Computer Network

- Computer Networking –(5 Marks) Questions → Section B.
- Computer Networking
  - Network
    - Centralized Computing, Decentralized Computing
    - Server-client, Cloud computing
  - Types of Network
    - LAN, WAN, WLAN, MAN, SAN,CAN
    - Mac Address
    - Switch and Router
    - Ethernet and Token Ring
    - Port Number
  - OSI Model →
  - IP Addressing → Classful. IP.

kg km/m.

Computer Network

- Common Protocols
  - ARP (Address Resolution Protocol)
  - IP (Internet Protocol)
  - TCP (Transmission Control Protocol)
  - UDP (User Datagram Protocol)
  - FTP (File Transfer Protocol)
  - DNS (Domain Name System)
  - HTTP (Hypertext Transfer Protocol)

Introduction

Computer Network

- A computer network is a system that connects two or more computing devices(node/ hosts/pc/machine) for transmitting and sharing information.
- The connections between computers in a network are made using physical wires or cables

Node

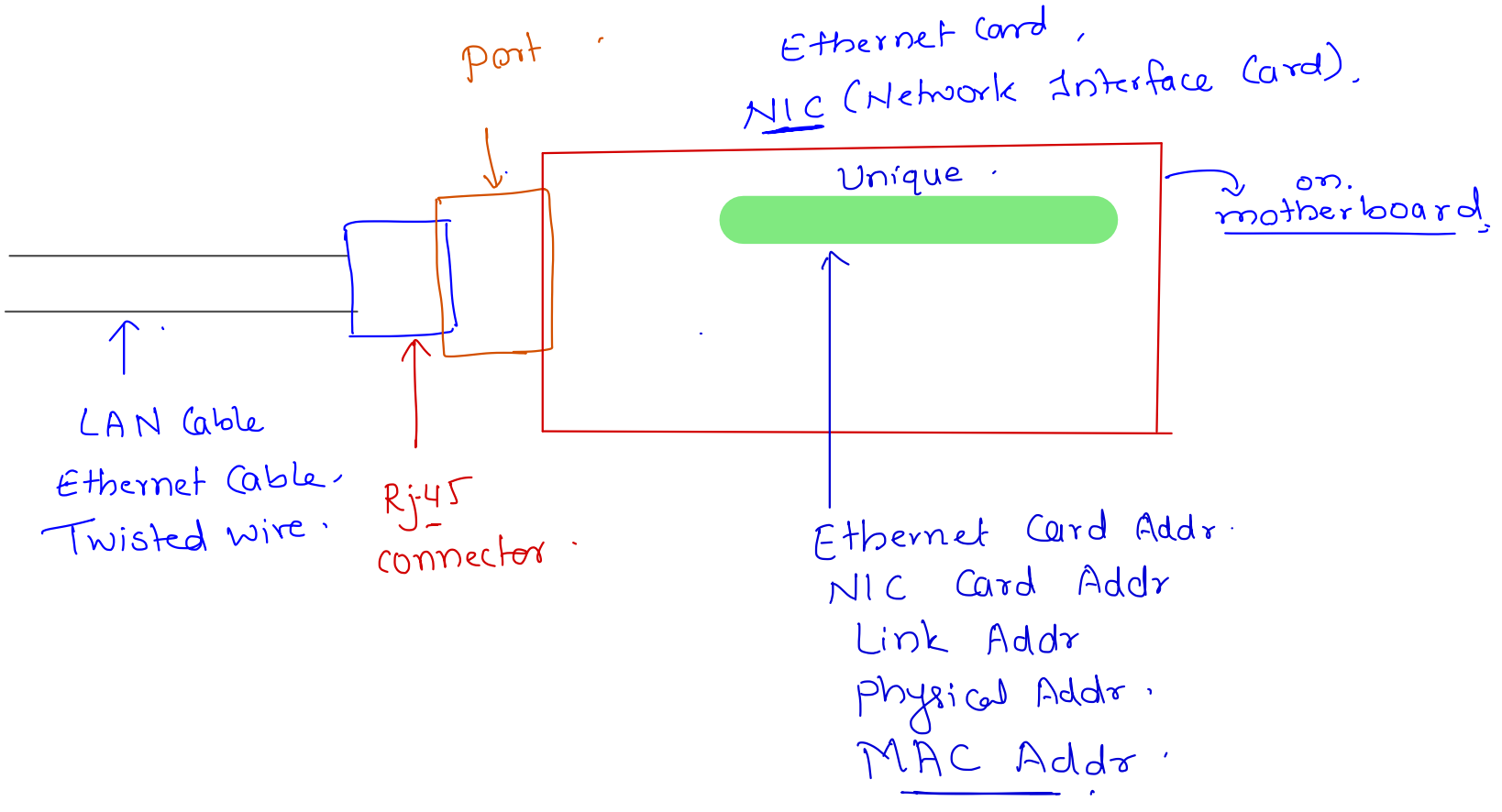
- Any devices connected to the network (a computer, a printer etc)

Data communication

- Data communications are the exchange of data between two nodes via same form of link(transmission medium) such as a cable.
- Data/Message/Packet/Frame/Information/Bits and Bytes /Payload / Segment

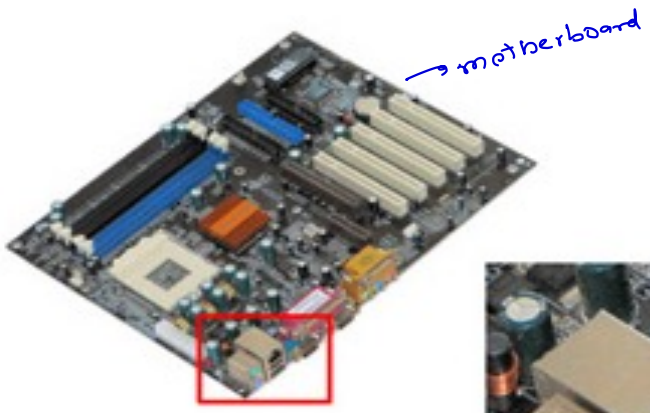
NIC- Network Interface card

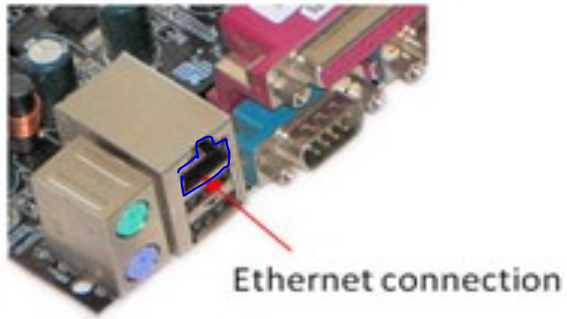
- NIC is the circuit board that is used to connect computers to the network.
- In most cases, this is an *Ethernet* card plugged in a computer's motherboard


Port
Ethernet Card
NIC (Network Interface Card)
Unique
on motherboard
LAN Cable
Ethernet Cable
Twisted wire
RJ-45
connector
Ethernet Card Addr
NIC Card Addr
Link Addr
physical Addr
MAC Addr

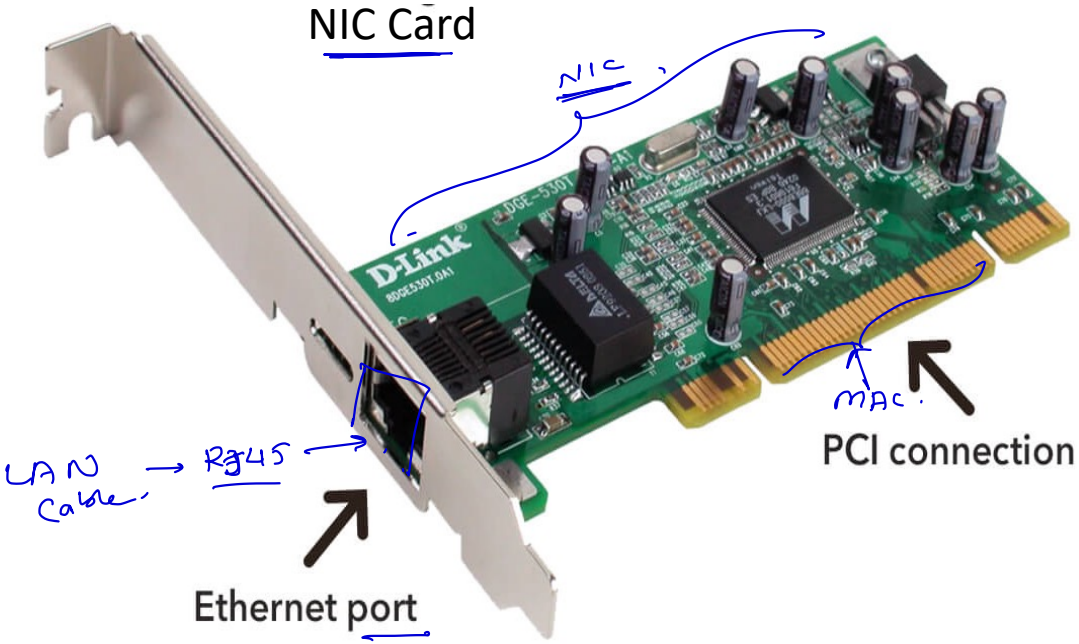
Computer Network

RJ-45 connector





NIC Card



Introduction

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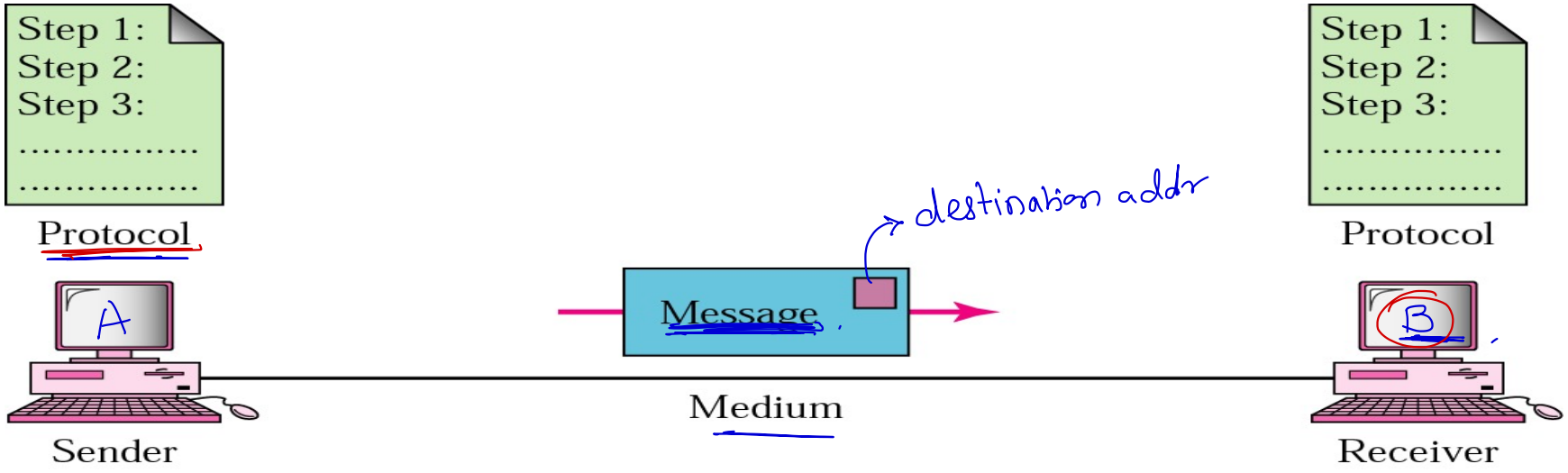
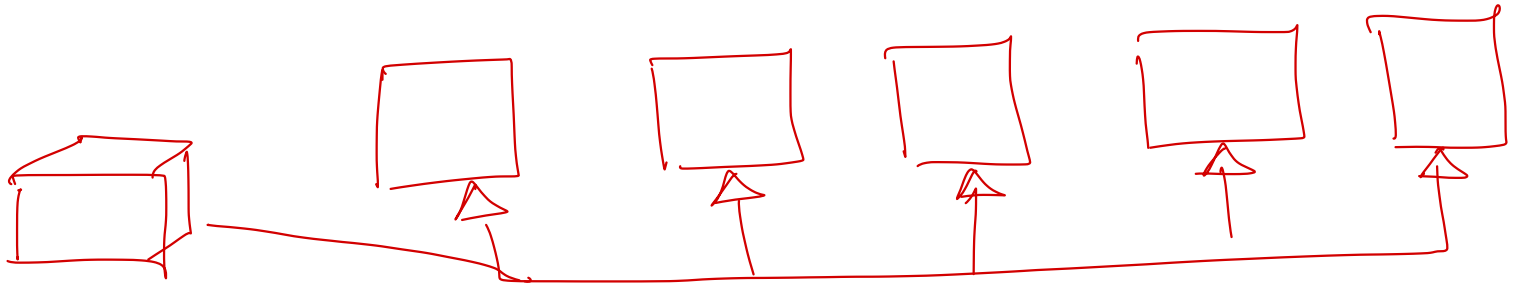


The effectiveness of a data communications system depends on four fundamental characteristics:
Delivery, Accuracy , Timeliness , Jitter(delay)

Need of Network/Applications of Network

- Information Sharing/File Sharing
- Enhance Communication
- Share Resources
- Remote Computing



Network Criteria

Performance

- depends on a number of factors, including the number of users, the type of transmission medium, the capabilities of the connected hardware, and the efficiency of the software.
- Measured in terms of Delay and Throughput.

Reliability

- is measured by the frequency of failure, the time it takes a link to recover from a failure
- Measured in terms of availability/robustness

Security

- Data protection against corruption/loss of data due to:
- Errors
- Malicious users / hackers

Performance-

8 devices Routers.

- 2 devices connections Router. ✓
- 6 devices Router.

Old machine.
OS
RAM 16MB.
HDD

New machine.
Lastest OS.
RAM 1GB.
HDD.
✓

Reliability . .

BANK 1 .

6 hrs . working .

11.00 am → Server down .

11.30 am → Server started , not .

30 min → Server down / working

5 hr 30 min → total working .

✓

BANK 2 .

6 hrs working .

11.00 am → Server down .

1 am → Server started .

2 hrs → Server down .

4 hrs → working .

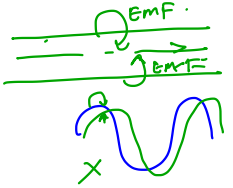
Transmission Medium.

Network.

- Wired / Guided
- Wireless / UnGuided, Air (EM).

distance, cost, appln.

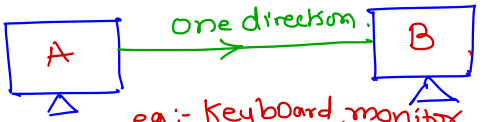
- Twisted wire / Category Cable (CAT)
  - 100m distance.
  - UTP, STP.
  - less costly.
  - eg:- Telephone line.
- Co-axial.
  - 1km distance
  - eg:- Cable TV.



- Optical fiber :→ light.
  - long distance
  - costly
  - eg:- JIO, Airtel Xtream, Tata.

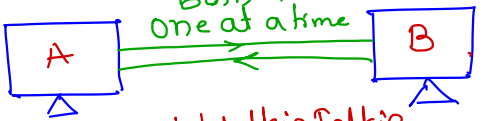
Transmission Mode / Data flow directions.

1. Simplex.



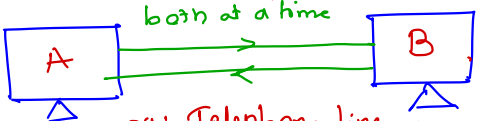
eg:- Keyboard, monitor.

2. Half-Duplex.



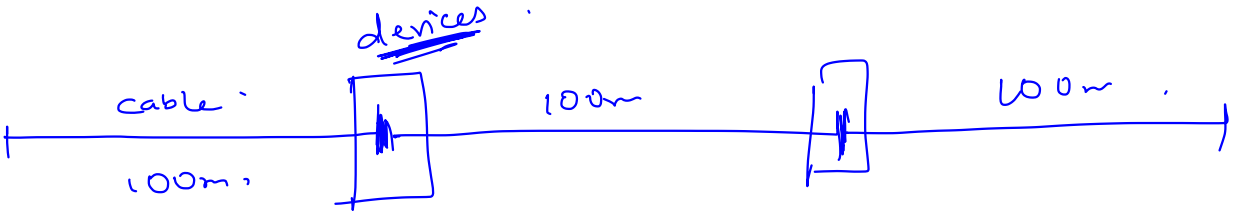
eg:- Walkie Talkie.
Fax.

3. Full-Duplex.



eg:- Telephone line.

twisted — 100m.



100m → twisted,

1km → Co-axial.

Network Types

Wired

Medium

- Wire / Cable

Cable Types

- co-axial
  - transfers the data in the form of electrical signals
- CAT Cable / Twisted Pair Cable (STP/UTP)
  - transfers the data in the form of electrical signals
- Fiber Optics
  - transfers the data in the form of light
  - Minimum 10gbps

Types

- LAN , MAN , WAN

- cat1 : - [it was used only for telephony network]
- cat2 : 1 mbps
- cat3 : 10 mbps
- cat4 : 16 mbps
- cat5 : 100 mbps
- cat5e: 125 mbps
- cat6 : 1000 mbps ~ 1 gbps
- cat7 : 10000 mbps ~ 10 gbps
- cat8 : 25000 mbps ~ 25 gbps

Wireless

Medium

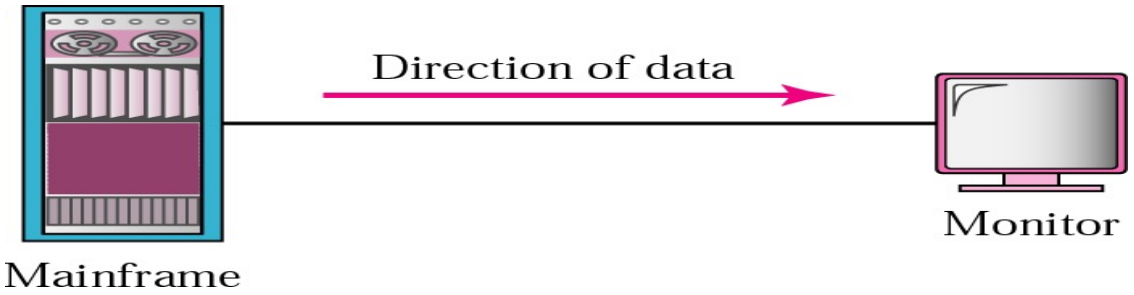
- Air (EM Waves)

Cable Types

- PAN
- WLAN
- WAN (GSM)

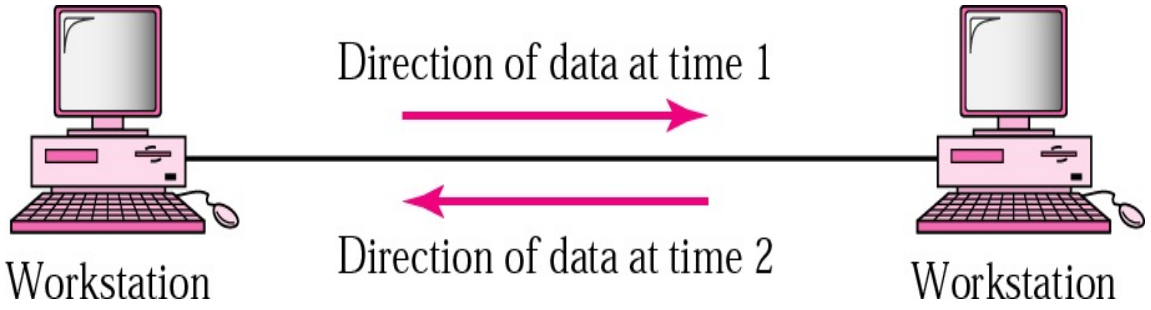
Transmission Medium(Media)

Transmission Modes / Data Flow Direction



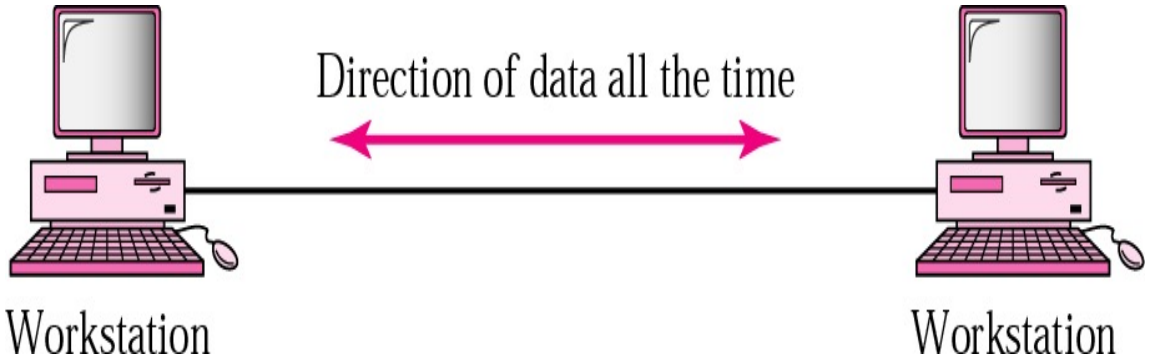
Simplex Mode

- Example: Keyboard and traditional monitors.



Half Duplex Mode

- each station can both transmit and receive, but not at the same time.
- Example: Walkie- talkie



Full Duplex Mode

- Example: Telephone Network there is communication between two persons by a telephone line, through which both can talk and listen at the same time.

Transmission Medium

Types of Transmission Medium

Wired/Guided

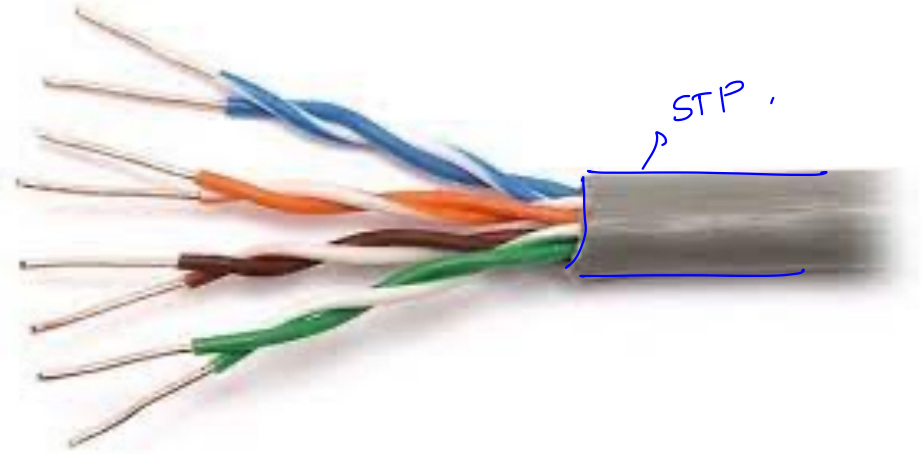
- Transmitted data travels through cabling system that has a fixed path.
- For example, copper wires, fibre optic wires, etc.

Wireless/Unguided

- Transmitted data travels through free space in form of electromagnetic signal.
- For example, radio waves, lasers, etc

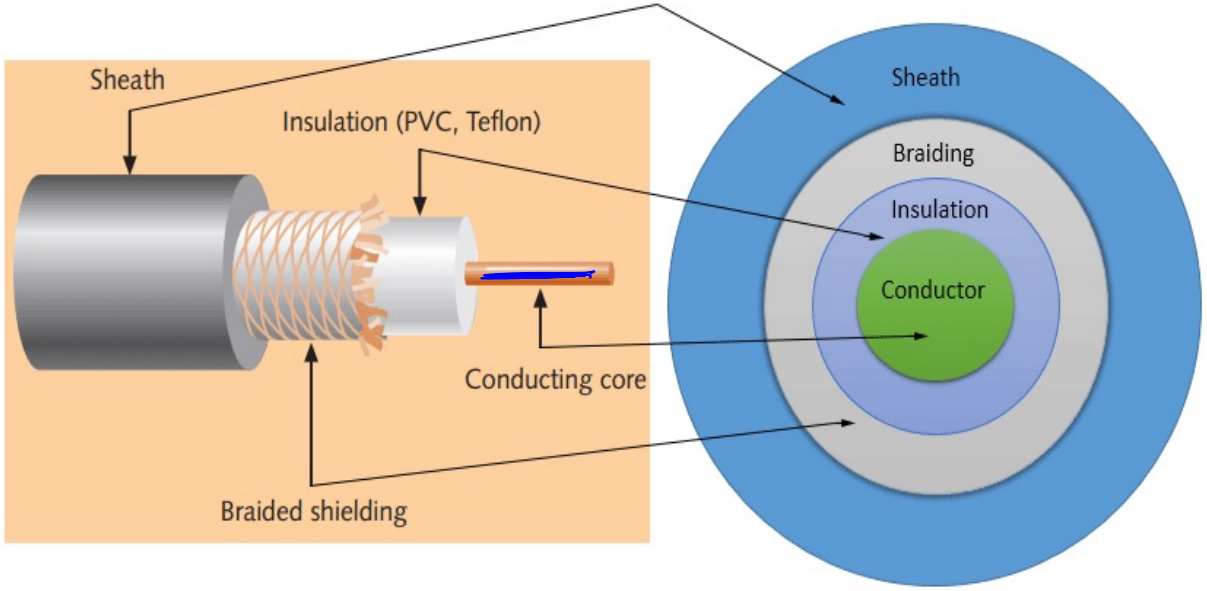
Twisted Pair (maximum length of 100 meter)

- Most common wires used for transmitting signals.
- To reduce this electromagnetic interference, pair of copper wires are twisted together.
- Shielding twisted pair cable
  - To counter the tendency of twisted pair cables to pick up noise signals, wires are shielded .
  - Such twisted pairs are called **shielded twisted pair (STP) cables**.
- The wires that are not shielded but simply bundled together in a protective sheath are called **unshielded twisted pair (UTP) cables**.



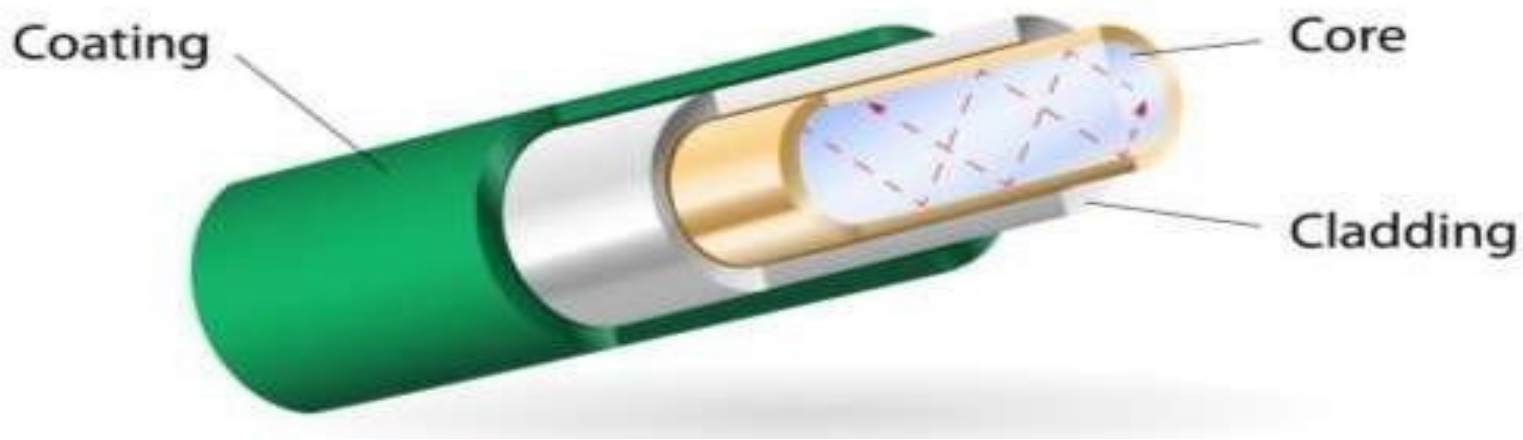
Coaxial Cable

- Coaxial cables are widely used for **cable TV** connections and **LANs**.
- **Coaxial cables** are copper cables with better **shielding** than twisted pair cables.
- Transmitted signals may travel **longer distances** at higher speeds.
  - e.g. 1 to 2 Gbps for 1 Km cable
- Can be used for both analog and digital signals
- Inexpensive as compared to fiber optic cables
- Easy to install and maintain

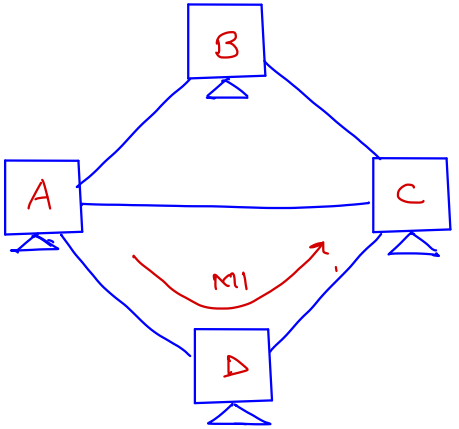


Optical Fiber

- Thin glass or plastic threads used to transmit data **using light waves** are called **optical fiber**.
- Signals carrying data can travel long distances without weakening
- Immune to electromagnetic interference , Suitable for industrial and noisy areas
- Three Layers:
  - **Core** made of high quality **silica glass** or **plastic**
  - **Cladding** made of high quality **silica glass** or **plastic**, with a lower refractive index than the core
- Protective outer covering called **buffer**



best path to transmit data → Switching



C A M1

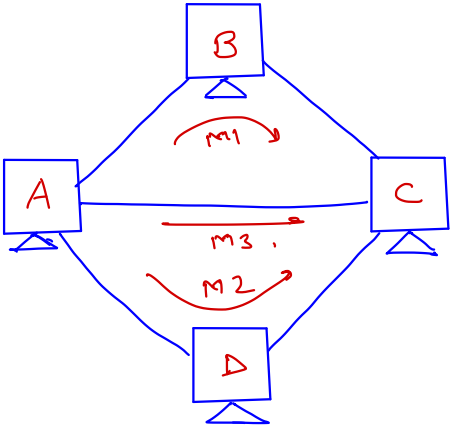
C → destination
A → Source
M1 → Message

(a) Circuit switching

① Est Connect
② Data transmit
③ disconnect

eg:- Telephone lines.

dedicated path.



(b) Message Switching

C A M1

decided path ✗

eg:- SMS

160 character

Message → 200

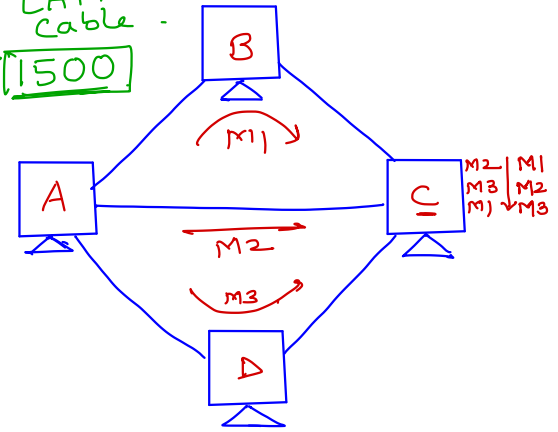
M1 → 160

M2 - 40

Ethernet

LAN Cable

1500



(c) Packet Switching

C A M → 3500

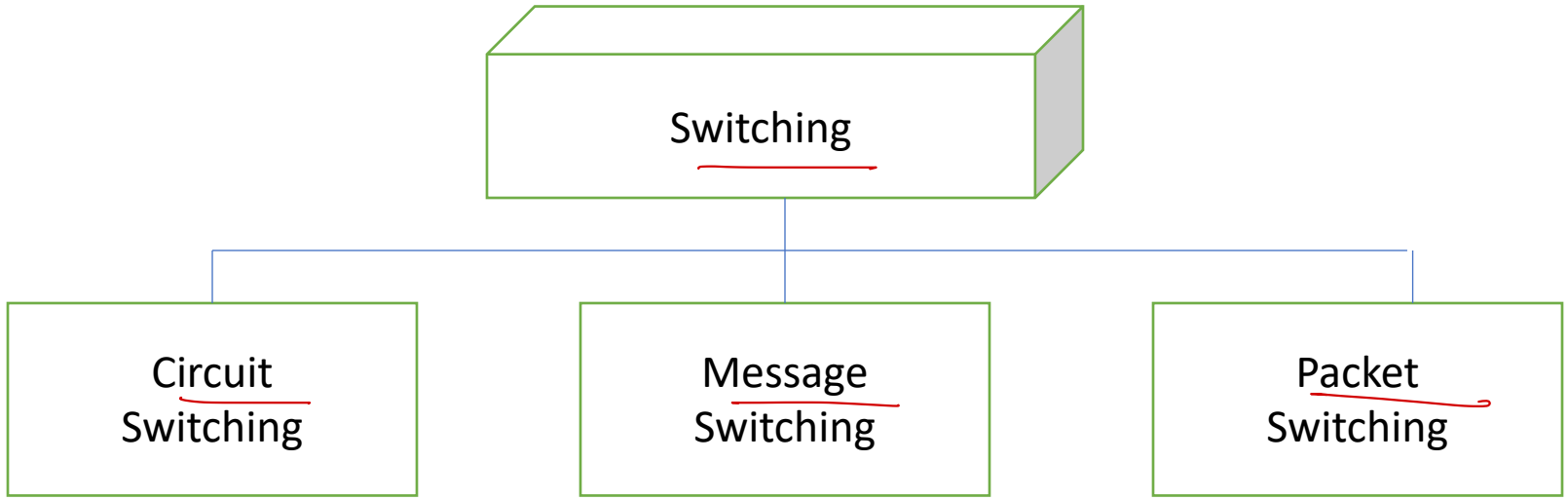
st	C A M1	2

2	C A M2	3

3	C A M3	end

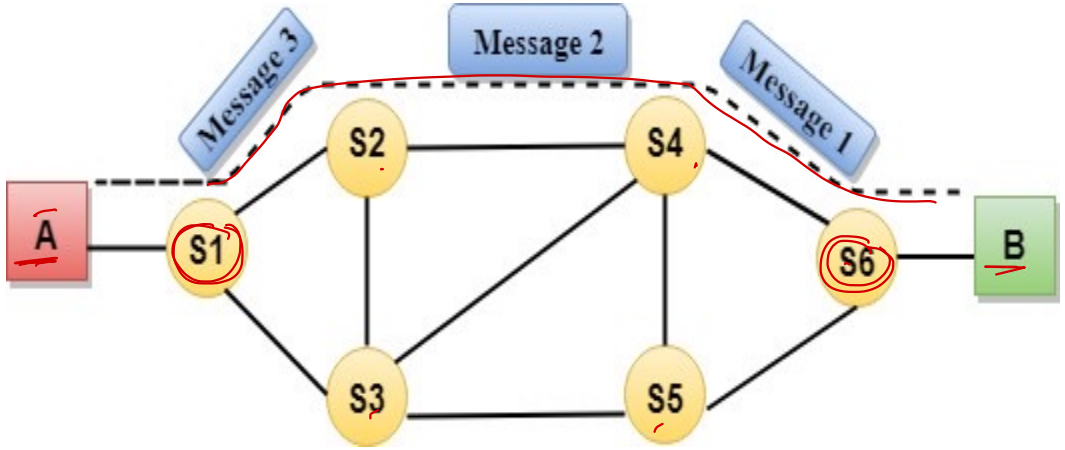
Switching

- 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.



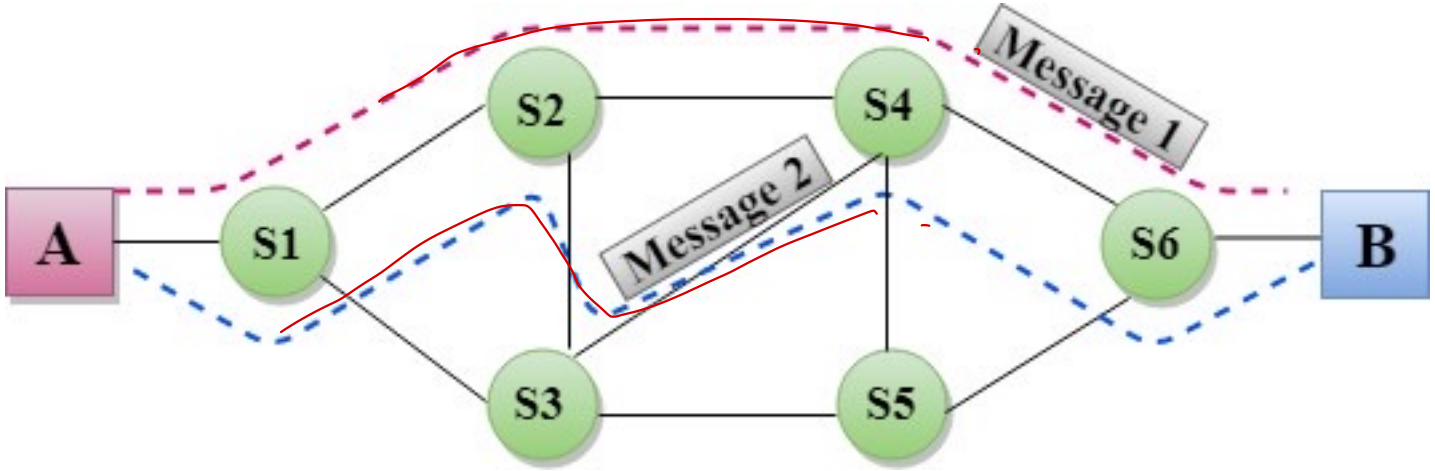
Circuit Switching

- 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



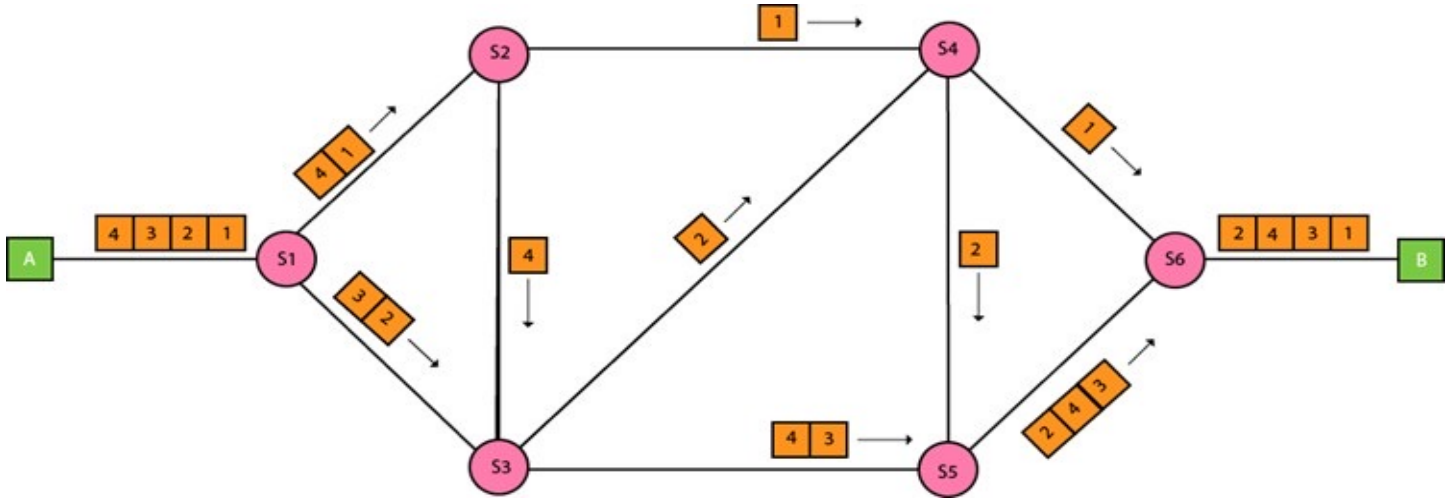
Message Switching

- 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



MUX

many i/p to one o/p.

Demux.

one i/p to many o/p.

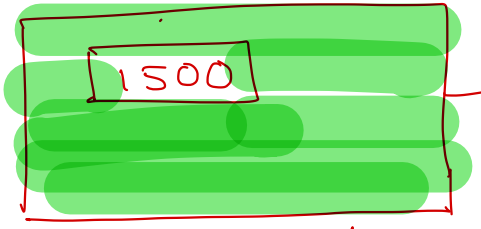
Multiplexing

TDM → Time.

FDM → Frequency.

LAN Ethernet → 1500

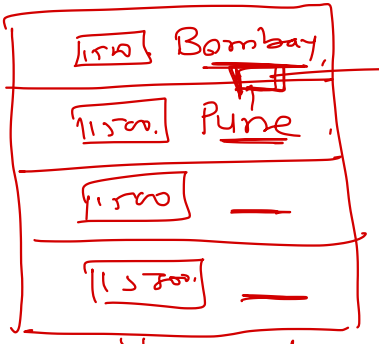
FDM & TDM → Digital.
→ Synch.



→ waste ⇒ FDM → analog

Channel/Bandwidth.

98.3



→ guard band.

Channel/Band.

TDM

timeslot.

Frame

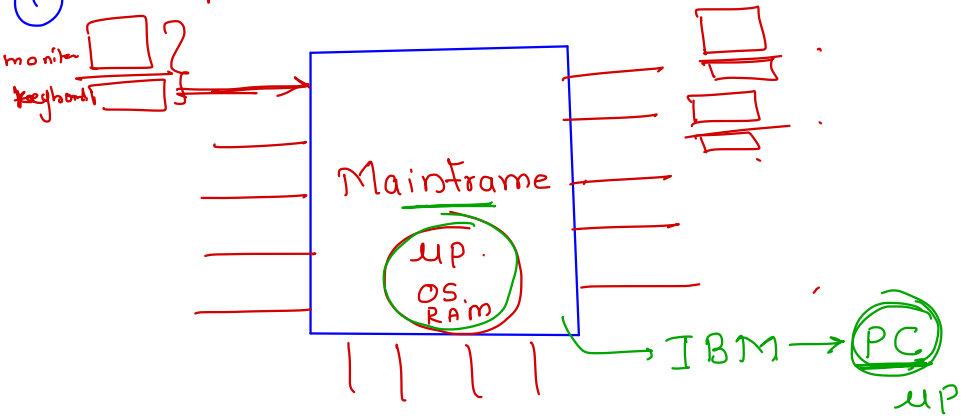
TDM v/s FDM

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

History of N/W.

25/50 user.

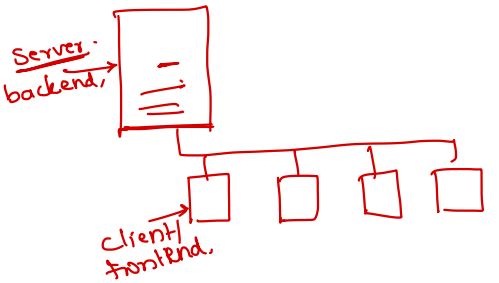
① dump.



Centralization.

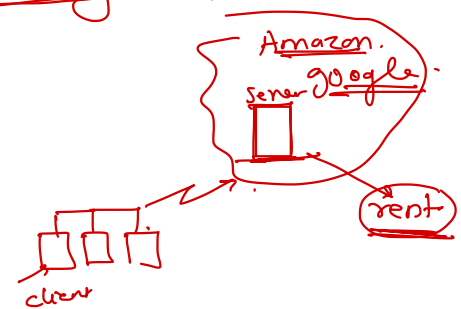
μP → Intel
HDD → Seget.

③

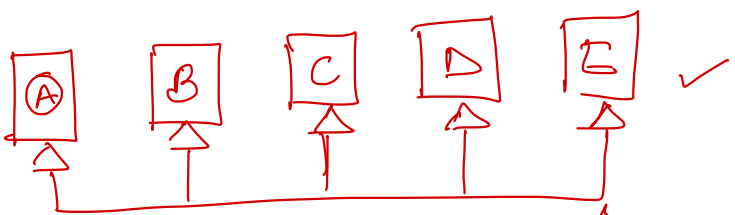


Server - Client/
client server model

④ Clouding Computing.



②



De-centralization/peer to peer/
multipoint

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

QUIZ

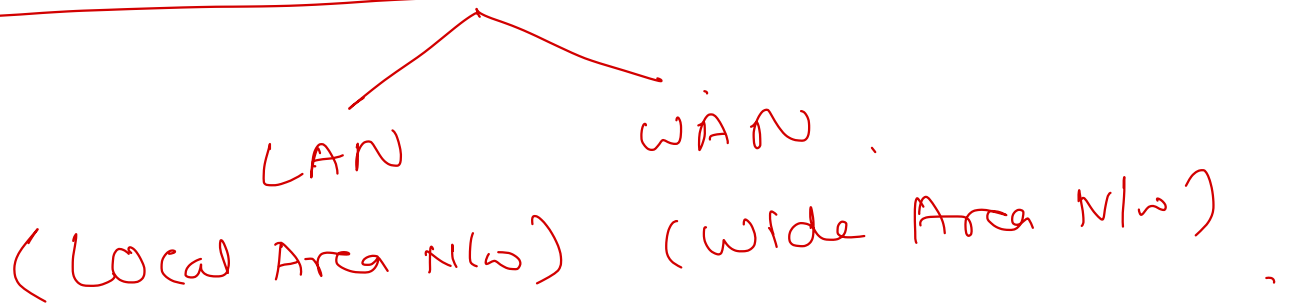
6. Which multiplexing technique is used to transmit digital signals?
a) FDM
b) TDM
c) WDM
d) FDM & WDM

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

Network Classification

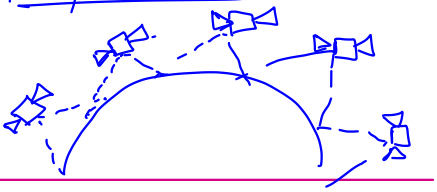


Network Classification.

- LAN
  - CAN – Campus Area N/w → eg:- Sunbeam Organization.
  - MAN – Metropolitance Area N/w → eg:- Cable TV.
  - PAN
    - Personal Area N/w.
    - Private Area N/w / Virtual Area N/w. (VPN).
  - SAN.
    - Storage Area N/w.
    - Server Area N/w..
- WAN
  - GAN – Galaxy Area N/w.

LAN WAN.

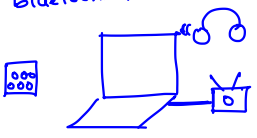
Galaxy Area N/w.



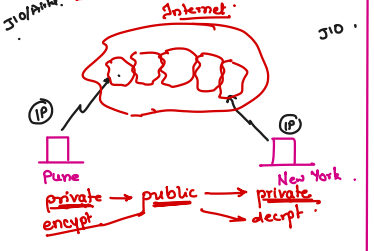
Personal Area N/w.

eg- Home.

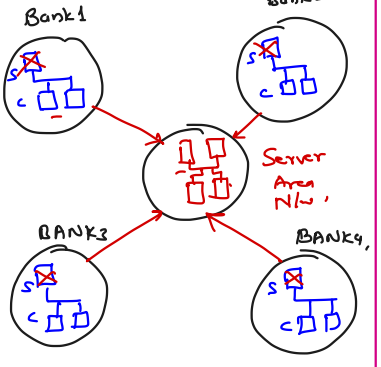
bluetooth.



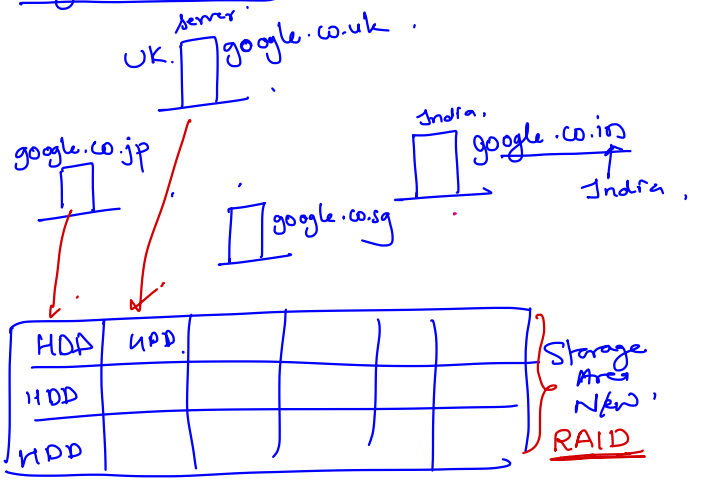
Private Area N/w / Virtual Area N/w.



Server Area N/w.



Storage Area N/w.

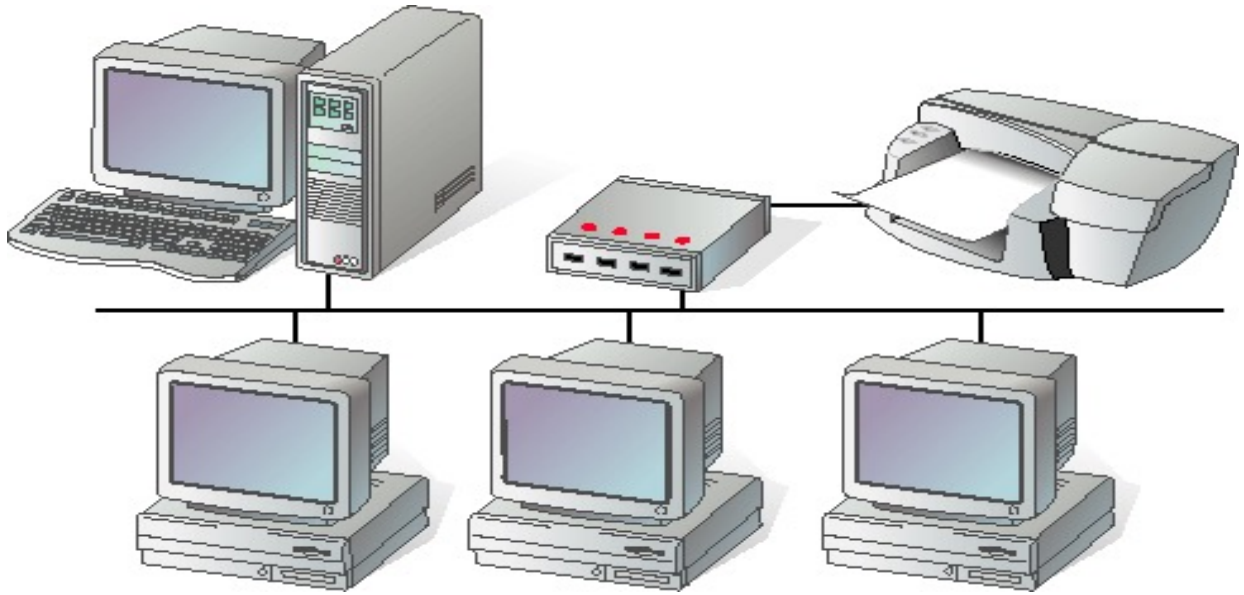


Network Classification

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

- **Token Ring (Not used)**

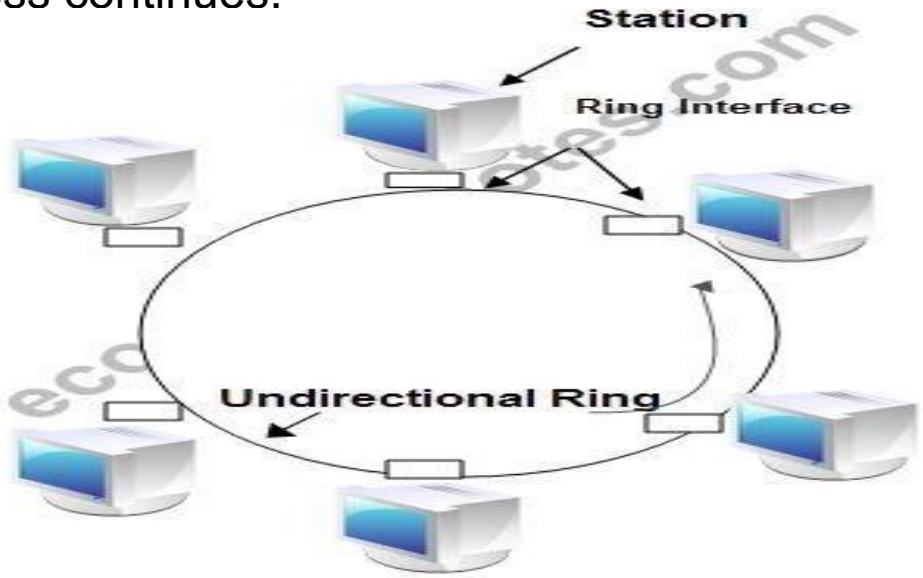
- Its copy write by IBM.
- It is a data link technology for local area networks (LANs) in which devices are connected in a star or ring topology.
- It was designed by only IBM PCs with 4mbps they increased upto 16mbps.

- **Ethernet (Used)**

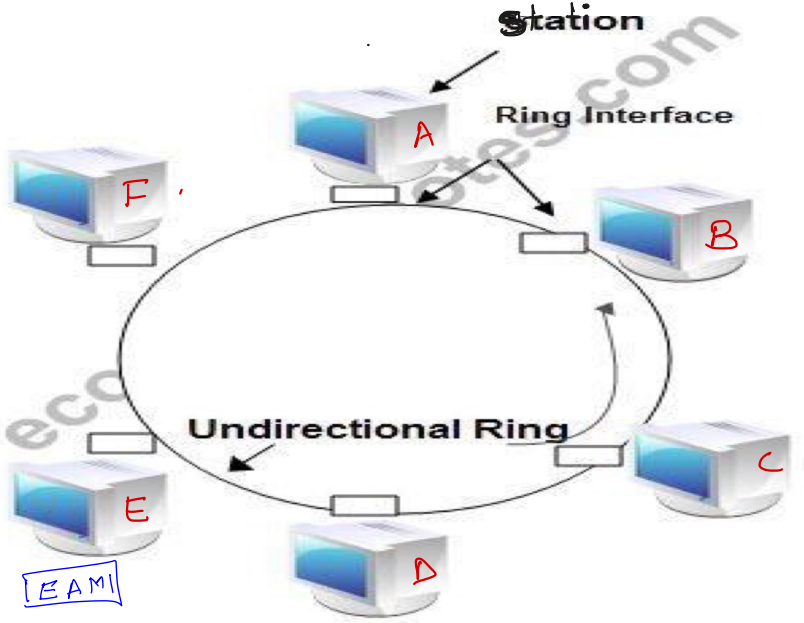
- It belongs to IEEE
- Its autonomous
  - 10mbps (Ethernet),
  - 100mbps (fast Ethernet)
  - 1Gbps (Gigabit Ethernet)
  - 10gbps (10 gig Ethernet)
  - 100gbps (100 gig Ethernet)
  - LRE (Long Range Ethernet)

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.



A Ring Network


Station
Ring Interface
A
B
C
D
E
F
Undirectional Ring
TEAM

Token Ring

- A Token–Ring network is a local area network topology that sends data in one direction throughout a specified number of locations by using token
- This token allows any sending station in the network (ring) to send the data when the token arrives at the location
- This topology was designed by IBM and it uses Token-Ring passing method
  - Only one node with token can talk
  - Traffic can flow clockwise, anti-clockwise or bi-directional
  - There is IEEE standard 802.5 which is Token Ring standard