

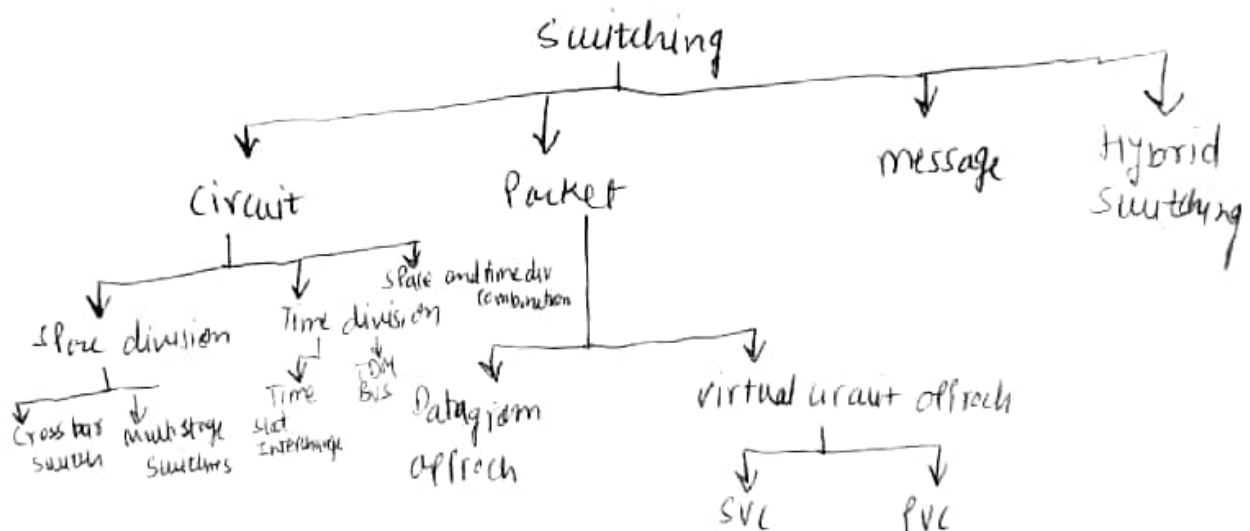
Unit - 3

Switching → whenever we have multiple devices, we have the problem of how to connect them to make one-to-one communication possible.

→ One solution is point to point connection between each pair of devices like Mesh or Star topology. These methods, however, are impractical and wasteful when applied to very large networks.

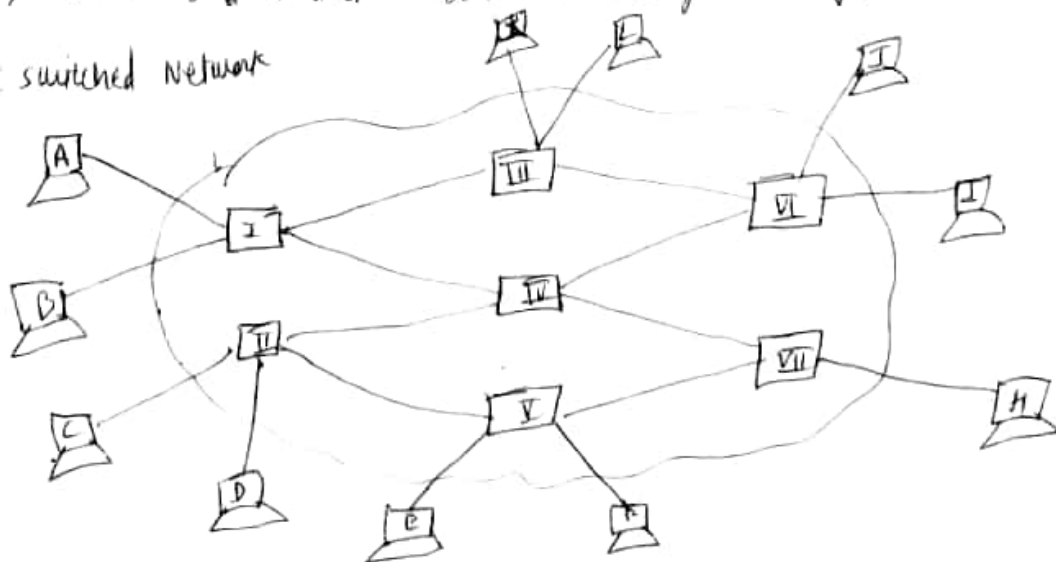
→ A better solution is switching. A switched network consists of a series of interlinked nodes, called switches.

→ Switches are hardware.



→ Circuit and Packet used commonly today.

fig: switched network



Circuit switching \rightarrow creates a direct physical connection between two devices such as phone or computer.

\rightarrow In fig instead of point-to-point connection between 3 comp on left to 4 comp on right require 12 links, we can use 4 switches to reduce the number and total length of the links.

\rightarrow by moving lever of switches one comp can connect to another

\rightarrow n IP and m outputs

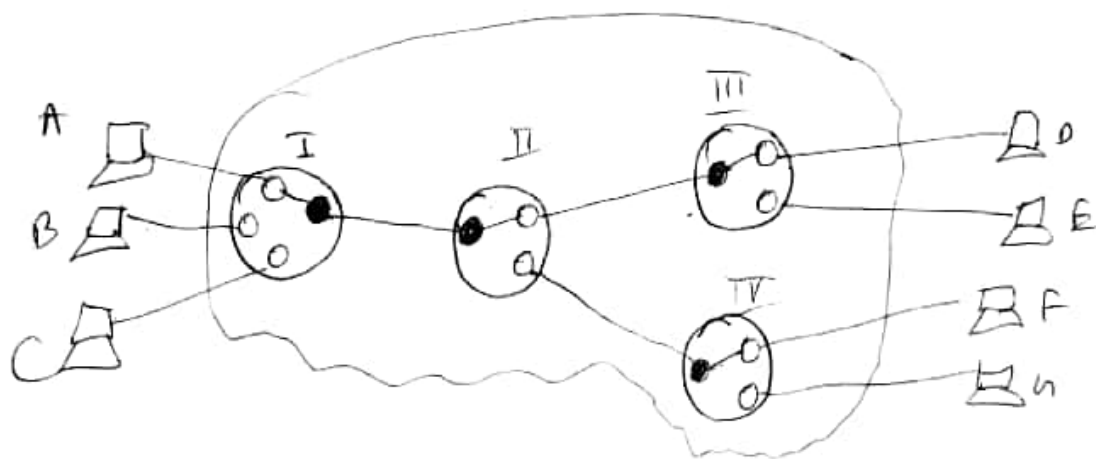


fig: Circuit switched network
(A is connected to D)

- * A ckt switch may be of two type
- 1) ckt switch
- 2) Folded switch



fig : A ckt switch

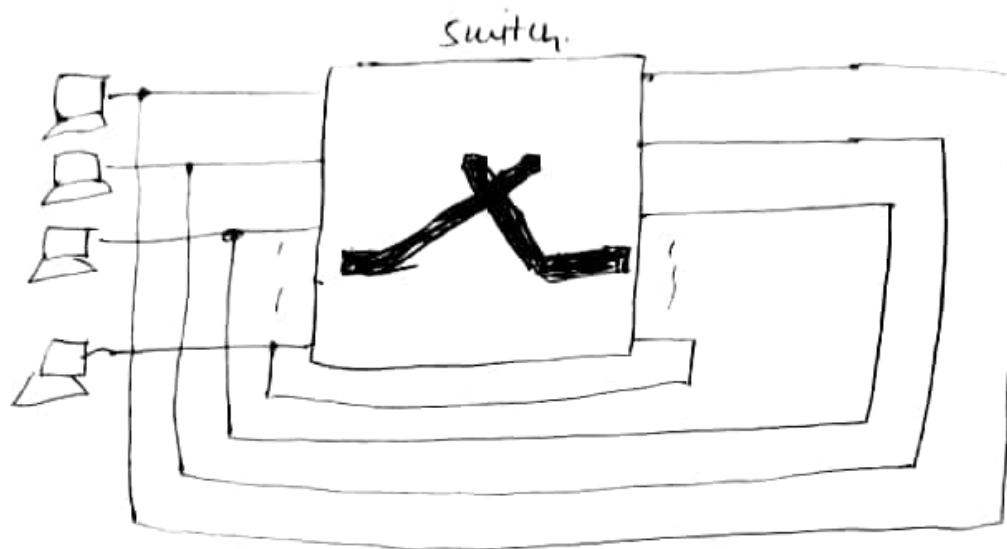


fig: folded switch

An n -by- n folded switch can connect n lines in full-duplex mode.

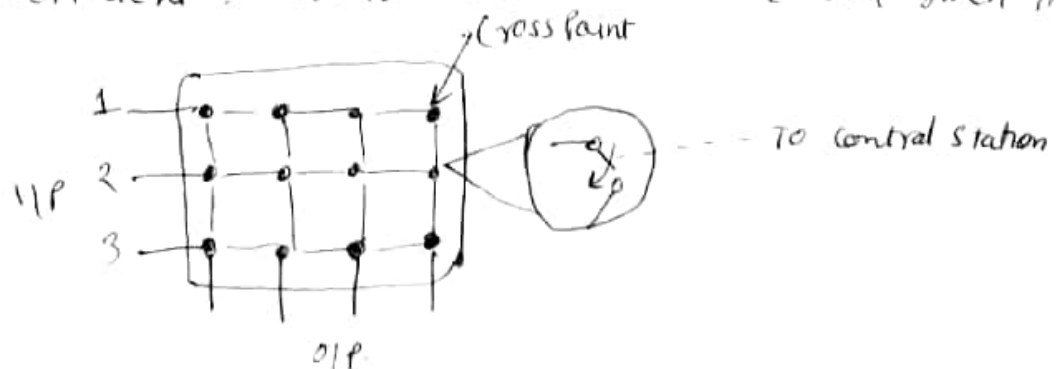
Space division switches: \rightarrow Paths in a circuit are separated from each other spatially.

\rightarrow was designed for use in analog networks but used in both analog and digital networks

Crossbar switches. \rightarrow Connects n i/p to m o/p. in a grid using electronic micro switch (transistor)

disad: \rightarrow connecting n i/p to m o/p using a crossbar switch require $n \times m$ crosspoints. for ex. to connect 1000 i/p to 1000 o/p 1000000 crosspoints are required.

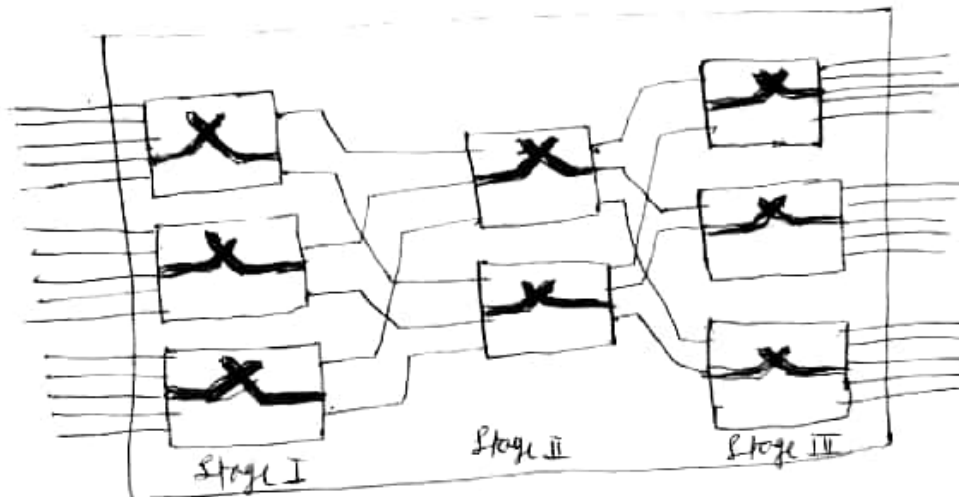
\rightarrow inefficient: 25% are not in use at a given time.



Multistage Switches \rightarrow Solⁿ to the previous problem is to use Multistage switches which combine several crossbar switches in several stages

\rightarrow Design of multistage switch depends on the no of stages and the no of switches required in each stage.

\rightarrow Normally middle stages have fewer switches than do the first and last stages.



Multistage switches provide several options for connecting each pair of linked devices i.e. Multiple paths

Blocking: \rightarrow Reduction in the no of crosspoints results in a phenomenon called Blocking.

Time division switches: \rightarrow Uses TDM
2 Methods

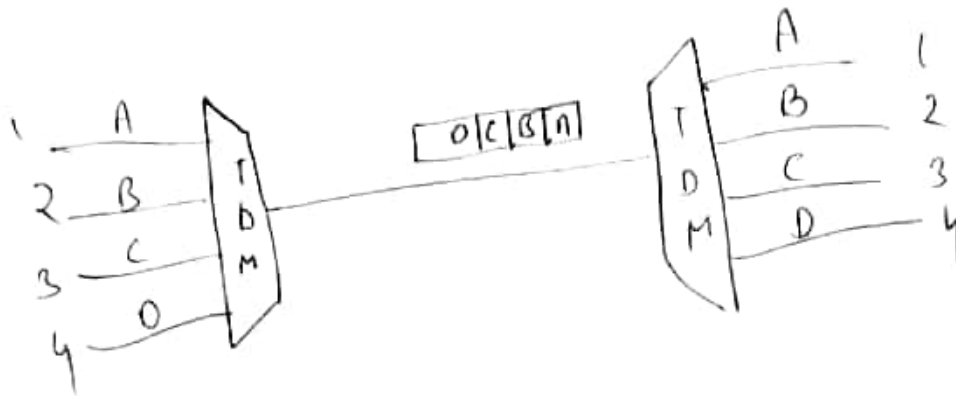
1) Time slot interchange (TSI) \rightarrow Imagine each IP line wants to send data to an O/P at

1 \rightarrow 3 2 \rightarrow 4 3 \rightarrow 1 4 \rightarrow 2

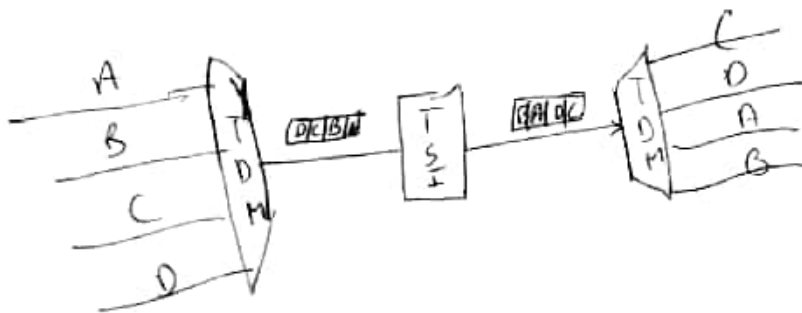
Fig a: \rightarrow Shows the results of ordinary time-division multiplexing. desired task is not completed.

Fig b: \rightarrow We insert a device called a Time-slot interchange (TSI) into the link. TSI changes ordering of the slots based on the desired connection

then DEMUX separate the slots, and passses them to proper o/p.

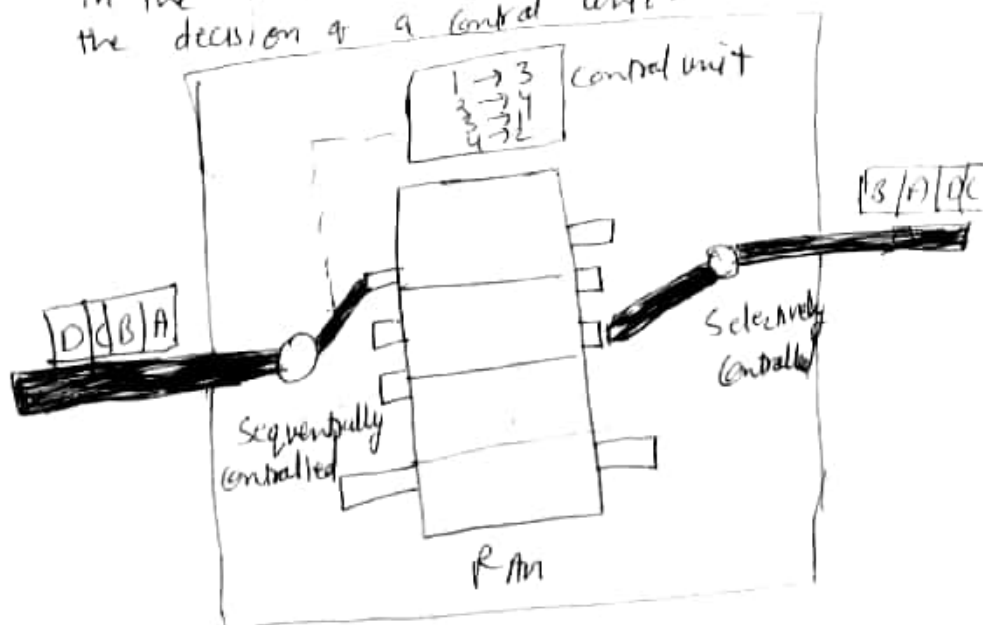


a) No Switching



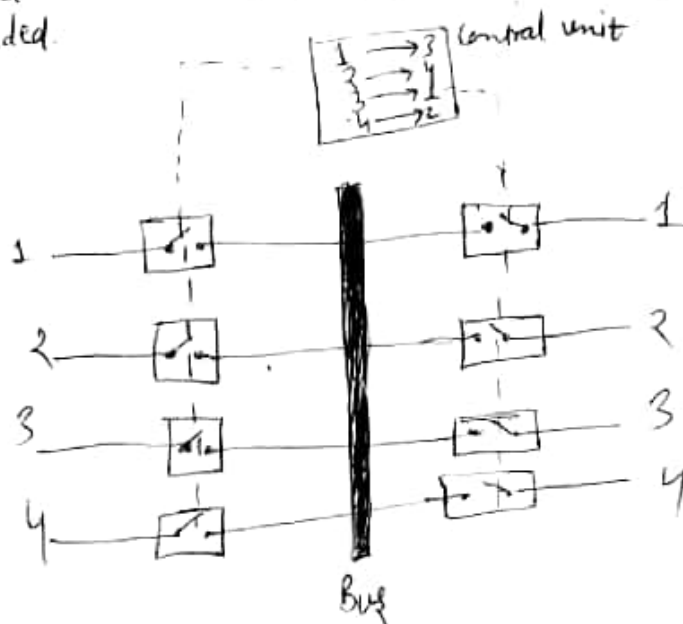
b) Switching.

TSI consists of RAM with several memory location no. of location is same as the no. of i/p. RAM fills up in the order received and then sent out in an order based on the decision of a control unit.



2) TDM Bus → fig shows a very simplified version of a TDM bus. The IIF and OIF lines are connected to a high speed bus through IIF and OIF gates (microswitches).

- Each IIF gate is closed during one of the four time slots during the same time slot only one OIF gate is also closed.
- Thus pair of gates allow a burst of data to be ~~transmitted~~ transferred from one specific IIF line to one specific OIF line using the bus.
- Control unit open and close the gate according to switching needed.



Space and Time Division Switching.

Space Division

- Instantaneous
- disad → No. of crosspoint required according to blocking

Time Division

- need no crosspoint
- disad → TSI creates delay. Each time slot must be stored by the RAM, then retrieved and passed on.

We combine both the tech to take adv. of the best of both.

Packet Switching: → Ckt switching was designed for voice communication: ∴ Disadv of Ckt switching

- Ckt switching creates temporary (dial) or permanent (leased) dedicated links that are well suited to tel. commⁿ.
- Ckt switching is less well suited to data and other non voice transmission line is ~~most~~ often idle and its facilities waste when ckt switching is use for data.
- Second weakness of ckt switching for data transmission is its data rate. creates the equivalent of a single cable between two devices and thereby assumes a single data rate for both devices.
- Third, inflexible. once ckt has been established, that ckt is the path taken by all parts of the transmission. whether or not it remains the most efficient or available.
- Finally, Ckt switching sees all transmission equally. But often with data communication we want to be able to prioritize.

(PS)

A better solution is Packet Switching. → in PS. Packet switched network, data are transmitted in discrete units of potentially variable length blocks. called packets.

- Max length of the packet is established by the network. Longer transmission are broken up into multiple packets. Each packet contains not only data but also a header with control information (priority codes, source and destination address).

- Packets are sent over the netw. node to node. At each node the packet is stored briefly then routed according to the information in its header.

Datagram Approach: → Each packet is treated independently from all others.

→ Packet in this tech are referred to as datagrams

→ figa shows datagram approach to deliver four packets from station A to station X. All four packets (datagram) belong to the same message but may go by different paths to reach their destination

→ datagrams arriving at their destination may be out of order. It is the responsibility of transport layer in most protocol to reorder the datagram before passing them on to the destination port.

→ there can be multiple links (or channel) for joining each pair of node.

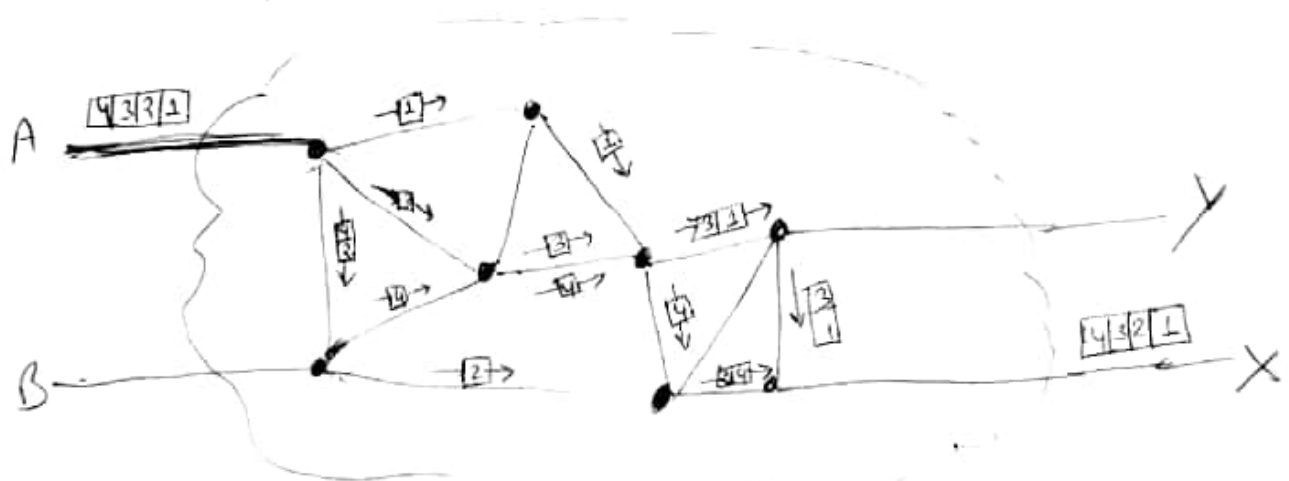
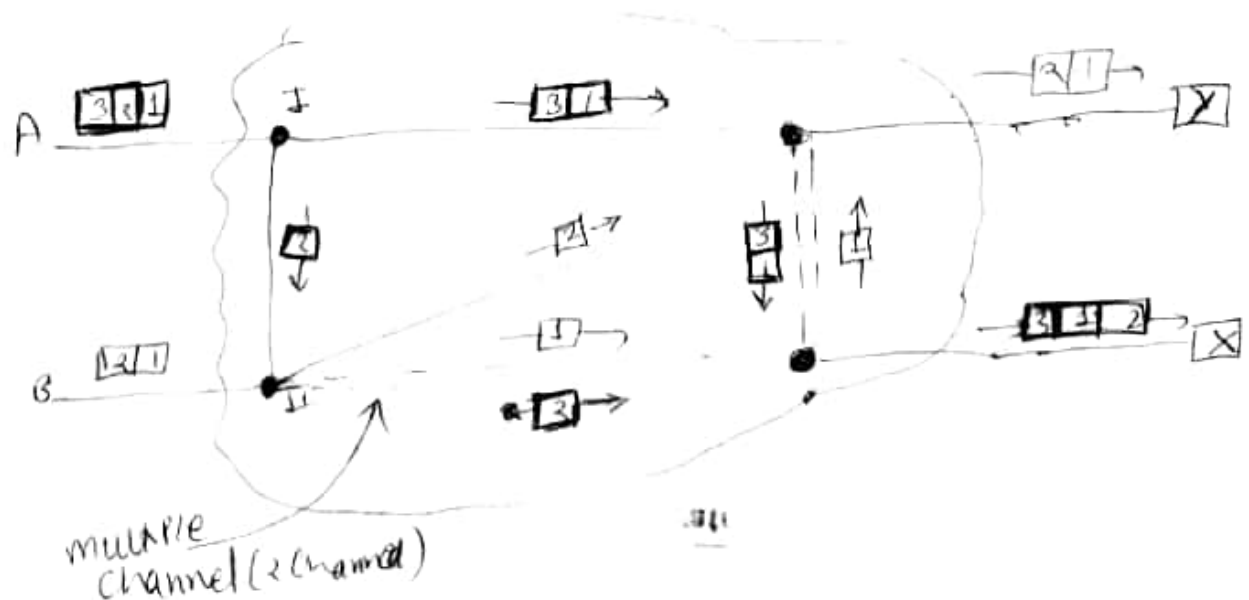


fig: Data gram approach



Virtual circuit approach: → The relationship between all packets belonging to a message or session is preserved. A single route is chosen between sender and receiver at the beginning of the session. When the data are sent, all packets of the transmission travel one after another along that route.

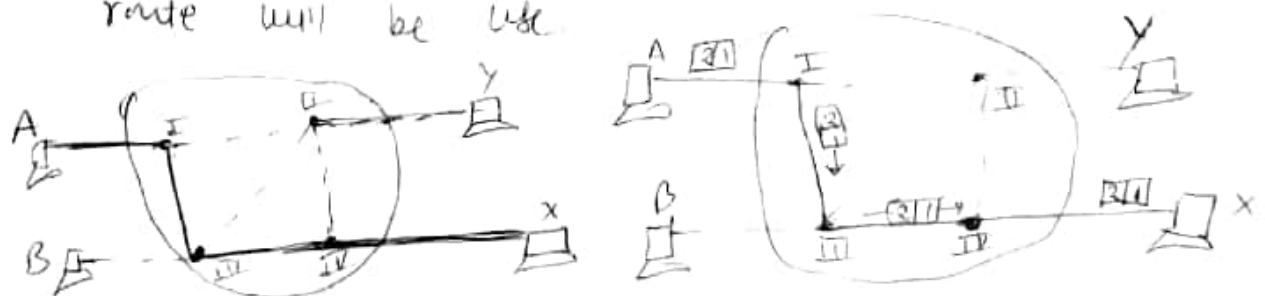
implemented in 2 formats.

1) SVC (Switched Virtual circuit) → is comparable conceptually to dial-up lines in circuit switching.

→ In this method, a virtual ckt is created whenever it is needed and exists only for the duration of specific exchange.

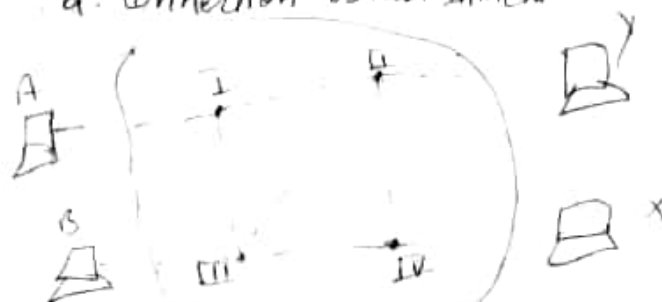
→ For ex. imagine that Station A wants to send four packets to stn X first A requests the establishment of a connection to X. Packets are sent once connection is in place. Packets are sent in sequential order. When last packet is received, if necessary, acknowledged the connection is released and that virtual ckt ceases to exist. Alternative route can be pick in case of failure.

→ Each time A wishes to send to X, same or different route will be use.



a. Connection establishment

b. Data transfer



c. Connection release

PVC (Permanent Virtual Circuits) : → are comparable to leased lines in circuit switching.

→ In this method same virtual circuit is provided between two users. No one else can use this dedicated circuit.

→ can be use without connection establishment and termination

→ two PVC users always get the same route for communication

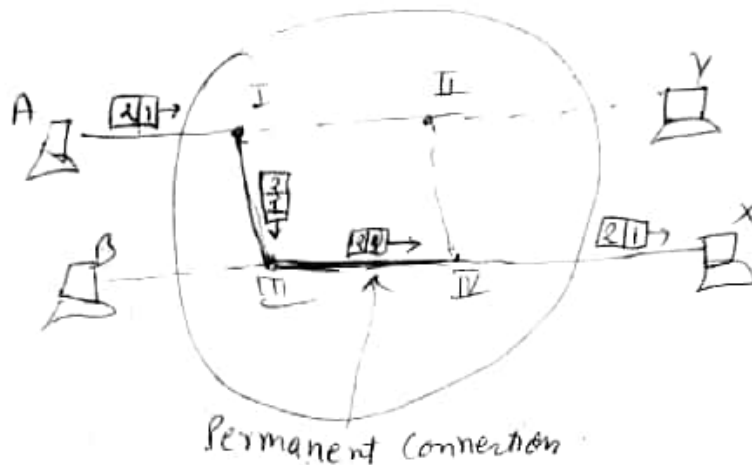


Fig: PVC.

Circuit switched connection versus virtual circuit connection:

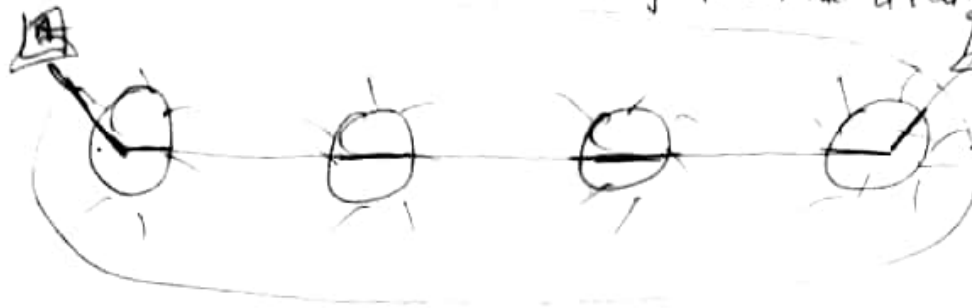
1) Path Although it seems that a circuit switched connection and a virtual circuit connections are the same. There are differences.

↓) Path versus route → A circuit switched connection creates a path between two points. and a physical path is created.

→ A virtual circuit connection creates a route between two points. (Paths are not physical)

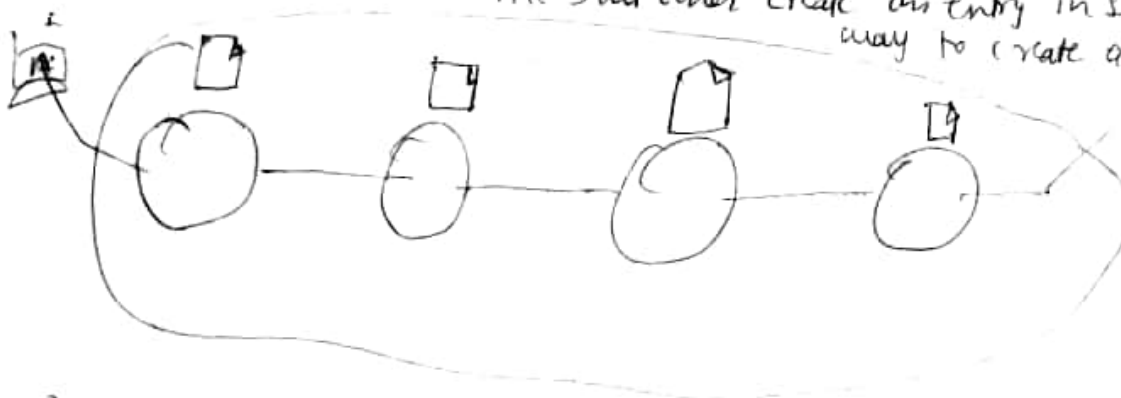
Each switch creates an entry in routing table. according to which packets travels.

All Switches are closed in such a way to create a path between A and B

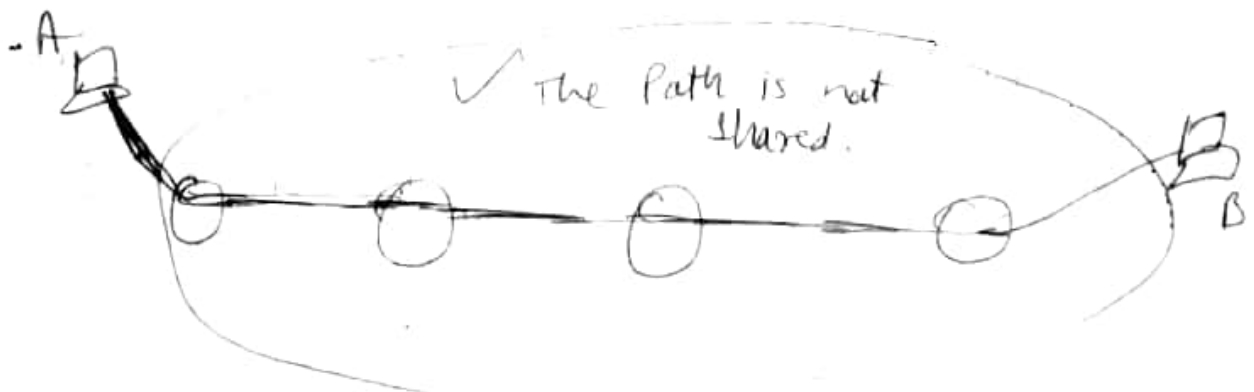


a) Circuit switched connection

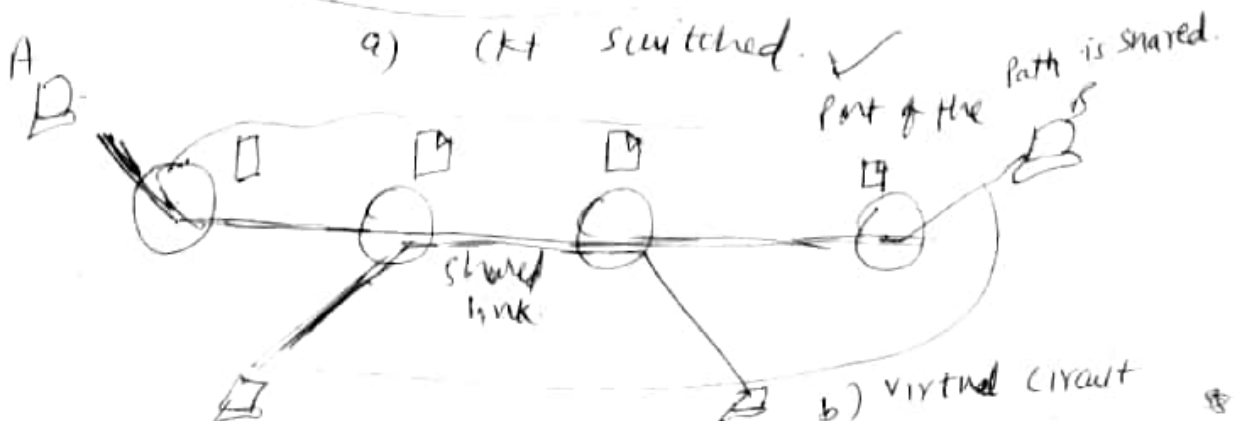
All switches create an entry in such a way to create a route for this connection



2) Dedicated vs sharing! →



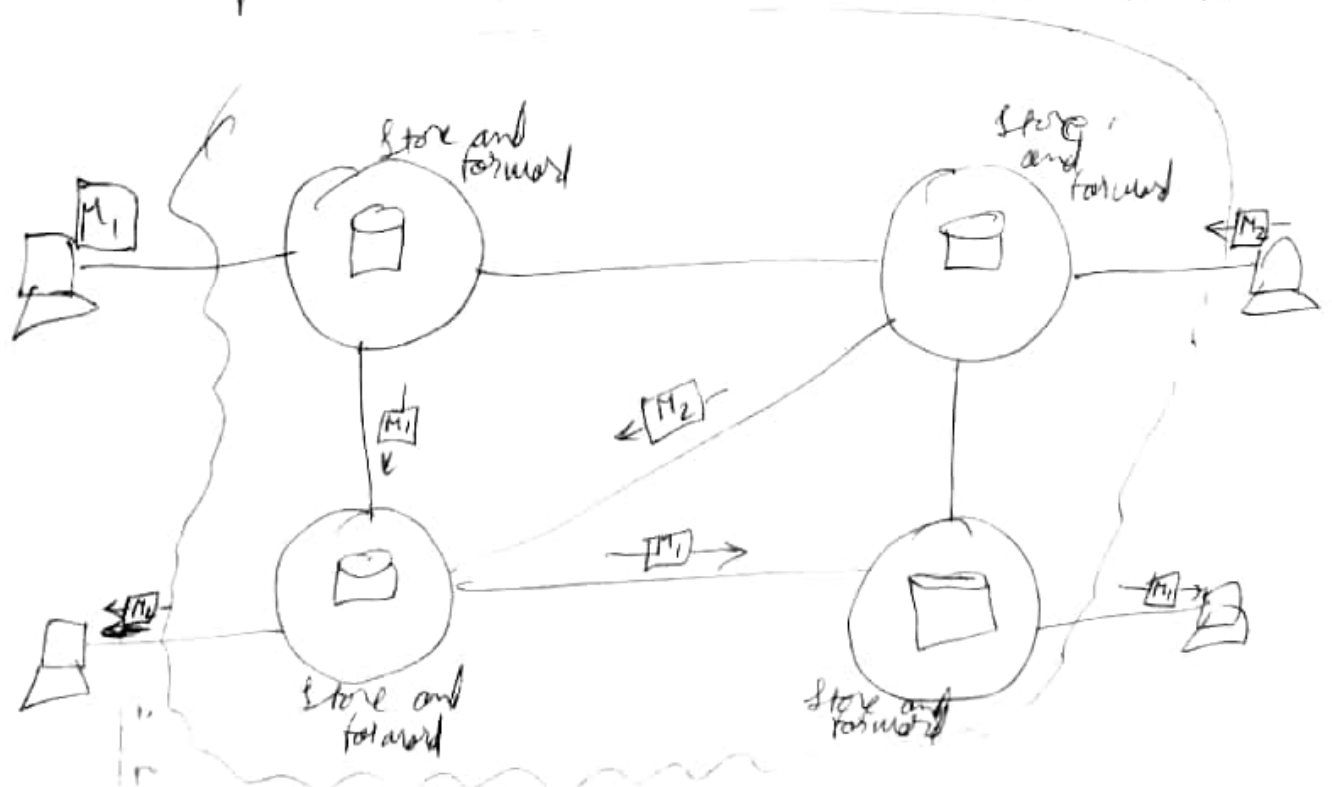
a) CT switched. ✓



b) virtual circuit

Message Switching : \rightarrow Best known by the term store and forward.

- \rightarrow In this a node (usually a computer with no floppy disks) receives a message, stores it until the appropriate route is free then send it along.
- \rightarrow Store and forward is considered a switching tech. because there is no direct link between the sender and receiver of a transmission.
- \rightarrow Note that in message switching, the messages are stored and relayed from secondary storage (disk), while in Packet switching the packets are stored and forwarded from primary storage (RAM).
- \rightarrow Use high level networking services (eg. delayed delivery, broadcast) for unintelligent devices.
- \rightarrow Since unintelligent devices have been replaced message switching have also been replaced.
- \rightarrow Delay at storage device make it less popular.



Hybrid Switching: → Enables both circuit and packet switched services to be provided in the same communication network.

Hybrid Switch = ATM switch + Packet switch

Datagram Network: → Datagram approach of Packet Switching

Connection oriented and Connectionless Services: →

There are two services given by the layer to layer above them.

- 1) Connection oriented service
- 2) Connectionless service

1) Connection oriented services: → There is a seq. of operation to be followed by the users of connection oriented service

There are 1) Connection is established

2) information is sent 3) Connection is released.

→ More reliable than connectionless service

→ we can send the message in connection oriented service if there is an error at the receiver's end

→ Ex is TCP (Transmission Control Protocol)

Connectionless services → Similar to postal service, as it carries the full address where the message (letter) is to be carried. Each message is routed independently from source to destination. The order of message sent can be different from the order received.

→ In connectionless the data is transferred in one direction from source to destination without checking that destination is still there or not or if it is prepared to accept the message.

→ Authentication is not needed in this. Ex. of connectionless service is VoIP

Difference

Connection oriented

- 1) Authentication is needed.
- 2) Checks whether message is received or not and sends again if an error occurs.
- 3) More reliable
- 4) Interface is stream based

Connectionless service

- 1) does not need
- 2) does not guarantee of message delivery
- 3) less reliable
- 4) message based.