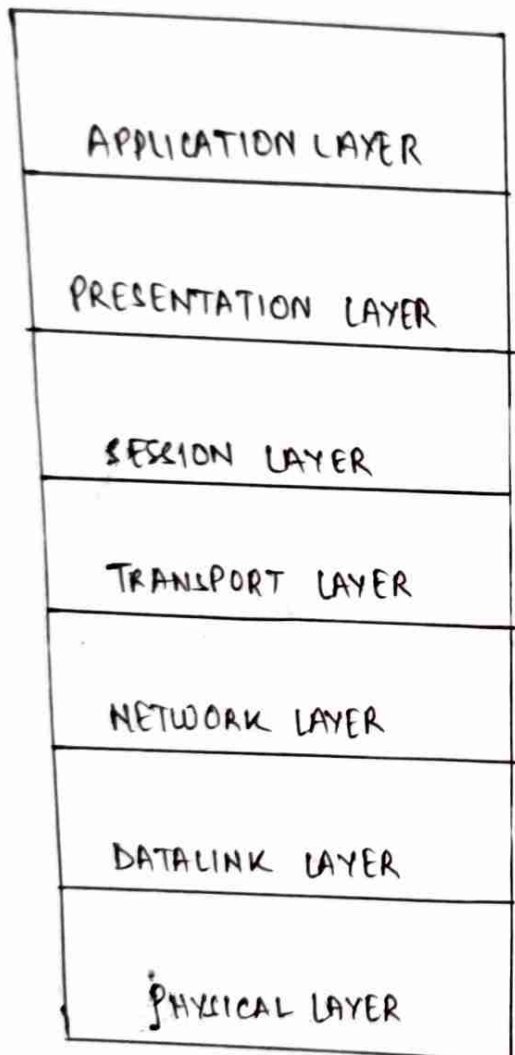
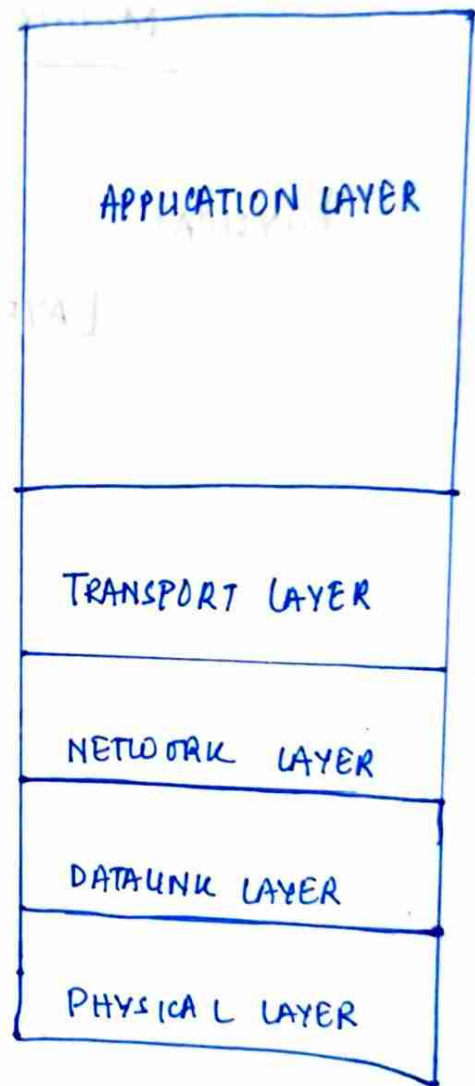


Each layer will be discussed thoroughly!!!



(ISO/OSI Model)



(TCP/IP Model)

CHAPTER-1. Data Communication and Computer Networks

- Computer network is a **telecommunication network** which allows **autonomous digital devices** to **exchange data** b/w each other using either **wired or wireless** connection to **share resources** interconnected by a single technology e.g. **internet**.

Goals of Computer Network

- a) **Facilitating Communication**: swift and efficient comm. b/w indiv. and organisation.
- b) **Resource sharing**: Allows user to share hardware and software resources.
- c) **Data Storage and Access**: Centralized storage systems that allows data access from any connected device.
- d) **Cost efficiency**: Reduces costs by sharing resources and avoiding duplication of hardware and software.
- e) **Reliability and Redundancy**: Enhances reliability through alternate paths and redundant systems in case of failures.

Application of Computer Application

- Business and Commerce - E-commerce, online banking, stock trading etc.
- Education - Virtual classrooms, Ed-tech, online exams etc.
- Healthcare - Telemedicine, electronic health records, patient monitoring etc.
- Government Services - Online public services, secure comm., E-governance.
- Entertainment - Online gaming, streaming services etc.
- Scientific research - facilitate data sharing and collaboration on research.
- Travel and Hospitality - Online ticket Booking, hotel reservation, GPS and navigation services etc.

1. Data Communication

- exchange of data between two devices via some transmission medium.

• components are :-

- Message** - information to be communicated e.g text, audio and video.
- Sender** - device who sends the message.
- Receiver** - device who receives the message.
- Transmission medium** - physical path with which message travels from sender to receiver.
- Protocol** - includes syntax, semantics, timing, de-facto, de-jure.

- Transmission mode

- Simplex Mode** - unidirectional (one device always sends, the other always receives. (Radio))
- Half duplex** - each station can transmit and receive, but not at the same time. (Walkie-Talkie)
- Full duplex** - both station can transmit and receive at the same time. Two half duplex connection. (Phone)

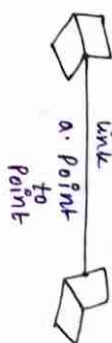
- Network criteria

- Delivery and accuracy** - delivering correct data to the correct destination without any error.
 - Performance** - can be measured in many ways including transmit time, response time, number of users, type of transmission medium, capabilities of connected hardware's and efficiency of software.
- Reliability** - measure of frequency of failure and time taken to resolve from the failure.

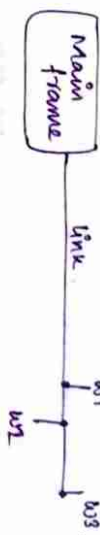
Security - includes protecting data from unauthorized access, protecting data from damage and development.

- Types of connection

- Point to point** :- provides a dedicated link between two devices. - we use actual length of wire or cable to connect two ends,



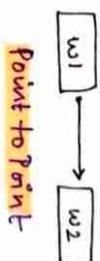
- Multipoint** :- provides two devices share a single link.



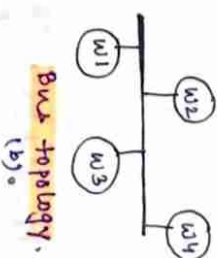
- Physical Topology

(network is laid out physically).

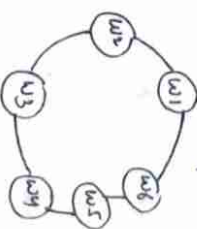
- geometric representation of relationship of all links and linking device to one another.



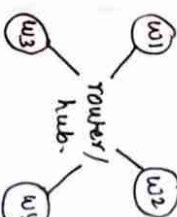
(a)



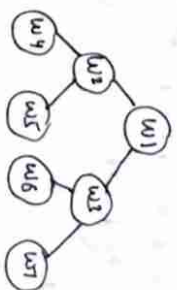
(b) Bus topology.



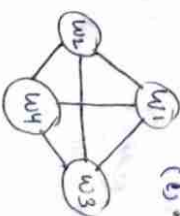
(c) Ring topology



(d) Star topology



(e) Tree topology



(f) Mesh topology

b. Bus Topology :

- One long cable acts as a backbone to which all devices in a network.
- Nodes are connected to main line using a drop line and tap.

- Tap is the connector.

Advantages:-

- (i) Easy installation.
- (ii) Uses less cable than mesh and star.

Disadvantages:-

- (i) Fault in bus cable stops all transmission.
- (ii) Difficult to add works.

c. Ring Topology :

- Each device has a dedicated point to point connection with the only device either side.
- Signal is uni-directional. Each device incorporates a repeater.

Advantages:-

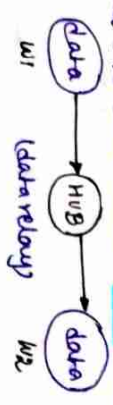
- (i) Ease of installation and reconfigure.
- (ii) Fault isolation is simplified.

Disadvantages:-

- (i) Any breakage in ring leads to fault in entire network.

d. Star Topology :

- Each device has a dedicated point to point link only to a central controller called a hub. No direct link.



Advantages:

- (i) robust (one link fails, only that link is affected).
- (ii) less expensive and easy to install.

Disadvantages:

- (i) Hub fails, network fails.
- (ii) More cabling.

e. MESH TECHNOLOGY

- Every workstation is connected to every other workstation (point to point link) to every device.

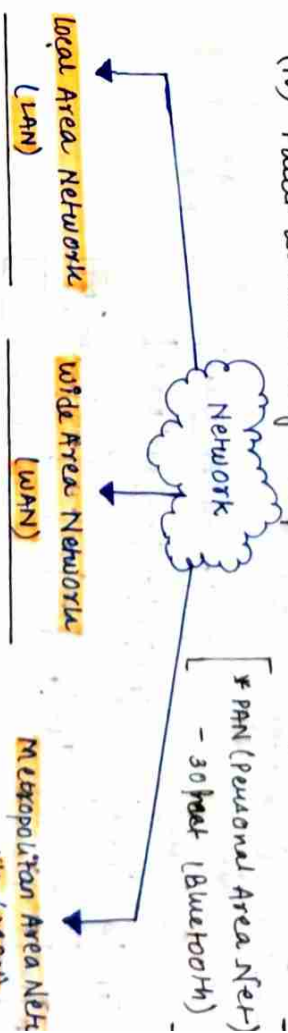
$$\left[n \left(\frac{n-1}{2} \right) \right] \text{ duplex mode links } (n = \text{number of nodes})$$

Advantages:

- (i) No traffic problems.
- (ii) Robust
- (iii) Privacy & security.
- (iv) Fault isolation easy.

Disadvantages:

1. Bulk wiring
2. Expensive
3. Installation and Reconnection are difficult.



• Range: few kilometres area

• Range: geographical large area.

• Range: city area

• may be privately owned and could be a network inside a building.

• made up of all networks

• larger than LAN and WAN.

- Network Models

- International Standards Organization (ISO) proposed Open System Interconnection to allow communication b/w two systems regardless of their architecture. (OSI)

ISO/OSI Models

- Purpose of the model is to facilitate communication between two different systems without requiring changes to the logic of underlying hardware and software.
- OSI is model not a protocol (flexible, Robust and Interoperable).