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Roll No: 19P-0061

Section:5-B

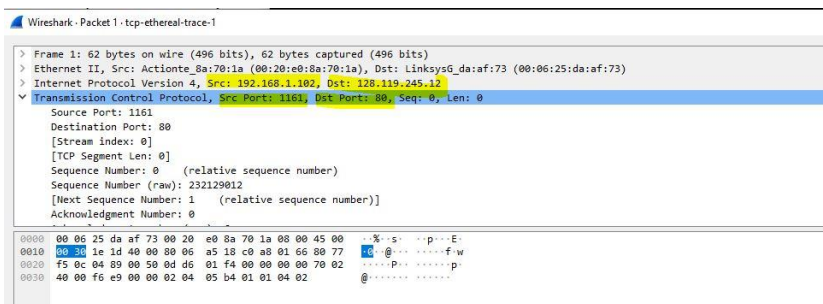# TCP Work

1.

Client IP: 192.168.1.102

Port: 1161

2.

Server IP: 128.119.245.12

Port: 80

Since by checking through nslookup command, I found out that the IP address of gaia.cs.umass.edu. So the destination IP address matched the IP of the website and the source IP is of client.
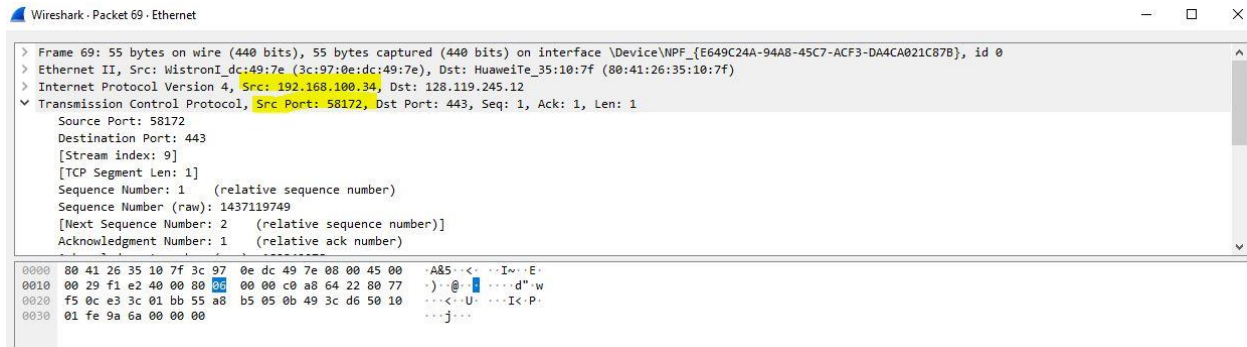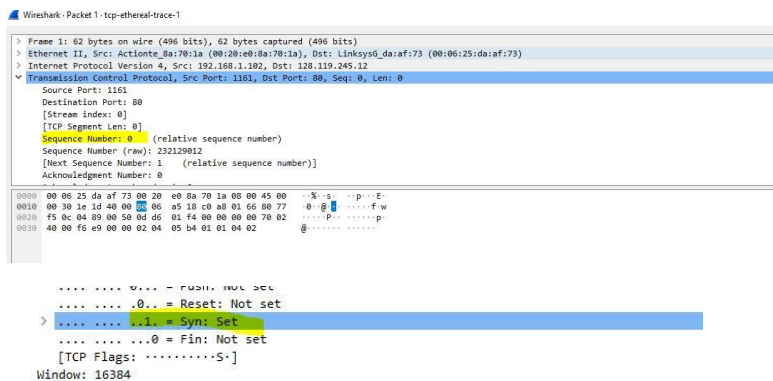
3.

My IP Address: 192.168.100.34

 My port no: 58172

Confirmed my IP from ipconfig

4.

Sequence Number of TCP SYN segment is set to 0 as it is initializing the TCP connection. SYN flag is in this segment which identifies it as SYN segment as it's value is set to 1.

5.

The sequence of the SYNACK segment sent by source (gaia.cs.umass.edu) is 0. The Acknowledgment number is 1. This is determined by adding 1 to the sequence number sent by the initial sequence number in the SYN segment sent by the client.

As the initial sequence number was 0 so 0+1 = 1.

The SYN and ACK flags are set to 1 making this segment as a SYNACK segment.

6.

Sequence number of packet containing POST command is 1.

7.

First 6 Segments

3 0.023265	192.168.1.102	128.119.245.12	TCP	54 1161 → 80	
4 0.026477	192.168.1.102	128.119.245.12	TCP	619 1161 → 80	
5 0.041737	192.168.1.102	128.119.245.12	TCP	1514 1161 → 80	
6 0.053937	128.119.245.12	192.168.1.102	TCP	60 80 → 1161	
7 0.054026	192.168.1.102	128.119.245.12	TCP	1514 1161 → 80	
8 0.054690	192.168.1.102	128.119.245.12	TCP	1514 1161 → 80	
9 0.077294	128.119.245.12	192.168.1.102	TCP	60 80 → 1161	
10 0.077405	192.168.1.102	128.119.245.12	TCP	1514 1161 → 80	
11 0.078157	192.168.1.102	128.119.245.12	TCP	1514 1161 → 80	
12 0.124085	128.119.245.12	192.168.1.102	TCP	60 80 → 1161	

The first 6 segments are 4,5,7,8,10 and 11

First 6 Acknowledgements

4 0.026477	192.168.1.102	128.119.245.12	TCP	619 1161 → 80	
5 0.041737	192.168.1.102	128.119.245.12	TCP	1514 1161 → 80	
6 0.053937	128.119.245.12	192.168.1.102	TCP	60 80 → 1161	—
7 0.054026	192.168.1.102	128.119.245.12	TCP	1514 1161 → 80	
8 0.054690	192.168.1.102	128.119.245.12	TCP	1514 1161 → 80	
9 0.077294	128.119.245.12	192.168.1.102	TCP	60 80 → 1161	—
10 0.077405	192.168.1.102	128.119.245.12	TCP	1514 1161 → 80	
11 0.078157	192.168.1.102	128.119.245.12	TCP	1514 1161 → 80	
12 0.124085	128.119.245.12	192.168.1.102	TCP	60 80 → 1161	—
13 0.124185	192.168.1.102	128.119.245.12	TCP	1201 1161 → 80	
14 0.169118	128.119.245.12	192.168.1.102	TCP	60 80 → 1161	—
15 0.217299	128.119.245.12	192.168.1.102	TCP	60 80 → 1161	—
16 0.267802	128.119.245.12	192.168.1.102	TCP	60 80 → 1161	—

The first 6 Acknowledgments are 6, 9, 12, 14, 15, 16

Sr no#	Sequence no	Sent Time	Ack time	RTT
1	1	0.026477	0.053937	0.027460
2	566	0. 041737	0.077294	0.035557
3	2026	0.054026	0.124085	0.070059
4	3486	0.054690	0.169118	0.114428
5	4946	0.077405	0.217299	0.139894
6	6406	0.078157	0.267802	0.189645

Estimated RTT

Formula:
   Estimated RTT = 0.875 * EstimatedRTT + 0.125 * SampleRTT

ESTIMATED RTT AFTER ACK OF SEGMENT 1:
ESTIMATED RTT = RTT FOR SEGMENT 1 = 0.027460
ESTIMATED RTT AFTER ACK OF SEGMENT 2:
ESTIMATED RTT = 0.875*0.027460 + 0.125*0.035557 = 0.028472125
ESTIMATED RTT AFTER ACK OF SEGMENT 3:
ESTIMATED RTT = 0.875*0.028472125 + 0.125*0.070059 = 0.03367048438
ESTIMATED RTT AFTER ACK OF SEGMENT 4:
ESTIMATED RTT = 0.875*0.03367048438 + 0.125*0.114428 = 0.04376517383
ESTIMATED RTT AFTER ACK OF SEGMENT 5:
ESTIMATED RTT = 0.875*0.04376517383 + 0.125*0.139894 = 0.0557812771
ESTIMATED RTT AFTER ACK OF SEGMENT 6:
ESTIMATED RTT = 0.875*0.0557812771 + 0.125*0.189645 = 0.07251424246

Round Trip Time for 192.168.1.102:1161 → 128.119.245.12:80

Round Trip Time for 192.168.1.102:1161 → 128.119.245.12:80

tcp-ethereal-trace-1
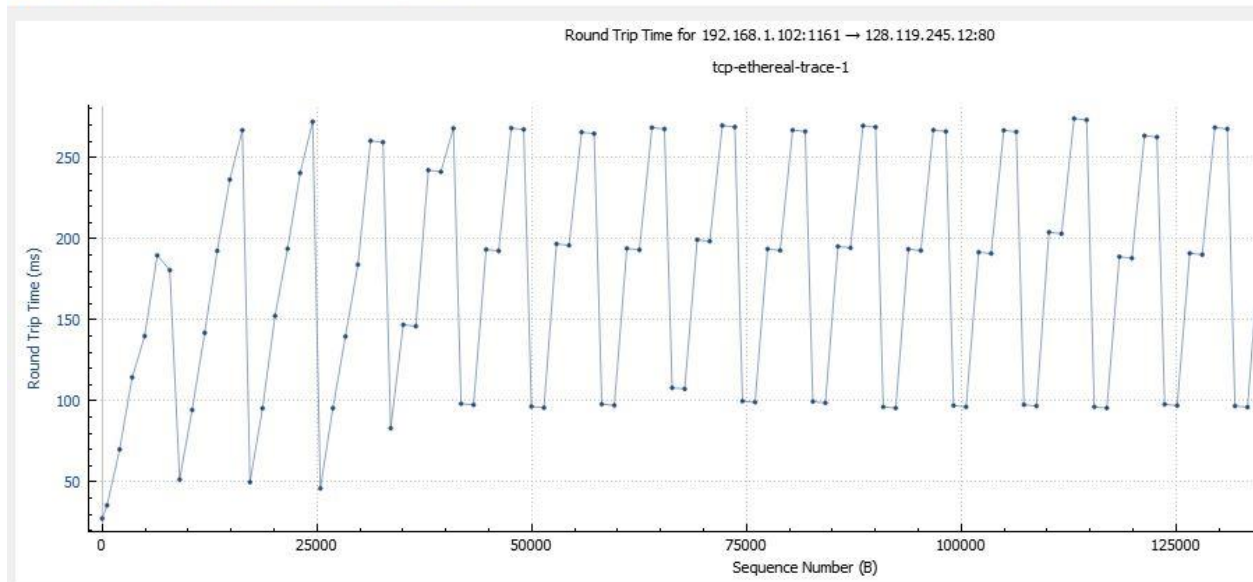
8.

Segment No.	Length
1	565
2	1460
3	1460
4	1460
5	1460
6	1460

```
4 0.026477      192.168.1.102        128.119.245.12        TCP      619 1161 → 80 [PSH, ACK] Seq=1 Ack=1 Win=17520 Len=565 [TCP segment of a reassembled PDU]
5 0.041737      192.168.1.102        128.119.245.12        TCP     1514 1161 → 80 [PSH, ACK] Seq=566 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
6 0.053937      128.119.245.12       192.168.1.102         TCP       60 80 → 1161 [ACK] Seq=1 Ack=566 Win=6780 Len=0
7 0.054026      192.168.1.102        128.119.245.12        TCP     1514 1161 → 80 [ACK] Seq=2026 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
8 0.054690      192.168.1.102        128.119.245.12        TCP     1514 1161 → 80 [ACK] Seq=3486 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
9 0.077294      128.119.245.12       192.168.1.102         TCP       60 80 → 1161 [ACK] Seq=1 Ack=2026 Win=8760 Len=0
10 0.077405     192.168.1.102        128.119.245.12        TCP     1514 1161 → 80 [ACK] Seq=4946 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
11 0.078157     192.168.1.102        128.119.245.12        TCP     1514 1161 → 80 [ACK] Seq=6406 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
```

9.

A. The minimum amount of available buffer space = 5840

This receiver window grows until it reaches the maximum receiver buffer size of 62780 bytes.

According to the trace, the sender is never throttled due to the lack of receiver buffer space.

```
2 0.023172      128.119.245.12          192.168.1.102          TCP        62 80 → 1161 [SYN, ACK] Seq=0 Ack=1 Win=5840 Len=0 MSS=1460
  > .... .... ..1. = Syn: Set
    .... .... ...0 = Fin: Not set
    [TCP Flags: ········A··S·]
  Window: 5840
  [Calculated window size: 5840]
  Checksum: 0x774d [unverified]
  [Checksum Status: Unverified]
```

10.

No retransmitted segments are observed. There are two ways to find retransmitted packets.

1. Packet tracer tells you if a packet is retransmitted.

2. By plotting a time-sequence graph.

If there is a point where the sequence number drops, then a packet has been retransmitted, but in the graph below, sequence numbers are continuously increasing.
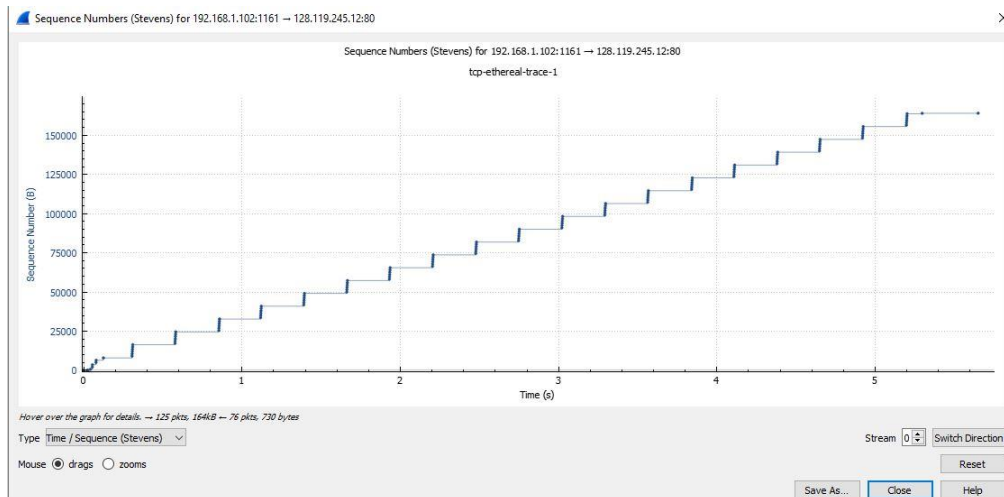
11.

Subtracting the acknowledgment numbers between 2 messages, we can know how much data has been received between the two ACK segments.

Example

(64005-61085) = 2920

| 87 2.029069 | 128.119.245.12 | 192.168.1.102 | TCP | 60 80 → 1161 [ACK] Seq=1 Ack=61085 Win=62780 Len=0 |
| 88 2.126682 | 128.119.245.12 | 192.168.1.102 | TCP | 60 80 → 1161 [ACK] Seq=1 Ack=64005 Win=62780 Len=0 |

12.

The size of the alice.txt file is 152,138 bytes. The time taken to download the file is the time for the first TCP segment - time for the last ACK segment. So, download time = 5.455830 - 0.026477 = 5.429353. The throughput is total bytes/total time taken = 152,138/5.429353 = 28021.3867 bytes/second.
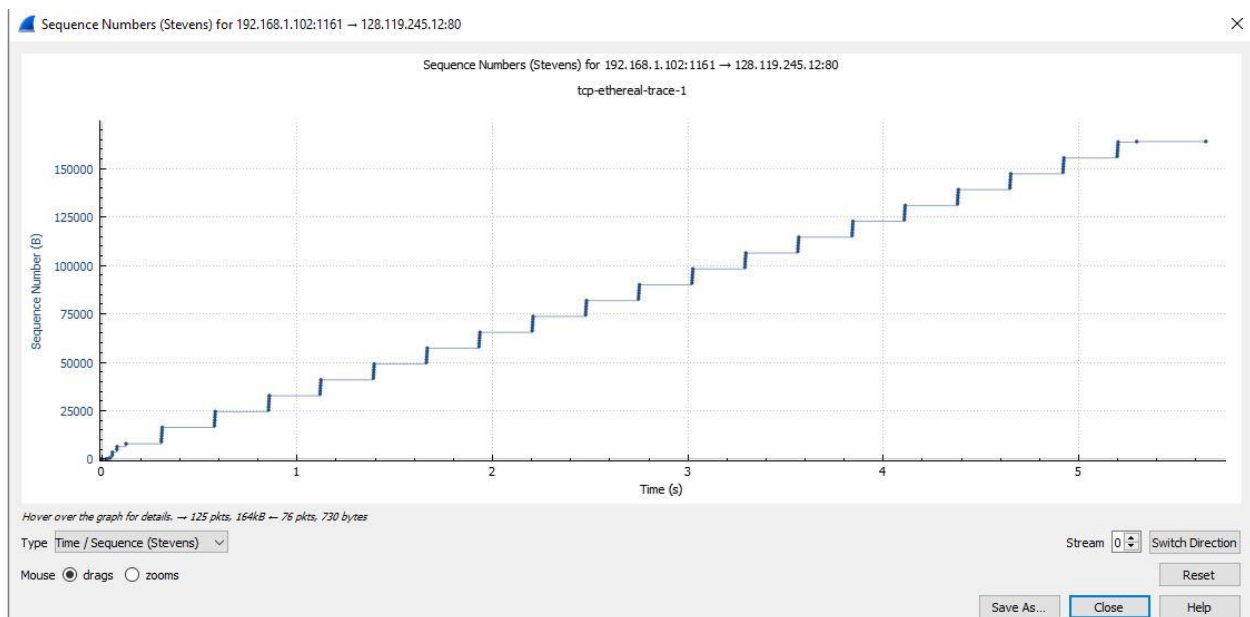
Size: 148 KB (152,138 bytes)

1st TCP Segment Time

| 4 0.026477 | 192.168.1.102 | 128.119.245.12 | TCP | 619 1161 → 80 [PSH, ACK] Seq=1 Ack=1 Win=17520 Len=565 [TCP segment of a reassembled PDU] |

Last ACK Time

| 202 5.455830 | 128.119.245.12 | 192.168.1.102 | TCP | 60 80 → 1161 [ACK] Seq=1 Ack=164091 Win=62780 Len=0 |

13.

we can see from this graph, the slow start phase starts from 0 seconds and lasts till about

0.17 seconds.

There is no congestion avoidance seen here since the size of the segments

remains the same throughout.

14.

Total Size of File: 152,136 bytes

Time For first segment: 1.60109

| 1332 13.160109 | 192.168.100.34 | 128.119.245.12 | TCP | 776 57513 → 80 [PSH, ACK] S |

Time for lask ACK= 14.053659

| 1532 14.053659 | 128.119.245.12 | 192.168.100.34 | TCP | 60 80 → 57513 [ACK] Seq=1 Ack=153046 Win=186240 Len=0 |

Time taken to upload= 14.053659-1.60109=12.452569

Throughput = 152,138/12.452569 = 12,217.39867492403 bytes/second.

Time Sequence Graph