

## CSE4074 COMPUTER NETWORK

### HW3 WIRESHARK TCP LAB SOLUTIONS

#### A First Look At The Captured Trace

- What is the IP address and TCP port number used by the client computer (source) that is transferring the file to gaia.cs.umass.edu?

**IP address: 192.168.1.37**

**TCP port number: 44934**

- What is the IP address of gaia.cs.umass.edu? On what port number is it sending and receiving TCP segments for this connection?

**IP address: 128.119.245.12**

**TCP port number: 80**

Wireshark capture of a TCP connection. The packet list shows the following packets:

No.	Time	Source	Destination	Protocol	Length	Info
912	2.495493818	192.168.1.37	128.119.245.12	TCP	74	44934 → 80 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 SACK_PERM=1 TSval=3760647898 TSecr=0 WS=128
913	2.495531768	192.168.1.37	128.119.245.12	TCP	74	44936 → 80 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 SACK_PERM=1 TSval=3760647898 TSecr=0 WS=128
989	2.647821173	128.119.245.12	192.168.1.37	TCP	74	80 → 44934 [SYN, ACK] Seq=0 Ack=1 Win=28960 Len=0 MSS=1412 SACK_PERM=1 TSval=2083785911 TSecr=3760647898 WS=128
990	2.647839427	192.168.1.37	128.119.245.12	TCP	66	44934 → 80 [ACK] Seq=1 Ack=1 Win=64256 Len=0 TSval=3760648051 TSecr=2083785911
993	2.648186009	192.168.1.37	128.119.245.12	HTTP	551	GET /wireshark-labs/TCP-wireshark-file1.html HTTP/1.1
997	2.655627426	128.119.245.12	192.168.1.37	TCP	74	80 → 44936 [SYN, ACK] Seq=0 Ack=1 Win=28960 Len=0 MSS=1412 SACK_PERM=1 TSval=2083785919 TSecr=3760647898 WS=128
998	2.655654211	192.168.1.37	128.119.245.12	TCP	66	44936 → 80 [ACK] Seq=1 Ack=1 Win=64256 Len=0 TSval=3760648058 TSecr=2083785919
10	2.792911012	128.119.245.12	192.168.1.37	TCP	66	80 → 44934 [ACK] Seq=1 Ack=486 Win=30080 Len=0 TSval=2083786056 TSecr=3760648051
10	2.795918242	128.119.245.12	192.168.1.37	HTTP	2260	HTTP/1.1 200 OK (text/html)
10	2.795964407	192.168.1.37	128.119.245.12	TCP	66	44934 → 80 [ACK] Seq=486 Ack=2195 Win=62080 Len=0 TSval=3760648199 TSecr=2083786057
10	2.953163488	192.168.1.37	128.119.245.12	HTTP	483	GET /favicon.ico HTTP/1.1
18	3.097142757	128.119.245.12	192.168.1.37	HTTP	550	HTTP/1.1 404 Not Found (text/html)

Packet 912 details:

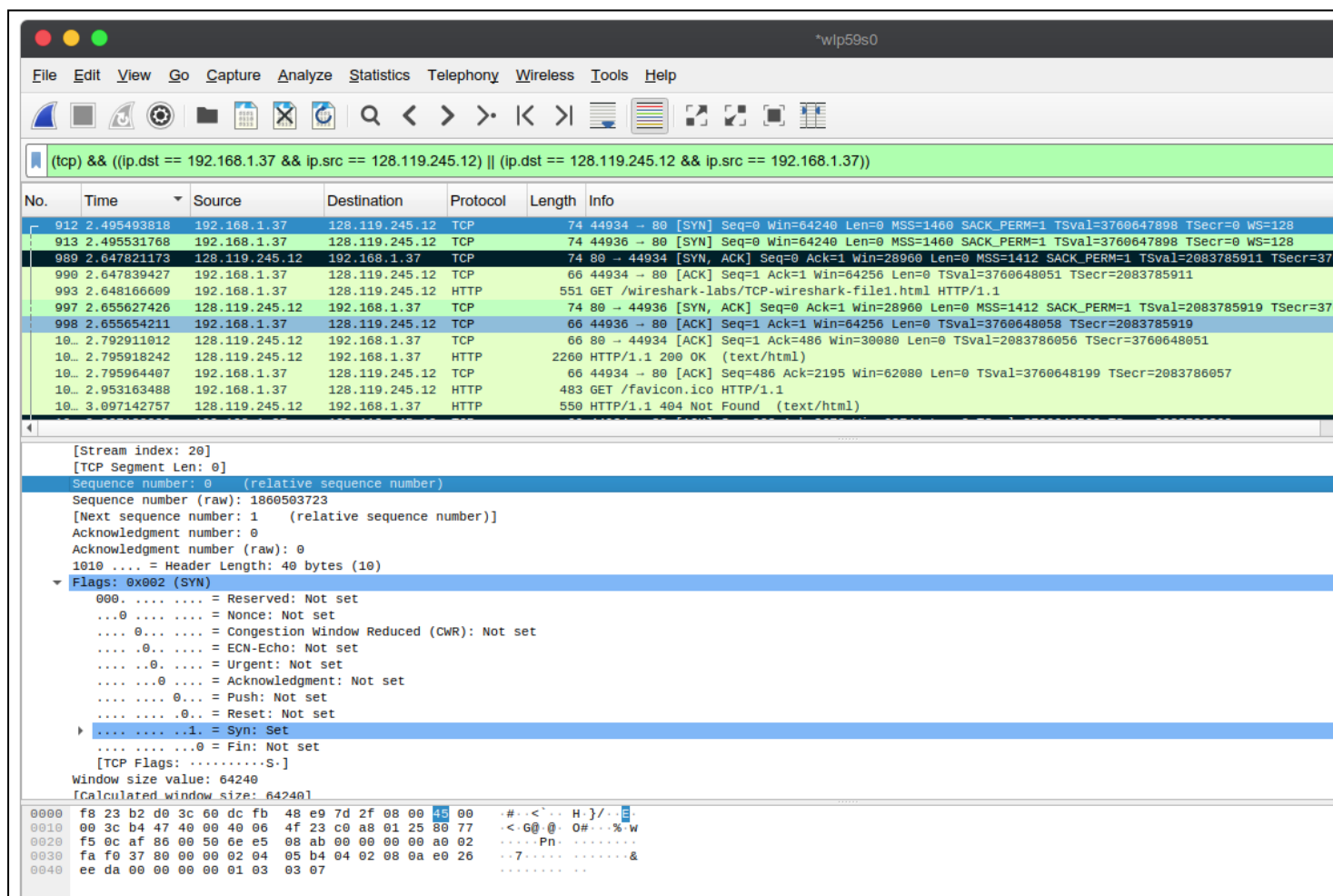
- Frame 912: 74 bytes on wire (592 bits), 74 bytes captured (592 bits) on interface wlp59s0, id 0
- Ethernet II, Src: IntelCor\_e9:7d:2f (dc:fb:48:e9:7d:2f), Dst: HuaweiTe\_d0:3c:60 (f8:23:b2:d0:3c:60)
- Internet Protocol Version 4, Src: 192.168.1.37, Dst: 128.119.245.12
- TCP, Src Port: 44934, Destination Port: 80, Seq: 0, Len: 0
- Sequence number: 0 (relative sequence number)
- Sequence number (raw): 1860593723
- Acknowledgment number: 0
- Acknowledgment number (raw): 0
- Flags: 0x0002 (SYN)

## TCP Basics

- What is the sequence number of the TCP SYN segment that is used to initiate the TCP connection between the client computer and gaia.cs.umass.edu? What is it in the segment that identifies the segment as a SYN segment?

**The sequence number is 0 (zero).**

**The SYN flag is set to 1 and it indicates that this segment is a SYN segment.**



No.	Time	Source	Destination	Protocol	Length	Info
912	2.495493818	192.168.1.37	128.119.245.12	TCP	74	44934 → 80 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 SACK_PERM=1 TSval=3760647898 TSecr=0 WS=128
913	2.495531768	192.168.1.37	128.119.245.12	TCP	74	44936 → 80 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 SACK_PERM=1 TSval=3760647898 TSecr=0 WS=128
989	2.647821173	128.119.245.12	192.168.1.37	TCP	74	80 → 44934 [SYN, ACK] Seq=0 Ack=1 Win=28960 Len=0 MSS=1412 SACK_PERM=1 TSval=2083785911 TSecr=3760647898
990	2.647839427	192.168.1.37	128.119.245.12	TCP	66	44934 → 80 [ACK] Seq=1 Ack=1 Win=64256 Len=0 TSval=3760648051 TSecr=2083785911
993	2.648166609	192.168.1.37	128.119.245.12	HTTP	551	GET /wireshark-labs/TCP-wireshark-file1.html HTTP/1.1
997	2.655627426	128.119.245.12	192.168.1.37	TCP	74	80 → 44936 [SYN, ACK] Seq=0 Ack=1 Win=28960 Len=0 MSS=1412 SACK_PERM=1 TSval=2083785919 TSecr=3760647898
998	2.655654211	192.168.1.37	128.119.245.12	TCP	66	44936 → 80 [ACK] Seq=1 Ack=1 Win=64256 Len=0 TSval=3760648058 TSecr=2083785919
10...	2.792911012	128.119.245.12	192.168.1.37	TCP	66	80 → 44934 [ACK] Seq=1 Ack=1 Win=30080 Len=0 TSval=2083786056 TSecr=3760648051
10...	2.795918242	128.119.245.12	192.168.1.37	HTTP	2260	HTTP/1.1 200 OK (text/html)
10...	2.795964407	192.168.1.37	128.119.245.12	TCP	66	44934 → 80 [ACK] Seq=486 Ack=2195 Win=62080 Len=0 TSval=3760648199 TSecr=2083786057
10...	2.953163488	192.168.1.37	128.119.245.12	HTTP	483	GET /favicon.ico HTTP/1.1
10...	3.097142757	128.119.245.12	192.168.1.37	HTTP	550	HTTP/1.1 404 Not Found (text/html)

[Stream index: 20]	
[TCP Segment Len: 0]	
Sequence number:	0 (relative sequence number)
Sequence number (raw):	1860503723
[Next sequence number:	1 (relative sequence number)]
Acknowledgment number:	0
Acknowledgment number (raw):	0
1810 .... = Header Length: 40 bytes (10)	
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
....0. ....	Syn: Set
....0. ....	Fin: Not set
[TCP Flags: .....S.]	
Window size value: 64240	
[Calculated window size: 64240]	

0000	f8 23 b2 d0 3c 60 dc fb 48 e9 7d 2f 08 00 45 00	..<...H...E
0010	00 3c b4 47 40 00 40 06 4f 23 c0 a8 01 25 80 77	...G@...0#...%W
0020	f5 0c af 86 00 50 6e e5 08 ab 00 00 00 00 a9 02	...Pn.....
0030	fa f0 37 00 00 00 02 04 05 b4 04 02 08 0a 0a 26	...7.....&
0040	ee da 00 00 00 00 01 03 03 07	.....

- What is the sequence number of the SYNACK segment sent by gaia.cs.umass.edu to the client computer in reply to the SYN? What is the value of the Acknowledgement field in the SYNACK segment? How did gaia.cs.umass.edu determine that value? What is it in the segment that identifies the segment as a SYNACK segment?

**Sequence number is 0 (zero).**

**Acknowledgement number is 1.**

**Acknowledgement field is determined by gaia.cs.umass.edu by adding 1 to the initial sequence number of SYN segment from the client.**

**A segment will be identified as a SYNACK segment if both SYN flag and Acknowledgement flag in the segment are set to 1.**

(tcp) && ((ip.dst == 192.168.1.37 && ip.src == 128.119.245.12)    (ip.dst == 128.119.245.12 && ip.src == 192.168.1.37))							
No.	Time	Source	Destination	Protocol	Length	Info	
912	2.495493818	192.168.1.37	128.119.245.12	TCP	74	44934 → 80 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 SACK_PERM=1 TSval=3760647898 TSecr=0 WS=128	
913	2.495531768	192.168.1.37	128.119.245.12	TCP	74	44936 → 80 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 SACK_PERM=1 TSval=3760647898 TSecr=0 WS=128	
989	2.647821173	128.119.245.12	192.168.1.37	TCP	74	80 → 44934 [SYN, ACK] Seq=0 Ack=1 Win=28960 Len=0 MSS=1412 SACK_PERM=1 TSval=2083785911 TSecr=3760647898 WS=128	
990	2.647839427	192.168.1.37	128.119.245.12	TCP	66	44934 → 80 [ACK] Seq=1 Ack=1 Win=64256 Len=0 TSval=3760648051 TSecr=2083785911	
993	2.648166609	192.168.1.37	128.119.245.12	HTTP	551	GET /wireshark-labs/TCP-wireshark-file1.html HTTP/1.1	
997	2.655627426	128.119.245.12	192.168.1.37	TCP	74	80 → 44936 [SYN, ACK] Seq=0 Ack=1 Win=28960 Len=0 MSS=1412 SACK_PERM=1 TSval=2083785919 TSecr=3760647898 WS=128	
998	2.655654211	192.168.1.37	128.119.245.12	TCP	66	44936 → 80 [ACK] Seq=1 Ack=1 Win=64256 Len=0 TSval=3760648058 TSecr=2083785919	
10..	2.792911012	128.119.245.12	192.168.1.37	TCP	66	80 → 44934 [ACK] Seq=1 Ack=486 Win=30080 Len=0 TSval=2083786056 TSecr=3760648051	
10..	2.795918242	128.119.245.12	192.168.1.37	HTTP	2260	HTTP/1.1 200 OK (text/html)	
10..	2.795964407	192.168.1.37	128.119.245.12	TCP	66	44934 → 80 [ACK] Seq=486 Ack=2195 Win=62080 Len=0 TSval=3760648199 TSecr=2083786057	
Source: 128.119.245.12 Destination: 192.168.1.37							
Transmission Control Protocol, Src Port: 80, Dst Port: 44934, Seq: 0, Ack: 1, Len: 0							
Source Port: 80 Destination Port: 44934 [Stream index: 20] [TCP Segment Len: 0] Sequence number: 0 (relative sequence number) Sequence number (raw): 1934376301 [Next sequence number: 1 (relative sequence number)] Acknowledgment number: 1 (relative ack number) Acknowledgment number (raw): 1860593724 1010 .... = Header Length: 40 bytes (10)							
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: 28960 [Calculated window size: 28960]							

6. What is the sequence number of the TCP segment containing the HTTP POST command? Note that in order to find the POST command, you'll need to dig into the packet content field at the bottom of the Wireshark window, looking for a segment with a "POST" within its DATA field.

**The sequence number of the TCP segment containing the HTTP Post command is 1.**

17..	10.110261772	128.119.245.12	192.168.1.37	TCP	66	80 → 44934 [ACK] Seq=2080 Ack=904 Win=31104 Len=0 TSval=2083793372 TSecr=3760655308	
17..	10.128240213	192.168.1.37	128.119.245.12	TCP	74	44944 → 80 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 SACK_PERM=1 TSval=3760655531 TSecr=0 WS=128	
17..	10.130330235	192.168.1.37	128.119.245.12	TCP	787	44936 → 80 [PSH, ACK] Seq=1 Ack=1 Win=64256 Len=721 TSval=3760655533 TSecr=2083785919 [TCP segment of a reassembled PDU]	
17..	10.130637516	192.168.1.37	128.119.245.12	TCP	2866	44936 → 80 [PSH, ACK] Seq=722 Ack=1 Win=64256 Len=2800 TSval=3760655533 TSecr=2083785919 [TCP segment of a reassembled PDU]	
17..	10.130648759	192.168.1.37	128.119.245.12	TCP	2866	44936 → 80 [PSH, ACK] Seq=3522 Ack=1 Win=64256 Len=2800 TSval=3760655533 TSecr=2083785919 [TCP segment of a reassembled PDU]	
17..	10.138501360	192.168.1.37	128.119.245.12	TCP	2866	44936 → 80 [PSH, ACK] Seq=6322 Ack=1 Win=64256 Len=2800 TSval=3760655541 TSecr=2083785919 [TCP segment of a reassembled PDU]	
17..	10.138524725	192.168.1.37	128.119.245.12	TCP	2866	44936 → 80 [PSH, ACK] Seq=9122 Ack=1 Win=64256 Len=2800 TSval=3760655541 TSecr=2083785919 [TCP segment of a reassembled PDU]	
17..	10.139762282	192.168.1.37	128.119.245.12	TCP	1466	44936 → 80 [ACK] Seq=11922 Ack=1 Win=64256 Len=1400 TSval=3760655542 TSecr=2083785919 [TCP segment of a reassembled PDU]	
17..	10.367350426	128.119.245.12	192.168.1.37	TCP	74	80 → 44944 [SYN, ACK] Seq=0 Ack=1 Win=28960 Len=0 MSS=1412 SACK_PERM=1 TSval=2083793543 TSecr=3760655531 WS=128	
Source: 192.168.1.37 Destination: 128.119.245.12							
Transmission Control Protocol, Src Port: 44936, Dst Port: 80, Seq: 1, Ack: 1, Len: 721							
Source Port: 44936 Destination Port: 80 [Stream index: 21] [TCP Segment Len: 721] Sequence number: 1 (relative sequence number) Sequence number (raw): 1461478802 [Next sequence number: 722 (relative sequence number)] Acknowledgment number: 1 (relative ack number) Acknowledgment number (raw): 2436687829 1000 .... = Header Length: 32 bytes (8) Flags: 0x018 (PSH, ACK) Window size value: 502 [Calculated window size: 64256] [Window size scaling factor: 128]							
0020	f5 0c af 88 00 50 57 1c 65 c8 91 3c e7 d5 80 18	.....Pw. e. <.....					
0030	01 f6 3a 49 00 00 01 01 08 0a e0 27 0c ad 7c 34	...I..... 4					
0040	0c bf 50 4f 53 54 20 2f 77 69 72 65 73 68 61 72	..POST / wireshar					
0050	0b 2d 0c 61 62 73 2f 6c 61 62 33 2d 31 2d 72 65	k-labs/l ab3-1-re					
0060	70 0c 79 2e 08 74 6d 20 48 54 54 50 2f 31 2e 31	ply.htm HTTP/1.1					
0070	0d 0a 48 6f 73 74 3a 20 67 61 69 61 2e 63 73 2e	..Host: gaia.cs.					
0080	75 6d 63 72 73 20 65 64 75 6d 63 42 65 60 65	..user-agent: u...					

7. Consider the TCP segment containing the HTTP POST as the first segment in the TCP connection. What are the sequence numbers of the first six segments in the TCP connection (including the segment containing the HTTP POST)?

1. sequence number:1
2. sequence number:11922
3. sequence number:21722
4. sequence number:39922
5. sequence number:49722
6. sequence number:91722

At what time was each segment sent?

1. segment:10.130530235
2. segment:10.139762282
3. segment:10.369526940
4. segment:10.373319231
5. segment:10.522738711
6. segment:10.637110418

When was the ACK for each segment received?

1. segment:10.367362319
2. segment:10.367362599
3. segment:10.367362699
4. segment:10.367362801
5. segment:10.367362901
6. segment:10.367362997

Given the difference between when each TCP segment was sent, and when its acknowledgement was received, what is the RTT value for each of the six segments?

1. RTT: 0.236832084
2. RTT: 0.227600317
3. RTT: 0.002164241
4. RTT: 0.00595643
5. RTT: 0.15537581
6. RTT: 0.269747421

What is the EstimatedRTT value (see Section 3.5.3, page 242 in text) after the receipt of each ACK?

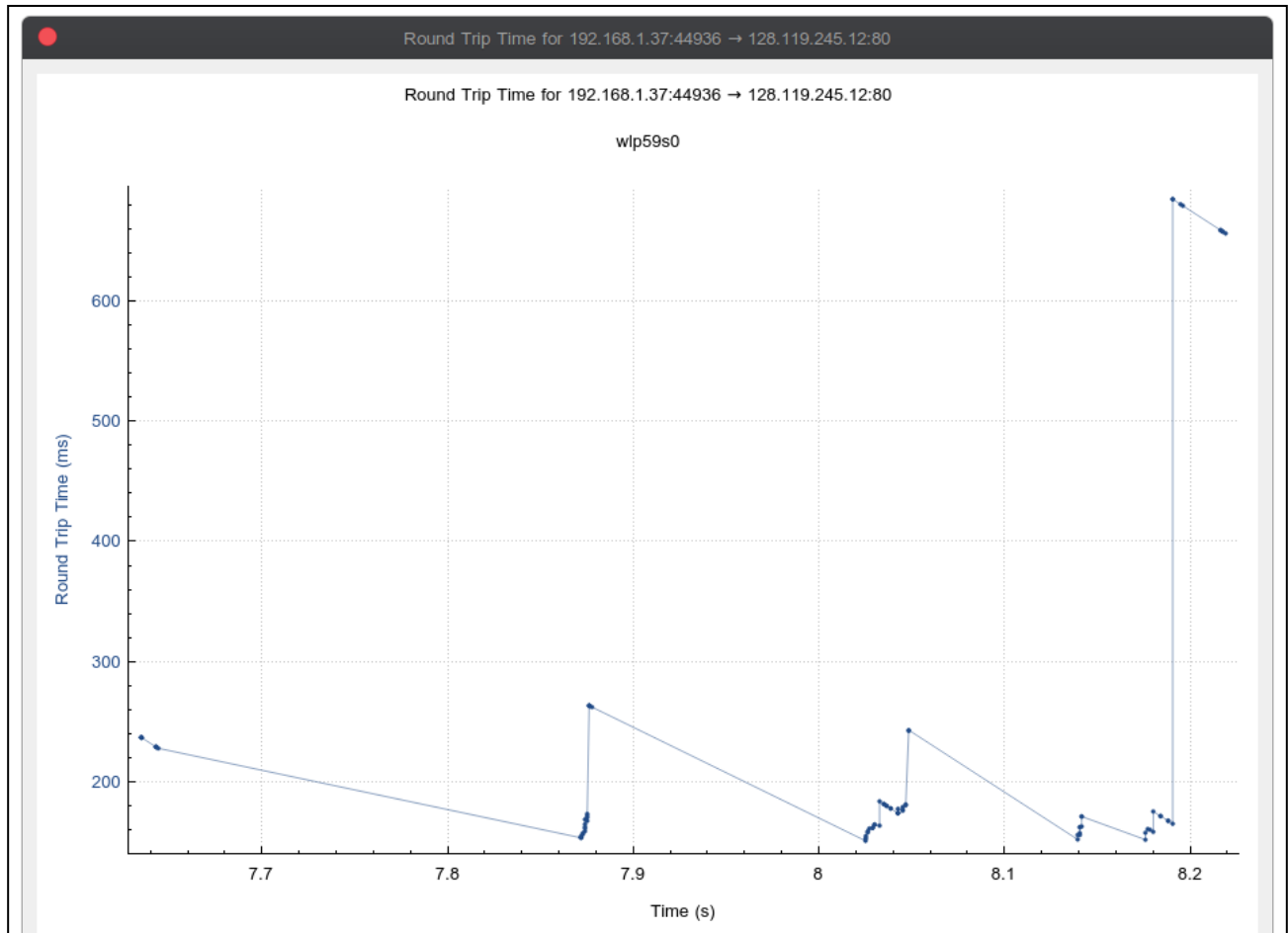
- EstimatedRTT after the receipt of the ACK of segment 1: 0.236832084  
EstimatedRTT after the receipt of the ACK of segment 2: 0.23567811312  
EstimatedRTT after the receipt of the ACK of segment 3: 0.2064888791  
EstimatedRTT after the receipt of the ACK of segment 4: 0.18142232296  
EstimatedRTT after the receipt of the ACK of segment 5: 0.17816650884  
EstimatedRTT after the receipt of the ACK of segment 6: 0.18961412286



(tcp) && ((ip.dst == 192.168.1.37 && ip.src == 128.119.245.12) || (ip.dst == 128.119.245.12 && ip.src == 192.168.1.37))

No.	Time	Source	Destination	Protocol	Length	Info
18..	2.795964497	192.168.1.37	128.119.245.12	TCP	66	44934 → 80 [ACK] Seq=486 Ack=2195 Win=62080 Len=0 TSval=3760648199 TSecr=2083786057
18..	2.953163488	192.168.1.37	128.119.245.12	HTTP	483	GET /favicon.ico HTTP/1.1
18..	3.097142757	128.119.245.12	192.168.1.37	HTTP	559	HTTP/1.1 404 Not Found (text/html)
18..	3.097183628	192.168.1.37	128.119.245.12	TCP	66	44934 → 80 [ACK] Seq=903 Ack=2679 Win=63744 Len=0 TSval=3760648500 TSecr=2083786360
18..	8.101346598	128.119.245.12	192.168.1.37	TCP	66	80 → 44934 [FIN, ACK] Seq=2679 Ack=903 Win=31104 Len=0 TSval=2083791365 TSecr=3760648500
18..	8.141755028	192.168.1.37	128.119.245.12	TCP	66	44934 → 80 [ACK] Seq=903 Ack=2680 Win=64128 Len=0 TSval=3760653544 TSecr=2083791365
18..	9.060224597	192.168.1.37	128.119.245.12	TCP	66	44934 → 80 [FIN, ACK] Seq=903 Ack=2680 Win=64128 Len=0 TSval=3760653544 TSecr=2083791365
17..	10.110281772	128.119.245.12	192.168.1.37	TCP	66	80 → 44934 [ACK] Seq=2680 Ack=904 Win=31104 Len=0 TSval=2083793372 TSecr=3760653544
17..	10.128240213	192.168.1.37	128.119.245.12	TCP	74	44944 → 80 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 SACK_PERM=1 TSval=3760655531 TSecr=0 WS=128
17..	10.130536235	192.168.1.37	128.119.245.12	TCP	787	44936 → 80 [PSH, ACK] Seq=1 Ack=1 Win=64256 Len=721 TSval=3760655533 TSecr=2083785919 [TCP segment of a reassembled PDU]
17..	10.130637516	192.168.1.37	128.119.245.12	TCP	2866	44936 → 80 [PSH, ACK] Seq=722 Ack=1 Win=64256 Len=2800 TSval=3760655533 TSecr=2083785919 [TCP segment of a reassembled PDU]
17..	10.130648750	192.168.1.37	128.119.245.12	TCP	2866	44936 → 80 [PSH, ACK] Seq=3522 Ack=1 Win=64256 Len=2800 TSval=3760655533 TSecr=2083785919 [TCP segment of a reassembled PDU]
17..	10.138591360	192.168.1.37	128.119.245.12	TCP	2866	44936 → 80 [PSH, ACK] Seq=6322 Ack=1 Win=64256 Len=2800 TSval=3760655541 TSecr=2083785919 [TCP segment of a reassembled PDU]
17..	10.138524725	192.168.1.37	128.119.245.12	TCP	2866	44936 → 80 [PSH, ACK] Seq=9122 Ack=1 Win=64256 Len=2800 TSval=3760655541 TSecr=2083785919 [TCP segment of a reassembled PDU]
17..	10.139762282	192.168.1.37	128.119.245.12	TCP	1466	44936 → 80 [ACK] Seq=11922 Ack=1 Win=64256 Len=1400 TSval=3760655542 TSecr=2083785919 [TCP segment of a reassembled PDU]
17..	10.367356426	128.119.245.12	192.168.1.37	TCP	74	80 → 44944 [SYN, ACK] Seq=0 Ack=1 Win=28960 Len=0 MSS=1412 SACK_PERM=1 TSval=2083793543 TSecr=3760655531 WS=128
18..	10.367362319	128.119.245.12	192.168.1.37	TCP	66	80 → 44936 [ACK] Seq=1 Ack=722 Win=30464 Len=0 TSval=2083793552 TSecr=3760655533
18..	10.367362599	128.119.245.12	192.168.1.37	TCP	66	80 → 44936 [ACK] Seq=1 Ack=2122 Win=33408 Len=0 TSval=2083793552 TSecr=3760655533
18..	10.367362699	128.119.245.12	192.168.1.37	TCP	66	80 → 44936 [ACK] Seq=1 Ack=3522 Win=36224 Len=0 TSval=2083793555 TSecr=3760655533
18..	10.367362801	128.119.245.12	192.168.1.37	TCP	66	80 → 44936 [ACK] Seq=1 Ack=4922 Win=39168 Len=0 TSval=2083793556 TSecr=3760655533
18..	10.367362991	128.119.245.12	192.168.1.37	TCP	66	80 → 44936 [ACK] Seq=1 Ack=6322 Win=42112 Len=0 TSval=2083793560 TSecr=3760655533
18..	10.367362997	128.119.245.12	192.168.1.37	TCP	66	80 → 44936 [ACK] Seq=1 Ack=7722 Win=44928 Len=0 TSval=2083793561 TSecr=3760655541
18..	10.367363099	128.119.245.12	192.168.1.37	TCP	66	80 → 44936 [ACK] Seq=1 Ack=9122 Win=47872 Len=0 TSval=2083793563 TSecr=3760655541
18..	10.367363193	128.119.245.12	192.168.1.37	TCP	66	80 → 44936 [ACK] Seq=1 Ack=10522 Win=50688 Len=0 TSval=2083793566 TSecr=3760655541
18..	10.367395114	192.168.1.37	128.119.245.12	TCP	2866	44936 → 80 [PSH, ACK] Seq=13322 Ack=1 Win=64256 Len=2800 TSval=3760655770 TSecr=2083793552 [TCP segment of a reassembled PDU]
18..	10.367423114	192.168.1.37	128.119.245.12	TCP	66	44944 → 80 [ACK] Seq=1 Ack=1 Win=64256 Len=0 TSval=3760655770 TSecr=2083793543
18..	10.367440480	192.168.1.37	128.119.245.12	TCP	2866	44936 → 80 [PSH, ACK] Seq=16122 Ack=1 Win=64256 Len=2800 TSval=3760655770 TSecr=2083793552 [TCP segment of a reassembled PDU]
18..	10.367489455	128.119.245.12	192.168.1.37	TCP	66	80 → 44936 [ACK] Seq=1 Ack=11922 Win=53632 Len=0 TSval=2083793567 TSecr=3760655541
18..	10.367489557	128.119.245.12	192.168.1.37	TCP	66	80 → 44936 [ACK] Seq=1 Ack=13322 Win=56576 Len=0 TSval=2083793569 TSecr=3760655542
18..	10.368392822	192.168.1.37	128.119.245.12	TCP	2866	44936 → 80 [PSH, ACK] Seq=18922 Ack=1 Win=64256 Len=2800 TSval=3760655771 TSecr=2083793569 [TCP segment of a reassembled PDU]
18..	10.369526940	192.168.1.37	128.119.245.12	TCP	1466	44936 → 80 [ACK] Seq=21722 Ack=1 Win=64256 Len=1400 TSval=3760655772 TSecr=2083793569 [TCP segment of a reassembled PDU]
18..	10.369551572	192.168.1.37	128.119.245.12	TCP	2866	44936 → 80 [PSH, ACK] Seq=23122 Ack=1 Win=64256 Len=2800 TSval=3760655772 TSecr=2083793569 [TCP segment of a reassembled PDU]
18..	10.369566455	192.168.1.37	128.119.245.12	TCP	2866	44936 → 80 [PSH, ACK] Seq=25922 Ack=1 Win=64256 Len=2800 TSval=3760655772 TSecr=2083793569 [TCP segment of a reassembled PDU]
18..	10.370769023	192.168.1.37	128.119.245.12	TCP	2866	44936 → 80 [PSH, ACK] Seq=28722 Ack=1 Win=64256 Len=2800 TSval=3760655773 TSecr=2083793569 [TCP segment of a reassembled PDU]
18..	10.370795545	192.168.1.37	128.119.245.12	TCP	2866	44936 → 80 [PSH, ACK] Seq=31522 Ack=1 Win=64256 Len=2800 TSval=3760655773 TSecr=2083793569 [TCP segment of a reassembled PDU]
18..	10.371825957	192.168.1.37	128.119.245.12	TCP	2866	44936 → 80 [PSH, ACK] Seq=34322 Ack=1 Win=64256 Len=2800 TSval=3760655774 TSecr=2083793569 [TCP segment of a reassembled PDU]
18..	10.371855638	192.168.1.37	128.119.245.12	TCP	2866	44936 → 80 [PSH, ACK] Seq=37122 Ack=1 Win=64256 Len=2800 TSval=3760655774 TSecr=2083793569 [TCP segment of a reassembled PDU]
18..	10.373319231	192.168.1.37	128.119.245.12	TCP	1466	44936 → 80 [ACK] Seq=39922 Ack=1 Win=64256 Len=1400 TSval=3760655776 TSecr=2083793569 [TCP segment of a reassembled PDU]
18..	10.520659552	128.119.245.12	192.168.1.37	TCP	66	80 → 44936 [ACK] Seq=1 Ack=14722 Win=59392 Len=0 TSval=2083793781 TSecr=3760655770
18..	10.520691850	192.168.1.37	128.119.245.12	TCP	2866	44936 → 80 [PSH, ACK] Seq=41322 Ack=1 Win=64256 Len=2800 TSval=3760655923 TSecr=2083793781 [TCP segment of a reassembled PDU]
18..	10.520848836	128.119.245.12	192.168.1.37	TCP	66	80 → 44936 [ACK] Seq=1 Ack=16122 Win=62336 Len=0 TSval=2083793783 TSecr=3760655770
18..	10.520874712	192.168.1.37	128.119.245.12	TCP	2866	44936 → 80 [PSH, ACK] Seq=44122 Ack=1 Win=64256 Len=2800 TSval=3760655924 TSecr=2083793783 [TCP segment of a reassembled PDU]
18..	10.521004303	128.119.245.12	192.168.1.37	TCP	66	80 → 44936 [ACK] Seq=1 Ack=17522 Win=65280 Len=0 TSval=2083793785 TSecr=3760655770
18..	10.521868863	192.168.1.37	128.119.245.12	TCP	2866	44936 → 80 [PSH, ACK] Seq=46922 Ack=1 Win=64256 Len=2800 TSval=3760655925 TSecr=2083793785 [TCP segment of a reassembled PDU]
18..	10.522108660	128.119.245.12	192.168.1.37	TCP	66	80 → 44936 [ACK] Seq=1 Ack=18922 Win=68096 Len=0 TSval=2083793787 TSecr=3760655770
18..	10.522738711	192.168.1.37	128.119.245.12	TCP	1466	44936 → 80 [ACK] Seq=49722 Ack=1 Win=64256 Len=1400 TSval=3760655925 TSecr=2083793787 [TCP segment of a reassembled PDU]
18..	10.524521700	128.119.245.12	192.168.1.37	TCP	66	80 → 44936 [ACK] Seq=1 Ack=20322 Win=71040 Len=0 TSval=2083793789 TSecr=3760655771
18..	10.524568721	192.168.1.37	128.119.245.12	TCP	2866	44936 → 80 [PSH, ACK] Seq=51122 Ack=1 Win=64256 Len=2800 TSval=3760655927 TSecr=2083793789 [TCP segment of a reassembled PDU]
18..	10.525496176	128.119.245.12	192.168.1.37	TCP	66	80 → 44936 [ACK] Seq=1 Ack=21722 Win=73856 Len=0 TSval=2083793791 TSecr=3760655771
18..	10.525536594	192.168.1.37	128.119.245.12	TCP	2866	44936 → 80 [PSH, ACK] Seq=53922 Ack=1 Win=64256 Len=2800 TSval=3760655928 TSecr=2083793791 [TCP segment of a reassembled PDU]
18..	10.528283241	128.119.245.12	192.168.1.37	TCP	66	80 → 44936 [ACK] Seq=1 Ack=23122 Win=76800 Len=0 TSval=2083793793 TSecr=3760655772
18..	10.530323240	192.168.1.37	128.119.245.12	TCP	2866	44936 → 80 [PSH, ACK] Seq=56722 Ack=1 Win=64256 Len=2800 TSval=3760656021 TSecr=2083793793 [TCP segment of a reassembled PDU]

Sequence number: 1 (relative sequence number)



8. What is the length of each of the first six TCP segments?

- 1. segment length: 1400
- 2. segment length: 1400
- 3. segment length: 1400
- 4. segment length: 1400
- 5. segment length: 1400
- 6. segment length: 1400

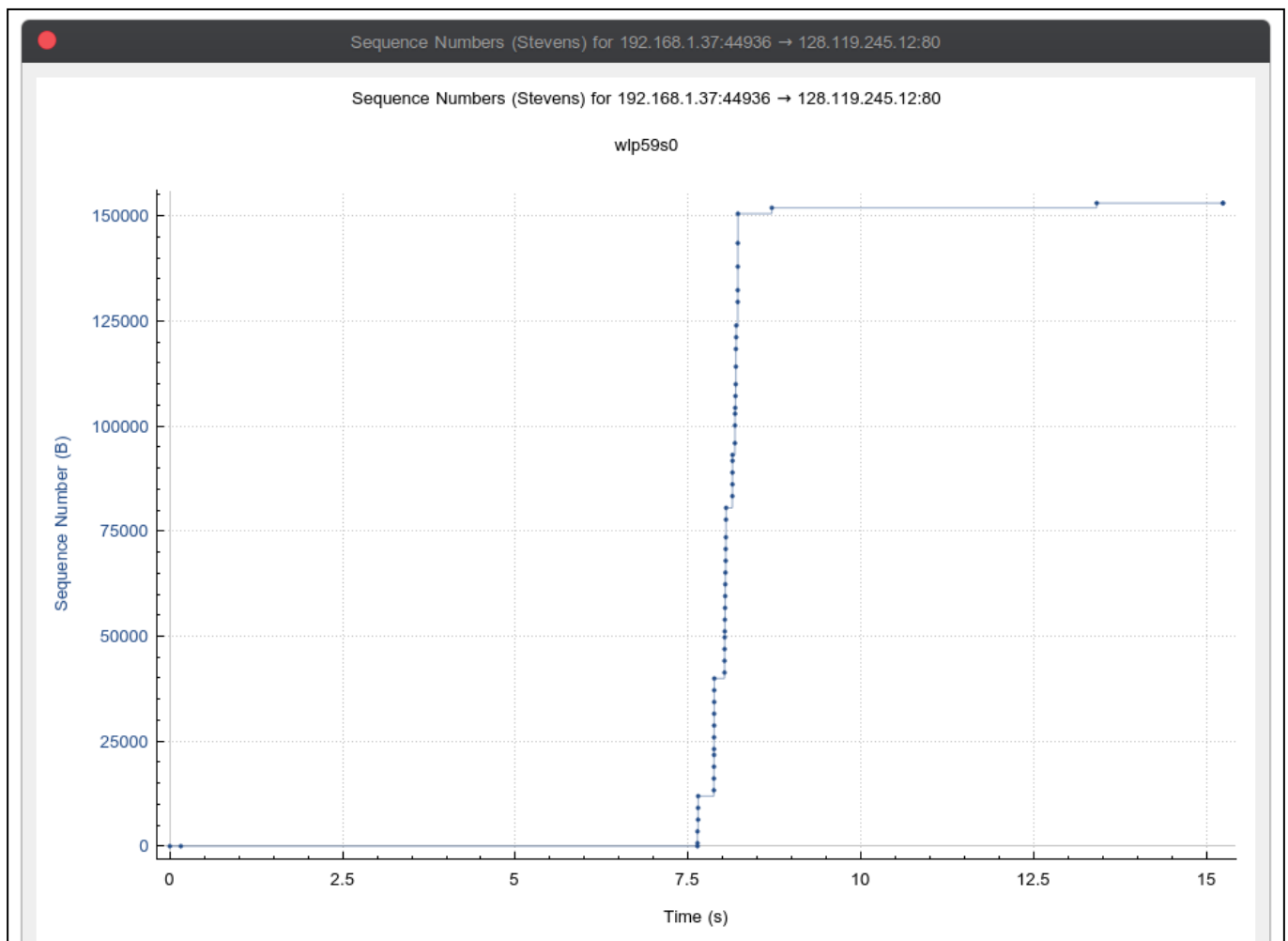
9. What is the minimum amount of available buffer space advertised at the receiver for the entire trace? Does the lack of receiver buffer space ever throttle the sender?

- 1. segment length: 28960
- 2. segment length: 64256
- 3. segment length: 64256
- 4. segment length: 64256
- 5. segment length: 64256
- 6. segment length: 64256

10. Are there any retransmitted segments in the trace file? What did you check for (in the trace) in order to answer this question?

**There are no retransmitted segments in the trace file.**

**All sequence numbers from the source to the destination are increasing monotonically with respect to time.**





11. How much data does the receiver typically acknowledge in an ACK? Can you identify cases where the receiver is ACKing every other received segment.

**We can see that the ACK numbers increase in the sequence of 722, 2122, 3522, 4922, 6322, 7722 and so on. The ACK numbers increases by 1400 each time, indicating that the receiver is acknowledging 1400 bytes.**

(tcp) && ((ip.dst == 192.168.1.37 && ip.src == 128.119.245.12)    (ip.dst == 128.119.245.12 && ip.src == 192.168.1.37))						
No.	Time	Source	Destination	Protocol	Length	Info
989	2.647821173	128.119.245.12	192.168.1.37	TCP	74	80 → 44934 [SYN, ACK] Seq=0 Ack=1 Win=28960 Len=0 MSS=1412 SACK_PERM=1 TSval=2083785 TSecr=2083785
997	2.655627426	128.119.245.12	192.168.1.37	TCP	74	80 → 44936 [SYN, ACK] Seq=0 Ack=1 Win=28960 Len=0 MSS=1412 SACK_PERM=1 TSval=2083785 TSecr=2083785
10...	2.792911012	128.119.245.12	192.168.1.37	TCP	66	80 → 44934 [ACK] Seq=1 Ack=486 Win=30080 Len=0 TSval=2083786056 TSecr=3760648051
10...	2.795918242	128.119.245.12	192.168.1.37	HTTP	2260	HTTP/1.1 200 OK (text/html)
10...	3.097142757	128.119.245.12	192.168.1.37	HTTP	550	HTTP/1.1 404 Not Found (text/html)
16...	8.101346590	128.119.245.12	192.168.1.37	TCP	66	80 → 44934 [FIN, ACK] Seq=2679 Ack=903 Win=31104 Len=0 TSval=2083791365 TSecr=3760648051
17...	10.110281772	128.119.245.12	192.168.1.37	TCP	66	80 → 44934 [ACK] Seq=2680 Ack=904 Win=31104 Len=0 TSval=2083793372 TSecr=3760655368
17...	10.367350426	128.119.245.12	192.168.1.37	TCP	74	80 → 44944 [SYN, ACK] Seq=0 Ack=1 Win=28960 Len=0 MSS=1412 SACK_PERM=1 TSval=2083793 TSecr=3760655368
18...	10.367362319	128.119.245.12	192.168.1.37	TCP	66	80 → 44936 [ACK] Seq=1 Ack=722 Win=30464 Len=0 TSval=2083793552 TSecr=3760655533
18...	10.367362599	128.119.245.12	192.168.1.37	TCP	66	80 → 44936 [ACK] Seq=1 Ack=2122 Win=33408 Len=0 TSval=2083793552 TSecr=3760655533
18...	10.367362699	128.119.245.12	192.168.1.37	TCP	66	80 → 44936 [ACK] Seq=1 Ack=3522 Win=36224 Len=0 TSval=2083793555 TSecr=3760655533
18...	10.367362801	128.119.245.12	192.168.1.37	TCP	66	80 → 44936 [ACK] Seq=1 Ack=4922 Win=39168 Len=0 TSval=2083793556 TSecr=3760655533
18...	10.367362901	128.119.245.12	192.168.1.37	TCP	66	80 → 44936 [ACK] Seq=1 Ack=6322 Win=42112 Len=0 TSval=2083793560 TSecr=3760655533
18...	10.367362997	128.119.245.12	192.168.1.37	TCP	66	80 → 44936 [ACK] Seq=1 Ack=7722 Win=44928 Len=0 TSval=2083793561 TSecr=3760655541
18...	10.367363099	128.119.245.12	192.168.1.37	TCP	66	80 → 44936 [ACK] Seq=1 Ack=9122 Win=47872 Len=0 TSval=2083793563 TSecr=3760655541
18...	10.367363193	128.119.245.12	192.168.1.37	TCP	66	80 → 44936 [ACK] Seq=1 Ack=10522 Win=50688 Len=0 TSval=2083793566 TSecr=3760655541
18...	10.367489455	128.119.245.12	192.168.1.37	TCP	66	80 → 44936 [ACK] Seq=1 Ack=11922 Win=53632 Len=0 TSval=2083793567 TSecr=3760655541

12. What is the throughput (bytes transferred per unit time) for the TCP connection? Explain how you calculated this value.

**Throughput = Amount of data transmitted / time incurred**

**Amount of data transmitted = 150522**

**Time incurred = 10.714081402 - 10.307358420**

**Throughput = 37,008 KByte/sec**

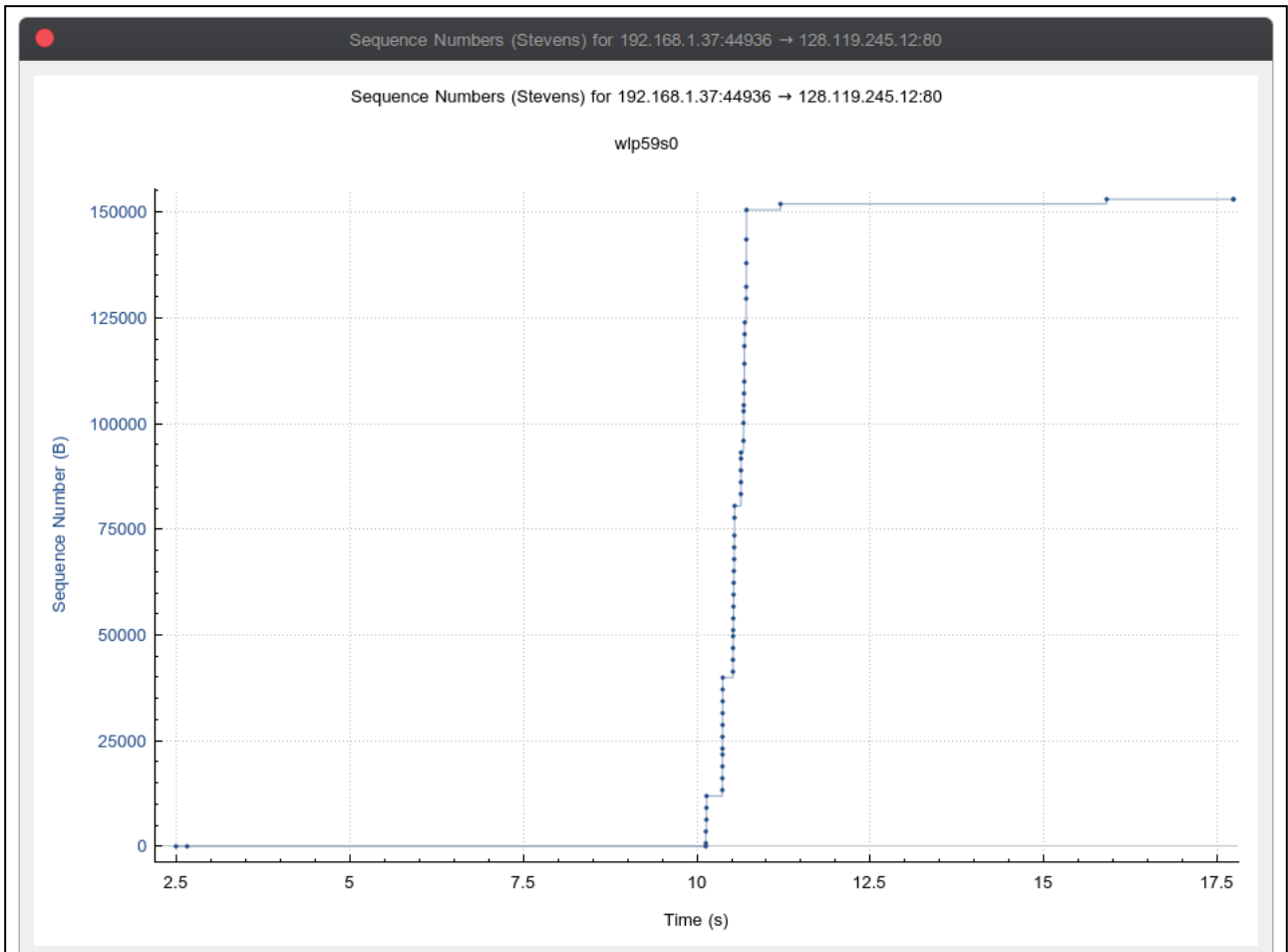
19...	10.712006413	128.119.245.12	192.168.1.37	TCP	66	80 → 44936 [ACK] Seq=1 Ack=72122 Win=178176 Len=0 TSval=2083793975 TSecr=3760655941
19...	10.713073030	192.168.1.37	128.119.245.12	TCP	5666	44936 → 80 [PSH, ACK] Seq=137922 Ack=1 Win=64256 Len=5600 TSval=3760656116 TSecr=2083793975
19...	10.713081272	192.168.1.37	128.119.245.12	TCP	7066	44936 → 80 [PSH, ACK] Seq=143522 Ack=1 Win=64256 Len=7000 TSval=3760656116 TSecr=2083793975
19...	10.714081402	192.168.1.37	128.119.245.12	HTTP	2587	POST /wireshark-labs/lab3-1-reply.htm HTTP/1.1 (text/plain)
19...	10.715507114	128.119.245.12	192.168.1.37	TCP	66	80 → 44936 [ACK] Seq=1 Ack=73522 Win=181120 Len=0 TSval=2083793977 TSecr=3760655941
19...	10.716592324	128.119.245.12	192.168.1.37	TCP	66	80 → 44936 [ACK] Seq=1 Ack=74922 Win=183296 Len=0 TSval=2083793980 TSecr=3760655943
19...	10.717158359	128.119.245.12	192.168.1.37	TCP	66	80 → 44936 [ACK] Seq=1 Ack=76322 Win=183296 Len=0 TSval=2083793981 TSecr=3760655943
19...	10.719519711	128.119.245.12	192.168.1.37	TCP	66	80 → 44936 [ACK] Seq=1 Ack=77722 Win=183296 Len=0 TSval=2083793984 TSecr=3760655943
19...	10.722701391	128.119.245.12	192.168.1.37	TCP	66	80 → 44936 [ACK] Seq=1 Ack=79122 Win=183296 Len=0 TSval=2083793985 TSecr=3760655945
19...	10.723379621	128.119.245.12	192.168.1.37	TCP	66	80 → 44936 [ACK] Seq=1 Ack=80522 Win=183296 Len=0 TSval=2083793987 TSecr=3760655945
19...	10.786130518	128.119.245.12	192.168.1.37	TCP	66	80 → 44936 [ACK] Seq=1 Ack=81922 Win=183296 Len=0 TSval=2083794048 TSecr=3760655947
▶ Frame 1934: 2587 bytes on wire (20696 bits), 2587 bytes captured (20696 bits) on interface wlp590e, id 0 ▶ Ethernet II, Src: IntelCor_e9:7d:2f (dc:fb:48:e9:7d:2f), Dst: HuaweiTe_d0:3c:60 (f8:23:b2:d0:3c:60) ▶ Internet Protocol Version 4, Src: 192.168.1.37, Dst: 128.119.245.12 ▶ Transmission Control Protocol, Src Port: 44936, Dst Port: 80, Seq: 150522, Ack: 1, Len: 2521 ▶ [52 Reassembled TCP Segments (153042 bytes): #1753(721), #1754(2800), #1755(2800), #1772(2800), #1773(2800), #1774(1400), #1806(2800), #1811(2800), #1823(2800)] ▶ Hypertext Transfer Protocol ▶ MIME Multipart Media Encapsulation, Type: multipart/form-data, Boundary: "----WebKitFormBoundaryAVhs2ALAMuXQcLd"						

## TCP Congestion Control In Action

13. Use the Time-Sequence-Graph(Stevens) plotting tool to view the sequence number versus time plot of segments being sent from the client to the gaia.cs.umass.edu server. Can you identify where TCP's slowstart phase begins and ends, and where congestion avoidance takes over? Comment on ways in which the measured data differs from the idealized behavior of TCP that we've studied in the text.

**The slowstart begins at 2.6 sec and ends at 10.13 sec.**

**10.13-2.6 = 7.53 sec**



(tcp) && ((ip.dst == 192.168.1.37 && ip.src == 128.119.245.12) || (ip.dst == 128.119.245.12 && ip.src == 192.168.1.37))

Packet list Narrow & Wide Case sensitive String post

No.	Time	Source	Destination	Protocol	Length	Info
998	2.655654211	192.168.1.37	128.119.245.12	TCP	66	44936 → 80 [ACK] Seq=1 Ack=1 Win=64256 Len=0 TSval=3760648058 TSecr=2083785919
1047	2.792911012	128.119.245.12	192.168.1.37	TCP	66	80 → 44934 [ACK] Seq=1 Ack=486 Win=30080 Len=0 TSval=2083786056 TSecr=3760648051
1053	2.795918242	128.119.245.12	192.168.1.37	HTTP	2260	HTTP/1.1 200 OK (text/html)
1054	2.795964407	192.168.1.37	128.119.245.12	TCP	66	44934 → 80 [ACK] Seq=486 Ack=2105 Win=62080 Len=0 TSval=3760648109 TSecr=2083786057
1076	2.953163488	192.168.1.37	128.119.245.12	HTTP	483	GET /favicon.ico
1080	3.097142757	128.119.245.12	192.168.1.37	HTTP	550	HTTP/1.1 404
1087	3.097143020	128.119.245.12	192.168.1.37	TCP	66	44934 → 80
1609	8.101346500	128.119.245.12	192.168.1.37	TCP	66	80 → 44934
1671	8.141735826	192.168.1.37	128.119.245.12	TCP	66	44934 → 80
1691	9.065624507	192.168.1.37	128.119.245.12	TCP	66	44934 → 80
1731	10.110281772	128.119.245.12	192.168.1.37	TCP	66	80 → 44934
1745	10.128240213	192.168.1.37	128.119.245.12	TCP	74	44944 → 80
1753	10.130530235	192.168.1.37	128.119.245.12	TCP	787	44936 → 80
1754	10.130637516	192.168.1.37	128.119.245.12	TCP	2866	44936 → 80
1755	10.130648759	192.168.1.37	128.119.245.12	TCP	2866	44936 → 80
1772	10.130581300	192.168.1.37	128.119.245.12	TCP	2866	44936 → 80
1773	10.130524725	192.168.1.37	128.119.245.12	TCP	2866	44936 → 80
1774	10.130762282	192.168.1.37	128.119.245.12	TCP	1466	44936 → 80
1797	10.367350426	128.119.245.12	192.168.1.37	TCP	74	80 → 44944
1800	10.367362319	128.119.245.12	192.168.1.37	TCP	66	80 → 44936
1810	10.367362599	128.119.245.12	192.168.1.37	TCP	66	80 → 44936

Frame 1053: 2260 bytes on wire (18080 bits), 2260 bytes captured (18080 bits) on interface  
Ethernet II, Src: HuaweiTe\_d0:3c:60 (f8:23:b2:d0:3c:60), Dst: IntelCor\_e9:7d:2f (dc:19:1b:33:00:00)  
Internet Protocol Version 4, Src: 128.119.245.12, Dst: 192.168.1.37  
Transmission Control Protocol, Src Port: 80, Dst Port: 44934, Seq: 1, Ack: 486, Len: 0  
Hypertext Transfer Protocol  
Line-based text data: text/html (32 lines)  
<TITLE>Upload page for TCP Wireshark Lab</TITLE>\n  
<body bgcolor="#FFFFFF">\n  
<p><font face="Arial, Helvetica, sans-serif" size="4">Upload page for TCP Wireshark Lab<br>\n  
Computer Networking: A Top Down Approach, 6th edition</font><font face="Arial, Helvetica, sans-serif" size="4">Copyright 2012 J.F. Kurose and K.W. Ross, All Rights Reserved </font></p>\n  
<p><font face="Arial, Helvetica, sans-serif">If you have followed the instructions for the TCP Wireshark Lab, you have <i>already</i> downloaded an ASCII copy of \n Alice and Wonderland from <a href="http://gaia.cs.umass.edu/wireshark-labs/alice">http://gaia.cs.umass.edu/wireshark-labs/alice</a> and you also <i>already</i> have the Wireshark packet sniffer running and capturing packets on your computer.<br>\n</font>\n  
<FORM METHOD=post ACTION="http://gaia.cs.umass.edu/wireshark-labs/lab3-1-reply.htm">\n<p><font face="Arial, Helvetica, sans-serif">Click on the browse button below to select the directory/file name for the copy of alice.txt that is stored on your computer.</font>\n

Sequence Numbers (Stevens) for 192.168.1.37:44936 → 128.119.245.12:80

wlp59s0

Sequence Number (B)

Time (s)

Hover over the graph for details. → 58 pkts, 154 kB ← 82 pkts, 777 bytes

Type Time / Sequence (Stevens) Stream 21 Switch Direction

Mouse ☒ drags ☐ zooms

Help Close Save As...