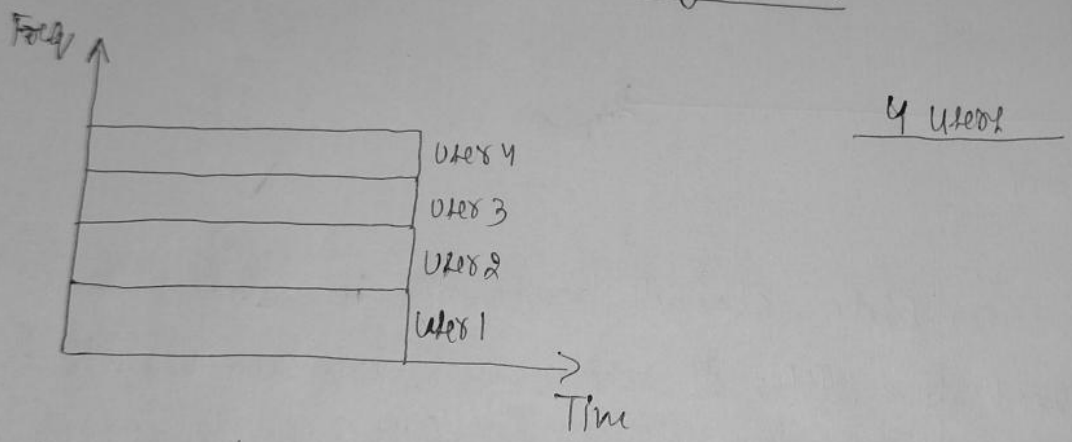
"Multiplexing" :-

Multiplexing is a technique, in which several message signals are combined into a composite signal, so that, they can be transmitted over a common channel.

But to transmit various signals over the same channel, it is essential to keep them apart, so that, they don't interfere with each other.

There are two types of multiplexing :-

1) Frequency Division Multiplexing (FDM) :-



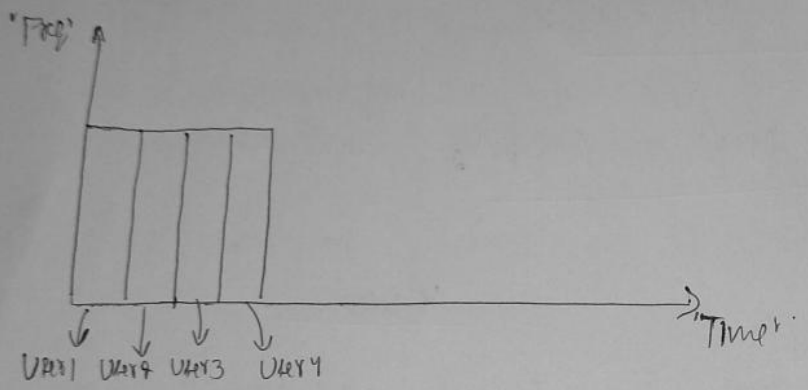
4 users

Suppose we have four users & they want to transmit their signals over a "common channel" but at the same time.
So, for achieving this, we are going to use a technique called "Frequency Division Multiplexing (FDM)" in which we divide the frequency into multiple bands as shown above.
Each user will have his own bandwidth available to transmit the signals.

Note :- Each user will be transmitting the signals for the entire time duration.

In FDM, all users use the same common channel at the same time (for full time) but they are allotted different frequencies to prevent any kind of signal interference. So the 'BW' is divided among users and not the time. There is a possibility of crosstalk in FDM since all signals are transmitted simultaneously.

2> "Time Division Multiplexing (TDM)" :->



4 Users

User 1, User 2, User 3 & User 4.

In TDM, the complete channel bandwidth is allotted to one user for a fixed time slot. It means each user can use the full bandwidth available, but for a fixed time (its own time slot). So the division is in time & not in the frequency

Crosstalk problem is not seen in TDM because only one time slot only one user is transmitting the signal.

P.T.O

Types of Cables in Computer Networks :-

In computer networks, we use different types of cables to connect different devices.

Note :- 'Cables are used in Wired connections'.

Cables :-
- Unshielded twisted pair Cables (10 Base T, 100 Base T)
- Coaxial Cable (10 Base 2, 10 Base 5)
- Fibre optic (100 Base Fx)

There are different type of cables that we can use to transmit the signals b/w devices.

Here we are using "10 Base T & 100 Base T"

'10' means '10 Mbps'

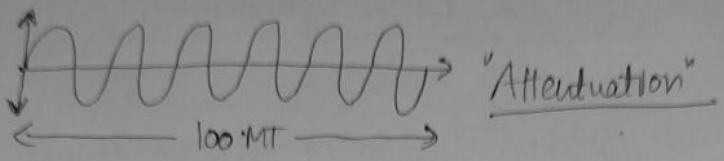
"Base means Base Band"

It means at a time only one signal can be transmitted over the channel.

Broad Band :- It means at a time multiple signals can be transmitted over the channel.

"T means 100 meters" In twisted pair cables, data moves in the form of electrical signals. & it is noted that electrical

Signals can travel upto "100 meters" without any problem
After 100 meters, Attenuation occurs.
↓
It means signal strength reduced.



Since signal travels upto 100 meters only in twisted pair cables.
Hence we use them in closet LAN generally.

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2) Coaxial cables :⇒ Signals are transmitted in electrical form.

↳ "10 Base 2" ⟶ "2 means 200 meters"
↳ "10 Base 5" ⟶ "5 means 500 meters"

Attenuation occurs after 200 meters.
in "10 Base 2"
& after 500 meters in "10 Base 5"

3) "Fibre optics" :⇒ Signals are transmitted in the form of light signals.

100 Base FX ⟶ "≃ 2 Km"
↓ ↘ "fibre channel"
100 mbps.

In this signal can move upto 2 Km without any attenuation

→ "Switching" :⇒

It is defined as a mechanism for moving information between different networks.

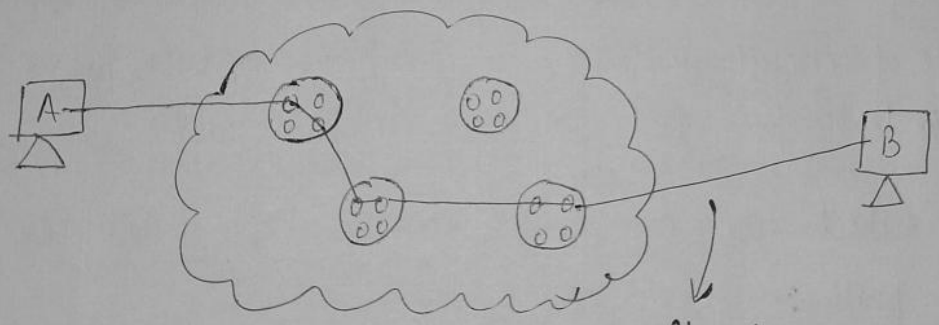
In large networks there might be multiple paths linking sender & receiver. Information may be switched as it travels through various communication channels.

Switching is of three types :

↳ "Circuit Switching" ↳ "Message Switching" & ↳ "Packet Switching"

↳ "Circuit Switching"

In this when a device communicates with another device, a sort of circuits gets formed b/w them.



Circuit.

"Means a dedicated path".

& this path is reserved for both these devices.

Now Device "A" & "B" are connected through this dedicated path & they will be using this path to transfer the data.

↳ When two nodes communicate with each other over a dedicated communication path, it is called "circuit-switching".

↳ There is a need of pre-specified route from which data will travel & no other data is permitted.

↳ In circuit switching, a dedicated channel (or circuit) is set up for a single connection b/w the sender & the recipient during the communication session.

↳ Once the connection is established between two parties, it will be available till the end of the conversation

↳ The channel is reserved b/w the users till the connection is active.

Note:- Circuit switching is used in 'telephone communication'

Eg:- In telephone communication system, the normal voice call is an example of circuit switching. The telephone service provider maintain an unbroken link for each telephone call.

Applications which use circuit switching may have to go through three phases:-

↳ Establish a circuit.
↳ Transfer the data.
↳ Disconnect the circuit

P.T.O

Advantages of circuit-switching"

1) The dedicated path/circuit established b/w sender & receiver provides a guaranteed data rate.

2) Once the circuit is established, data is transmitted without any delay as there is no waiting time at each switch.

3) Since a dedicated continuous transmission path is established, the method is suitable for long continuous transmission.

"Disadvantage of circuit-switching"

1) As the connection is dedicated, it cannot be used to transmit any other data even if the channel is free.

2) It is inefficient in terms of utilization of system resources. As resources are allocated for the entire duration of connection, these are not available to other connections.

3) Dedicated channels require more bandwidth.

4) Prior to actual data transfer, the time required to establish a physical link b/w the two stations is too long.

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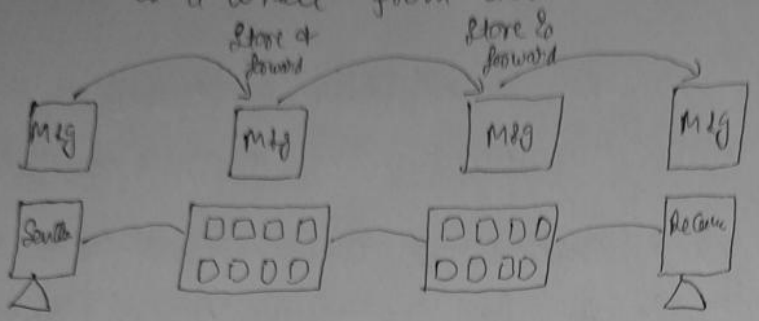
(2) "Message Switching":-

In Message switching, it is not necessary to establish a dedicated path between transmitter & receiver.

In message switching, when source node sends a message, the destination address is appended to the message. So in message switching there is no need to establish a dedicated path b/w two comm. nodes

↳ For sending message, there are many intermediary message switching nodes which are responsible for transferring the message, & the message is transmitted as a whole from source node - to destination



↳ Each message switching node receive the entire-message, store it in its entirety on disk, and then transmit the message to the next node.

↳ if the next node does not have enough resources to accomodate large size message, the message is stored and switch waits.

↳ This type of network is called store & forward network

Note:- "Message switching" is very slow because of "store & forward technique"

It is not recommended for real time applications like voice & video.

Advantages:-

1) Channel efficiency can be greater compared to circuit-switched systems, because more devices are sharing the channel.

2) Traffic congestion can be reduced, because messages may be temporarily stored in route.

3) message priorities can be established due to store & forward technique.

Disadvantages :-

1) Message switching is not compatible with interactive applications.
2) Message switching is very slow becoz of store & forward technique.
3) It is not recommended for real time applications like voice & video
4) Store & forward devices are expensive, becoz they must have large disks to hold potentially long messages.

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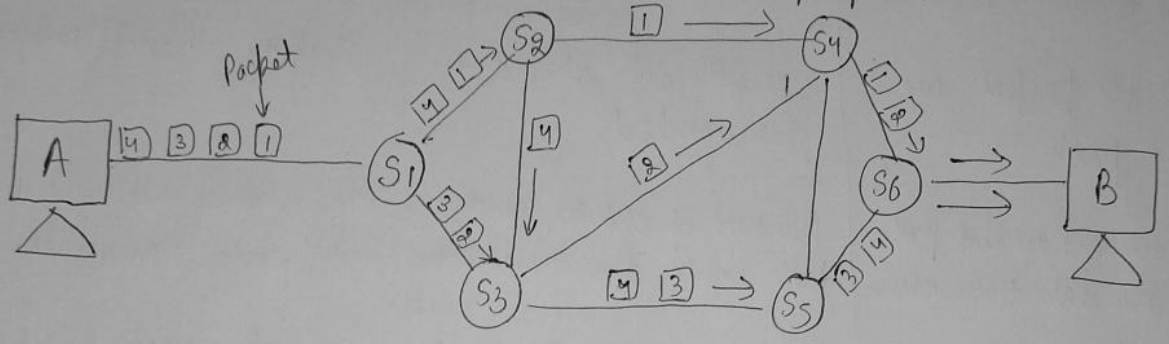
(3) "Packet Switching" :- In packet switching, entire message is divided into small parts known as packets.



& Now each packet can be transmitted through a separate route. Due to which message gets delivered without any waiting. Each packet is assigned a sequence number, which helps the receiver to reconstruct the original message.

Each packet stores the source add, destination address & ~~the~~ switching node's address also.

↳ In packet switching, messages are divided into smaller pieces called packets.

↳ Each packet includes source, destination & intermediate node address information, so that individual packets can be

routed through the internetwork independently:-

↳ It is easier for intermediate n/w devices to store small size packets. & they do not take much resources either on carrier path or in the internal memory of switches.

Difference b/w Circuit Packet & Message Switching:-

Circuit	Message	Packet
There is physical connection b/w transmitter & receiver	No physical path is set in advance	No physical path is set in advance.
All the packets use same path	Packets are stored & forwarded.	Packets travel independently.
Need an end to end path before the data transmission	No need of end to end path before data transmission	No need of end to end path before data transmission.
Reserves the entire bandwidth in advance	Does not reserve the bandwidth in advance	Does not reserve bandwidth in advance
Waste of bandwidth is possible	No waste of bandwidth	No waste of bandwidth
It must support store & forward transmission	It support store & forward transmission	It supports store & forward transmission
Not suitable for handling interactive traffic	Suitable for handling interactive traffic	Suitable for handling interactive traffic