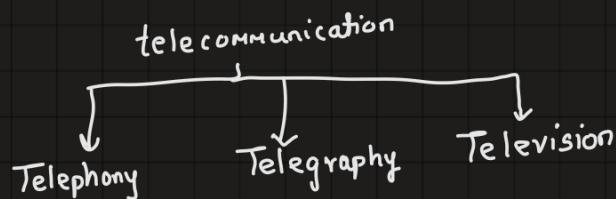


VI>

Data → information presented in whatever agreed form by all parties creating and using data.

Communication: Sharing information/exchange of information from sender party to receiver party.



Data Communication:

- Exchange of data between 2 or more devices via some form of transmission medium.
- Communication system is made of combination of hardware and software.

Effective ness depends on following 4 characteristics:

→ Delivery

- data should be delivered to the intended device and only by the intended user/device

→ Accuracy

- System must deliver data accurately.
- message altered and uncorrected is unusable.

→ Timeliness

- Message must be delivered in a timely manner.
- In case of video/audio, timely delivery means delivering as soon as produced, in same order, without significant delay.
- This kind of delivery is called as real time transmission.

Characteristics

- . Delivery
- . Accuracy
- . Timeliness
- . Jitter

- Jitter:

- uneven delay in delivery of audio/video packets.
- variation in packet arrival time.

Data Communication System:



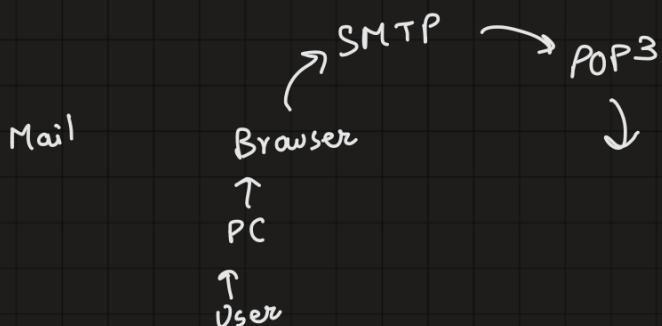
- Message
- Sender
- Receiver
- Transmission Medium
- Protocol

Message
↓
Info to be communicated

Sender
↳ Initiates the communication
↳ Computer, workstation, telephone handset, etc.

Receiver
↓
Device that receives
e.g.

Transmission Medium:
↳ Physical path by which a message travels from sender to receiver.
↳ e.g. coaxial cable, fibre optic, radio waves.



Q. Read about TCP Handshake?

Q. What happens to Email sent to wrong address?

Email daemon

↳ Sends notification that address incorrect/ not received by receiver.

Protocol

- ↳ Set of rule that govern data communication.
- ↳ without protocol, two devices might be connected but not communicating.
- represents an agreement between the communicating devices.

Protocol functions:

- Data Sequencing
 - defines method of numbering of packets to detect loss / duplication of packets and to correctly identify packets belonging to message.
- Breaking a long message into smaller fixed size packet.
- Data Routing
 - Most efficient path between source and destination.
 - ↳ How to route your data.
- Data formatting
 - which group of bits or characters within packet constitute data, control, addressing, or other information.
- Flow control
 - ↳ Prevents a fast sender from overwhelming a slow receiver.
 - It ensures resource sharing and protection against traffic congestion by regulating flow of data on communication lines.
- Error control
 - rules designed to detect error in messages & to ensure retransmission of correct data.
- Precedence and order of data.
- Connection establishment and termination.
 - ↳ necessary to avoid deadlocks.
- Data security
 - ↳ preventing unauthorised access.
- Log information

Protocol Functions

- 1) Data Sequencing
- 2) Data Routing
- 3) Data Formatting
- 4) Flow Control
- 5) Error Control
- 6)

Data Representation

Data Representation

Text
Numbers
Images
Audio
Video

1. Text

↳ represented in bit pattern

American Standard Code for Information Interchange (ASCII)

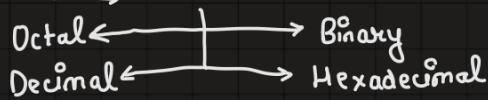
Read from
forouzan book

2. Numbers:

↳ also represented by bit patterns.

↳ Number directly converted to binary
for easier calculation.

↳ Numbers



remember
values for
A-z ,a-z , 0-9 ,
Space , DEL , RETURN
key .

3. Images

→ Matrix of Pixels, each pixel is a small dot.

→ Size of pixels decides the resolution.

→ Grayscale image

00 - Black
11 - White
01 → dark gray
10 → light gray

} pixels

Bits per pixel (bpp)	No. of colors
1	2
2	4
3	8
4	16
5	32
6	64
7	128
8	256

→ Methods to represent color:
rgb → Red Green Blue
ycm → Yellow, Cyan, Magenta

4. Audio:

↳ It is continuous, not discrete.

5. Video:

↳

Data flow

- 1) Simplex
- 2) Half duplex
- 3) Full duplex

- 1. Simplex
- 2. Half duplex
- 3. Full duplex

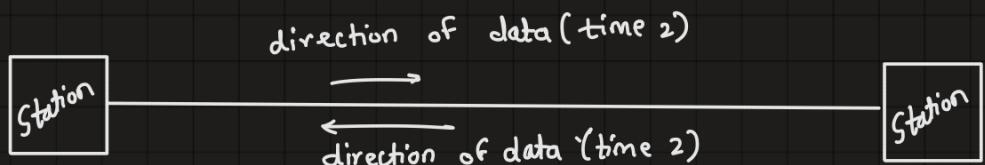
1) Simplex

↳ Sending information one way.

↳ Only works for one way communication.

2. Half duplex.

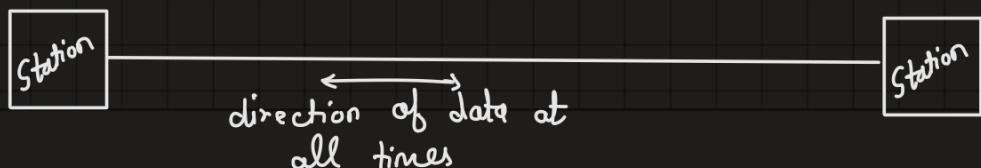
→ Each can transmit data (send/receive) but not simultaneously



- Walkie talkies and Citizens band radios (e.g. of half duplex).
- Used when no need of communication at same time.

Full Duplex:

→ transmission is simultaneous



* Most important concept of Data communication system → Message.

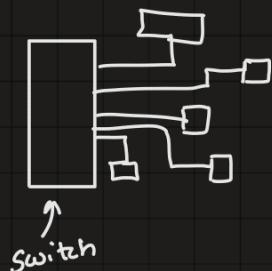
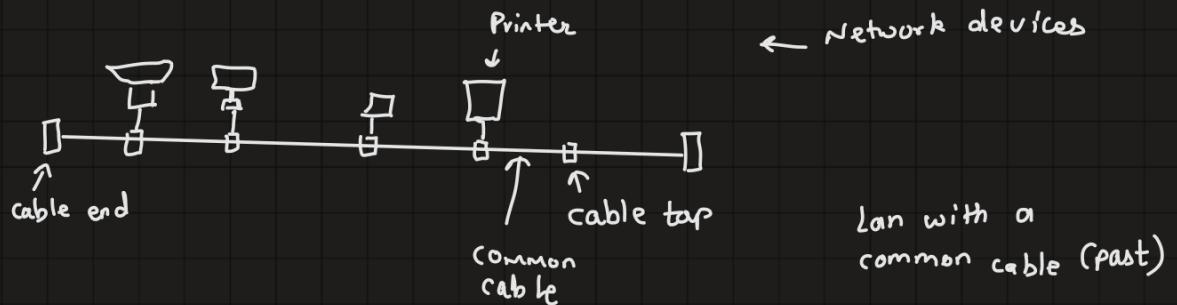
Network Categories

- 1) LAN
- 2) WAN

1) LAN

→ Local Area Network

→ LAN size is limited to a few kilometers.

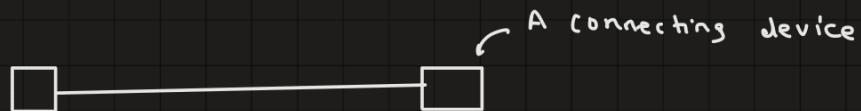


Topologies:

- 1) Bus
- 2) Ring
- 3) Star

→ Early LANs had speed of 4-16 Mbps; Nowadays its about 100-1000 Mbps.

Wide Area Network (WAN):



Point to Point WAN



A switched WAN

3) Metropolitan Area Network:

- Bigger than WAN

Topology

way in which network is laid out physically.

- 1) Mesh
- 2) Star
- 3) Bus
- 4) Ring

1) Mesh

• Each node connected to every other node.

Adv:

- Robustness
- Each connection carries its own data load, separate data lines.

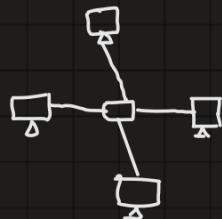
Disadvantage:

- Costly, expensive

3) Star topology

- Each device has a central controller called Hub.

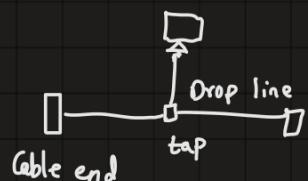
Adv: Robust



□ - hub

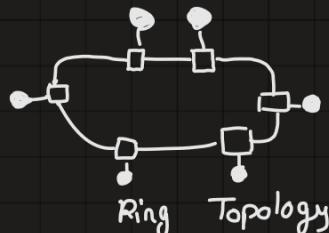
■ - Networking device

4) Bus Topology



Drop line - Connection running between computer & main cable.

Ring Topology :→



• has repeater → to ~~strengthen~~ amplify/strengthen the signal.

- - Workstation
- - Repeater

If there are 20 machines, you won't be using bus topology, because of signal dying out without reaching intended recipient due to huge no of taps.

Disadvantage:

→ Unidirectional traffic

→ In a single ring, a break in the ring can disable entire network.

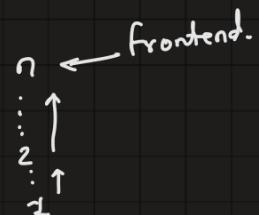
→ The weakness can be solved by using a dual ring or a switch capable of closing off the break.

Hybrid topology:

Protocol Layering:

23/03/2023

Layer 1: Usually Physical Layer.



Layer 2:

Layer n: Usually front Layer.

OSI Model

OSI Model

- 1) Application
- 2) Presentation
- 3) Session
- 4) Transport
- 5) Network
- 6) Data Link
- 7) Physical



Open Systems Interconnection (OSI) model

* How does sending email work?

Protocols & steps.

[IMP]

TCP/IP

- Transmission Control Protocol / Internet Protocol



Network Layer → Router (Layer 3)
Data link Layer → Switch (Layer 2)

* Logical connection between layers of the TCP/IP protocol suite.
(switch Diagram).

Layer 1)

Physical Layer

- II - for sending bits of data in frame

Layer 2)

Data link

→ Responsible for taking datagram and moving across best available link

→ takes datagram and encapsulates it in a packet called frame.

Layer 3)

Network Layer:

→ Creating connection between source and destination.

→ Includes ① Internet Protocol (IP)

② Internet Control Message Protocol (ICMP)

③ Internet Group Message Protocol (IGMP)

④ Dynamic Host Configuration Protocol (DHCP)

4) Transport Layer :

→ encapsulates packet in segment

→ Protocol :

TCP → Connection Oriented Protocol

UDP → Message Oriented Protocol (Connectionless Protocol)

SCTP → Stream Control Transmission Protocol

Used for streaming multimedia .

5) Application Layer :

→ Process to process communication is duty of application layer.

Protocols :

HTTP → A vehicle for accessing web .

SMTP

FTP

TELNET

SSH

SNMP

DNS

Encapsulation &
Decapsulation of
data