Handbook on

# Telecom

(Edition - 1)

Ready Reference for all
Telecom Aspirants, Entrepreneurs & Students

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# Part-I

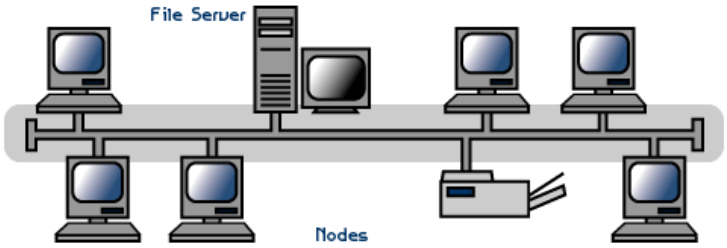
# Networking

## What is networking?

Connectivity amongst many entities for desired communication .A network consists of two or more nodes linked in order to i.e computer/server/printer etc., share resources and information (such as data files, videos, printers and CD etc).

The computers on a network may be linked through cables, telephone lines, radio waves, satellites, or infrared light beams.

## Topology – Linear Bus




A linear bus topology consists of a main cable bus which run through the number of nodes / computers receiving carrying and delivering the desired information to respective nodes

### Advantages of a Linear Bus Topology

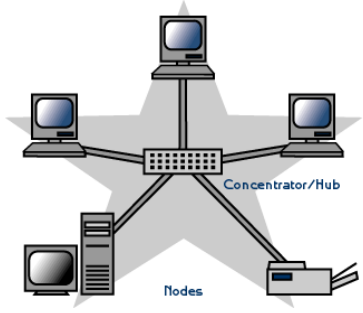
- ◊ Easy to connect a computer or peripheral to a linear bus.
- ◊ Requires less cable length than a star topology.

### Disadvantages of a Linear Bus Topology

- ◊ Entire network shuts down if there is a break in the main cable.
- ◊ Difficult to identify the problem, if the entire network shuts down.
- ◊ Not recommended as a stand-alone solution in a large building.

## Topology - Star

In Star topology each node/Computer connects to the central server through a separate path.



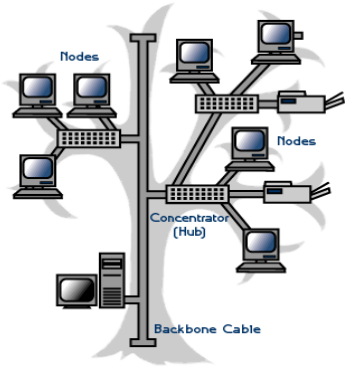

### Advantages of a Star Topology

- ◊ Easy to install and wire.
- ◊ No disruptions to the network when connecting or removing devices.
- ◊ Modular and scalable design, easy to detect faults and to remove parts.

### Disadvantages of a Star Topology

- ◊ Requires more cable length than a linear topology.
- ◊ If the central node i.e. hub, switch, or concentrator fails, nodes attached are disabled.
- ◊ More expensive than linear bus topologies because of the cost of the hubs etc.

## Topology – Tree




A tree topology combines characteristics of linear bus and star topologies. It consists of groups of star-configured workstations connected to a linear bus backbone cable segments.

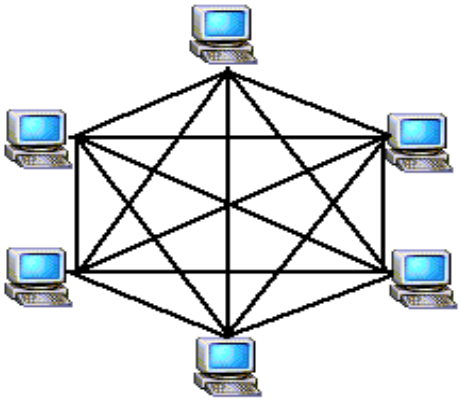
### Advantages of a Tree Topology

- ◊ Point-to-point wiring for individual and software
- ◊ Supported by several hardware venders.

### Disadvantages of a Tree Topology

- ◊ Overall length of each segment is limited by the type of cabling used.
- ◊ If the backbone line breaks, the entire segment goes down.
- ◊ More difficult to configure and wire than other topologies.

## Topology - Mesh



A Mesh topology provides each device with a point-to-point connection to every other device in the network. These are most commonly used in WAN's, which connect networks over telecommunication links.

### Advantages of Mesh Network

- ◊ Mesh networks provide redundancy, in the event of a link failure.
- ◊ Meshed networks enable data to be routed through any other site connected to the network.

### Disadvantage of Mesh Network

- ◊ Because each device has a point-to-point connection to every other device, mesh topologies are the most expensive and difficult to maintain

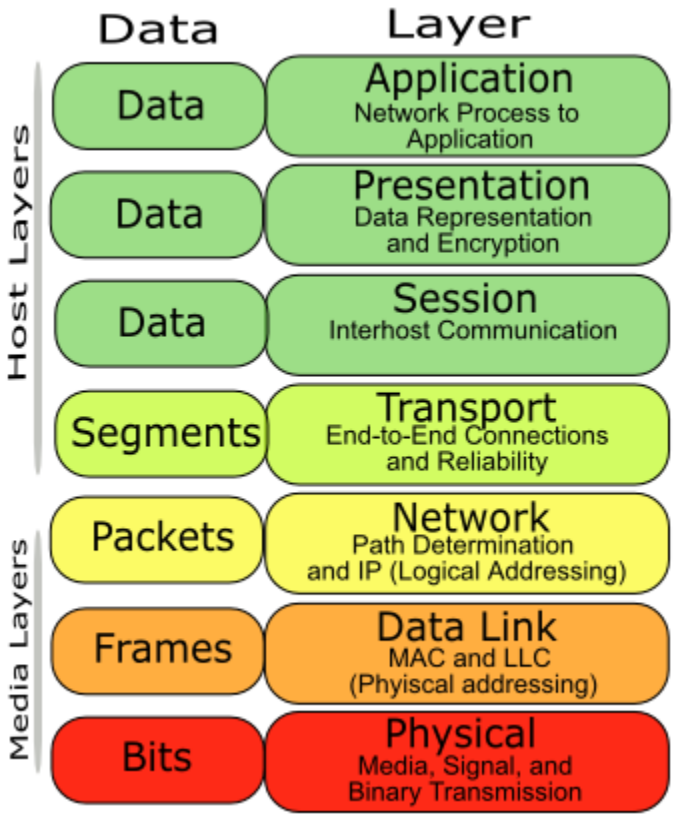
## Summary Chart

| Physical Technology | Common Cable | Common Protocol |
|---|---|---|
| Linear Bus | Twisted Pair Coaxial Cable | Ethernet |
| Star | Twisted pair fiber | Ethernet |
| Tree | Twisted Pair Coaxial Cable | Ethernet |
| Mesh | Twisted pair fiber | Ethernet |

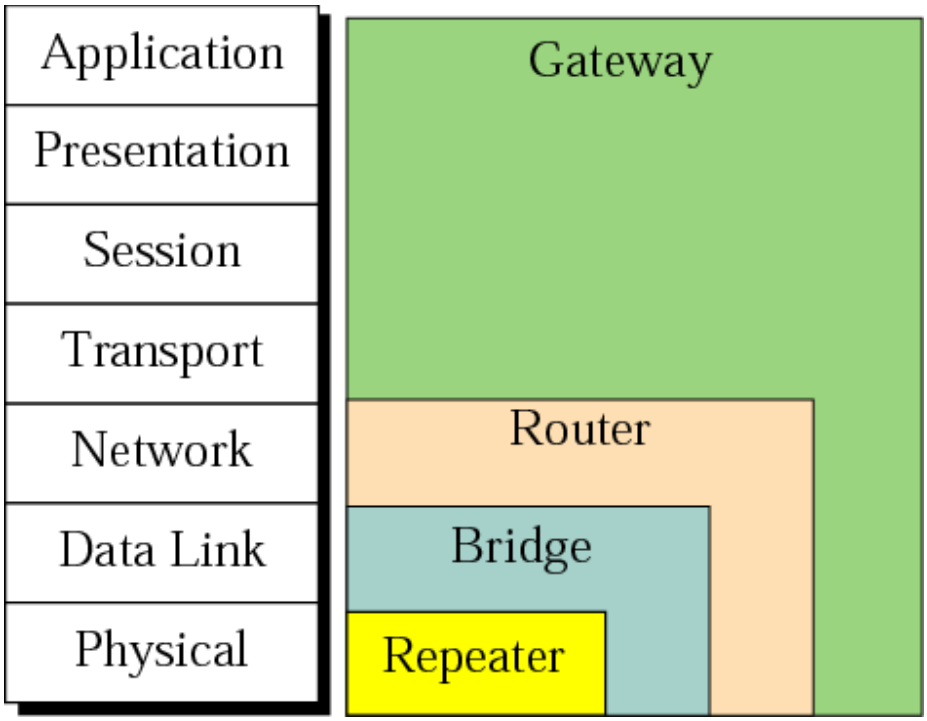
## Major Consideration while designing network

1. Cost of components required
2. Length and Type of cable required
3. Scalability to be taken into account

## Networking Model




## Connecting devices and the OSI model




## Explanation of OSI Model

### Application (Layer 7)

This layer supports application and end-user processes. Communication partners are identified, quality of service is identified, user authentication and privacy are considered, and any constraints on data syntax are identified. Everything at this layer is application-specific. This layer provides application services for file transfers, e-mail, and other network software services. Telnet and FTP are applications that exist entirely in the application level. Tiered application architectures are part of this layer.

### Presentation (Layer 6)

This layer provides independence from differences in data representation (e.g., encryption) by translating from application to network format, and vice versa. The presentation layer works to transform data into the form that the application layer can accept. This layer formats and encrypts data to be sent across a network, providing freedom from compatibility problems. It is sometimes called the syntax layer.

### Session (Layer 5)

This layer establishes, manages and terminates connections between applications. The session layer sets up, coordinates, and terminates conversations, exchanges, and dialogues between the applications at each end. It deals with session and connection coordination.

### Transport (Layer 4)

This layer provides transparent transfer of data between end systems, or hosts, and is responsible for end-to-end error recovery and flow control. It ensures complete data transfer.

### Network (Layer 3)

This layer provides switching and routing technologies, creating logical paths, known as virtual circuits, for transmitting data from node to node. Routing and forwarding are functions of this layer, as well as addressing, internetworking, error handling, congestion control and packet sequencing.

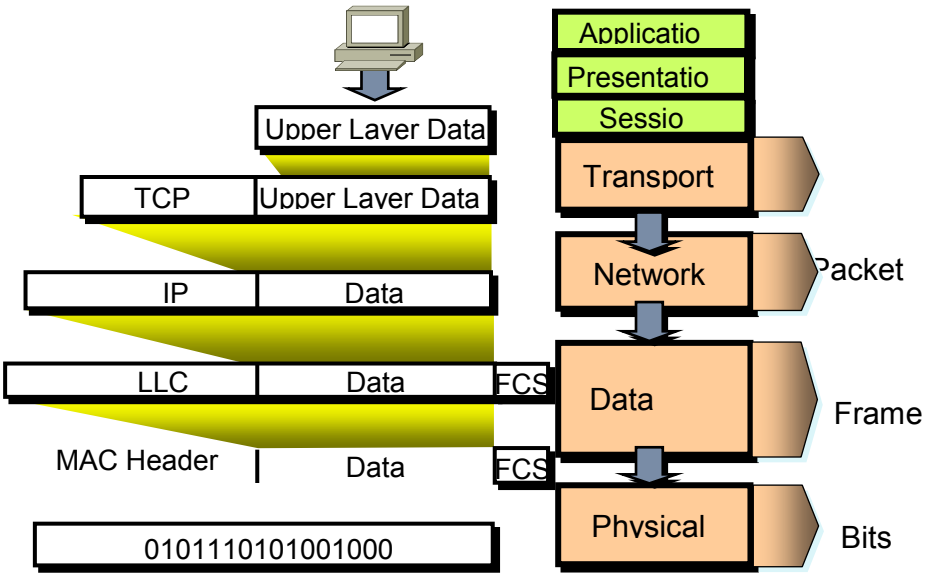
### Data Link (Layer 2)

At this layer, data packets are encoded and decoded into bits. It furnishes transmission protocol knowledge and management and handles errors in the physical layer, flow control and frame synchronization. The data link layer is divided into two sub layers: The Media Access Control (MAC) layer and the Logical Link Control (LLC) layer. The MAC sub layer controls how a computer on the network gains access to the data and permission to transmit it. The LLC layer controls frame synchronization, flow control and error checking.

### Physical (Layer 1)

This layer conveys the bit stream - electrical impulse, light or radio signal through the network at the electrical and mechanical level. It provides the hardware means of sending and receiving data on a carrier, including defining cables, cards and physical aspects. Fast Ethernet, RS232, and ATM are protocols with physical layer components.

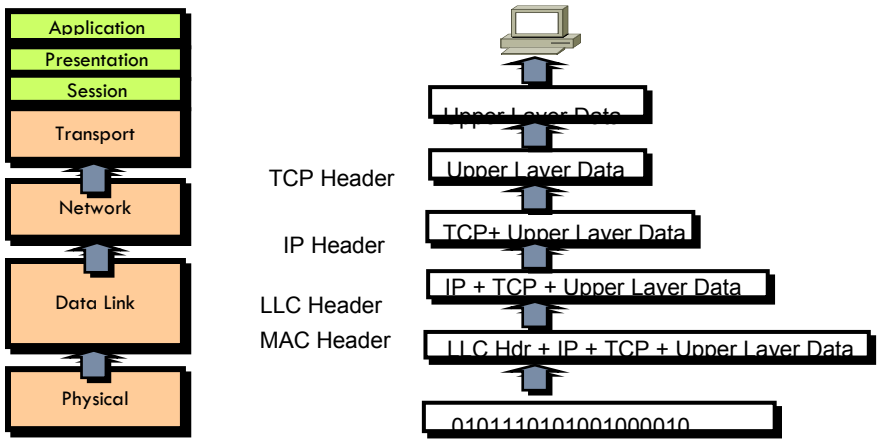
## En-capsulation




## En-capsulation:

As we move up the layers, respective information of upper layer is added as a header, known as en-capsulation of data

## De-capsulation:




## De-capsulation

As we move down the layers, respective information of downward layer is removed and information is seized, known as de-capsulation of data

## Control information

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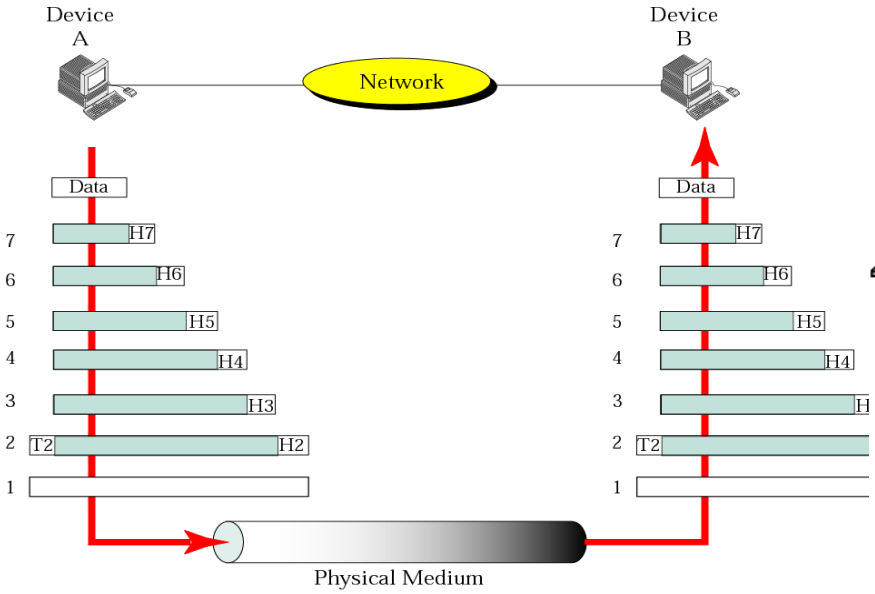
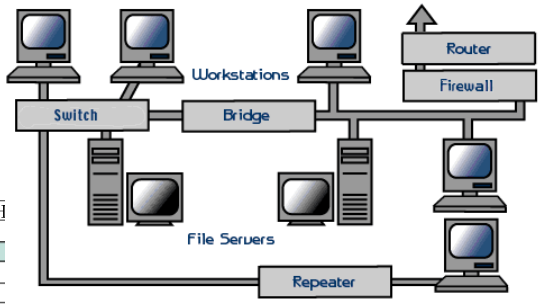
Control Information is added to the data in the form of headers or trailers

The header or trailer is dropped in each layer




## Components of Network




1. Network Server
2. Workstation
3. Network Interface card
4. Hubs
5. Switches
6. Bridges
7. Routers
8. Firewall

## Components of Network

### 1. Network Server

These are very fast computers with a large amount storage space, along with one or more network interfaces. The network operating system provides tools to share server resources and information with network users

### Design Requirement

- ◊ Fastest processor(s)
- ◊ Large amount of RAM

- ◊ Multiple large, fast hard drives
- ◊ Extra expansion slots
- ◊ Fast network interface card(s)
- ◊ Workstation

## 2. Workstation

Computers that humans use are broadly categorized as workstations. A typical workstation is a computer that is configured with a network interface card, networking software, and the appropriate cables.

Workstations do not necessarily need large storage hard drives, because files can be saved on the file server. Almost any computer can serve as a network workstation.


Portal Veins
Simultaneous Dual Mode