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

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Last compiled on: Monday 18th March, 2024, 11:07

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

2.1 Solution for (a)

The numbers of fields in question are as follows:

- Questions: 1
- Answer RRs: 0
- Authority RRs: 0
- Additional RRs: 0

Question section has information about the query being made. There is one question field in the captured packet, which is a question asking for the address of `cse.postech.ac.kr`. Answer RRs are answers for given question. RR is an acronym for "request record". Since this packet is a packet sent from the client to the server, there is no data for this section. Authority RRs contains records for other authoritative servers, and additional RRs has other helpful records. Like answer RRs, these fields typically contin answers from DNS servers, so there is no data for these sections as well.

2.2 Solution for (b)

	Name	Type	Address	Name server	Time to live
Answers	cse.postech.ac.kr	A	141.223.5.78		172800
Authoritative nameservers	N/A				
Additional records	N/A				

2.3 Solution for (c)

No authoritative servers were listed in the captured packet.

2.4 Solution for (d)

SOA record is a record which has administrative information about the zone.

2.5 Solution for (e)

The response packet contains this RR because we queried nonexistent domain. Since there is no address corresponding to the domain, the DNS system instead responds with information about the zone corresponding to `ac.kr`. In our situation, we deliberately picked such domain so the provided information in SOA record is of no use. However, if we are really wanting the address for this domain and there was none found, the information in the record might be useful for troubleshooting and debugging.

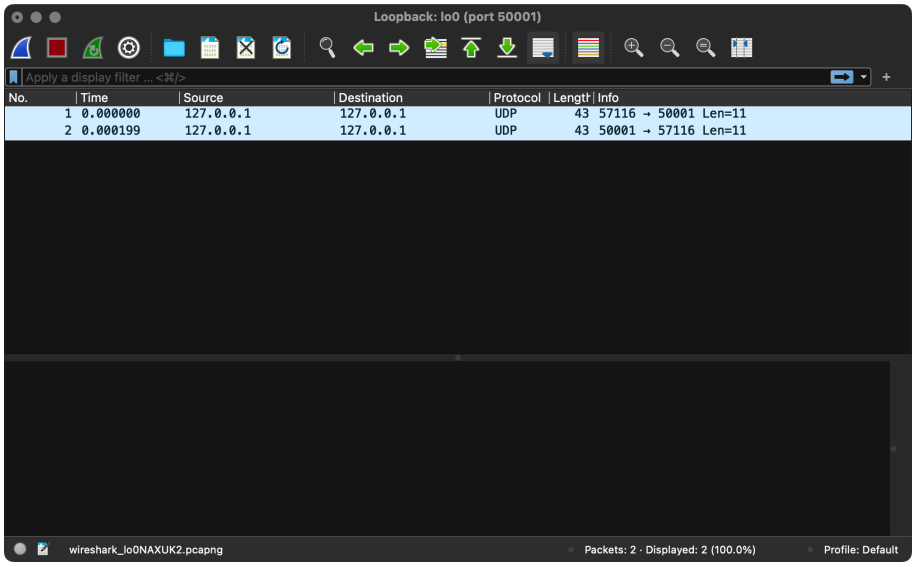
2.6 Solution for (f)

We can infer that the DNS queries of the two examples were recursive as the DNS server responded immediately with answer or authoritative nameservers.

3 Problem #3

3.1 Solution for (a)

Two packets were captured:



3.2 Solution for (b)

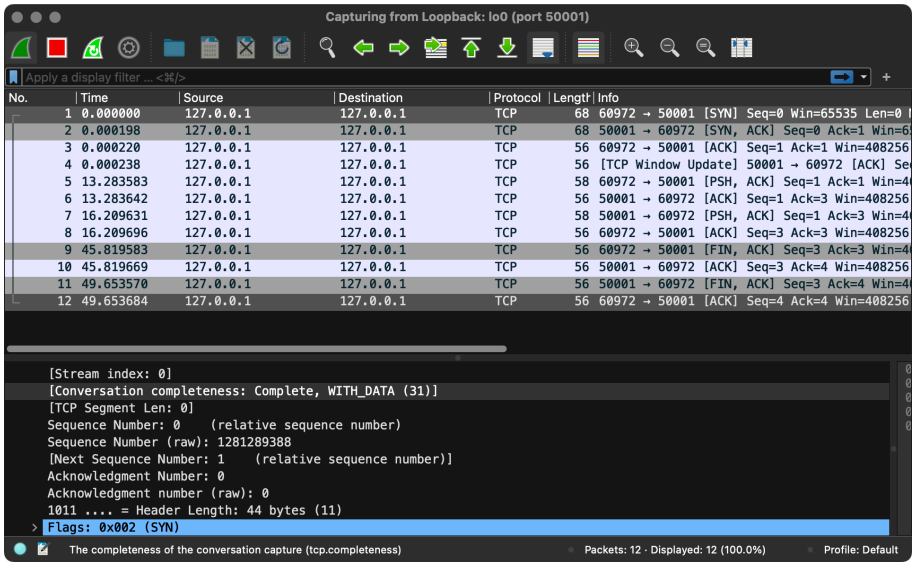
One packet(the first one) was sent from the client to the server, and the another one(the second one) was sent from the server to the client. The client used port 57116 to communicate with the server.

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	60972	127.0.0.1	50001	SYN			
2	127.0.0.1	50001	127.0.0.1	60972	SYN, ACK			
3	127.0.0.1	60972	127.0.0.1	50001	ACK			
4	127.0.0.1	50001	127.0.0.1	60972	ACK			
bp2								
5	127.0.0.1	60972	127.0.0.1	50001	PSH, ACK	2	6869	hi
6	127.0.0.1	50001	127.0.0.1	60972	ACK			
bp3								
7	127.0.0.1	50001	127.0.0.1	60972	PSH, ACK	2	4849	HI
8	127.0.0.1	60972	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	60972	FIN, ACK			
12	127.0.0.1	60972	127.0.0.1	50001	ACK			