CS & IT ENGINEERING

COMPUTER NETWORKS

Medium Access Control

Lecture No-01

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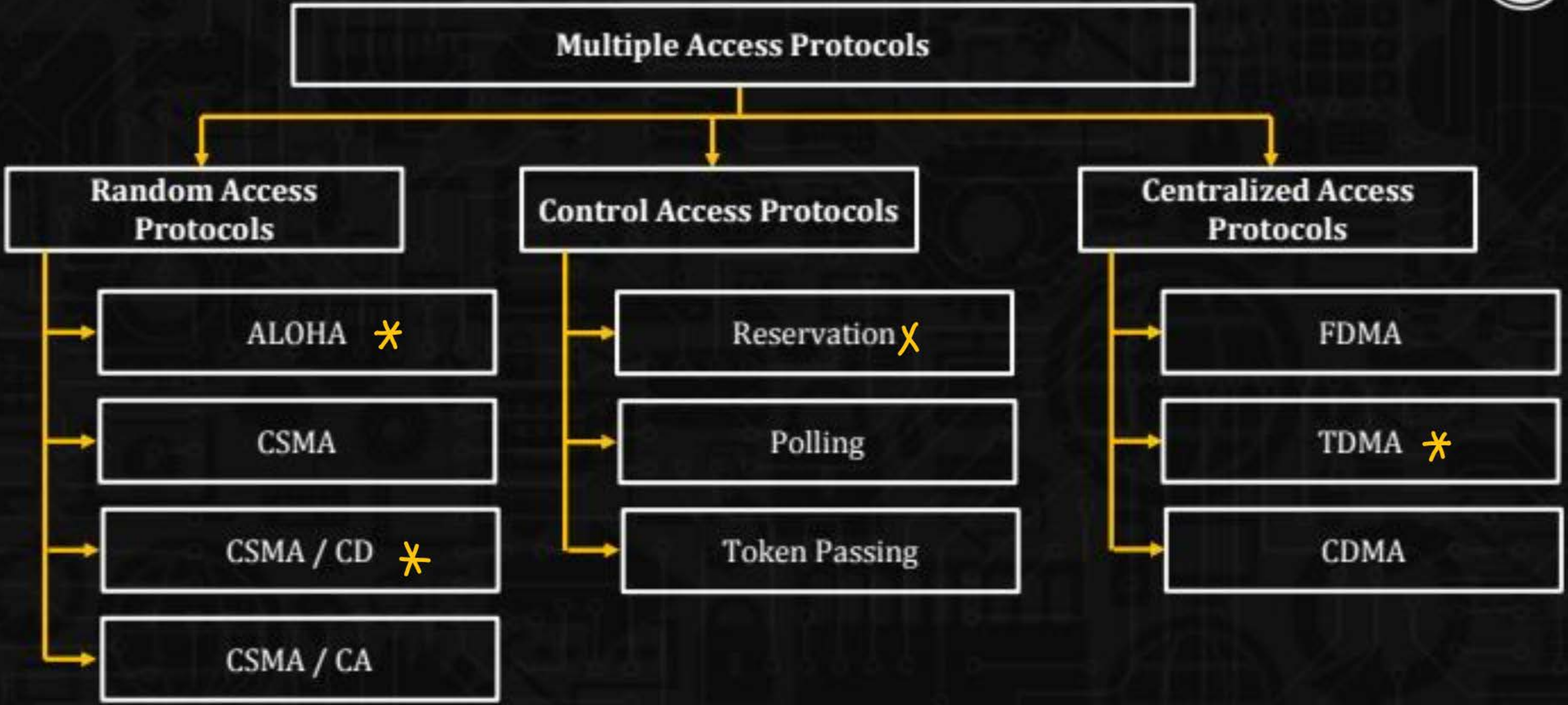
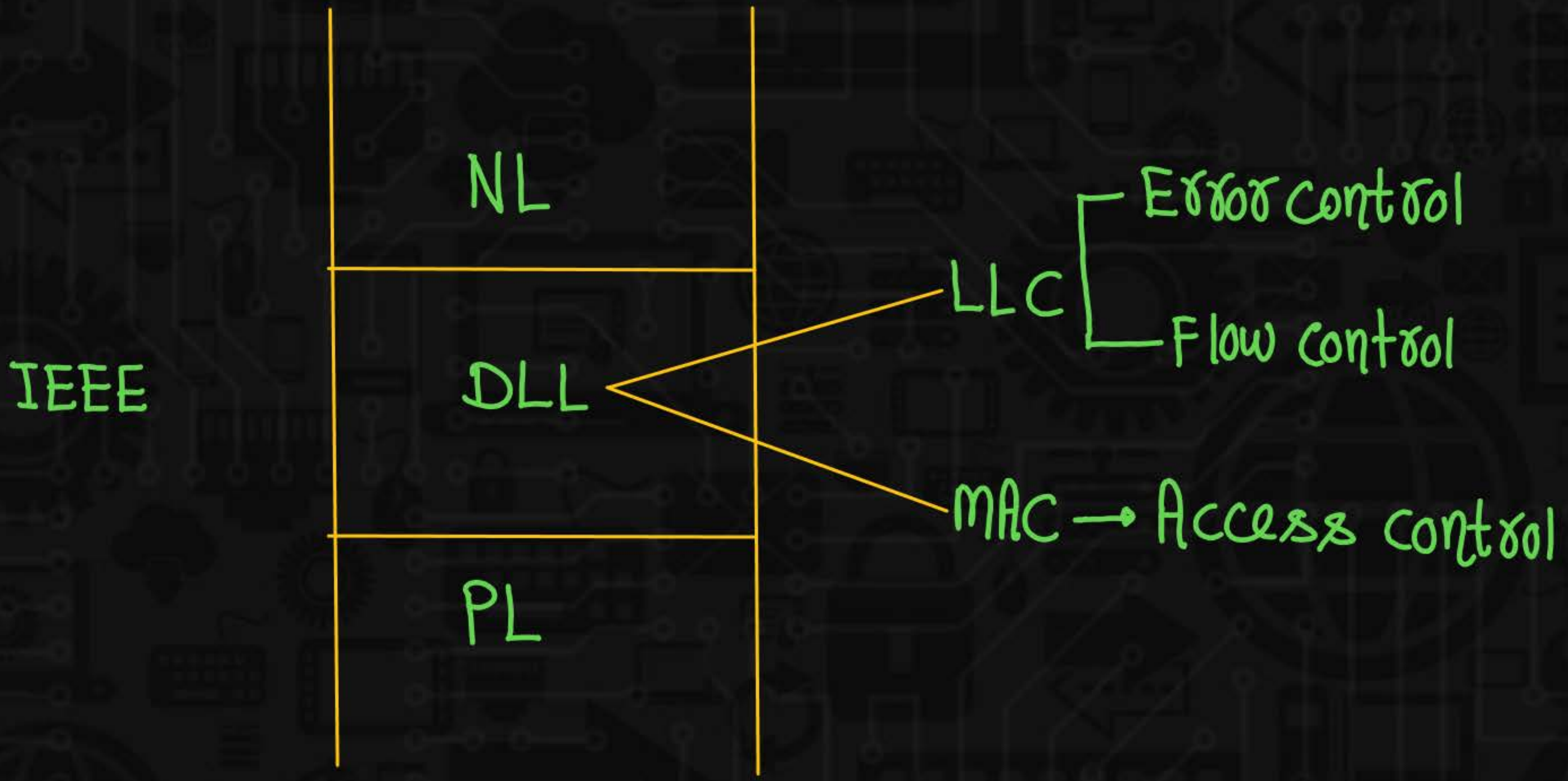
TOPICS TO BE COVERED

Multiple Access Protocols Part-1

Multiple Access Protocols

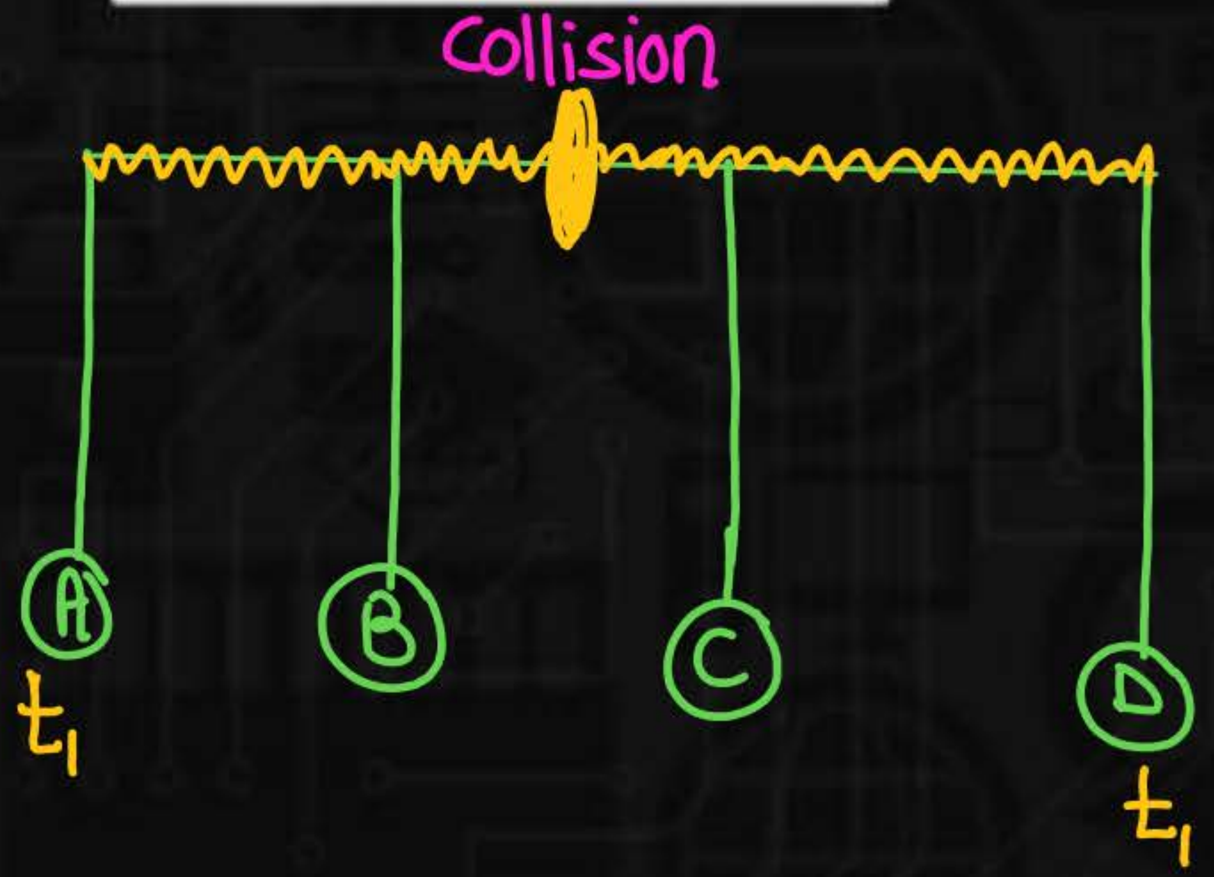

Multiple Access Protocols
Random Access Protocols
ALOHA
CSMA
CSMA / CD
CSMA / CA
Control Access Protocols
Reservation
Polling
Token Passing
Centralized Access Protocols
FDMA
TDMA
CDMA


IEEE
NL
DLL
PL
LLC
Error control
Flow control
MAC → Access control

Links

Point to point Link

Broadcast Link



Random Access Protocols

Randam Access Protoclos

1. ALOHA
   - Pure Alloha
   - Slotted Aloha
2. CSMA
3. CSMA|CD
4. CSMA|CA

Random Access Protocols

1. In Random Access, No station is superior to another station and None is assigned control over another i.e. no station permits or stops other station to send data.
2. Any station can send the data whenever it wants.
3. If more than one station tries to send then there is an access conflict (collision and the Frames will be either destroyed or modified).
4. To Avoid collision station must send data by executing a procedure or condition defined by the protocol.
5. There is no fixed order in which station send data so these are called Random Access Protocols.
6. Each station competes for the channel hence these are also known as contention methods.

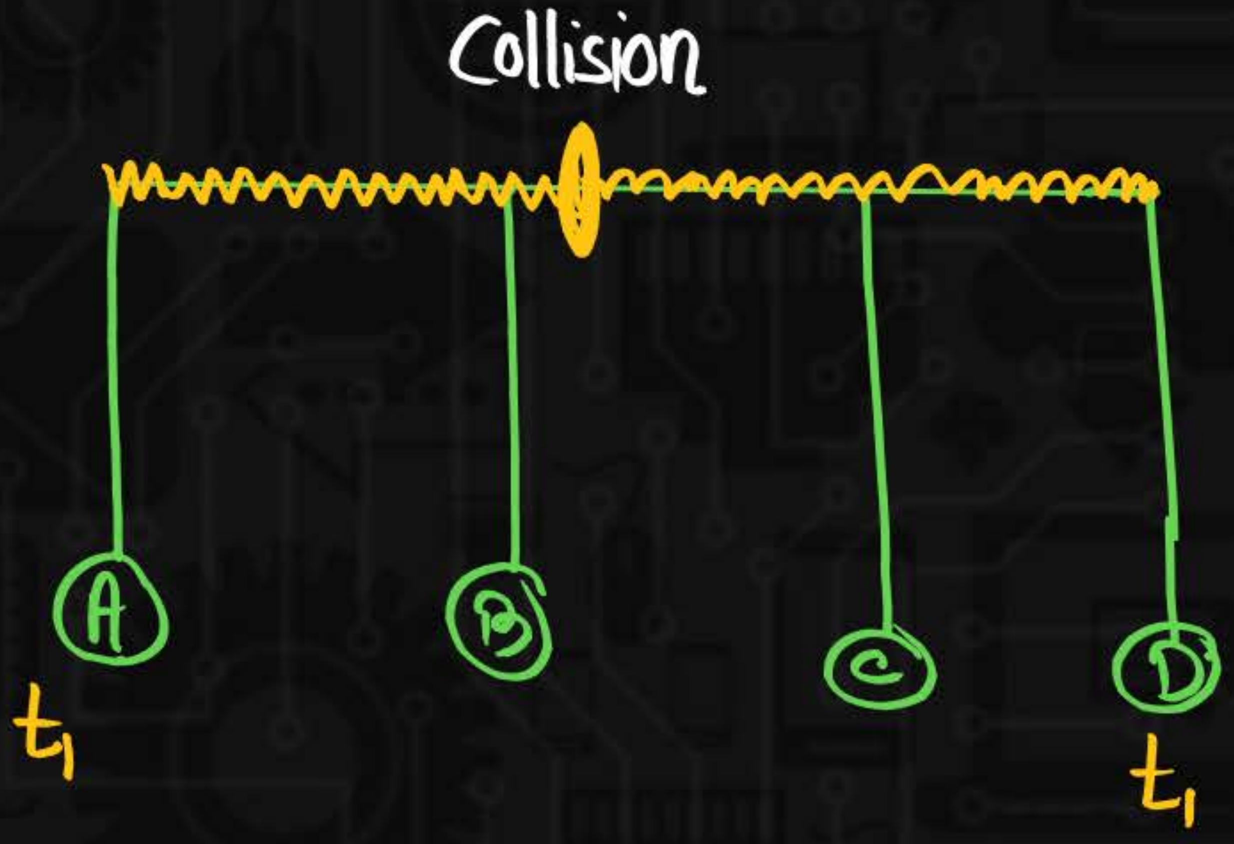
Introduction
To
ALOHA

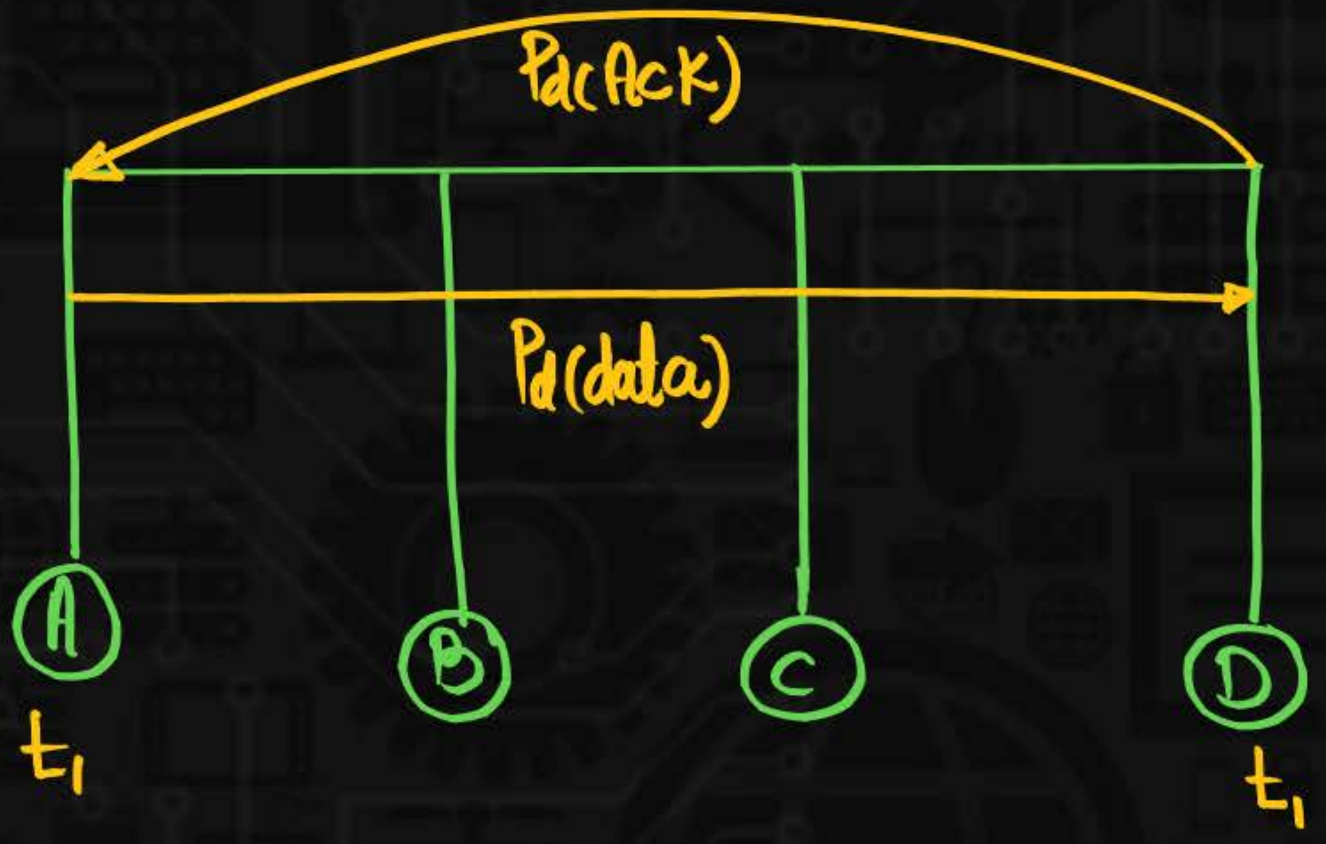
ALOHA

- Aloha was developed at university of hawaii in 1970’s.
- It was Designed for wireless LAN but it can be used in any shared medium.
- Each station sends equal size Frame.

PURE ALOHA

- It allows the stations to transmit the data at any time whenever they want.
- Hence collision chances are very high
- After transmitting the data packet stations must wait for the acknowledgment.
- If acknowledgment does not arrive after a time out period, the station assume that frame (or the acknowledgement) has been destroyed.
- The time out period is equal to the maximum possible round trip propagation delay i.e. 2*Pd





$T.O = 2 * P_d$

or

$WT = 2 * P_d$

$T.O = 2 * P_d$

or

$WT = 2 * P_d$

- After time out, station will again send data but If it immediately tries to send data packet then collision will occur. Hence no station can effectively send data.

Because time out is also same For all the Station.

- So station must not send frame immediately after time out.
- It must wait for random amount of time called back-off time. Back off time = k x slot time.

or WT

$(0 \text{ to } 2^n - 1)$

$$\text{slot time} = (RTT(2 * P_d) \text{ or } T_d \text{ or } P_d)$$

$K \rightarrow$ Any Randam Number in b/w 0 to $2^n - 1$

$n \rightarrow$ Collision Number

Note: Collision Number is with respect to data PKt.

Note:

Maximum number of attempts for the station is 15.

Binary exponential Back off Algorithm (2 Station)

Station A

Data- Pkt - 1

$n = 1$

$K \rightarrow 0 \text{ to } 2^n - 1$

$K \rightarrow 0 \text{ to } 2^1 - 1$

$K \rightarrow 0, 1$

Station B

Data- Pkt - 1

$n = 1$

$K \rightarrow 0 \text{ to } 2^n - 1$

$K \rightarrow 0 \text{ to } 2^1 - 1$

$K \rightarrow 0, 1$

A	B	
0	0	→ Collision
0	1	→ A won
1	0	→ B won
1	1	→ Collision

$P(A) = \frac{1}{4} = 25\%$

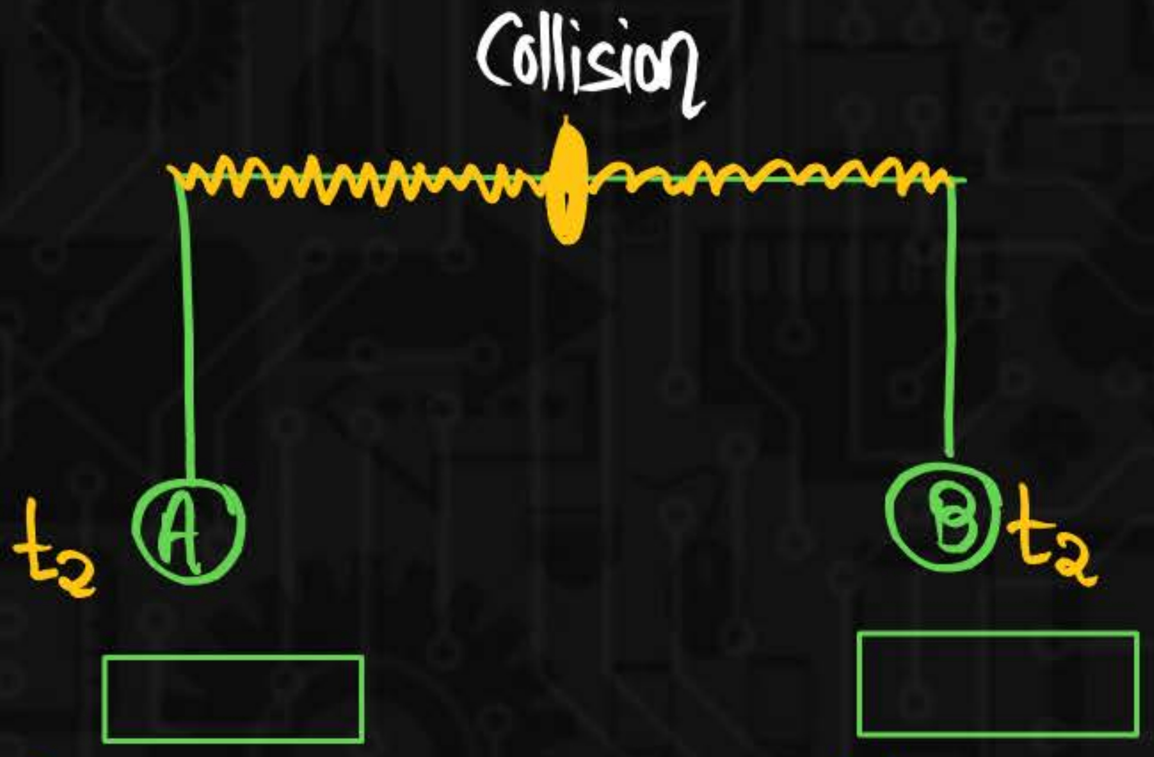
$P(B) = \frac{1}{4} = 25\%$

$P(\text{Collision}) = \frac{2}{4} = 50\%$

If we choose $\overset{A}{0}, \overset{B}{1}$ i.e. $(0, 1)$

Back off time for A $= K * \text{slot time}$
or
WT for A $= 0 * \text{slot time} = 0$

Back off time for B $= K * \text{slot time}$
or
Waiting time for B $= 1 * \text{slot time}$



data Pkt-2

$n = 1$

$K \to 0 \text{ to } 2^n - 1$

$K \to 0 \text{ to } 2^1 - 1$

$K \to (0, 1)$

data Pkt-1

$n = 2$

$K \to 0 \text{ to } 2^n - 1$

$K \to 0 \text{ to } 2^2 - 1$

$K \to 0 \text{ to } 3$

$K \to (0, 1, 2, 3)$

A	B	
0	0	→ Collision
0	1	→ A won
0	2	→ A won
0	3	→ A won
1	0	→ B won
1	1	→ Collision
1	2	→ A won
1	3	→ A won

$P(A) = \frac{5}{8} = 0.625 = 62.5\%$

$P(B) = \frac{1}{8} = 0.125 = 12.5\%$

$P(\text{Collision}) = \frac{2}{8} = \frac{1}{4} = 25\%$

data Pkt-3

$n = 1$

$K \rightarrow 0 \text{ to } 2^n - 1$

$K \rightarrow 0 \text{ to } 2^1 - 1$

$K \rightarrow (0, 1)$

data Pkt-1

$n = 3$

$K \rightarrow 0 \text{ to } 2^n - 1$

$K \rightarrow 0 \text{ to } 2^3 - 1$

$K \rightarrow 0 \text{ to } 7$

$K = \{0, 1, 2, 3, 4, 5, 6, 7\}$

A	B	
0	0	→ Collision
0	1	→ A won
0	2	→ A "
0	3	→ A "
0	4	→ A "
0	5	→ A "
0	6	→ A "
0	7	→ A "
1	0	→ B won
1	1	→ Collision
1	2	→ A won
1	3	→ A "
1	4	→ A "
1	5	→ A "
1	6	→ A "
1	7	→ A "

$P(A) = \frac{13}{16} = 0.8125 = 81.25\%$

$P(B) = \frac{1}{16} = 0.0625 = 6.25\%$

$P(\text{Collision}) = \frac{2}{16} = 0.125 = 12.5\%$

Initially the Probability of collision = 100%

After 1st collision the Probability of collision = 50%

After 2nd " " " " " = 25%

After 3rd " " " " " = 12.5%

⋮

Probability of collision is decreasing exponentially so Back OFF Algorithm is also known as exponential Back-OFF Algorithm

Disadvantage of Back Off Algorithm:

This algorithm suffers from capture effect. If any station wins in the 1^{st} collision then it have a more probability for wining in the next collision.

ex: initially $P(A) = 25\%$

$P(A) = 62.5\%$

$P(A) = 81.25\%$


THANK YOU
GW
SOLDIERS !