

HACETTEPE UNIVERSITY
COMPUTER ENGINEERING DEPARTMENT
COMPUTER NETWORKS LABORATORY



EXPERIMENT 5

TCP

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GROUP NUMBER : 12

IP address of our computer: 192.168.1.55

1. IP address of our source computer is 192.168.1.55 and TCP source port number is 53845

246	3.118385	192.168.1.55	128.119.245.12	TCP	1506 [TCP Retransmission] 53845 → 80 [ACK] Seq=9466 Ack=1 Win=131328 Len=1452
> Frame 246: 1506 bytes on wire (12048 bits), 1506 bytes captured (12048 bits) on interface \Device\NPF_{2F86FA23-1860-4715-956B-3A40FB10F6C4}, id 0					
> Ethernet II, Src: IntelCor_83:5e:f5 (f8:94:c2:83:5e:f5), Dst: Tp-LinkT_62:5c:80 (1c:44:19:62:5c:80)					
> Internet Protocol Version 4, Src: 192.168.1.55, Dst: 128.119.245.12					
✓ Transmission Control Protocol, Src Port: 53845, Dst Port: 80, Seq: 9466, Ack: 1, Len: 1452					
Source Port: 53845					
Destination Port: 80					
[Stream index: 7]					
[TCP Segment Len: 1452]					
Sequence number: 9466 (relative sequence number)					
Sequence number (raw): 1798028335					
[Next sequence number: 10918 (relative sequence number)]					
Acknowledgment number: 1 (relative ack number)					
Acknowledgment number (raw): 3367737245					
0101 = Header Length: 20 bytes (5)					
> Flags: 0x010 (ACK)					
Window size value: 513					
[Calculated window size: 131328]					

2. IP address of gaia.cs.umass.edu is 128.119.245.12 and port number is 80 which is source port.

http						
No.	Time	Source	Destination	Protocol	Length	Info
174	2.214564	192.168.1.1	192.168.1.55	ICMP	590	Destination unreachable (Fragmentation needed)
426	5.135808	128.119.245.12	192.168.1.55	HTTP	831	HTTP/1.1 200 OK (text/html)
> Frame 426: 831 bytes on wire (6648 bits), 831 bytes captured (6648 bits) on interface \Device\NPF_{2F86FA23-1860-4715-956B-3A40FB10F6C4}, id 0						
> Ethernet II, Src: Tp-LinkT_62:5c:80 (1c:44:19:62:5c:80), Dst: IntelCor_83:5e:f5 (f8:94:c2:83:5e:f5)						
> Internet Protocol Version 4, Src: 128.119.245.12, Dst: 192.168.1.55						
✓ Transmission Control Protocol, Src Port: 80, Dst Port: 53845, Seq: 1, Ack: 153075, Len: 777						
Source Port: 80						
Destination Port: 53845						
[Stream index: 7]						
[TCP Segment Len: 777]						
Sequence number: 1 (relative sequence number)						
Sequence number (raw): 3367737245						
[Next sequence number: 778 (relative sequence number)]						
Acknowledgment number: 153075 (relative ack number)						
Acknowledgment number (raw): 1798171944						
0101 = Header Length: 20 bytes (5)						
> Flags: 0x018 (PSH, ACK)						
Window size value: 2000						
[Calculated window size: 256000]						
[Window size scaling factor: 128]						
Checksum: 0x57df [unverified]						
[Checksum Status: Unverified]						
Urgent pointer: 0						
> [SEQ/ACK analysis]						
> [Timestamps]						
TCP payload (777 bytes)						
> Hypertext Transfer Protocol						
> Line-based text data: text/html (11 lines)						

3. TCP port is 53845 and IP address is 192.168.1.55

246	3.118385	192.168.1.55	128.119.245.12	TCP	1506 [TCP Retransmission] 53845 → 80 [ACK] Seq=9466 Ack=1 Win=131328 Len=1452
> Frame 246: 1506 bytes on wire (12048 bits), 1506 bytes captured (12048 bits) on interface \Device\NPF_{2F86FA23-1860-4715-956B-3A40FB10F6C4}, id 0					
> Ethernet II, Src: IntelCor_83:5e:f5 (f8:94:c2:83:5e:f5), Dst: Tp-LinkT_62:5c:80 (1c:44:19:62:5c:80)					
> Internet Protocol Version 4, Src: 192.168.1.55, Dst: 128.119.245.12					
✓ Transmission Control Protocol, Src Port: 53845, Dst Port: 80, Seq: 9466, Ack: 1, Len: 1452					
Source Port: 53845					
Destination Port: 80					
[Stream index: 7]					
[TCP Segment Len: 1452]					
Sequence number: 9466 (relative sequence number)					
Sequence number (raw): 1798028335					
[Next sequence number: 10918 (relative sequence number)]					
Acknowledgment number: 1 (relative ack number)					
Acknowledgment number (raw): 3367737245					
0101 = Header Length: 20 bytes (5)					
> Flags: 0x010 (ACK)					
Window size value: 513					
[Calculated window size: 131328]					

4. The sequence number of TCP SYN segment is 0. It is used to initiate the TCP connection between our client computer and gaia.cs.umass.edu.

No.	Time	Source	Destination	Protocol	Length	Info
133	2.069441	192.168.1.55	128.119.245.12	TCP	66	53845 → 80 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 WS=256 SACK_PERM=1
134	2.069577	192.168.1.55	128.119.245.12	TCP	66	53846 → 80 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 WS=256 SACK_PERM=1

> Frame 133: 66 bytes on wire (528 bits), 66 bytes captured (528 bits) on interface \Device\NPF_{2F86FA23-1860-4715-956B-3A40FB10F6C4}, id 0
> Ethernet II, Src: IntelCor_83:5e:f5 (f8:94:c2:83:5e:f5), Dst: Tp-LinkT_62:5c:80 (1c:44:19:62:5c:80)
> Internet Protocol Version 4, Src: 192.168.1.55, Dst: 128.119.245.12
▼ Transmission Control Protocol, Src Port: 53845, Dst Port: 80, Seq: 0, Len: 0
Source Port: 53845
Destination Port: 80
[Stream index: 7]
[TCP Segment Len: 0]
Sequence number: 0 (relative sequence number)
Sequence number (raw): 1798018869
[Next sequence number: 1 (relative sequence number)]
Acknowledgment number: 0
Acknowledgment number (raw): 0
1000 = Header Length: 32 bytes (8)
▼ Flags: 0x002 (SYN)
000. = Reserved: Not set
...0 = Nonce: Not set
.... 0... = Congestion Window Reduced (CWR): Not set
.... .0.. = ECN-Echo: Not set
.... ..0. = Urgent: Not set
.... ...0 = Acknowledgment: Not set
....0... = Push: Not set
....0.. = Reset: Not set
>1. = Syn: Set
....0 = Fin: Not set
[TCP Flags:S.]
Window size value: 64240
[Calculated window size: 64240]

5. The sequence number of SYN_ACK segment sent by gaia.cs.umass.edu website to our client computer in reply to SYN is 0. Server adds 1 to initial sequence number of SYN segment from the client computer. Because of that, our initial sequence number is 0 thus, SYN_ACK segment is 1. SYN and Acknowledgment flag indicates that this segment is a SYN_ACK segment if they both set to 1.

152	2.208827	128.119.245.12	192.168.1.55	TCP	66	80 → 53845 [SYN, ACK] Seq=0 Ack=1 Win=29200 Len=0 MSS=1460 SACK_PERM=1 WS=128
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▼ Transmission Control Protocol, Src Port: 80, Dst Port: 53845, Seq: 0, Ack: 1, Len: 0
Source Port: 80
Destination Port: 53845
[Stream index: 7]
[TCP Segment Len: 0]
Sequence number: 0 (relative sequence number)
Sequence number (raw): 3367737244
[Next sequence number: 1 (relative sequence number)]
Acknowledgment number: 1 (relative ack number)
Acknowledgment number (raw): 1798018870
1000 = Header Length: 32 bytes (8)
▼ Flags: 0x012 (SYN, ACK)
000. = Reserved: Not set
...0 = Nonce: Not set
.... 0... = Congestion Window Reduced (CWR): Not set
.... .0.. = ECN-Echo: Not set
.... ..0. = Urgent: Not set
.... ...1 = Acknowledgment: Set
....0... = Push: Not set
....0.. = Reset: Not set
>1. = Syn: Set
....0 = Fin: Not set
[TCP Flags:A..S.]
Window size value: 29200
[Calculated window size: 29200]
Checksum: 0x902d [unverified]
[Checksum Status: Unverified]

6. Sequence number of TCP segment that contains HTTP POST is 1. It is in 6th segment.

156 2.209504 192.168.1.55 128.119.245.12 TCP 807 53845 → 80 [PSH, ACK] Seq=1 Ack=1 Win=131328 Len=753 [TCP segment of a reassembled PDU]

[TCP Segment Len: 753]
Sequence number: 1 (relative sequence number)
Sequence number (raw): 1798018870
[Next sequence number: 754 (relative sequence number)]
Acknowledgment number: 1 (relative ack number)
Acknowledgment number (raw): 3367737245
0101 = Header Length: 20 bytes (5)
Flags: 0x018 (PSH, ACK)
000. = Reserved: Not set
...0 = Nonce: Not set
....0... = Congestion Window Reduced (CWR): Not set
....0... = ECH-Echo: Not set
....0... = Urgent: Not set
....1... = Acknowledgment: Set
....1... = Push: Set
....0... = Reset: Not set
....0... = Syn: Not set
....0... = Fin: Not set
[TCP Flags:AP...]

0000 1c 44 19 62 5c 80 f8 94 c2 83 5e f5 08 00 45 00 .D.b\...^...E.
0010 03 19 2c c1 40 00 80 06 93 ba c0 a8 01 37 80 77 .., @... ..7-w
0020 f5 0c d2 55 00 50 6b 2b 97 36 c8 bb 97 9d 50 18 ...U.Pk+ .6....P-
0030 02 01 07 6c 00 00 50 4f 53 54 20 2f 77 69 72 65 .1..PD ST /wire
0040 73 68 61 72 6b 2d 6c 61 62 73 2f 6c 61 62 33 2d shark-la bs/lab3-
0050 31 2d 72 65 70 6c 79 2e 68 74 6d 20 48 54 54 50 1-reply. htm HTTP
0060 2f 31 2e 31 0d 0a 48 6f 73 74 3a 20 67 61 69 61 /1.1- Ho st: gaia
0070 2e 63 73 2e 75 6d 61 73 73 2e 65 64 75 0d 0a 43 .cs.umass.edu- C
0080 6f 6e 6e 65 63 74 69 6f 6e 3a 20 6b 65 65 70 2d onnectio n: keep-
0090 61 6c 69 76 65 0d 0a 43 6f 6e 74 65 6e 74 2d 4c alive- C ontent-L
00a0 65 6e 67 74 68 3a 20 31 35 32 33 32 31 0d 0a 43 length: 1 52321- C
00b0 61 63 68 65 2d 43 6f 6e 74 72 6f 6c 3a 20 6d 61 ache-Cont rol: ma
00c0 78 2d 61 67 65 3d 30 0d 0a 55 70 67 72 61 64 65 x-age=0- Upgrade
00d0 2d 49 6e 73 65 63 75 72 65 2d 52 65 71 75 65 73 -Insecur e-Reques
00e0 74 73 3a 20 31 0d 0a 4f 72 69 67 69 6e 3a 20 68 ts: 1-0 rigin: h
00f0 74 74 70 3a 2f 2f 67 61 69 61 2e 63 73 2e 75 6d ttp://ga ia.cs.um
0100 61 73 73 2e 65 64 75 0d 0a 43 6f 6e 74 65 6e 74 ass.edu- Content
0110 2d 54 79 70 65 3a 20 6d 75 6c 74 69 70 61 72 74 -Type: m ultipart
0120 2f 66 6f 72 6d 2d 64 61 74 61 3b 20 62 6f 75 6e /form-da ta; boun
0130 64 61 72 79 3d 2d 2d 2d 2d 57 65 62 4b 69 74 46 dary=--- WebKitF

7. Sequence numbers of first 6 segment are: 1, 754, 2214, 3674, 5134, 6594

No.	Time	Source	Destination	Protocol	Length	Info
155	2.209324	192.168.1.55	128.119.245.12	TCP	54	53846 → 80 [ACK] Seq=1 Ack=1 Win=131328 Len=0
156	2.209504	192.168.1.55	128.119.245.12	TCP	807	53845 → 80 [PSH, ACK] Seq=1 Ack=1 Win=131328 Len=753 [TCP segment of a reassembled PDU]
157	2.209780	192.168.1.55	128.119.245.12	TCP	1514	53845 → 80 [ACK] Seq=754 Ack=1 Win=131328 Len=1460 [TCP segment of a reassembled PDU]
158	2.209780	192.168.1.55	128.119.245.12	TCP	1514	53845 → 80 [ACK] Seq=2214 Ack=1 Win=131328 Len=1460 [TCP segment of a reassembled PDU]
159	2.209780	192.168.1.55	128.119.245.12	TCP	1514	53845 → 80 [ACK] Seq=3674 Ack=1 Win=131328 Len=1460 [TCP segment of a reassembled PDU]
160	2.209780	192.168.1.55	128.119.245.12	TCP	1514	53845 → 80 [ACK] Seq=5134 Ack=1 Win=131328 Len=1460 [TCP segment of a reassembled PDU]
161	2.209780	192.168.1.55	128.119.245.12	TCP	1514	53845 → 80 [ACK] Seq=6594 Ack=1 Win=131328 Len=1460 [TCP segment of a reassembled PDU]
162	2.209780	192.168.1.55	128.119.245.12	TCP	1514	53845 → 80 [ACK] Seq=8054 Ack=1 Win=131328 Len=1460 [TCP segment of a reassembled PDU]

> Frame 156: 807 bytes on wire (6456 bits), 807 bytes captured (6456 bits) on interface \Device\NPF_{2F86FA23-1860-4715-956B-3A40FB10F6C4}, id 0
> Ethernet II, Src: IntelCor_83:5e:f5 (f8:94:c2:83:5e:f5), Dst: Tp-LinkT_62:5c:80 (1c:44:19:62:5c:80)
> Internet Protocol Version 4, Src: 192.168.1.55, Dst: 128.119.245.12
v Transmission Control Protocol, Src Port: 53845, Dst Port: 80, Seq: 1, Ack: 1, Len: 753
Source Port: 53845
Destination Port: 80
[Stream index: 7]
[TCP Segment Len: 753]
Sequence number: 1 (relative sequence number)
Sequence number (raw): 1798018870
[Next sequence number: 754 (relative sequence number)]
Acknowledgment number: 1 (relative ack number)
Acknowledgment number (raw): 3367737245
0101 = Header Length: 20 bytes (5)
Flags: 0x018 (PSH, ACK)
000. = Reserved: Not set

Sequence number	Sent time	ACK received time	RTT (seconds)
1	2.209504	2.212378	0.002874
754	2.209780	2.215534	0.005754
2214	2.209780	2.348727	0.138947
3674	2.209780	2.838023	0,628243
5134	2.209780	3.117821	0,908041
6594	2.209780	3.118279	0,908499

By using the formula: $\text{EstimatedRTT} = 0.875 * \text{EstimatedRTT} + 0.125 * \text{SampleRTT}$

(RTT for segment 1 is found by: $2.212378 - 2.209504 = 0.002874$)

EstimatedRTT after the receipt of the ACK of segment 1:

EstimatedRTT = RTT for Segment 1 = 0.002874 second

EstimatedRTT after the receipt of the ACK of segment 2:

EstimatedRTT = $0.875 * 0.002874 + 0.125 * 0.005754 = 0,003234$

EstimatedRTT after the receipt of the ACK of segment 3:

EstimatedRTT = $0.875 * 0,003234 + 0.125 * 0.138947 = 0,020198125$

EstimatedRTT after the receipt of the ACK of segment 4:

EstimatedRTT = $0.875 * 0,020198125 + 0.125 * 0.628243 = 0.09620373437$

EstimatedRTT after the receipt of the ACK of segment 5:

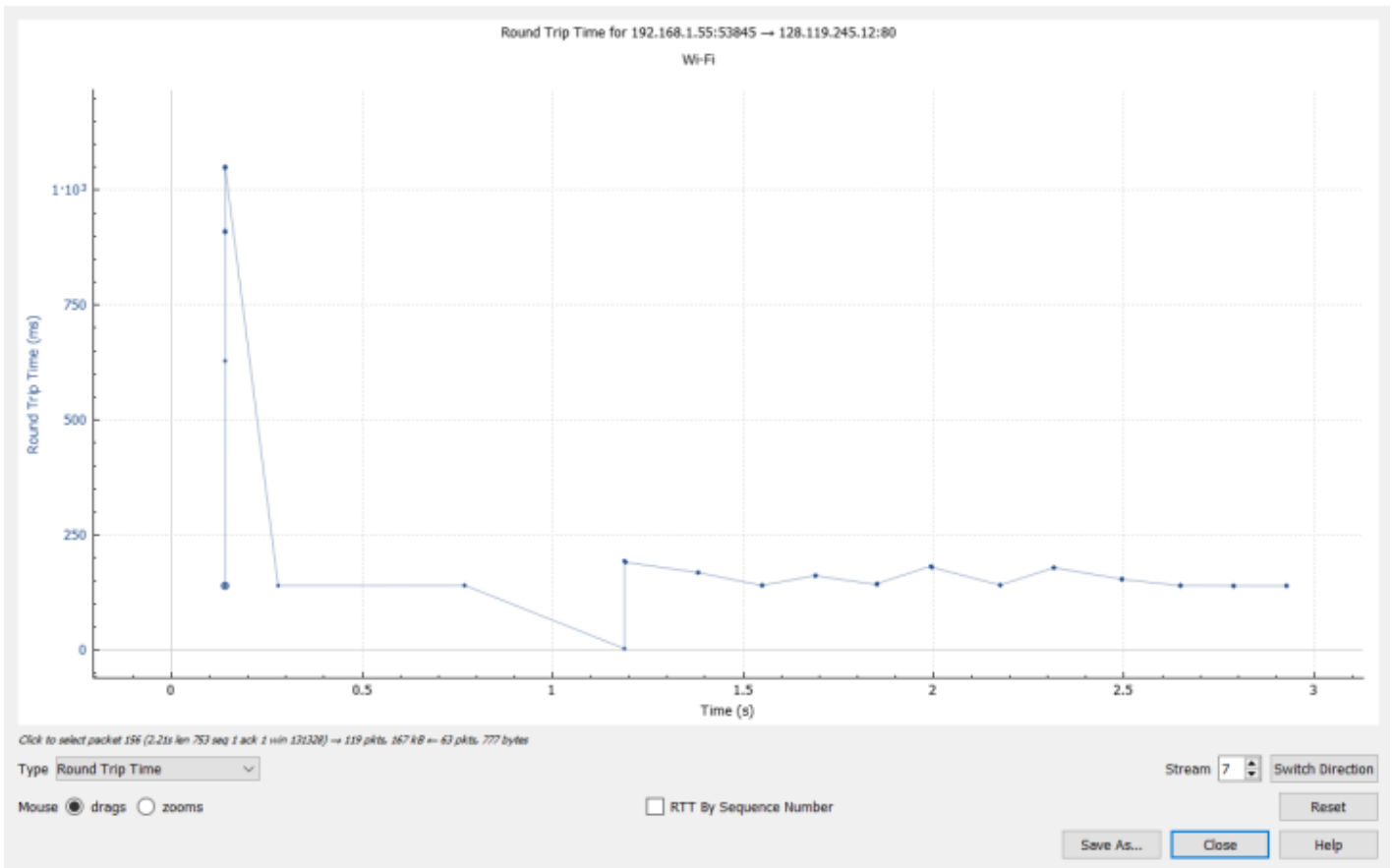
EstimatedRTT = $0.875 * 0.09620373437 + 0.125 * 0.908041 = 0.19768339257$

EstimatedRTT after the receipt of the ACK of segment 6:

EstimatedRTT = $0.875 * 0.19768339257 + 0.125 * 0,908499 = 0.28653534349$ second

No.	Time	Source	Destination	Protocol	Length	Info
167	2.212378	128.119.245.12	192.168.1.55	TCP	54	80 → 53838 [ACK] Seq=1 Ack=2 Win=229 Len=0
168	2.212889	192.168.1.1	192.168.1.55	ICMP	590	Destination unreachable (Fragmentation needed)
169	2.213241	192.168.1.1	192.168.1.55	ICMP	590	Destination unreachable (Fragmentation needed)
170	2.213595	192.168.1.1	192.168.1.55	ICMP	590	Destination unreachable (Fragmentation needed)
171	2.213727	192.168.1.1	192.168.1.55	ICMP	590	Destination unreachable (Fragmentation needed)
172	2.214081	192.168.1.1	192.168.1.55	ICMP	590	Destination unreachable (Fragmentation needed)
173	2.214441	192.168.1.1	192.168.1.55	ICMP	590	Destination unreachable (Fragmentation needed)
174	2.214564	192.168.1.1	192.168.1.55	ICMP	590	Destination unreachable (Fragmentation needed)
175	2.214964	192.168.1.1	192.168.1.55	ICMP	590	Destination unreachable (Fragmentation needed)
176	2.215534	128.119.245.12	192.168.1.55	TCP	54	80 → 53837 [ACK] Seq=1 Ack=2 Win=229 Len=0
185	2.348727	128.119.245.12	192.168.1.55	TCP	54	80 → 53845 [ACK] Seq=1 Ack=754 Win=30720 Len=0
190	2.348762	192.168.1.55	128.119.245.12	TCP	1506	53845 → 80 [ACK] Seq=13894 Ack=1 Win=131328 Len=1452 [TCP segment of a reassembled PDU]
198	2.488280	128.119.245.12	192.168.1.55	TCP	66	[TCP Window Update] 80 → 53845 [ACK] Seq=1 Ack=754 Win=33664 Len=0 SLE=13894 SRE=15346
209	2.697464	192.168.1.55	128.119.245.12	TCP	1506	[TCP Retransmission] 53845 → 80 [ACK] Seq=754 Ack=1 Win=131328 Len=1452
220	2.838023	128.119.245.12	192.168.1.55	TCP	66	80 → 53845 [ACK] Seq=1 Ack=2206 Win=36608 Len=0 SLE=13894 SRE=15346
221	2.838065	192.168.1.55	128.119.245.12	TCP	1506	53845 → 80 [ACK] Seq=15346 Ack=1 Win=131328 Len=1452 [TCP segment of a reassembled PDU]
222	2.838065	192.168.1.55	128.119.245.12	TCP	1506	53845 → 80 [PSH, ACK] Seq=16798 Ack=1 Win=131328 Len=1452 [TCP segment of a reassembled PDU]
230	2.977829	128.119.245.12	192.168.1.55	TCP	66	[TCP Window Update] 80 → 53845 [ACK] Seq=1 Ack=2206 Win=39552 Len=0 SLE=13894 SRE=16798
231	2.977871	192.168.1.55	128.119.245.12	TCP	1506	[TCP Retransmission] 53845 → 80 [ACK] Seq=2206 Ack=1 Win=131328 Len=1452
232	2.977871	192.168.1.55	128.119.245.12	TCP	1506	[TCP Retransmission] 53845 → 80 [ACK] Seq=3658 Ack=1 Win=131328 Len=1452
233	2.977871	192.168.1.55	128.119.245.12	TCP	1506	[TCP Retransmission] 53845 → 80 [ACK] Seq=5110 Ack=1 Win=131328 Len=1452
234	2.978434	128.119.245.12	192.168.1.55	TCP	66	[TCP Window Update] 80 → 53845 [ACK] Seq=1 Ack=2206 Win=42496 Len=0 SLE=13894 SRE=18250
242	3.117821	128.119.245.12	192.168.1.55	TCP	66	80 → 53845 [ACK] Seq=1 Ack=3658 Win=45312 Len=0 SLE=13894 SRE=18250
243	3.117929	192.168.1.55	128.119.245.12	TCP	1506	[TCP Retransmission] 53845 → 80 [ACK] Seq=6562 Ack=1 Win=131328 Len=1452
244	3.117929	192.168.1.55	128.119.245.12	TCP	1506	[TCP Retransmission] 53845 → 80 [ACK] Seq=8014 Ack=1 Win=131328 Len=1452
245	3.118279	128.119.245.12	192.168.1.55	TCP	66	80 → 53845 [ACK] Seq=1 Ack=5110 Win=48256 Len=0 SLE=13894 SRE=18250

> Frame 156: 807 bytes on wire (6456 bits). 807 bytes captured (6456 bits) on interface \Device\NPF {2F86FA23-1860-4715-956B-3A40F810F6C4}. id 0



8. The length of first TCP segment is 753 bytes and other five segments' length is 1460 bytes.

No.	Time	Source	Destination	Protocol	Length	Info
155	2.209324	192.168.1.55	128.119.245.12	TCP	54	53846 → 80 [ACK] Seq=1 Ack=1 Win=131328 Len=0
156	2.209504	192.168.1.55	128.119.245.12	TCP	807	53845 → 80 [PSH, ACK] Seq=1 Ack=1 Win=131328 Len=753 [TCP segment of a reassembled PDU]
157	2.209780	192.168.1.55	128.119.245.12	TCP	1514	53845 → 80 [ACK] Seq=754 Ack=1 Win=131328 Len=1460 [TCP segment of a reassembled PDU]
158	2.209780	192.168.1.55	128.119.245.12	TCP	1514	53845 → 80 [ACK] Seq=2214 Ack=1 Win=131328 Len=1460 [TCP segment of a reassembled PDU]
159	2.209780	192.168.1.55	128.119.245.12	TCP	1514	53845 → 80 [ACK] Seq=3674 Ack=1 Win=131328 Len=1460 [TCP segment of a reassembled PDU]
160	2.209780	192.168.1.55	128.119.245.12	TCP	1514	53845 → 80 [ACK] Seq=5134 Ack=1 Win=131328 Len=1460 [TCP segment of a reassembled PDU]
161	2.209780	192.168.1.55	128.119.245.12	TCP	1514	53845 → 80 [ACK] Seq=6594 Ack=1 Win=131328 Len=1460 [TCP segment of a reassembled PDU]
162	2.209780	192.168.1.55	128.119.245.12	TCP	1514	53845 → 80 [ACK] Seq=8054 Ack=1 Win=131328 Len=1460 [TCP segment of a reassembled PDU]

> Frame 156: 807 bytes on wire (6456 bits), 807 bytes captured (6456 bits) on interface \Device\NPF_{2F86FA23-1860-4715-956B-3A40FB10F6C4}, id 0

> Ethernet II, Src: IntelCor_83:5e:f5 (f8:94:c2:83:5e:f5), Dst: Tp-LinkT_62:5c:80 (1c:44:19:62:5c:80)

> Internet Protocol Version 4, Src: 192.168.1.55, Dst: 128.119.245.12

▼ Transmission Control Protocol, Src Port: 53845, Dst Port: 80, Seq: 1, Ack: 1, Len: 753

Source Port: 53845

Destination Port: 80

[Stream index: 7]

[TCP Segment Len: 753]

Sequence number: 1 (relative sequence number)

Sequence number (raw): 1798018870

[Next sequence number: 754 (relative sequence number)]

Acknowledgment number: 1 (relative ack number)

Acknowledgment number (raw): 3367737245

0101 = Header Length: 20 bytes (5)

▼ Flags: 0x018 (PSH, ACK)

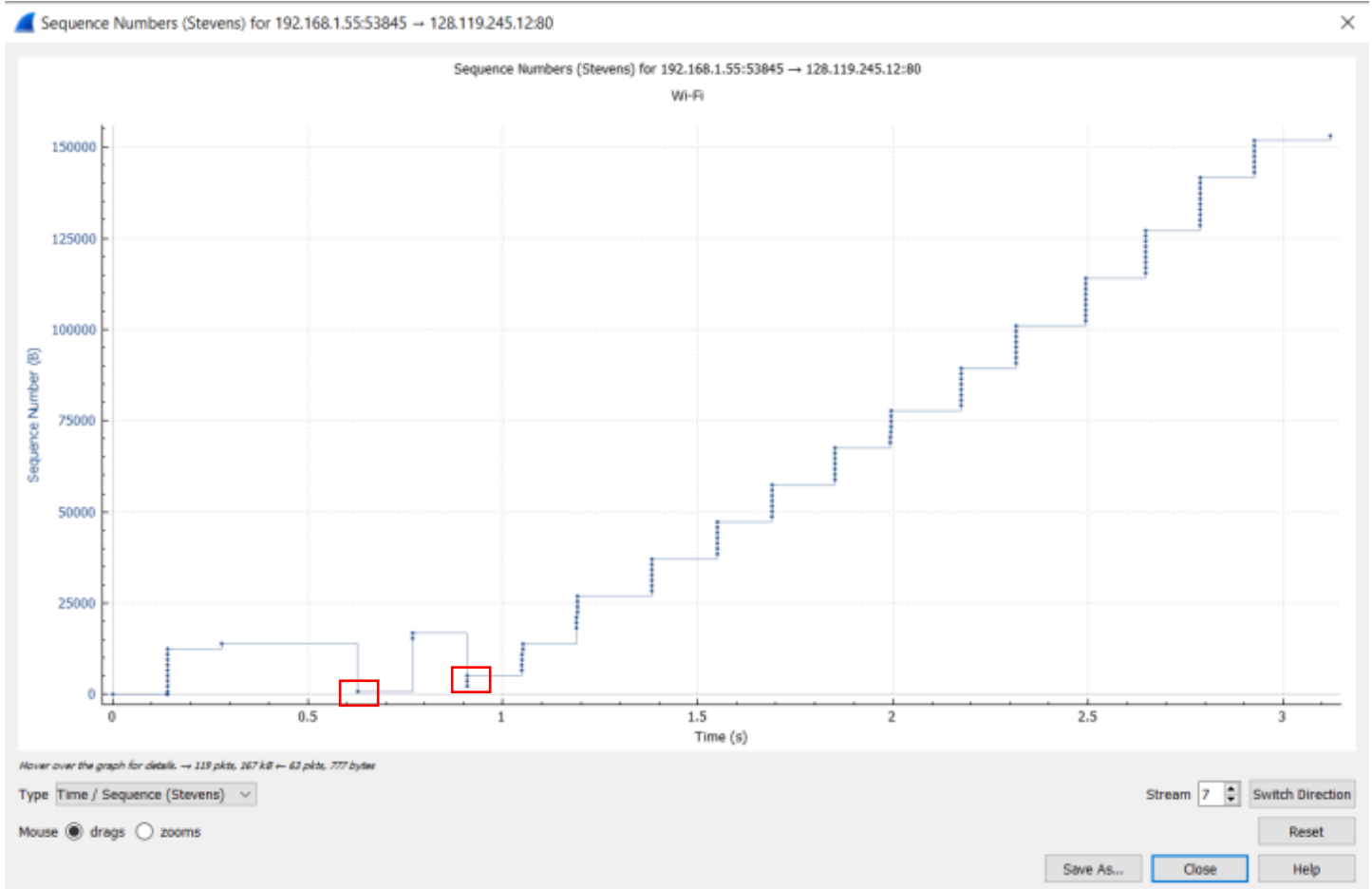
000. = Reserved: Not set

9. The minimum amount of available buffer space (receiver window) advertised at the received for the entire trace is 29200 bytes. It is found by looking at the first acknowledgement from the server.

No.	Time	Source	Destination	Protocol	Length	Info
152	2.208827	128.119.245.12	192.168.1.55	TCP	66	80 → 53845 [SYN, ACK] Seq=0 Ack=1 Win=29200 Len=0 MSS=1460 SACK_PERM=1 WS=128
153	2.208900	192.168.1.55	128.119.245.12	TCP	54	53845 → 80 [ACK] Seq=1 Ack=1 Win=131328 Len=0

> Frame 152: 66 bytes on wire (528 bits), 66 bytes captured (528 bits) on interface \Device\NPF_{2F86FA23-1860-4715-956B-3A40FB10F6C4}, id 0
> Ethernet II, Src: Tp-LinkT_62:5c:80 (1c:44:19:62:5c:80), Dst: IntelCor_83:5e:f5 (f8:94:c2:83:5e:f5)
> Internet Protocol Version 4, Src: 128.119.245.12, Dst: 192.168.1.55
▼ Transmission Control Protocol, Src Port: 80, Dst Port: 53845, Seq: 0, Ack: 1, Len: 0
Source Port: 80
Destination Port: 53845
[Stream index: 7]
[TCP Segment Len: 0]
Sequence number: 0 (relative sequence number)
Sequence number (raw): 3367737244
[Next sequence number: 1 (relative sequence number)]
Acknowledgment number: 1 (relative ack number)
Acknowledgment number (raw): 1798018870
1000 = Header Length: 32 bytes (8)
▼ Flags: 0x012 (SYN, ACK)
000. = Reserved: Not set
...0 = Nonce: Not set
...0... = Congestion Window Reduced (CWR): Not set
....0... = ECN-Echo: Not set
....0... = Urgent: Not set
....0... = Acknowledgment: Set
....0... = Push: Not set
....0... = Reset: Not set
>0... = Syn: Set
....0... = Fin: Not set
[TCP Flags:A..S.]
Window size value: 29200
[Calculated window size: 29200]
Checksum: 0x902d [unverified]
[Checksum Status: Unverified]
Urgent pointer: 0
> Options: (12 bytes), Maximum segment size, No-Operation (NOP), No-Operation (NOP), SACK permitted, No-Operation (NOP), Window scale
> [SEQ/ACK analysis]
> [Timestamps]

10. There are 4 retransmitted segments in the trace file. We found this by looking at Stevens table.



Except these ones, sequence numbers are increasing monotonically with respect to time.

11. The difference between two consecutive ACK is (67546 – 66094 =) 1452 as we can see in the screenshot below. That specifies the data received by server between these two ACKs.

332	4.063857	192.168.1.55	128.119.245.12	TCP	1506	53845 → 80	[ACK]	Seq=71902	Ack=1	Win=131328	Len=1452	[TCP segment of a reassembled PDU]
333	4.064615	128.119.245.12	192.168.1.55	TCP	54	80 → 53845	[ACK]	Seq=1	Ack=66094	Win=164736	Len=0	
334	4.064615	128.119.245.12	192.168.1.55	TCP	54	80 → 53845	[ACK]	Seq=1	Ack=67546	Win=167552	Len=0	
335	4.064659	192.168.1.55	128.119.245.12	TCP	1506	53845 → 80	[ACK]	Seq=73354	Ack=1	Win=131328	Len=1452	[TCP segment of a reassembled PDU]
336	4.064659	192.168.1.55	128.119.245.12	TCP	1506	53845 → 80	[ACK]	Seq=74806	Ack=1	Win=131328	Len=1452	[TCP segment of a reassembled PDU]

> Internet Protocol Version 4, Src: 128.119.245.12, Dst: 192.168.1.55

▼ Transmission Control Protocol, Src Port: 80, Dst Port: 53845, Seq: 1, Ack: 66094, Len: 0

Source Port: 80

Destination Port: 53845

[Stream index: 7]

[TCP Segment Len: 0]

Sequence number: 1 (relative sequence number)

Sequence number (raw): 3367737245

[Next sequence number: 1 (relative sequence number)]

Acknowledgment number: 66094 (relative ack number)

Acknowledgment number (raw): 1798084963

0101 = Header Length: 20 bytes (5)

▼ Flags: 0x010 (ACK)

000. = Reserved: Not set

...0 = Nonce: Not set

....0... = Congestion Window Reduced (CWR): Not set

....0... = ECN-Echo: Not set

12. Time for first TCP segment: 2.209504

156	2.209504	192.168.1.55	128.119.245.12	TCP	807	53845 → 80	[PSH, ACK]	Seq=1	Ack=1	Win=131328	Len=753	[TCP segment of a reassembled PDU]
157	2.260790	192.168.1.55	128.119.245.12	TCP	1514	53845 → 80	[ACK]	Seq=754	Ack=1	Win=131328	Len=1460	[TCP segment of a reassembled PDU]

▼ Flags: 0x018 (PSH, ACK)

000. = Reserved: Not set

...0 = Nonce: Not set

....0... = Congestion Window Reduced (CWR): Not set

....0... = ECN-Echo: Not set

....0... = Urgent: Not set

....1... = Acknowledgment: Set

....1... = Push: Set

....0... = Reset: Not set

....0... = Syn: Not set

....0... = Fin: Not set

[TCP Flags:AP...]

Window size value: 513

[Calculated window size: 131328]

[Window size scaling factor: 256]

Checksum: 0x076c [unverified]

[Checksum Status: Unverified]

Urgent pointer: 0

> [SEQ/ACK analysis]

▼ [Timestamps]



[Time since first frame in this TCP stream: 0.140063000 seconds]

[Time since previous frame in this TCP stream: 0.000604000 seconds]

TCP payload (753 bytes)

TCP segment data (753 bytes)

alice.txt Özellikleri

Genel	Güvenlik	Ayrıntılar	Önceki Sürümler
 <input type="text" value="alice.txt"/>			
Dosya türü:	Metin Belgesi (.txt)		
Birlikte aç:	 WordPad <input type="button" value="Değiştir..."/>		
Konum:	C:\Users\pc\Desktop		
Boyut	148 KB (152.138 bayt)		
Diskteki boyut	152 KB (155.648 bayt)		

Size of alice.txt: 152138 bytes

Time for last ACK: 5.135453

425	5.135453	128.119.245.12	192.168.1.55	TCP	54 80 → 53845 [ACK] Seq=1 Ack=153075 Win=256000 Len=0
426	5.135808	128.119.245.12	192.168.1.55	HTTP	831 HTTP/1.1 200 OK (text/html)

Acknowledgment number: 153075 (relative ack number)

Acknowledgment number (raw): 1798171944

0101 = Header Length: 20 bytes (5)

✓ Flags: 0x010 (ACK)

000. = Reserved: Not set

```
...0 .... = Nonce: Not set
```

```
.... 0... .... = Congestion Window Reduced (CWR): Not set
```

```
.... .0.. .... = ECN-Echo: Not set
```

```
.... ..0. .... = Urgent: Not set
```

.... 1 = Acknowledgment: Set

```
.... 0... = Push: Not set
```

```
.....0.. = Reset: Not set
```

```
.... ..0. = Syn: Not set
```

```
.... 0 = Fin: Not set
[TCB Flags: 0]
```

```
[TCP Flags: .....A....]
```

```
Window size value: 2000
```

```
[Calculated window size: 256000]
```

```
[Window size scaling factor: 128]
```

Checksum: 0xe54b [unverified]

[Checksum Status: Unverified]

Urgent pointer: 0

- > [SEQ/ACK analysis]

- ▼ [Timestamps]

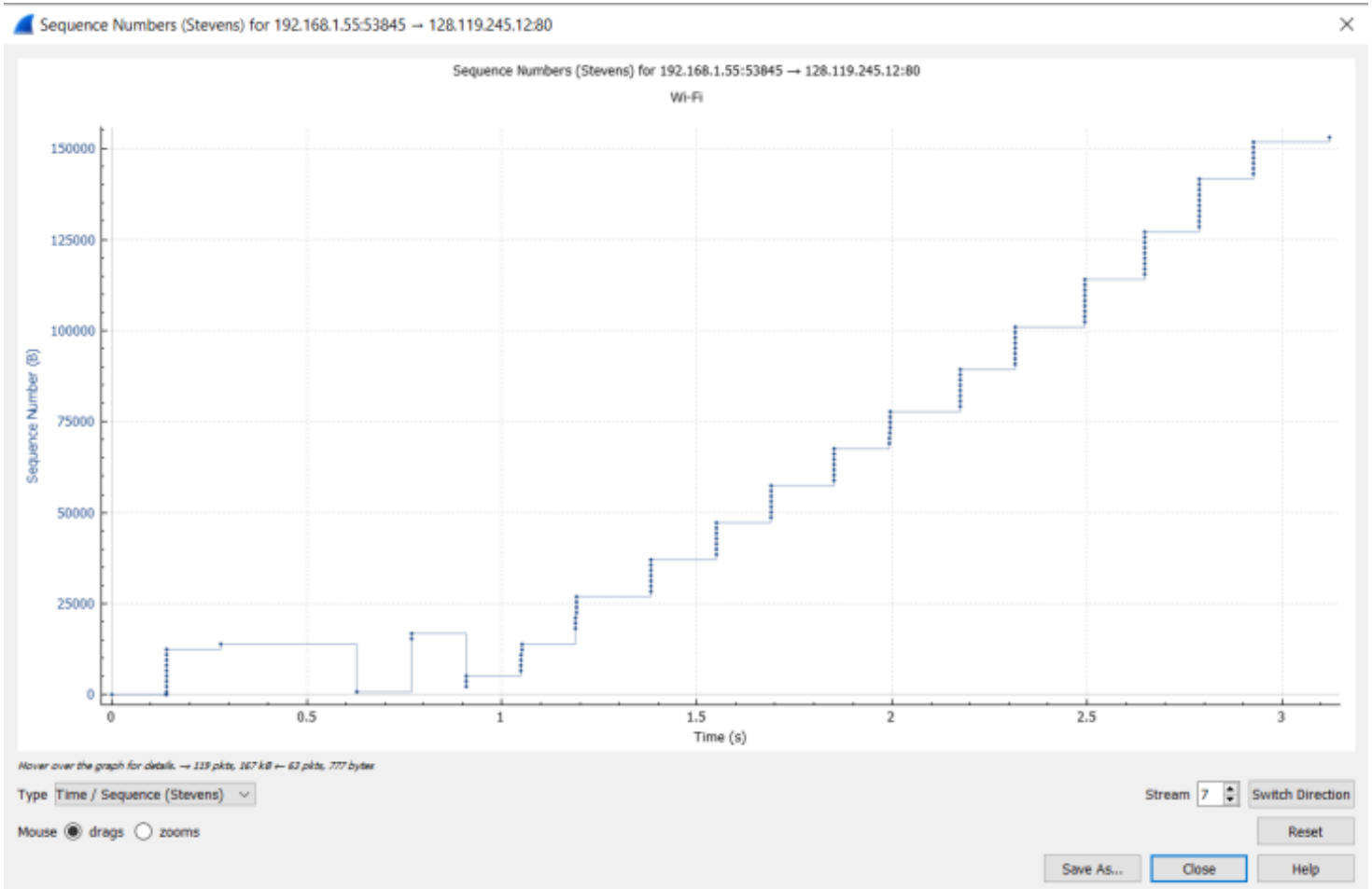
```
[Time since first frame in this TCP stream: 3.066012000 seconds]
```

```
[Time since previous frame in this TCP stream: 0.000119000 seconds]
```

According to formula:

time incurred: $5.135453 - 2.209504 = 2.925949$

Throughput for TCP connection: file size / time incurred = 152138 / 2.925949
= 51996.1216002 bytes/sec = 51.996 kB/sec



13. If we look at the Stevens table above, slowstart phase of TCP begins at nearly 0.15 and ends at about 0.30. Congestion avoidance takes over at about 0.15. Afterward there are a couple resent transmissions but after this the amount of data transmitted gets consistent after around 1.08 because the amount of data sent gets lesser.

14. We already answered 😊

