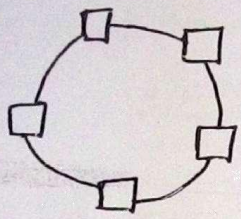
∴ Maintanence cost is high. [It is difficult to diagnose fault].

RING TOPOLOGY :-



- Multi-drop connection in which ~~communication~~ message is broadcasted.
- Pull & ignore.
- Used where high performance is required.
- Here whenever an information is send it is send with a time interval, if it is fetched in that particular time interval the info is fetched otherwise it is discarded.

FEATURES :-

* Direct transmission of message
* Only the receiver receives rest ignores message.

ADVANATAGES :-

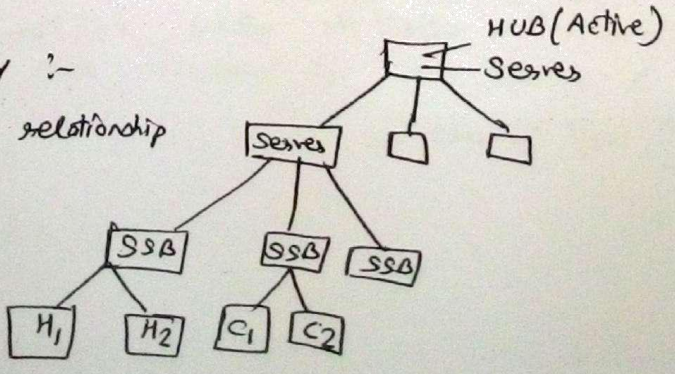
* System growth is easy
* All system have equal access.
* Data packet travel at greater speed.
* ~~Congestion~~

DISADVANTAGES

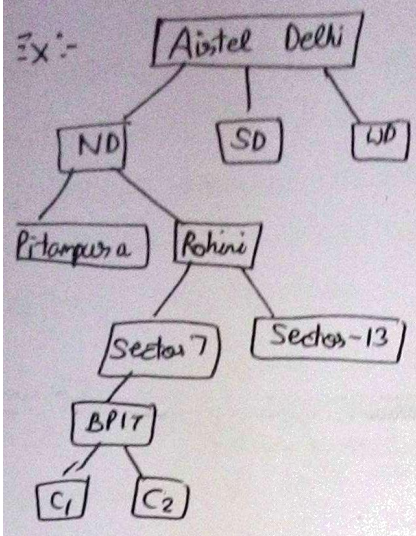
* Congestion is high.
* If 2 machines want to traffic at ~~for~~ same time, it will cause congestion.

TREE TOPOLOGY :-

→ parent-child relationship

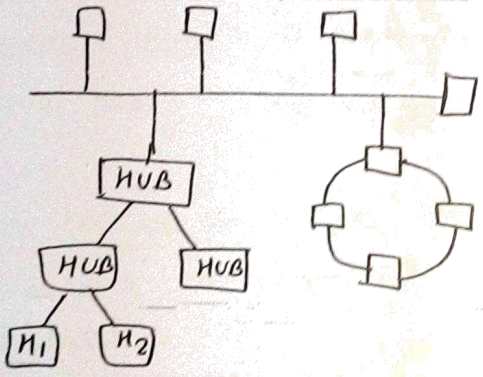


Ex:-



HYBRID TOPOLOGY

- used for establishing the internet.



ADVANTAGES :-

- Expansion is very easy
- failure at 1 node doesn't affect the entire system
- easy to install & easy to use.

DISADVAN

→ System

DISADVANTAGES :-

→ System is very complex.

→ Large no. of wires are required.

$\frac{n(n-1)}{2}$ n → devices

→ each link has a dedicated bandwidth. So huge bandwidth wastage is there.

→ Scalability is difficult.

Q-) An education lab has fully connected mesh topology consisting of 10 devices. Calculate the no. of cables to establish mesh topology & calculate the no. of ports required by each computer.

$n = 10$

$\frac{n(n-1)}{2}$

$= \frac{10 \times 9}{2}$

$= 45.$

No. of ports by each device $= \frac{n-1}{}$

$= 9$

Q-) Assume 7 devices are to be arranged in a room. Calculate the no. of links & ports required by Mesh Topology & compare it with ring topology.

links $= \frac{7 \times 6}{2} = 21$

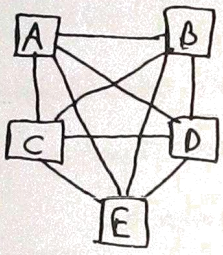
Ports by each device $= 6.$

DISADVANTAGES :-

- Totally dependent on hub
- Cost of hub is very high

MESH TOPOLOGY

Each device has a dedicated point-to-point link to every other device on the network.



No. of wires required to establish the mesh topology are

$$= \frac{n(n-1)}{2}.$$

ADVANTAGES :-

→ loss of information is minimum

→ reliable system as every system has dedicated link.

→ fault identification is easy.

→ fault isolation is also easy.

→ ~~fe~~ ideally used in real time scenario (alternate path are also available).

NETWORK RANGE :-

Range is a physical size of the network - Acc. to size of network the network is classified in 4 categories :-

	Range
- PAN	1m
- LAN	10m - 1km
- MAN	10km - 180km
- WAN	over 180 km

→ 10,000km over → known as internet.

PAN → Personal area network

- personal use
- ~~Ex~~ One to one connection
- Ex :- using printer, ~~blue~~ bluetooth connection

LAN

- Local area network
- When network is established within a room / lab.

~~snow~~

- For establishing LAN :- - routers
  - repeaters
  - computers
  - wires
- network interface card
- other peripheral devices.

FEATURES :-

- max. transmission speed (as distance is less)
- less complexity
- cheap (configuration is easy to install)
- fault detection & isolation is easy.
- delay is minimum.
- uses broadcast technology.

- reliability in LAN is high (following direct path)
- Peripheral devices can only be used through LAN

MAN

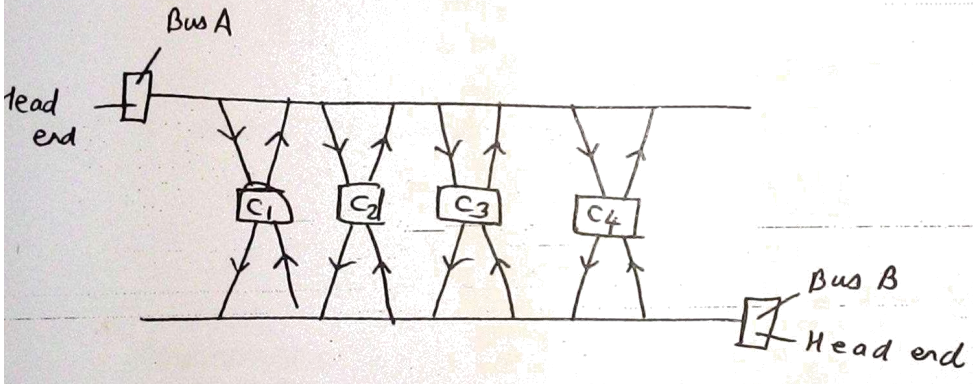
- Metropolitan area network

Ex: Cable network

- To increase the transmission speed of MAN, a new standard was developed.

IEEE 802-6

DQDB → Distributed Queue Dual Bus

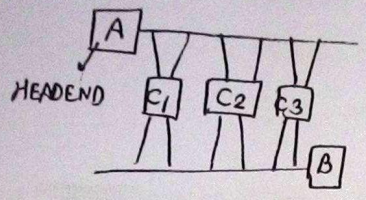


WAN

- Wide area network

P.T.O.

At the time of configuration, it is decided whether connection is upstream (connected with upper bus) or downstream.



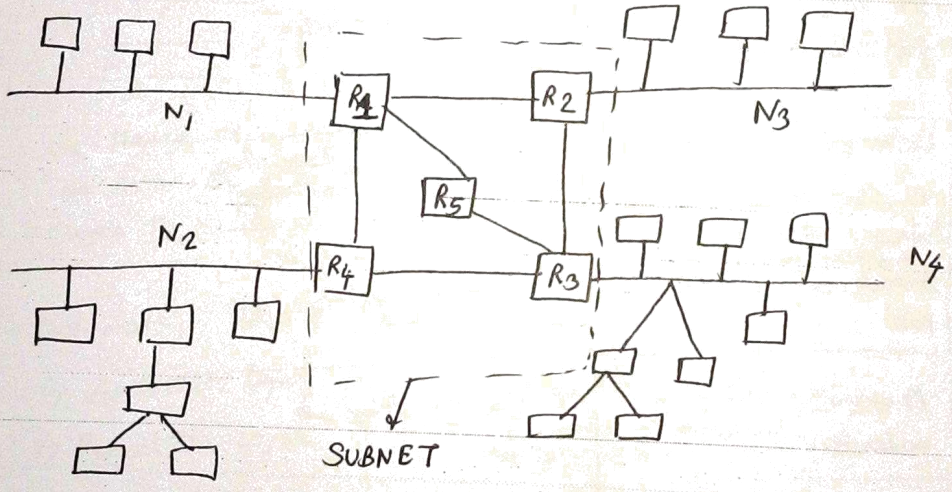
→ If C_1 is connected upstream then bus A (upper bus) is primary bus & lower bus is secondary bus.

→ ~~System is right of C_1~~ To transfer data to the system right of C_1, upstream is used & for left of C_1 downstream is used.

→ Whenever we want to transfer data through bus, headend will decide whether data is to be transferred from bus or not.

WAN (WIDE AREA NETWORKS).

→ Connecting multiple MANs.



→ ROUTERS are used that ~~prov~~ decides the path for the information so that it reaches destination.

→ In WAN, connection is established between routers.

→ Now routers are responsible to transfer data among their network.

→ As distance is very large so it is not possible to connect all systems hence routers are used.

→ SUBNET has ~~basic~~ 2 ~~com~~ basic components :-

1) TRANSMISSION LINES are responsible for transferring message to respected routers.

2) SWITCHING ELEMENTS are specilized computers used to connect 2 or more transmission lines.

...next path if no one else can use it. Also if a router is performing some other work prior to this one then first router will complete that work & then will transmit this one.

MECHANISM :- Store & forward point to point.

SUBNET MASK :- Address of subnet.

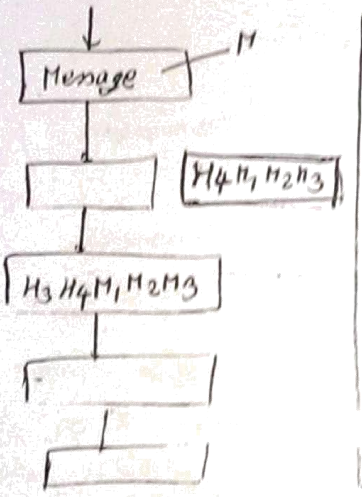
Default subnet mask is 255.255.255.0.

LAN	MAN	WAN
Used for private networks.	Used for private & public networks.	Used for private and public networks.
LAN is established in smaller area.	MAN is established in moderate area	WAN is established in wider area
Design is very easy	Design is bit tricky	Design is highly complicated
It uses coaxial & twisted pair cables as connections.	It uses fibre optics for connections.	It uses satellite communication.
Data rate is high	Data rate is moderate.	Data rate is slow (As distance is very large)
Principle of working is multitasking & point to point.	Principle of working is multitasking & point-to-point.	Principle of working is switching & point-to-point.
Propagation delay is negligible.	Propagation delay is moderate.	Propagation delay is highest.
Error rate is lowest.	Error rate is moderate.	Error rate is highest.
Equipment for LAN is less expensive	Equipments are more expensive.	Equipments are most expensive.
Most suitable for time critical applications.	Less suitable for time critical applications.	Least suitable for time critical applications.

Layered Approach :-

- Staircase approach
- Output of first layer is input of next layer.
- First message goes to topmost layer.

→ Whenever a layer processes the message that is taken from another layer, it adds a signature (header) to the message.



As Message M is bigger it is broken into different messages M_1, M_2, M_3.

In network architecture, we will study 2 module models :-

- OSI Model
- TCP/IP Model.

OSI (OPEN SYSTEM INTERCONNECTION/INTERFACE MODELS)

- It was introduced in late 1970.
- It was designed by international organizations standard.
- It is a provides set of protocols that allows any 2 system to communicate regardless of their architecture.

→ OSI models has 7 layers.

1. Application Layer → For sender/receiver, first layer. → interface of human & machine.
2. Presentation Layer
3. Session Layer
4. Transport Layer
5. Network Layer
6. Data Link Layer
7. Physical Layer → For receiver/sender, first layer.

- **APPLICATION LAYER**
  - also known as HUMAN LAYER.
  - It takes message from the sender, thus human interacts in this layer.
- **PRESENTATION LAYER**
  - presents the layer for communication.
  - It finalizes the syntax as well as data compression.

- Data Presentation :- conversion from native form to common form.
- Data compression :- Layer is responsible to reduce volume of data.
- Encryption :- Layer is responsible to hide the details of message.

- It only sends text to ~~further layers~~ next layer.

INTERFACING BETWEEN 2 LAYERS means when message is transferred from 1 layer to next one.

SESSION LAYER

is responsible for establishing, maintaining & termination of session.

- Now to provide collision whenever a machine establishes a connection with session, no other machine will interface with it.

~~It is~~

- It is responsible to maintain the exchange of ~~informal~~ message b/w computers.
It is also responsible for synchronization.
It is function of this layer to insert checkpoints.
Checkpoints ~~tells us~~ acknowledges that at this position data or message is ~~receive~~ received.

• TRANSPORT LAYER

~~It decides whether transportation will take place on a sin~~
It decides whether complete transmission of message will take place on a single path or on multiple paths.
It allows multiple paths. (MULTIPLEXING)
It divides the data into small groups.

NETWORK LAYER

It is responsible for proper ~~networking~~ routing b/w source to destination.
It acts as a network controller.

DATA LINK LAYER

- It deals with errors detection & errors correction
- It divides packets into frames.
(As in ~~t~~ networking, frames of message are transmitted, not the packets).

*PHYSICAL LAYER :-

- It converts frame message to machine language.
- After converting into bits, it converts message to electrical signals.
- It activates, maintains & deactivates physical connection.
- It decides whether communication is simplex, half-duplex or full duplex.

TRANSMISSION MEDIA :-

It can be defined as anything that carry information from source to destination.

2 types :-

1.) GUIDED TRANSMISSION MEDIA :- Contains signal energy & guided within a solid media.
- point to point communication
- Discrete network topology
- additional transmission capacity can be added by using more wires.

2.) UNGUIDED TRANSMISSION MEDIA :- Signal energy propagates through electromganetic waves.
- for broadcasting.
- continuous network topology
- It is not possible to procure additional capacity.

GUIDED MEDIA TYPES

1.) TWISTED PAIR :-

orange - white of orange (O-o)
blue - (Bb)
green - (Gg)
brown - (Br br)

SWITCHING :-

→ It helps to connect devices via switches.

→ SWITCHED NETWORK :- Workstation, servers are connected via switches.

→ They are not bothered by of data.

→ HUB are active componest whereas switches only transfer data.

→ The fundamental of working of switches is STORE & FORWARD.

→ Here only receiver will get the data by the help of tokens.

→ SWITCHING :- Concept how switches work in switched network.

SWITCHING are of 3 types :-

- CIRCUIT SWITCHING :- Before transmission of message, connection is established
- MESSAGE SWITCHING :- No path establishment, message is send directly from sender to receiver.
- PACKET SWITCHING :-

I) CIRCUIT SWITCHING :-

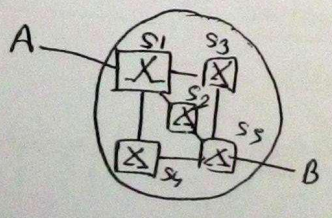
~~Types~~ :- Different phases are :-

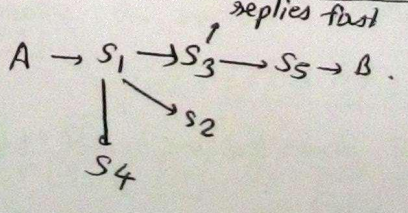
1.) Connection established :- Here first switch will send the ~~connec~~ message to all its connection if it is not directly connected with destination.

Now the switch (S_2) that will ~~send the~~ reply first ~~to~~ with the first switch is included. So, S_2 will check whether it has a path connected to destination.

As So, path that gives reply first ~~is~~ given higher priority

→ Here, simply path is as connection is fixed. Data is not transfered. This is known as ~~CONNECTION~~ PATH ADVERTISING.





CONGES

2.) DATA TRANSFER :-

- Since in previous ~~this~~ steps, all switches are fixed so they cannot be be used ~~if~~ to transfer other data.

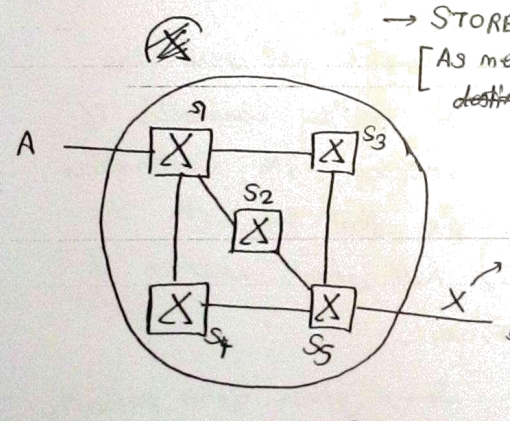
- Here it is time consuming as first connection is fixed, then data is transferred. ← DISADVANTAGE

It ~~also takes large~~ can also take large bandwidth for smaller message even. As whole message is transferred at a time (not divided into diff. packets) so memory is wasted as it is fixed. Channel bandwidth is wasted.

3.) TERMINATION

ADVANTAGE :- data is not stored.

I MESSAGE SWITCHING :-



→ STORE & FORWARD COMMUNICATION
[As message is stored at intermediate ~~destination~~].

No path b/w S5 & B. So S5 waits for ~~connecti~~ activation of connection as checks for other connection.

→ Not reliable way of switching as here no acknowledgement is send to sender whether message is received or not.

ADVANTAGE :-

- Path is not dedicated. Channel bandwidth is not wasted. It is properly used.
- Proper traffic management.
- Congestion minimized.

CONGESTION :- Path is not available or ...

- No limit on block size. So if switch does not have that much space then that message gets truncated. Hence message becomes a waste.

III.) PACKET SWITCHING :-

The message is divided into different packets & each packet can follow different path.

ADVANTAGE :-

- delay is minimized
- bandwidth is properly optimized.
- ~~to~~ Not time consuming.

- Each packet will have a header which will contain details of receiver.

1.) DATAGRAM PACKET SWITCHING :-

Message is divided into different datagram & each datagram is send through different routes.

[Packets are known as DATAGRAM].

2.) VIRTUAL CIRCUIT SWITCHING :-

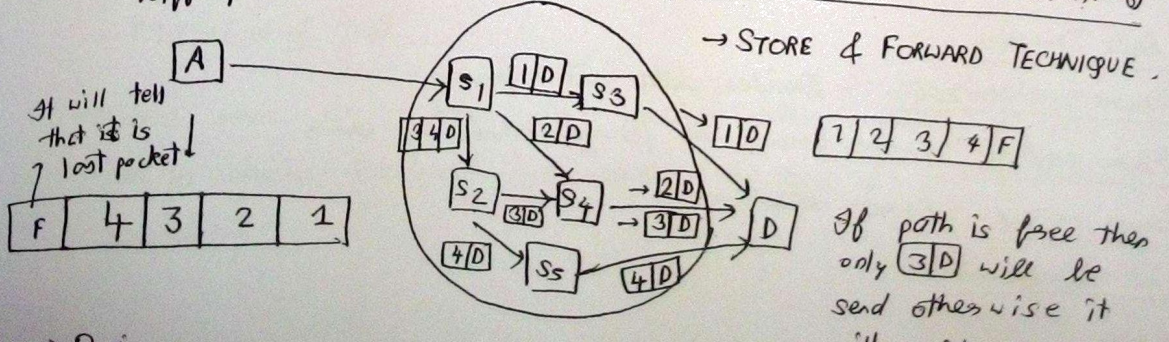
A virtual circuit is created before the actual data is send.

~~→ No of packets are divide numb~~

→ Diff. packets are numbered.

DATAGRAM CIRCUIT SWITCHING

→ STORE & FORWARD TECHNIQUE.

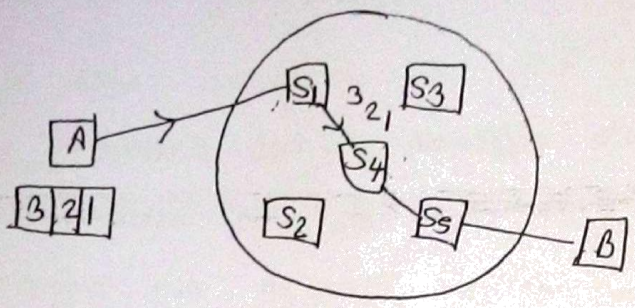


If path is free then only 3D will be send otherwise it will wait.

→ ~~D ii~~

2) VIRTUAL CIRCUIT SWITCHING :-

It is a combination of circuit switching & datagram switching.



Here first each switch will check & establish the connection. Then that connection will get freeze. Now after connection is fixed, message is divided into different packets known as datagram. ~~These message~~ Switch S_1 will transfer all the packets after some duration to the next switch. Now here next intermediate switch S_4 will send the packets to next one.

Acknowledgement of single packet is taken

UNIT 2 :-

DATA LINK LAYER :-

- second last layer of OSI
- last layer of TCP/IP.

Functions are :-

- Data Transfer
- Frame synchronization :- Divides data into frames
- Flow control :- Proper frames are flowing without any errors.
- Error control :- Error detection
- Link Management.