Practice Questions about MAC protocols

Q.1 Link speed = C = 10 Mbps ; MTU = L = 1500 byte

Max. distance between two nodes = 100 meters

Signal speed over the medium = $\frac{2}{3} \times 10^8$ meters/sec

T_{prop} = Max propagation delay between 2 nodes in LAN

$$= \frac{\text{Max. distance between two nodes}}{\text{Signal speed over the medium}} = \frac{100}{\frac{2}{3} \times 10^8} = 1.5\ \mu\text{sec}$$

t_{trans} = Time to transmit max. size frame $= \frac{MTU}{C}$

$$= \frac{1500 \times 8}{10 \times 10^6} = 1.2\ \text{mSec}$$

CSMA/CD → Efficiency $= \frac{1}{1 + 5\frac{t_{prop}}{t_{trans}}} = \frac{1}{1 + \left(5 \times \frac{1.5\ \mu\text{sec}}{1.2\ \text{msec}}\right)}$

$$= \frac{160}{161} = 0.9938$$

Q.2 The maximum number of bits transmitted by a node before detecting collision is the number of bits that can be transmitted within $(2 \times t_{prop})$ sec. [t_{prop}: Propagation time between two nodes]

↝ Node A transmitted 60 byte (480 bits) from a frame before detecting collision.

So, in $(2 \times t_{prop})$ sec, node A transmitted 480 bits

Then, t_{prop} = propagation delay between two nodes = 240 bit times

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Q.3 For a C = 100 Mbps broadcast channel,

$$1 \text{ bit time} = \frac{1}{C} = 0.01 \ \mu\text{sec}$$

$$\text{The wait time} = R \times 512 \text{ bit time} = 100 \times 512 \times \frac{1}{100} \times 10^{-6}$$

$$= 512 \times 10^{-6} \text{ sec} = 512 \ \mu\text{sec}.$$

Q.4 Before a station can attempt to transmit on the wire, it must first wait until it has heard 96 bit-time of silence.

Interframe Gap (IFG) = 96 bit_times

↝ for 100 Mbps Link ⟶ 1 bit_time = $\frac{1}{100\ \text{Mbps}} = 0.01 \times 10^{-6}$ sec

So, IFG = $96 \times 0.01 \times 10^{-6} = 0.96 \times 10^{-6}$ sec

↝ for 1Gbps Link ⟶ 1 bit_time = $\frac{1}{1\ \text{Gbps}} = 0.001 \times 10^{-6}$ sec

So, IfG = $96 \times 0.001 \times 10^{-6} = 0.096 \times 10^{-6}$ Sec

IfG for 100 Mbps Link is 10 times the IfG for 1Gbps Link

This widely differing values come from the difference in the value of bit-time for each link.

Q.5 (a) Collision is detected by Current sensing (it takes more Power [electrical Current] when two transmitters step on each other)

→ receiver will drop any Packets received during Collision.

(b) CSMA/CD is used by Ethernet protocol which is a Connectionless (No handshaking between sending and receiving NICs). So, receiving NIC doesn't send Acks or NACKs to sending NIC. Therefore, it is important for the sender to know if its transmitted frame has collided or not.

Q.6 (a) Yes (b) NO (c) NO

Q.7 If the Payload is ephemeral, errors are tolerated.

↳ Phone (Voice over IP) & TV (Live show or game)

If the Payload is Long lived (information, records, financial), errors are more Critical. So, fail of CRC will Cause a serious errors and problems for end users.

Q.8 Although the maximum throughput of slotted ALOHA is 36.8%. However, it will be increased if used with a host use CSMA/CD algorithm. Since, it will try to retransmit any collision packet in another slot, but CSMA/CD will wait for the backoff time before it try to transmit again after each collision. Also, since the backoff time is increased exponentially after each collision. So, the performance of CSMA/CD protocol will decrease significantly.