4 CIRCUIT SWITCHING

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THAPAR INSTITUTE
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Course: Computer and Communication Networks

Topic: Switching Techniques : Circuit Switching

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Outline of the lecture

- Switched Network
- Taxonomy of switched networks
- Circuit Switched Network
- Phases of Circuit switching Communication
- Space Division Switching
- Time Division Switching
- Advantages and Disadvantages of circuit switched network

How two devices perform the communication if there are number of devices in a network ??

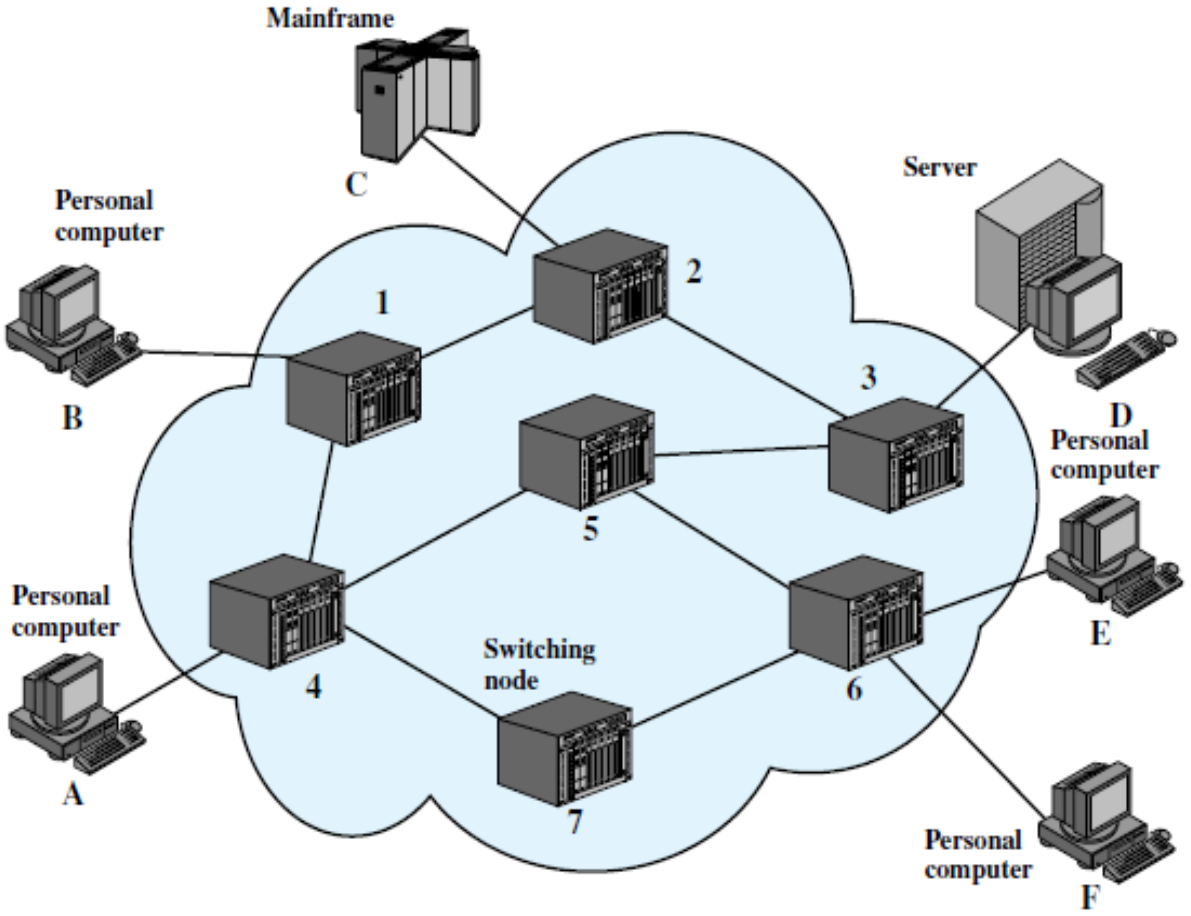
Switching

Switched Network

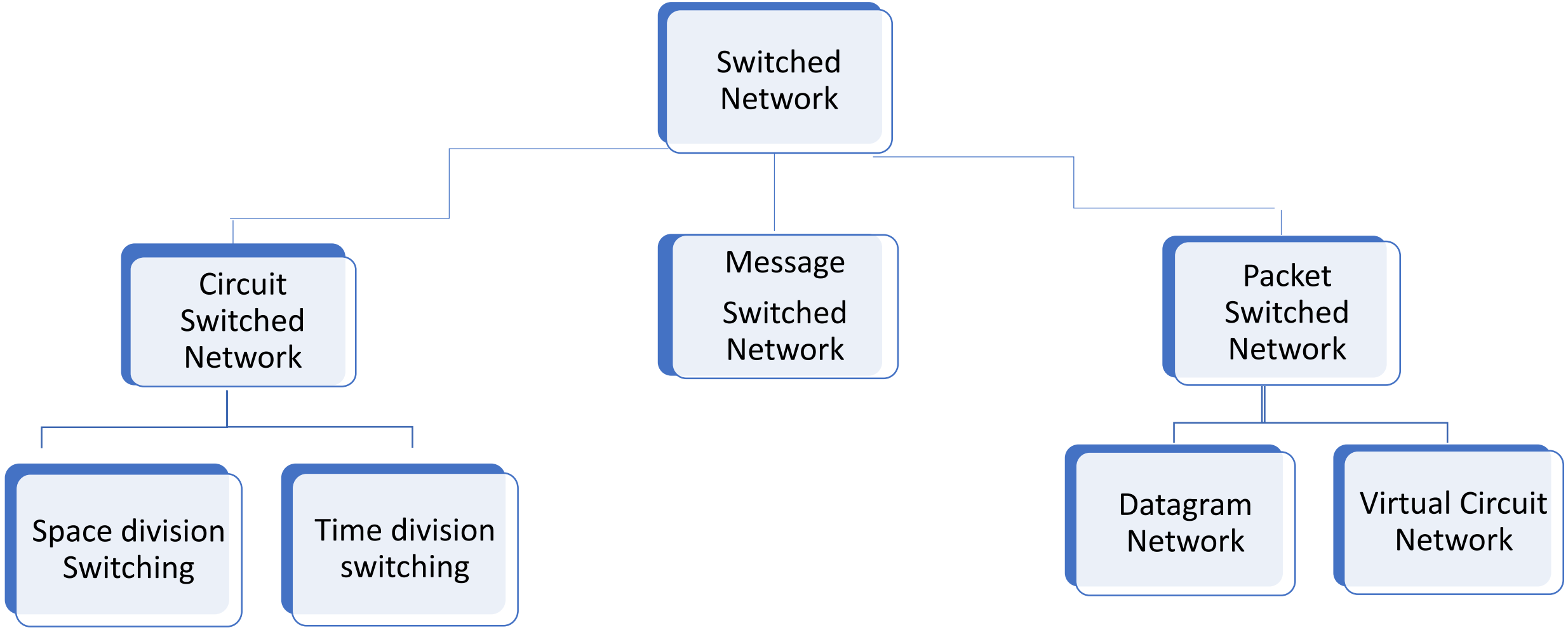
In a switched communication network, data entering the network from a station are routed to the destination by being switched from node to node.

Switches : these are capable to make connections between two or more devices.

Switching: Decide best route to connect multiple devices.



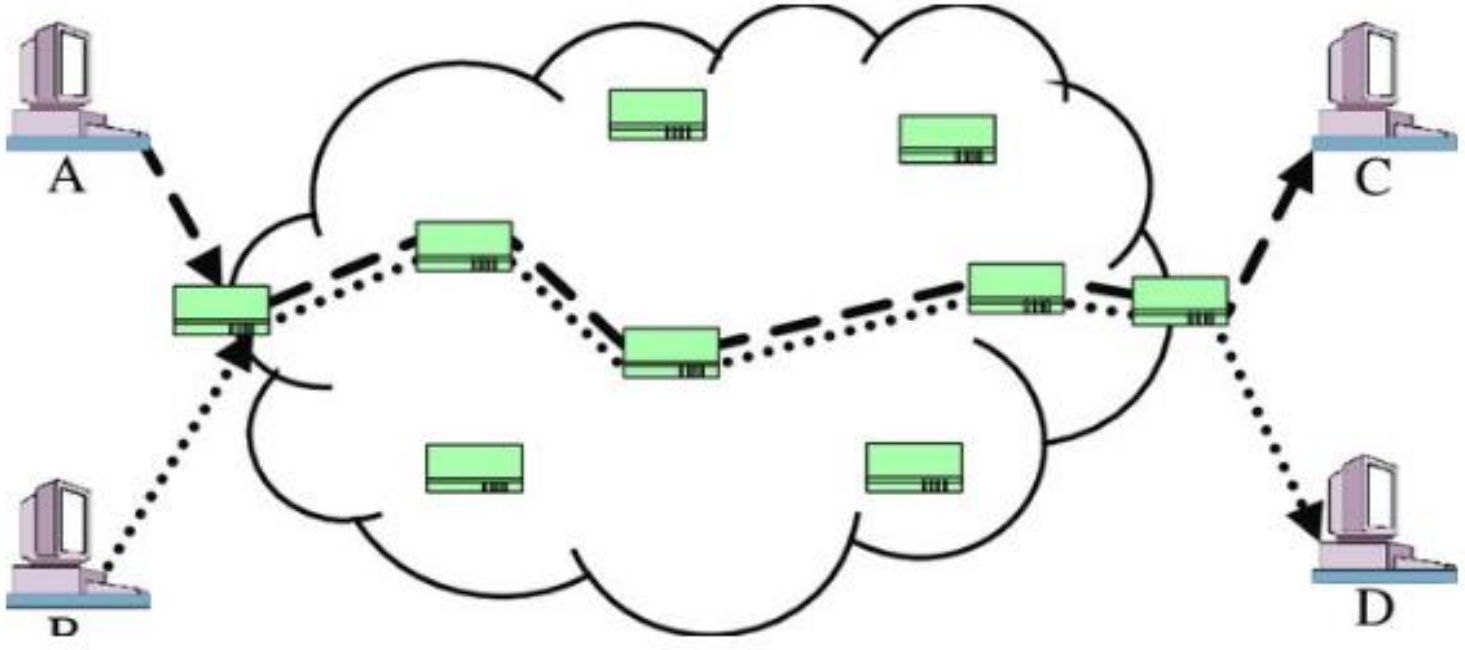
Taxonomy of switched networks



Reference: 1. Ferouzan, Behrouz A., Data Communications and Networking, 2. Stallings William, Data and Computer Communication

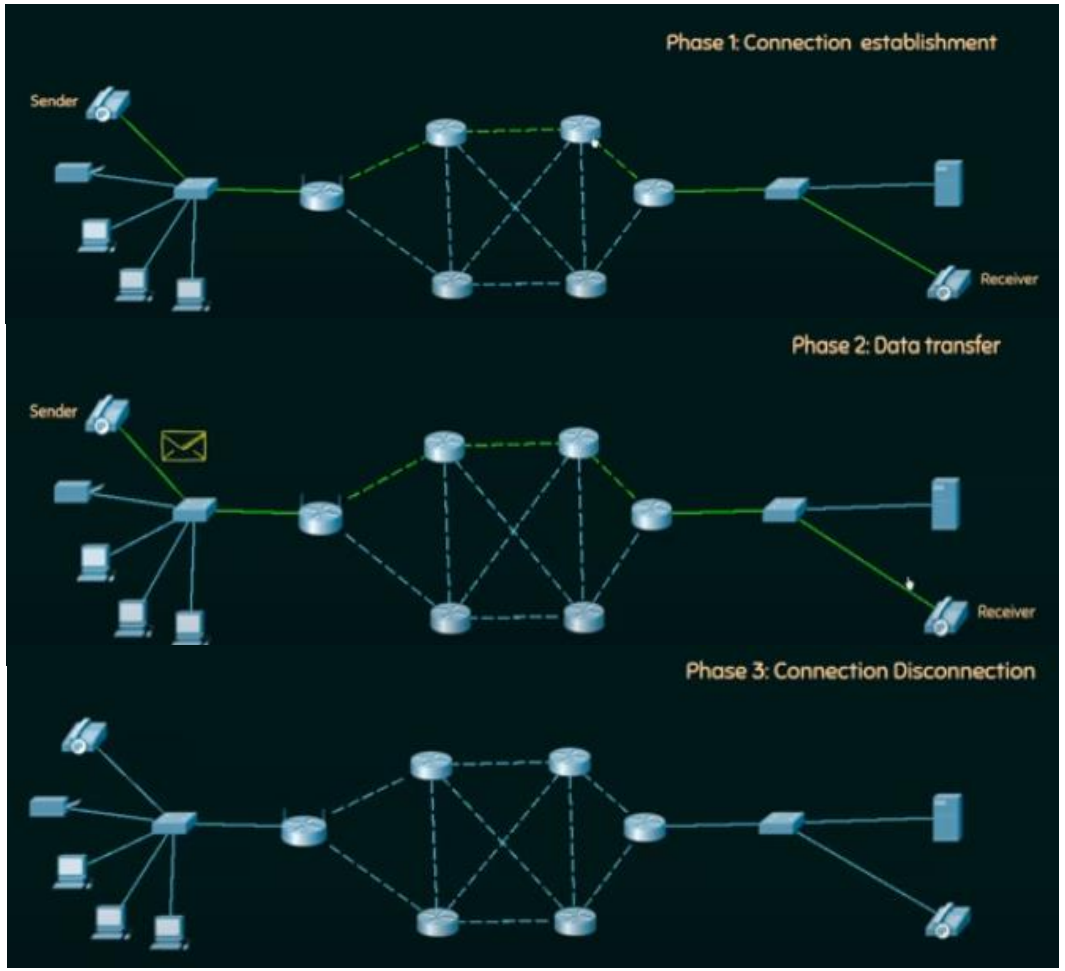
Circuit Switched Network

- Dedicated physical path



Phases Of Circuit switching Communication

- Establishment or Setup Phase
- Data Transfer Phase
- Disconnect or Teardown Phase



Reference: 1. Ferouzan, Behrouz A., Data Communications and Networking, 2. Stallings William, Data and Computer Communication 3. https://www.youtube.com/watch?v=-HlJ4psu5aU

Circuit Switched Network

- Transferring of data
- provides a constant bit delay and fixed data rate channel between the sender and receiver.
- Circuit Switching is at the physical layer .
- Uses less bandwidth.
- Easier to implement.
- Example: Analog telephone network.

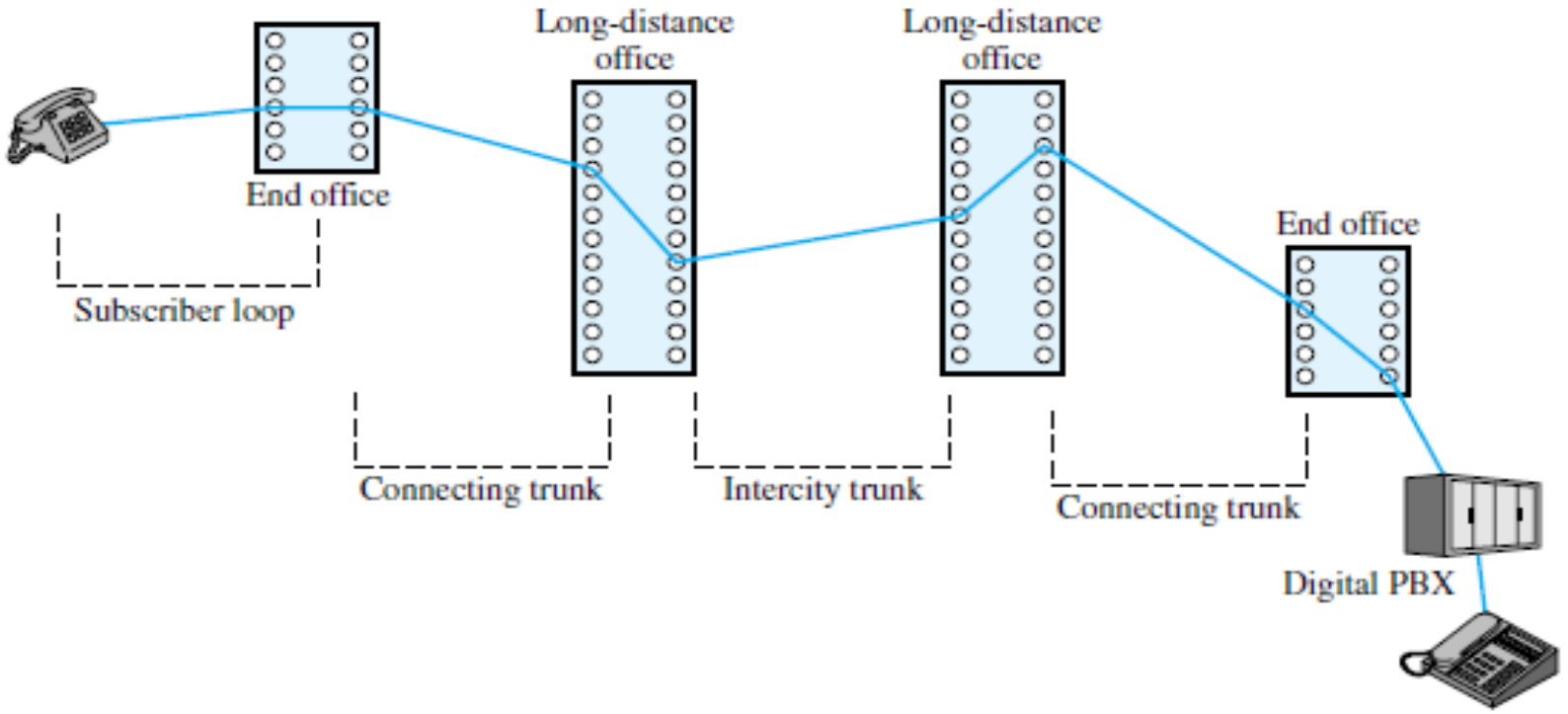
- Total time taken to transmit a message in circuit switched network

= Connection set up time + Transmission delay + Propagation delay + Tear down time

Transmission delay = Message size / Bandwidth

Propagation delay = (Number of hops on way x Distance between 2 hops) / Propagation speed

Example of a circuit-switching network



- *Advantages of Circuit Switching –*
- Dedicated physical path.
- It uses a fixed bandwidth
- data transmission delay is negligible.
- Better quality of communication.
- continuous transmission over a long duration.

- *Disadvantages of Circuit Switching –*
- Dedicated connection.
- Inefficient utilization of the system resource.
- More bandwidth requirement.
- Wastage of bandwidth.

Consider all links in the network use TDM with 24 slots and have a data rate of 1.536 Mbps. Assume that host A takes 500 msec to establish an end to end circuit with host B before begin to transmit the file. If the file is 512 kilobytes, then how much time will it take to send the file from host A to host B?

Calculating Bandwidth Per User-

Total bandwidth = Number of users x Bandwidth per user

So, Bandwidth per user

= Total bandwidth / Number of users

= 1.536 Mbps / 24

= 0.064 Mbps

= 64 Kbps

Calculating Transmission Delay-

Transmission delay (T_t)

= File size / Bandwidth

= 512 KB / 64 Kbps

= $(512 \times 2^{10} \times 8 \text{ bits}) / (64 \times 10^3 \text{ bits per sec})$

= 65.536 sec

= 65536 msec

Calculating Time Required To Send File-

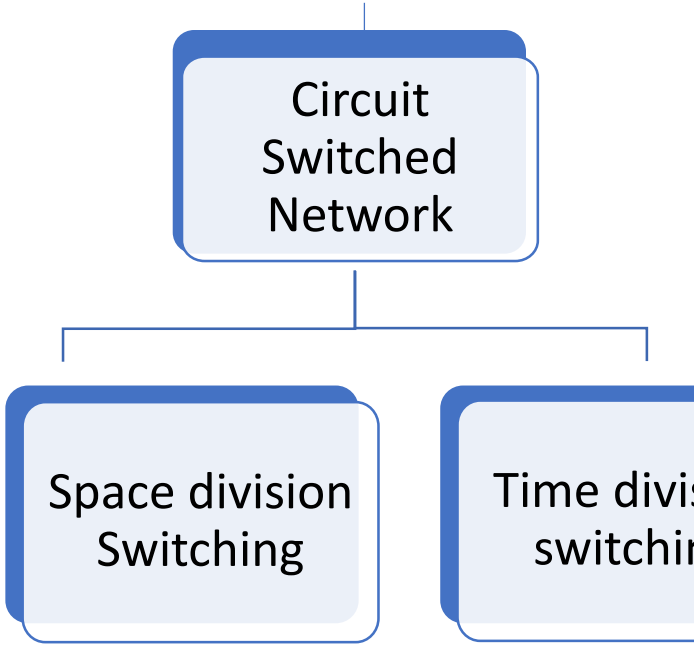
Time taken to send a file in circuit switched network

= Connection set up time + Transmission delay

= 500 msec + 65536 msec

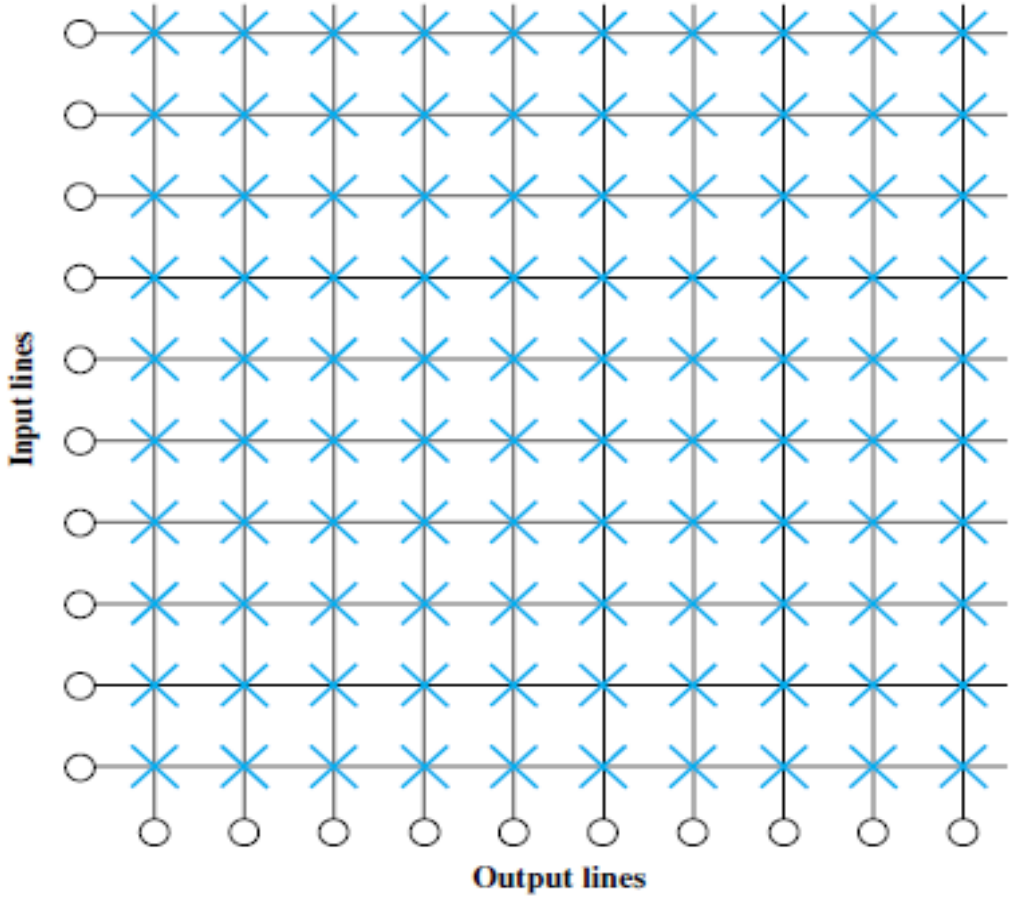
= 66036 sec

Space Division Switching

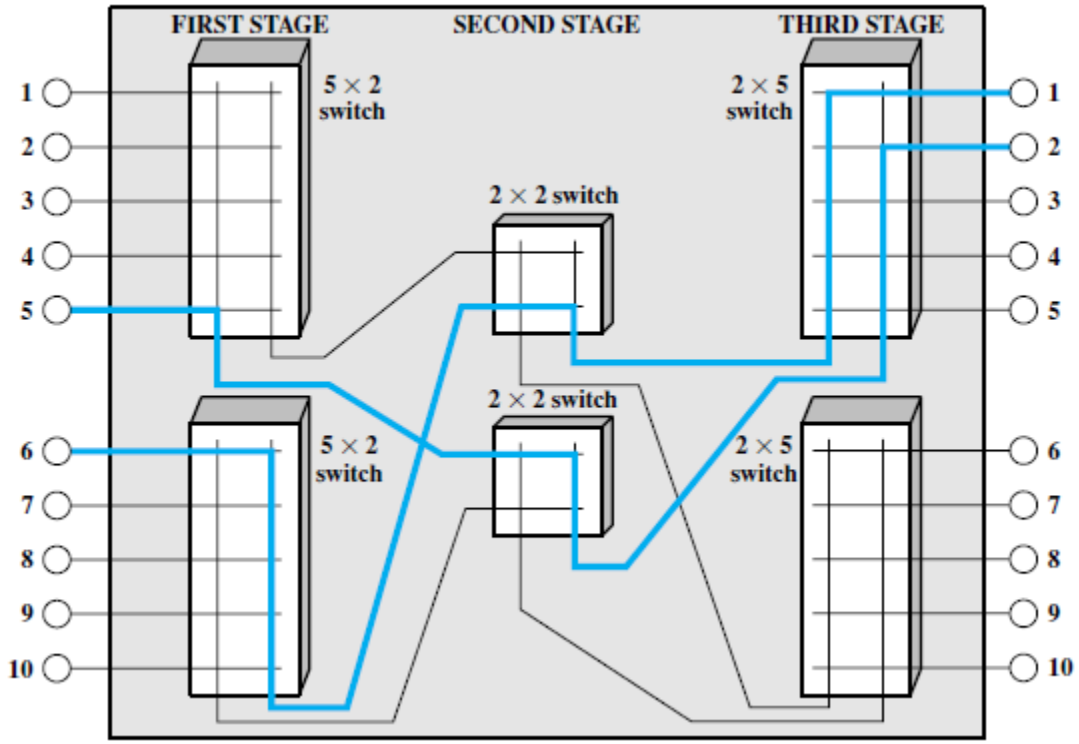


- Signal paths are physically separate from one another (divided in space).
- Each connection requires the establishment of a physical path through the switch to the transfer of signals between the two endpoints.
- Technology is used in both analog and digital circuits.

*Crossbar switch (*Space Division Switch)

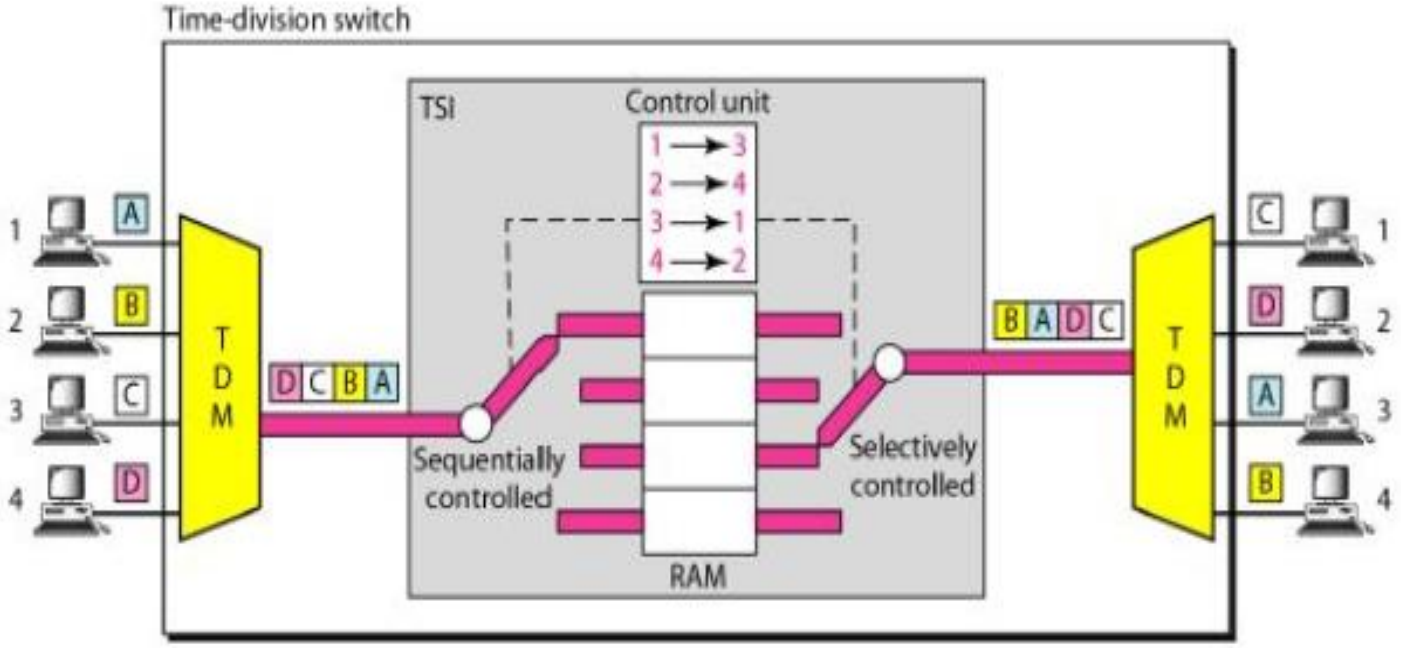


Three-Stage Space Division Switch(Multistage Switch)



Time Division Switching (Time slot Interchange)

- Uses time division multiplexing (TDM) inside a switch.
- It consist of random access memory
- The number of locations is the same as the number of inputs.
- The RAM fills up with incoming data from time slots in the order received.
- Slots are then sent out in an order based on the decisions of a control unit.



Reference: 1. Ferouzan, Behrouz A., Data Communications and Networking.

- *Advantages of Circuit Switching –*

- The data rate is fixed and dedicated as the connection is established using dedicated physical path.
- It uses a fixed bandwidth
- Once the circuit is established, there is no waiting time and the data transmission delay is negligible therefore communication channel increases the quality of communication.
- Since a dedicated path is established, it is a good choice for continuous transmission over a long duration.

- *Disadvantages of Circuit Switching –*

- Since the connection is dedicated it cannot be used for any other data transmission even if the channel is free.
- It is inefficient in terms of utilization of the system resource. As it is allocated for the entire conversation, we can't use the resource for other connection.
- More bandwidth is required for the dedicated channels .
- Establishment of physical links between senders and receivers takes huge time prior to the actual data transfer.
- As a dedicated path has to be established for each connection, circuit switching is more expensive.
- Even if there is no transfer of data, the link is still maintained until it is terminated by users. By this channel remains ideal for a long time thereby making circuit switching inefficient.

Thank You