Discussion #9
EE450

Sample Problems
- CSMA/CD

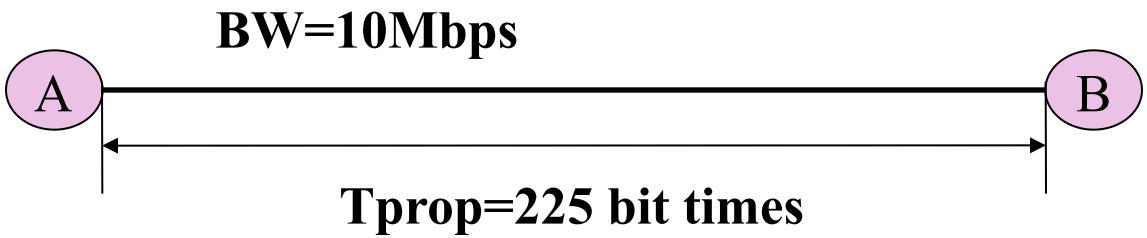
Problem#1: Description

- Two nodes A and B on the same 10Mbps Ethernet Segment.
- The propagation delay between them is equivalent to 225 bit times (225*bit duration).
- Both nodes start to transmit at the same time , t=0.
- Upon detecting the collision, each node transmit a jamming signal equivalent to 48 bit times.
- Node “A” will retransmit immediately after it senses the medium is idle (not after it detects a collision).
- Station B will schedule its retransmission 51.2 microsec after it senses the medium is idle (not after it detects a collision).

Problem#1 : Questions?

- Construct a timeline diagram to indicate all the events involved in the question.
- At what time will node “A” start retransmission?
- At what time will the frame from “A” be completely delivered to “B”?
- Will there be a collision the second time?
- What is the effective throughput for station “A” assuming that the frame length is the minimum allowed which is 512 bits?

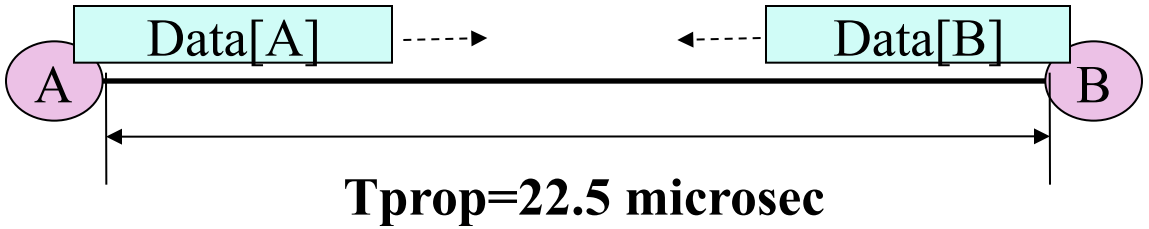
Problem#1: Solution



1 bit time = 1 bit / 10 Mbps = 0.1 microsec

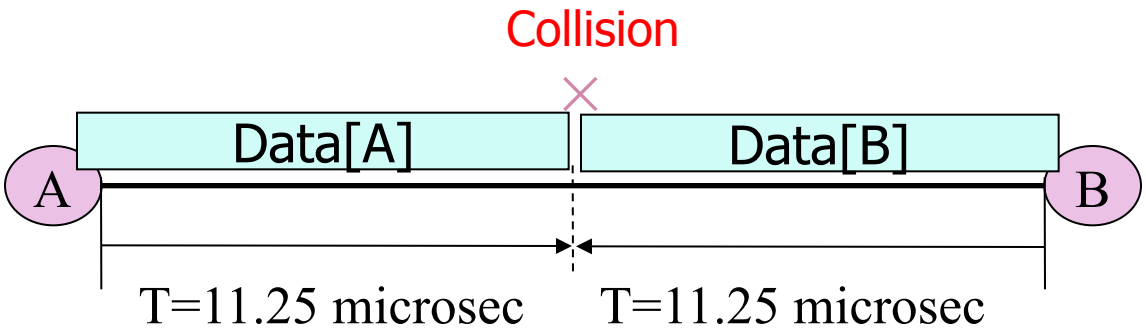
Tprop = 225 bit times = 22.5 microsec

T= 0 sec

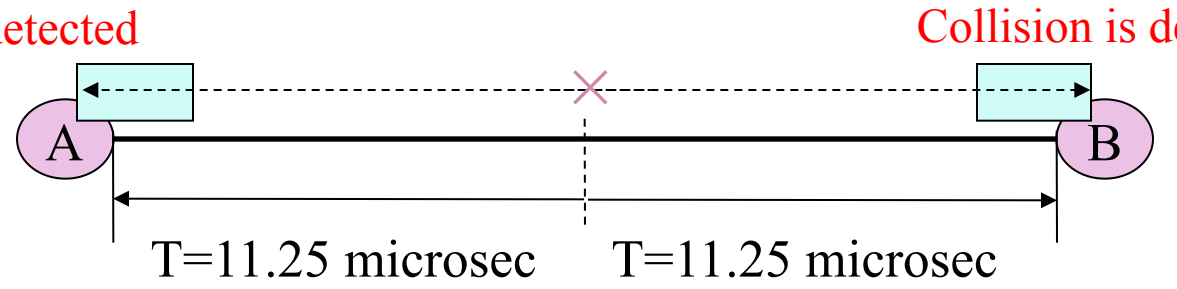


Collision

T= 0 + 22.5/2
= 11.25 microsec



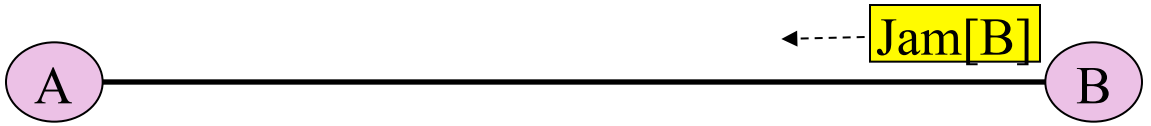
T= 11.25 + 22.5/2
=22.5 microsec



A transmitting data station that detects another signal while transmitting a frame, stops transmitting that frame, transmits a jam signal, and then waits for a random time interval (known as "backoff delay" and determined using the truncated binary exponential backoff algorithm) before trying to send that frame again.

Jamming Signal

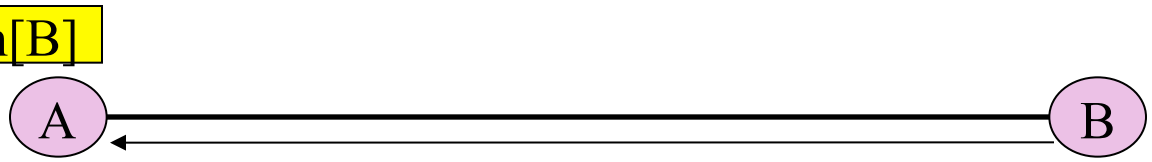
T= 22.5 +4.8
= 27.3 microsec



T_{Jam} =48 bit times= 4.8 microsec

B's Jamming signal is transmitted.

T= 27.3 + 22.5
= 49.8 microsec

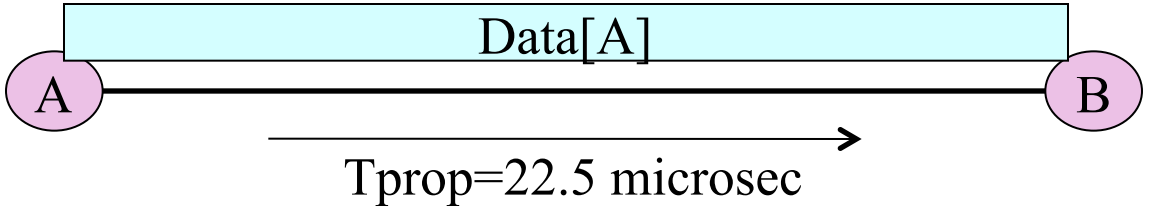


Tprop=22.5 microsec

The last bit of B's Jamming signal is received at A.
A now senses the medium as idle so it starts retransmission.
B schedules its retransmission for 51.2 microsec later,
i.e. at T= 49.8 + 51.2 = 101 microsec

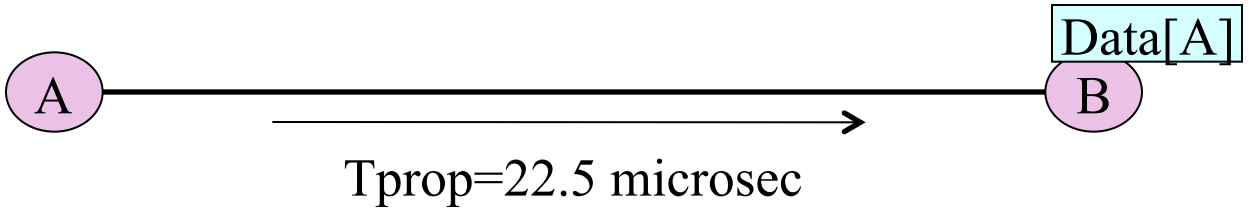
A's Retransmission

T= 49.8 + 22.5
= 72.3 microsec

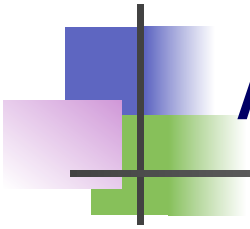


The first bit of A's retransmitted frame is received at B at T= 72.3 microsec.

T= 72.3 + 51.2
= 123.5 microsec



Frame size =512 bits , Frame transmission time= 512/10 Mbps=51.2 microsec
The last bit of A's retransmitted frame is received at B at T= 123.5 microsec.



A second Collision?

- There won't be a second collision, because at T=101 microsec, B senses the medium to be busy so it doesn't transmit and reschedules its retransmission.

- Throughput for A :

Frame size / Transfer time = 512 bits/123.5 microsec = 4.15 Mbps

Problem#2: Description

- Consider a 100Mbps 100BaseT Ethernet.
- Assume propagation speed is 1.8×10^8 m/sec
- Assume a frame length of 72 bytes and no repeaters.
  - In order to have an efficiency of 0.5, what should be the maximum distance between the nodes?
  - Does this maximum distance ensure that a transmitting node A will be able to detect whether any other node transmitted while A was transmitting? Why or why not?
  - How does your maximum distance compare with the actual 100 Mbps standard?

Problem#2: Solution

- We want $1/(1 + 5a) = 0.5$ or
- Equivalently $a = 0.2 = t_{prop} / t_{trans}$ (I)

- $t_{prop} = d /(1.8 \times 10^8)$ m/sec (II)
- t_{trans} = Frame size/BW= (576 bits) /(10^8 bits/sec) = 5.76μ sec (III)

- Substitute (II) & (III) in (I)
- Solve for d and we obtain $d = 207$ meters.

Problem#2: Solution

- For the 100 Mbps Ethernet standard, the maximum distance between two hosts is 200 m.
- For transmitting station *A* to detect whether any other station transmitted during *A* 's interval, t_{trans} must be greater than $2t_{prop}$.
- Therefore 2×207 m/1.8×10^8 m/sec = 2.30μ sec.
- Because $5.76 > 2.30$, *A* will detect *B* 's signal before the end of its transmission.