Assignment 1 Jiayu Wang 1039580

Q1

file size = 10 * 30 * 1280 * 720 * 3 * 8 = 6.63552 * 10^9 bits

1) T-delay = (6.63552*10^9) / (56*10^3) ≈ 118491.43 s

P-delay = (10,000 * 10^3)/ (200,000 * 10^3) = 0.05 s

L = T-delay + P-delay = 11849.14 + 0.05 =118491.48 s

2) T-delay = (6.63552*10^9) / (100*10^6) = 66.3552 s

P-delay = (10,000 * 10^3)/ (200,000 * 10^3) = 0.05 s

L = T-delay + p-delay = 66.4052 s

Q2

1) Using Shannon's theorem: max.datarate = B * log(1+S/N), hence:

128*10^3 = 8*10^3 * $\log_2$ (1 + S/N), solving to get:

S/N = $2^{16} - 1$ = 65,535, so minimum signal-to-noise ratio is 10* $\log_{10}$S/N ≈ 48.165 dB

2) Using Nyquist's theorem: max.datarate = 2B * $\log_2$V, hence:

128*10^3 = 2*8*10^3 * $\log_2$V, solving to get:

Minimum signal levels V = 2^8

So we should send the data using signal levels ≥ 2^8

Q3

Using Hamming code: n ≤ 2^k - k – 1, when n = 48, solving to get: k_{min} = 6 hence the minimum number of check bits is 6.

We should put check bits in positions p that are power of 2, starting with position 1 (p1), so the positions are: P_1, P_2, P_4, P_8, P_{16}, P_{32}

Q4

The benefits of having layered structure in networks are:

1) modularity. It means developers can only focus on one or some layers instead of knowing the whole design of all layers.

2) flexibility. It means it can change protocols on one layer while operation on other layers will not be affected.

3) Such layered structure is also beneficial for standardization.

Q5

(1) The source IP depends on my computer, which is 192.168.1.100, my private IP address. (My public IP address is 203.221.148.60) The destination IP address is 167.179.104.53, for the 'milossr.xyz' web server.

We can use 'ipconfig' on command line to validate the source IP address.

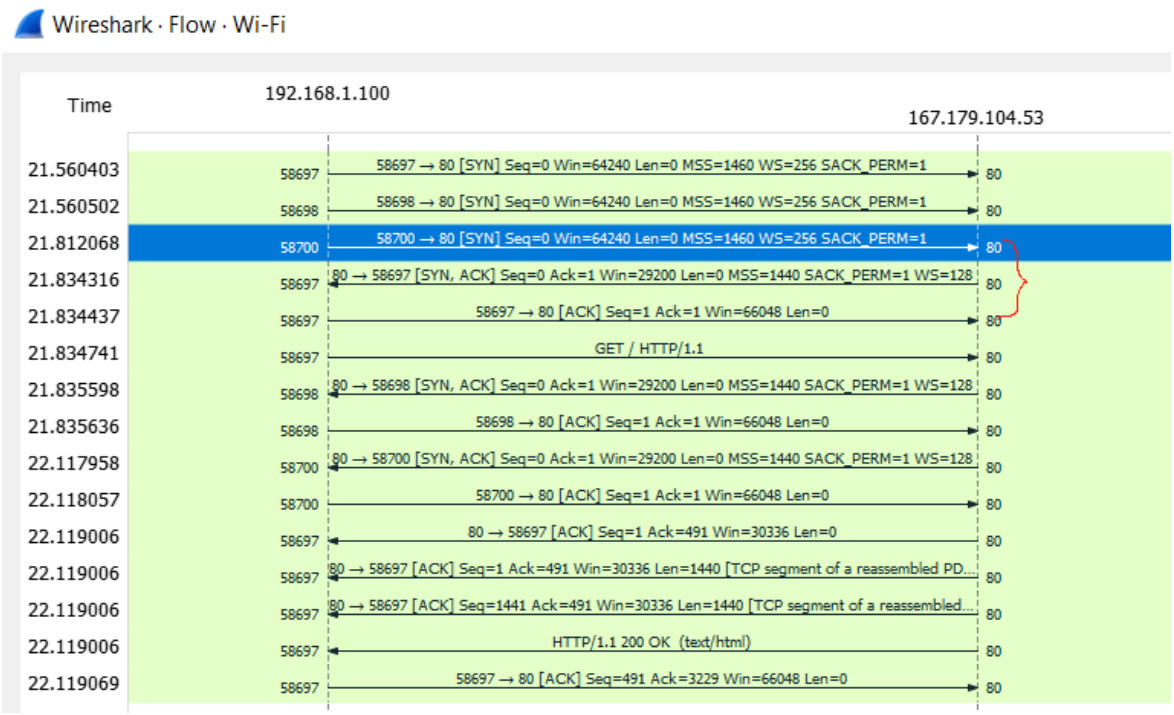
We can use 'wget' command (shown below) to validate the destination IP address by sending request to the server.

```
[jiayu@spartan-login2 ~]$ wget http://milossr.xyz
--2020-09-03 23:44:02--  http://milossr.xyz/
Resolving milossr.xyz (milossr.xyz)... 167.179.104.53
Connecting to milossr.xyz (milossr.xyz)|167.179.104.53|:80... connected.
HTTP request sent, awaiting response... 200 OK
Length: 8116 (7.9K) [text/html]
Saving to: 'index.html'

100%[==========================================================================================================>] 8,116       --.-K/s   in 0s

2020-09-03 23:44:03 (969 MB/s) - 'index.html' saved [8116/8116]
```

(2)



Here in this flow graph, the third, fourth and fifth lines demonstrate TCP 3-way handshake, hence:

The third line, which stands for the first handshake, shows the client executes CONNECT by sending SYN to the server.

The fourth line, which stands for the second handshake, shows the server executes ACCEPT by sending SYN and ACK back to the server.