

## Comparison

### Key Parameters

Ownership

Speed

Delay

Congestion

Fault tolerance

Maintenance

### LAN

Owned by Private organizations

LAN speed is quite high

Network Propagation Delay is short

LAN has low congestion as compared to WAN

Higher than WAN

Maintaining LAN is Easy & less costly

### MAN

Ownership can be Private or Public  
MAN speed is Average

Moderate

MAN has higher congestion than LAN

MAN is lower than LAN

Designing & maintaining MAN is complex & more costly than LAN

### WAN

Ownership can be Private or Public  
WAN speed is lower than that of LAN

longer

WAN has higher congestion than MAN, LAN.

Lower than Both.

Design & maintaining WAN is complex & more costly than Both.



# Layered Architecture - OSI Layer

Application - layer is responsible for interface to application user.  
This layer encompasses protocols which directly interact with the user.

Presentation - layer defines how data in native format of remote hosts.

Session - layer maintains sessions b/w remote hosts

Transport - responsible for End-End delivery b/w hosts

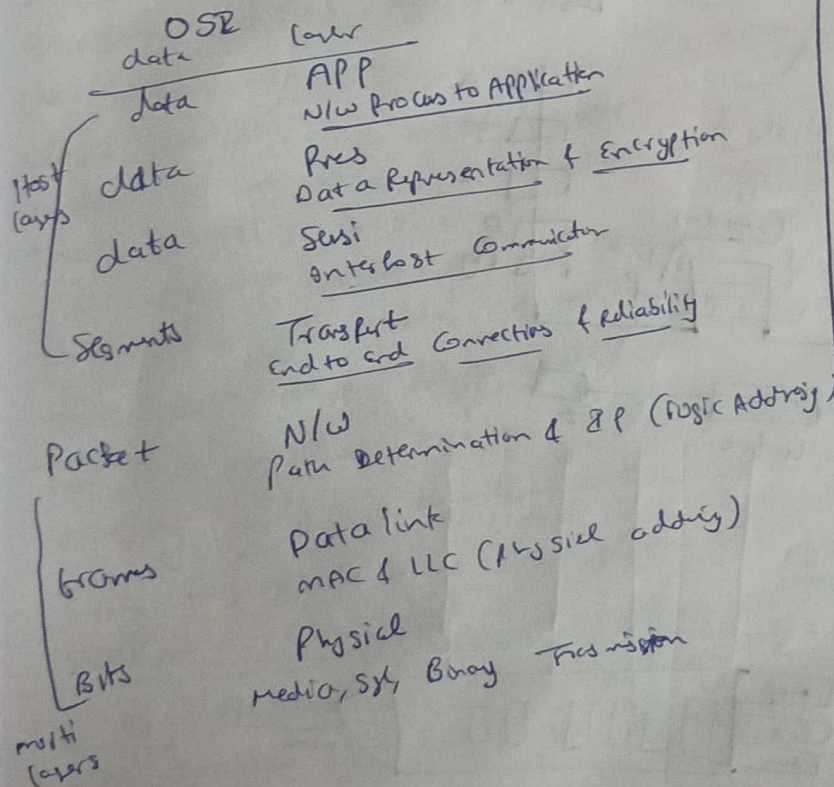
N/w - layer is responsible for address assignment and uniquely addressing hosts in a n/w.

Data link - layer responsible for reading and writing data from & onto the line

- link errors are detected at this layer.

Physical layer - layer defines hardware, cabling wiring, power output, pulse rate etc.

## APSTNDP



## OSI

### Responsibility

APP - To Provide users access to n/w resources

Pres - Provide fn of translation & Encryption & Compression.

Session - to establish, manage & terminate sessions

Transport - to provide process delivery of message

N/w Layer - to provide source to destination of msg

Data - Provide hop to hop delivery of frames

Physical - to transmit data over a bit stream from one hop to next & provide electrical & mechanical specifications



on a piecewise fashion

## Circuit Switching

- two communicating stations are connected by a dedicated communication path, which consists of intermediate nodes in the N/w & the links that connect these nodes.

- A circuit-switched N/w consists of a set of switches connected by one or more dedicated physical links.

The end systems such as computer are directly connected to a switch.

- Each connection uses only one dedicated channel on each link.

Efficiency: resources are allocated during the entire duration of connection, so not efficient.

- resources are unavailable to other connections.

- However, in computer N/w, a computer can be connected to another computer even if there is no activity for a long time.

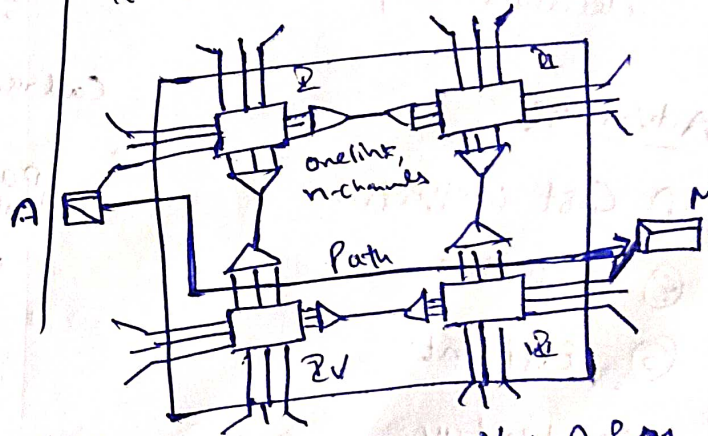
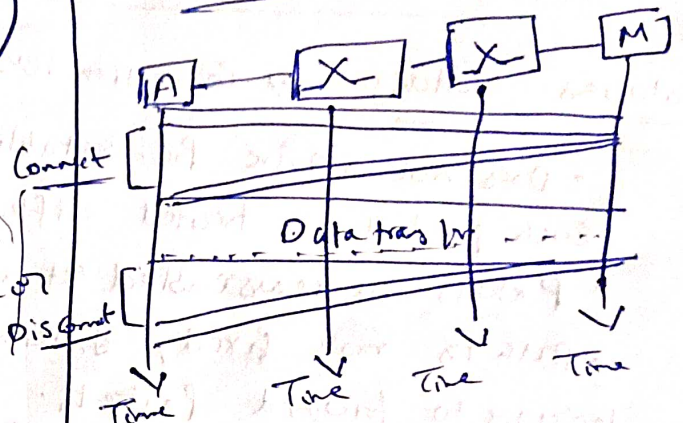
3 phases to connect & transfer the information.

Setup

Data Transfer

Tear down

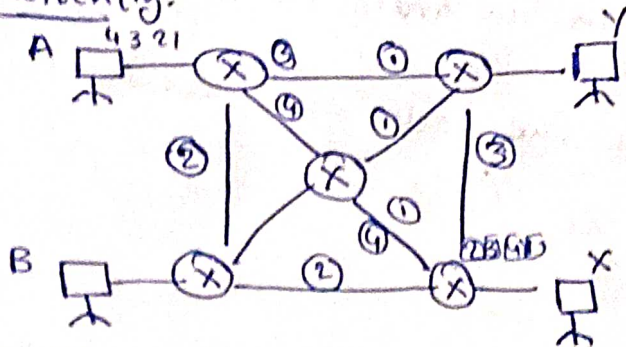
Technique



Circuit Switching b/w A & M via Switch 1-4-11



## Packet Switching

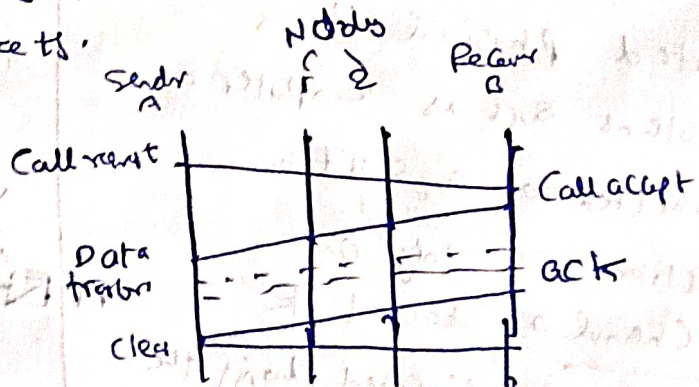


- NO resource reservation, resources are allocated on demand
- Packet is handover from node to node across N/w. Each receiving node temporarily stores the packet, until next node is ready to receive it
- This technique is store & forward & overcomes limitation of circuit

Virtual Circuit  $\rightarrow$  Connection oriented.  $\rightarrow$  Call request & accept  
Route is established before data. Packets are used to establish connection b/w sender & receiver

Datagram Switching  $\rightarrow$  Connection less.

- Does not require Pre-Established route.
- Each packet is treated differently.
- Packets are reassembled at receiving end in correct order.
- Path is not fixed, intermediate nodes takes their route decisions to forward packets.



## Advantage

- ① Cost ineffective
- ② Reliable
- ③ Efficient

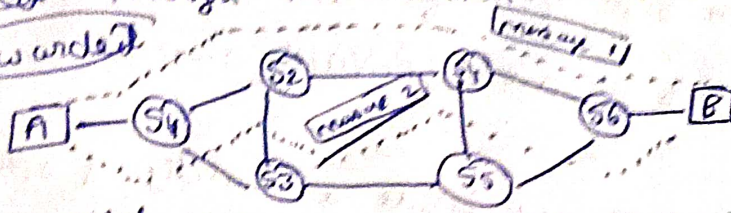
## Disadvantage

- $\rightarrow$  Protocols used are very complex
- $\rightarrow$  requiring high implementation cost
- $\rightarrow$  if N/w is overloaded, requires retransmission of lost packets.



## Message Switching

- technique in which msg is transferred as a complete unit & routed through intermediate nodes at which it is stored & forwarded.



- no establishment of dedicated path b/w sender & receiver.
- destination address is appended to message.
- Each & every node stores entire msg & forward to next node.
- message switching treats each msg as an independent entity

### Advantages

1. Efficient utilization of resources.
2. Traffic Congestion can be reduced. B/w msg is temporarily stored in nodes.
3. msg Priority can be used to manage N/w.
4. Size of msg which is sent over N/w can be varied.  $\therefore$  It supports data of unlimited size

### disadvantages

- long delay can occur due to storing & forwarding facility provided by message switching technique

### Comparison b/w Switching

	<u>Circuit</u>	<u>msg</u>	<u>Packet</u>
1) Path Established in advance	Yes	No	No
2) Store & forward Technique	No	Yes	Yes
3) message follows multiple Route.	No	Yes	Yes

### Comparison b/w Packet Switching

	<u>Virtual</u>	<u>Datagram</u>
1) Node takes routing decision	No	Yes
2) Congestion occurs	Yes	No



## Token Ring

- defined by IEEE 802.5
- Standards are Connectedly Ring topology, sometimes star
- token is passed over physical ring formed by stations & coaxial cable w/
- max time for token to reach a station can be calculated
- does not provide better bandwidth
- reliable & star topology use
- Expensive
- Designed for large industries

## Token Bus

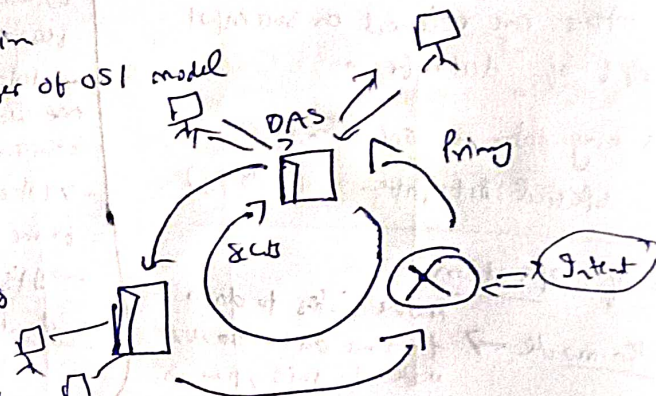
- 802.4
- underlying topology connect to stations either bus or tree
- token is passed along virtual Ring of stations connected to LAN.
- not possible to calculate time for token transfer
- provide better B.W
- ~~cheap~~ unreliable & bus is used
- cheaper
- Designed for offices

## (FDDI) fiber distributed Data Interface

- FDDI is a fiber LAN technology
- developed in 1980's / token ring based

### features

- uses optical fiber as physical medium
- operates in physical & MAC layer of OSI model
- similar to 802.5 token ring
- extends range up to 200km
- offers up to 1000 connections
- transmission rate of about 100Mbps
- Backbone for WAN
- uses 3 topologies Ring, Star, Mesh
- Becomes obsolete Bcoz of cost, complex, advent of fast Ethernet



### (FDDI)

- Consists of dual ring [Prim & Sec]
- Traffic on each ring flows in opposite direction
- Primary ring on clockwise
- Secondary ring on counter clockwise
- SAS is connected to Pri
- DAS is "Both" Sec & Prim
- These stations are concentrators

SAS - Single Attachment Station  
Used primarily to connect Ethernet LAN's or individual servers to FDDI Backbone

DAS - Dual Attachment  
Used primarily for N/W Backbones that require fault tolerance.

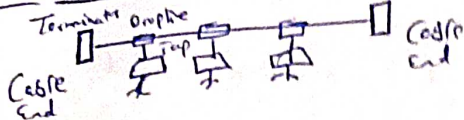
Primary ring for data & transmission

Secondary ~~is~~ Backup if Primary fails [Purpose of dual is to provide reliability & robustness]



Categories - Uses one long cable to which N/w devices are either directly attached or are attached by using short drop cables.

Bus Topology: Each node is connected to single cable



Advantage:

- ① Easy to connect a computer or peripheral to linear BUS
- ② Require less cable length than star or mesh topology

Disadvantage:

- ① Entire N/w shuts down if there is a break in main cable.
- ② Terminators are required at both ends
- ③ Difficult in fault detection
- ④ Add new devices require modification

Linear BUS: If all N/w nodes are connected to combine transmission medium that has two end points the BUS is linear.

Distributed: If all N/w nodes are connected to combine transmission medium that has more than 2 end points created by branching the main section of transmitting medium.



Ring - Each device dedicated point-to-point connection with only 2 devices on either side of it

- Signal is passed along ring in one direction, from device to device, until it reaches destination
- Each device in ring topology has a repeater.

FDDI, SONET or token ring technologies are used to build Ring topology

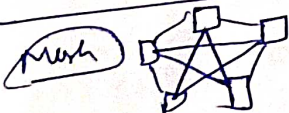
- mostly this topology use in schools, Buidly

Advantages: Easy to install

: managing is easier as to add or remove a device from topology only two links are required to be changed

Disadvantages:

- A link failure can fail the entire N/w as signal will not travel forward due to failure
- Data traffic issues, since all the data is circulating in a ring.



Full Connected



Partially Connected  
Not all nodes directly connected to each other

- has a dedicated point to point link to every other device
- topology is robust
- Privacy or security is maintained
- if one link becomes unstable, does not incapacitate the entire system

(eg): telephone regional offices in each regional office needs to be connected to every other regional office

Advantages:

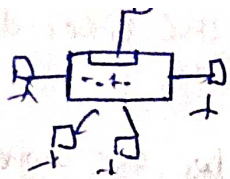
- ① multiple connections mean each node can transmit to & receive from more than one node at the same time.
- ② New nodes can be added without interruption or interfering with other nodes.

Disadvantage

- Installation & reconnection are difficult
- hardware required to connect each link is expensive



## Star



— Each device has a dedicated path to point link only to a central controller, usually called a hub.

- devices are not directly linked to each other
- switch or hub acts as central point through which all communications are passed
- Controller acts as Exchange
- Star is mainly used to connect devices in LAN's

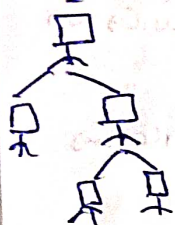
Advantages: Less expensive than mesh topology.

- Easy to install & reconfigure
- robust

disadvantages:

Star topology is dependency of whole topology on one single point, the hub, if hub goes down, whole system is dead.

Tree Topology: is a special type of structure in which connected elements are arranged like branches of tree.



- top level of hierarchy, is the central root node
- central root would be only node having no higher node in hierarchy

→ Tree hierarchy is symmetrical

- Branching factor is fixed no. of nodes connected to next level in hierarchy

Advantages — Point-to-point wiring for individual segments

- supported by several hardware & software vendors

Disadvantages:

- overall length of each segment is limited by type of cabling used
- if backbone fails/breaks, entire segment goes down.
- more difficult to configure