CS & IT ENGINEERING

COMPUTER NETWORKS

Medium Access Control

Lecture No-04

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Multiple Access Protocols-4

Persistent methods in CSMA

Persistent methods in CSMA

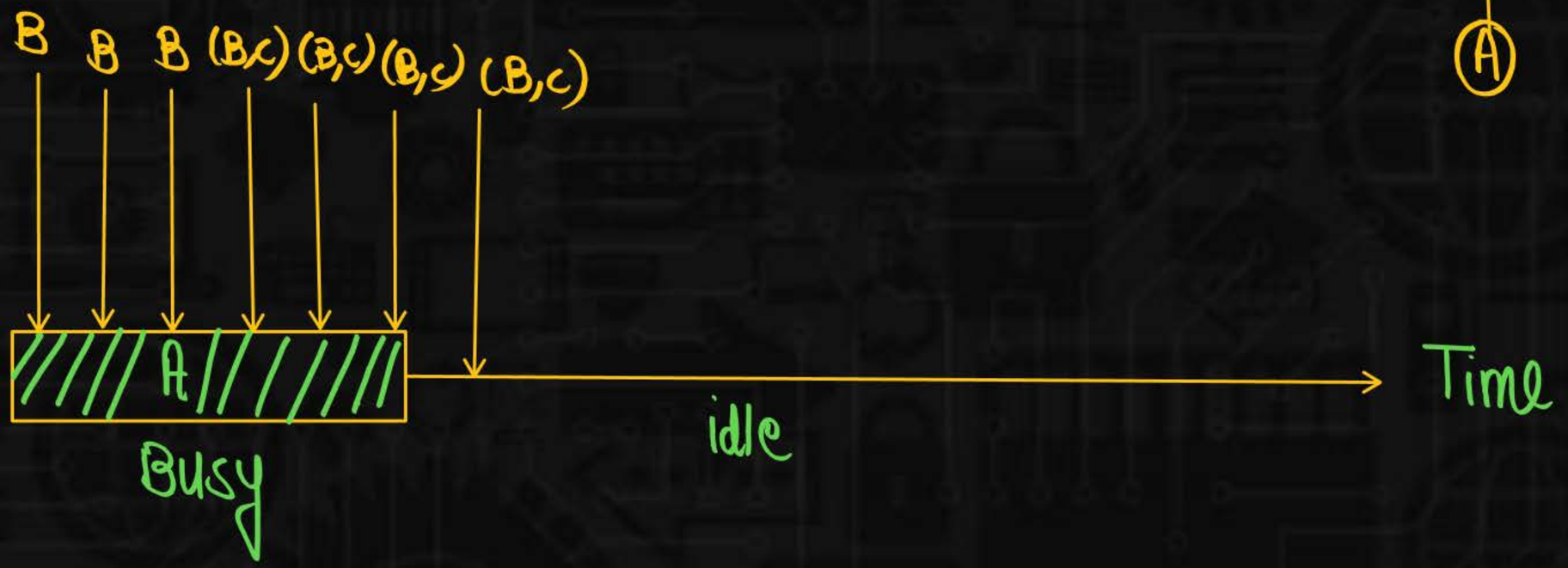
- What should a station do if the channel is busy?
- What should a station do if the channel is idle?

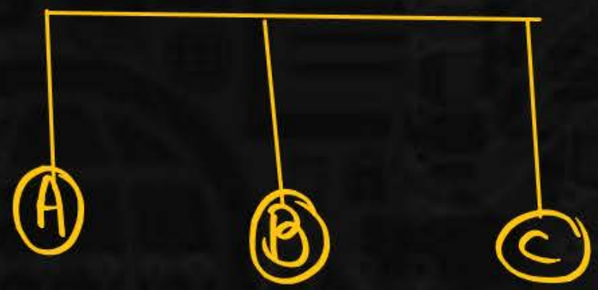
3 Methods

1. 1 Persistent
2. Non-persistent
3. P-persistent

1 Persistent CSMA

In the case of 1-persistent CSMA Station will continuously sense the channel and once the channel is idle. It send it's frame immediately (with Probability 1)

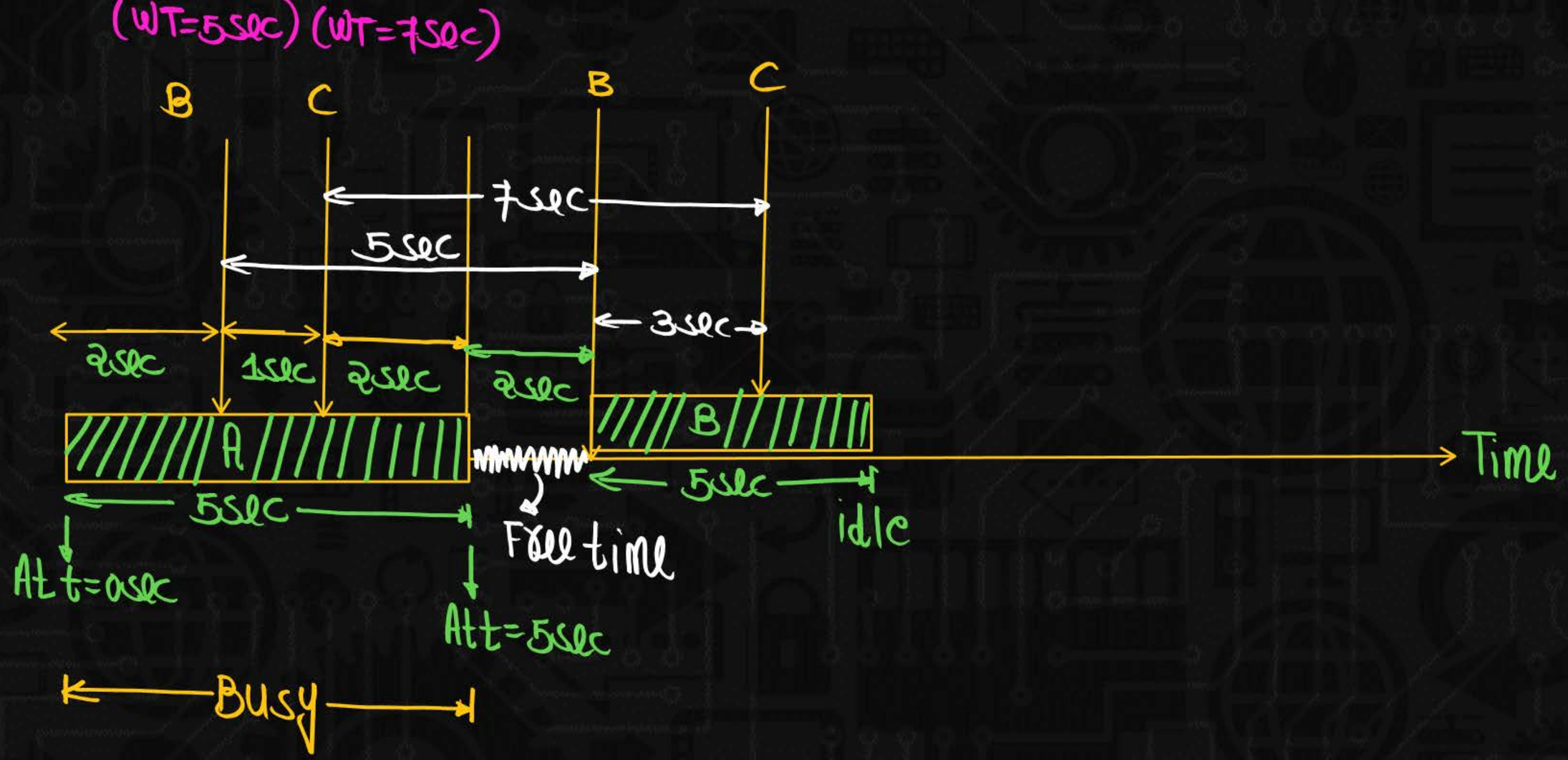




- Probability of collision is high for example, If two station become ready in the middle of third transmission, both will wait politely until the transmission ends, and then both will begin transmitting exactly simultaneously then collision will occur.
- Ethernet LAN uses 1- Persistent method

Non persistent CSMA:

- In non persistent CSMA ,once the station is ready with the data it will sense the channel, if channel is busy then it will wait for random amount of time and again sense the channel.
- Once the channel is free then it immediately transmit the frame

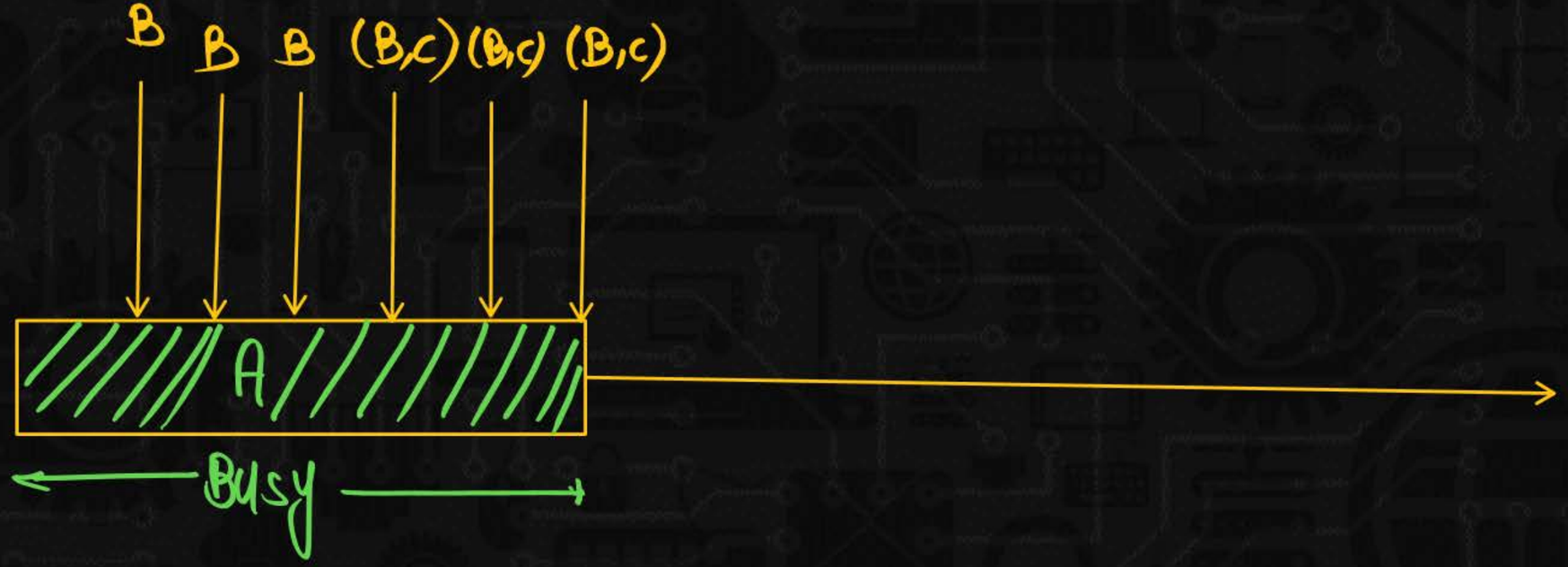

(WT=5sec) (WT=7sec)
B
C
B
C
7sec
5sec
3sec
2sec
1sec
2sec
2sec
A
B
Time
5sec
5sec
Free time
idle
At t=0sec
At t=5sec
Busy

Note:-

- In non persistent CSMA finding the channel idle at the same time by different station is less. So collision are less compared to 1 persistent
- This method reduce the efficiency of the network because the medium remains idle when there may be stations with frame to send.

P- persistent CSMA:

- P-persistent method is used if the channel has time slot with a slot duration equal to or greater than the maximum propagation time.
- It uses advantages of both 1 persistent and non persistent
- It reduce the chances of collision and improve efficiency
- In this method, after the station finds the channel idle it follow these steps:
  1. With probability p , the station send its frame.
  2. With the probability (1-p) the station wait for the beginning of the next time slot and check the line again


B
B
B
(B,C)
(B,C)
(B,C)
A
Busy

S·P → sending Port → For sending the data

L·P → Listening Port → For detecting the collision

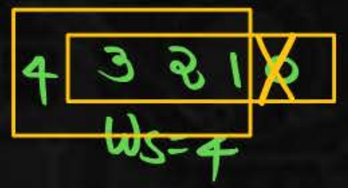
CSMA/CD

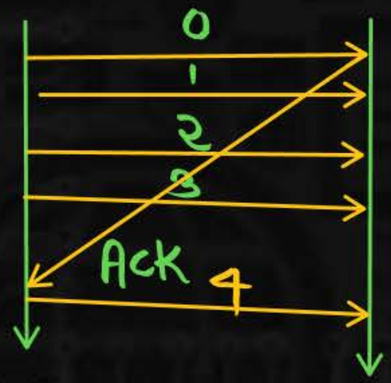
CSMA/CD (Carrier Sense multiple access/Collision Detection)

- CSMA does not specify what station will do after collision.
- In CSMA if two station sense the channel to be idle and begin transmitting simultaneously, then both station data will be collide and still stations will keep on sending the data.
- Better way to save the time and bandwidth is to detect the collision and immediately stop transmission this strategy is used in CSMA/CD.
- In CSMA/CD station do not send the entire frame and then look for collision.
- In CSMA/CD transmitting the frame and detecting the collision are continuous process.
- Sender needs two different port i.e one for sending the data and another for detecting the collision.
- If collision is detected then sender immediately stop transmitting the data.

No Acknowledgement:

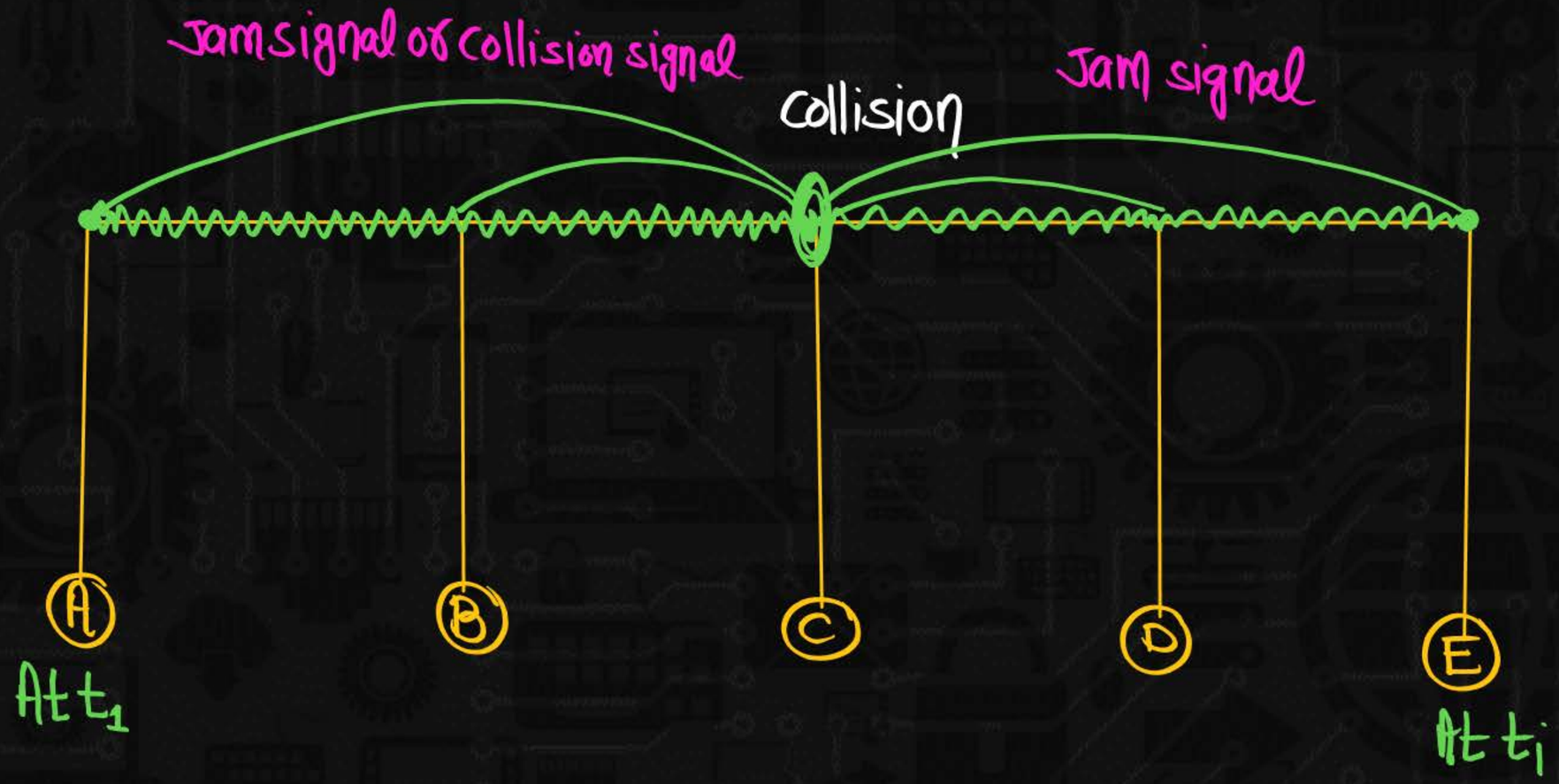
There is no need of acknowledgement, if collision is not detected then frame is definitely received by receiver.



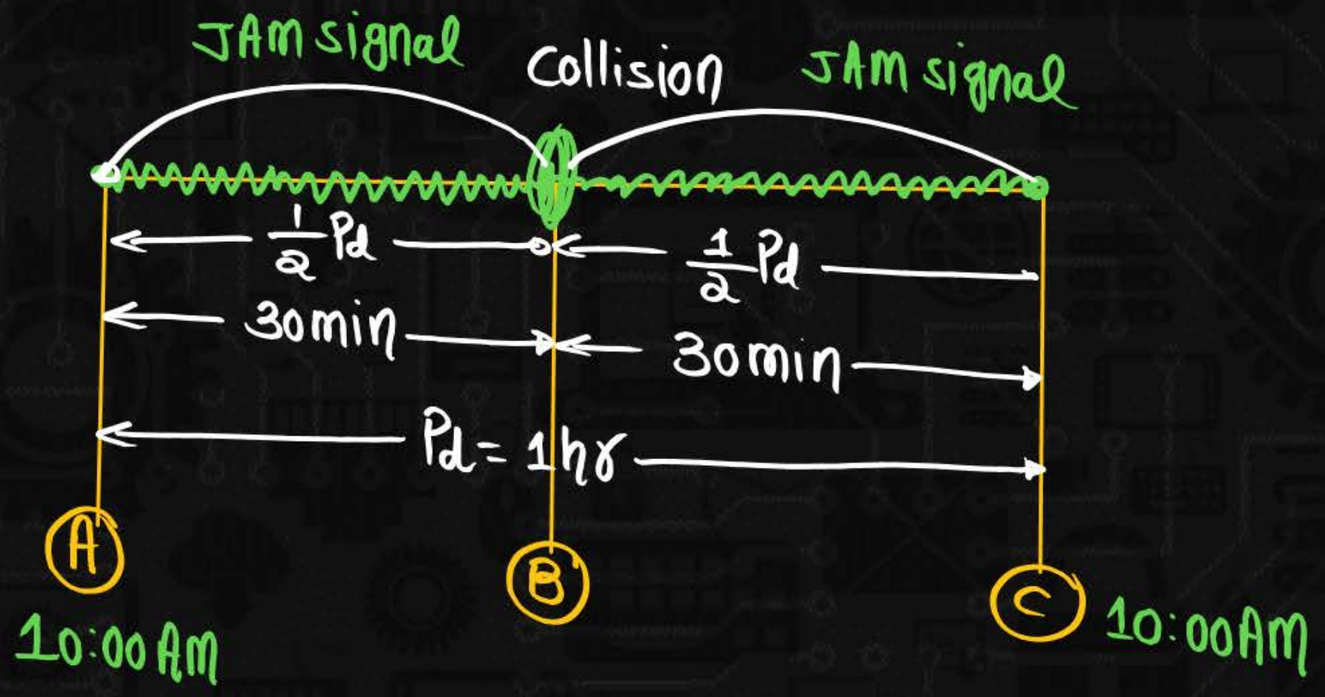


No Copy:

Once frame is transmitted sender does dot maintain a copy of that frame because station is simultaneously sending the frame and detecting the collision, if collision is not detected that means receiver has successfully received the frame.


Jam signal or collision signal
collision
Jam signal
A
B
C
D
E
At t_1
At t_i

Minimum Frame size For detecting the collision

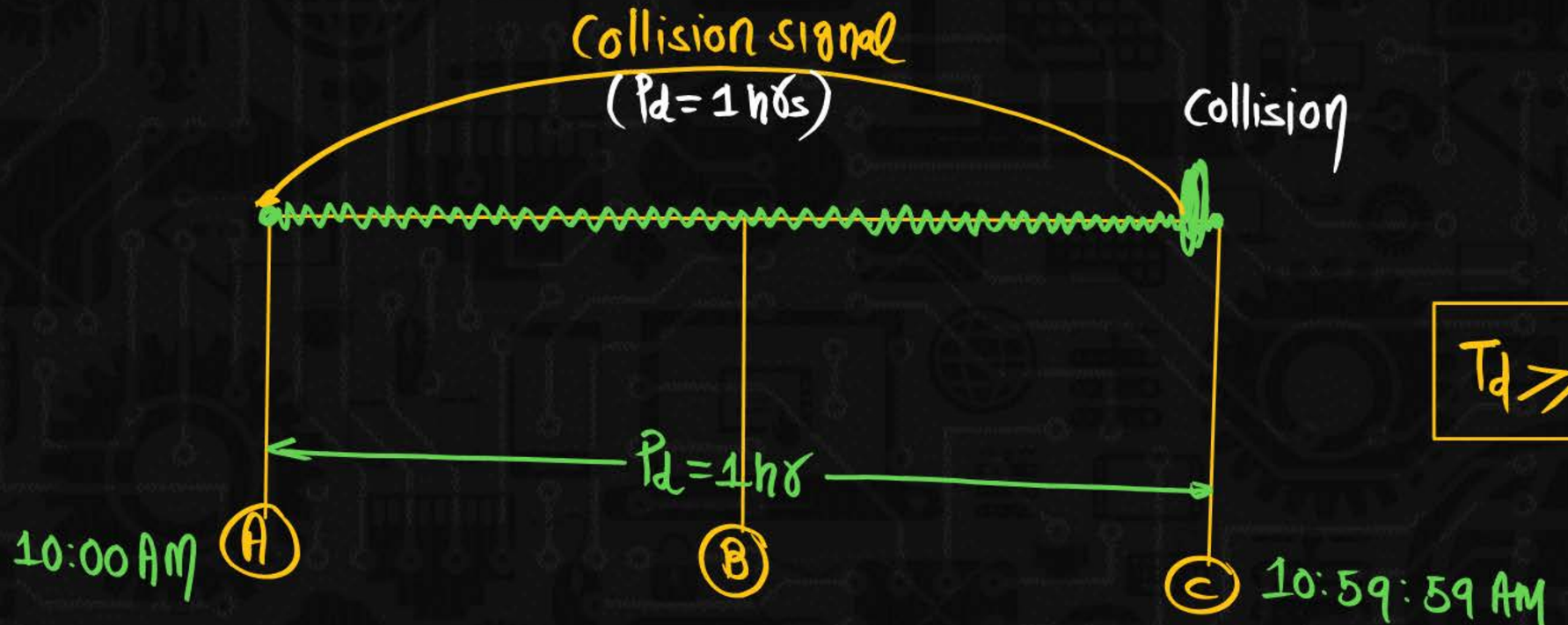


$T_d \geq P_d$

At 10:00 A.M Both A, C start transmitting data

At 10:30 A.M → Collision

At 11:00 AM → Both A and C received Collision signal



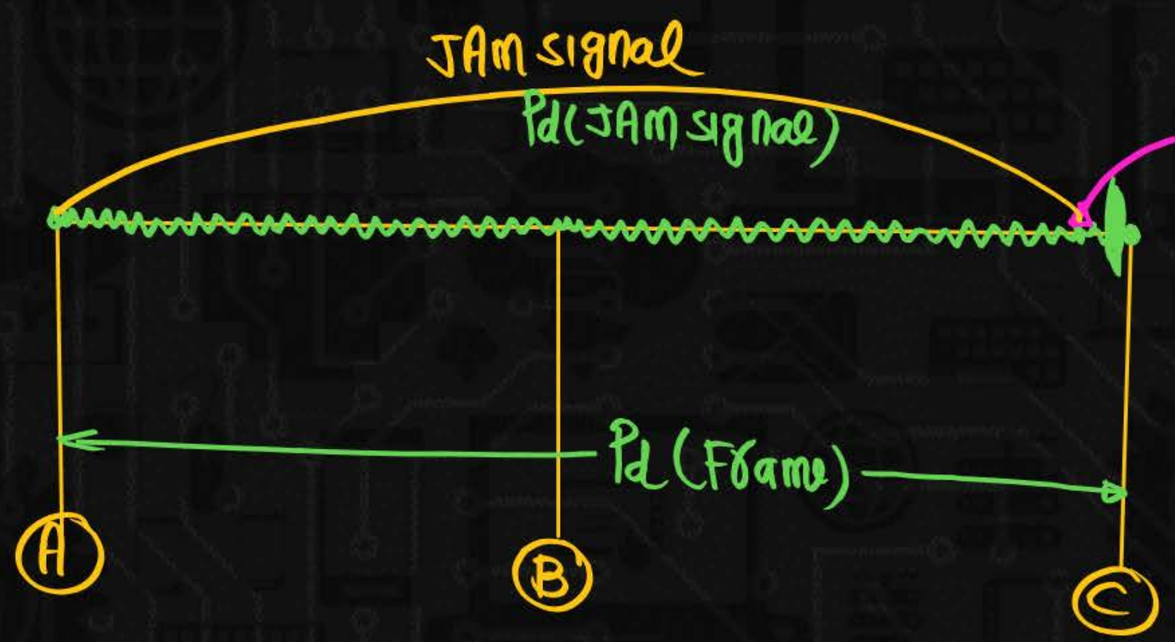
$T_d \geq 2 * P_d$

At 10:00 AM → 'A' start transmitting data

At 10:59:59 AM → 'C' start transmitting data

At 11:00 AM → collision

At 12:00 PM → A received Collision signal



$$T_d(\text{JAM signal}) = \frac{\text{JAM signal size}}{\text{Bandwidth}}$$

$$T_d(\text{Frame}) \geq P_d(\text{Frame}) + T_d(\text{JAM signal}) + P_d(\text{JAM signal})$$

$$T_d(\text{Frame}) \geq 2 * P_d + T_d(\text{JAM signal})$$

exact Formula

Minimum Frame size to detect the collision

$$\frac{\text{Frame size } (L)}{\text{Bandwidth } (B)} \geq 2 * P_d + T_d(\text{JAM signal})$$

$$\text{Frame size} \geq \left(2 * P_d + T_d(\text{JAM signal})\right) * \text{Bandwidth}$$

$$\boxed{L \geq \left(2 * P_d + T_d(\text{JAM signal})\right) * B}$$

→ minimum Frame size For detecting the collision in CSMA/CD

Problem Solving on CSMA/CD

Q.1 Building a CSMA/CD network running at 1 Gbps over a I-km cable with no repeaters. The signal speed in the cable is200,000 km/sec. The minimum frame size is ____bits.

[GATE – 2005]

$B = 1\,Gbps = 10^9$ bits/sec , $d = 1$ KM , $v = 200000$ km/sec

$T_d(Frame) \geq 2 * P_d + T_d(JAM\ signal)$

$T_d(JAM\ signal) = 0$

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

$L \geq 2 * P_d * B$

$L \geq 2 * \frac{d}{v} * B$

$L \geq 2 * \frac{1\ KM}{200000\ KM/sec} * 10^9$ bits/sec

$L \geq 10^4$ bits

$L \geq 10,000$ bits

Q2. Consider a CSMA/CD network that transmits data at a rate of 100 Mbps (10^8 bits per second) over a 1 km (kilometer) cable with no repeaters. If the minimum frame size required for this network is 1250 bytes, what is the signal speed (km/sec) in the cable?

[GATE – 2015]

A. 8000

B. 10000

C. 16000

D. 20000

$B = 10^8$ bits/sec

$d = 1$ km

$L = 1250$ Byte

$L = 8 * 1250 = 10,000$ bits

$v = ?$

$$T_d(\text{Frame}) \geq 2 * P_d + T_d(\text{JAM signal})$$

$$\frac{L}{B} \geq 2 * \frac{d}{v}$$

$$\frac{10{,}000 \text{ bits}}{10^8 \text{ bits/sec}} \geq \frac{2 * 1 \text{ km}}{v}$$

$$\frac{1}{10^4} \geq \frac{2}{v}$$

$$v = 2 * 10^4 \text{ km/sec}$$

$$v = 20{,}000 \text{ km/sec}$$

Q.3 A network has a data transmission bandwidth of 20×10^6 bits per second. It uses CSMA/CD in the MAC layer. The maximum signal propagation time from one node to another node is 40 microseconds. The minimum size of a frame in the network is _____ bytes.

[GATE – 2016]

$B = 20 * 10^6$ bits/sec

$P_d = 40\ \mu sec = 40 * 10^{-6}$ sec

$L = ?$

$T_d(Frame) \geq 2 * P_d + T_d(Jam\ signal)$

$T_d(Jam\ signal) = 0$

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

$L \geq 2 * P_d * B$

$L \geq 2 * 40 * 10^{-6}\ sec * 20 * 10^6\ bits/sec$

$L \geq 1600$ bits

$L \geq \frac{1600}{8}$ Byte $= 200$ Byte


THANK YOU
GW
SOLDIERS !