Assignment 3

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1. EUI-48 MAC address space can manage 2^{48};
   IPv4 address space can manage 2^{32};
   IPv6 address space can manage 2^{128};

2. The frame structure is identical because all these three Ethernet technologies use the standard Ethernet frame structure, however they differ by the speed at which they transmit the data. The speed is 10, 100, 1000 Mbps per second relatively.

3. Collision detection is not implemented in the 802.11 MAC protocol because of 2 reasons:
   a) In 802.11 MAC protocol the strength of the received signal is usually much weaker than the strength of the transmitted signal. To determine collision we would have to build hardware that detects collision.
   b) Due to hidden terminal problem and fading even if the adapter is capable of transmitting and listening at the same time, the adapter would still not be able to detect all collisions.

4. With reliable delivery service for every link we know that IP datagram sent over the link will be received without any errors but there is no way to guarantee that the IP datagram will arrive in the ultimate destination in the correct order. With TCP we can ensure that the receiving side of the application the byte stream is in the right order, there is also the additional risk of packet loss due to equipment failure and routing loops.

5.

a) Decrease the transmission rate: We know that bit rate and bit error have a proportional relationship that if the bit rate is lowered proportionally the error rate would also go down.
b) Increase the transmission power: The strength of the signal weakens as you move further away from the source and to overcome this hurdle we could increase the power output.

6 G = 10011
D = 0110100011
We need to append 4 zeros bit at the end of D because (len(G) - 1 = 4)

0110100011
↓
1 1 0 1 0 0 0 1 1 0 0 0 0
1 0 0 1 1
0 1 0 0 1 0
1 0 0 1 1
0 0 0 0 1 0 1 1 0
1 0 0 1 1
0 0 1 0 1 0 0
1 0 0 1 1
0 0 $\boxed{1110}$ R

7. a) After the fifth collision the probability that a node chooses K=10 is 1/32.
b) 512 bits = 64 bytes
K = 10
For 10 Mbps:
$\frac{64\ bytes}{10\ Mbps}$ = 51.2μs

So we have K * 51.2μs = 0.512ms

c) 512 bits = 64 bytes
K = 1
For 100Mbps:
$\frac{64\ bytes}{100\ Mbps}$ = 5.12μs
So we have K * 5.12μs = 0.00512 ms

8. a) MAC addresses are made of 48 bits and are usually represented as a string of 12 hexa digits, so the answer is 12.

b)
i) A sends a frame to all stations. Switch learns about A and makes an entry, then sends the frame to all stations.

MAC address	Station
0A	A

ii) Switch learns about B and makes an entry, but it doesn't know where it's C, so it floods the frame out to all stations. C eventually receives the frame.

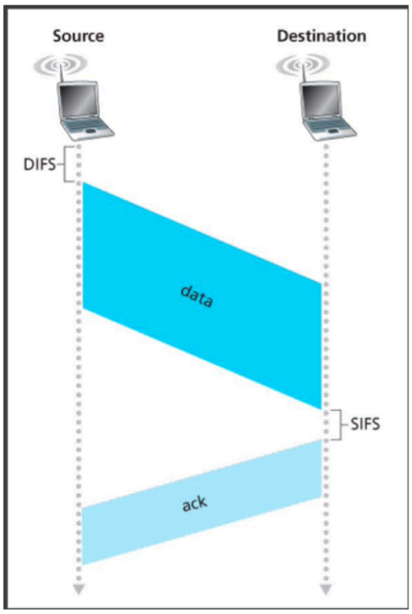
MAC address	Station
0A	A
0B	B

iii) Switch receives an answer from C and adds it. It already knows where B is, so it doesn't need to flood.

MAC address	Station
0A	A
0B	B
0C	C

9. a) The range used for fragmentation threshold is 256-2346. The default value is 2346 which means that it is disabled and will never be used.
In order for RTS/CTS to be skipped in the RTS threshold must be larger than the fragmentation threshold though.

b) The formula for T_{tot} is:



RTS + CTS are skipped so we don't need to count them in the formula.

T_{tot} = DIFS + T_{trans1} + T_{prop1} + $T_{process1}$ + SIFS + T_{trans2} + T_{prop2} + $T_{process2}$

We ignore the propagation delay and the process delay.
T_{tot} = DIFS +T_{trans1} + SIFS + T_{trans2}

Rate = 11 Mbps
Length = 32 bytes

T_{trans2} = 256 bits/11Mbps = 2,3e^{-5} = 23 usec
ACK = 23 usec

T_{tot} = DIFS + SIFS + T_{trans1} + 23 usec

c) T_{tot} = DIFS + SIFS + T_{trans1} + 23 usec
T_{tot} = 50 usec + 10 usec + T_{trans1} + 23 usec
T_{tot} = T_{trans1} + 83 usec

d) From the book:
RSSI = 10 * log (Pr)

Now we reverse the formula to isolate Pr:
(RSSI/10) = log(p)

p = $10^{RSSI/10}$ = 10 mW

mW = milliwatt