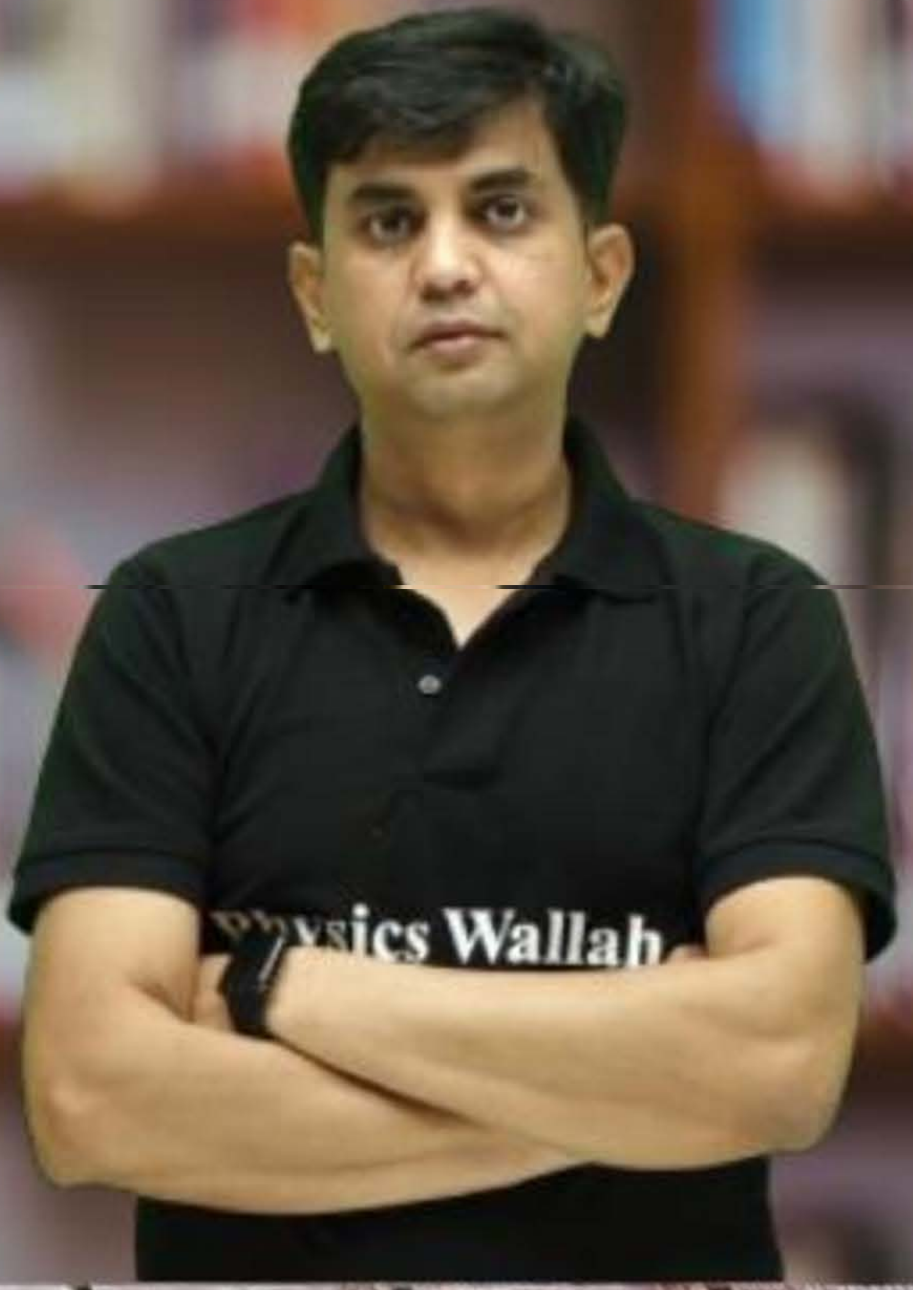
CS & IT ENGINEERING

Computer Network

Flow Control



DPP - 01 Discussion Notes

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[MCQ]

#Q. Consider two hosts are connected directly using point-to-point link. The link bandwidth is 10 Kbps, distance is 5 km, signal propagation speed is 10^5 meter per second and packet size is 200 bits than calculate transmission delay for a packet and one-way propagation delay (in millisecond) ?

A. 20 and 50

B. 20 and 500

C. 200 and 50

D. 200 and 500

$$t_x = \frac{200 \text{ bits}}{10 \text{ Kbps}} = \frac{200 \text{ bits}}{10 * 10^3 \text{ bits/sec}} = 20 \text{ ms}$$

$$t_p = \frac{5 \text{ KM}}{10^5 \text{ m/sec}} = \frac{5 * 10^3 \text{ m}}{10^2 * 10^3 \text{ m/sec}} = 50 \text{ ms}$$

$\boxed{\text{Ans: A}}$

[NAT]

#Q. Consider two hosts S and D are connected directly using point-to-point link. The link bandwidth is 20 Kbps, signal propagation speed is 10^6 meter per second and distance is 40 km. Suppose host S wants to send a data of size 500 bits to host D in one packet. Calculate how much time (in millisecond) it takes to deliver the data completely from S to D?

$$t_x = \frac{500\ \text{bits}}{20\ \text{Kbps}} = \frac{500\ \text{bits}}{20 * 10^3\ \text{bits/sec}} = 25\ \text{ms}$$

$$t_p = \frac{40\ \text{KM}}{10^6\ \text{m/sec}} = \frac{40 * 10^3\ \text{m}}{10^3 * 10^3\ \text{m/sec}} = 40\ \text{ms}$$

$$\boxed{\text{Ans} = 65}$$

$$\text{Total time} = (t_x + t_p) = (25 + 40)\ \text{ms} = 65\ \text{ms}$$

[NAT]

#Q. Consider two hosts S and D are connected via one packet switch (takes negligible processing delay). Each link bandwidth is 1 Mbps, signal propagation speed is $4 * 10^6$ meter per second and length of each link is 20 km. Suppose host S wants to send a file of size 8000 bytes to host D, by dividing the file into 2000 bits packets. Calculate how much time (in millisecond) it takes to deliver the file completely from S to D ?

$$t_x = \frac{2000 \text{ bits}}{1 \text{ Mbps}} = \frac{2*10^3 \text{ bits}}{10^6 \text{ bits/sec}} = 2\text{ms}$$

$$t_p = \frac{20 \text{ KM}}{4*10^6 \text{ m/sec}} = \frac{20*10^3 \text{ m}}{4*10^6 \text{ m/sec}} = 5\text{ms}$$

$$N = \frac{8000 \text{ bytes}}{2000 \text{ bits}} = \frac{64*10^3 \text{ bits}}{2*10^3 \text{ bits}} = 32$$

$$\text{Total Time} = (N*t_x + t_p) + (t_x + t_p)$$
$$= (32*2+5) + (2+5) \text{ ms}$$
$$= 76 \text{ ms}$$

$$\boxed{\text{Ans} = 76}$$

[NAT]

#Q. Consider two hosts S and D are connected via two routers over a single path, routers takes negligible processing delay. Each link bandwidth is 100 Kbps, signal propagation speed is 10^6 meter per second and length of each link is 10 km. Suppose host S wants to send a file of size 5000 bytes to host D, by dividing the file into 1000 bits packets. Calculate how much time (in millisecond) it takes to deliver the file completely from S to D ?

$$t_x = \frac{1000 \text{ bits}}{100 \text{ Kbps}} = \frac{1000 \text{ bits}}{100 * 10^3 \text{ bits/sec}} = 10 \text{ ms}$$

$$t_p = \frac{10 \text{ KM}}{10^6 \text{ m/sec}} = \frac{10 * 10^3 \text{ m}}{10^3 * 10^3 \text{ m/sec}} = 10 \text{ ms}$$

$$N = \frac{5000 \text{ bytes}}{1000 \text{ bits}} = \frac{40 * 10^3 \text{ bits}}{10^3 \text{ bits}} = 40$$

Total time =

$$(N * t_x + t_p) + (t_x + t_p) + (t_x + t_p)$$

$$= (40 * 10 + 10) + (10 + 10) + (10 + 10) \text{ ms}$$

$$= 450 \text{ ms}$$

$$\boxed{\text{Ans} = 450}$$

[NAT]

#Q. Consider two hosts are connected via point-to-point link using Stop-and-Wait protocol for flow control. The transmission rate of the link is 5 Kbps and the one-way propagation delay of the link is 50 milliseconds. The frame size is 500 bits. Calculate channel utilization in percentage (rounded off to nearest integer) ?

$$t_x = \frac{500 \text{ bits}}{5 \text{ Kbps}} = \frac{500 \text{ bits}}{5 * 10^3 \text{ bits/sec}} = 100 \text{ ms}$$

$$t_p = 50 \text{ ms}$$

$$\text{Cycle time} = [t_x + 2t_p]$$
$$= (100 + 2 * 50) \text{ ms}$$
$$= 200 \text{ ms}$$

$$\eta = \frac{t_x}{\text{Cycle time}}$$
$$= \frac{100 \text{ ms}}{200 \text{ ms}} = \frac{1}{2}$$
$$= \frac{1}{2} * 100 \%$$
$$= 50 \%$$

$$\boxed{\text{Ans} = 50}$$

[NAT]

#Q. Consider two hosts are connected via point-to-point link using Stop-and-Wait protocol for flow control. The transmission rate of the link is 2 Mbps and frame size is 4000 bytes. To achieve 50 percent link utilization, calculate one-way propagation delay in milliseconds ?

$$t_x = \frac{4000 \text{ bytes}}{2 \text{ Mbps}} = \frac{32 * 10^3 \text{ bits}}{2 * 10^6 \text{ bits/sec}} = 16 \text{ ms}$$

$$\eta = \frac{t_x}{\text{Cycle time}}$$

$$\frac{1}{2} = \frac{t_x}{(t_x + 2t_p)}$$

$$t_x = 2t_p$$

$$t_p = \frac{t_x}{2}$$

$$t_p = \frac{16 \text{ ms}}{2} = 8 \text{ ms}$$

$$\boxed{\text{Ans} = 8}$$

[NAT]

#Q. Consider two hosts are connected via point-to-point link using Stop-and-Wait protocol for flow control. The transmission delay for a frame and one-way propagation delay of the link are 15 and 30 milliseconds respectively. If link bandwidth is 50 Kbps then calculate throughtput of the link in Kbps ?

$t_x = 15$ ms
$t_p = 30$ ms

Cycle time $= (t_x + 2t_p) = (15 + 2 * 30)$ ms
$= 75$ ms

$$\eta = \frac{t_x}{\text{Cycle time}} = \frac{15\text{ ms}}{75\text{ ms}} = \frac{1}{5}$$

Throughput $= \eta * \text{Bandwidth}$
$= \frac{1}{5} * 50$ Kbps
$= 10$ Kbps

$\boxed{\text{Ans} = 10}$

[NAT]

#Q. Consider two hosts are connected via point-to-point link using Stop-and-Wait protocol for flow control. The link bandwidth is 4 Kbps, one-way propagation delay of the link are 800 milliseconds. To achieve 50 percent link utilization calculate packet size in bytes ?

$$\eta = \frac{t_x}{\text{Cycle time}}$$

$$\frac{1}{2} = \frac{t_x}{(t_x + 2t_p)}$$

$$t_x = 2t_p$$

$$\text{Packet size} = (2t_p) * \text{Bandwidth}$$
$$= (2 * 800\,ms) * 4\,kbps$$
$$= 64 * 10^2 * 10^{-3}\,sec * 10^3\,bits/sec$$
$$= 6400\,bits$$
$$= 800\,bytes$$

$$\boxed{\text{Ans} = 800}$$

[NAT]

#Q. Consider a packet error probability is 0.3 in Stop-and-Wait ARQ. What should be minimum number of transmission required to transmit 140 packets?

$P_b = 0.3$

$N = 140$

Total transmissions =

$= N + N * P_b + N * P_b^2 + N * P_b^3 + \dots$

$= N * [1 + P_b + P_b^2 + P_b^3 + \dots]$

$= N * \frac{1}{(1-P_b)} = \frac{N}{(1-P_b)}$

$= \frac{140}{(1-0.3)} = \frac{140}{0.7} = 200$

$\boxed{\text{Ans} = 200}$

[MCQ]

#Q. Consider two hosts are connected via point-to-point link using Sliding Window protocol for flow control. The transmission delay for a frame and propagation delay of the link are 10 and 30 milliseconds. Calculate optimal window size ?

A 1

B 3

C 4

D 7

$t_x = 10\,ms$
$t_p = 30\,ms$

$\text{Cycle time} = (t_x + 2t_p) = (10 + 2*30)\,ms = 70\,ms$

$\text{optional window size} = \left\lceil \frac{\text{Cycle time}}{t_x} \right\rceil = \left\lceil \frac{70\,ms}{10\,ms} \right\rceil = 7$

$\boxed{\text{Ans: D}}$

[NAT]

#Q. Consider two hosts A and B are connected via point-to-point link using Go-Back-4-ARQ flow control strategy with transmit window size $\boxed{4.}$ Host A wants to send a file (divided into 10 packets) to host B, if every 6th packet that A transmits gets lost (but no ACKs from B ever get lost), then what is the number of packets that A will transmit for sending the file to B ?

1	2	3	4	5	6	7	8	9
✓	✓	✓	✓	✓	✗	Discard	Discard	Discard

6	7	8	9	10
✓	✓	✗	discard	discard

8	9	10
✓	✓	✓

$\boxed{Ans = 17}$

[MCQ]

#Q. Consider two hosts connected directly through point-to-point link uses Go Back N ARQ for flow control. The transmission delay and propagation delay (in millisecond) are $\boxed{2 \text{ and } 250.}$ What should be minimum number of bits required for sequence number field to achieve full utilization ?

A 7

B 8

C 9

D 10

$\boxed{\text{Ans : B}}$

$t_x = 2\,ms$, $t_p = 250\,ms$

Cycle time $= (t_x + 2t_p)$

$= (2 + 2 * 250)\,ms = 502\,ms$

Optimal window Size (N)

$= \left\lceil \dfrac{\text{Cycle time}}{t_x} \right\rceil = \left\lceil \dfrac{502\,ms}{2\,ms} \right\rceil$

$N = 251$

Min^m no. of bits for sequence no. field

$= \lceil \log_2 (N+1) \rceil$ bits

$= \lceil \log_2 (252) \rceil$ bits

$= 8$ bits

[NAT]

#Q. Consider a 2 Mbps communication link with one-way propagation delay of 120 milliseconds. Go back N ARQ protocol is used on this link to send data with a frame size of 2000 bits. Neglect the transmission time of acknowledgment. The minimum number of bits required for the sequence number field to achieve 50% utilization is ________.

$$t_x = \frac{2000 \text{ bits}}{2 \text{ Mbps}} = \frac{2 * 10^3 \text{ bits}}{2 * 10^6 \text{ bits/sec}} = 1 \text{ ms} \quad \Big| \quad t_p = 120 \text{ ms}$$

$$\text{Cycle time} = (t_x + 2t_p) = (1 + 2 * 120) \text{ ms} = 241 \text{ ms}$$

For 50% utilization

$$N = \left\lceil \frac{\text{Cycle time}}{2 t_x} \right\rceil = \left\lceil \frac{241 \text{ ms}}{2 * 1 \text{ ms}} \right\rceil = 121$$

Min^m no of bits for seq. no

$$= \lceil \log_2(N+1) \rceil \text{ bits}$$

$$= \lceil \log_2(122) \rceil \text{ bits}$$

$$= 7 \text{ bits}$$

$$\boxed{\text{Ans} = 7}$$

[MCQ]

#Q. Consider two hosts connected directly through point-to-point link uses Selective Repeat ARQ for flow control. The transmission delay and propagation delay (in millisecond) are 4 and 250. What should be minimum number of bits required for sequence number field to achieve full utilization?

A 5

B 6

C 7

D 8

$t_x = 4ms,\ t_p = 250ms$

Cycle time $= (t_x + 2t_p)$

$= (4 + 2 * 250)ms = 504ms$

Optimal window size

$N = \left\lceil \frac{\text{Cycle time}}{t_x} \right\rceil = \left\lceil \frac{504ms}{4ms} \right\rceil$

$N = 126$

Min^m no of bits for seq. no

$= \lceil \log_2(2N) \rceil$ bits

$= \lceil \log_2(252) \rceil$ bits

$= 8$ bits

$\boxed{\text{Ans: D}}$

[NAT]

#Q. Consider a 1 Mbps communication link with one-way propagation delay of 80 milliseconds. Selective repeat protocol is used on this link to send data with a frame size of 2000 bits. Neglect the transmission time of acknowledgment. The minimum number of bits required for the sequence number field to achieve 100% utilization is ________.

$t_x = \frac{2000 \text{ bits}}{1 \text{ Mbps}} = \frac{2*10^3 \text{ bits}}{10^6 \text{ bits/sec}} = 2 \text{ ms}$ | $t_p = 80 \text{ ms}$

$\text{Cycle time} = (t_x + 2t_p) = (2 + 2*80) \text{ ms} = 162 \text{ ms}$

Optimal window size

$N = \left\lceil \frac{\text{Cycle time}}{t_x} \right\rceil = \left\lceil \frac{162 \text{ ms}}{2 \text{ ms}} \right\rceil$

$N = 81$

Min^m no. of bits for seq. no.

$= \lceil \log_2(2N) \rceil$ bits

$= \lceil \log_2(162) \rceil = 8$ bits

$\boxed{\text{Ans} = 8}$

THANK - YOU