CENG 435 - Data Communications and Networking
2023-1
Wireshark Assignment 3

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1. IP address of my (the client) computer: 144.122.97.2

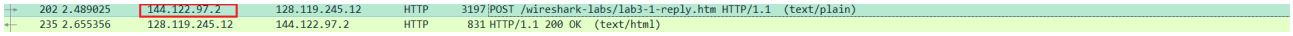


Figure 1: IP address of the client computer

2. The client-side port number of the client computer (source): 64535

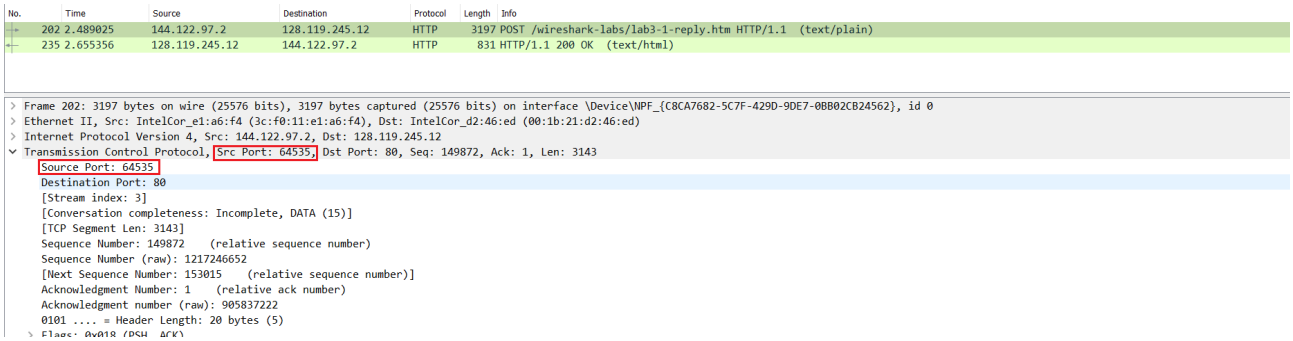


Figure 2: Port number of the client computer

3. IP address of gaia.cs.umass.edu: 128.119.245.12

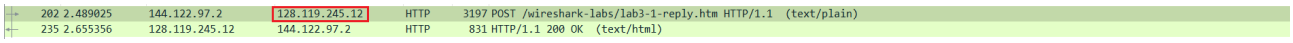


Figure 3: IP address of gaia.cs.umass.edu

4. Port number in which gaia.cs.umass.edu sending and receiving TCP segments for this TCP connection: 80

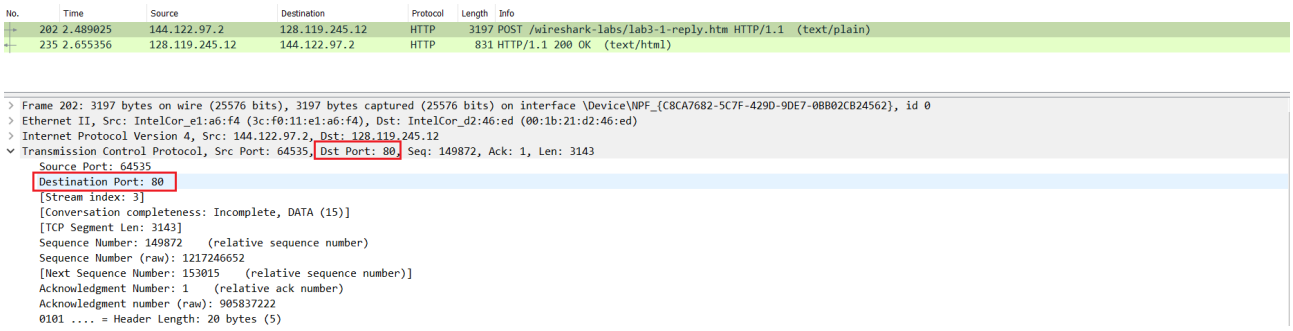


Figure 4: Port number of gaia.cs.umass.edu

5. Sequence number of the TCP SYN segment: 1217096780

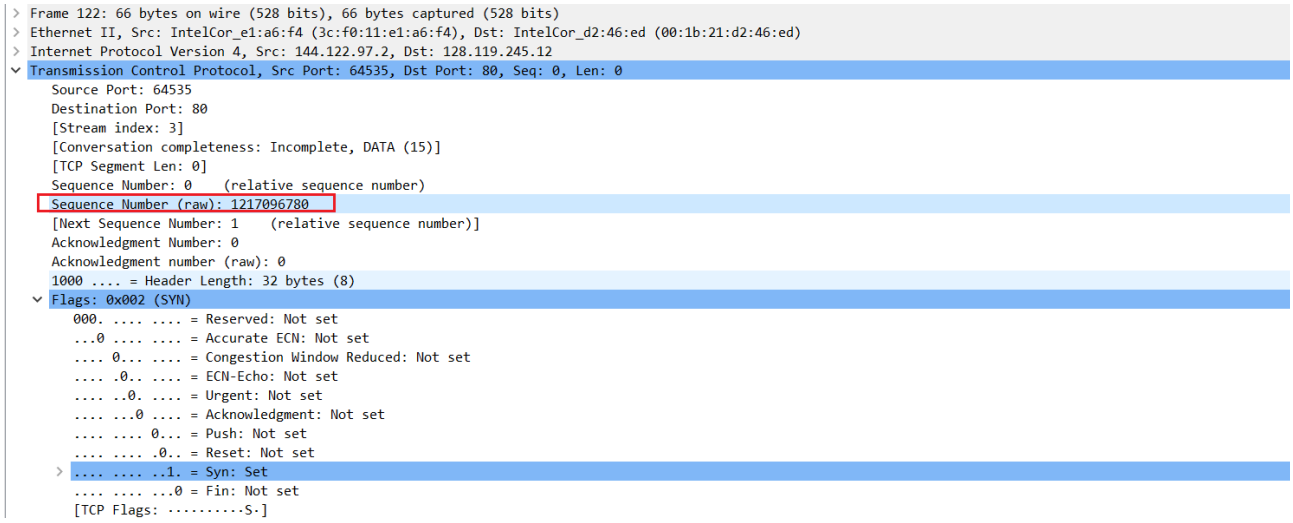


Figure 5: Sequence number of the TCP SYN segment

6.

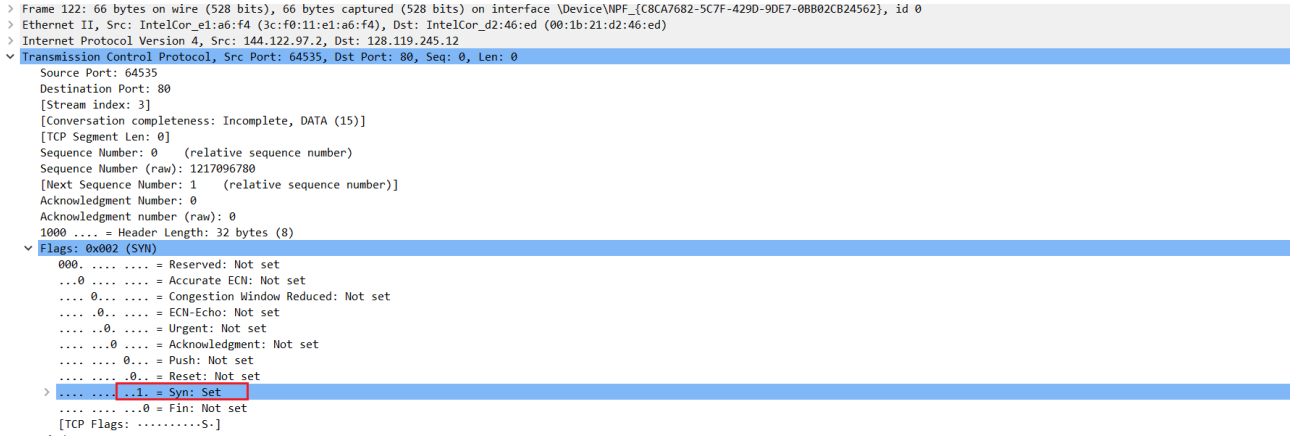


Figure 6: Identification of SYN segment

7.

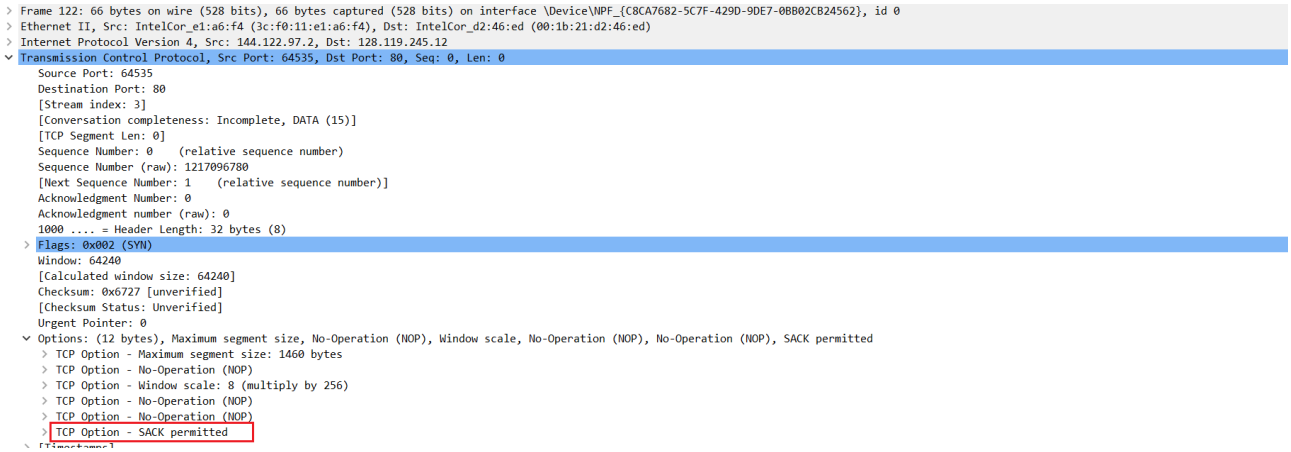


Figure 7: Selective Acknowledgment is permitted

8. Sequence number of the TCP SYNACK segment: 905837221

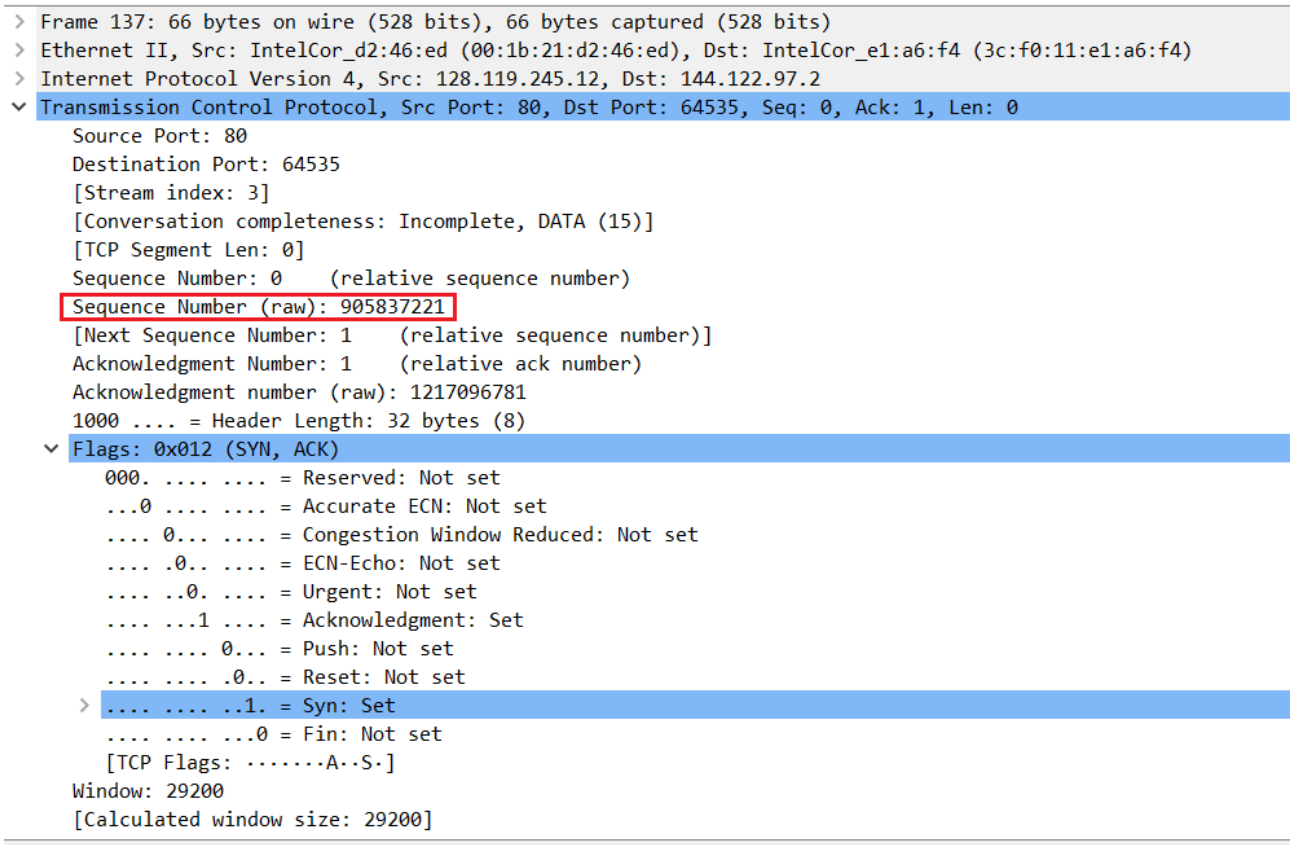


Figure 8: Sequence number of the TCP SYNACK segment

9.

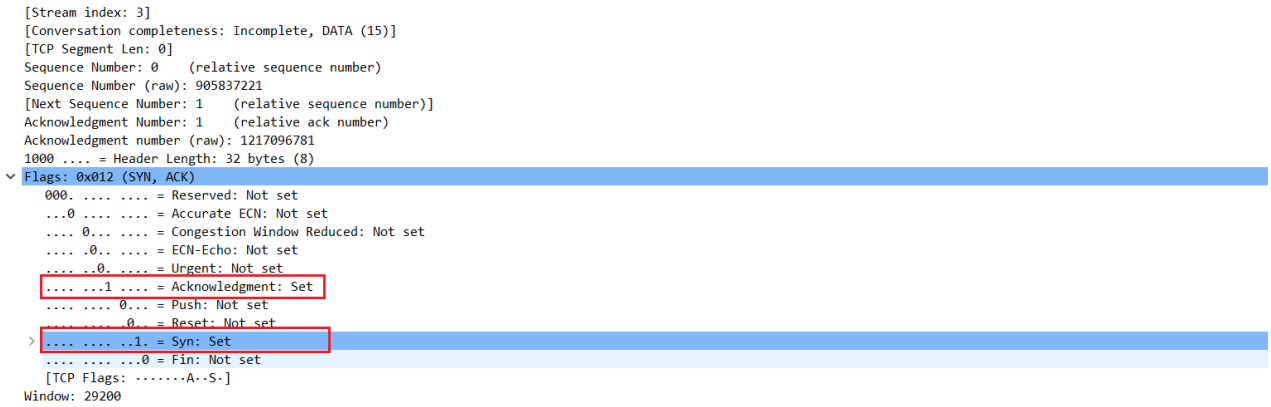


Figure 9: Identification of SYNACK segment

10. Value in the Acknowledgment field of the TCP SYNACK segment: 1217096781

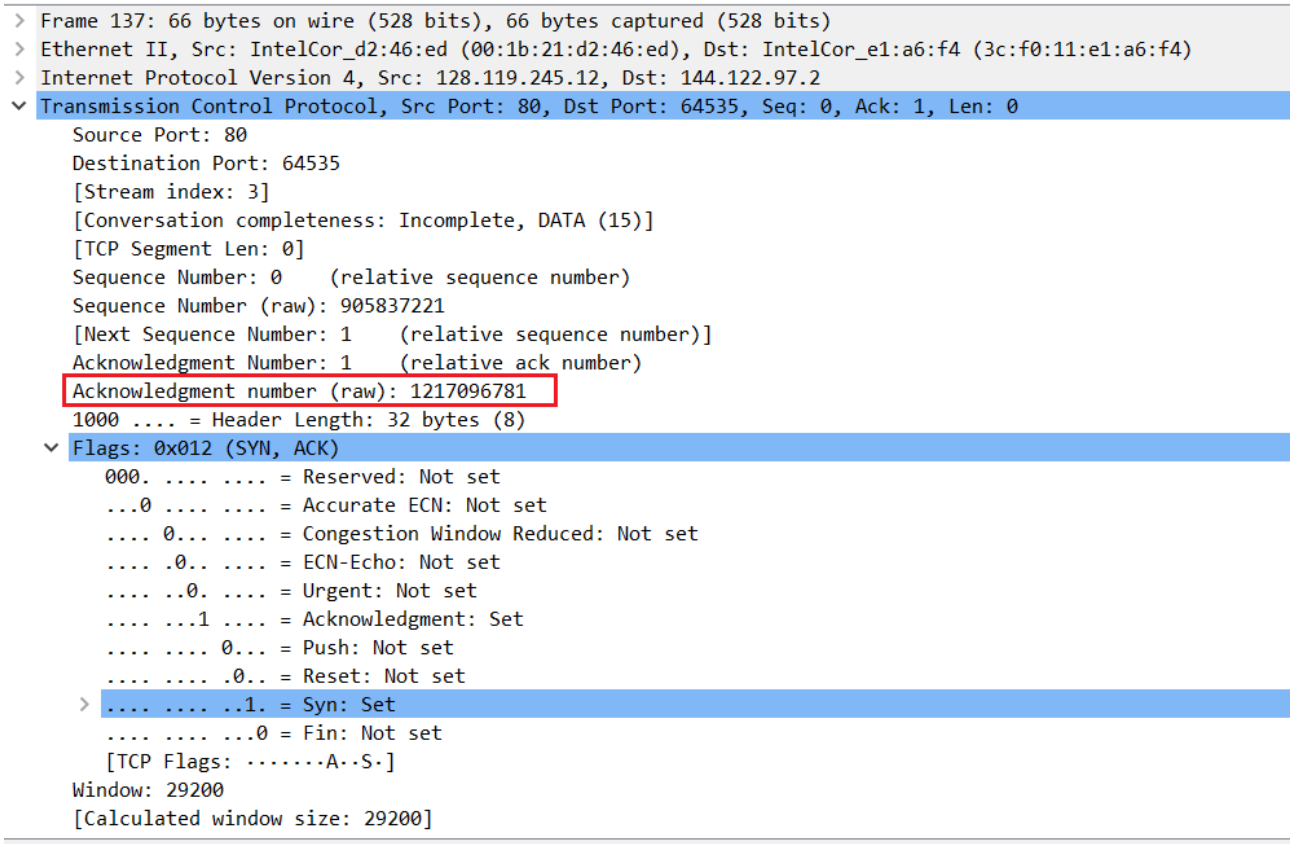


Figure 10: Acknowledgment field of the TCP SYNACK segment

11. The value of the ACK number field is the sequence number of the next expected byte of data to be received at the server on the client-to-server direction of this connection – one higher that the sequence number used as the sequence number in the initial SYN segment sent from client to server.

12. Sequence number of the TCP segment containing the HTTP POST command: 1217096781

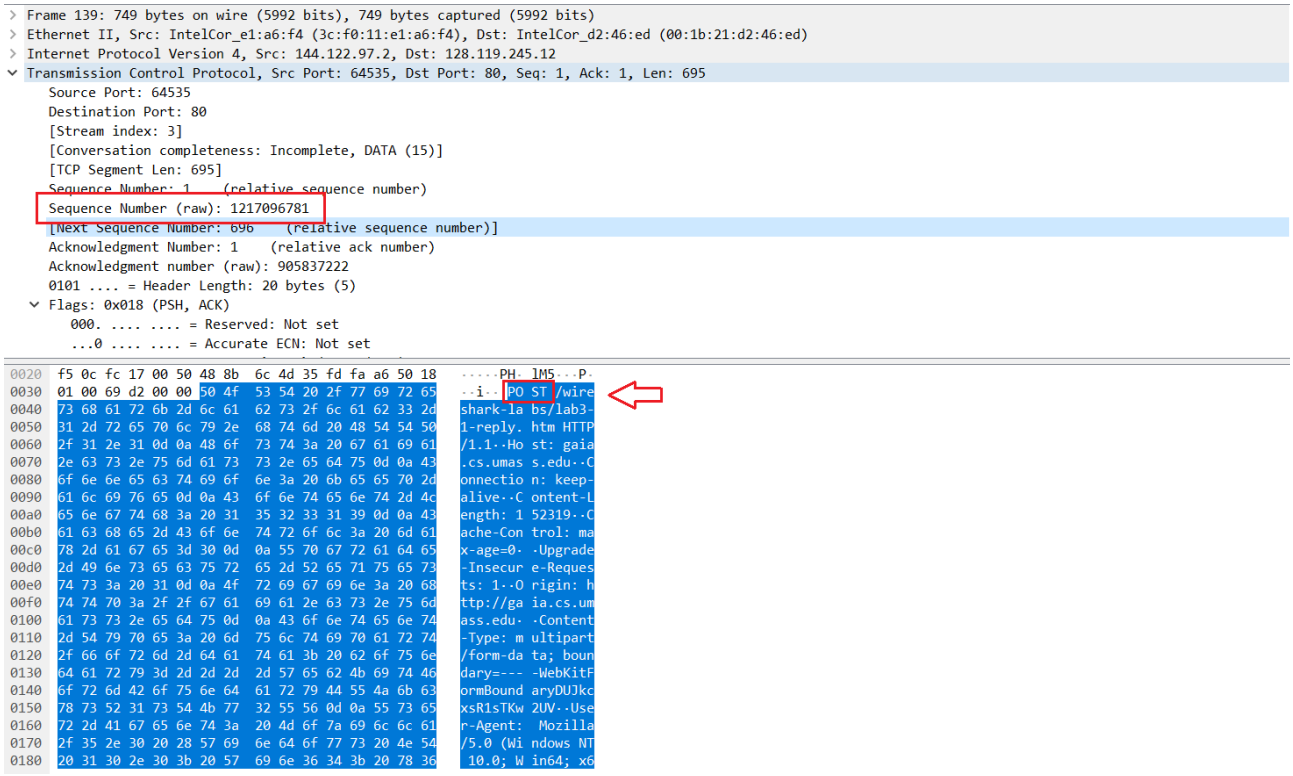


Figure 11: Sequence number of the TCP segment containing the HTTP POST command

13. Number of bytes of data are contained in the payload (data) field of this TCP segment: 695

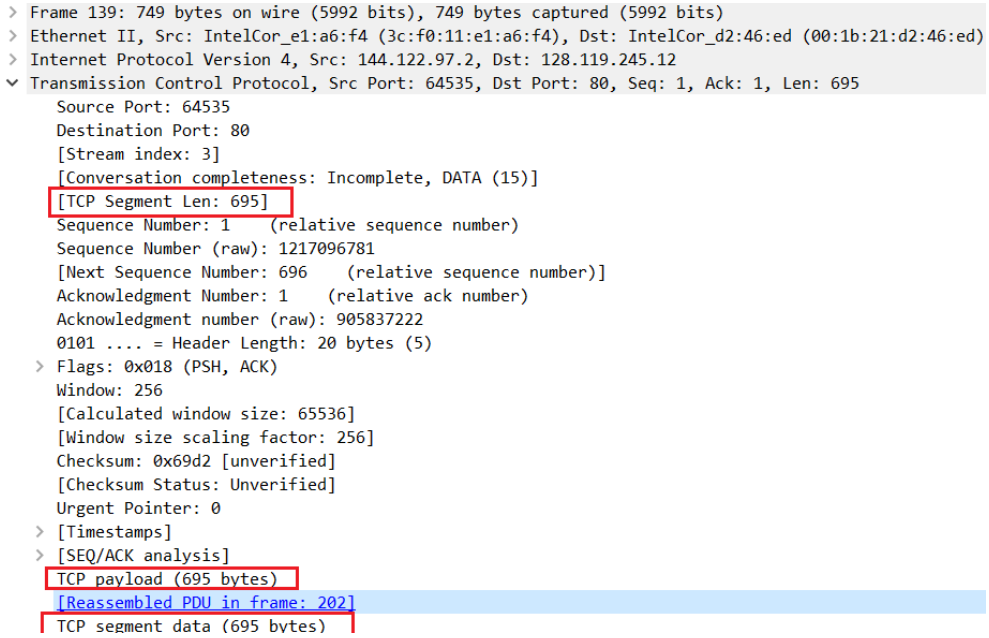


Figure 12: Number of bytes of data are contained in the payload (data)

14. Nope. Not even close. The alice.txt file is much larger, and so multiple TCP segments will be needed to transfer the file as part of the single application-level HTTP POST message. **I understand this from the fact that content of the file is spread across multiple segment. Here is a part of the content in another (the second segment sent to server) segment.**

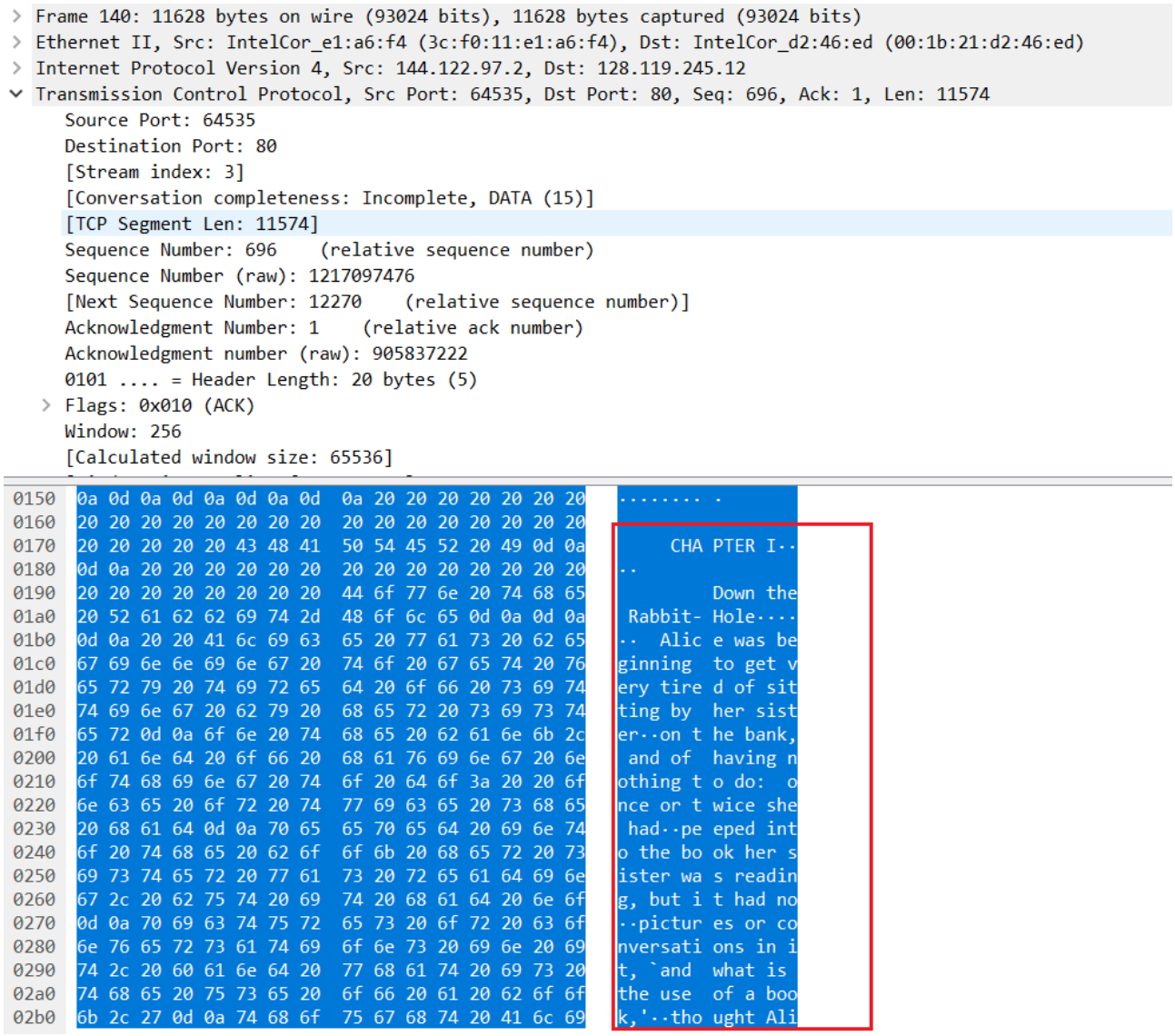


Figure 13: Part of the data in alice.txt in another segment

15. Time that the first segment (the one containing the HTTP POST) in the data-transfer part of the TCP connection sent: 2.021111

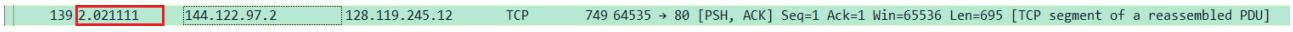


Figure 14: t_{sent}

16. Time that the ACK for this first data-containing segment received: 2.174320

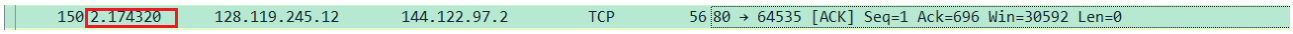


Figure 15: t_{ACK}

17. $t_{ACK} - t_{sent} = 2.174320 - 2.021111 = 0.153209$ s

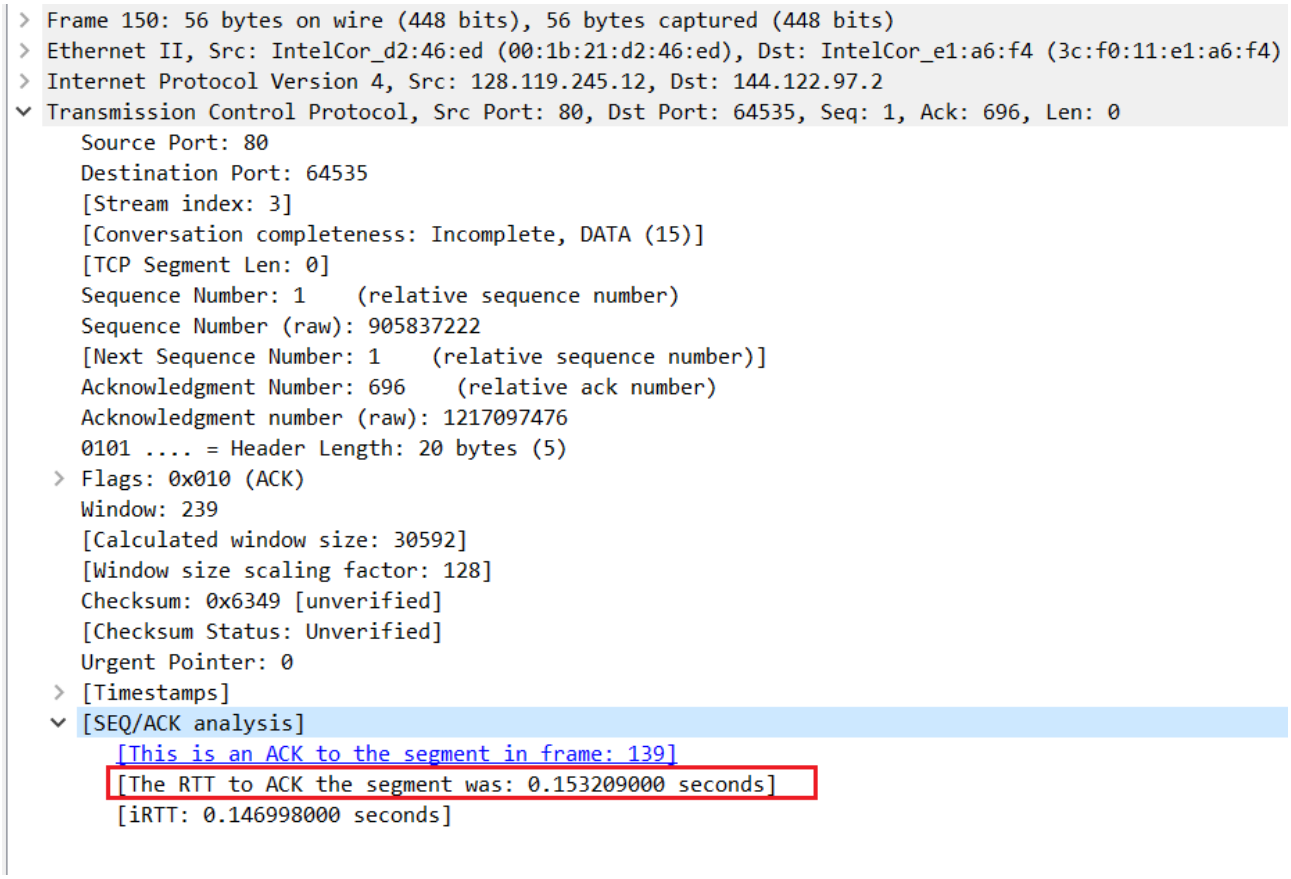


Figure 16: RTT for the first segment

18. $t_{ACK2} - t_{sent2} = 2.174320 - 2.021336 = 0.152984$ s

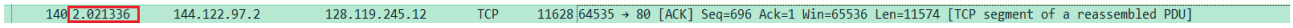


Figure 17: t_{sent2}

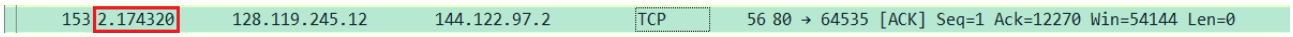


Figure 18: t_{ACK2}

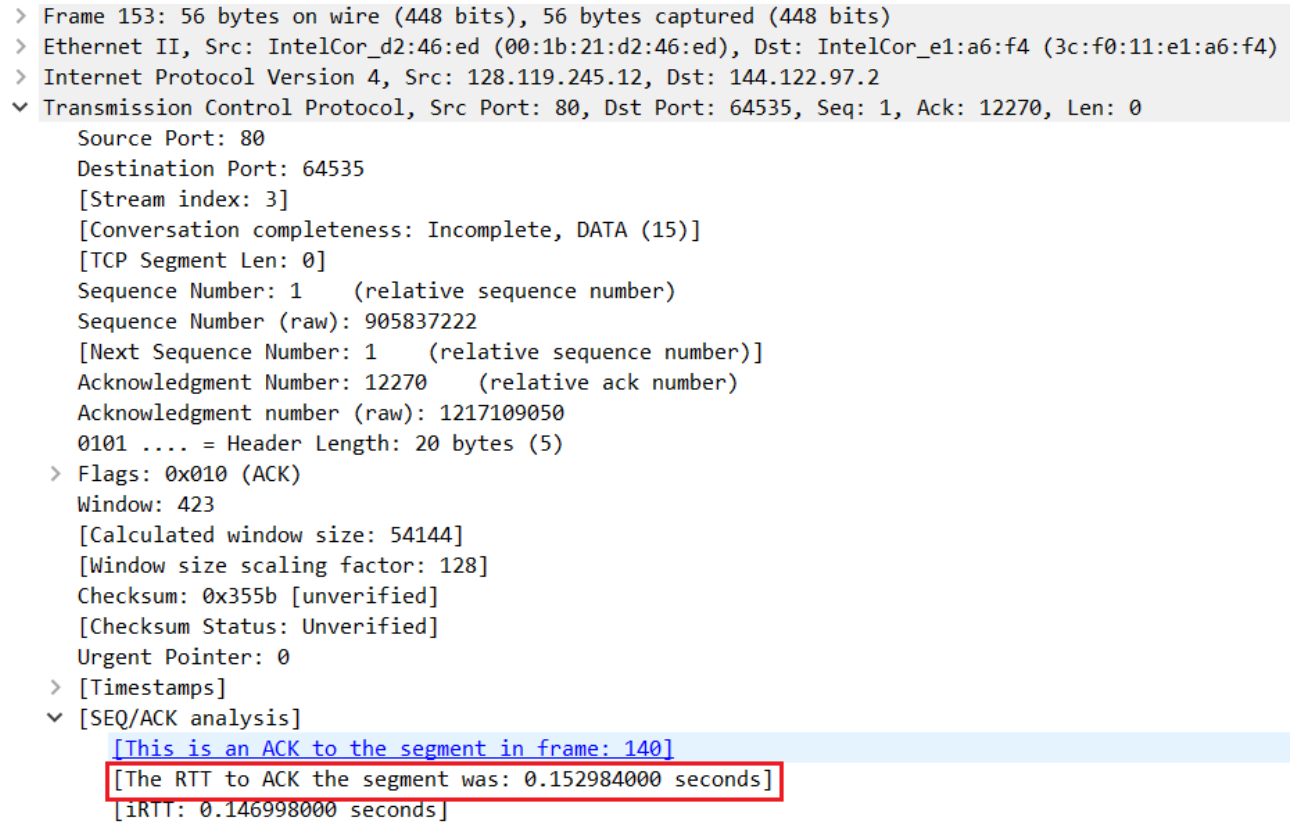


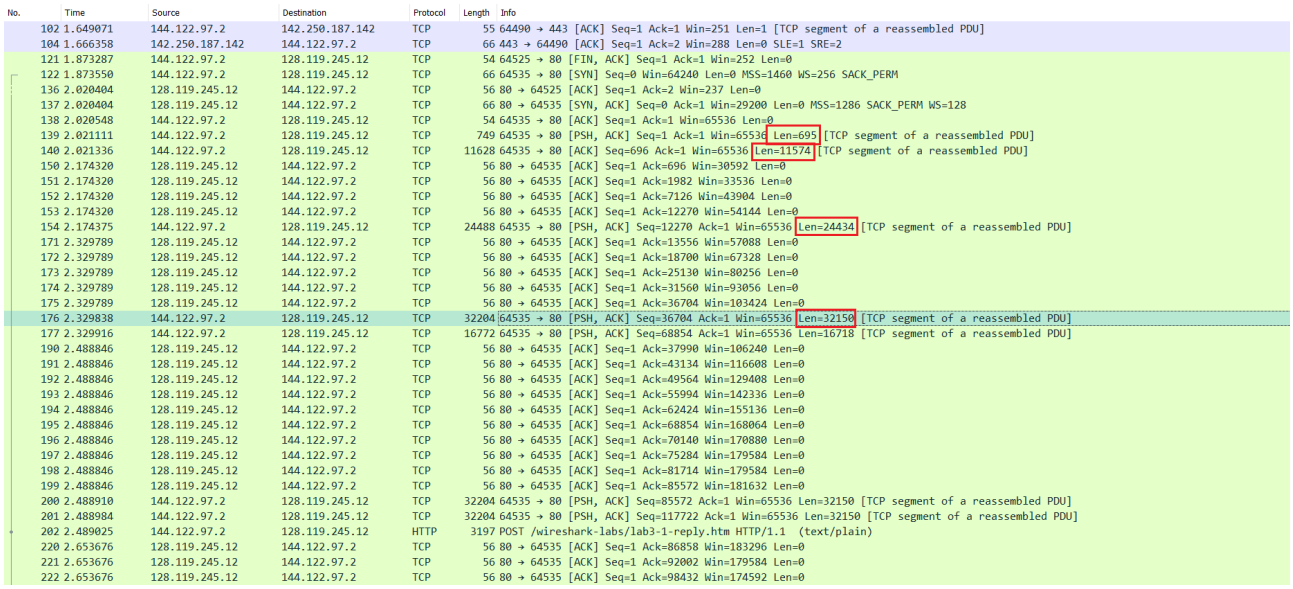
Figure 19: RTT for the second segment

19. Estimated RTT = (1 - 0.125) × Estimated RTT + 0.125 × Sample RTT

Estimated RTT after receiving ACK of the first segment
Estimated RTT = 0.153209

Estimated RTT after receiving ACK of the second segment
Estimated RTT = (1 - 0.125) × 0.153209 + 0.125 × 0.152984 = **0.153181** s

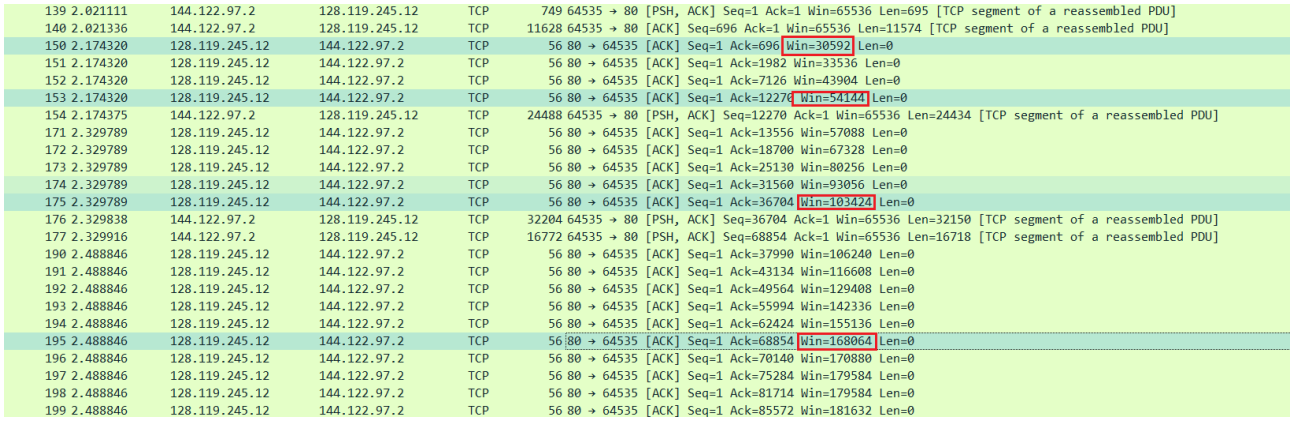
20.



No.	Time	Source	Destination	Protocol	Length	Info
102	1.649071	144.122.97.2	142.250.187.142	TCP	55	64490 → 443 [ACK] Seq=1 Ack=1 Win=251 Len=1 [TCP segment of a reassembled PDU]
104	1.666358	142.250.187.142	144.122.97.2	TCP	66	443 → 64490 [ACK] Seq=1 Ack=2 Win=288 Len=0 SLE=1 SRE=2
121	1.873287	144.122.97.2	128.119.245.12	TCP	54	64525 → 80 [FIN, ACK] Seq=1 Ack=1 Win=252 Len=0
122	1.873550	144.122.97.2	128.119.245.12	TCP	66	64535 → 80 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 WS=256 SACK_PERM
136	2.020404	128.119.245.12	144.122.97.2	TCP	56	80 → 64525 [ACK] Seq=1 Ack=2 Win=237 Len=0
137	2.020404	128.119.245.12	144.122.97.2	TCP	66	80 → 64535 [SYN, ACK] Seq=0 Ack=1 Win=29200 Len=0 MSS=1286 SACK_PERM WS=128
138	2.020548	144.122.97.2	128.119.245.12	TCP	54	64535 → 80 [ACK] Seq=1 Ack=1 Win=65536 Len=0
139	2.021111	144.122.97.2	128.119.245.12	TCP	749	64535 → 80 [PSH, ACK] Seq=1 Ack=1 Win=65536 Len=695 [TCP segment of a reassembled PDU]
140	2.021336	144.122.97.2	128.119.245.12	TCP	11628	64535 → 80 [ACK] Seq=696 Ack=1 Win=65536 Len=11574 [TCP segment of a reassembled PDU]
150	2.174320	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=696 Win=30592 Len=0
151	2.174320	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=1982 Win=33536 Len=0
152	2.174320	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=7126 Win=43904 Len=0
153	2.174320	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=12270 Win=54144 Len=0
154	2.174375	144.122.97.2	128.119.245.12	TCP	24488	64535 → 80 [PSH, ACK] Seq=12270 Ack=1 Win=65536 Len=24434 [TCP segment of a reassembled PDU]
171	2.329789	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=13556 Win=57088 Len=0
172	2.329789	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=18700 Win=67328 Len=0
173	2.329789	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=25130 Win=80256 Len=0
174	2.329789	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=31560 Win=93056 Len=0
175	2.329789	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=36704 Win=103424 Len=0
176	2.329838	144.122.97.2	128.119.245.12	TCP	32204	64535 → 80 [PSH, ACK] Seq=36704 Ack=1 Win=65536 Len=32150 [TCP segment of a reassembled PDU]
177	2.329916	144.122.97.2	128.119.245.12	TCP	16772	64535 → 80 [PSH, ACK] Seq=68854 Ack=1 Win=65536 Len=16718 [TCP segment of a reassembled PDU]
190	2.488846	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=37990 Win=106240 Len=0
191	2.488846	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=43134 Win=116608 Len=0
192	2.488846	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=49564 Win=129408 Len=0
193	2.488846	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=55994 Win=142336 Len=0
194	2.488846	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=62424 Win=155136 Len=0
195	2.488846	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=68854 Win=168064 Len=0
196	2.488846	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=70140 Win=170880 Len=0
197	2.488846	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=75284 Win=179584 Len=0
198	2.488846	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=81714 Win=179584 Len=0
199	2.488846	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=85572 Win=181632 Len=0
200	2.488910	144.122.97.2	128.119.245.12	TCP	32204	64535 → 80 [PSH, ACK] Seq=85572 Ack=1 Win=65536 Len=32150 [TCP segment of a reassembled PDU]
201	2.488984	144.122.97.2	128.119.245.12	TCP	32204	64535 → 80 [PSH, ACK] Seq=117722 Ack=1 Win=65536 Len=32150 [TCP segment of a reassembled PDU]
202	2.489025	144.122.97.2	128.119.245.12	HTTP	3197	POST /wireshark-labs/lab3-1-reply.htm HTTP/1.1 (text/plain)
220	2.653676	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=86858 Win=183296 Len=0
221	2.653676	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=92002 Win=179584 Len=0
222	2.653676	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=98432 Win=174592 Len=0

Figure 20: Length (header plus payload) of each of the first four data-carrying TCP segments

21.



139	2.021111	144.122.97.2	128.119.245.12	TCP	749	64535 → 80 [PSH, ACK] Seq=1 Ack=1 Win=65536 Len=695 [TCP segment of a reassembled PDU]
140	2.021336	144.122.97.2	128.119.245.12	TCP	11628	64535 → 80 [ACK] Seq=696 Ack=1 Win=65536 Len=11574 [TCP segment of a reassembled PDU]
150	2.174320	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=696 Win=30592 Len=0
151	2.174320	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=1982 Win=33536 Len=0
152	2.174320	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=7126 Win=43904 Len=0
153	2.174320	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=12270 Win=54144 Len=0
154	2.174375	144.122.97.2	128.119.245.12	TCP	24488	64535 → 80 [PSH, ACK] Seq=12270 Ack=1 Win=65536 Len=24434 [TCP segment of a reassembled PDU]
171	2.329789	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=13556 Win=57088 Len=0
172	2.329789	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=18700 Win=67328 Len=0
173	2.329789	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=25130 Win=80256 Len=0
174	2.329789	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=31560 Win=93056 Len=0
175	2.329789	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=36704 Win=103424 Len=0
176	2.329838	144.122.97.2	128.119.245.12	TCP	32204	64535 → 80 [PSH, ACK] Seq=36704 Ack=1 Win=65536 Len=32150 [TCP segment of a reassembled PDU]
177	2.329916	144.122.97.2	128.119.245.12	TCP	16772	64535 → 80 [PSH, ACK] Seq=68854 Ack=1 Win=65536 Len=16718 [TCP segment of a reassembled PDU]
190	2.488846	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=37990 Win=106240 Len=0
191	2.488846	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=43134 Win=116608 Len=0
192	2.488846	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=49564 Win=129408 Len=0
193	2.488846	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=55994 Win=142336 Len=0
194	2.488846	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=62424 Win=155136 Len=0
195	2.488846	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=68854 Win=168064 Len=0
196	2.488846	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=70140 Win=170880 Len=0
197	2.488846	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=75284 Win=179584 Len=0
198	2.488846	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=81714 Win=179584 Len=0
199	2.488846	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=85572 Win=181632 Len=0

Figure 21: Minimum amount of available buffer space advertised to the client

22.

No.	Time	Source	Destination	Protocol	Length	Info
121	1.873287	144.122.97.2	128.119.245.12	TCP	54	64525 → 80 [FIN, ACK] Seq=1 Ack=1 Win=252 Len=0
122	1.873550	144.122.97.2	128.119.245.12	TCP	66	64535 → 80 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 WS=256 SACK_PERM
136	2.020404	128.119.245.12	144.122.97.2	TCP	56	80 → 64525 [ACK] Seq=1 Ack=2 Win=237 Len=0
137	2.020404	128.119.245.12	144.122.97.2	TCP	66	80 → 64535 [SYN, ACK] Seq=0 Ack=1 Win=29200 Len=0 MSS=1286 SACK_PERM WS=128
138	2.020548	144.122.97.2	128.119.245.12	TCP	54	64535 → 80 [ACK] Seq=1 Ack=1 Win=65536 Len=0
139	2.021111	144.122.97.2	128.119.245.12	TCP	749	64535 → 80 [PSH, ACK] Seq=1 Ack=1 Win=65536 Len=695 [TCP segment of a reassembled PDU]
140	2.021336	144.122.97.2	128.119.245.12	TCP	11628	64535 → 80 [ACK] Seq=696 Ack=1 Win=65536 Len=11574 [TCP segment of a reassembled PDU]
150	2.174320	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=696 Win=30592 Len=0
151	2.174320	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=1982 Win=33536 Len=0
152	2.174320	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=7126 Win=43904 Len=0
153	2.174320	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=12270 Win=54144 Len=0
154	2.174375	144.122.97.2	128.119.245.12	TCP	24488	64535 → 80 [PSH, ACK] Seq=12270 Ack=1 Win=65536 Len=24434 [TCP segment of a reassembled PDU]
171	2.329789	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=13556 Win=57088 Len=0
172	2.329789	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=18700 Win=67328 Len=0
173	2.329789	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=25130 Win=80256 Len=0
174	2.329789	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=31560 Win=93056 Len=0
175	2.329789	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=36704 Win=103424 Len=0
176	2.329838	144.122.97.2	128.119.245.12	TCP	32204	64535 → 80 [PSH, ACK] Seq=36704 Ack=1 Win=65536 Len=32150 [TCP segment of a reassembled PDU]
177	2.329916	144.122.97.2	128.119.245.12	TCP	16772	64535 → 80 [PSH, ACK] Seq=68854 Ack=1 Win=65536 Len=16718 [TCP segment of a reassembled PDU]
190	2.488846	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=37990 Win=106240 Len=0
191	2.488846	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=43134 Win=116608 Len=0
192	2.488846	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=49564 Win=129408 Len=0
193	2.488846	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=55994 Win=142336 Len=0
194	2.488846	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=62424 Win=155136 Len=0
195	2.488846	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=68854 Win=168064 Len=0
196	2.488846	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=70140 Win=170880 Len=0
197	2.488846	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=75284 Win=179584 Len=0
198	2.488846	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=81714 Win=179584 Len=0
199	2.488846	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=85572 Win=181632 Len=0
200	2.488910	144.122.97.2	128.119.245.12	TCP	32204	64535 → 80 [PSH, ACK] Seq=85572 Ack=1 Win=65536 Len=32150 [TCP segment of a reassembled PDU]
201	2.488984	144.122.97.2	128.119.245.12	TCP	32204	64535 → 80 [PSH, ACK] Seq=117722 Ack=1 Win=65536 Len=32150 [TCP segment of a reassembled PDU]
202	2.489025	144.122.97.2	128.119.245.12	HTTP	3197	POST /wireshark-labs/lab3-1-reply.htm HTTP/1.1 (text/plain)
220	2.653676	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=86858 Win=183296 Len=0
221	2.653676	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=92002 Win=179584 Len=0
222	2.653676	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=98432 Win=174592 Len=0
223	2.653676	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=104862 Win=196096 Len=0
224	2.653676	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=111292 Win=209024 Len=0
225	2.653676	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=117722 Win=221824 Len=0

Figure 22: Throttle check

23. (together with 24)

24.

No.	Time	Source	Destination	Protocol	Length	Info
139	2.021111	144.122.97.2	128.119.245.12	TCP	749	64535 → 80 [PSH, ACK] Seq=1 Ack=1 Win=65536 Len=695 [TCP segment of a reassembled PDU]
140	2.021336	144.122.97.2	128.119.245.12	TCP	11628	64535 → 80 [ACK] Seq=696 Ack=1 Win=65536 Len=11574 [TCP segment of a reassembled PDU]
150	2.174320	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=696 Win=30592 Len=0
151	2.174320	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=1982 Win=33536 Len=0
152	2.174320	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=7126 Win=43904 Len=0
153	2.174320	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=12270 Win=54144 Len=0
154	2.174375	144.122.97.2	128.119.245.12	TCP	24488	64535 → 80 [PSH, ACK] Seq=12270 Ack=1 Win=65536 Len=24434 [TCP segment of a reassembled PDU]
171	2.329789	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=13556 Win=57088 Len=0
172	2.329789	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=18700 Win=67328 Len=0
173	2.329789	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=25130 Win=80256 Len=0
174	2.329789	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=31560 Win=93056 Len=0
175	2.329789	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=36704 Win=103424 Len=0
176	2.329838	144.122.97.2	128.119.245.12	TCP	32204	64535 → 80 [PSH, ACK] Seq=36704 Ack=1 Win=65536 Len=32150 [TCP segment of a reassembled PDU]
177	2.329916	144.122.97.2	128.119.245.12	TCP	16772	64535 → 80 [PSH, ACK] Seq=68854 Ack=1 Win=65536 Len=16718 [TCP segment of a reassembled PDU]
190	2.488846	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=37990 Win=106240 Len=0
191	2.488846	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=43134 Win=116608 Len=0
192	2.488846	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=49564 Win=129408 Len=0
193	2.488846	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=55994 Win=142336 Len=0
194	2.488846	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=62424 Win=155136 Len=0
195	2.488846	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=68854 Win=168064 Len=0
196	2.488846	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=70140 Win=170880 Len=0
197	2.488846	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=75284 Win=179584 Len=0
198	2.488846	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=81714 Win=179584 Len=0
199	2.488846	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=85572 Win=181632 Len=0
200	2.488910	144.122.97.2	128.119.245.12	TCP	32204	64535 → 80 [PSH, ACK] Seq=85572 Ack=1 Win=65536 Len=32150 [TCP segment of a reassembled PDU]
201	2.488984	144.122.97.2	128.119.245.12	TCP	32204	64535 → 80 [PSH, ACK] Seq=117722 Ack=1 Win=65536 Len=32150 [TCP segment of a reassembled PDU]
202	2.489025	144.122.97.2	128.119.245.12	HTTP	3197	POST /wireshark-labs/lab3-1-reply.htm HTTP/1.1 (text/plain)
220	2.653676	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=86858 Win=183296 Len=0

Figure 23: Retransmittion check

25. 1982 - 696 = 1286
    7126 - 1982 = 5144
    12270 - 7126 = 5144
    18700 - 13556 = 5144
    25130 - 18700 = 6430
    .
    .
    .
    As you can see they are different. But they are multiple of 1286.

No.	Time	Source	Destination	Protocol	Length	Info
78	1.269786	195.175.180.171	144.122.97.2	TCP	56	443 → 64461 [ACK] Seq=1 Ack=9572 Win=4306 Len=0
84	1.356000	195.175.180.171	144.122.97.2	TLSv1.2	400	Application Data
85	1.356000	195.175.180.171	144.122.97.2	TLSv1.2	92	Application Data
86	1.356118	144.122.97.2	195.175.180.171	TCP	54	64461 → 443 [ACK] Seq=9572 Ack=385 Win=1020 Len=0
102	1.649071	144.122.97.2	142.250.187.142	TCP	55	64490 → 443 [ACK] Seq=1 Ack=1 Win=251 Len=1 [TCP segment of a reassembled PDU]
104	1.666358	142.250.187.142	144.122.97.2	TCP	66	443 → 64490 [ACK] Seq=1 Ack=2 Win=288 Len=0 SLE=1 SRE=2
121	1.873287	144.122.97.2	128.119.245.12	TCP	54	64525 → 80 [FIN, ACK] Seq=1 Ack=1 Win=252 Len=0
122	1.873550	144.122.97.2	128.119.245.12	TCP	66	64535 → 80 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 WS=256 SACK_PERM
136	2.020404	128.119.245.12	144.122.97.2	TCP	56	80 → 64525 [ACK] Seq=1 Ack=2 Win=237 Len=0
137	2.020404	128.119.245.12	144.122.97.2	TCP	66	80 → 64535 [SYN, ACK] Seq=0 Ack=1 Win=29200 Len=0 MSS=1286 SACK_PERM WS=128
138	2.020548	144.122.97.2	128.119.245.12	TCP	54	64535 → 80 [ACK] Seq=1 Ack=1 Win=65536 Len=0
139	2.021111	144.122.97.2	128.119.245.12	TCP	749	64535 → 80 [PSH, ACK] Seq=1 Ack=1 Win=65536 Len=695 [TCP segment of a reassembled PDU]
140	2.021336	144.122.97.2	128.119.245.12	TCP	11628	64535 → 80 [ACK] Seq=696 Ack=1 Win=65536 Len=11574 [TCP segment of a reassembled PDU]
150	2.174320	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=696 Win=30592 Len=0
151	2.174320	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=1982 Win=33536 Len=0
152	2.174320	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=7126 Win=43904 Len=0
153	2.174320	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=12270 Win=54144 Len=0
154	2.174375	144.122.97.2	128.119.245.12	TCP	24488	64535 → 80 [PSH, ACK] Seq=12270 Ack=1 Win=65536 Len=24434 [TCP segment of a reassembled PDU]
171	2.329789	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=13556 Win=57088 Len=0
172	2.329789	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=18700 Win=67328 Len=0
173	2.329789	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=25130 Win=80256 Len=0
174	2.329789	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=31560 Win=93056 Len=0
175	2.329789	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=36704 Win=103424 Len=0
176	2.329838	144.122.97.2	128.119.245.12	TCP	32204	64535 → 80 [PSH, ACK] Seq=36704 Ack=1 Win=65536 Len=32150 [TCP segment of a reassembled PDU]
177	2.329916	144.122.97.2	128.119.245.12	TCP	16772	64535 → 80 [PSH, ACK] Seq=68854 Ack=1 Win=65536 Len=16718 [TCP segment of a reassembled PDU]
190	2.488846	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=37990 Win=106240 Len=0
191	2.488846	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=43134 Win=116608 Len=0
192	2.488846	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=49564 Win=129408 Len=0
193	2.488846	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=55994 Win=142336 Len=0
194	2.488846	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=62424 Win=155136 Len=0
195	2.488846	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=68854 Win=168064 Len=0
196	2.488846	128.119.245.12	144.122.97.2	TCP	56	80 → 64535 [ACK] Seq=1 Ack=70140 Win=170880 Len=0

26. (together with 25)

27. (together with 28)

28.

I calculated throughput (bytes transferred per unit time) for the TCP connection as follows:

Total number of bytes transferred = 152319 bytes
Elapsed time = 2.701119 - 1.873287 = 0.827832 s
Throughput ≈ 184000 bit per second = 0.184 Mbps
So, I said Around 1.2 Mbps.

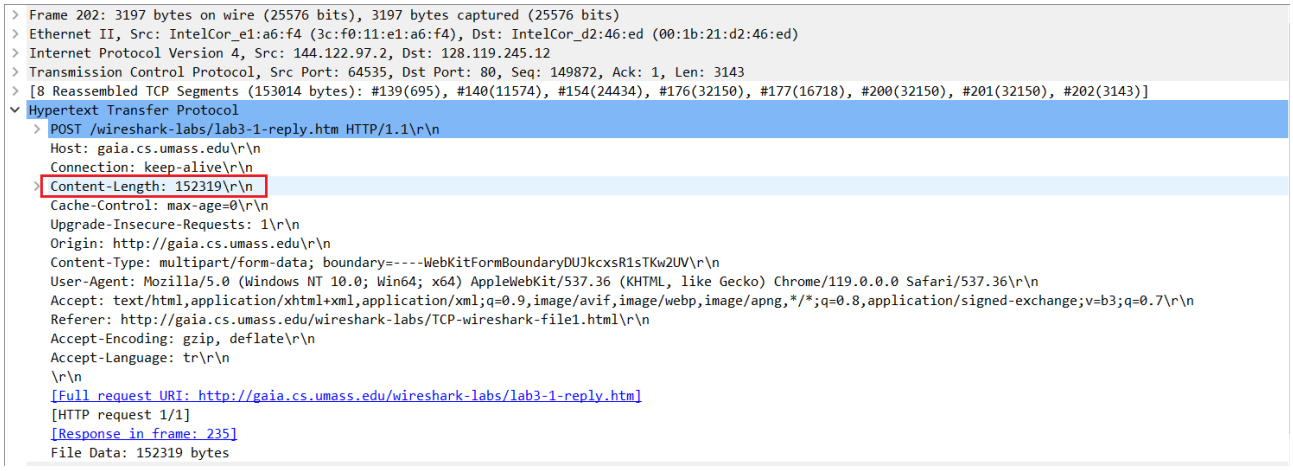


Figure 24: Total number of bytes transferred

Figure 25: t_{start}

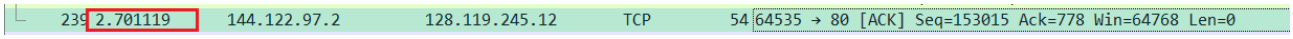


Figure 26: t_{last}

29. (merged with 30)

30.

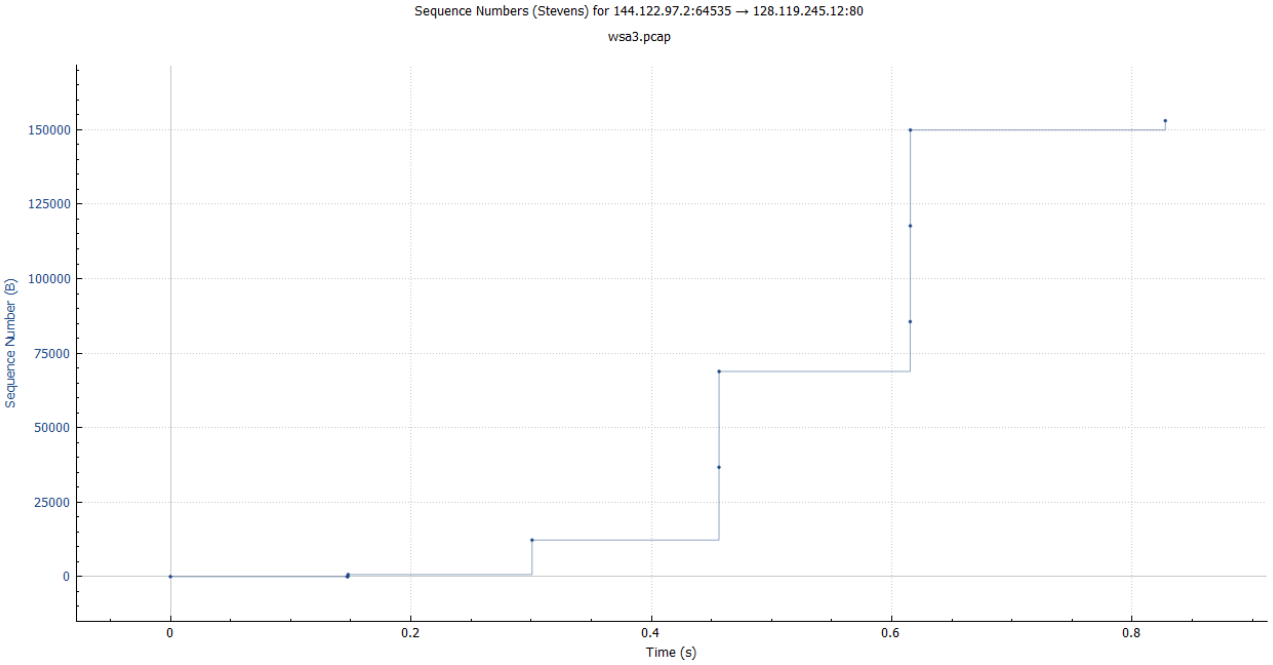


Figure 27: Time-Sequence-Graph (Stevens)

TCP is in its slow start phase as shown in the graph. Observe that eacp step takes approximately 0.15 seconds in the graph. Therefore, the period is nearly equal to the Round Trip Time which I calculated in the previous questions. So it is approximately equal to 0.153 seconds.