CS & IT ENGINEERING

COMPUTER NETWORKS

Medium Access Control

Lecture No-06

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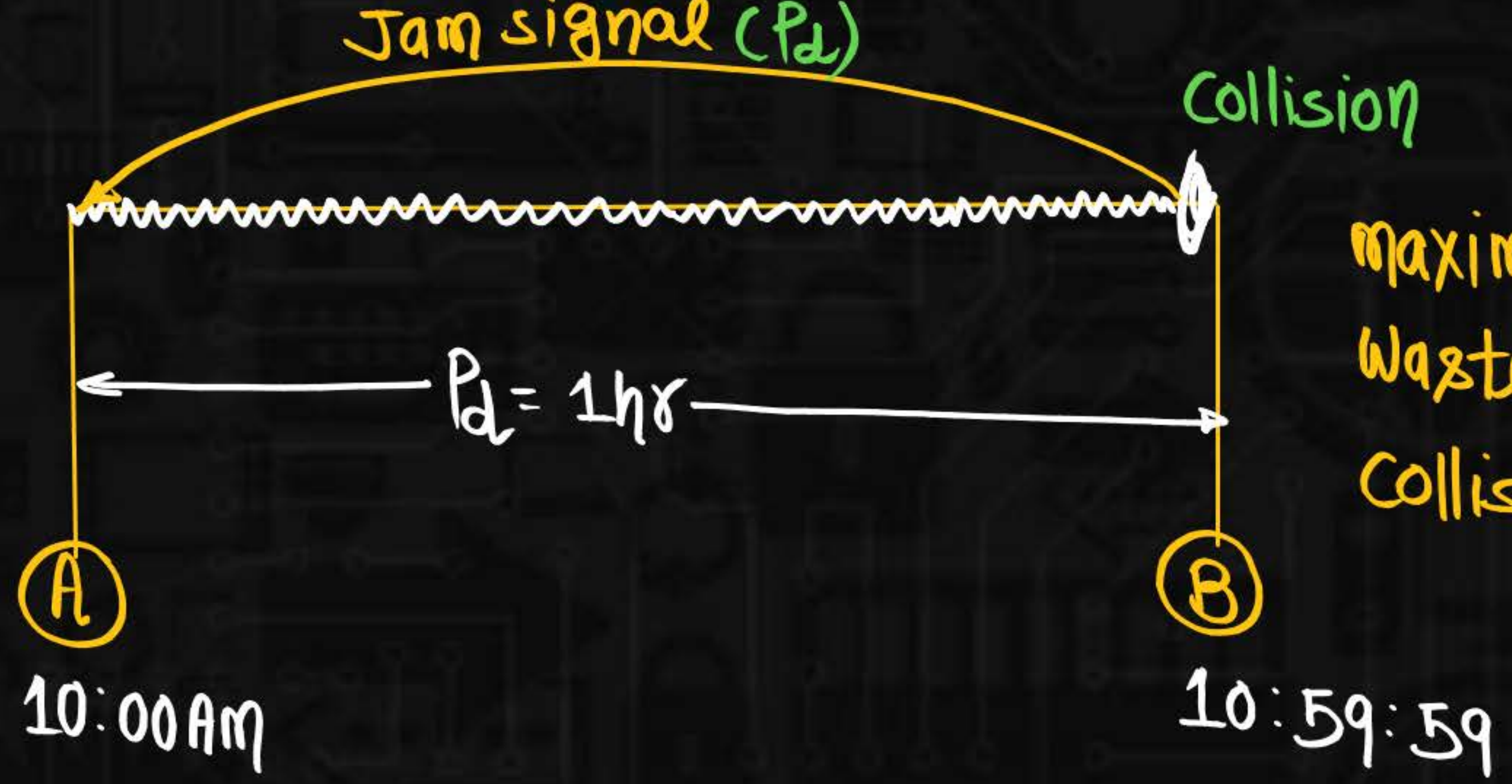
TOPICS TO BE COVERED

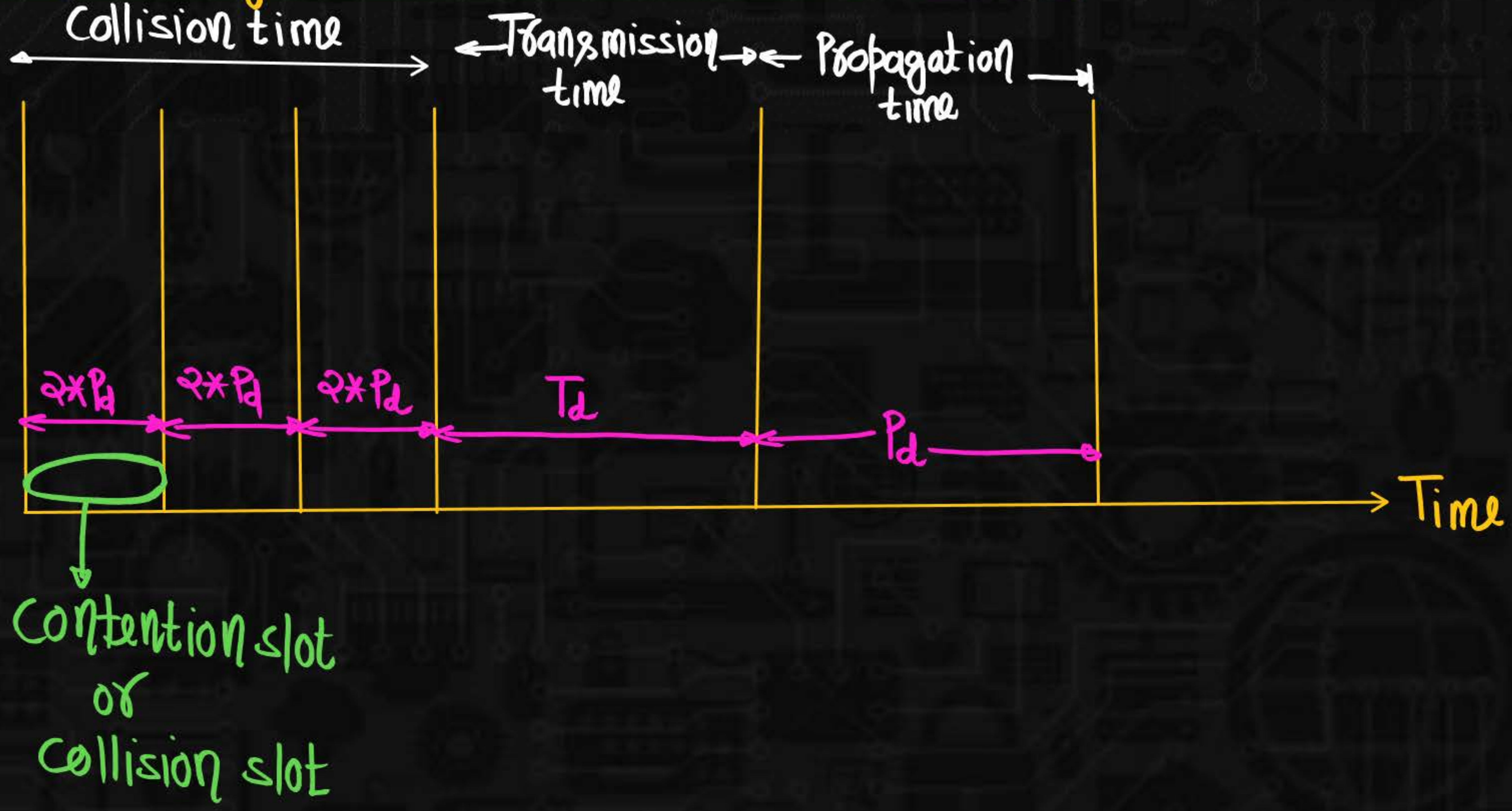
Multiple Access Protocols-6

Efficiency of Ethernet (CSMA/CD)



maximum time wasted in one collision $= 2 * P_d$

Efficiency Calculation of Ethernet (CSMA/CD)



$$\text{efficiency} = \frac{\text{useful time}}{\text{Total time}}$$

$$\eta = \frac{\text{Transmission delay}}{\text{collision time} + \text{Transmission time} + \text{Propagation time}}$$

$$\eta = \frac{T_d}{c * 2 * P_d + T_d + P_d}$$

$$\eta = \frac{T_d}{e * 2 * P_d + T_d + P_d}$$

$$\eta = \frac{\cancel{T_d}}{\cancel{T_d}\left[e * 2 * \frac{P_d}{T_d} + 1 + \frac{P_d}{T_d}\right]}$$

$(e = 2.72)$

$\left(\frac{P_d}{T_d} = a\right)$

c = No. of contention slots or No. of collision slot

$$\eta = \frac{1}{e*2*a+1+a}$$

$$\eta = \frac{1}{2.72*2*a+1+a}$$

$$\eta = \frac{1}{5.44a+1+a}$$

$$\eta = \frac{1}{6.44a+1}$$

$$\boxed{\eta = \frac{1}{1+6.44a}}$$

$$\eta = \frac{1}{1+6.44a}$$

$$= \frac{1}{1+6.44\frac{P_d}{T_d}}$$

$$= \frac{1}{1+6.44*\frac{d}{v}*\frac{B}{L}}$$

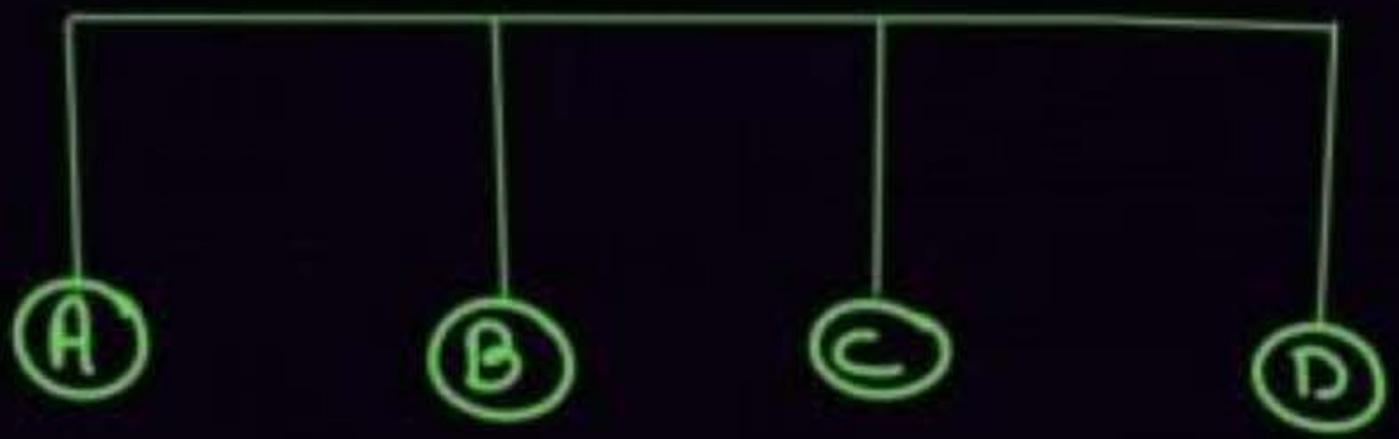
$B \rightarrow$ Fixed , $v \rightarrow$ Fixed

$d\uparrow$ $\eta\downarrow \rightarrow$ Good For LAN not for WAN

$L\uparrow$ $\eta\uparrow \rightarrow$ Good for Large Packet size

1. In Ethernet efficiency is High when transmission delay is High and Propagation delay is Low

2. In Ethernet efficiency is Low when Propagation delay is High and Transmission delay is Low



N = Total Number OF station in Ethernet

p = Probability OF station to transFer the data Packet

$(1-p)$ = Probability OF station Not to transFer the data Packet

" For the successFul transmission OF one station then Remaining $(N-1)$ station should Not transFer the data PKt"

$(1-p)^{N-1}$ = Probability of $(N-1)$ station Not to transfer the data Packet

$p(1-p)^{N-1}$ = Probability of success for a single station

$N \cdot p(1-p)^{N-1}$ = Probability of success for any station among 'N' stations

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

For $\max(P_{succ})$

$$\frac{d}{dp}(P_{succ}) = 0$$

$$\frac{d}{dp}\left[N\cdot p(1-p)^{N-1}\right]$$

$$N\left[p\cdot\frac{d}{dp}(1-p)^{N-1} + (1-p)\frac{d}{dp}p\right]$$

$$\boxed{p=\frac{1}{N}}$$

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

$$= \cancel{N} * \frac{1}{\cancel{N}}\left(1-\frac{1}{N}\right)^{N-1}$$

$$= \left(1-\frac{1}{N}\right)^{N-1}$$

If there are sufficienty Large Number OF Stations i.e $n \to \infty$ then we Have-

$$\lim_{N\to\infty}(P_{suc})_{max} = \lim_{N\to\infty}\left(1-\frac{1}{N}\right)^{N-1}$$

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

Number of times we need to try Before getting the 1st success = 'e'

From Here, we conclude-

Average Number of collision that might occur Before a successful transmission = e

Q.1 The efficiency of Ethernet

A. Increases when propagation delay and transmission delay are low

B. Increase When propagation delay and transmission delay are high

C. Increase when Propagation delay is low and transmission delay is high

D. Increases when propagation delay is high and transmission delay is low

Q.2 Which of the following statements is TRUE about CSMA/CD

[GATE – 2005]

CSMA|CD

A. IEEE 802.11 wireless LAN runs CSMA/CD protocol

B. Ethernet is not based on CSMA/CD protocol

C. CSMA/CD is not suitable for a high propagation delay network like satellite network

D. There is no contention in a CSMA/CD network

Q.3 The network consists of 4 hosts distributed as shown below.

Assume this network uses CSMA/CD and signal travel at 3×10^5 kM/sec.

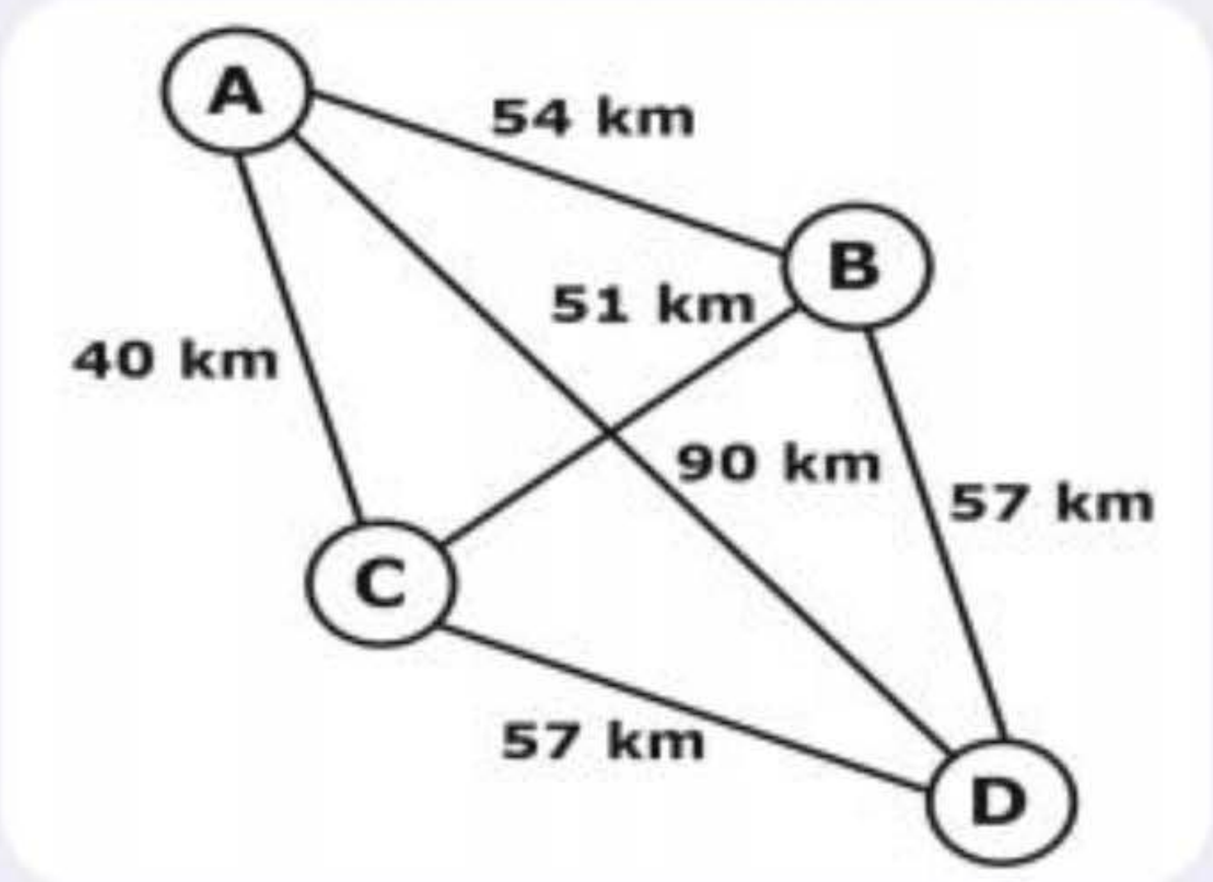
If sender send at 1 Mbps, what could be minimum size of the packet?

A. 600 bits

B. 400 bits

C. 6000 bits

D. 1500 bits



$v = 3 * 10^5$ km/sec

$B = 1$ mbPs $= 10^6$ bits/sec

$L = ?$

$$\boxed{T_d(F) \geq 2 * P_d + \cancel{T_d(JS)}}$$

$$\frac{L}{B} \geq 2 * P_d$$

$$L \geq 2 * P_d * B$$

$$L \geq 2 * 30 * \cancel{10}^{-5} \cancel{sec} * \cancel{10}^{6} \text{ bits}/\cancel{sec}$$

$$L \geq 2 * 30 * 10 \text{ bits}$$

$$L \geq 600 \text{ bits}$$

$$P_d = \frac{d}{v}$$

$$P_d = \frac{\cancel{9}0 \text{ km}}{\cancel{3} * 10^5 \text{ km/sec}}$$

$$P_d = 30 * 10^{-5} \text{ sec}$$

TDMA(Time division Multiple Access)

In time division multiple access-

- Time of the link is divided into fixed size intervals called as time slots.
- Time slots are allocated to the stations in round robin manner.
- Each station transmit its data during the time slot allocated to it.
- In case, station does not have any data to send, its time slot goes waste.

Disadvantage

- If any station does not have data to send during its time slot, then its time slot goes waste.
- This reduce the efficiency.
- This time slot could have been allocated to some other station willing to send data.

Note:

- Effective bandwidth/bandwidth utilization/Throughput

  = Efficiency * Bandwidth

- Maximum available effective bandwidth

  =Total no of stations* Bandwidth requirement of 1 station.

Problem:

If transmission delay and propagation delay of a packet in Time division multiplexing is 1 msec each at 8Mbps bandwidth, then-

a. Find the efficiency?

b. Find the effective bandwidth/throughput?

c. How many maximum stations can be connected to the network if each station requires 4kbps bandwidth ?


THANK YOU
GW
SOLDIERS !