CS & IT ENGINEERING

COMPUTER NETWORKS

Medium Access Control

Lecture No-02

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Multiple Access Protocols Part-2

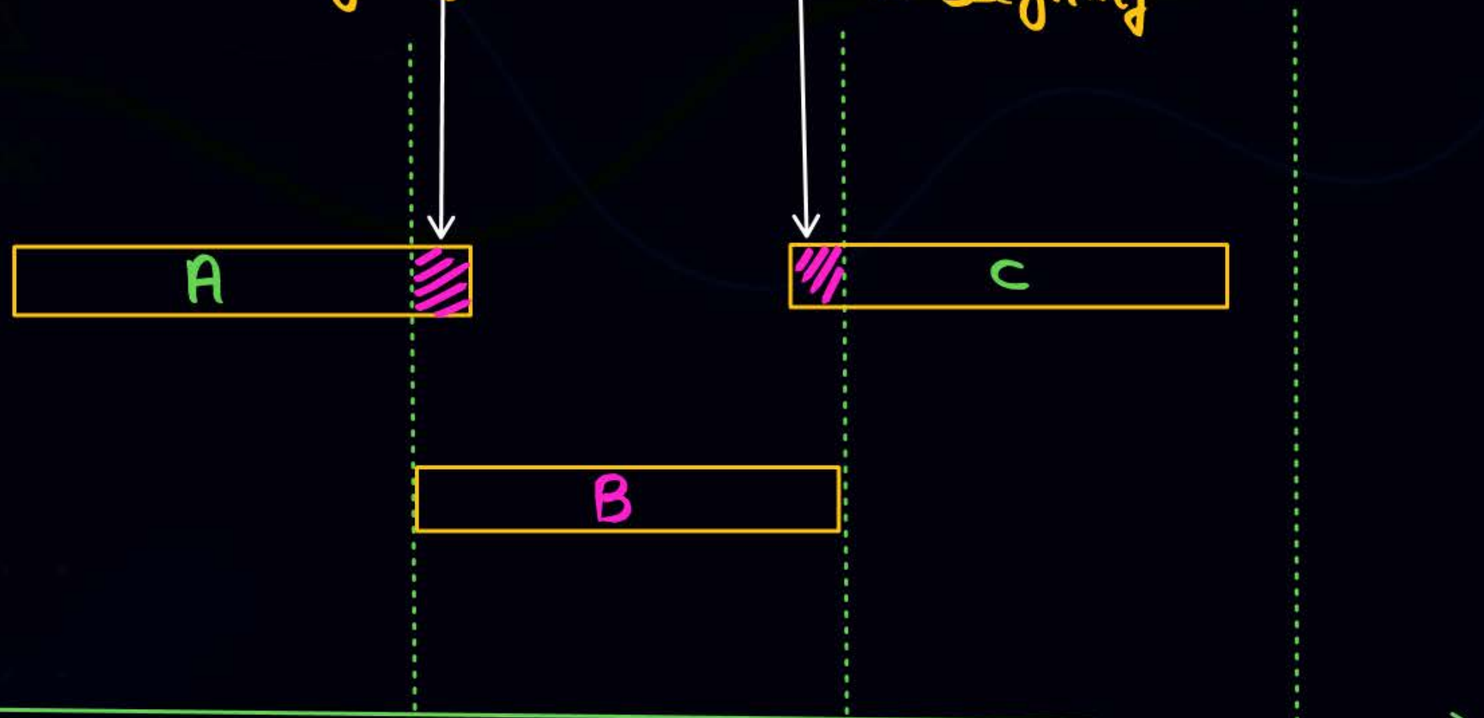
Vulnerable Time For Pure ALOHA

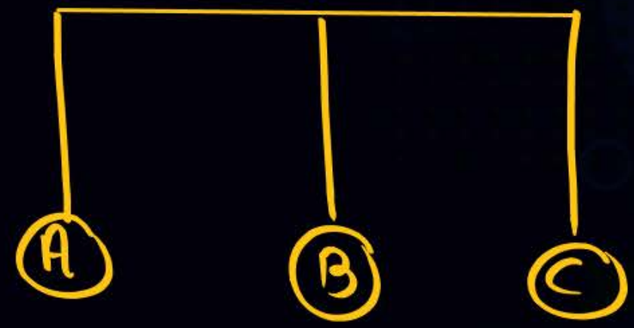
Vulnerable time for Pure ALOHA

Vulnerable time is the range of time where collision take place.

A end collide with B Begning

B end collide with C Begning





Vulnerable time = 10min

Vulnerable time For Pure Aloha = 2 * Tf

Transmission time for single Frame $(T_f) = \frac{\text{Frame size}}{\text{Bandwith}} = \frac{L}{B}$

Assume Transmission time For single frame $T_f = 5\text{min}$

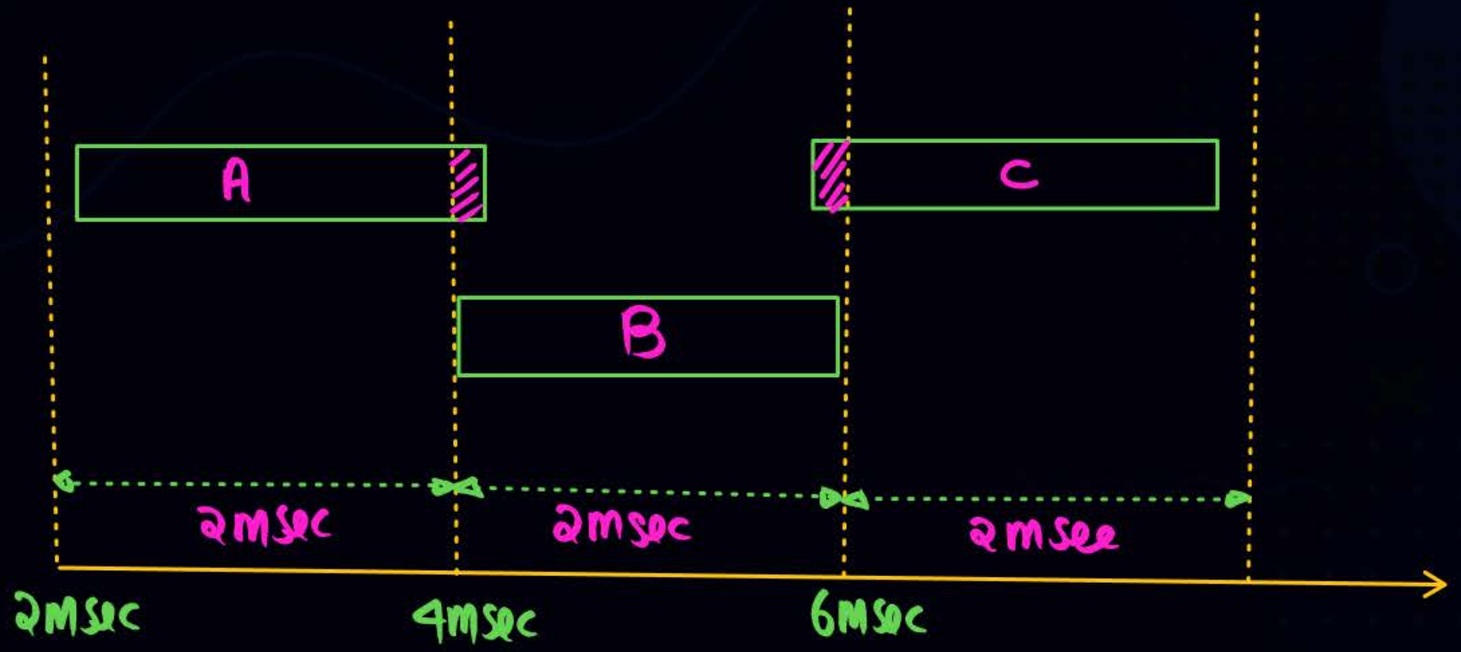
2.

Assume T_f = 2msec

A starts at 2.001msec

A → 2.001msec to 4.001sec

C starts at 5.99msec



2msec —— 6msec

Vulnerable time = 4msec

Vulnerable time For Pure Aloha = 2 * T_f

Throughput
Of
Pure ALOHA

Throughput Of Pure ALOHA

e = २.७१८२

$S = G \times e^{-2G}$

G = Number of frames generated by n/w in one Frame transmission time

For Maximum Throughput

- We put $\frac{ds}{dG} = 0$
- Maximum value of s occurs at $G = \frac{1}{2}$
- Substituting G = ½ in the above equation we get
- Maximum throughput of pure aloha

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

So maximum throughput of pure aloha = 18.4%

Note :

Note

① If 1000 frames are generated by the N|w in one Frame transmission time then maximum 184 Frames will be delicwred sycceesFully

② $S_{max} \rightarrow G = \frac{1}{2}$

i) one HalF Frame should be generated in one Frame transmission time to achicve maximum throughput.

OR

one Frame should be generated in two Frame transmission time to achieve maximum throughput $\Rightarrow$ Vulnerable time $= 2 * T_f$

Note:

① If one Frame is generated by the Network in two frame transmission time then in this situation we will achieve maximum throughput.

② Vulnerable time $2T_f$ is basically representing if one Frame is generated by the N/w in two Frame transmission time then there will be no Collision. So if there is no collission so we will achieve Maximum throughput.

Example:

A pure aloha network transmits 200 bit frames on a shared channel of 200 kbps. What is the throughput if the system(all station together) produces

Q.1) 1000 Frames generated by n/w in 1sec

Q.2) 500 Frames generated by n/w in 1sec

Q.3) 250 Frames generated by n/w in 1sec

NOTE: Throughput is defined as average number of frames successfully transmitted per second)

Frame size = 200 bits

Bandwidth = 200 KbPs = $200 * 10^3$ bits/sec

Transmission time = $\frac{\text{Frame size}}{\text{Bandwidth}}$

$= \frac{200 \text{ bits}}{200 * 10^3 \text{ bits/sec}} = 10^{-3}$ sec = 1ms

Soln: Q.1

1 sec ⟶ 1000

1 msec = 10^{-3} sec ⟶ $1000 * 10^{-3}$ Frame

$G = 1$ (No. of Frames generated in one Frame transmission time)

Throughput $S = G * e^{-2G}$

$= 1 * e^{-2*1}$

$= \frac{1}{e^2} = 0.135$

Throughput = 13.5 %

Avg. No. of Frames successfully transmitted Per sec = $1000 * 0.135$

$= 135$

Soln Q.2

1 sec ⟶ 500 frame

1 msec = 10^{-3} sec ⟶ $500 * 10^{-3}$ Frame

→ $5 * 10^{-1}$

→ $\frac{5}{10}$ Frame

$$G = \frac{1}{2}$$

Throughput $S = G * e^{-2G}$

$$= \frac{1}{2} * e^{-2 * \frac{1}{2}}$$

$$= \frac{1}{2e} = 0.184$$

Throughput = 18.4 %

Avg. No. of frames successfully transmitted Per sec = $500 * 0.184$

$= 92$

Soln Q.3

$G = \frac{1}{4}$

Throughput $= 0.152$

$= 15.2\%$

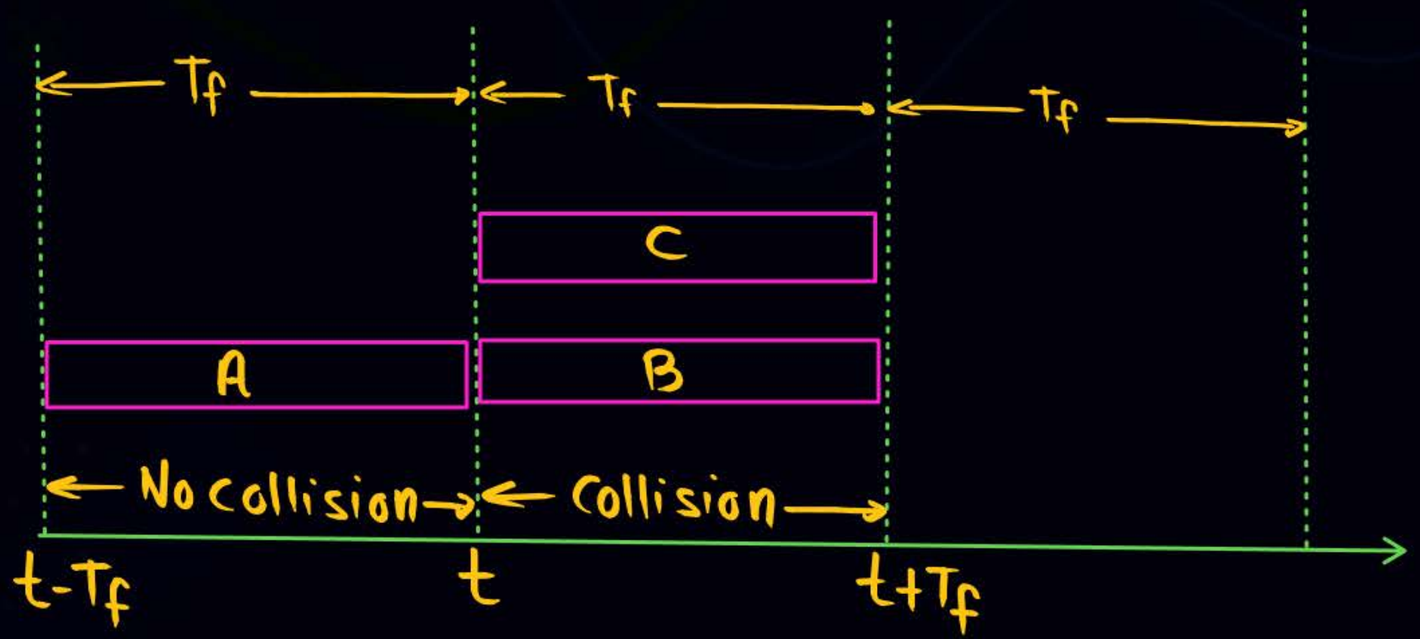
Avg. No. of frames successfully transmitted $= 0.152 * 250$

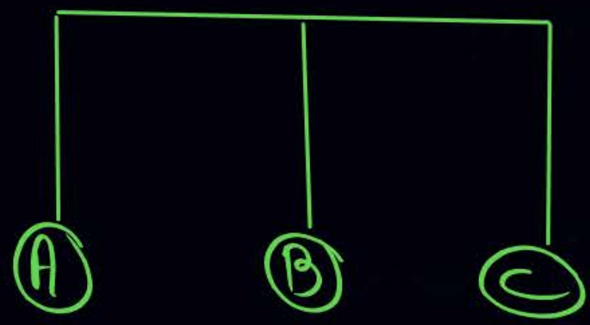
$= 38$

Slotted ALOHA

Slotted ALOHA

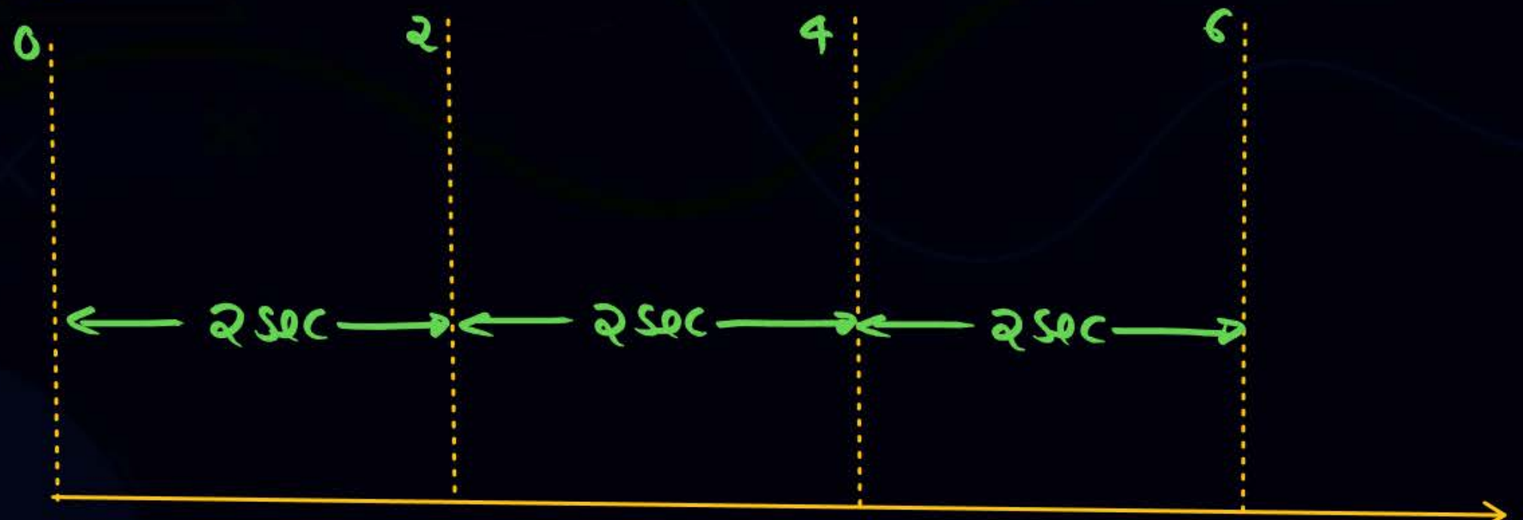
- Slotted aloha divides the time of shared channel into discrete intervals called as time slot (time slot = Transmission time For one frame).
- Any station can transmit its data in any time slot.
- The only condition is that station must start its transmission from the Beginning of time slat.
- If the Beginning of the slot is missed, then station has to wait until the beginning of next time slot.
- A collision may occur if two or more stations try to transmit data at the beginning of the same time slot.





Vulnerable time For Slotted Aloha = T_f

Ex-2



A → 2.3 sec
B → 3.1 sec
C → 3.3 sec
} 4 sec

② Note

Assume T_f = 2 sec

Station A starts at 2.3 sec → 4 sec
Station B start at 5.2 sec → 6 sec
} ① Note

Note

① For example T_f = 2 sec. and station Has data to send at 2.3 sec. then it will send at 4 sec. and station Has data to send at 5.2 sec then it will send at 6 sec.

② In slotted aloha Collision can take Place For example if three station Have data to send at 2.3, 3.1, 3.3 sec then all of them will send at 4 sec.

Vulnerable time for Slotted ALOHA

Vulnerable time is the range of time where collision take place.

Vulnerable time for slotted Aloha = T_f

Throughput Of Slotted ALOHA

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

G = Number of frames generated by n/w in one Frame transmission time

For Maximum Throughput

- We put $\frac{ds}{dG} = 0$
- Maximum value of s occurs at $G = 1$
- Substituting G = 1 in the above equation we get
- Maximum throughput of pure alone

$= 1 \times e^{-1} \quad = \frac{1}{e} \quad = 0.368$

So maximum throughput of slotted aloha = 36.8%

Note

If 1000 Frames are generated by the N/w in one Frame transmission time then maximum 368 frames delivered successfully

Note

① one Frames should be generated in one time slot (one Frame transmission time) to achieve maximum throughput.

$S_{max} \longrightarrow G = 1$

② Vulnerable time T_f is basically representing if one Frame is generated by the N/w in one slot time (one Frame transmission time) then there will be no Collision. So if there is no collission so we will achieve Maximum throughput.

Example:

A slotted aloha network transmits 200 bit frames on a shared channel of 200 kbps. What is the throughput if the system(all station together) produces

Q.1) 1000 Frames generated by n/w in 1sec

Q.2) 500 Frames generated by n/w in 1sec Ans: 151

Q.3) 250 Frames generated by n/w in 1sec Ans: 49

NOTE: Throughput is defined as average number of frames successfully transmitted per second)

Frame size = 200 bits

B = 200 Kbps = $200 * 10^3$ bits/sec

Transmission time = $\frac{200 \text{ bits}}{200 * 10^3 \text{ bits/sec}}$

$= 10^{-3}$ sec = 1 msec

Soln: Gx. 1

1 sec ⟶ 1000 Frames

1 msec = 10^{-3} sec ⟶ $1000 * 10^{-3}$ Frame

G_1 = 1 Frame

$\boxed{G = 1}$

Throughput $S = G * e^{-G}$

$S = 1 * e^{-1}$

$= \frac{1}{e}$

$= 0.368$

Throughput = 36.8 %

Avg No. of frames successfully transmitted per sec = $1000 * 0.368$

$= 368$

Pure Aloha	Slotted Aloha
(1) Any station transmit the data at any time	Any station can transmit the data at the beginning of any time slot
(2) Vulnerable time in which collision may occur = $2 \times T_f$	Vulnerable time in which collision may occur = T_f
(3) Throughput of pure aloha = $G \times e^{-2G}$	Throughput of slotted Aloha = $G \times e^{-G}$
(4) Maximum throughput $s_{max} = 18.4\ \%$ (When G = 1/2)	Maximum throughput $s_{max} = 36.8\ \%$ (When G = 1)
(5) The main Advantage of pure aloha is it simplicity in implementation	The main advantage of slotted aloha is that it reduces the number of collisions to Half and double the throughput of pure aloha


THANK YOU
GW
SOLDIERS !