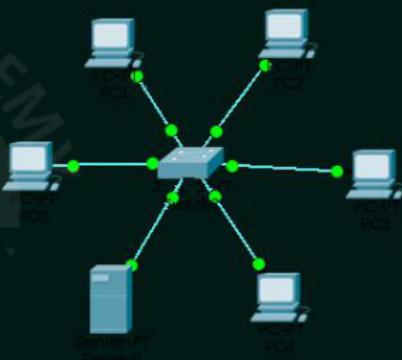
- ★ No Centralized administration.
- ★ All peers are equal.
- ★ Simple sharing applications.
- ★ Not scalable.



Peer-to-Peer Network★★★★

## CLIENT SERVER NETWORK

- ★ Centralized administration.
- ★ Request-Response model.
- ★ Scalable.
- ★ Server may be overloaded.



Client Server Network★★★

## OUTCOMES

Upon the completion of this session, the learner will be able to

- ★ Understand nodes in computer network.
- ★ Understand different media in computer network.
- ★ Understand various services offered by computer network.

Outcomes ★★★

## COMPONENTS OF A COMPUTER NETWORK

1. Nodes
2. Media
3. Services



Components of a computer network

### 1. NODES

End nodes (End devices).

Intermediary nodes.



1.Nodes

## **END NODES(DEVICES)**

Computers

Network Printers

VoIP Phones

Telepresence endpoint

Security cameras

Mobile handheld devices (Smart phones, tablets, PDAs, Wireless debit/credit card reader, barcode scanner)

End nodes(devices)

## **INTERMEDIARY NODES**

Switches

Wireless Access Point

Routers

Security Devices (Firewall)

Bridges

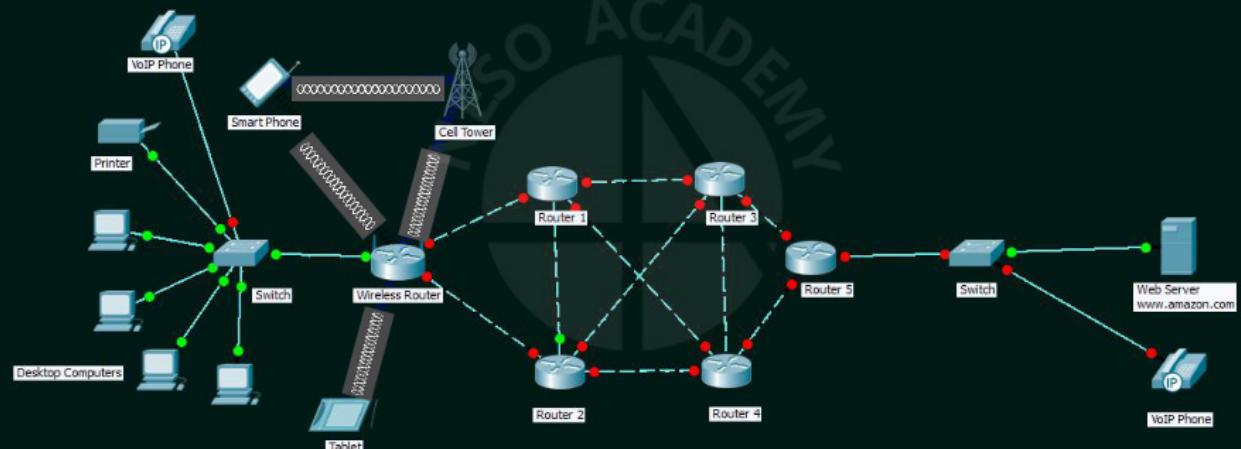
Hubs

Repeaters

Cell Tower

Intermediary nodes

## COMPONENTS – NODES, MEDIA AND SERVICES



Components -Nodes, media and services

## 2. MEDIA

Wired Medium (Guided Medium)

Wireless Medium (Unguided Medium)

2. Media

## WIRED MEDIA

Ethernet straight-through cable

Ethernet crossover cable

Fiber Optic cable

Coaxial cable

USB cable

Wired media

## WIRED MEDIA

Ethernet straight-through cable

Ethernet crossover cable

Fiber Optic cable

Coaxial cable

USB cable



Wired media

## WIRED MEDIA

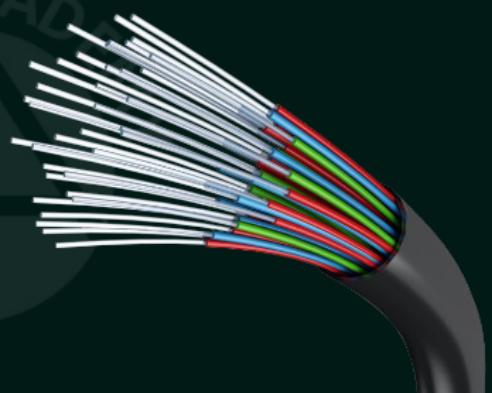
Ethernet straight-through cable

Ethernet crossover cable

Fiber Optic cable

Coaxial cable

USB cable



Wired media

## WIRED MEDIA

Ethernet straight-through cable

Ethernet crossover cable

Fiber Optic cable

Coaxial cable

USB cable



Wired media

## WIRED MEDIA

Ethernet straight-through cable

Ethernet crossover cable

Fiber Optic cable

Coaxial cable

**USB cable**



Wired media

## WIRELESS MEDIA

Infrared (Example: short range communication – TV remote control)

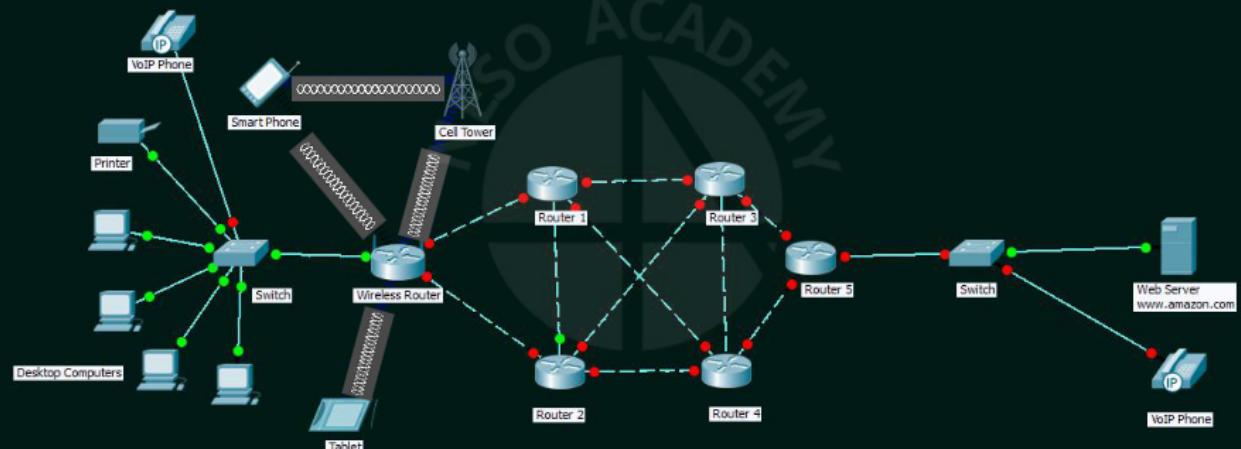
Radio (Example: Bluetooth, Wi-Fi)

Microwaves (Example: Cellular System)

Satellite (Example: Long range communication – GPS)

Wireless media

## COMPONENTS – NODES, MEDIA AND SERVICES



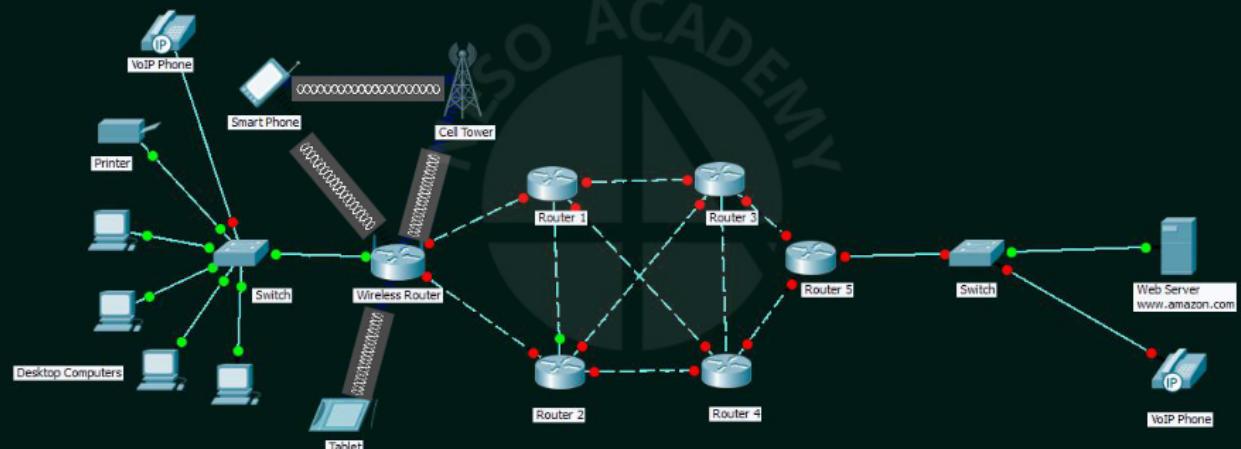
Components -Nodes, media and services

### 3. SERVICES

- |                   |                 |
|-------------------|-----------------|
| e-Mail            | Online game     |
| Storage services  | Voice over IP   |
| File sharing      | Video telephony |
| Instant messaging | World Wide Web  |

3. Services

## COMPONENTS – NODES, MEDIA AND SERVICES



Components -Nodes, media and services

## OUTCOMES

Upon the completion of this session, the learner will be able to

- ★ Understand LAN, MAN and WAN.
- ★ Know various devices involved in LAN, MAN and WAN.
- ★ Know the new trends in computer networks.

Outcomes ★★★

## CLASSIFICATION OF COMPUTER NETWORKS

1. Local Area Network (LAN)
2. Metropolitan Area Network (MAN)
3. Wide Area Network (WAN)

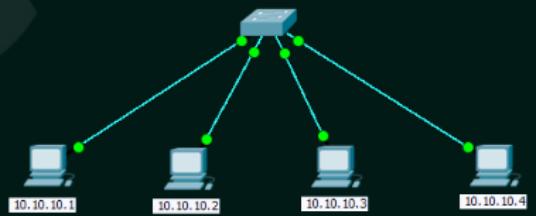
### Classification of Computer Networks

#### 1. LOCAL AREA NETWORK (LAN)

A Local Area Network (LAN) is a computer network that interconnects computers within a **limited area** such as a residence, school, laboratory, university campus or office building.

##### LAN - DEVICES

- ★ Wired LAN (Example: Ethernet – Hub, Switch)
- ★ Wireless LAN (Example: Wi-Fi)



#### 1. Local Area Network (LAN) ★★

## 2. METROPOLITAN AREA NETWORK (MAN)

A metropolitan area network (MAN) is a computer network that interconnects users with computer resources in a geographic region of the size of a **metropolitan area (City)**.

### MAN- DEVICES

- ★ Switches/Hub
- ★ Routers/Bridges

## 2. Metropolitan Area Network (MAN)★★

## 2. METROPOLITAN AREA NETWORK (MAN)



## 2. Metropolitan Area Network (MAN)

### 3. WIDE AREA NETWORK (WAN)

A wide area network (WAN) is a telecommunications network that extends over a large geographical area for the primary purpose of computer networking.

#### WAN - Devices

End devices and intermediary devices

### 3. Wide Area Network (WAN)

#### 3. WIDE AREA NETWORK (WAN)



### 3. Wide Area Network (WAN)

## THE INTERNET



The Internet

## NEW TRENDS

- Bring Your Own Device (BYOD)
- Online collaboration
- Cloud computing

New trends

## STORAGE AREA NETWORK (SAN)

### Cloud Computing

It is the on-demand availability of computer system resources, especially data storage and computing power, without direct active management by the user.

Storage Area Network (SAN)

## OUTCOMES

Upon the completion of this session, the learner will be able to

- ★ Understand various network topologies such as bus, star, ring, mesh and hybrid.
- ★ Understand the advantages and disadvantages of each topology.

Outcomes ★★

## NETWORK TOPOLOGY

Arrangement of nodes of a computer network.

Topology = Layout.



Network Topology

## PHYSICAL TOPOLOGY AND LOGICAL TOPOLOGY

Physical Topology – Placement of various nodes.

Logical topology – Data flow and connection between nodes in the network.



Physical Topology and Logical Topology

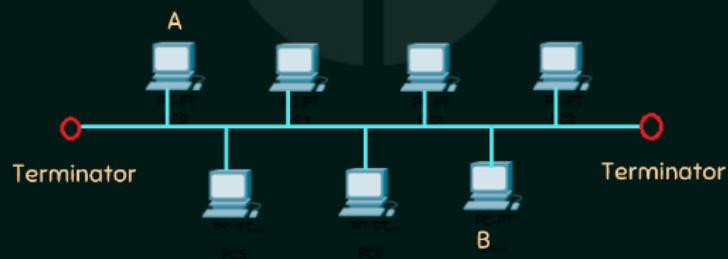
## NETWORK TOPOLOGY

- ★ Bus
- ★ Ring
- ★ Star
- ★ Mesh
- ★ Hybrid

Network topology★★★★★

## BUS TOPOLOGY

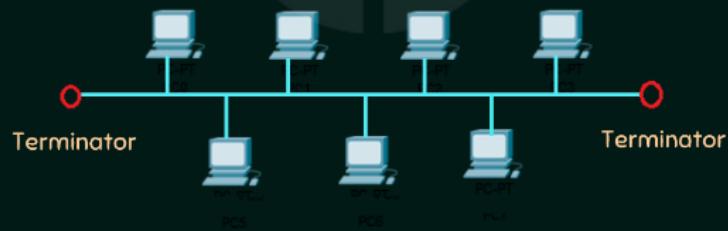
- ★ All data transmitted between nodes in the network is transmitted over this **common transmission medium** and is able to be received by all nodes in the network simultaneously.
- ★ A signal containing the address of the intended receiving machine travels from a source machine in **both directions** to all machines connected to the bus until it finds the intended recipient.



Bus topology★★

## BUS TOPOLOGY

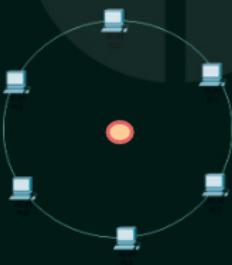
Advantages	Disadvantages
Only one wire – Less expensive.	Not fault tolerant (No redundancy).
Suited for temporary network.	Limited cable length.
Node failures does not affect others.	No security.



Bus topology

## RING TOPOLOGY

- ★ A ring topology is a bus topology in a closed loop.
- ★ Peer-to-Peer LAN topology.
- ★ Two connections: one to each of its nearest neighbors.
- ★ Unidirectional.
- ★ Sending and receiving data takes place with the help of a TOKEN.



Ring topology★★★★★

## RING TOPOLOGY



Ring topology

## RING TOPOLOGY

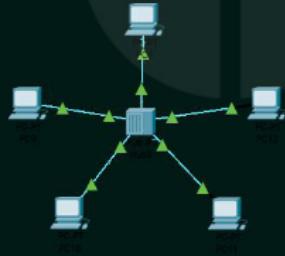
Advantages	Disadvantages
Performance better than Bus topology.	Unidirectional. Single point of failure will affect the whole network.
Can cause bottleneck due to weak links.	↑ in load – ↓ in performance.
All nodes with equal access.	No security.



Ring topology↑↓

## STAR TOPOLOGY

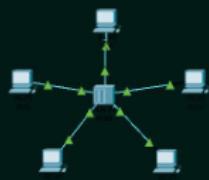
- ★ Every node is connected to a central node called a hub or switch.
- ★ Centralized Management.
- ★ All traffic must pass through the hub or switch.



Star topology★★★

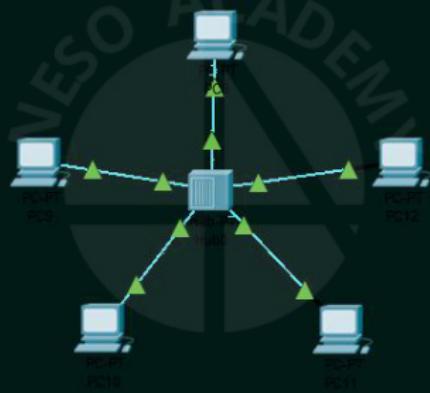
## STAR TOPOLOGY

Advantages	Disadvantages
Easy to design and implement.	Single point of failure affects the whole network.
Centralized administration.	Bottlenecks due to overloaded switch/Hub.
Scalable.	Increased cost due to switch/hub.



Star topology

## STAR TOPOLOGY



Star topology

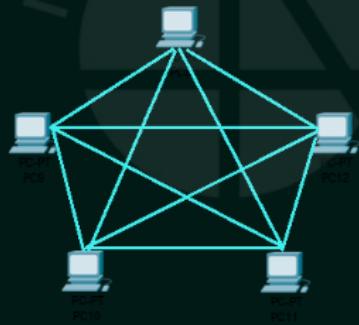
## EXTENDED STAR TOPOLOGY



Extended Star topology

## MESH TOPOLOGY

- ★ Each node is directly connected to every other nodes in the network.
- ★ Fault tolerant and reliable.



Mesh topology★★

## MESH TOPOLOGY

Advantages	Disadvantages
Fault tolerant.	Issues with broadcasting messages.
Reliable.	Expensive and impractical for large networks.



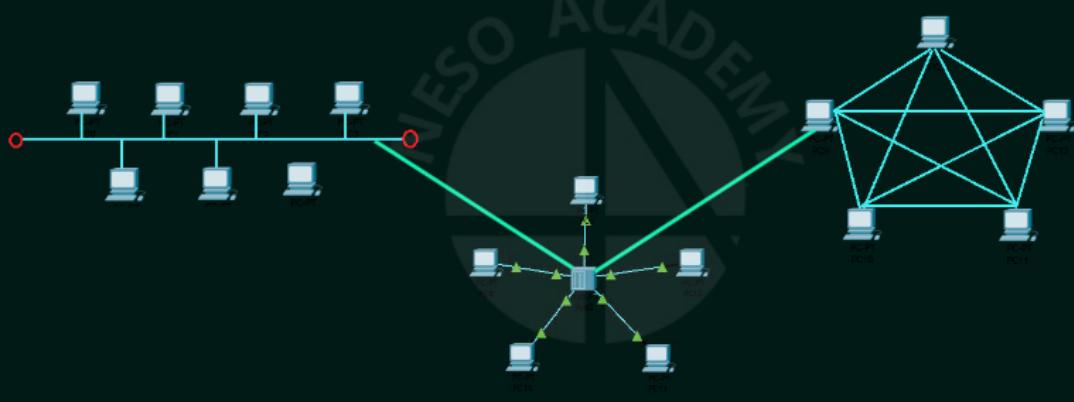
Mesh topology

**FIND THE TOPOLOGY??**



Find the topology??

**HYBRID TOPOLOGY**



Hybrid topology

## OUTCOMES

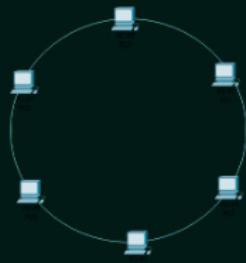
Upon the completion of this session, the learner will be able to

- ★ Determine the number of links(cables) and ports required for a given topology.

Outcomes ★

## QUESTION 1

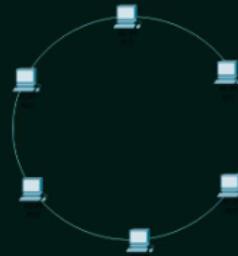
Identify the given topology and determine how many cables and ports are required to have such network?



Question 1

## RING TOPOLOGY

No. of Nodes (N)	No of Cables (=N)	No. of Ports/device (NOPD)	Total No. of ports in the network (TNOP) = N X NOPD
2	2	2	4
3	3	2	6
4	4	2	8
<b>N</b>	<b>N</b>	<b>2</b>	<b><math>2 \times N</math></b>



Ring Topology

### QUESTION 1

Identify the given topology and determine how many cables and ports are required to have such network?

**Solution:** (Here N=6)

**Topology:** Ring Topology

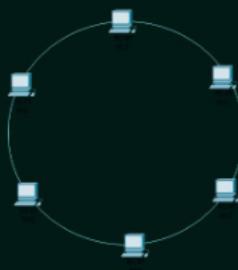
No. of cables = N

No of cables = 6

$TNOP = N \times NOPD$

Here N=6, NOPD=2

$TNOP = 6 \times 2 = 12$

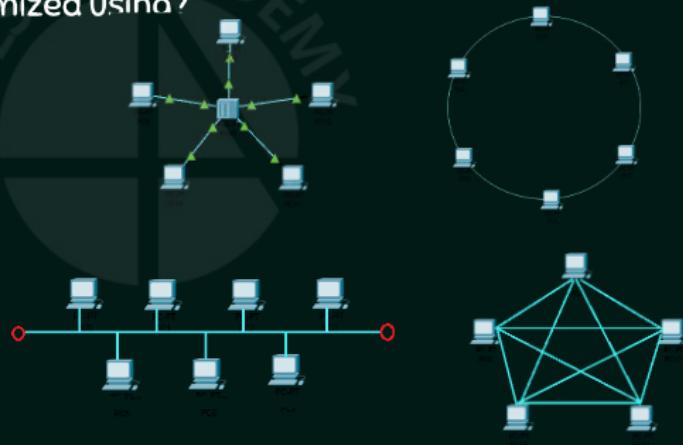


Question 1

## QUESTION 2

Traffic problem can be minimized using?

- a. Star X
- b. Bus X
- c. Ring X
- d. Mesh



Question 2

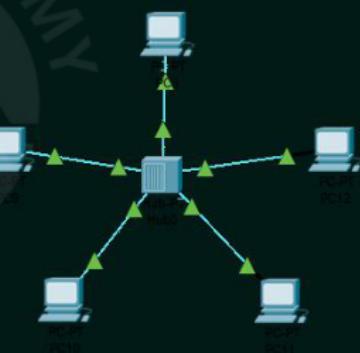
## QUESTION 3

How many ports and cables links are needed for a star topology?

Solution:

$$\begin{array}{lcl} \text{No. of cables} & : N \\ \text{No. of cables} & : 5 \end{array}$$

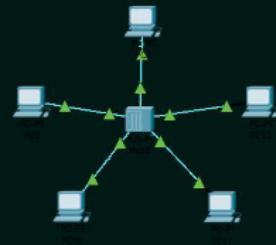
$$\begin{array}{ll} \text{No.of ports} & = 2 \times N \\ \text{No. of ports} & = 2 \times 5 \\ \text{No. of ports} & = 10 \end{array}$$



Question 3

## STAR TOPOLOGY

No. of Nodes (N)	No of Cables (=N)	No of Ports/device (NOPD)	Total No. of ports in the network (TNOP) = 2 X N
2	2	1	4
3	3	1	6
4	4	1	8
N	N	1	2 x N



Star Topology

## HOME WORK

Assume six devices are arranged in a mesh topology.

- (i) How many cables are needed?
- (ii) How many ports are needed for each device?
- (iii) How many ports are there in the entire network?

Home work

## OUTCOMES

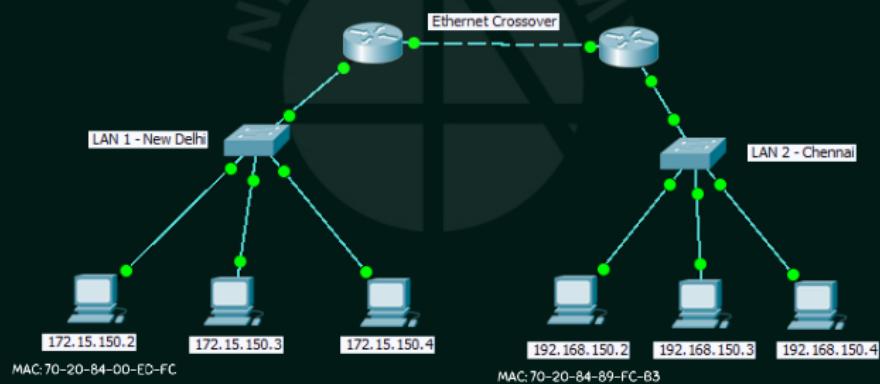
Upon the completion of this session, the learner will be able to

- ★ Understand the basics of IP addressing.
- ★ Know how to see the IP address in real device.
- ★ Identify valid and invalid IP addresses.

Outcomes ★★★

## IP ADDRESS

Every node in the computer network is identified with the help of IP address.



IP Address

## IP ADDRESS (IPV4)

- ★ Every node in the computer network is identified with the help of IP address.
- ★ Logical address.
- ★ Can change based on the location of the device.
- ★ Assigned by manually or dynamically.
- ★ Represented in decimal and it has 4 octets (x.x.x.x).
- ★ 0.0.0.0 to 255.255.255.255 (32 bits).

IP Address (IPV4)★★★★★

## ACTIVITY TIME

Identify the valid and invalid IP addresses in the following set and place the options in the appropriate columns.

- a. 24.25.26.8
- b. 10.3.156.256
- c. 0.0.0.0
- d. 255.255.255.255
- e. 100.2.6.345.456
- f. 16.2e.45.67

Valid IP Addresses	Invalid IP Addresses
a, c, d	b, e, f

Activity Time

## OUTCOMES

Upon the completion of this session, the learner will be able to

- ★ Understand the basics of MAC addressing.
- ★ Understand the difference between IP address and MAC Address.
- ★ See the MAC address in real devices.

Outcomes ★★★

## MAC ADDRESS

MAC stands for Media Access Control.

Every node in the LAN is identified with the help of MAC address.

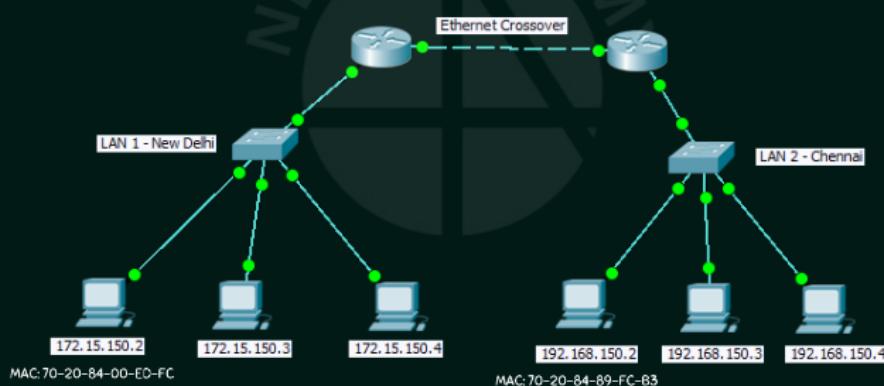
IP Address = Location of a person.

MAC Address = Name of the person.

MAC Address

## MAC ADDRESS

- ★ Every node in the LAN is identified with the help of MAC address.



MAC Address★

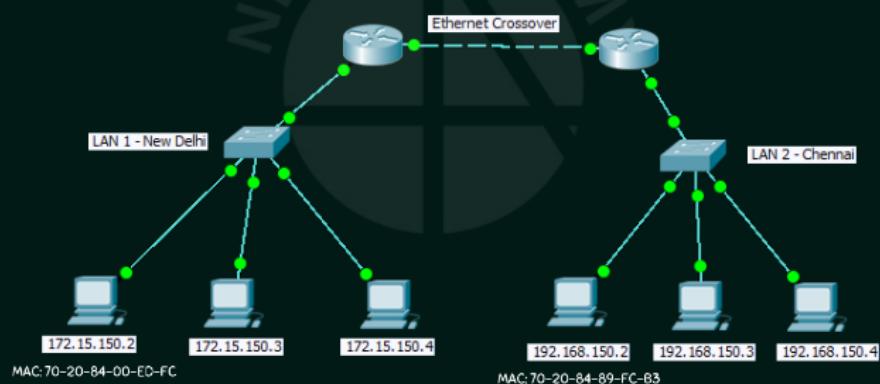
## MAC ADDRESS

- ★ Every node in the LAN is identified with the help of MAC address.
- ★ Physical address or Hardware Address.
- ★ Unique.
- ★ Cannot be changed.
- ★ Assigned by the manufacturer.
- ★ Represented in hexadecimal.
- ★ Example: 70-20-84-00-ED-FC (48 bits).
- ★ Separator: hyphen(-), period(.), and colon(:).

MAC Address★★★★★★★★

## MAC ADDRESS

- ★ Every node in the LAN is identified with the help of MAC address.



MAC Address★

## IP ADDRESS Vs MAC ADDRESS

IP Address	MAC Address
Needed for communication.	Needed for communication.
32 bits.	48 bits.
Represented in Decimal.	Represented in hexadecimal.
Router needs IP Address to forward data.	Switch needs MAC address to forward data
Example: 10.10.23.56	Example: 70-20-84-00-ED-FC

IP Address Vs MAC Address

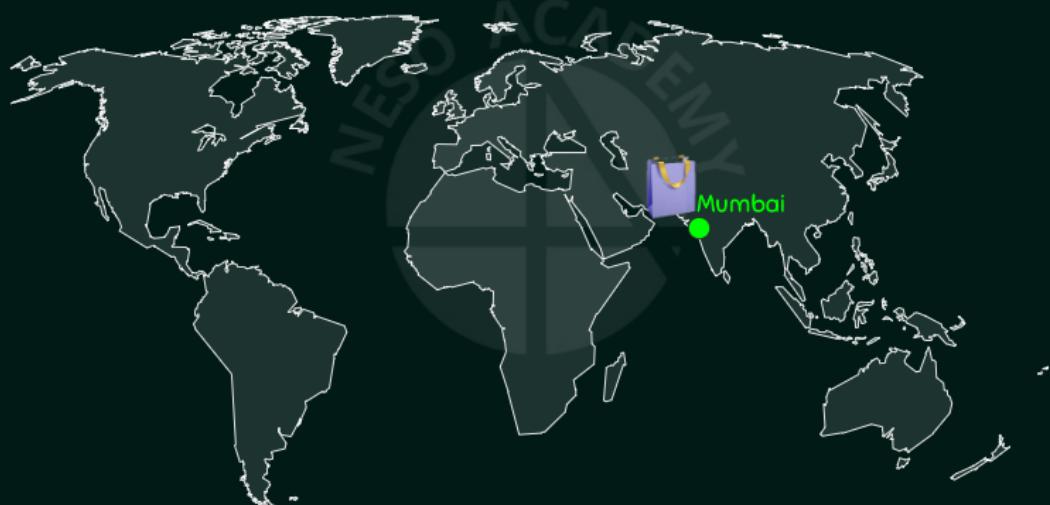
## OUTCOMES

Upon the completion of this session, the learner will be able to

- ★ Understand the basics of Port addressing (Port number).
- ★ Know three key points to ponder.
- ★ See port number in real devices.

Outcomes ★★★

## ANALOGY



Analogy

## ANALOGY



Analogy

## DERIVATIONS FROM ANALOGY

Reaching our city = Reaching our network. (IP Address)

Reaching our Apartment = Reaching the host. (MAC Address)

Reaching the right person = Reaching the right process. (Port Address)

Derivations from analogy

## PORT ADDRESS OR PORT NUMBER

- ★ In a node, many processes will be running.
- ★ Data which are sent/received must reach the right process.
- ★ Every process in a node is uniquely identified using **port numbers**.
- ★ Port = Communication endpoint.
- ★ Fixed port numbers and dynamic port numbers ( 0 – 65535)

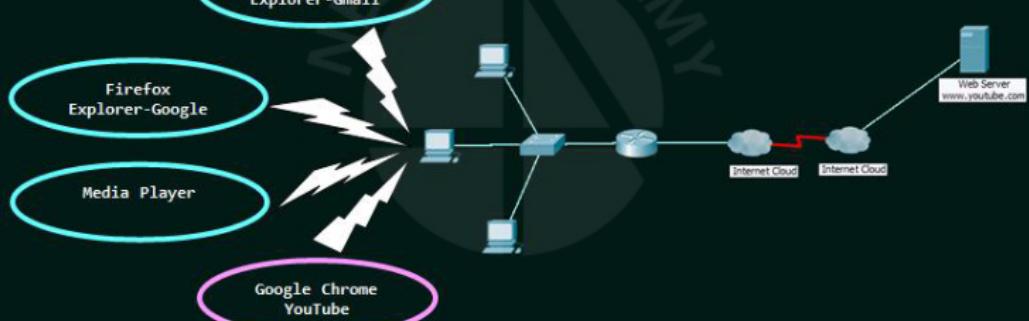
Example:

Fixed port numbers : 25, 80 etc.,

OS assigned dynamic port numbers : 62414.

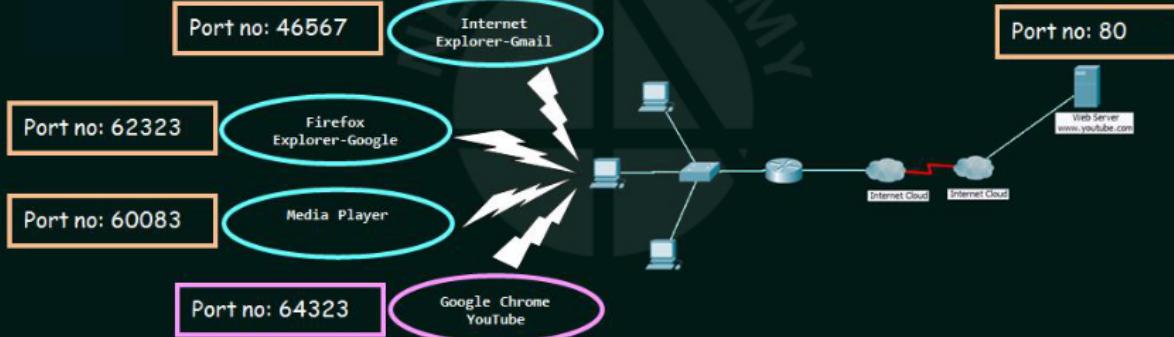
Port Address or Port Number★★★★★

## PORT ADDRESS OR PORT NUMBERS



Port Address or Port Numbers

## PORT ADDRESS OR PORT NUMBERS



Port Address or Port Numbers

## 3 KEY POINTS TO PONDER

Before sending the data, any node must

- ★ Attach source IP address and destination IP address.
- ★ Attach source MAC address and destination MAC address.
- ★ Attach source port number and destination port number.

3 Key points to ponder★★★

## OUTCOMES

Upon the completion of this session, the learner will be able to

- ★ Understand switching.
- ★ Understand various switching techniques such as circuit switching, message switching and packet switching.

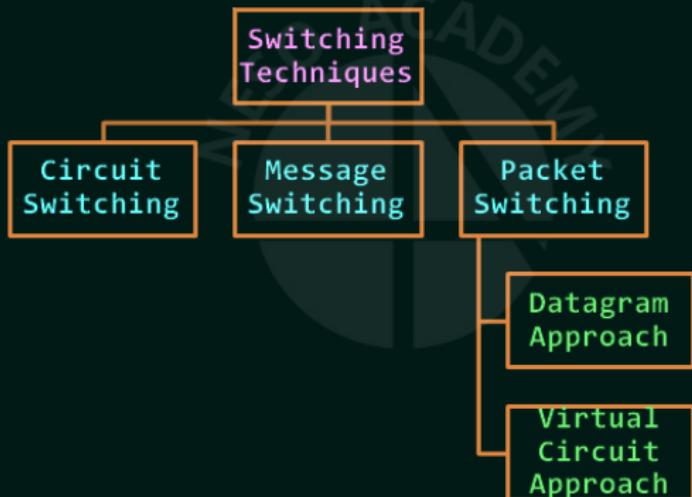
Outcomes ★★

## SWITCHING

- ★ Switching in computer network helps in deciding the best route for data transmission if there are multiple paths in a larger network.
- ★ One-to-One connection.

Switching★★

## SWITCHING TECHNIQUES



Switching techniques

## CIRCUIT SWITCHING

- ★ A dedicated path is established between the sender and receiver.
- ★ Before data transfer, connection will be established first.
- ★ **Example:** Telephone network.

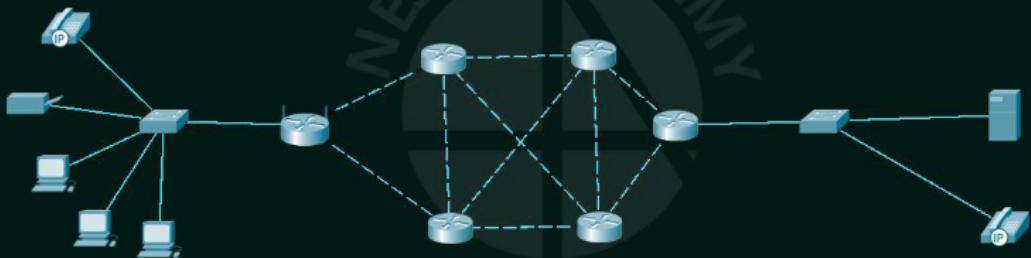
### 3 phases in circuit switching:

1. Connection establishment.
2. Data transfer
3. Connection Disconnection.

Circuit switching★★★

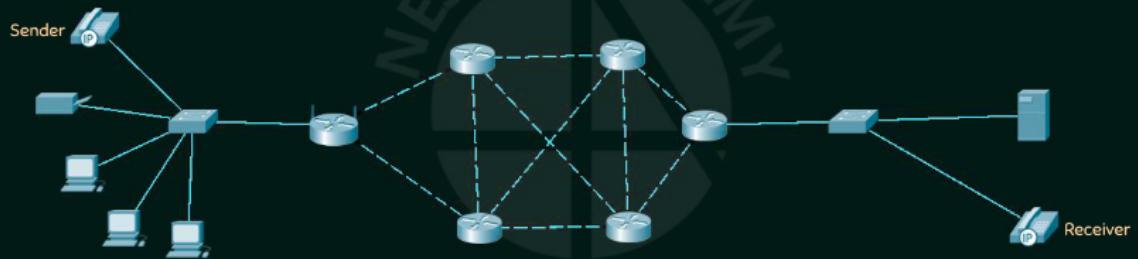
## EXAMPLE FOR CIRCUIT SWITCHING

Phase 1: Connection establishment



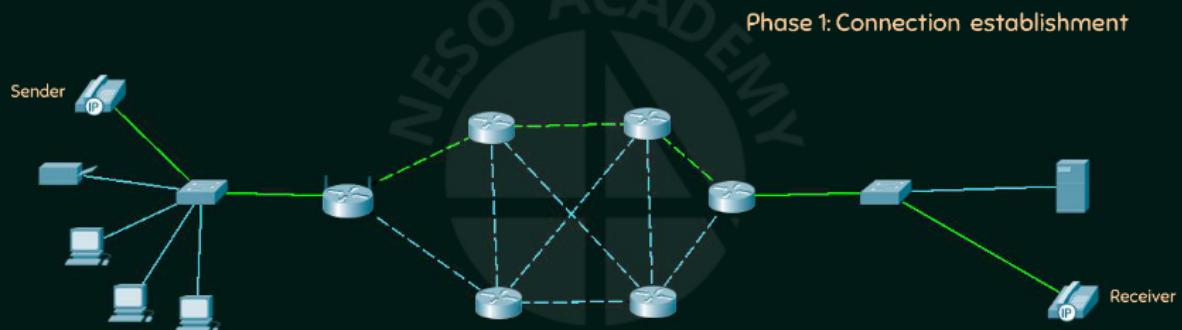
Example for circuit switching

## EXAMPLE FOR CIRCUIT SWITCHING



Example for circuit switching

## EXAMPLE FOR CIRCUIT SWITCHING



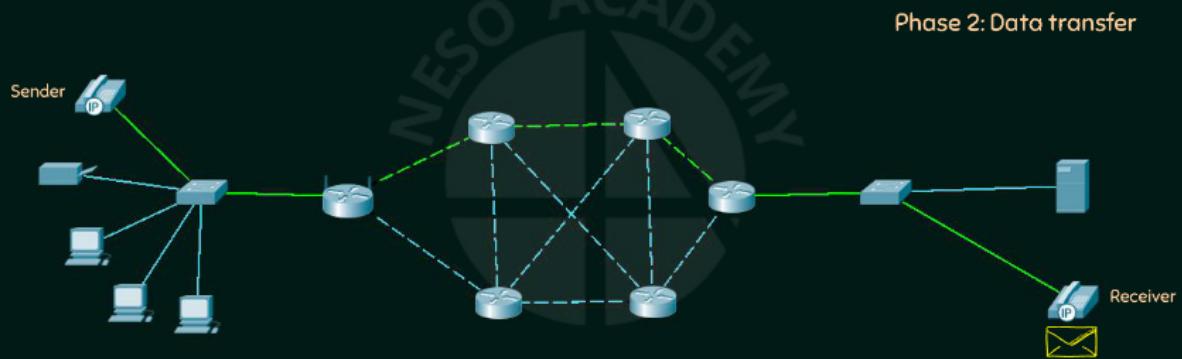
Example for circuit switching

## EXAMPLE FOR CIRCUIT SWITCHING



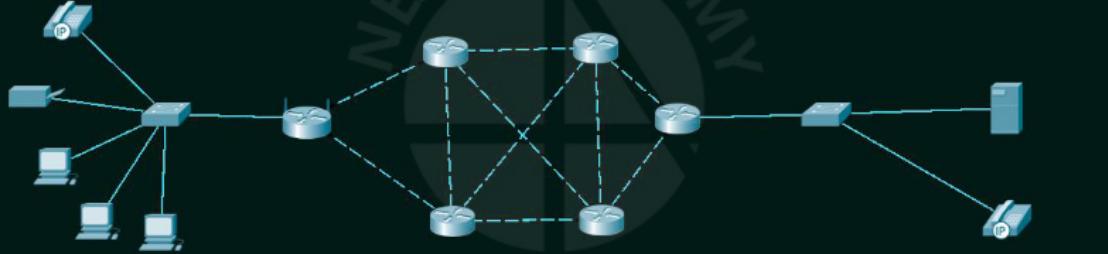
Example for circuit switching

## EXAMPLE FOR CIRCUIT SWITCHING



Example for circuit switching

## EXAMPLE FOR CIRCUIT SWITCHING



Example for circuit switching

## MESSAGE SWITCHING

- ★ Store and forward mechanism.
- ★ Message is transferred as a complete unit and forwarded using store and forward mechanism at the intermediary node.
- ★ Not suited for streaming media and real-time applications.

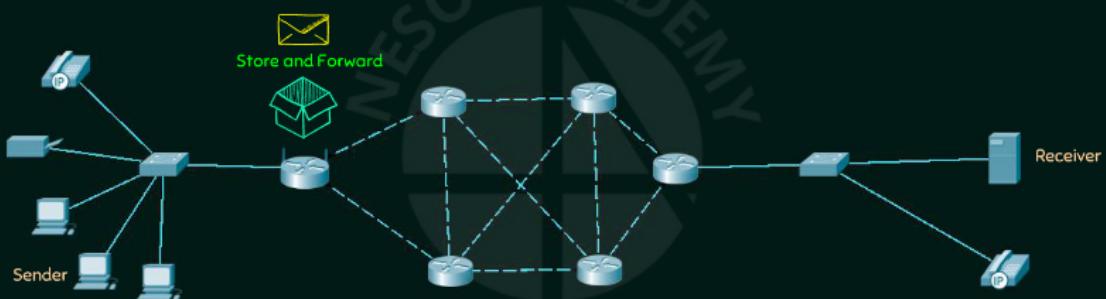
Message switching★★★

### EXAMPLE FOR MESSAGE SWITCHING



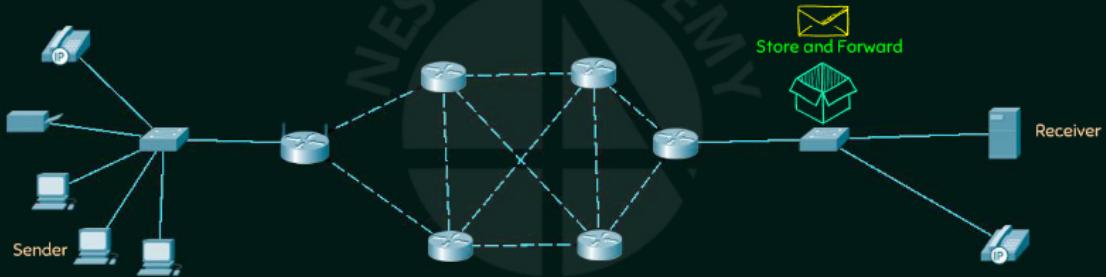
Example for message switching

## EXAMPLE FOR PACKET SWITCHING



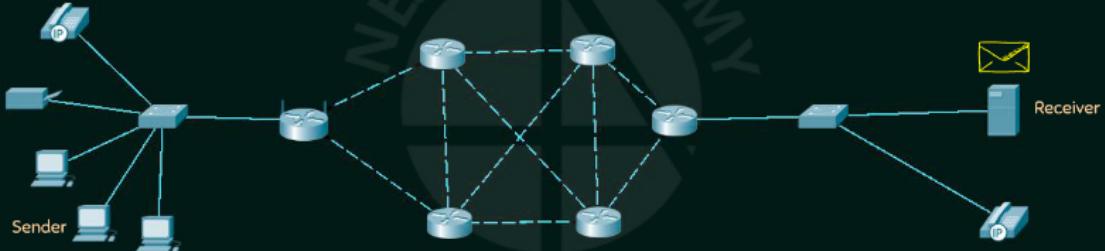
Example for packet switching

## EXAMPLE FOR MESSAGE SWITCHING



Example for message switching

## EXAMPLE FOR MESSAGE SWITCHING



Example for message switching

## PACKET SWITCHING

- ★ The internet is a packet switched network.
- ★ Message is broken into individual chunks called as **packets**.
- ★ Each packet is sent individually.
- ★ Each packet will have **source and destination IP address** with sequence number.
- ★ Sequence numbers will help the receiver to
  - Reorder the packets.
  - Detect missing packets and
  - Send acknowledgments.

Packet switching ★★★★★○○○

## TWO APPROACHES TO PACKET SWITCHING

1. Datagram Approach.
2. Virtual Circuit Approach.

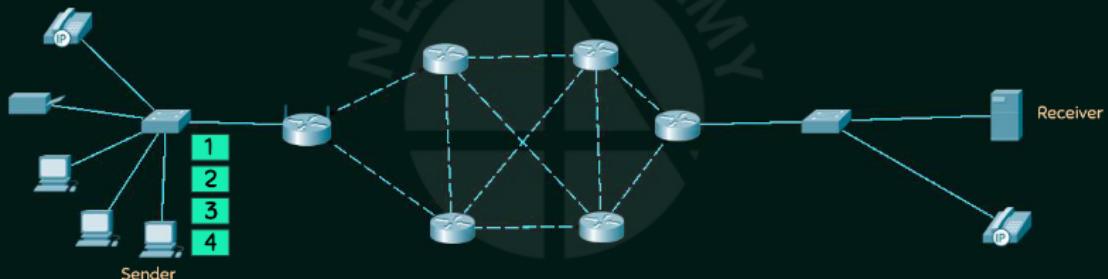
Two approaches to packet switching

### PACKET SWITCHING – DATAGRAM APPROACH

- ★ Datagram Packet Switching is also known as **connectionless switching**.
- ★ Each independent entity is called as datagram.
- ★ Datagrams contain destination information and the intermediary devices uses this information to forward datagrams to right destination.
- ★ In Datagram Packet Switching approach, the path is not fixed.
- ★ Intermediate nodes take the routing decisions to forward the packets.

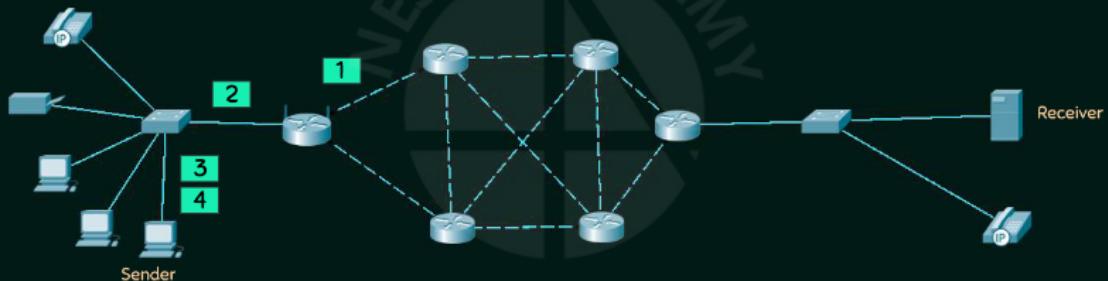
Packet switching -Datagram approach★★★★★

## EXAMPLE FOR PACKET SWITCHING – DATAGRAM



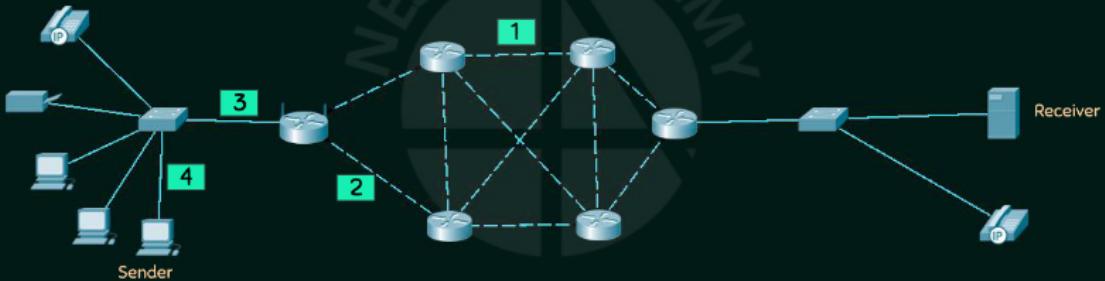
Example for packet switching -datagram

## EXAMPLE FOR PACKET SWITCHING – DATAGRAM



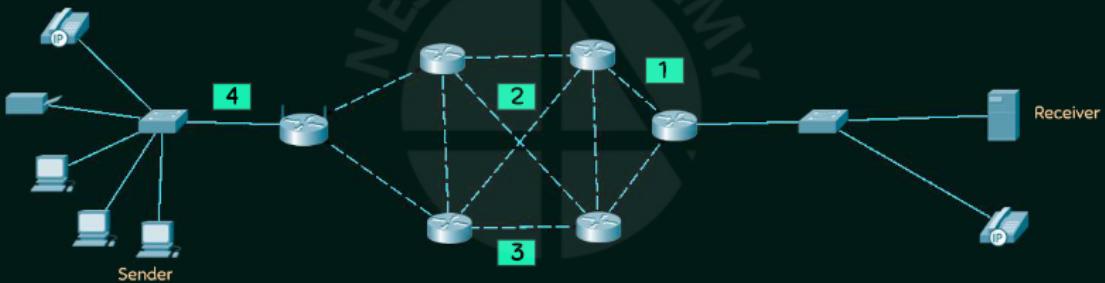
Example for packet switching -datagram

## EXAMPLE FOR PACKET SWITCHING – DATAGRAM



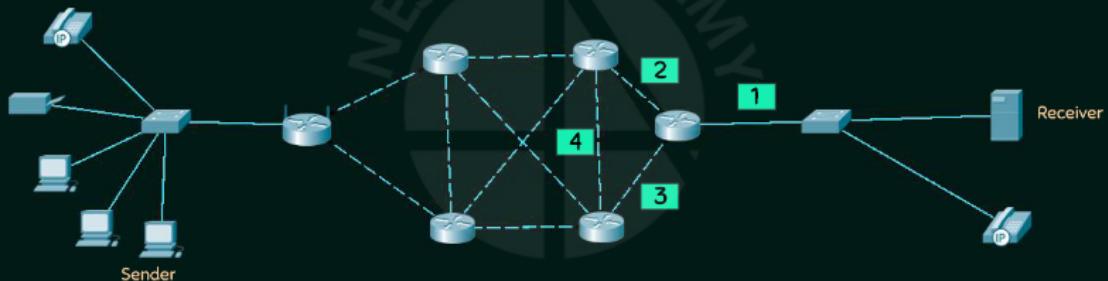
Example for packet switching -datagram

## EXAMPLE FOR PACKET SWITCHING – DATAGRAM



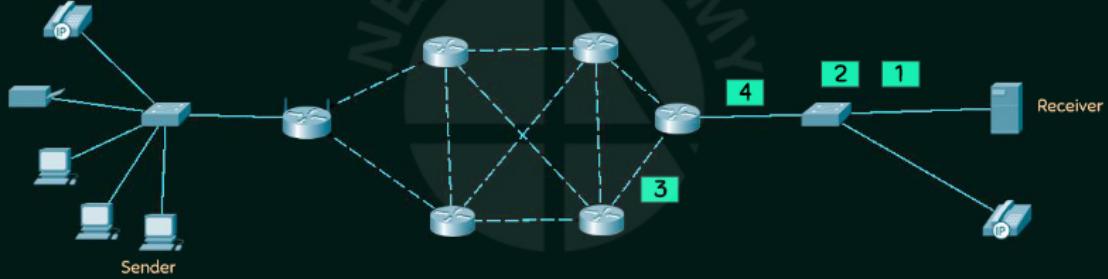
Example for packet switching -datagram

## EXAMPLE FOR PACKET SWITCHING – DATAGRAM



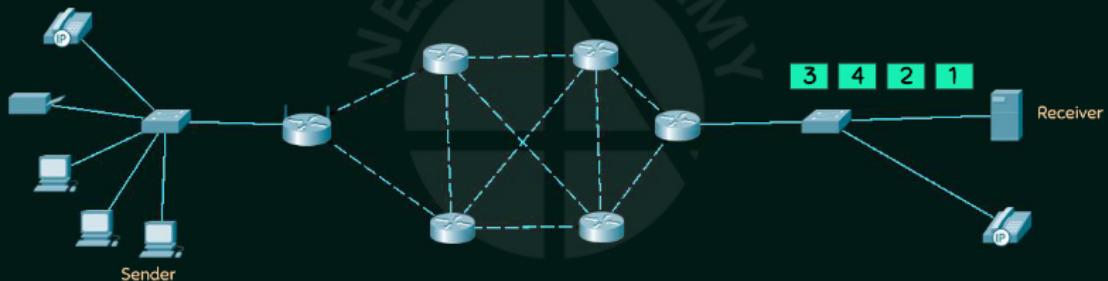
Example for packet switching -datagram

## EXAMPLE FOR PACKET SWITCHING – DATAGRAM



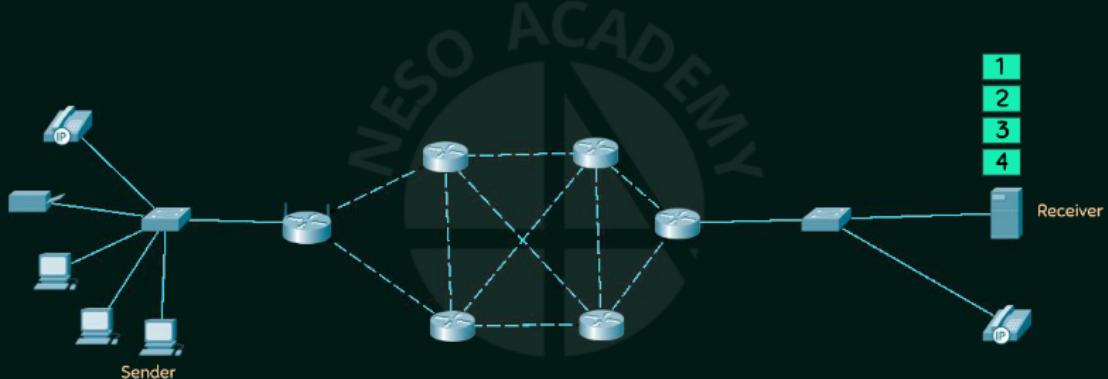
Example for packet switching -datagram

## EXAMPLE FOR PACKET SWITCHING – DATAGRAM



Example for packet switching -datagram

## EXAMPLE FOR PACKET SWITCHING – DATAGRAM



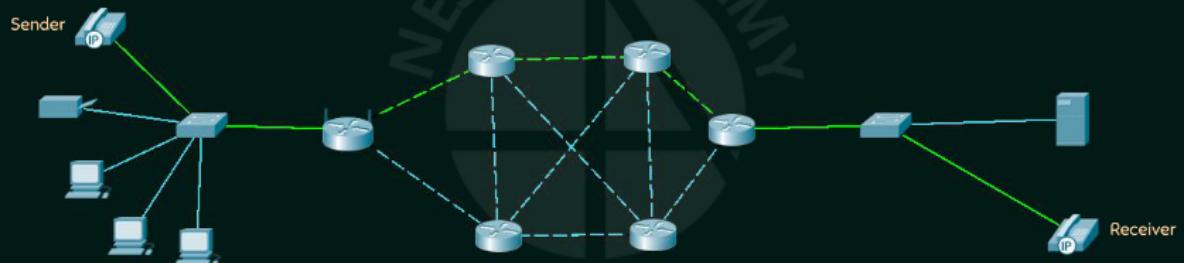
Example for packet switching -datagram

## PACKET SWITCHING – VIRTUAL CIRCUIT APPROACH

- ★ Virtual Circuit Switching is also known as **connection-oriented switching**.
- ★ In the case of Virtual circuit switching, a preplanned route is established before the messages are sent.
- ★ Call request and call accept packets are used to establish the connection between sender and receiver.
- ★ In this approach, the path is fixed for the duration of a logical connection.

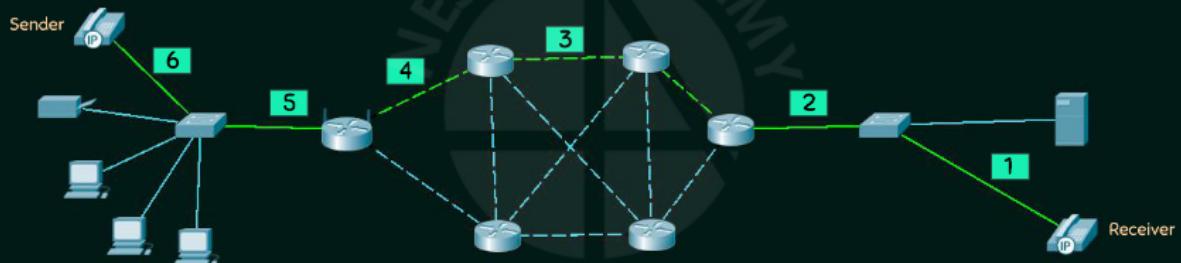
Packet switching -Virtual Circuit approach★★★★

### EXAMPLE FOR PACKET SWITCHING – VIRTUAL CIRCUIT



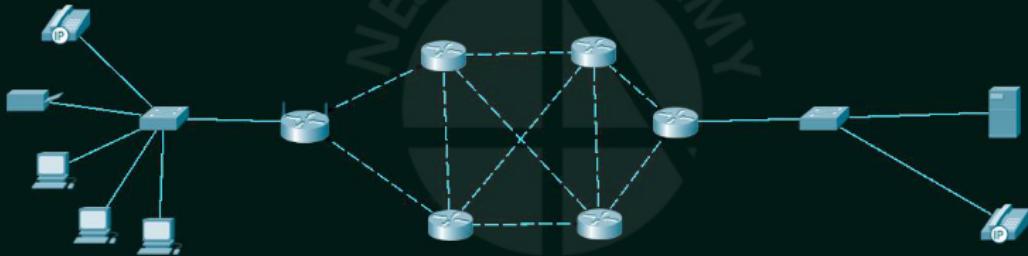
Example for packet switching -virtual circuit

## EXAMPLE FOR PACKET SWITCHING – VIRTUAL CIRCUIT



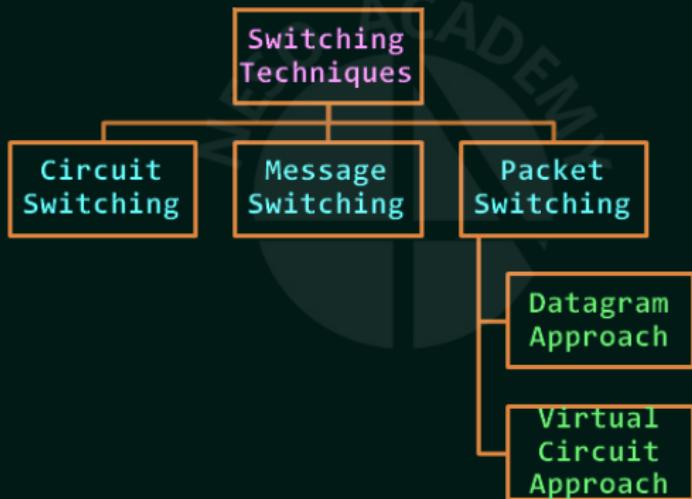
Example for packet switching -virtual circuit

## EXAMPLE FOR PACKET SWITCHING – VIRTUAL CIRCUIT



Example for packet switching -virtual circuit

## SWITCHING TECHNIQUES



Switching techniques

## OUTCOMES

Upon the completion of this session, the learner will be able to

- ★ Understand layering in computer network.
- ★ Understand the benefits of layering.
- ★ Know the introduction of OSI reference model and TCP/IP model.

Outcomes ★★★

## LAYERING

Layering means decomposing the problem into more manageable components (Layers).

**Advantages:**

- ★ It provides more modular design.
- ★ Easy to troubleshoot.

Layering★★

## PROTOCOLS

- ★ It is a set of rules that governs data communication.
- ★ The protocols in each layer governs the activities of the data communication.

Protocols★★

## LAYERED ARCHITECTURES

- ★ The OSI Reference Model.
- ★ The TCP/IP Model.

Layered Architectures★★

## THE OSI MODEL

- ★ OSI stands for Open System Interconnection.
- ★ It is a model for understanding and designing a network architecture that is flexible, robust, and interoperable.
- ★ Developed by the International Standards for Organizations (ISO).
- ★ **The OSI model is not a protocol.**
- ★ It is only a guideline and hence it is referred as OSI reference model.

The OSI Model★★★★★

## THE OSI MODEL

- ★ The purpose of the OSI model is to show how to facilitate communication between different systems without requiring changes to the logic of the underlying hardware and software.
- ★ The OSI model was never fully implemented.

The OSI Model★★

## THE TCP/IP MODEL

- ★ TCP/IP = Transmission Control Protocol/Internet Protocol.
- ★ The TCP/IP protocol suite was developed prior to the OSI model.
- ★ Therefore, the layers in the TCP/IP protocol suite do not exactly match those in the OSI model.
- ★ **TCP/IP is a hierarchical protocol** made up of interactive modules, each of which provides a specific functionality.

The TCP/IP Model★★★★

## OUTCOMES

Upon the completion of this session, the learner will be able to

- ★ Understand the OSI reference model.
- ★ List various layers in the OSI reference model.
- ★ Understand how each layers interact with other layers.

Outcomes ★★★

## LAYERING – A RECAP

- ★ Layering means **decomposing** the problem of building a network into more manageable components (Layers).
- ★ More modular design and easy to troubleshoot.

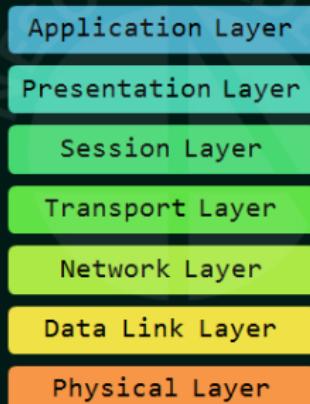
Layering -A recap★★

## THE OSI MODEL

- ★ The purpose of the OSI model is to facilitate communication between different systems without requiring changes to the logic of the underlying hardware and software.

The OSI Model★

## LAYERS IN THE OSI REFERENCE MODEL



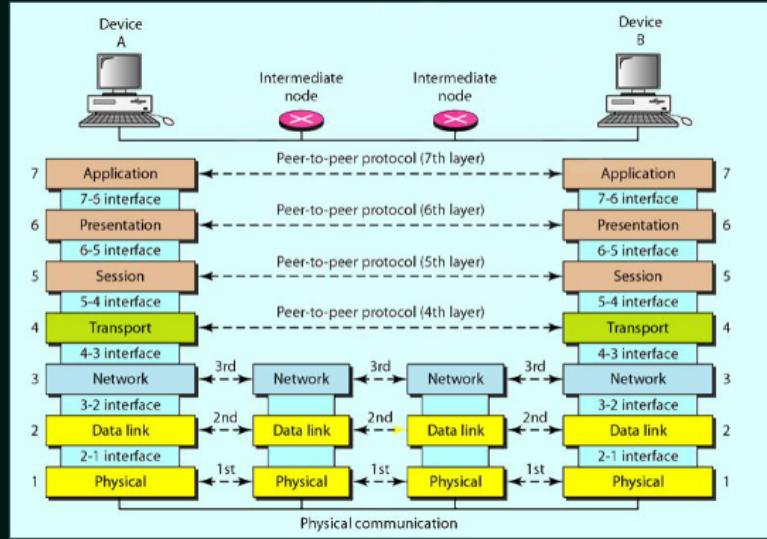
Layers in the OSI reference model

## HOW TO REMEMBER THE LAYERS?

Away	Application Layer
Pizza	Presentation Layer
Sausage	Session Layer
Throw	Transport Layer
Not	Network Layer
Do	Data Link Layer
Please	Physical Layer

How to remember the layers?

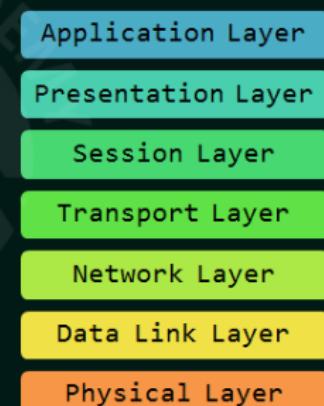
## LAYERS IN THE OSI REFERENCE MODEL



Layers in the OSI reference model

## REVISITING THE SYLLABUS (BOTTOM UP APPROACH)

- ★ Chapter 1: Fundamentals
- ★ Chapter 2: Data Link Layer
- ★ Chapter 3: Network Layer
- ★ Chapter 4: Transport Layer
- ★ Chapter 5: Application Layer
- ★ Chapter 6: Network Security



★★★★★ Revisiting the syllabus (Bottom up approach)

## ACTIVITY TIME

Identify the correct order of OSI layering in the following?

Application Layer

Session Layer

Presentation Layer

Transport Layer

Network Layer

Data Link Layer

Physical Layer

Application Layer

Presentation Layer

Session Layer

Network Layer

Transport Layer

Data Link Layer

Physical Layer

Application Layer

Presentation Layer

Session Layer

Transport Layer

Network Layer

Data Link Layer

Physical Layer

Application Layer

Presentation Layer

Transport Layer

Session Layer

Network Layer

Data Link Layer

Physical Layer

A

B

C

D

Activity Time

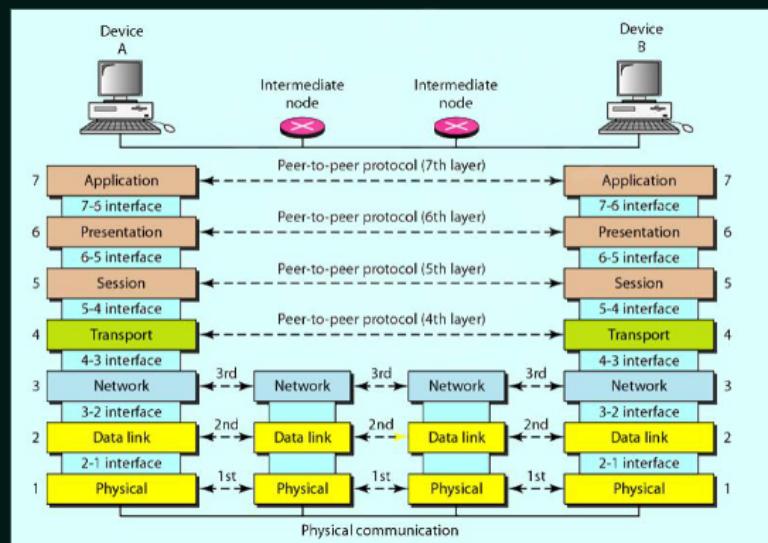
## OUTCOMES

Upon the completion of this session, the learner will be able to

- ★ Understand the services offered by Application Layer.
  - ★ Understand the services offered by Presentation Layer.
  - ★ Understand the services offered by Session Layer.

## Outcomes ★★★

## LAYERS IN THE OSI REFERENCE MODEL – A RECAP



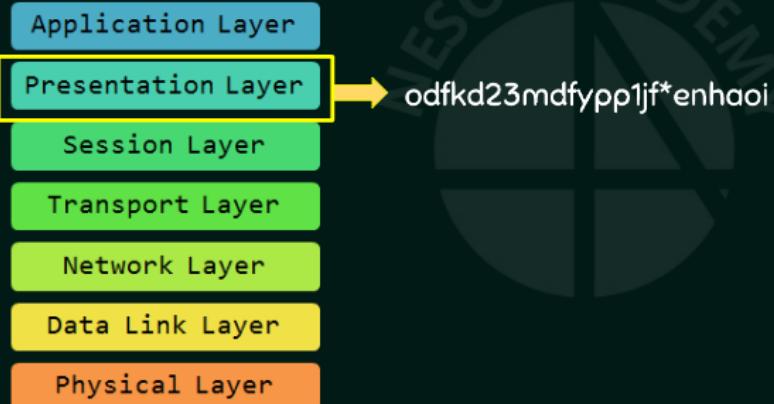
## Layers in the OSI reference model -A Recap

## LAYERS IN THE OSI REFERENCE MODEL



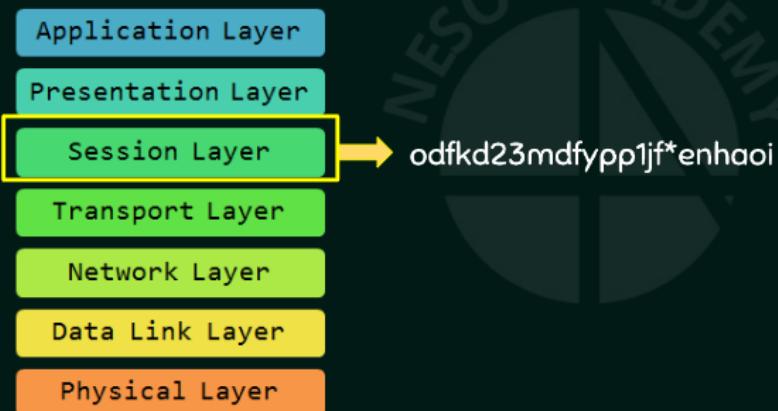
Layers in the OSI reference model

## LAYERS IN THE OSI REFERENCE MODEL



Layers in the OSI reference model

## LAYERS IN THE OSI REFERENCE MODEL



Layers in the OSI reference model

## LAYERS IN THE OSI REFERENCE MODEL



Layers in the OSI reference model

## LAYERS IN THE OSI REFERENCE MODEL



Layers in the OSI reference model

## LAYERS IN THE OSI REFERENCE MODEL



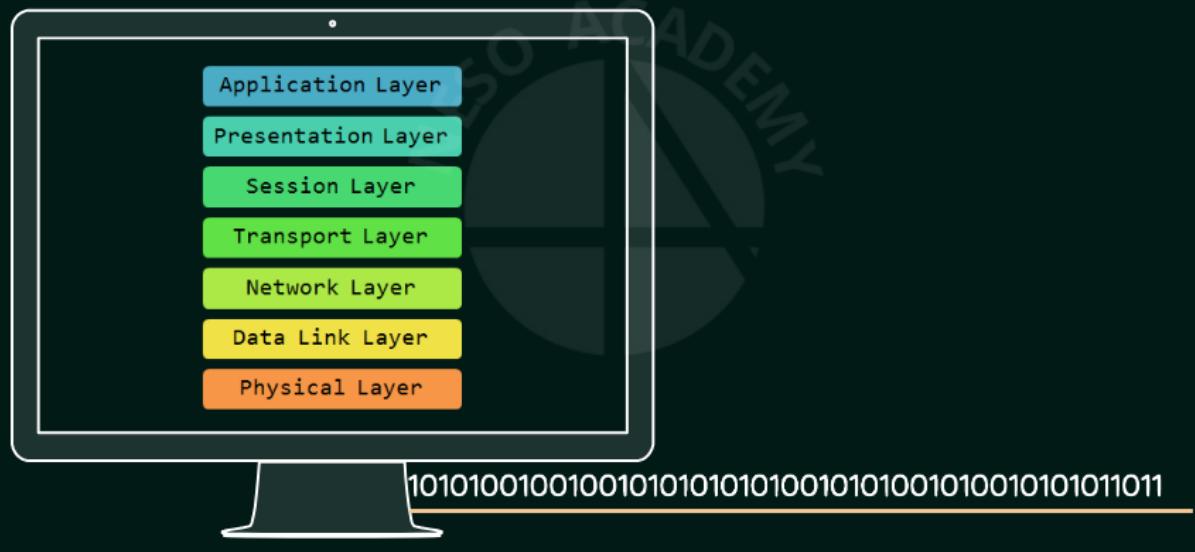
Layers in the OSI reference model

## LAYERS IN THE OSI REFERENCE MODEL



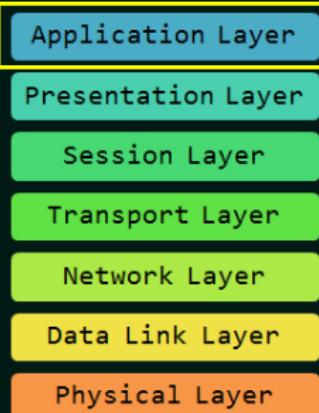
Layers in the OSI reference model

## LAYERS IN THE OSI REFERENCE MODEL



Layers in the OSI reference model

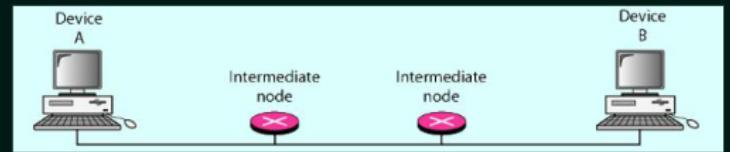
## LAYERS IN THE OSI REFERENCE MODEL



It enables the user to access the network resources.

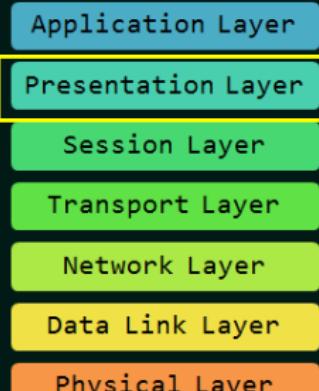
### SERVICES PROVIDED BY APPLICATION LAYER

- ★ File Transfer and Access Management (FTAM).
- ★ Mail Services.
- ★ Directory services.

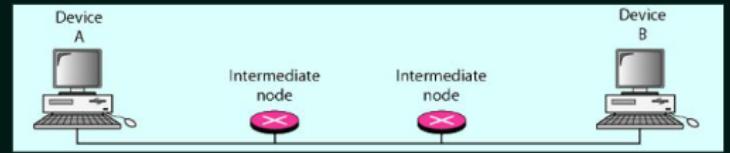


Layers in the OSI reference model★★★

## LAYERS IN THE OSI REFERENCE MODEL

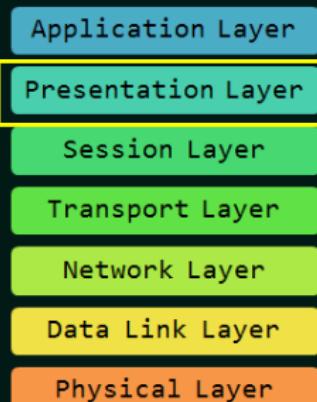


It is concerned with the syntax and semantics of the information exchanged between two systems.



Layers in the OSI reference model

## LAYERS IN THE OSI REFERENCE MODEL



It is concerned with the syntax and semantics of the information exchanged between two systems.

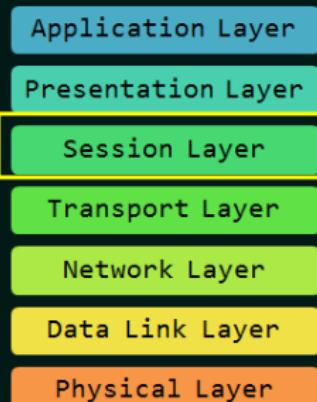
### SERVICES PROVIDED BY PRESENTATION LAYER

- ★ Translation.
- ★ Encryption.
- ★ Compression



Layers in the OSI reference model★★★

## LAYERS IN THE OSI REFERENCE MODEL



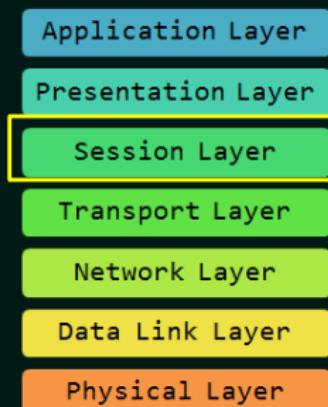
It establishes, maintains, and synchronizes the interaction among communicating devices

### SERVICES PROVIDED BY SESSION LAYER

- ★ Dialog control.
- ★ Synchronization.

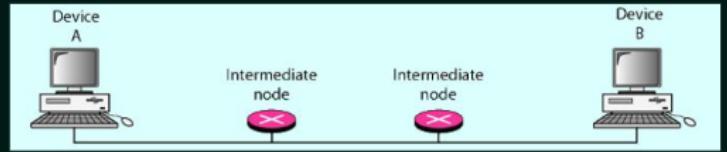
Layers in the OSI reference model★★

## LAYERS IN THE OSI REFERENCE MODEL



It establishes, maintains, and synchronizes the interaction among communicating devices  
**SERVICES PROVIDED BY SESSION LAYER**

- ★ Dialog control.
- ★ Synchronization.



Layers in the OSI reference model ★★

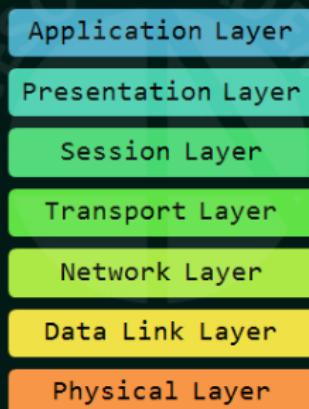
## OUTCOMES

Upon the completion of this session, the learner will be able to

- ★ Understand the services offered by Transport Layer.
- ★ Understand the services offered by Network Layer.
- ★ Understand the services offered by Data Link Layer.
- ★ Understand the services offered by Physical Layer.

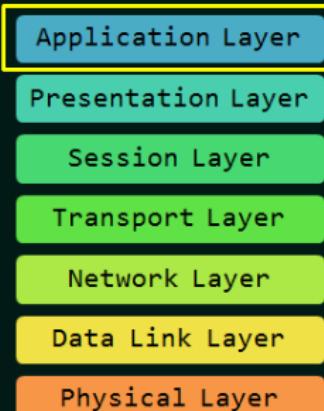
Outcomes ★★★★

## LAYERS IN THE OSI REFERENCE MODEL – A RECAP



Layers in the OSI reference model -A recap

## APPLICATION LAYER – A RECAP



It enables the user to access the network resources.

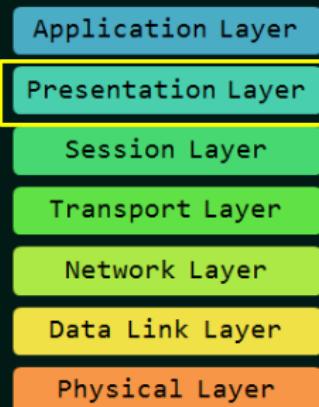
### SERVICES PROVIDED BY APPLICATION LAYER

- ★ File Transfer and Access Management (FTAM).
- ★ Mail Services.
- ★ Directory services.



Application Layer -A Recap★★★

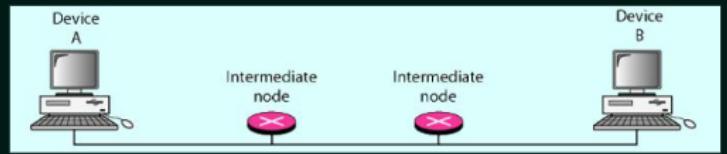
## PRESENTATION LAYER – A RECAP



It is concerned with the syntax and semantics of the information exchanged between two systems.

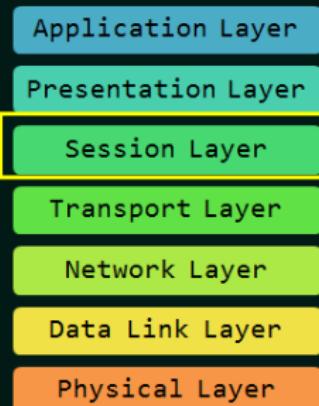
### SERVICES PROVIDED BY PRESENTATION LAYER

- ★ Translation.
- ★ Encryption.
- ★ Compression



Presentation Layer -A recap★★★

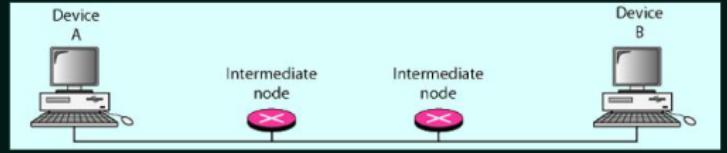
## SESSION LAYER – A RECAP



It establishes, maintains, and synchronizes the interaction among communicating devices.

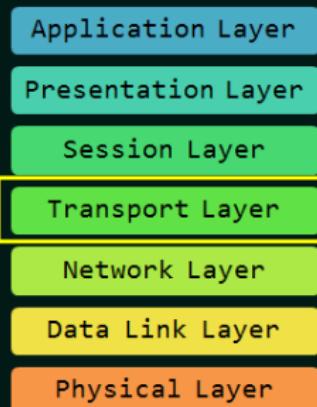
### SERVICES PROVIDED BY SESSION LAYER

- ★ Dialog control.
- ★ Synchronization.



Session layer -A recap★★

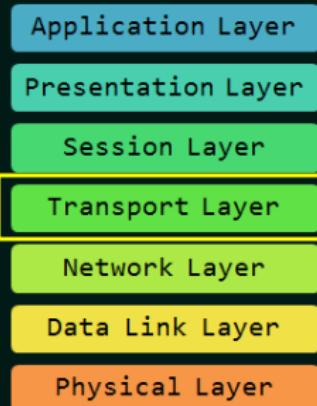
## LAYERS IN THE OSI REFERENCE MODEL



It is responsible for process to process delivery of the entire message.

Layers in the OSI reference model

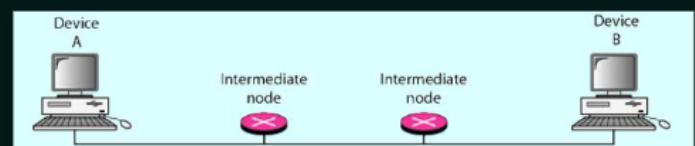
## LAYERS IN THE OSI REFERENCE MODEL



It is responsible for process to process delivery of the entire message.

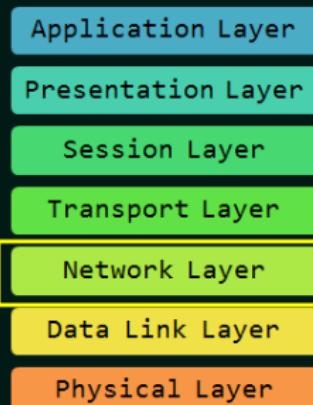
### SERVICES PROVIDED BY TRANSPORT LAYER

- ★ Port addressing.
- ★ Segmentation and Reassembly.
- ★ Connection control.
- ★ End-to-End Flow Control.
- ★ Error Control



Layers in the OSI reference model★★★★★

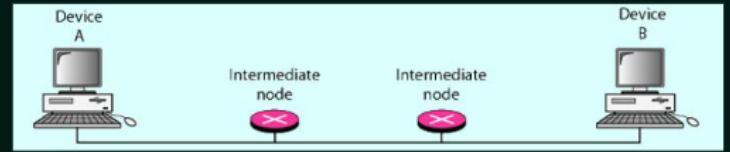
## LAYERS IN THE OSI REFERENCE MODEL



It is responsible for delivery of data from the original source to the destination network.

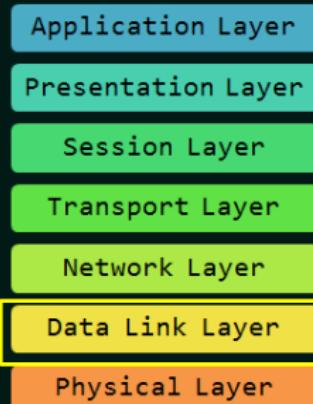
### SERVICES PROVIDED BY NETWORK LAYER

- ★ Logical addressing.
- ★ Routing.



Layers in the OSI reference model★★

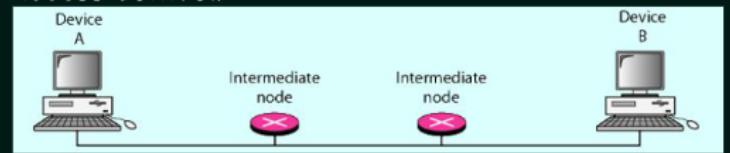
## LAYERS IN THE OSI REFERENCE MODEL



It is responsible for moving data(frames) from one node to another node.

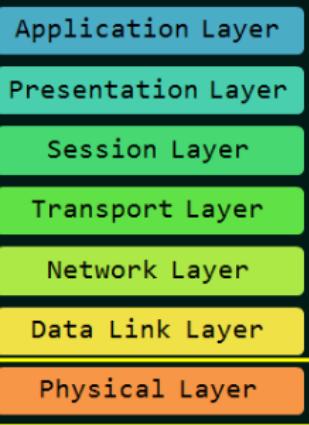
### SERVICES PROVIDED BY DATA LINK LAYER

- ★ Framing.
- ★ Physical Addressing.
- ★ Flow Control.
- ★ Error Control.
- ★ Access Control.



Layers in the OSI reference model★★★★★

## LAYERS IN THE OSI REFERENCE MODEL



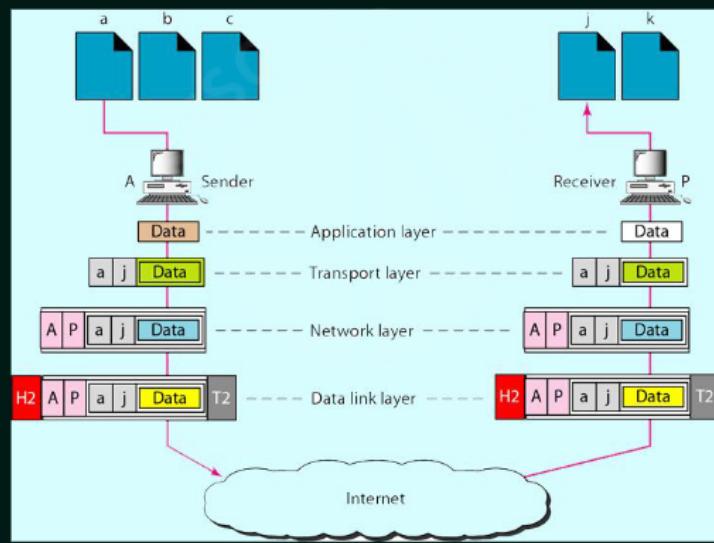
It is responsible for transmitting bits over a medium. It also provides electrical and mechanical specifications.

### SERVICES PROVIDED BY PHYSICAL LAYER

- ★ Physical characteristics of the media.
- ★ Representation of bits.
- ★ Data rate.
- ★ Synchronization of bits.
- ★ Line configuration.
- ★ Physical topology.

Layers in the OSI reference model ★★★★★★

## LAYERS IN THE OSI REFERENCE MODEL



Layers in the OSI reference model

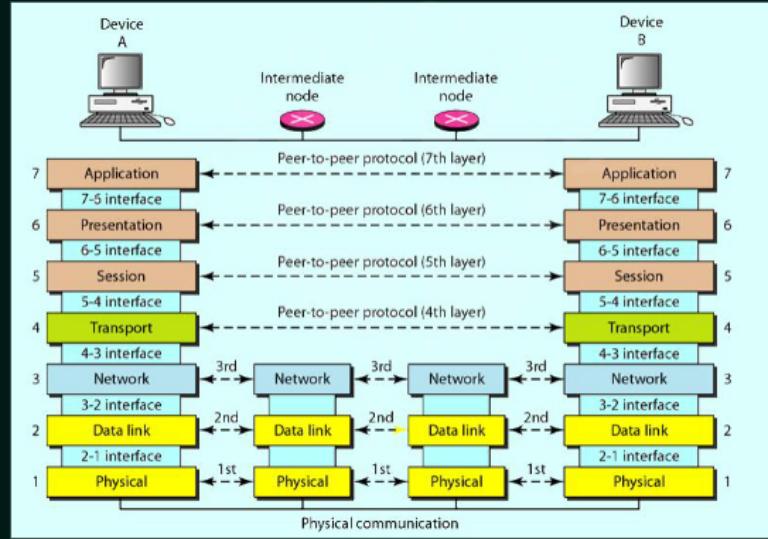
## OUTCOMES

Upon the completion of this session, the learner will be able to

- ★ Recall the services offered by each layer of the OSI model.
- ★ Understand the working of OSI reference model with an example.

Outcomes ★★

## LAYERS IN THE OSI REFERENCE MODEL – A RECAP



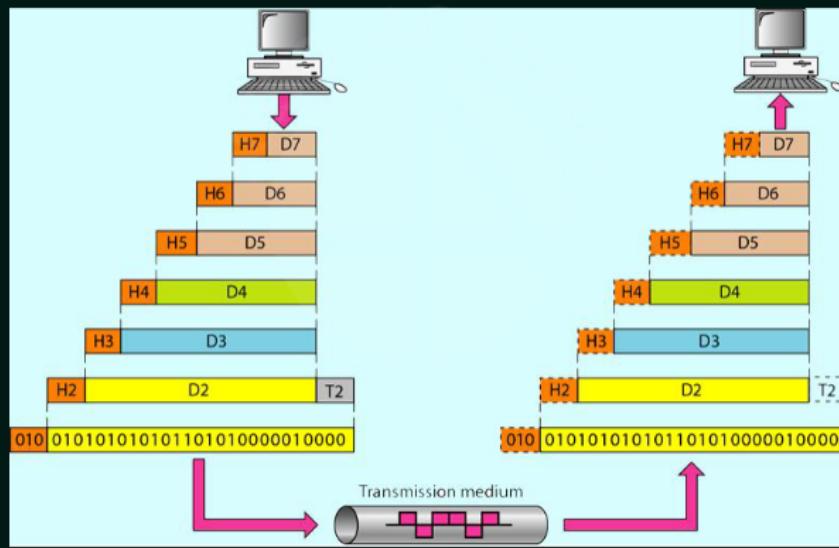
Layers in the OSI reference model -A Recap

## SERVICES OFFERED BY EACH LAYER

Application Layer	FTAM, Mail Services and Directory Services.
Presentation Layer	Translation, Encryption and Compression.
Session Layer	Dialog control and Synchronization.
Transport Layer	Port Addressing, Segmentation and Reassembly, Connection Control, Flow control and Error Control
Network Layer	Logical Addressing and Routing.
Data Link Layer	Framing, Physical Addressing, Flow Control, Error Control, and Access Control.
Physical Layer	Physical characteristics of the media, Representation of bits, Data rate, Synchronization of bits, Line configuration, Physical topology and Transmission mode.

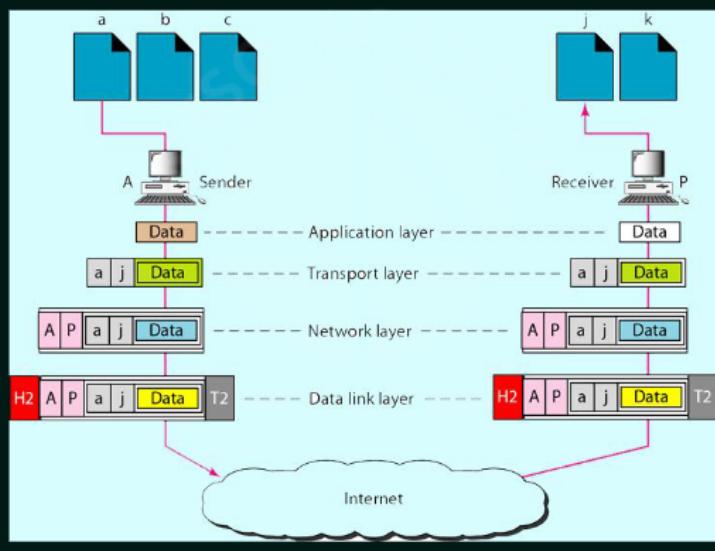
Services offered by each layer

## WORKING OF THE OSI REFERENCE MODEL



Working of the OSI reference model

## WORKING OF THE OSI REFERENCE MODEL



Working of the OSI reference model

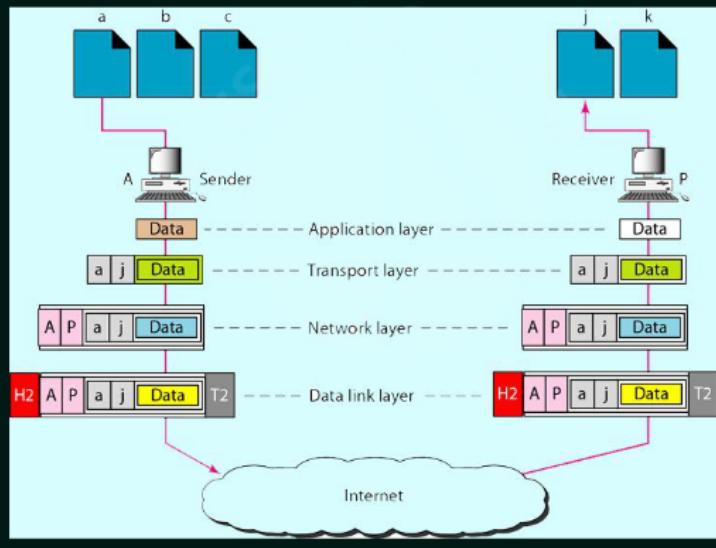
## OUTCOMES

Upon the completion of this session, the learner will be able to

- ★ Understand the role of Port Addressing, IP Addressing and MAC Addressing in Computer Network with examples.

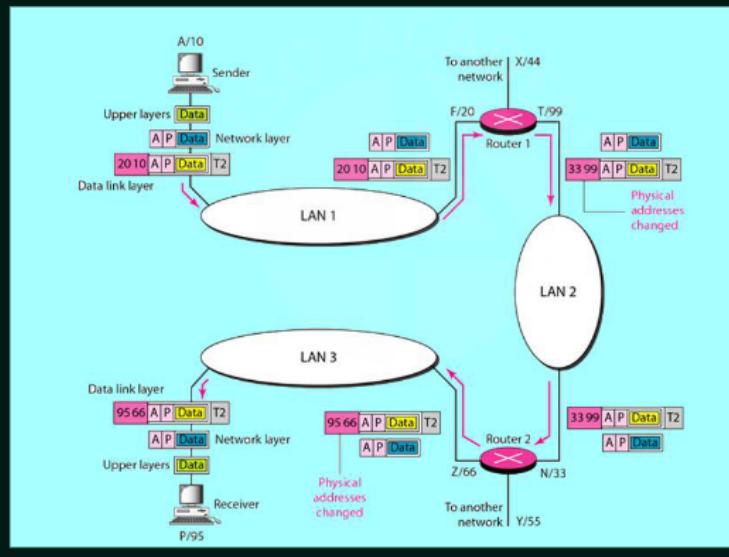
Outcomes ★

## PORT ADDRESSING AND IP ADDRESSING



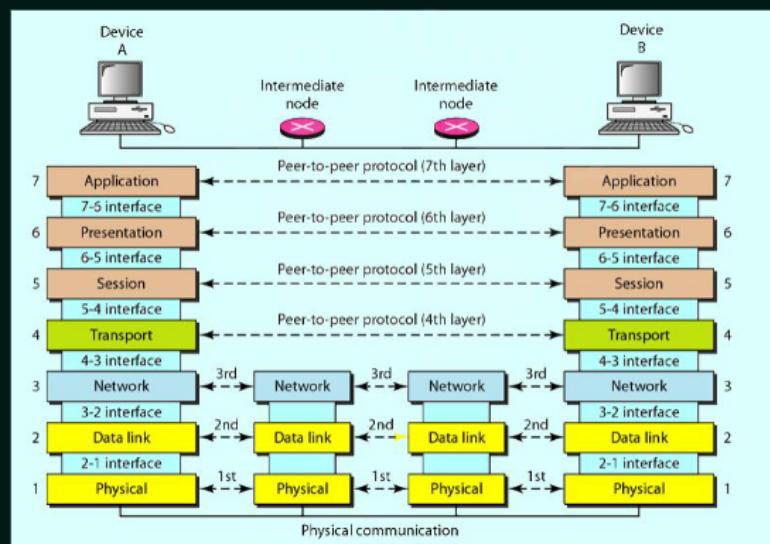
Port Addressing and IP Addressing

## IP ADDRESSING AND MAC ADDRESSING



IP Addressing and MAC Addressing

# IP ADDRESSING AND MAC ADDRESSING



## IP Addressing and MAC Addressing

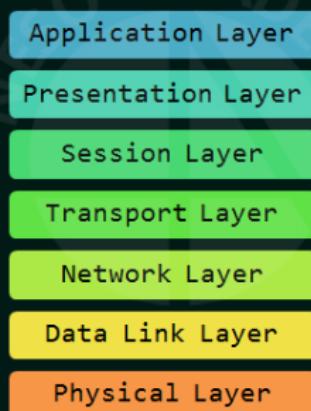
## OUTCOMES

Upon the completion of this session, the learner will be able to

- ★ Understand the TCP/IP Protocol suite.
- ★ Compare OSI and TCP/IP models.
- ★ Understand the list of protocols in the TCP/IP Protocol suite.
- ★ Know about Protocol Data Unit (PDU).

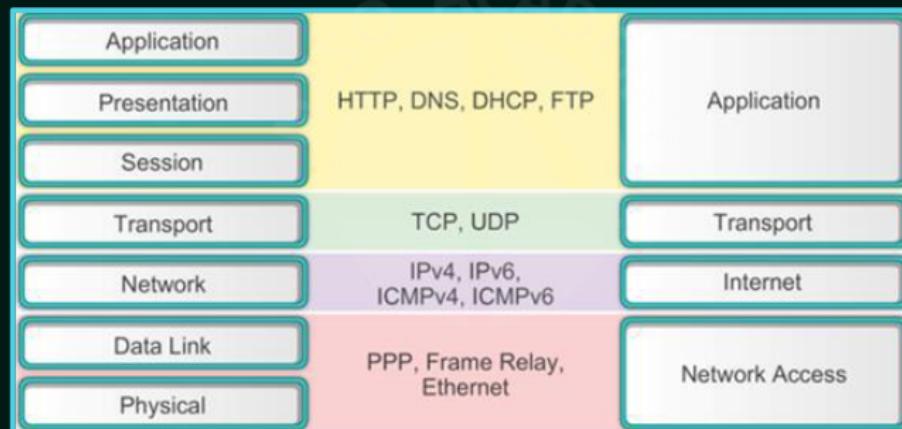
Outcomes ★★★★

## THE OSI REFERENCE MODEL



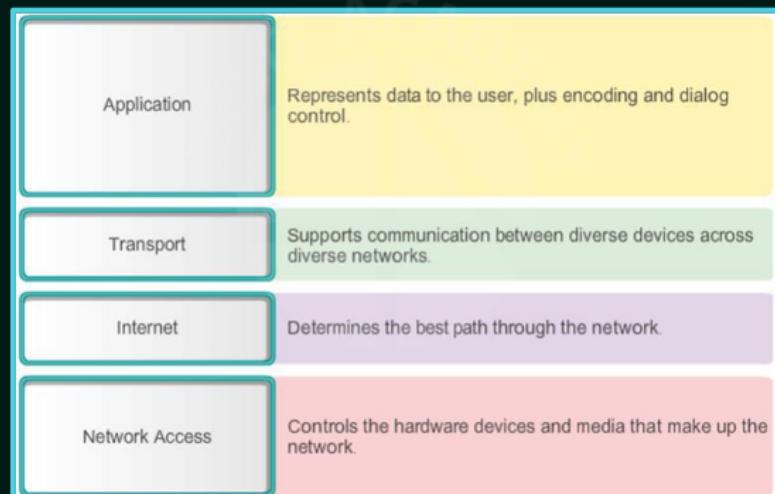
The OSI reference model

## OSI REFERENCE MODEL Vs TCP/IP MODEL



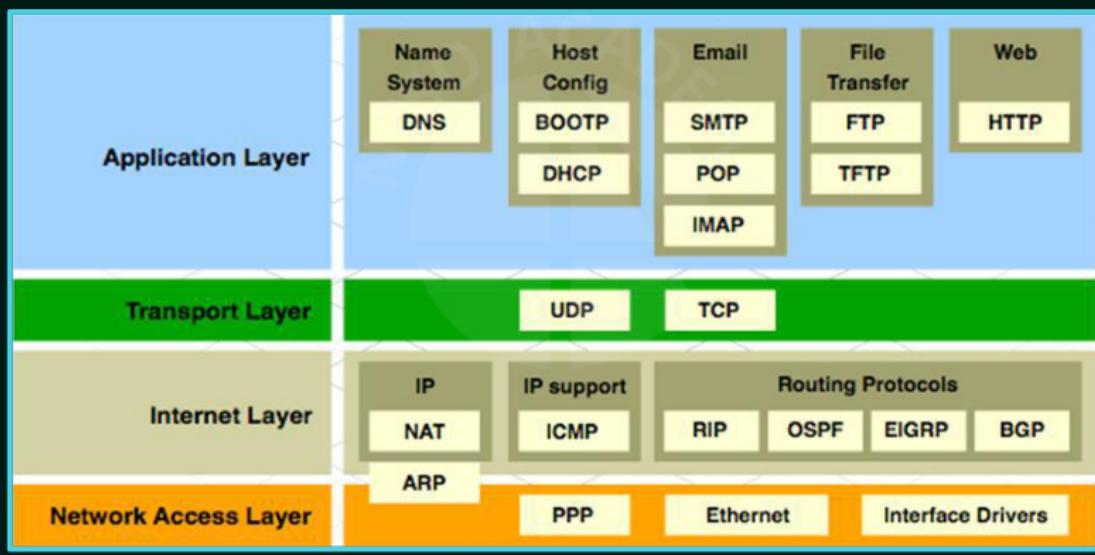
OSI Reference model Vs TCP/IP model

## THE TCP/IP MODEL



The TCP/IP model

## THE TCP/IP PROTOCOL SUITE



The TCP/IP protocol suite

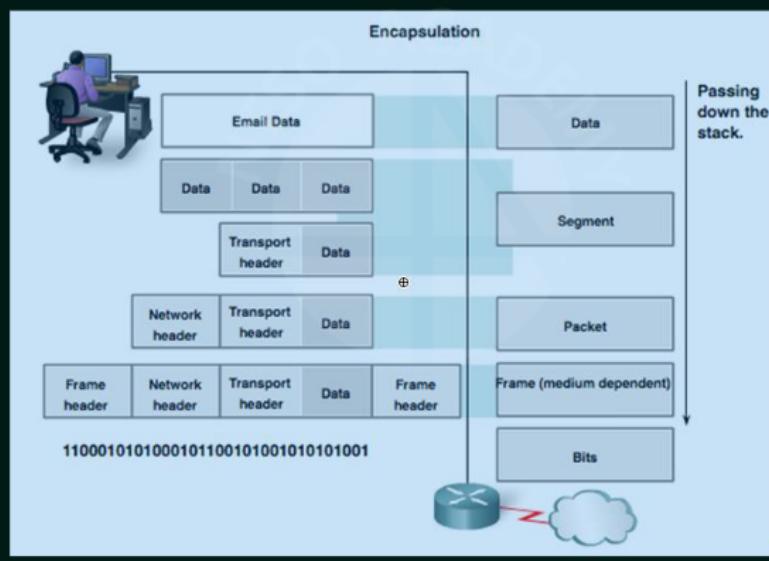
## PROTOCOL DATA UNIT (PDU)

Protocol Data Units (PDUs) are named according to the protocols of the TCP/IP suite: data, segment, packet, frame, and bits.

Application Layer - Data
Transport Layer - Segment
Network Layer - Packet
Data Link Layer - Frame
Physical Layer- Bits

## Protocol Data Unit (PDU)

## PROTOCOL DATA UNIT (PDU)



## Protocol Data Unit (PDU)

## ACTIVITY TIME

Identify the correct LAYER-PDU pair in the following.

Application – Data	Application – Data	Application – Data	Application – Data
Transport – Segment	Transport – Frame	Transport – Segment	Transport – Segment
Network – Frame	Network – Packet	Network – Frame	Network – Packet
Data Link – Packet	Data Link – Segment	Data Link – Packet	Data Link – Frame
Physical – Bit	Physical – Bit	Physical – Bit	Physical – Bit
A	B	C	D

Activity Time

## OUTCOMES

Upon the completion of this session, the learner will be able to

- ★ Know the basic networking commands such as
  - IPCONFIG
  - IPCONFIG/ALL
  - NSLOOKUP
  - PING
  - TRACERT

Outcomes ★★★★★

## OUTCOMES

Upon the completion of this session, the learner will be able to

- ★ Download and work with Cisco Packet Tracer (CPT).
- ★ Know the basics of Cisco Packet Tracer.
- ★ Establish an example peer-to-peer network using CPT.

Outcomes ★★★

## CISCO PACKET TRACER

- ★ Cisco – The leaders in networking.
- ★ An innovative and powerful networking simulation tool used for practice, discovery and troubleshooting.
- ★ Helps to understand networks practically.

Cisco packet tracer★★★

## OUTCOMES

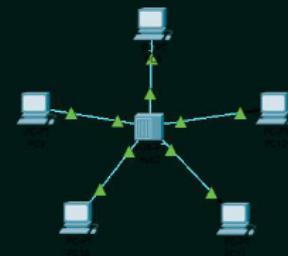
Upon the completion of this session, the learner will be able to

- ★ Know the basics of Cisco Packet Tracer.
- ★ Know about hub.
- ★ Simulate LAN using hub.
- ★ Understand the pros and cons of hub.

Outcomes ★★★★

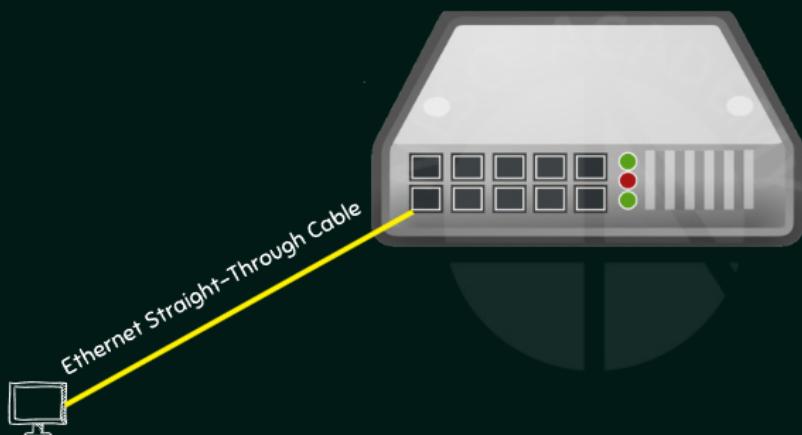
## Hub

- ★ a.k.a Network Hub.
- ★ Hub works at the physical layer of the OSI model.
- ★ Used to set up LAN.
- ★ Has multiple ports.
- ★ Star topology.
- ★ When a packet arrives at one port, it is copied to the other ports so that all segments of the LAN can see all packets.



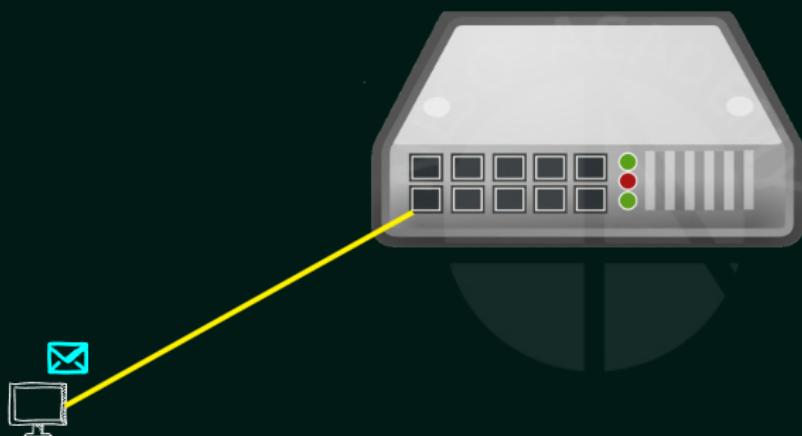
Hub★★★★★

## WORKING OF HUB



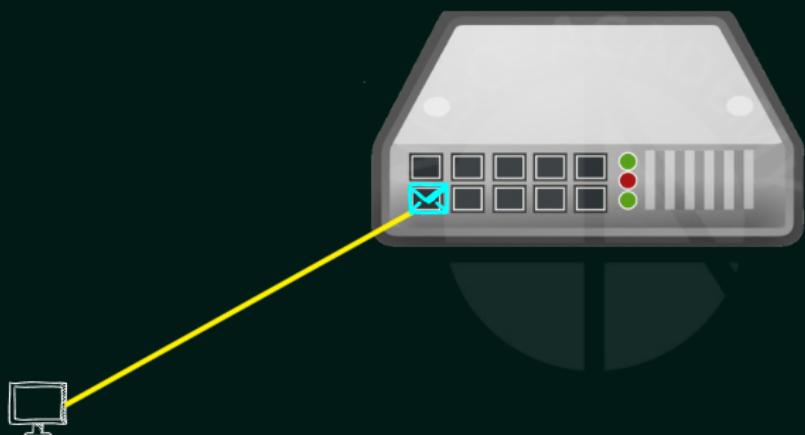
Working of hub

## WORKING OF HUB



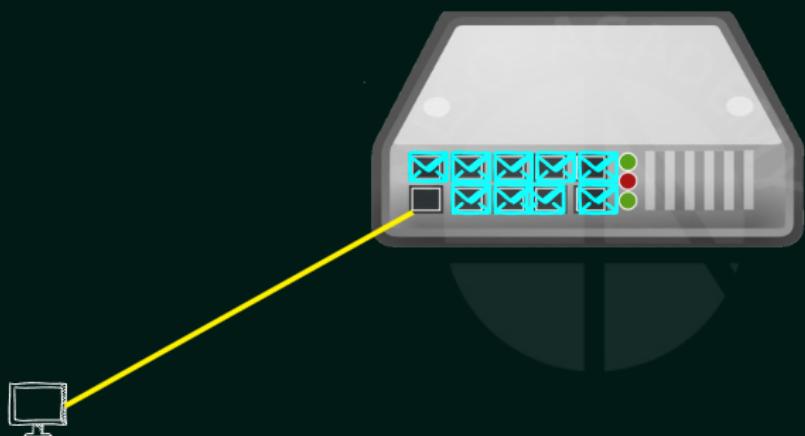
Working of hub

## WORKING OF HUB



Working of hub

## WORKING OF HUB



Working of hub

## HUB – PROS AND CONS

### PROS

- ★ Cheaper than switches.
- ★ Works good for smaller network.

### CONS

- ★ Issues with broadcast.
- ★ No memory.
- ★ Normally runs in half duplex mode.

Hub -Pros and Cons★★★★★

## OUTCOMES

Upon the completion of this session, the learner will be able to

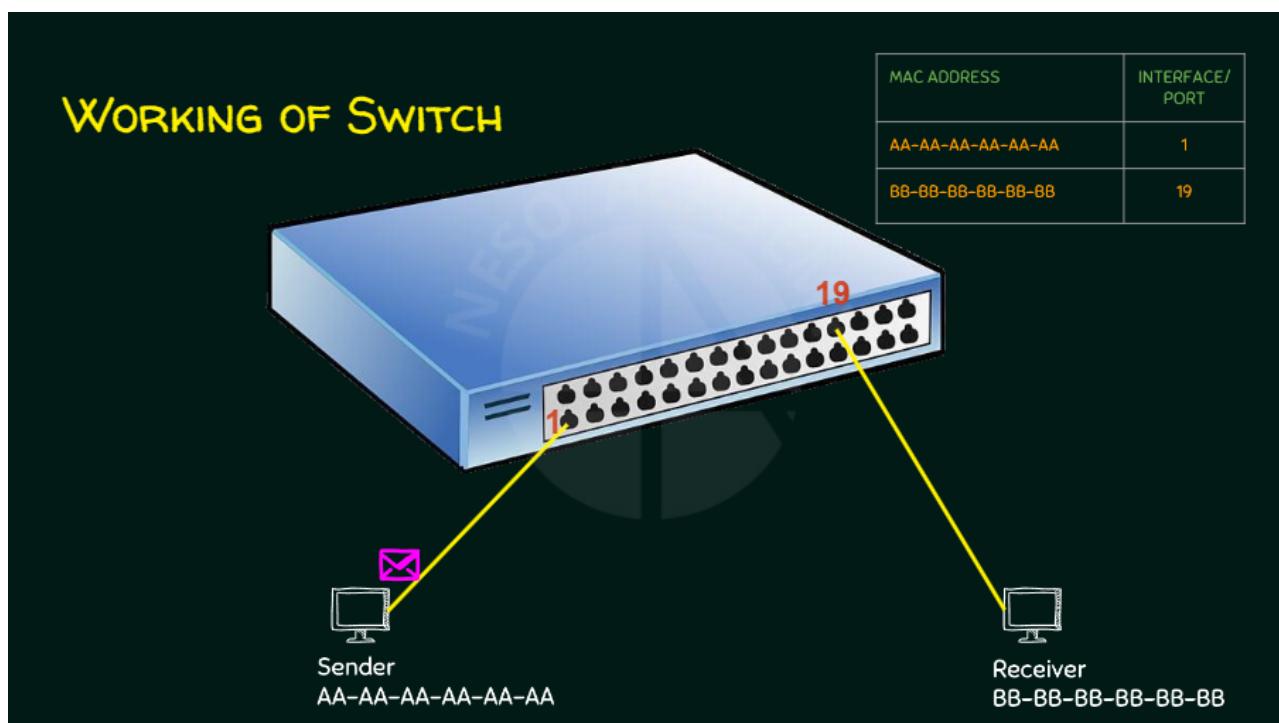
- ★ Learn the Cisco Packet Tracer using switch.
- ★ Simulate LAN using switch.
- ★ Understand the difference between hub and switch.

Outcomes ★★★

## SWITCH

- ★ A switch is a networking hardware that connects devices on a computer network to establish a local area network.
- ★ Unlike hub, switch has memory.
- ★ Stores MAC ADDRESS TABLE.
- ★ Layer 2 Device for setting up LAN.

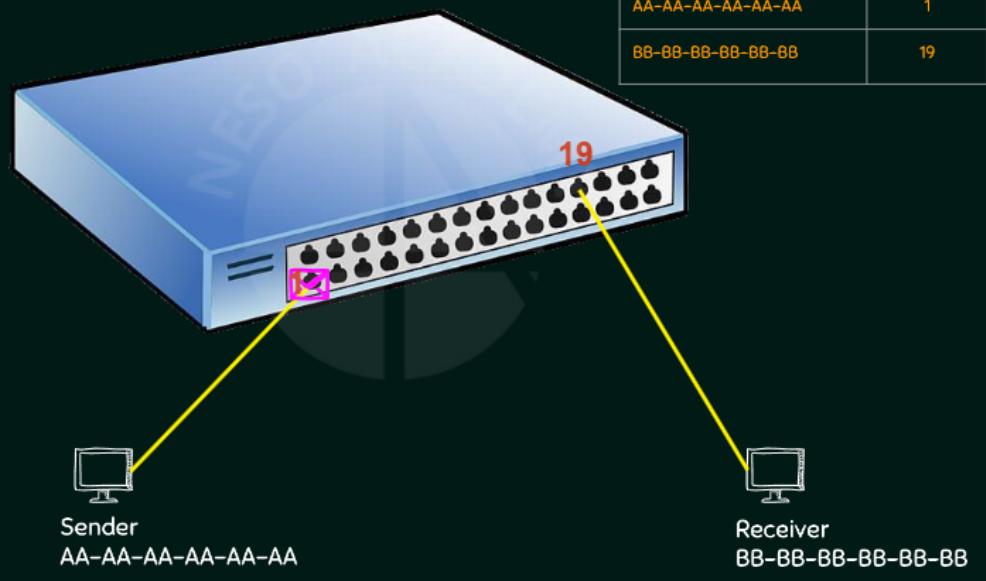
Switch★★★



Working of Switch119

## WORKING OF SWITCH

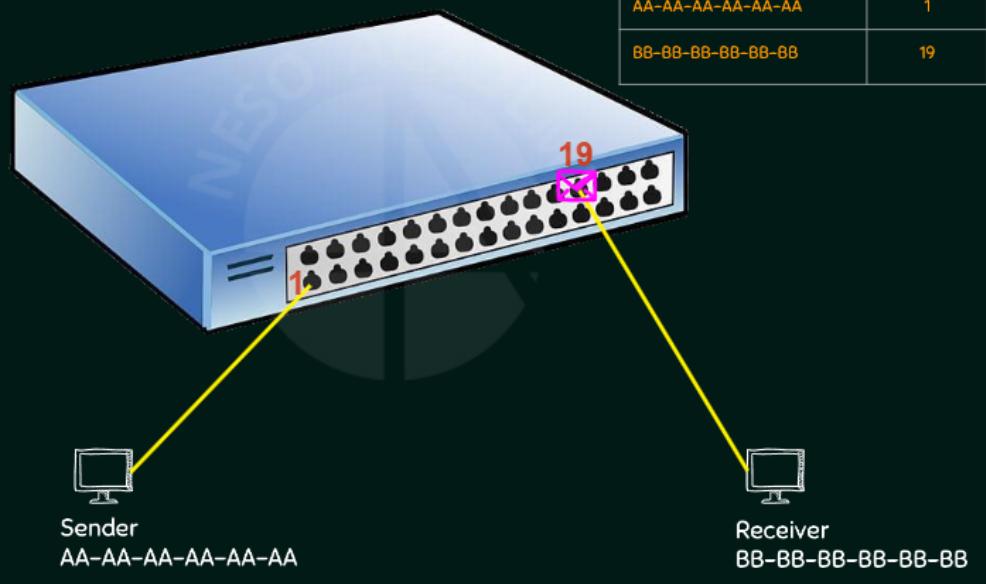
MAC ADDRESS	INTERFACE/ PORT
AA-AA-AA-AA-AA-AA	1
BB-BB-BB-BB-BB-BB	19



Working of Switch119

## WORKING OF SWITCH

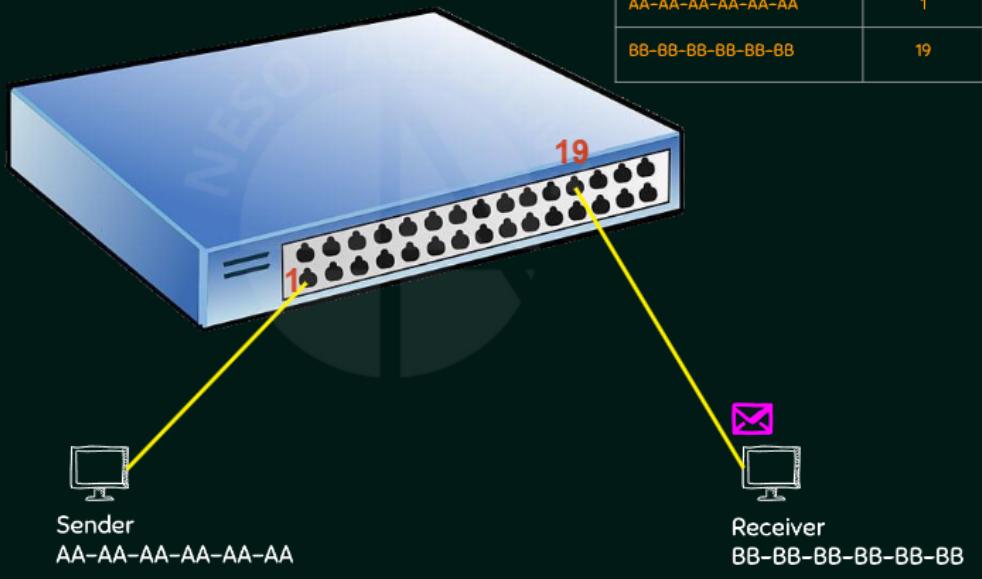
MAC ADDRESS	INTERFACE/ PORT
AA-AA-AA-AA-AA-AA	1
BB-BB-BB-BB-BB-BB	19



Working of Switch119

## WORKING OF SWITCH

MAC ADDRESS	INTERFACE/ PORT
AA-AA-AA-AA-AA-AA	1
BB-BB-BB-BB-BB-BB	19



Working of Switch119

## HUB VERSUS SWITCH

Hub	Switch
Layer 1 device.	Layer 2 device.
Works at physical layer.	Works at Data Link Layer.
Has no memory.	Has memory and stores MAC Address Table.
Not an intelligent device.	Intelligent device.
Floods the network due to broadcasting.	Can do unicasting, multicasting and broadcasting.
Security risks are high.	Security risks are low.
Less efficient.	More efficient.
Half Duplex.	Full Duplex.

Hub versus Switch  
 Layer 1 device.  
 Layer 2 device.  
 Works at physical layer.  
 Works at Data Link Layer.  
 Has no memory.  
 Has memory and stores MAC Address Table.  
 Not an intelligent device.  
 Intelligent device.  
 Floods the network due to broadcasting.  
 Can do unicasting, multicasting and broadcasting.  
 Security risks are high.  
 Security risks are low.  
 Less efficient.  
 More efficient.  
 Half Duplex.  
 Full Duplex.

## OUTCOMES

Upon the completion of this session, the learner will be able to

- ★ Know the basics of routers.
- ★ Understand how to connect two different LAN using router theoretically.
- ★ Understand the difference between switch and router.

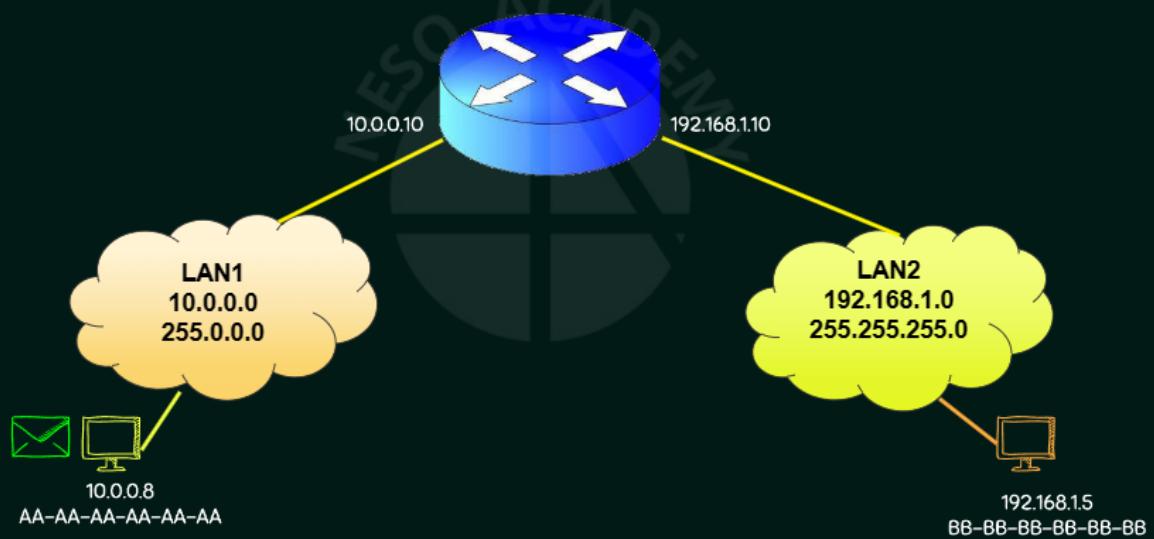
Outcomes ★★★

## ROUTER

- ★ A router is a networking device that forwards data packets between computer networks.
- ★ A router is connected to at least two networks, commonly two LANs or WANs or a LAN and its ISP's network.
- ★ It is a layer 3 (Network layer) device.
- ★ Stores routing table.

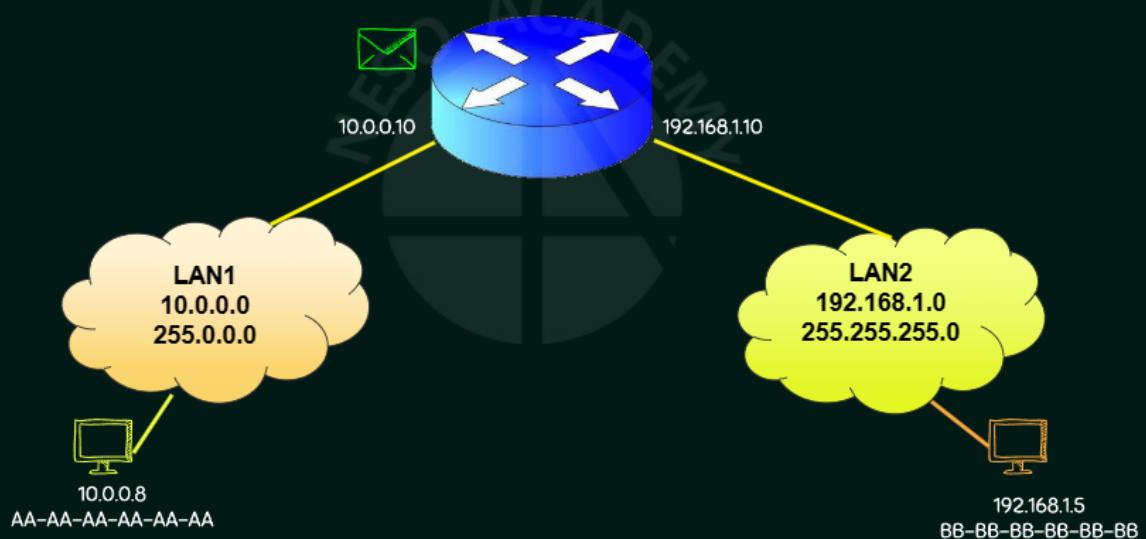
Router★★★★

## WORKING OF ROUTER



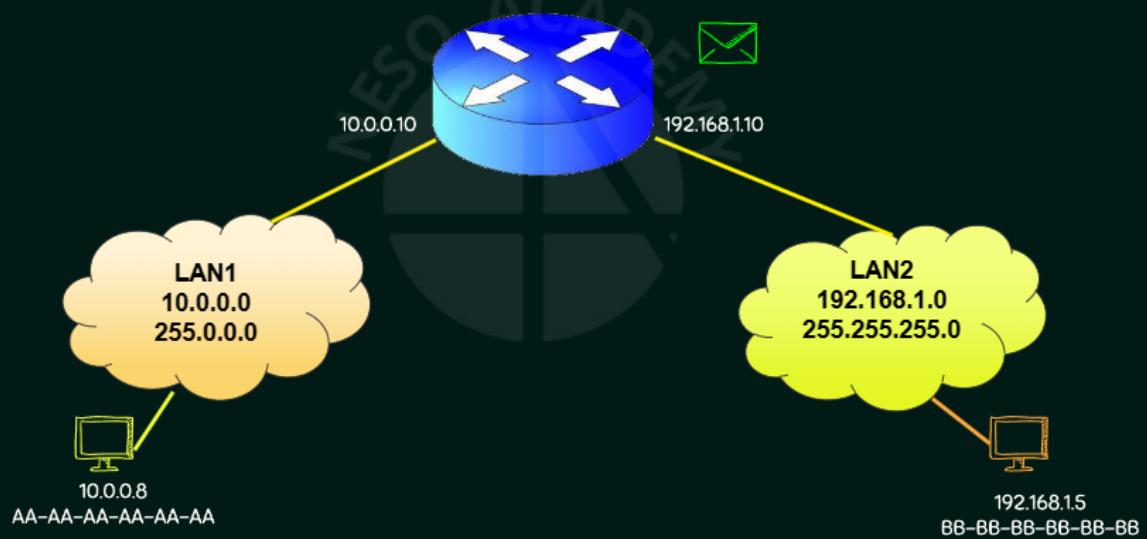
Working of Router  
LAN1 10.0.0.0 255.0.0.0  
LAN2 192.168.1.0 255.255.255.0

## WORKING OF ROUTER



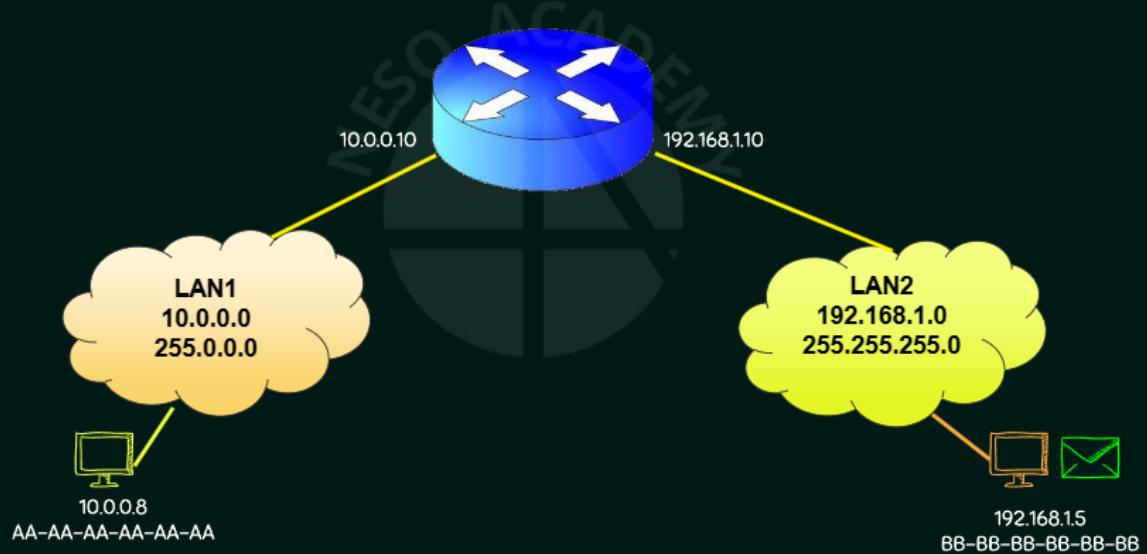
Working of Router  
LAN1 10.0.0.0 255.0.0.0  
LAN2 192.168.1.0 255.255.255.0

## WORKING OF ROUTER



Working of Router  
LAN1 10.0.0.0 255.0.0.0  
LAN2 192.168.1.0 255.255.255.0

## WORKING OF ROUTER



Working of Router  
LAN1 10.0.0.0 255.0.0.0  
LAN2 192.168.1.0 255.255.255.0

## SWITCH VERSUS ROUTER

Switch	Router
A network switch is a computer networking device that is used to connect many devices together on a computer network.	A router is a networking device that connects a local network to other local networks.
Operates at Data Link Layer. (Layer 2 Device)	Operates at network layer. (Layer 3 Device)
Has memory and stores MAC Address Table.	Has memory and stores Routing table.
Decisions are taken based on MAC address.	Decisions are taken based on IP address.
Half/Full Duplex.	Full Duplex.
LAN.	LAN, MAN, and WAN.

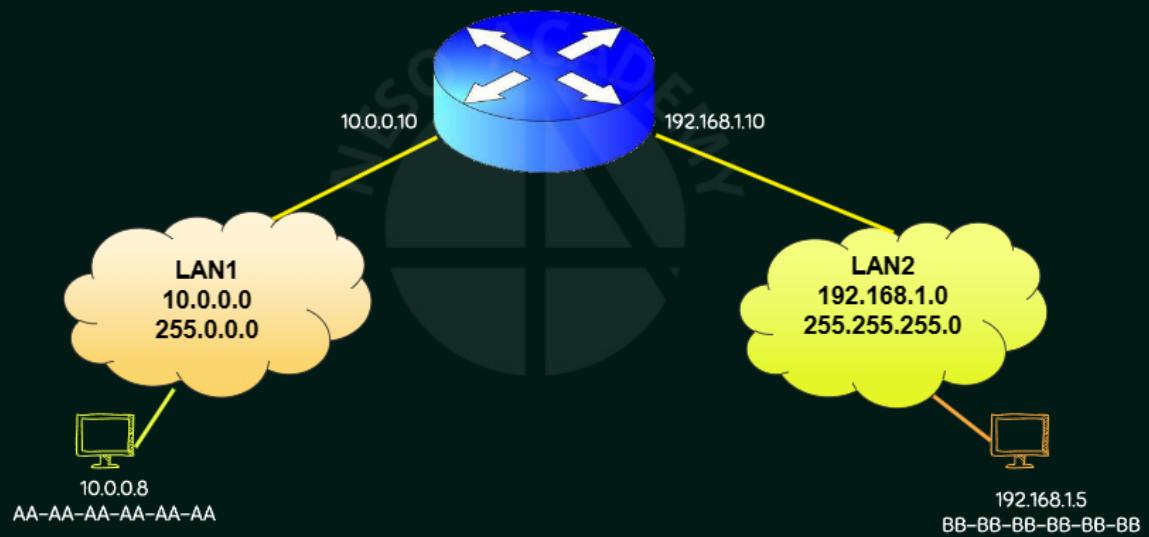
Switch versus Router

## ROUTER – A RECAP

- ★ Connects two or more different LANs.
- ★ It is a layer 3 (Network layer) device.
- ★ Stores routing table.
- ★ Router – Inevitable device in the internet.

Router -a recap★★★★

## WORKING OF ROUTER



Working of Router  
LAN1 10.0.0.0 255.0.0.0  
LAN2 192.168.1.0 255.255.255.0

## OUTCOME

Upon the completion of this session, the learner will be able to

- ★ Understand the basics of repeater.
- ★ Know the working of repeater using CPT.

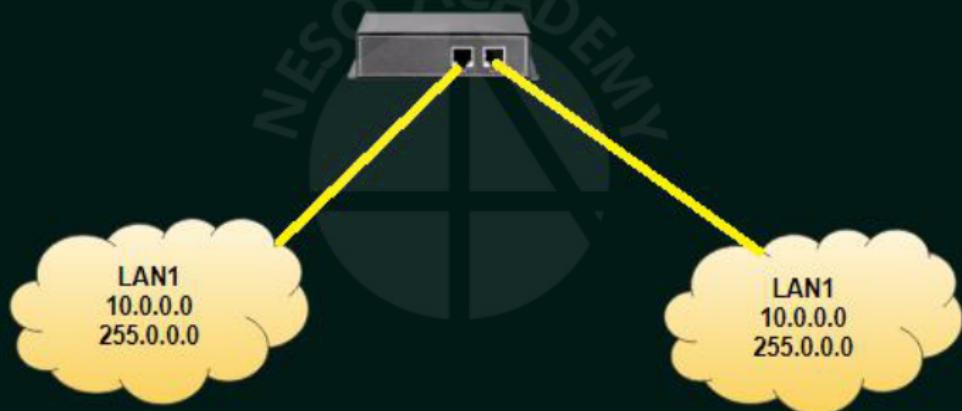
Outcome ★★

## REPEATER

- ★ The data signals generally become too weak or corrupted if they tend travel a long distance.
- ★ Repeater regenerates the signal over the same network.
- ★ It operates at the physical layer.
- ★ They do not amplify the signal.
- ★ It is a 2 port device.

Repeater★★★★★

## WORKING OF REPEATER



Working of Repeater

## OUTCOMES

Upon the completion of this session, the learner will be able to

- ★ Understand the basics of bridge.
- ★ Know the types of bridge.
- ★ Understand the working of bridge.
- ★ Understand the difference between router and bridge.

Outcomes ★★★★

## BRIDGE

- ★ Bridge = Repeater + Functionality of reading MAC address.
- ★ It is a layer 2 device.
- ★ It is also used for interconnecting two LANs on the same protocol.
- ★ It is also a two port device.

Bridge★★★★

## TYPES OF BRIDGES

### ★ Transparent Bridges.

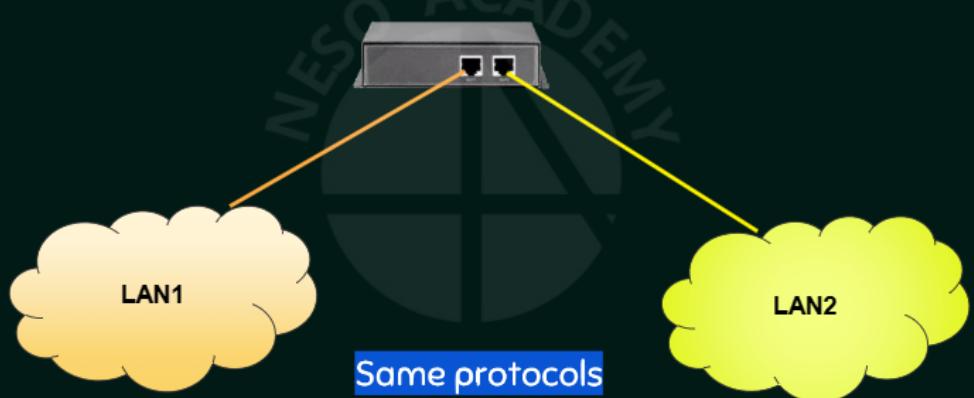
- ★ These are the bridge in which the stations are completely unaware of the bridge's existence.
- ★ Reconfiguration of the stations is unnecessary even if bridge is added or removed from network.

### ★ Source Routing Bridges.

- ★ In these bridges, routing operation is performed by source station and the frame specifies which route to follow.

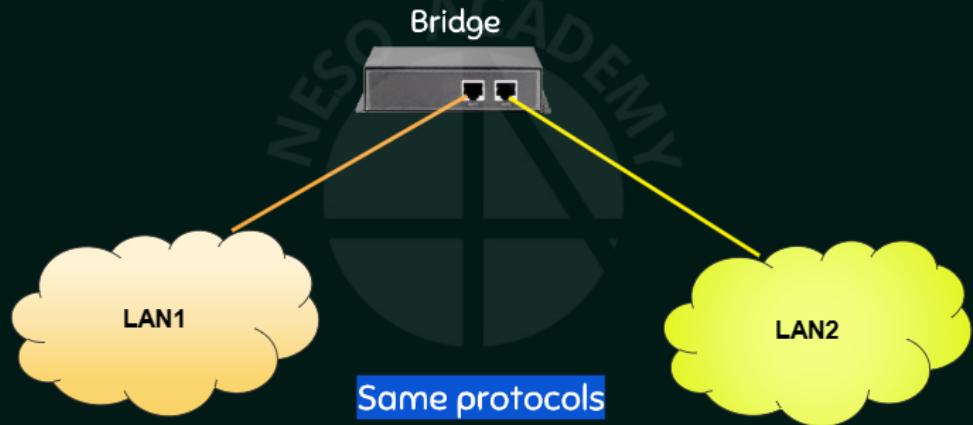
Types of bridges★★★★★

## WORKING OF BRIDGE



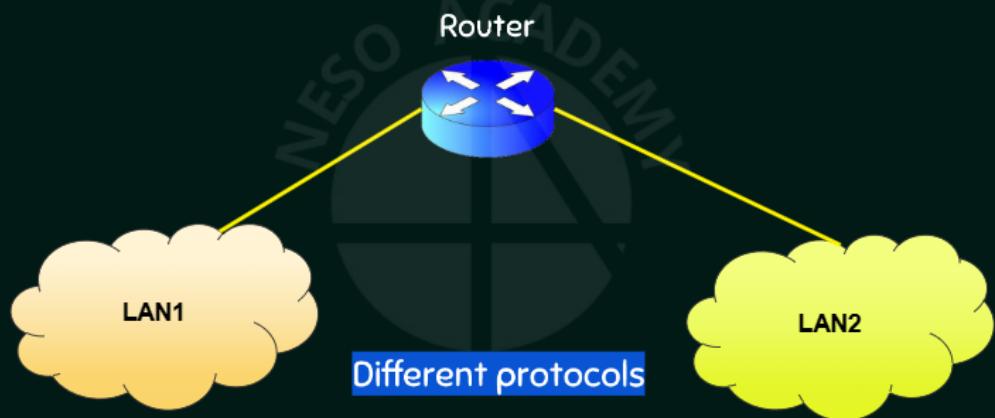
Working of Bridge LAN1 LAN2

## ROUTER VERSUS BRIDGE



Router versus Bridge LAN1 LAN2

## ROUTER VERSUS BRIDGE



Router versus Bridge LAN1 LAN2

## OUTCOMES

Upon the completion of this session, the learner will be able to

- ★ Understand the basics of bridge.
- ★ Know the types of bridge.
- ★ Understand the working of bridge.
- ★ Understand the difference between router and bridge.

Outcomes ★★★★

THANK YOU!

Thank you!

## OUTCOME

Upon the completion of this session, the learner will be able to

- ★ List various networking devices.

Outcome★

## LIST OF VARIOUS NETWORK DEVICES

- ★ Repeater
- ★ Hub
- ★ Switch
- ★ Bridge
- ★ Router
- ★ Multi-layer switch (Layer 3 Switch)
- ★ Brouter
- ★ Modem
- ★ Firewall (Security Device)

List of various network devices ★★★★★★★★★

## QUESTION 1

Which of the following devices is a component of PC that connects PC to the networking device?

- a. Bridge
- b. Hub
- c. NIC card
- d. Gateway

Question 1

## QUESTION 2

Which of the following devices that modulates digital signals into analog signals that can be transmitted over traditional telephone lines?

- a. Bridge
- b. Hub
- c. Switch
- d. Modem

Question 2

### QUESTION 3

Which of the following devices take data sent from one network device and broadcasts the same to all the devices regardless of the intended recipient?

- a. Bridge
- b. Hub
- c. Switch
- d. Modem

Question 3

### QUESTION 4

In a network where security is a primary concern, which of the devices can be recommended : Switch or Hub?

Answer

Switch

Question 4

## QUESTION 5

You being a network administrator, your client wants you to suggest either switch or Hub to be used in a medium-sized network. Which device will you recommend to such network?

- a. Switch
- b. Hub
- c. Either a or b
- d. Neither a nor b

Question 5

## QUESTION 6

Which of the following network device that connects two lan segments of same protocol?

- a. Hub
- b. Bridge
- c. Repeater
- d. Switch

Question 6

## QUESTION 7

Which of the following network devices that can connect any two or more different networks that has two or more different protocols?

- a. Bridge
- b. Router
- c. Repeater
- d. Switch

Question 7

## QUESTION 8

Which of the following are OSI layer 2 network devices?

- a. Hub
- b. Bridge
- c. Repeater
- d. Switch

Question 8

## QUESTION 9

Which of the following network devices has the functionality of a bridge and router?

- a. Hub
- b. Bridge
- c. Repeater
- d. Brouter 

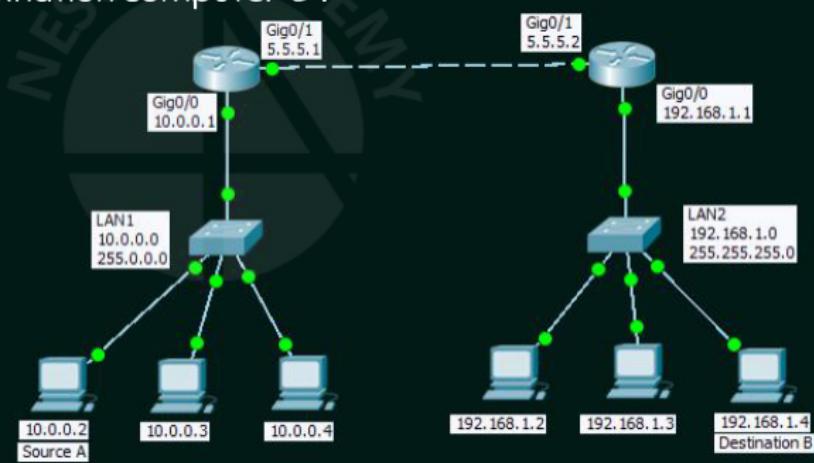
Question 9

## QUESTION 10

In the given network scenario, how many different destination MAC addresses can be noted in the frame in its journey from the source computer 'A' to the destination computer 'B'?

Answer

3 



Question 10