CS & IT ENGINEERING

COMPUTER NETWORKS

Medium Access Control

Lecture No-07

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Multiple Access Protocols-6

Q.4 There are n stations in a slotted LAN. Each station attempts to transmit with a probability p in each time slot. What is the probability that ONLY one station transmits in a given time slot?

[GATE – 2005]

A. $Np(1-p)^{n-1}$

B. $(1-p)^{n-1}$

C. $P(1-p)^{n-1}$

D. $1-(1-p)^{n-1}$

$$P_{succ} = N \cdot p(1-p)^{N-1}$$

Slotted ALOHA allows a node to transmit continuously at the full rate, R, when that node is the only active node.

already suffered a collision.) Suppose there are N nodes. Then the probability that a given slot is a successful slot is the probability that one of the nodes transmits and that the remaining $N - 1$ nodes do not transmit. The probability that a given node transmits is p; the probability that the remaining nodes do not transmit is $(1 - p)^{N-1}$. Therefore the probability a given node has a success is $p(1 - p)^{N-1}$. Because there are N nodes, the probability that any one of the N nodes has a success is $Np(1 - p)^{N-1}$.

Q.5 Consider a LAN with four nodes S_1, S_2, S_3 and S_4. Time is divided into fixed-size slots, and a node can begin its transmission only at the beginning of a slot. A collision is said to have occurred if more than one node transmit in the same slot. The probability of generation of a frame in a time slot by S_1, S_2, S_3 and S_4 are 0.1, 0.2, 0.3 and 0.4, respectively. The probability of sending a frame in the first slot without any collision by any of these four stations is_____.

Ans: 0.4404

[GATE – 2015]

$S_1 = 0.1,\ S_2 = 0.2,\ S_3 = 0.3,\ S_4 = 0.4$

$$P_{succ} = N \cdot P(1-P)^{N-1}$$

$$P_{succ} = 4 \cdot p(1-p)^3$$

	S_1	S_2	S_3	S_4	
For S_1	p	$(1-p)$	$(1-p)$	$(1-p)$	
	0.1	0.8	0.7	0.6	$= 0.0336$
For S_2	$(1-p)$	p	$(1-p)$	$(1-p)$	$+$
	0.9	0.2	0.7	0.6	$= 0.0756$
For S_3	$(1-p)$	$(1-p)$	p	$(1-p)$	$+$
	0.9	0.8	0.3	0.6	$= 0.1296$
For S_4	$(1-p)$	$(1-p)$	$(1-p)$	p	$+$
	0.9	0.8	0.7	0.4	$= 0.2016$
					0.4404

Q.6 Suppose CSMA/CD protocol is used for channel access in an Ethernet LAN and 3 hosts are in LAN. Each host can transmit data in an idle slot (empty slot) with probability 0.8. What is the probability that only one host can transmit data in an idle slot?

A. 0.032

B. 0.096 ✓

C. 0.128

D. 0.384

No. of Host (N) = 3

Each Host transmitting probability (p) = 0.8

Probability that only one Host can transmit data in an idle Host [through of the channel] $= N \cdot p(1-p)^{N-1}$

$= 3 * 0.8 * (0.2)^2$

$= 3 * 0.8 * 0.2 * 0.2$

Q.7 Suppose CSMA/CD protocol is used for channel access in an Ethernet LAN and each host can transmit data in an idle (empty) slot with probability 0.75. The total number of hosts exist in the LAN. When probability that particular host only transmit in an idle slot is 0.1875 is _____.

Each Host can transmit data in an idle slot with Probability (p) = 0.75

Total No. of Host (N) = ?

Probability that Paritcular Host only transmit in an idle slot (throughput of Host) = 0.1875

Throughput of Host $= p(1-p)^{N-1}$

$0.1875 = 0.75 * (0.25)^{N-1}$

$N = 2$

Note: Throughput of Host $= p(1-p)^{N-1}$

Throughput of channel $= N \cdot p(1-p)^{N-1}$

Q.8 Consider a simplified time slotted MAC protocol, where each host always has data to send and transmits with probability p = 0.2 in every slot. There is no backoff and one frame can be transmitted in one slot. If more than one host transmits in the same slot, then the transmissions are unsuccessful due to collision. What is the maximum number of hosts which this protocol can support, if each host has to be provided a minimum through put of 0.16 frames per time slot?

[GATE – 2008]

p = 0.2

Maximum No. of Host(N) = ?

Throughput of Host = 0.16

A. 1

B. 2

C. 3

D. 4

Throughput of Host $= P(1-p)^{N-1}$

$0.16 = 0.2 * (0.8)^{N-1}$

$(0.8)^{1} = (0.8)^{N-1}$

$N-1 = 1$

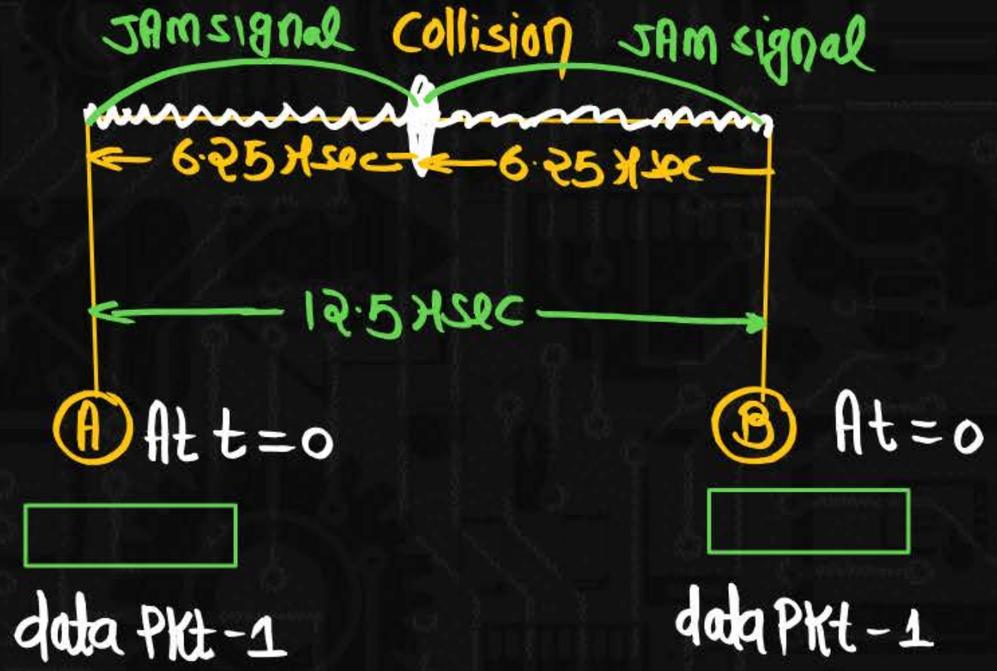
$N = 2$

Q.9

Suppose two nodes, A and B are attached to opposite ends of the cable with propagation delay of 12.5 µsec. Both nodes attempt to transmit at time t=0. Frames collide and after first collision, A draws k=0 and B draws k=1 in the exponential backoff protocol. At what time (in µsec) is A's packet completely delivered at B, if Bandwidth of the link is 10 Mbps and packet size is 1000 bits for the following,

(a) With Purging 137.5 µsec

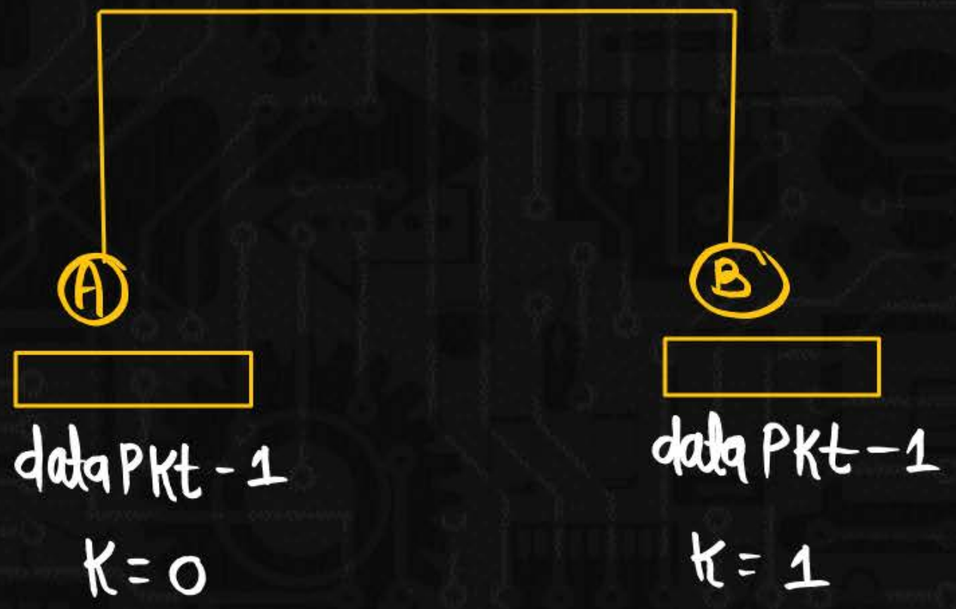
(b) Without Purging 125 µsec



At $t=0$ → Both station A and B start transmitting data

At $t=6.25\ \mu sec$ → Both station A and B data PKt will be collide

At $t=12.5\ \mu sec$ → Both station A and B receive JAM signal



WT OF A = Pd (By using purging)

WT OF A = 12.5 μsec

↳ A can't start retransmitting data immediatly it will wait one P_d i.e 12.5 μsec

At t = 12.5 μsec + 12.5 μsec = 25 μsec

At t = 25 μsec 'A' start retransmitting the data

Pkt size = 1000 bits, B = 10 mbps = $10 * 10^6$ bits/s

Transmission time = $\frac{\text{Pkt size}}{\text{Bandwidth}} = \frac{1000 \text{ bits}}{10 * 10^6 \text{ bits/sec}}$

$= 100 * 10^{-6}$

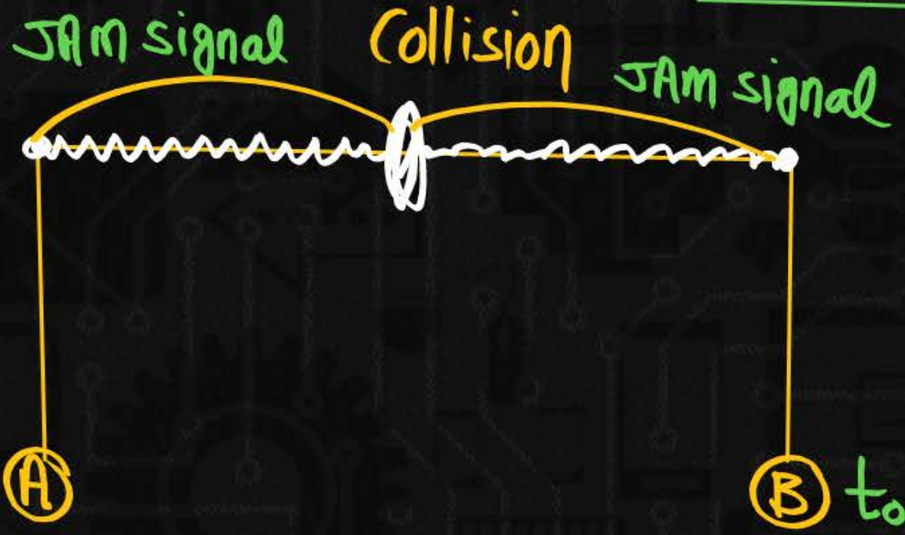
$= 100$ μsec

At t = 25 μsec + 100 μsec = 125 μsec

At t = 125 μsec A complete its transmission

At $t = 125\,\mu sec + \underset{(Pd)}{12.5\,\mu sec} = 137.5\,\mu sec$ 'n's Packet completly delivered at B

Concept of Purging (cleaning)



A	B	
0	0	→ collision
0	1	→ A won
1	0	→ B won
1	1	→ collision

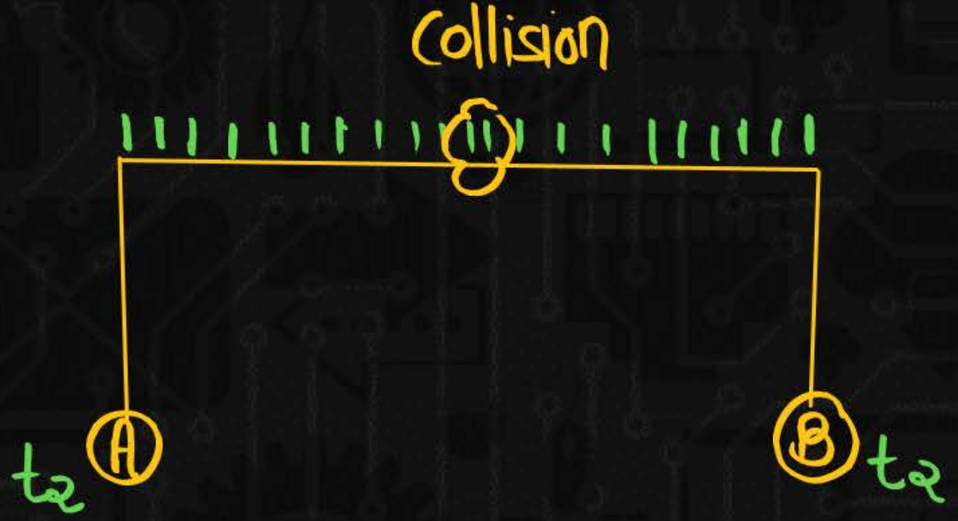
If we choose $(^{A}0, ^{B}1)$

WT of A = K * slot duration

WT of A = 0 * slot duration = 0

WT of B = K * slot duration

= 1 * slot duration



Concept of Purging (cleaning)

data Pkt - 1

$K = 0$

WT of A = P_d

data Pkt - 1

$K = 1$

WT of B = K * slot duration

WT of B = 1 * slot duration


THANK YOU
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