



CS & IT ENGINEERING

Computer Networks

Switching

Lecture No.- 02



By- Ankit Doyla Sir

Recap of Previous Lecture



Topic

DVR

Topic

LSR

Topics to be Covered



Topic

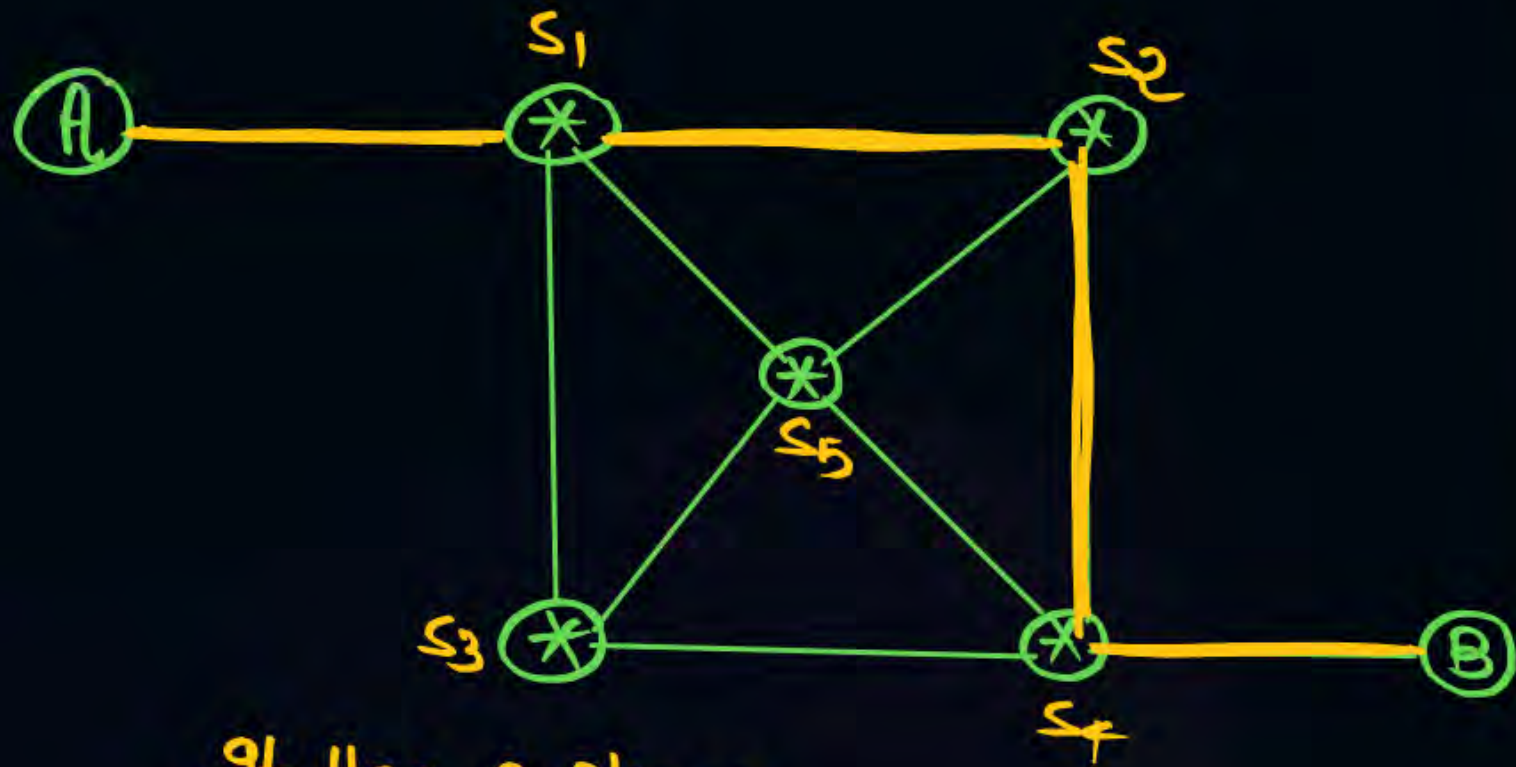
circuit switching > packet switching





Circuit switching Vs Packet Switching

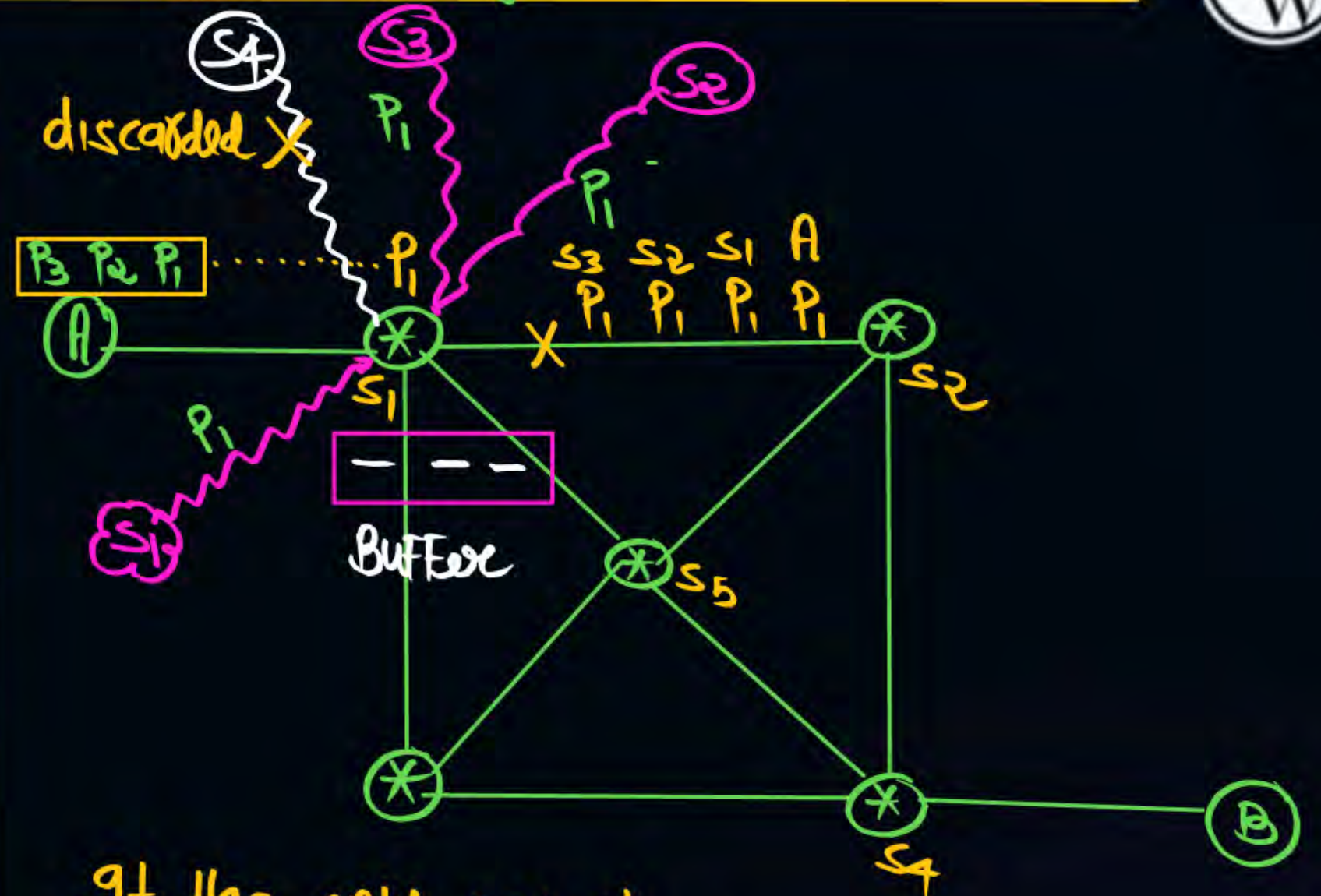
circuit switching



It Has 3 Phases

- (i) connection establishment
- (ii) data transfer
- (iii) connection termination

Packet switching



It Has only one Phase

- (i) data transfer phase



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



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

Problem Solving
On
Packet Switching



Topic : Packetization in packet switching:

- The process of dividing a single message into smaller size packet is called as packetization.
- These smaller size packets are sent one after other.
- It gives the advantage of pipelining and reduce the total time taken to transmit the message.



Topic : Problem solving on Packet Switching

#Q. Consider the store and forward packet switched network given below. Assume that the bandwidth of each link is 10^6 bytes/sec. A user on host A sends a file of size 10^3 bytes to host B through routers R1 and R2 in three different ways. In the first case a single packet containing the complete file is transmitted from A to B. In the second case, the file is split into 10 equal parts, and these packets are transmitted from A to B. In the third case, the file is split into 20 equal parts and the packets are sent from A to B. Each packet contains 100 bytes of header information along with the user data. Consider only transmission time and ignore processing, queuing and propagation delays. Also assume that there are no errors during transmission. Let T_1 , T_2 and T_3 be the times taken to transmit the file in the first, second and third case respectively. Which one of the following is correct?

GATE 2014

A. $T_1 < T_2 < T_3$

B. $T_1 > T_2 > T_3$

C. $T_2 = T_3, T_3 < T_1$

D. $T_1 = T_3, T_3 > T_2$

Optimal Packet Size

If the packet size is not chosen properly then it might increase the total time taken to transmit the message. So it is very important to choose the packet size properly.



Topic : Optimal Packet Size

Generalized Formula for optimal packet size

Suppose

M = Message size

h = Header size

p = Payload/Packet data size

assume bandwidth is 'b' bits/sec

Number of Hops = X

Total No. of Packet = M/p



Topic : Optimal Packet Size

When message is Packetized then these are send in a pipelined manner to reduce transmission time but there is a threshold on packet size 'P' Hence it may not be more large or more small It must be optimum.

“Now we first derive transmission delay (1st packet takes transmission delay by all the intermediate nodes and source or transmission delay on all hopes and rest all packet take only one hope transmission delay due to pipeline)



Topic : Optimal Packet Size

$$\begin{aligned}\text{Transmission time(TT)} &= \left(\frac{p+h}{b}\right) X + \left(\frac{M}{p} - 1\right) \left(\frac{p+h}{b}\right) \\ &= \frac{1}{b} \left[(p+h) X + \frac{1}{p} (M-p)(p+h) \right]\end{aligned}$$

So resultantly we want to find minimum transmission delay at optimum packet size so differentiate TT w.r.t 'p' we get

$$\frac{d}{dp} TT = \frac{1}{b} (X * p^2 - p^2 - Mh) = 0$$

$$\text{so } p^2 = \left(\frac{Mh}{X-1} \right)$$

$$p = \sqrt{\frac{Mh}{X-1}}$$



Topic : Problem solving on Packet Switching

#Q. In a packet switching network, packets are routed from source to destination along a single path having two intermediate nodes. If the message size is 24 bytes and each packet contains a header of 3 bytes, then the optimum packet size is:

- A. 4
- B. 6
- C. 7
- D. 9

GATE 2005



Topic : Problem solving on Packet Switching

#Q. Consider a source computer (S) transmitting a file of size 10^6 bits to a destination computer (D) over a network of two routers (R1 and R2) and three links (L1, L2 and L3). L1 connects S to R1, L2 connects R1 to R2 and L3 connects R2 to D. Let each link be of length 100 km. Assume signals travel over each link at a speed of 10^8 meters per second. Assume that the link bandwidth on each link is 1 Mbps. Let the file be broken down into 1000 packets each of size 1000 bits. Find the total sum of transmission and propagation delays in transmitting the file from S to D?

A. 1005 ms

B. 1010 ms

GATE 2005

C. 3000 ms

D. 3003 ms



Topic : Problem solving on Packet Switching

#Q. Two hosts are connected via a packet switch with 10^7 bits per second links. Each link has a propagation delay of 20 microseconds. The switch begins forwarding a packet 35 microseconds after it receives the same. If 10000 bits of data are to be transmitted between the two hosts using a packet size of 5000 bits, the time elapsed between the transmission of the first bit of data and the reception of the last bit of the data in microseconds is _____.

GATE 2015



Topic : Problem solving on Packet Switching

#Q. Suppose two hosts are connected through two intermediate switches.



Suppose each link (one way) propagation delay is 20 ms and each link data transfer rate is 1 Mbps. If packet size is 1000 Bytes then the amount of time required to send one file of size 5000 Bytes from sender to receiver (Consider for processing overhead at switch is negligible) is _____.



Topic : Problem solving on Packet Switching

#Q. Consider two hosts A and B are connected through two routers R_1 and R_2 .



Each link has propagation delay (one way) 20 ms, data transfer rate is 1 Mbps and processing delay at each router is 2 ms. Host A uses pipeline protocol for flow control. The time required (in ms) to transmit a file of size 12000 Bytes from host A to host B, using packet size 1000 Bytes is _____.



Topic : Problem solving on Packet Switching

- #Q. Consider a host computer (A) transmitting a file of size 10^5 bits to a host computer (B) over a network of routers (R_1, R_2, \dots, R_n) and links (L_1, L_2, \dots, L_n). L_1 connect A to R_1 ; L_2 connect R_1 to R_2 . L_3 connect R_2 to R_3 and L_n connect R_{n-1} to B. Let each link be of length 100 km. Assume signals travel over each link at a speed of 10^8 meter per second. Let the file be broken down into 100 packets of each of size 1000 bits. Assume bandwidth on each links is 1 Mbps. The total sum of transmission delay and propagation delay in transmitting the file from A to B is 119 msec. Assume Y is number of routers between A and B, and X is number of minimum links between A and B then find $x + y$?



2 mins Summary



Topic

One

Packet Switching

Topic

Two

Circuit Switching

Topic

Three

Topic

Four

Topic

Five

THANK - YOU