CS & IT ENGINEERING

COMPUTER NETWORKS

Switching

Lecture No- 02

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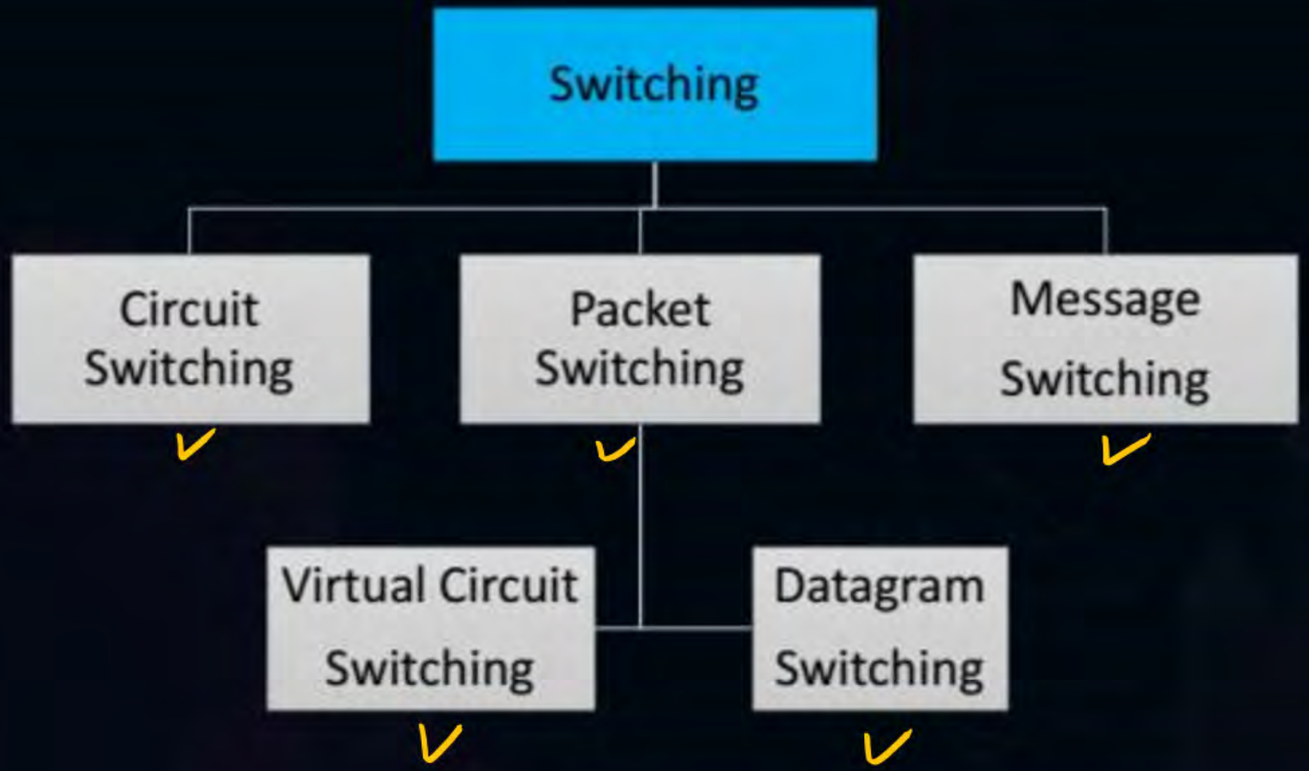
- **SWITCHING**
  - Packet SWITCHING

Topic : Switching

The process of forwarding packets from one port to another port is called as switching.

Topic : Switching



Topic : Switching

- Switching is done at Network layer but circuit switching is not done at Network Layer.
- Circuit switching was designed for telephone Network.
- When the Circuit switching was invented there was No concept of OSI Layer or TCP/IP Layer.

Topic : Circuit Switching

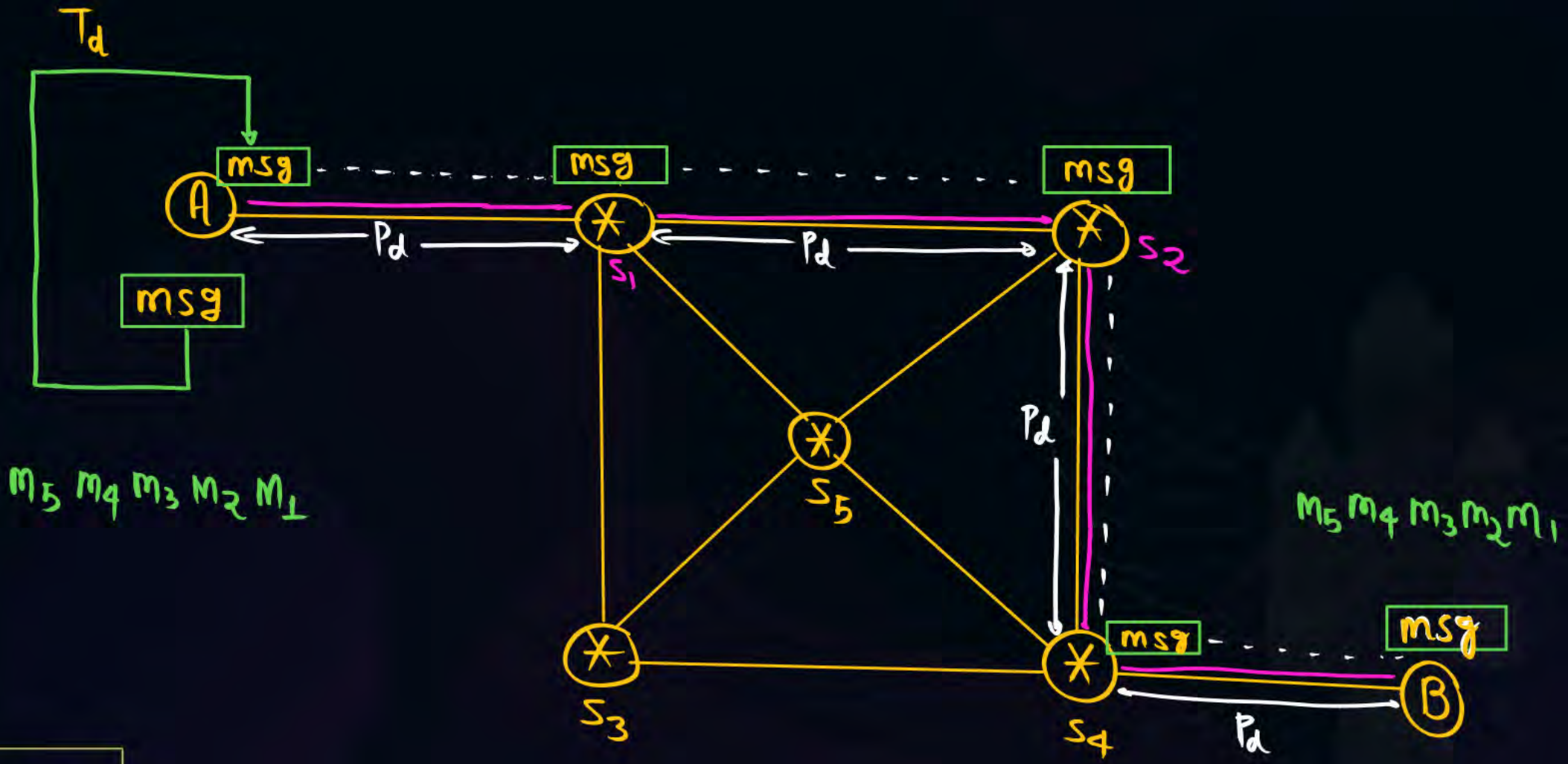
The Communication in a circuit switched network take place in 3 phases

(1) Circuit establishment or setup phase

(2) Data transfer phase

(3) Circuit disconnection or tear down phase

Slide


T_d
msg
msg
msg
A
P_d
P_d
S_1
S_2
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$m_5\ m_4\ m_3\ m_2\ m_1$
$m_5\ m_4\ m_3\ m_2\ m_1$
msg
msg
S_3
S_4
P_d
B

Slide 4

msg size = m
Bandwidth = B
Velocity = v
No. of Hops = X
Length of each Hop = d

Total time taken to send msg From source to Destination = Setup time + Transmission time + Propagation time + Tear down time

$$\text{Total time} = S + \frac{m}{B} + X.\frac{d}{v} + T$$

Topic : Circuit Switching

1. Circuit establishment or setup phase:

- In circuit switched network before actual data transfer take place a dedicated circuit or physical path is established between sender and receiver.
- The dedicated path establish between the sender and receiver is maintained for entire duration of conversation .
- Before starting communication the station must make a reservation of resource to be used during the communication.
- These resources can be switch buffers, switch processing time, switch input output port. These resources remains dedicated during the entire duration of data transfer.

Topic : Circuit Switching

2. Data transfer phase:

- After the circuit is established , the entire data travels over the dedicated path from sender to receiver .
- The data flows are continuous b/w sender and receiver .
- There is no addressing involved in the data transfer i.e no header.

Topic : Circuit Switching

3. Circuit disconnection or tear down phase:

- After the data transfer is completed , the circuit is disconnected.
- When sender needs to disconnect , a signal is sent to each switch to release the resources.

NOTE: Circuit switching is implemented at physical layer

Topic : Circuit Switching

Advantages of Circuit switching:

- A well defined and dedicated path exists for the data to travel.
- There is no waiting time at any switch Once the circuit is established data is transferred with out any delay.
- There is no header overhead.
- Data always reaches the receiver end in order.
- No reordering is required.

Topic : Circuit Switching

Disadvantages of Circuit switching:

- As the connection is dedicated it can not be used to transmit any other system data even if channel is free.
- 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.
- Dedicated channel required more bandwidth.
- Time required to establish a physical link b/w two station is too long.
- Routing decisions can not be changed once the circuit is established.

Topic : Computer Networks

#Q. Consider a circuit switched network. The circuit setup time is S sec, the propagation delay is 'd' sec per hop, and the data rate is 'b' bps. What is the delay in sending an x bit message over a k-hop path ?

A. S+x/b+kd

B. S

C. S+x/b

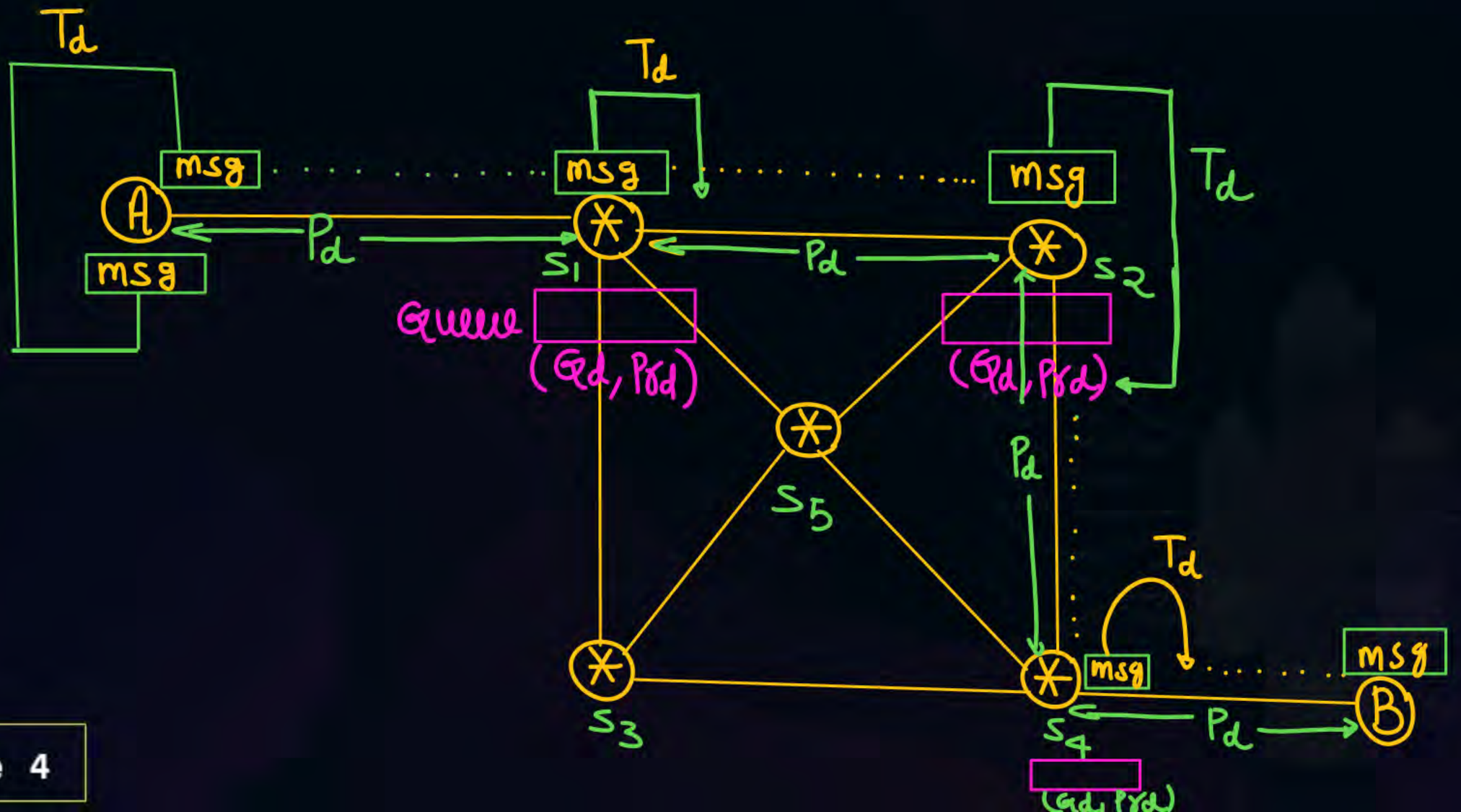
D. S+x/b+(k-1)d

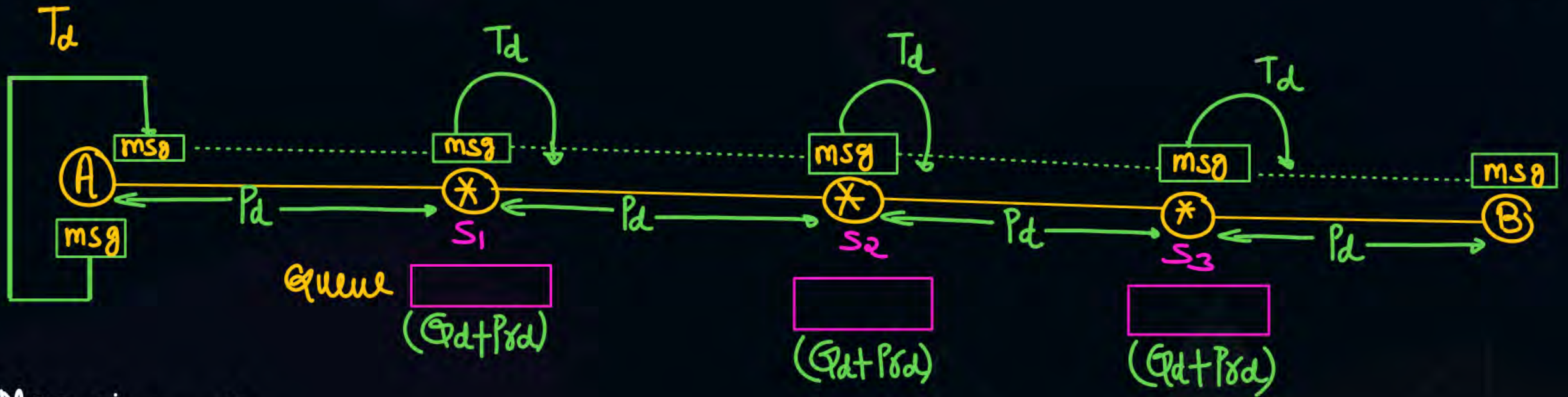
Circuit switching

Total time = $S + TT + PT + T$

Total time = $S + \frac{X}{b} + Kd$

Packet switching





Msg size = m

Bandwidth = B

No. OF Hops = X

Length OF each Hop = d

Total time = Transmission time + Propagation time + Queing delay + Processing delay

$$\text{Total time} = X\cdot\frac{m}{B} + X\frac{d}{v} + X-1\,(Qd+Psd)$$

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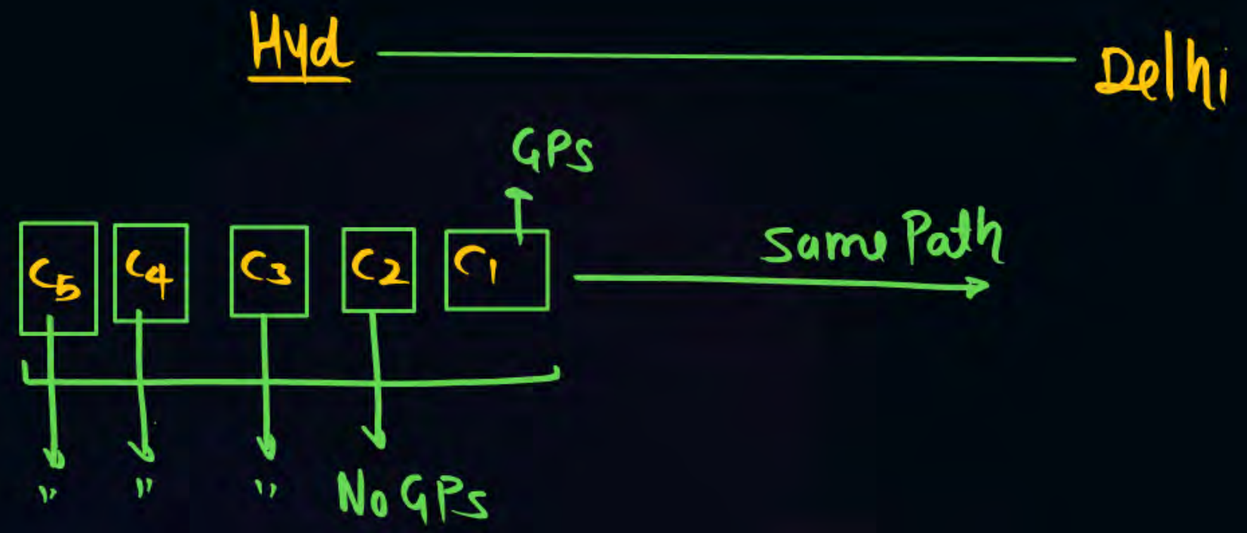
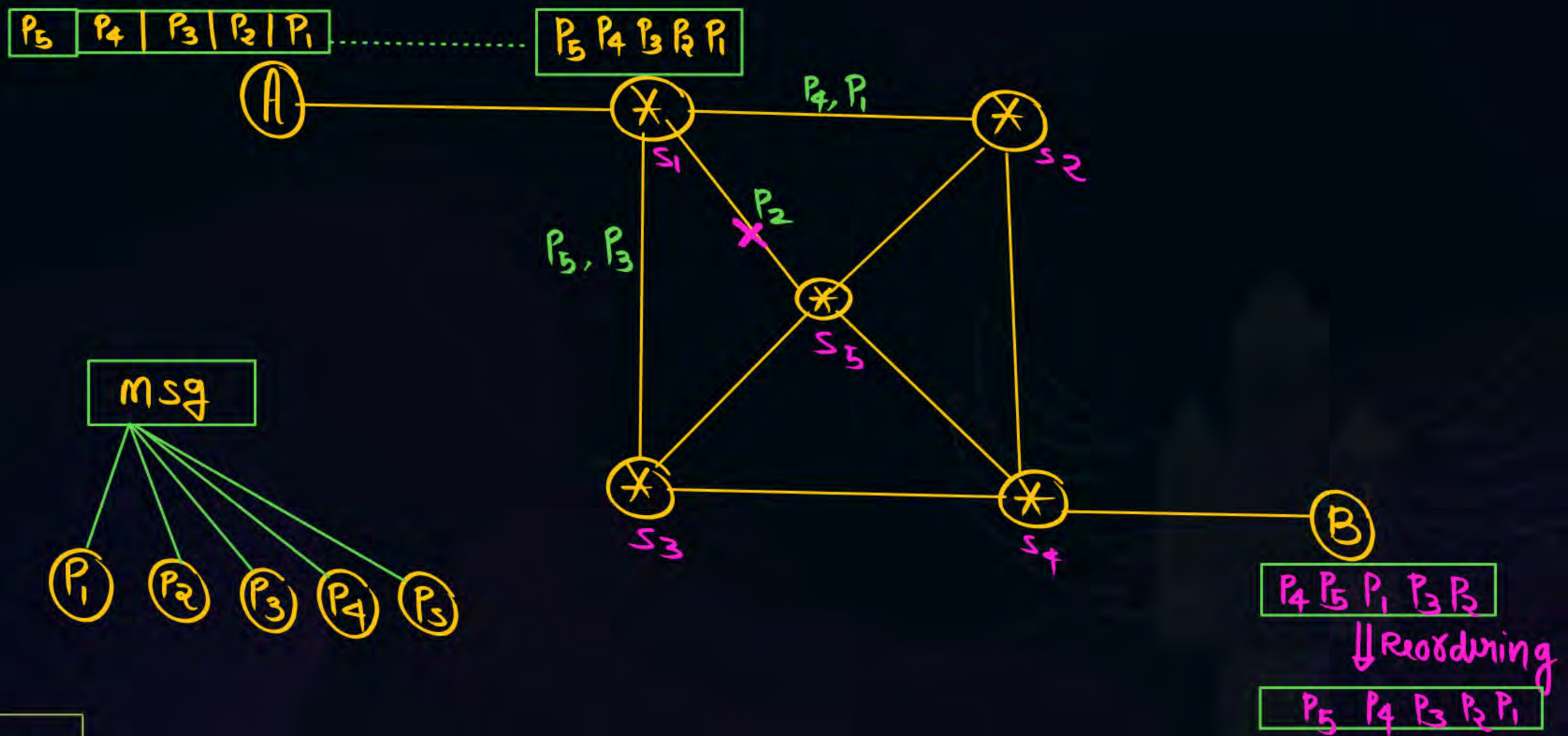
Topic : Packet Switching

- Packet switching is a method of transferring the message to a network in the form of packets.
- The message is broken into small pieces(fixed or variable size) called packet.
- At the destination all these small parts has to be reassembled belonging to same message.
- No pre setup or reservation of resource is needed.
- Packet switching uses store & forward technique.
- More than one path is possible b/w a pair of source and destination.
- Each packet contains source and destination address using which they independently travel through the network.
- Packets belonging to same message may travel different paths to reach their destination.
- If there is a congestion at some path , packets are allowed to choose different paths over an existing network.

Topic : Packet Switching

- Packet switched networks were designed to overcome the weakness of circuit switched networks since circuit switched networks were not effective for small messages.


Hyd
Delhi
GPS
C5
C4
C3
C2
C1
Same Path
No GPS


P5 P4 P3 P2 P1
P5 P4 P3 P2 P1
A
S1
S2
S3
S4
S5
P4, P1
P2
P5, P3
msg
P1
P2
P3
P4
P5
B
P4 P5 P1 P3 P2
Reordering
P5 P4 P3 P2 P1

Topic : Packet Switching

Advantages of Packet switching:

- More fault tolerant because packet may follow different path in case link down.
- There is no setup or teardown phases.
- Efficiency of packet switching is better than that of circuit switching.
- More reliable as destination can detect the missing packet.
- Cost effective and comparatively cheaper to implement.

Topic : Packet Switching

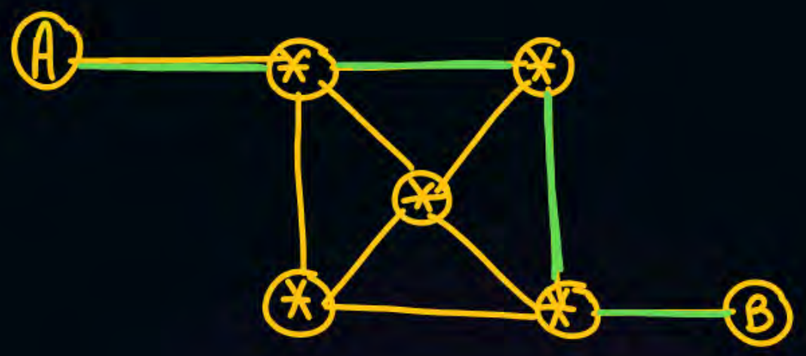
Disadvantages of Packet switching:

- Packet switching doesn't give packets in order , whereas circuit switching provides ordered delivery of packets because all the packets follow the same path.
- Since the packets are unordered , we need to provide sequence numbers for each packets.
- Transmission delay is more in packet switching.
- Packet switching is beneficial only for small messages , but for Large messages circuit switching is better.

Circuit switching	Packet switching
setup time + Tear down Time	$(X-1)\frac{M}{B} + (X-1)(Qd + Pd)$

Circuit switching
Vs
Packet Switching

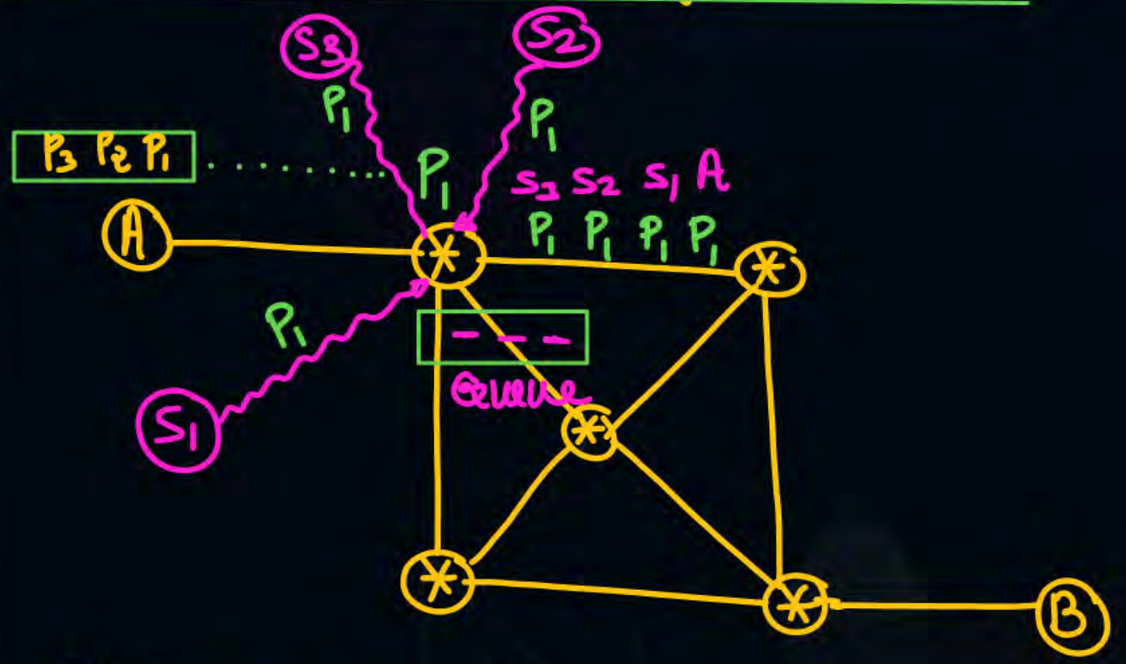
Circuit switching



It Has 3 Phases

i) Connection establishment
ii) Data transfer
iii) Connection termination

Packet switching



It Has only one Phase

① Data transfer

Circuit Switching	Packet switching
(1) It has Three phases- (i) Connection establishment (ii) Data transfer (iii) Connection termination	It has only one phase- Data transfer
(2) Physical path between source and destination	No physical path
(3) All packets use same path	Packet may follow different path(travel independently)
(4) Reserve the entire bandwidth in advance	Does not reserve
(5) Bandwidth wastage	No Bandwidth wastage

Circuit Switching	Packet switching
(6) No store and forward transmission	Support store and forward transmission
(7) Congestion can happen during connection establishment phase	Congestion can happen during data transfer phase
(8) It is reliable	Not reliable
(9) Better for sending large message	Better for sending small messages
(10) Not fault tolerant technique	Fault tolerant technique

THANK YOU!