CSED353: Chap. 2 Exercises (due Mar. 18)

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1 Problem #1

1.1 Solution for (a)

From the parameters given in the question, we can determine the parameters for internet access link as follows:

$$L = 2,000,000 \text{ bits/req} \quad R = 54,000,000 \text{ bps} \quad a = 20 \text{ req/s}$$

Then, the utilization for access link is

$$\rho = \frac{La}{R} = 0.741$$

So the access link delay can be calculated as

$$\frac{L}{R}\left(\frac{\rho}{1-\rho}\right) + \frac{L}{R} = 0.143 \text{ s}$$

For LAN, we can use $R = 10,000,000,000$ bps and obtain the LAN utilization of

$$\rho = \frac{La}{R} = 0.004$$

so the LAN delay can be calculated as

$$\frac{L}{R}\left(\frac{\rho}{1-\rho}\right) + \frac{L}{R} = 0.000201 \text{ s}$$

Since the internet delay is given as 3 seconds, we obtain the final result as

$$0.143 \text{ s} + 3 \text{ s} + 0.000201 \text{ s} = 3.143 \text{ s}$$

1.2 Solution for (b)

By taking cache into account, we can obtain utilization for access link as

$$\rho = 0.4 \times \frac{La}{R} = 0.296$$

Assuming that round trip from and to the local web cache is negligible in the case of cache miss, the delay from the origin servers can be obtained as

$$\frac{L}{R}\left(\frac{\rho}{1-\rho}\right) + \frac{L}{R} + 3 \text{ s} = 3.05 \text{ s}$$

The utilization of LAN is

$$\rho = 0.6 \times \frac{La}{R} = 0.0240$$

Then the delay for cache server can be obtained as

$$\frac{L}{R}\left(\frac{\rho}{1-\rho}\right) + \frac{L}{R} = 0.00205 \text{ s}$$

The final result is

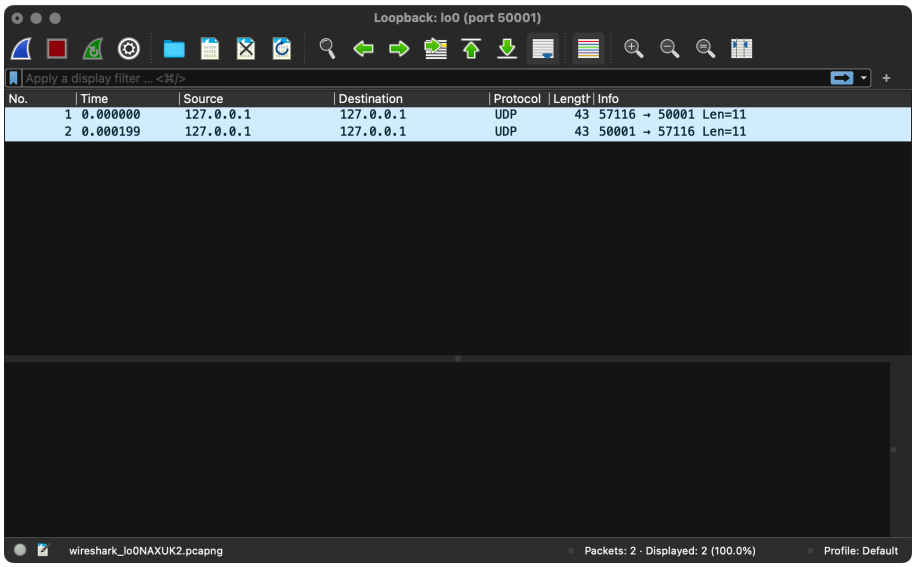
$$0.4 \times 3.05 \text{ s} + 0.6 \times 0.00205 \text{ s} = 1.22 \text{ s}$$

2 Problem #2

3 Problem #3

3.1 Solution for (a)

Two packets were captured:



3.2 Solution for (b)

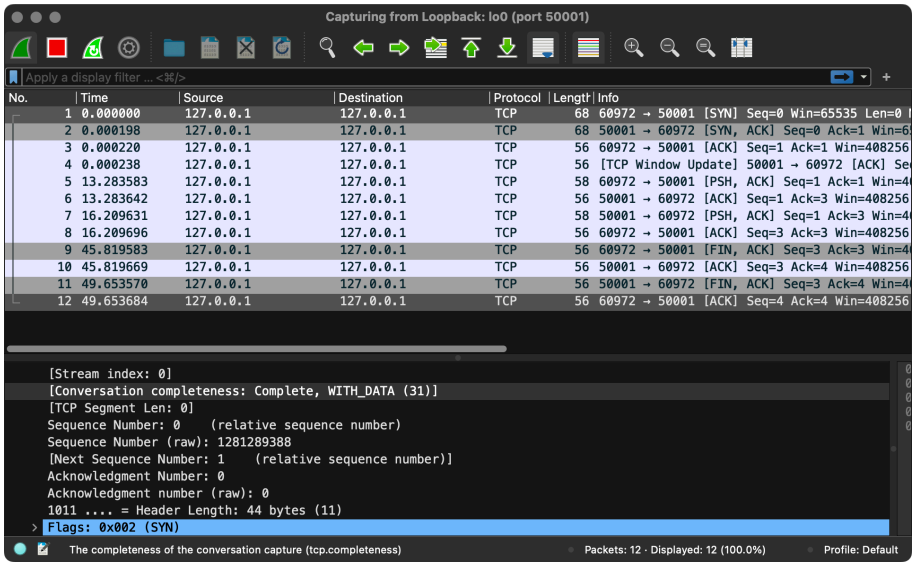
One packet(the first one) was sent from the client to the server, and the another one(the second one) was sent from the server to the client. The client used port 57116 to communicate with the server.

Packet No.	Src. IP	Src. Port	Dest. IP	Dest. Port	Data Length	Data	Text-converted Data
N/A							
bp1							
1	127.0.0.1	60783	127.0.0.1	50001	11	`68656c6c20776f726c6421`	`hell world!`
bp2							
2	127.0.0.1	50001	127.0.0.1	60783	11	`48454c4c20574f524c4421`	`HELL WORLD!`

4 Problem #4

4.1 Solution for (a)

12 packets were captured:



Compared to the UDP exercise, 10 more packets were captured.

4.2 Solution for (b)

Six packets were sent from the client to the server, and the other six were from the server to the client. The client used port 60972 to communicate with the server.

Packet No.	Source IP	Source Port	Dest. IP	Dest. Port	Flags	Data Length	Data	Text-converted Data
N/A								
bp1								
1	127.0.0.1	60792	127.0.0.1	50001	SYN			
2	127.0.0.1	50001	127.0.0.1	60792	SYN, ACK			
3	127.0.0.1	60792	127.0.0.1	50001	ACK			
4	127.0.0.1	50001	127.0.0.1	60792	ACK			
bp2								
5	127.0.0.1	60792	127.0.0.1	50001	PSH, ACK	2	6869	hi
6	127.0.0.1	50001	127.0.0.1	60792	ACK			
bp3								
7	127.0.0.1	50001	127.0.0.1	60792	PSH, ACK	2	4849	HI
8	127.0.0.1	60792	127.0.0.1	50001	ACK			
bp4								
9	127.0.0.1	60972	127.0.0.1	50001	FIN, ACK			
10	127.0.0.1	50001	127.0.0.1	60972	ACK			
bp5								
11	127.0.0.1	50001	127.0.0.1	60792	FIN, ACK			
12	127.0.0.1	60972	127.0.0.1	50001	ACK			