CMPE 206-01 Computer Network Design Spring 2020

HW#3 Solutions

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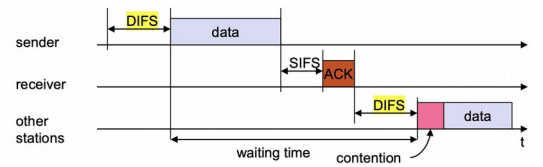
Solution 1)
1.1.

Githublink: https://github.com/spring2020-cmpe206-01/HaoRan-012494781

1.1
a).Since A can interact with all stations, and other station will see A'S packets, so when A is sending to B , all nodes will notice and no other communication is possible.
b).Since B is sending to A, and A can interfere with other nodes, so no communication is possible.
c).B's packet could be seen by ACE,so E can send to D at the same time.
1.2
Since it need to be detected while transmitting the data, and for wireless, it's impossible to know the collision, instead the wired medium could detect the collision, so CSMA/CD is for wired network not wireless network.
1.3
No, Because if we only use physical layer, it will not detect the hidden station, since it will only detect the channel signal power, and if the power of signal < threadhold, it thought the channel will be free and send data and therefore cause collision.
1.4
Virtual Carrier Sensing is based on physical Carrier Sensing, besides physical carrier sensing has his own responsibility that is detecting if the channel is busy and etc.
1.5
For the worst case, s has the highest slot number, and all the node has data to send, then it will wait until the others finish sending data.
1.6
Stations:2,3,5,7,11,13 want to send.
Slot1:2,3,5,7,11,13
Slot2:2,3,5,7
Slot3:2,3
Slot4:2
Slot5:3
Slot6:5,7
Slot7:5
Slot8:7
Slot9:11,13
Slot10:11
Slot11:13
So totally, we need 11 slots
2.
For the first time , it will cause collision, the second time each station pick randomly from either 0 or 1, so the collision possibility is ½, therefore for the k round the possibility would be$1/2^{i-1}$ (it choose integer from 1 to 2^{i-1}). so for the k-1 times fail and the round k is success, the possibility would be :

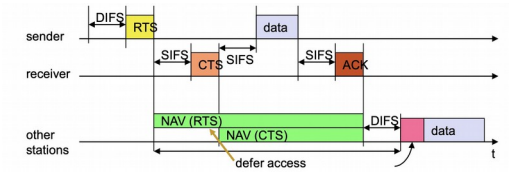
$$P_k = \left(\prod_{i=1}^{k-1} \frac{1}{2^{i-1}}\right) \times \left(1 - \frac{1}{2^{k-1}}\right) \quad \text{..... (1)}$$

According to the equation, we could get the Mean number of round k's contention period is $SUM_{1\text{-}K}(kp_k)$
3.1
According to the graph below:



We can see the Total time to transimit a data frame is composite with DIFS, DATA,SIFS,ACK, and from the piazza, I know there will be contensions, even though there is no rts and cts.

Therefore: transmit DATA with the Header
$T_{data}=(28+1248)*8/(54*10^6)*10^6=189.04$ μs
$T_{ack}=(14*8)/(54*10^6)*10^6=2.07$ μs
$T_{total}=T_{contention}+DIFS+T_{data}+SIFS+T_{ack}=36+34+189.04+16+2.07=277.11$ μs.
Then the Mac Layer throughput=1248*8/277.11=36.03Mbps.
3.2



When we use RTS and CTS, we have more SIFS to go, because RTS and CTS are also frames.
$T_{rts}=20*8/54=2.96$ μs.
$T_{cts}=14*8/54=2.07$ μs.
$T_{total}= T_{contention}+DIFS+T_{rts}+SIFS+T_{cts}+SIFS+T_{data}+SIFS+T_{ack}=314.14$ μs.
Throughput=1248*8/314.14=31.78 Mbps.

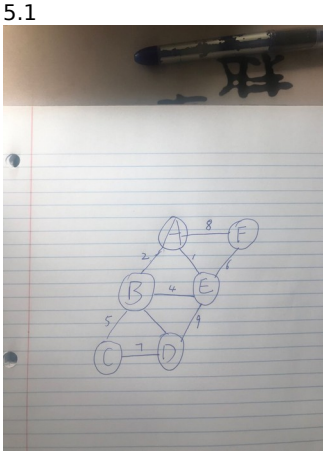
4.1

Dest	Next	Metric
A	A	0
B	B	2
C	D	4
D	D	1

4.2

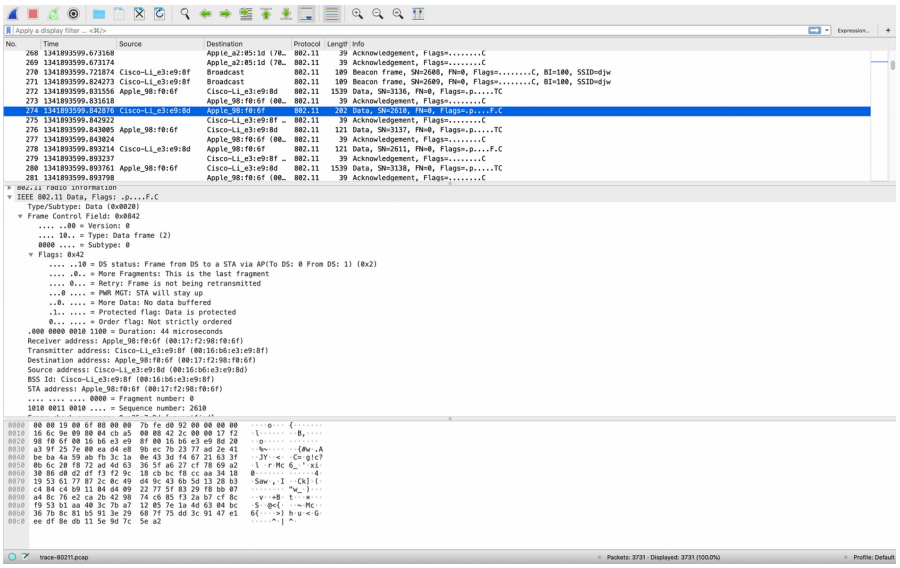
Dest	Next	Metric
A	A	0
B	B	2
C	B	3
D	D	1
E	C	5

5.1



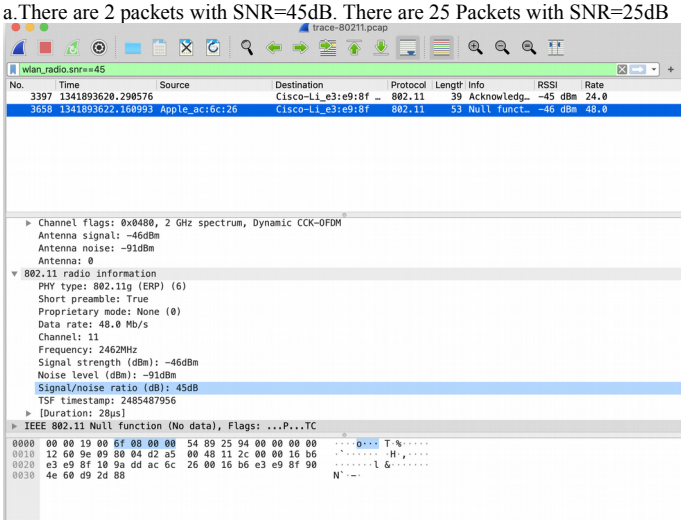
5.2
B->A->E
5.3
A->E->F

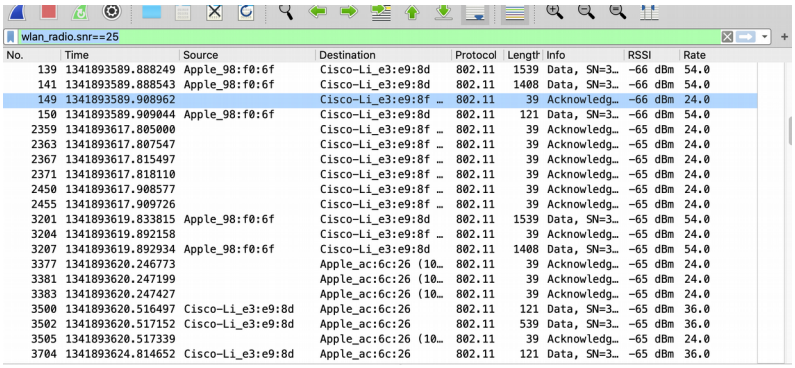
6.1
My last ID is 1, so I will look for n=274



6.2

a.There are 2 packets with SNR=45dB. There are 25 Packets with SNR=25dB



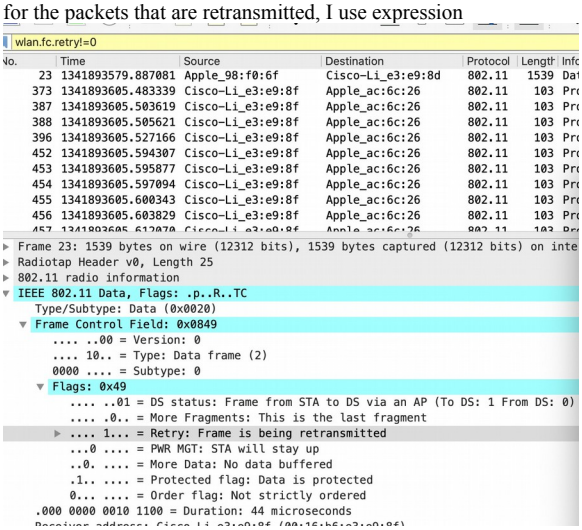


Statistics

Measurement	Captured	Displayed
Packets	3731	25 (0.7%)

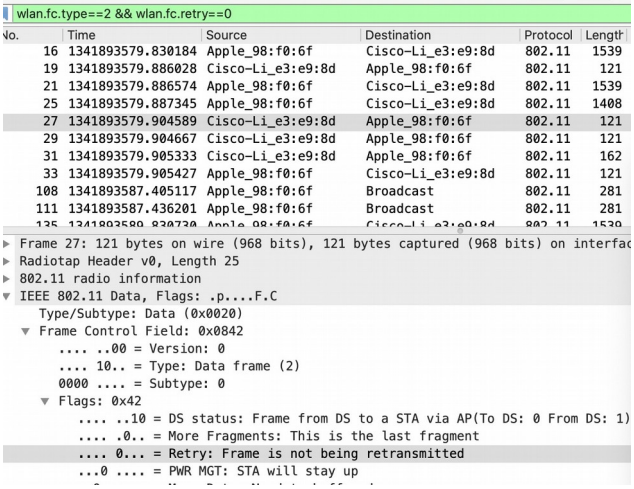
b.

for the packets that are retransmitted, I use expression



Measurement	Captured	Displayed
Packets	3731	363 (9.7%)

For the packets Original transmissions I use "wlan.fc.type==2 && wlan.fc.retry==0" and I got data:



Measurement	Captured	Displayed
Packets	3731	1430 (38.3%)

Therefore the transmit rate is 363/1430=25.38%

c.
there is no ACK frames that have a retry flag of 1.

Reference:

1. https://www.chegg.com/homework-help/questions-and-answers/answer-following-questions-csma-3-5-sentences-21-carrier-sense-multiple-access-cs-threshol-q24171301
2.https://www.wireshark.org/#learnWS
3. https://en.wikipedia.org/wiki/IEEE_802.11_RTS/CTS