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SECTION:- 4(B)

Assignment #05

12.2 Q2. A pure Aloha network transmits 200-bits frames on a shared channel of 200kbps. what is the Requirement to make this frame collision free?

Given data:-

Message = 200 bits
Bandwidth = 200 kbps

Solution:-

Transmission time = message / Bandwidth

$T = \frac{200 \text{ bits}}{200 \text{ kbps}}$

$T = 1ms$

Vulnerable time = 2 x Transmission time
= 2 x 1ms
= 2ms

Throughput of pure Aloha is

(efficiency) $\eta = G \times e^{-2G}$

$\eta = G \times e^{-2G}$ $G = 1$

$= 1 \times e^{-2(1)}$

$\eta = \frac{1}{e^2}$

$\eta = \frac{1}{(2.71)^2}$

$\eta = 0.136$

$\eta = 13.6\%$

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Q- A pure ALOHA network transmits 200-bit frames on a shared channel of 200kbps. What is the throughput if the system produces
a) 1000 frames per second (b) 500 frames per second
c) 250 frames per second

Sol:-

Transmission time = Frame bits / Bandwidth of channel

$= \frac{200 \text{ bits}}{200 \text{ kbps}} = \frac{200}{200 \times 10^3} = 10^{-3}$

$= 1 \text{ ms}$

a) 1000 frames per second:-

If the system creates 1000 frame per second then 1 frame per millisecond

$= 1000 \times 10^{-3}$

$= 10^3 \times 10^{-3} = 1$

so $G = 1$.

Efficiency $\eta = G \times e^{-2G}$

$\eta = 1 \times e^{-2}$

$\eta = \frac{1}{e^2}$

$\eta = \frac{1}{(2.718)^2} \Rightarrow 0.135$

Throughput $S = \eta \times$ no of frames

$S = 0.135 \times 100 = 13.5\%$

$0.135 \times 1000 = 135$ frames

b) 500 frames per second:-

$G = 500 \times 10^{-3}$

$G = \frac{500}{1000}$

$G = 1/2$

Efficiency $\Rightarrow \eta = G \times e^{-2G}$

$= \frac{1}{2} e^{-2 \times \frac{1}{2}} \Rightarrow \frac{1}{2e} \Rightarrow 0.184$

$\eta = 18.4\%$

$= 10 \times 10^6$ bytes

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$S = \eta \times \text{frames}$

Throughput (S) $= 0.184 \times 500$

$S = 91$

91 frames were probably send out of 500

(c) 250 frames per second.

$G = 250 \times 10^{-3}$

$G = \frac{250}{1000}$

$G = 1/4$

$\therefore$ Efficiency (η) $= G e^{-2G} = 1/2$

$= \frac{1}{4} e^{-2 \times 1/4}$

$= \frac{1}{4} e^{-1/2}$

$\eta = 0.152$

$\eta = 15.2\%$

throughput $S = 0.152 \times 250$

$= 37.9$

$S = 38$

38 frames send out of 250.

Example 12.4:-

A slotted Aloha network transmits 200-bit frame on a shared channel of 200 Kbps. what is the throughput if the system produces

(a) 1000 frames per second (b) 500 frames per second (c) 250 frames per second.

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Sol:-

1) Transmission time = $\frac{\text{message}}{\text{Bandwidth}}$

$T = \frac{200 \text{ bits}}{200 \text{ kbps}} = \frac{200}{200 \times 10^3}$

$T = 10^{-3}$ s

$T = 1$ ms

$G = 1000 \times 10^{-3}$

$G = 1000/1000$

$G = 1$.

$S = G \times e^{-G}$

$S = 1 \times e^{-1}$

$S = \frac{1}{e}$.

$S = \frac{1}{2.71}$

$S = 0.368$

Through put (S) = $0.368 \times$ frames

$= 0.368 \times 1000$

$= 368$ frames

368 frames out of 1000 and 632 were collide.

2) 500 frames per second:

$G = 1/2$

$S = G \times e^{-G}$

$S = \frac{1}{2e^{1/2}} \Rightarrow \frac{1}{2(2.71)^{1/2}}$

$S = 0.3032$

Throughput $S = 0.3032 \times 500$

151 frames send out of 500 and 349 were collide with each other.

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(c): 250 frames per second:

$G_1 = 25 \text{ frames}$

$G_1 = 25 \times 10^{-3}$

$G_1 = 250 \text{ frames/1000} \Rightarrow 1/4$

$G_1 = 1/4$

$S = G_1 \times e^{-G_1}$

$S = \frac{1}{4} \times e^{-1/4}$

$S = \frac{1}{4e^{1/4}}$

$S = \frac{1}{4(2.71)^{1/4}}$

$S = 0.1947$

Throughput (S) $= 0.1947 \times 250$

$S = 48.7$

$S \approx 49$ frames were send out of 250 and 201 were take part in collision.

Question 12.5:-

A network using CSMA/CD has a bandwidth of 10 Mbps. If the maximum propagation time (including the delays in the devices and ignoring the time needed to send a jamming signal, is 25.6 μs. what is the minimum size of the frame?

solution:-

Given data:-

Bandwidth B) = 10 Mbps

$= 10 \times 10^6$ bits/sec

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Propagation delay $T_p = 25.6\,\mu s$

$= 25.6 \times 10^{-6}\ s$

transmission time = $2 \times T_p$

$TT = 2 \times$ Propagation delay

Transmission time = $\frac{\text{Message}}{\text{Bandwidth}}$

$TT = \frac{L}{B}$

$\frac{L}{B} = 2 \times T_p$

Message size = $2 \times T_p \times$ Bandwidth

Putting values in above formula,

$= 2 \times 25.6\,\mu s \times 10\,Mbps$

$= 516$ bits

or

$= 516/8$

$= 64$ bytes

The size of Frame is 64 bytes