



Sunbeam Infotech

www.sunbeaminfo.com

QUIZ

1. Communication between a computer and a keyboard involves _____ transmission.
a) Automatic
b) Half-duplex
c) Full-duplex
 d) Simplex

2. A _____ is the physical path over which a message travels.
 a) Path
b) Medium
c) Protocol
d) Route

3. Which of this is not a network edge device?
a) PC
b) Smartphones
c) Servers
 d) Switch



QUIZ

4. Three or more devices share a link in _____ connection.

- a) Unipoint
- b) Multipoint
- c) Point to point
- d) Simplex

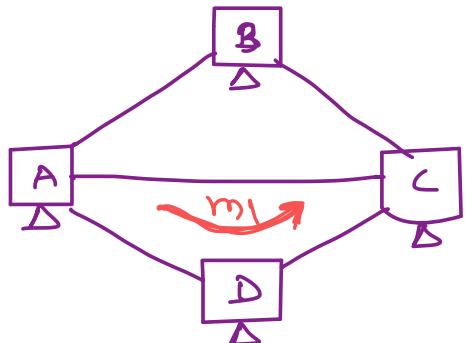
5. What kind of transmission medium is most appropriate to carry data in a computer network that is exposed to electrical interferences?

- a. Unshielded twisted pair
- b. Optical fibre
- c. Coaxial cable
- d. Microwave



Selection of Best Route to transmit the data is called as switching

← Switching.



① Circuit Switching

CAMI → message

C → Destination

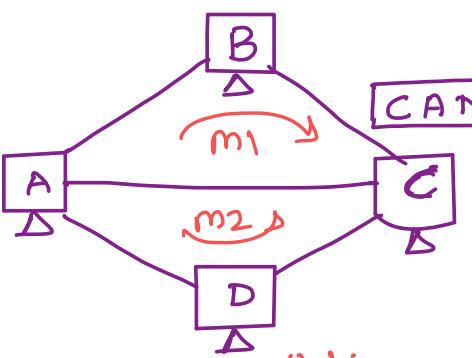
A → Source.

M1 → Message

eg: Telephone
Line.

dedicated path.

- 1) Connection est.
- 2) data transmit
- 3) Connection disconnect



Message Switching

CAMI

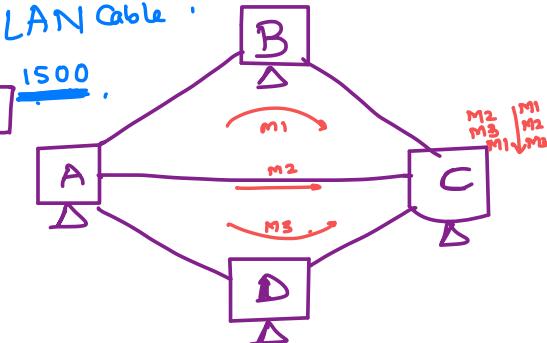
eg: SMS .

no dedicated path .

char → 160 ch ,

180 ch → M1
M2

Ethernet Cable .
LAN Cable .



Packet Switching

CAMI

Message - 350D ,
→ M1 → 1500
→ M2 → 1500
→ M3 → 500

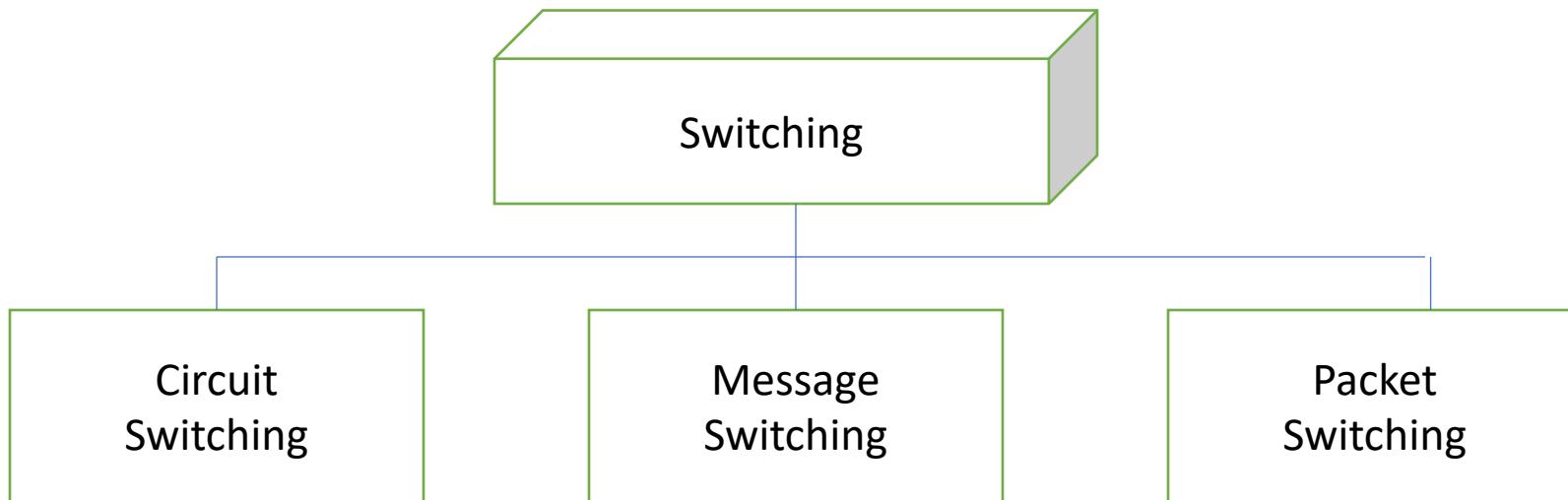
1 | C A M1 | 2

2 | C A M2 | 3

3 | C A M3 | end

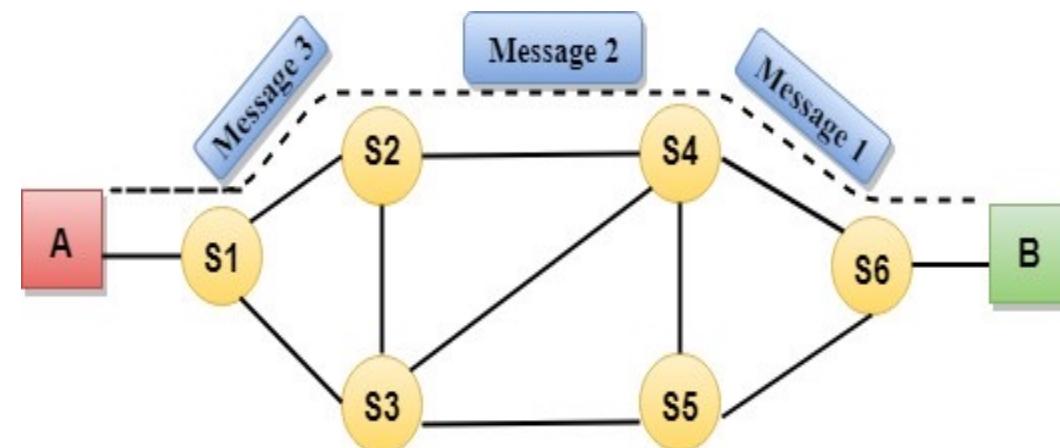
Switching

- In large networks, there can be multiple paths from sender to receiver.
- The switching technique will decide the best route for data transmission.
- Switching technique is used to connect the systems for making one-to-one communication.
- The mechanism for exchange of information between different computer networks and network segments is called switching in Networking.



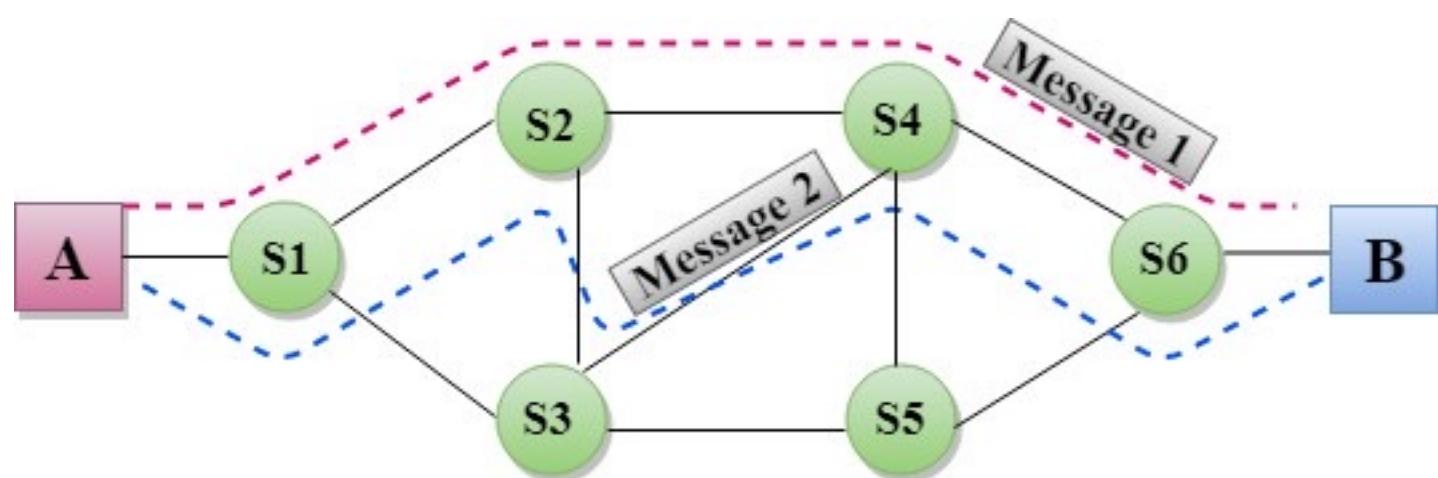
Circuit Switching

- Establishes a dedicated path between sender and receiver.
- once the connection is established then the dedicated path will remain to exist until the connection is terminated.
- Operates in a similar way as the telephone works.
- when any user wants to send the data a request signal is sent to the receiver then the receiver sends back the acknowledgment to ensure the availability of the dedicated path. After receiving the acknowledgment, dedicated path transfers the data.
- Three Phases:
 - Circuit Establishment
 - Data Transfer
 - Circuit Disconnect



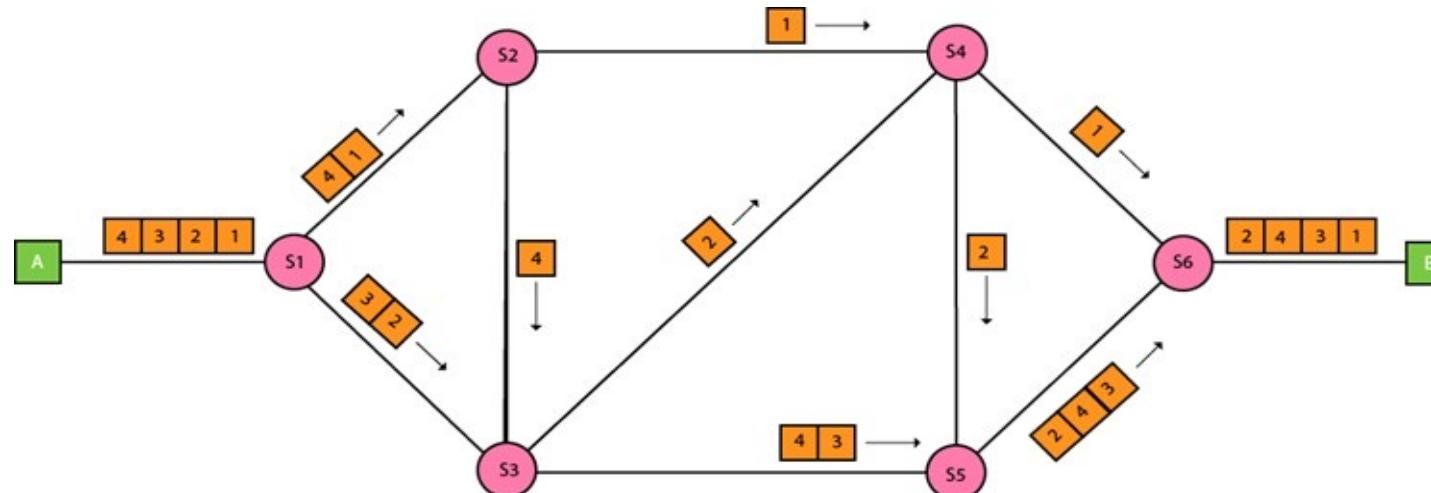
Message Switching

- There is no establishment of a dedicated path between the sender and receiver.
- The destination address is appended to the message.
- provides a dynamic routing as the message is routed through the intermediate nodes based on the information available in the message.
- they can provide the most efficient routes.
- Uses a method of **store and forward network**



Packet Switching

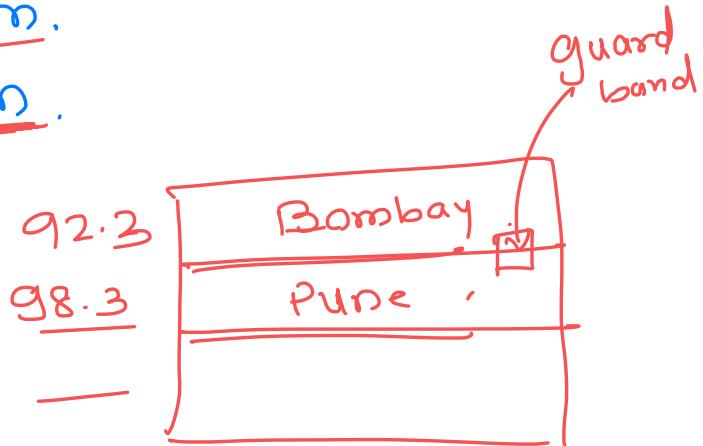
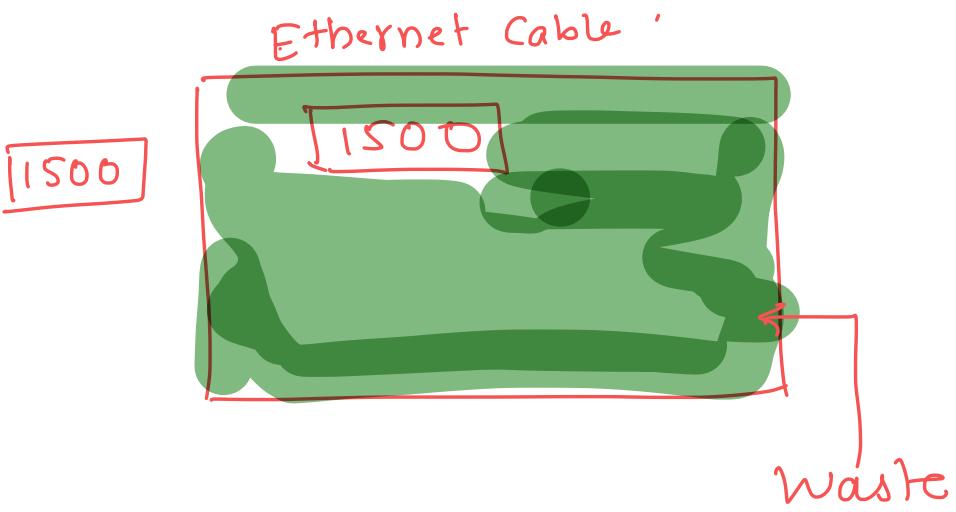
- Message is divided in packets , packets are given a unique number to identify their order at the receiving end.
- Every packet contains some information in its headers such as source address, destination address and sequence number.
- Packets will travel across the network, taking the shortest path as possible.
- All the packets are reassembled at the receiving end in correct order.
- If any packet is missing or corrupted, then the message will be sent to resend the message.
- If the correct order of the packets is reached, then the acknowledgment message will be sent



Multiplexing

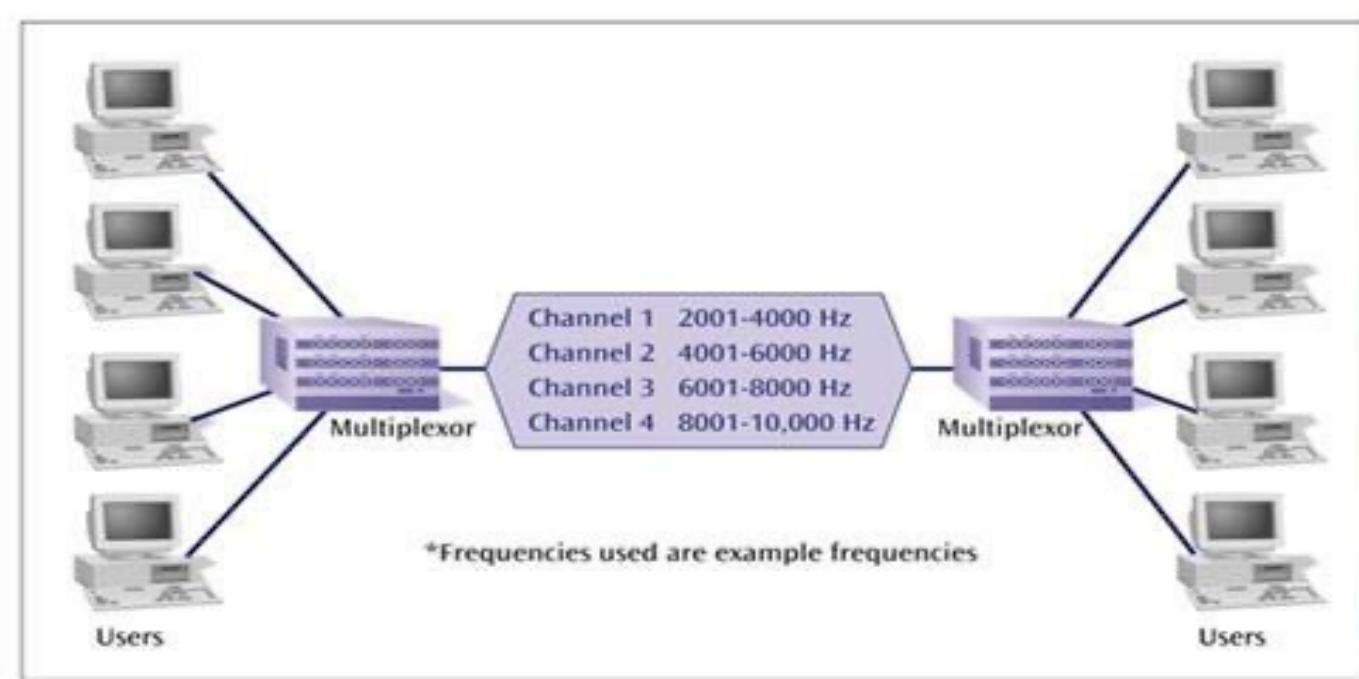


MUX \longleftrightarrow FDM.
MUX \longleftrightarrow TDM.

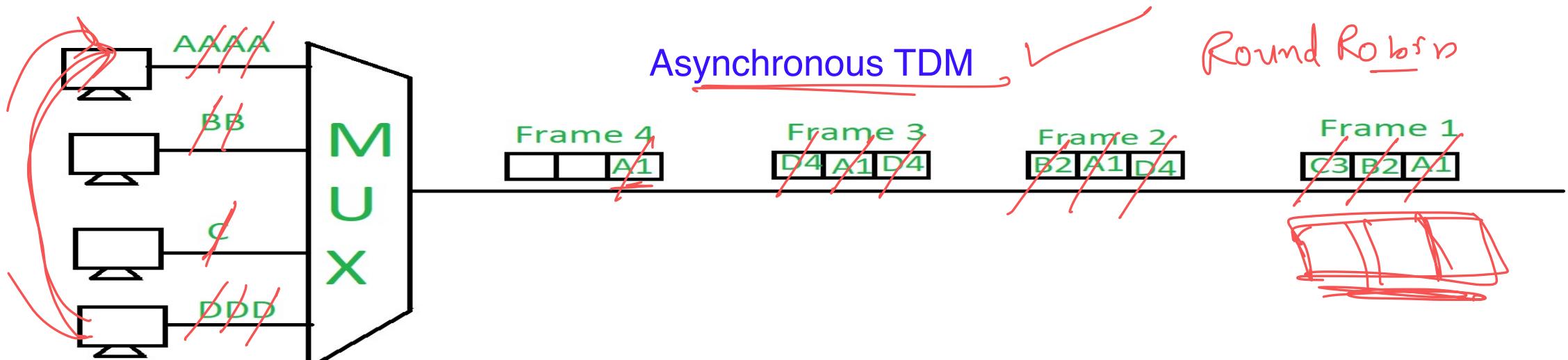
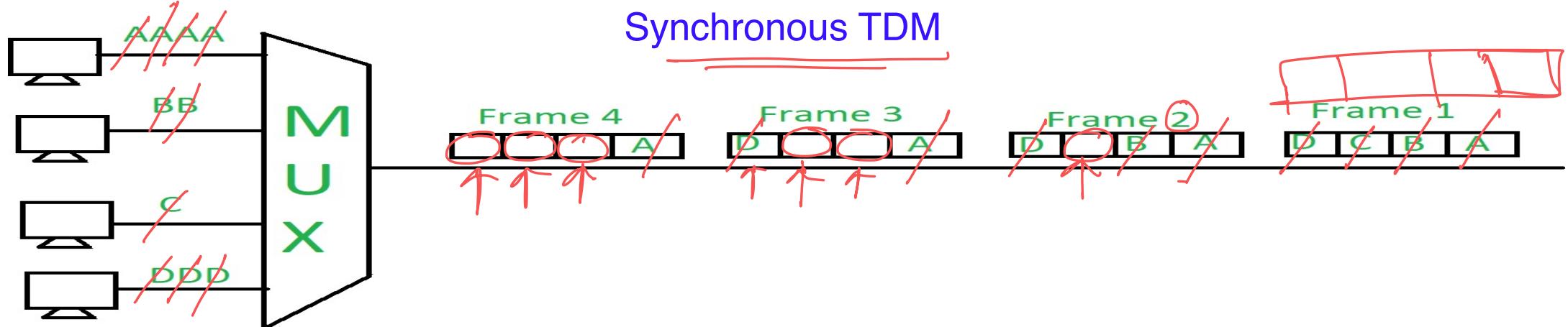


Multiplexing

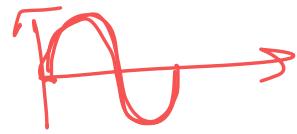
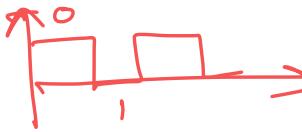
- A communication channel such as an optical fiber or coaxial cable can carry only one signal at any moment in time. Wastage of Bandwidth
- Multiplexing is the process of combining multiple signals into one, in such a manner that each individual signal can be retrieved at the destination.
- Multiplexing is used in the cases where the signals of lower bandwidth and the transmitting media is having higher bandwidth.
- Methods of Multiplexing:
 - FDM(Frequency Division Multiplexing)
 - TDM(Time Division Multiplexing)



Time Division Multiplexing (TDM)



TDM v/s FDM



digital.

	TDM (Time Division Multiplexing)	FDM(Frequency Division Multiplexing)
1	TDM works with <u>digital signals</u> as well as <u>analog signals</u> .	While FDM works with <u>only analog signals</u> .
2	TDM has <u>low conflict</u> .	While it has <u>high conflict</u> .
3	TDM is <u>efficient</u> .	While it is <u>inefficient</u> .
4	In TDM, <u>time sharing</u> takes place.	While in this, <u>frequency sharing</u> takes place.
5	Here <u>synchronization pulse</u> is necessary.	Here <u>Guard band</u> is necessary.
6	Framing bits (<u>Sync Pulses</u>) are used in TDM at the start of a frame in order to enable synchronization	FDM uses <u>Guard bands</u> to separate the signals and prevent its overlapping



QUIZ

6. Which multiplexing technique is used to transmit digital signals?

- a) FDM
- b) TDM
- c) WDM
- d) FDM & WDM

7. In TDM, slots are further divided into _____

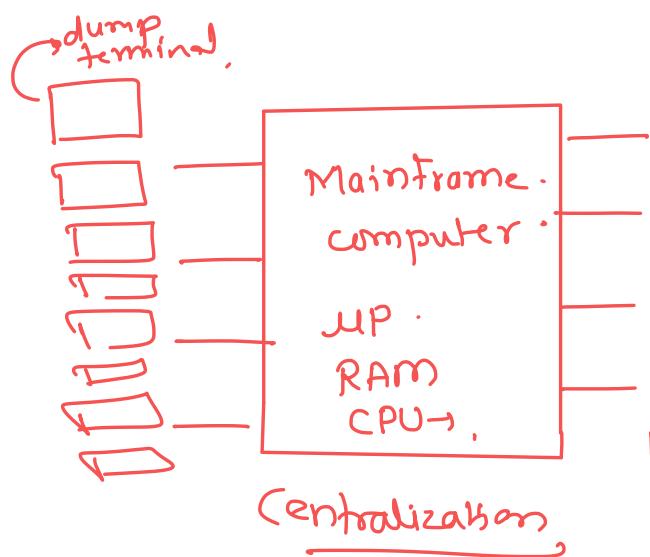
- a) Seconds
- b) Frames
- c) Packets
- d) Bits

8. In _____ transmission, the channel capacity is shared by both communicating devices at all times.

- a) Simplex
- b) Half-duplex
- c) Full-Duplex
- d) Half -Simplex

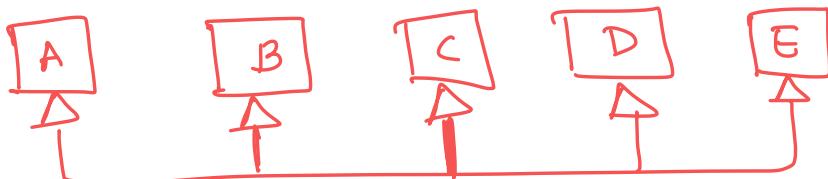


History

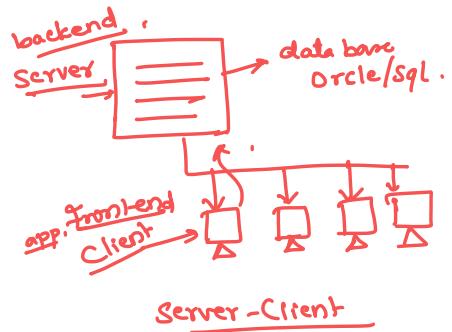


Centralization

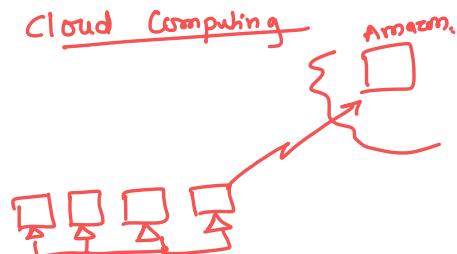
IBM → desktop



De-centralization / Multi-point/
peer to peer

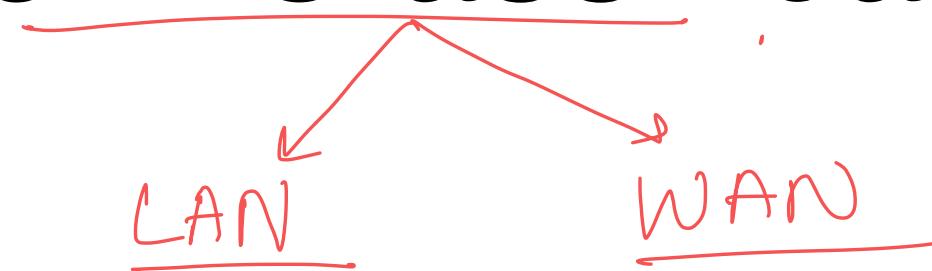


Server - Client



Cloud Computing

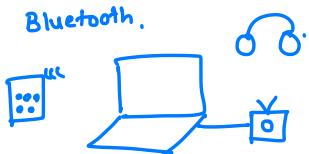
Network Classification



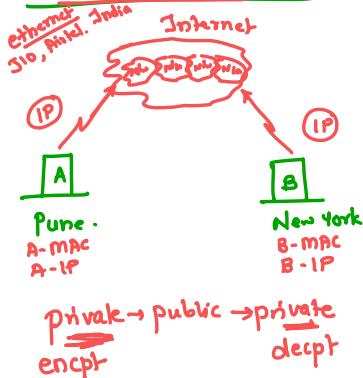
LAN
 CAN → Campus Area N/w → eg: College
 MAN → Metropolitan Area N/w → eg: Cable TV
 PAN → Personal Area N/w
 SAN → Private Area N/w
 ↳ Server area N/w.

N/w
 LAN → WAN
 GAN → Galaxy Area N/w.

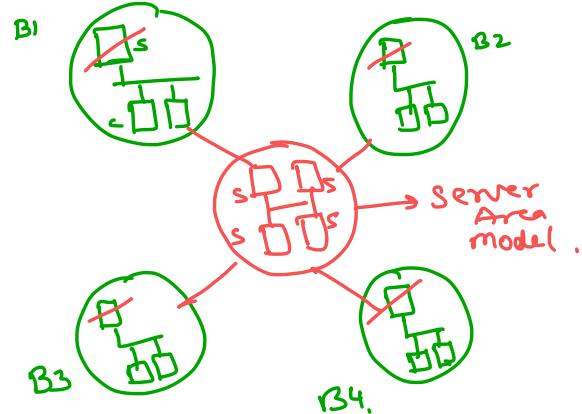
① Personal Area N/w.



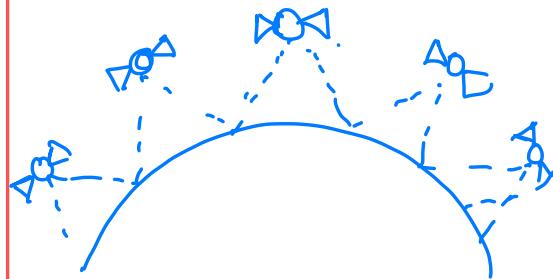
② Private Area N/w



③ Server Area N/w



Galaxy Area N/w.



Network Classification

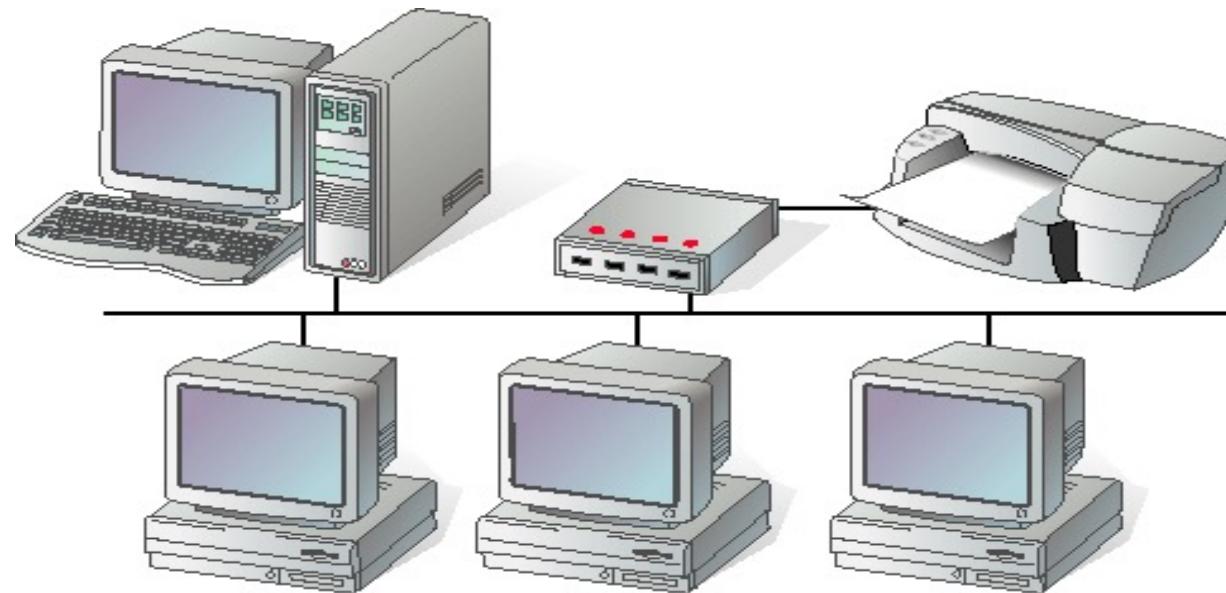
LAN

Interprocessor distance	Processors located in same	Example
1 m	Square meter	Personal area network
10 m	Room	
100 m	Building	Local area network
1 km	Campus	
10 km	City	Metropolitan area network
100 km	Country	
1000 km	Continent	Wide area network
10,000 km	Planet	The Internet



LAN (Local Area Network) : Wired Network

- Network in small geographical Area (Room, Building or a Campus)
- Short distances (100 meters)
- **Designed to provide local interconnectivity**
- LAN's can either be made wired or wireless. Twisted pair, coax or fiber optic cable can be used in wired LAN's
- a network that is used for communicating among computer devices, usually within an office building or home.



Wired Network Designing

LAN

Token Ring (Not used)

- Its copy write by IBM.
- It is a data link technology for local area networks (LANs) in which devices are connected in a star or ring topology.
- It was designed by only IBM PCs with 4mbps they increased upto 16mbps.

4 m bps - 16 m bps X

Ethernet (Used)

- It belongs to IEEE
- Its autonomous
 - 10mbps (Ethernet),
 - 100mbps (fast Ethernet)
 - 1Gbps (Gigabit Ethernet)
 - 10gbps (10 gig Ethernet)
 - 100gbps (100 gig Ethernet)
 - LRE (Long Range Ethernet)

40 mbps

60

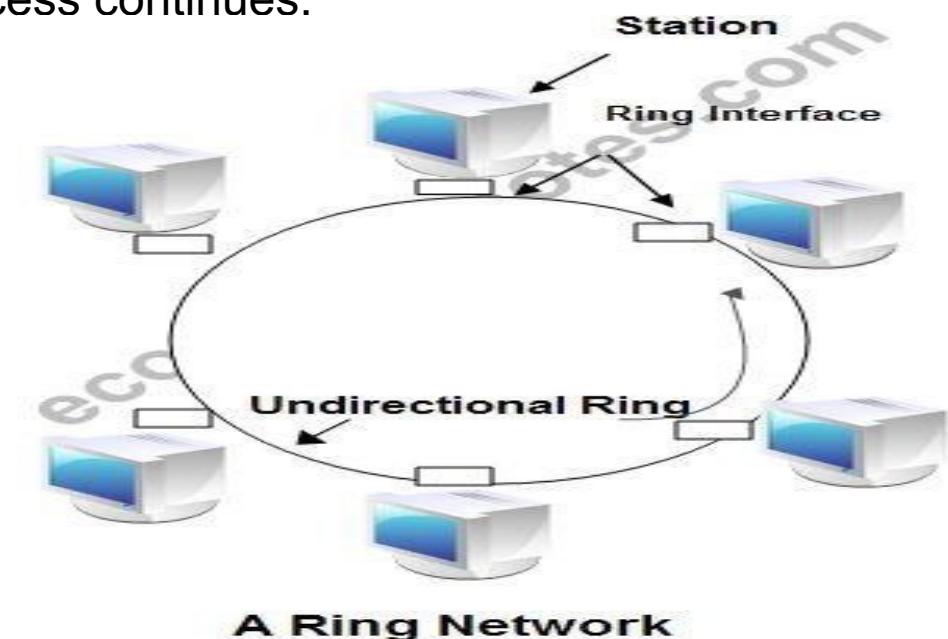
80

100

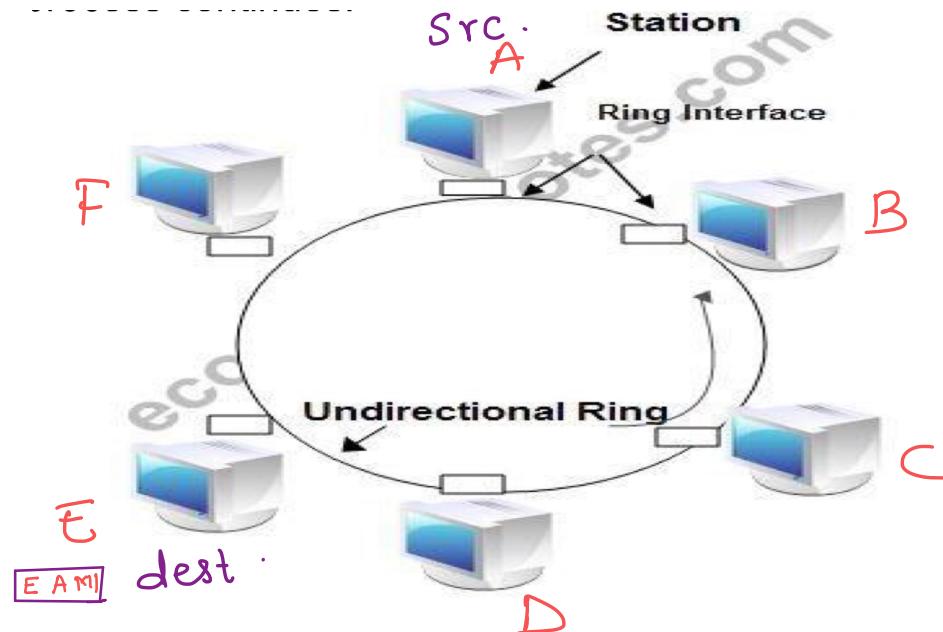
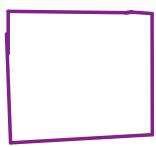


Token Ring

- The token ring LAN process is delineated by the following sequence of events:
 - A token continually circulates inside the token ring LAN
 - To transmit a message, a node inserts a message and destination address inside an empty token.
 - The token is examined by each successive node.
 - The destination node copies the message data and returns the token to the source with the source address and a data receipt message.
- The source receives the returned token, verifies copied and received data and empties the token.
- The empty token now changes to circulation mode, and the process continues.



Ring Topology.



Ethernet (Transfer speed 10 Mbps, 100 Mbps, or above)

- Ethernet is the dominant cabling and low level data delivery technology used in Local Area Networks (LAN's).
- It was developed by Xerox corp. along with DEC and Intel.
- **Features:**
 1. Ethernet Addresses are 6 bytes(48 bits) long.
 2. Ethernet supports networks built with twisted pair, thin and thick coaxial and fiber optic cabling.
 3. To prevent the loss of data, when two or more devices attempt to send packets at the same time, Ethernet detects collisions.

1Byte = 8-bit

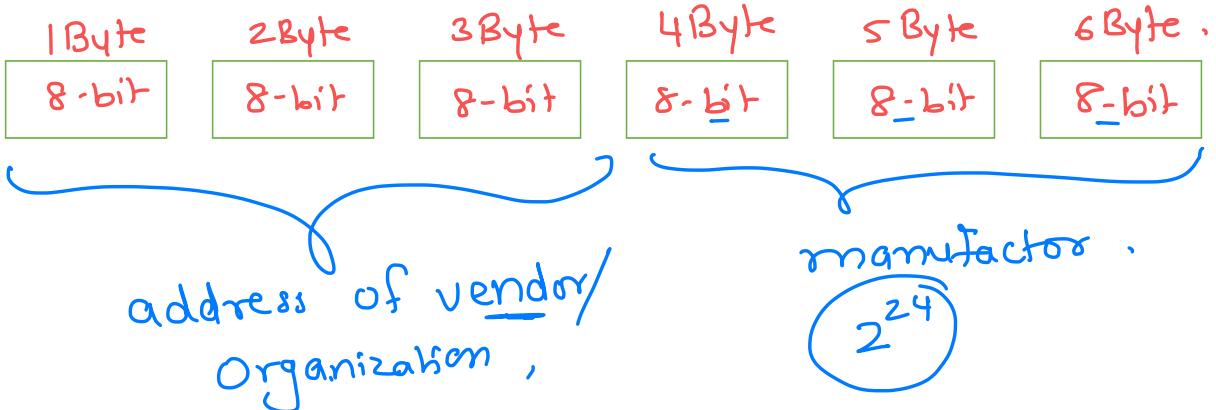
Ethernet : MAC Address → physical Address.

NIC Card.
Ethernet Card.

Unique

MAC address - 48 bit (6 Bytes)
Ethernet address.

2^1
 2^2
 2^3
 2^4
 \vdots
 2^{48}



DELL

20:47:47:00:00:00
20:47:47:00:00:01
20:47:47:00:00:10
 :11

Cisco .

00:00:0C:00:00:00
00:00:0C:00:00:01
 :10
 :11

$$2^8 = 256$$

8-bit

(256)

Ethernet Address/ MAC Address

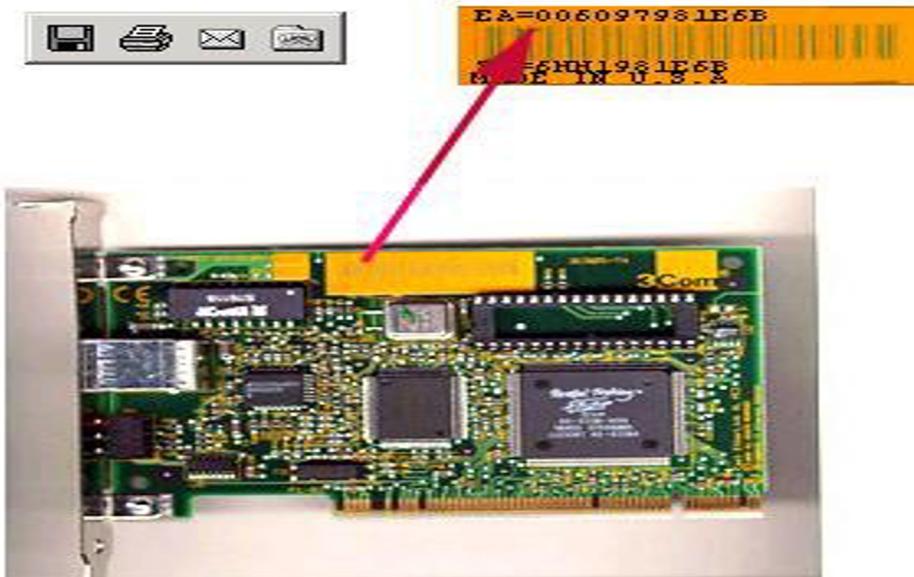
MAC → ifconfig all.

IEEE

Example: 47:20:1B:2E:08:EE

- First three bytes from left specify the vendor.
- the last 24 bit should be created uniquely by the company

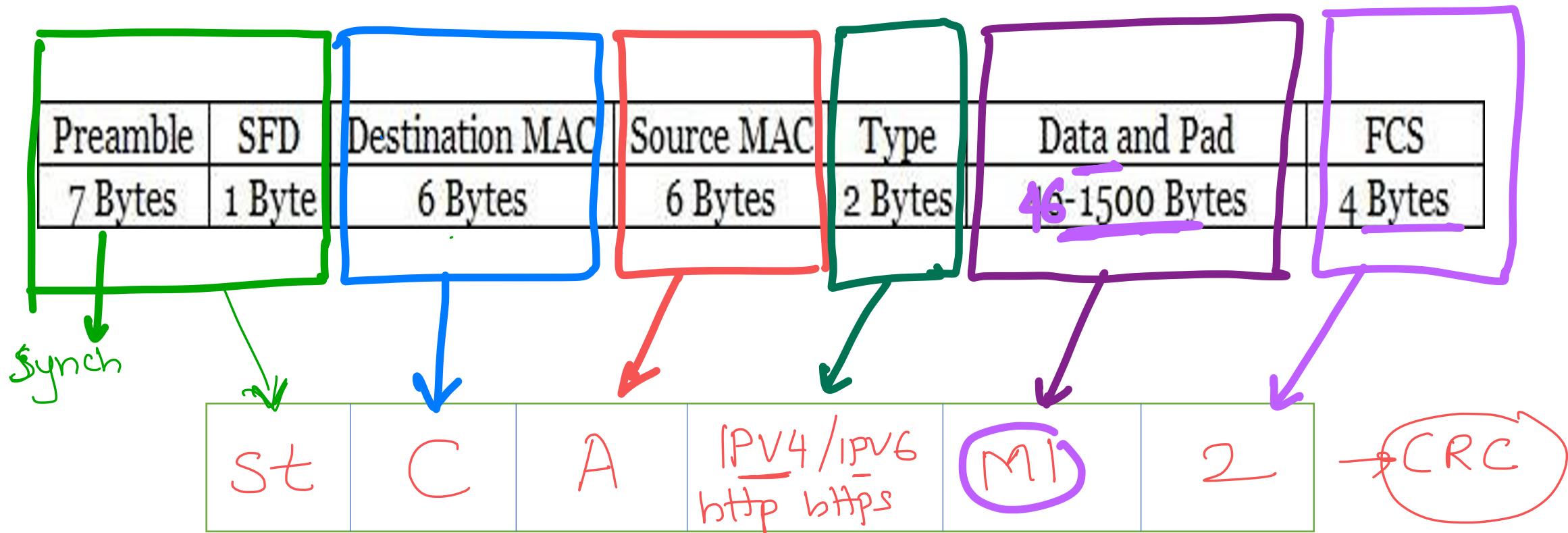
Cisco	00-00-0C
Dell	20-47-47
Sun	08-00-20
IBM	08-00-5A
Nokia	00-40-43



Windows → ipconfig/all : Ethernet adapter Ethernet(Physical Address)

A network interface card (NIC) / Ethernet Card is a piece of computer hardware designed to allow computers to communicate over a computer network.

Ethernet Frame



Ethernet Frame Format/MAC Frame

Preamble	SFD	Destination MAC	Source MAC	Type	Data and Pad	FCS
7 Bytes	1 Byte	6 Bytes	6 Bytes	2 Bytes	46-1500 Bytes	4 Bytes

Preamble

- informs the receiving system that a frame is starting and enables synchronization. In IEEE 802.3, eighth byte is start of frame (10101011)

SFD (Start Frame Delimiter)

- signifies that the Destination MAC Address field begins with the next byte.

Destination MAC

- identifies the receiving system.

Source MAC

- identifies the sending system.

Type

- defines the type of protocol inside the frame, for example IPv4 or IPv6.

Data and Pad

- contains the payload data.
- Padding data is added to meet the minimum length requirement for this field (46 bytes).

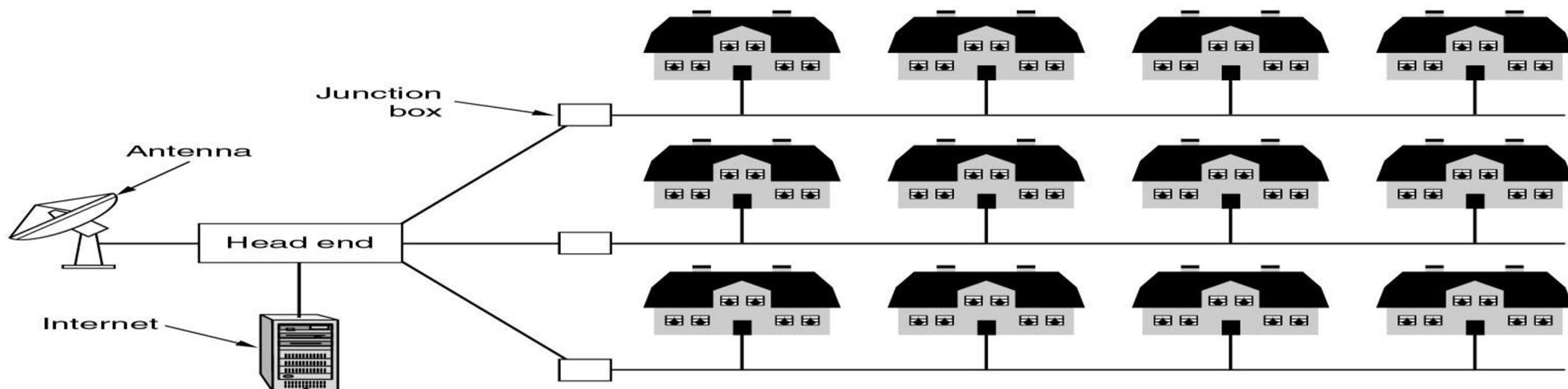
FCS (Frame Check Sequence)

- contains a 32-bit Cyclic Redundancy Check (CRC) which allows detection of corrupted data.



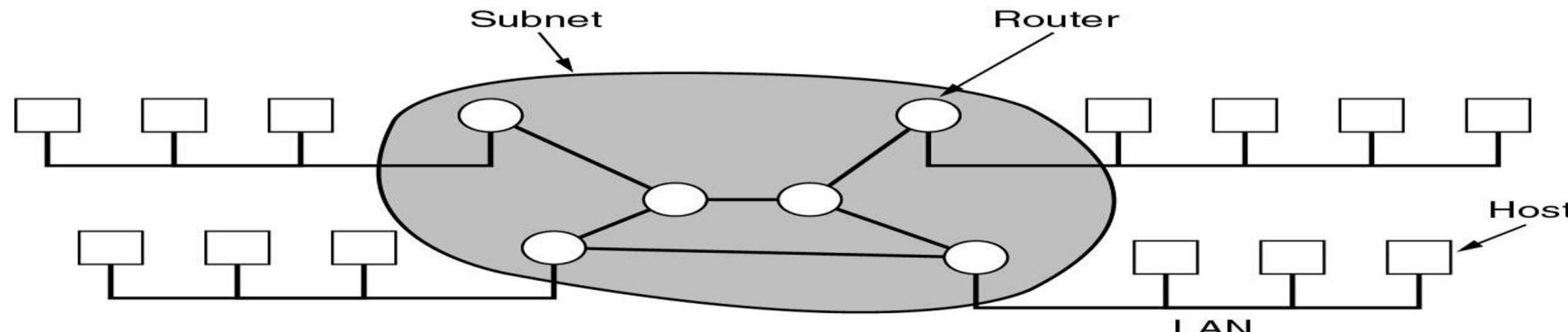
MAN

- A MAN spans the distance of a typical metropolitan city.
- The cost of installation and operation is higher.
- MANs use high-speed connections such as fiber optics to achieve higher speeds.
- Provide connectivity over areas such as a city, a campus
- More than 100m , Designed to handle data communication for multiple organizations in a city and nearby cities as well
- e.g. cable television network



WAN

- Network spread geographically (Country or across Globe)
- WANs consist of two distinct components:
 - transmission lines (copper, fiber, microwave) and switches (electronics, optics)
 - Store-and-forward or packet-switched subnet
- WANs span a larger area than a single city.
- These use long distance telecommunication networks for connection, thereby increasing the cost.
- The Internet is a good example of a WAN.
- More than 1000m long distance, Provide connectivity over large areas



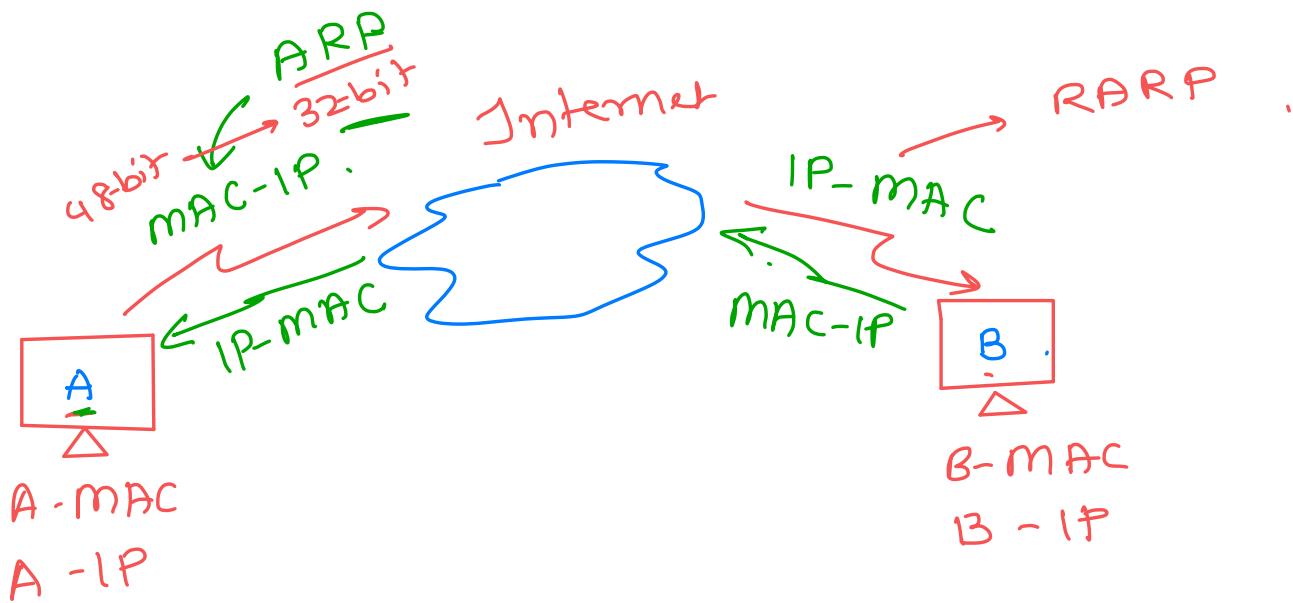
Address Resolution Protocol (ARP)



Address Resolution Protocol (ARP)

Reverse ARP (RARP)

MAC - Physical
IP - Logical.



ARP

- Address resolution refers to the process of finding an address of a computer in a network.
- The address is "resolved" using a protocol in which a piece of information is sent by a client process executing on the local computer to a server process executing on a remote computer.
- The address resolution procedure is completed when the client receives a response from the server containing the required address.
- The job of the ARP is essentially to translate 32-bit addresses to 48-bit addresses and vice-versa



Design a N/w.

1. 100m range → twisted pair cable .
2. less costly → twisted ,
3. 25mbps → Ethernet .
4. wired type → LAN .

Network Physical Structure



Physical Structure

Type of Connection

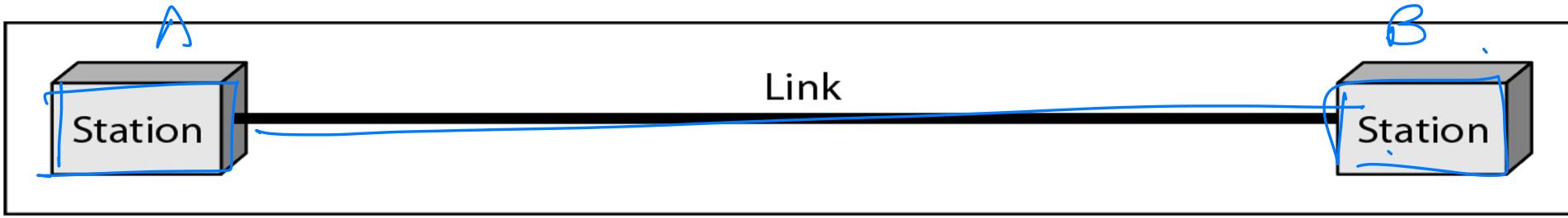
- Point to Point - single transmitter and receiver
- Multipoint - multiple recipients of single transmission

Physical Topology

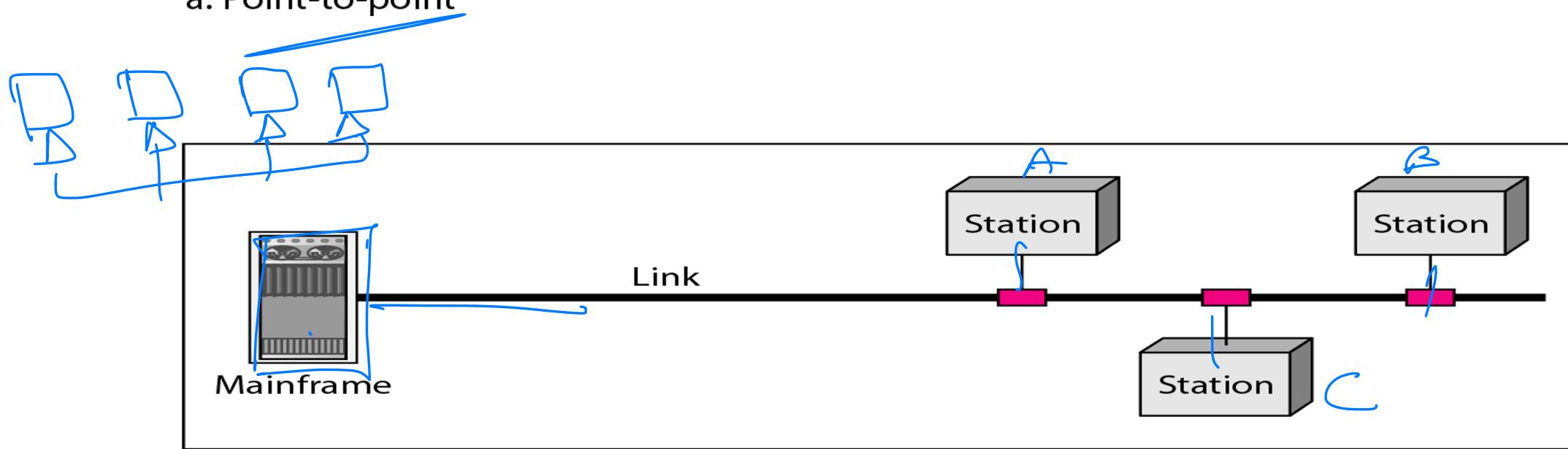
- Connection of devices
- Refers to the way in which a network is laid out physically
- The geometric representation of the relationship of all the links and linking devices (usually called nodes) to one another.
- **Type of transmission** - unicast, multicast, broadcast



Types of Connection



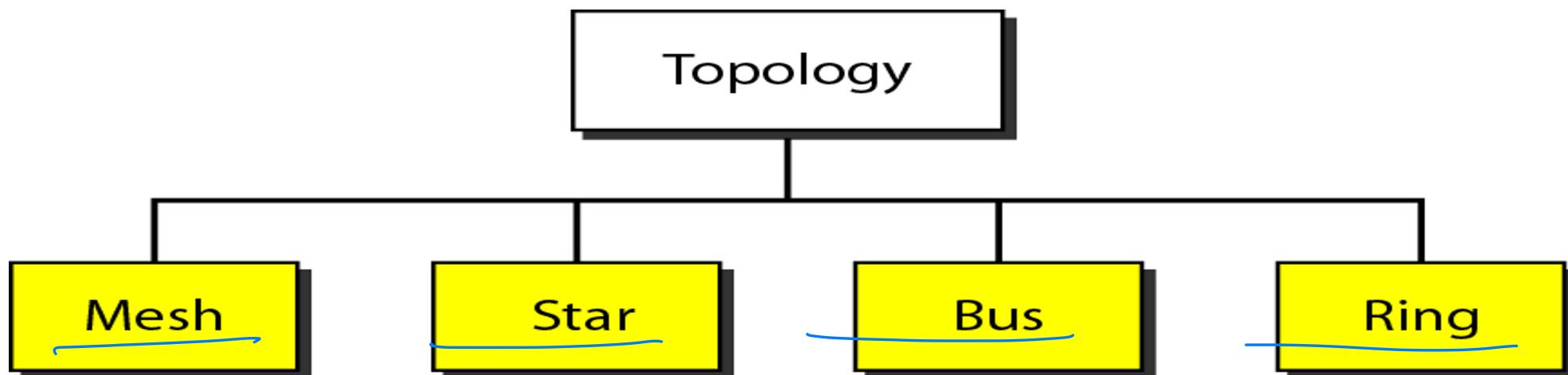
a. Point-to-point



b. Multipoint

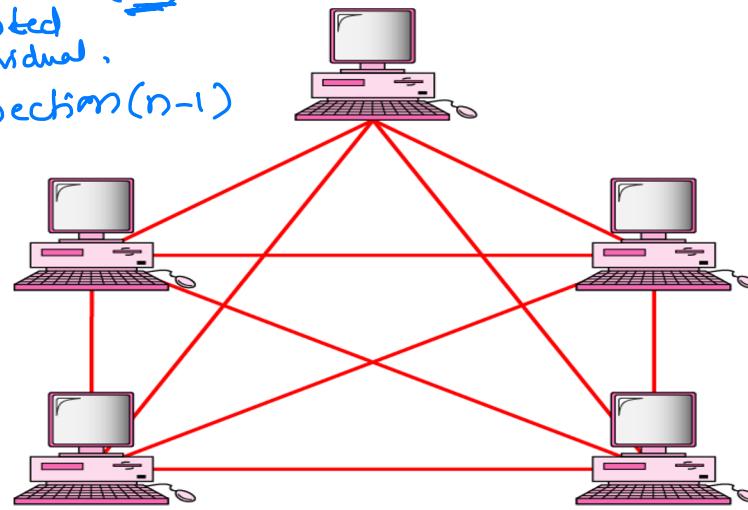
Physical Topology

- Topology defines the way hosts are connected to the network
- The network topology defines the way in which computers, printers, and other devices are connected.
- A network topology describes the layout of the wire and devices as well as the paths used by data transmissions.

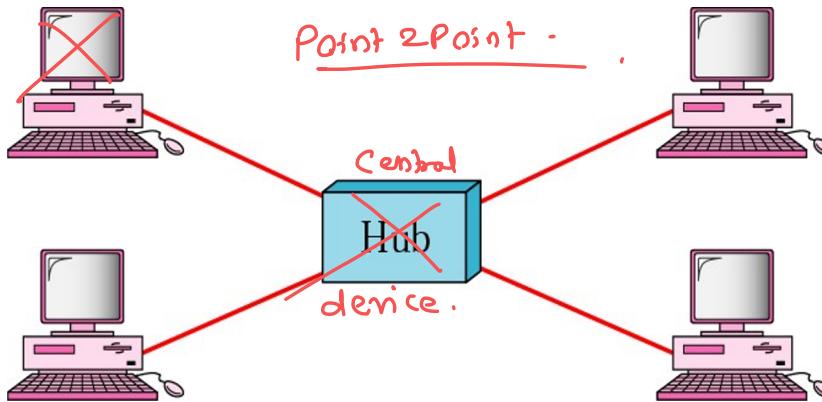


Network Topology

- S machine (n)
Connected
Individual.
- 4 connection ($n-1$)
- Costly
- P2P



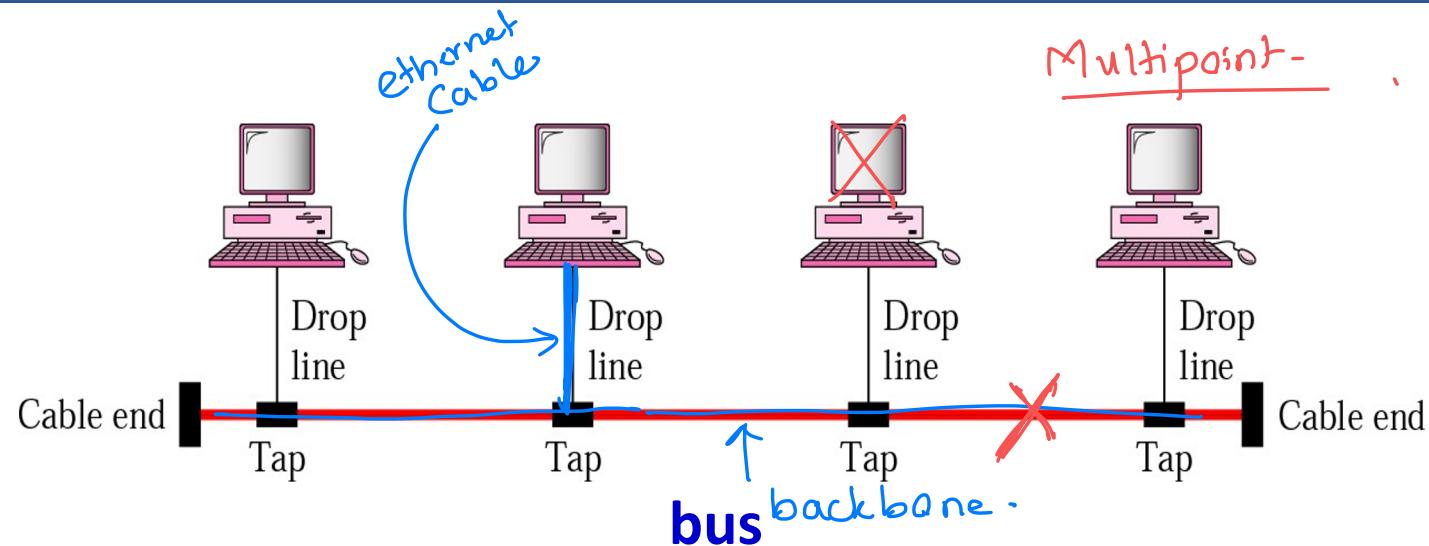
mesh



star

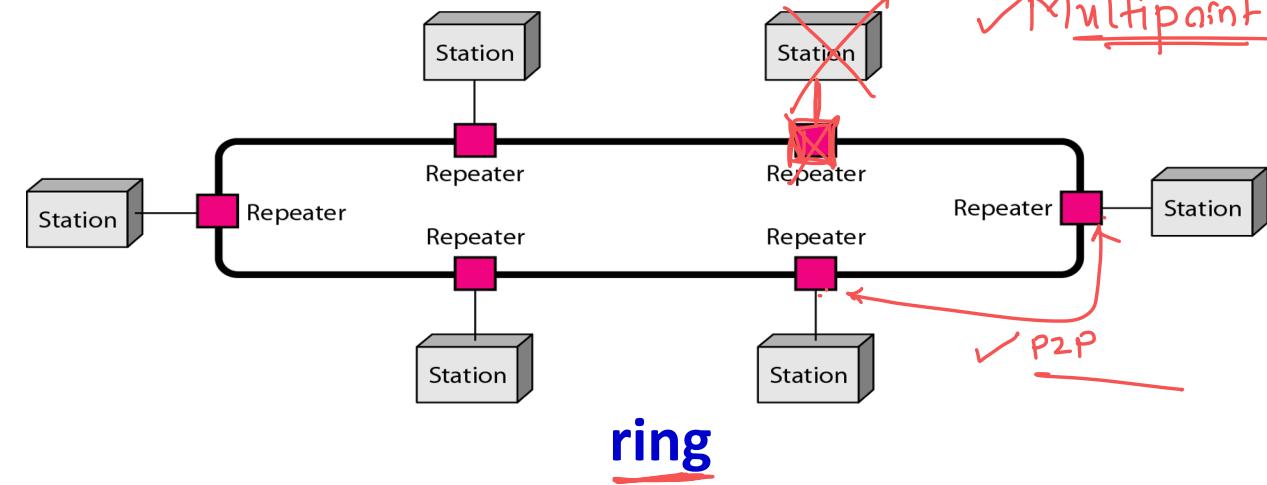
Point 2 Point -

Central
device.



bus backbone -

Multipoint-



ring

Multipoint

