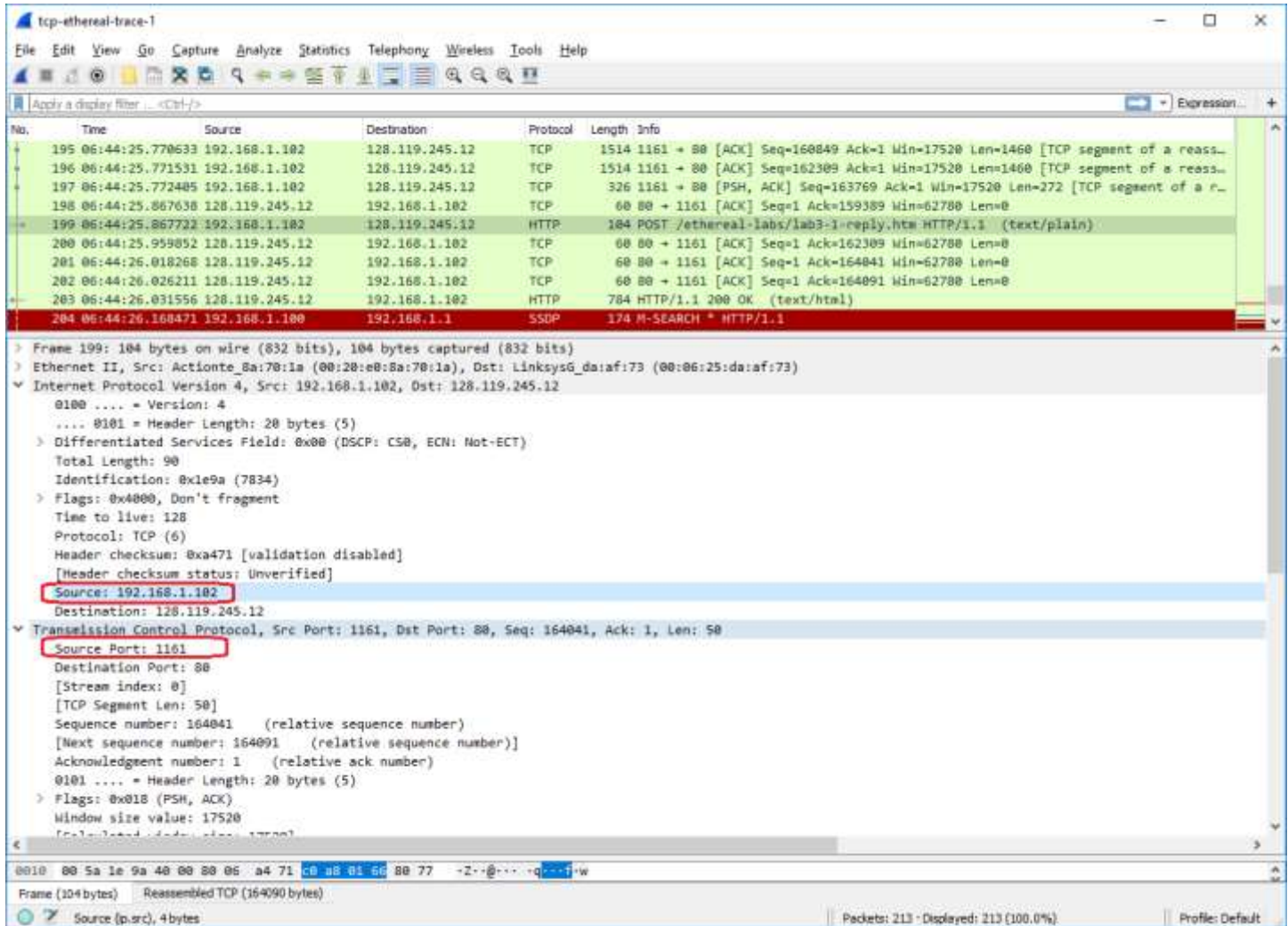


Lab 3: Wireshark

- 1) 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? To answer this question, it's probably easiest to select an HTTP message and explore the details of the TCP packet used to carry this HTTP message, using the "details of the selected packet header window" (refer to Figure 2 in the "Getting Started with Wireshark" Lab if you're uncertain about the Wireshark windows).

The source IP address for the client computer is 192.168.1.102 and the source TCP port is 1161.



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

The destination IP address for gaia.cs.umass.edu is 128.119.245.12 and the destination TCP port is 80.

The image shows a Wireshark packet capture analysis. The top pane displays a list of captured packets. The bottom pane shows a detailed view of a selected packet, including its Ethernet II header, Internet Protocol Version 4 header, and Transmission Control Protocol (TCP) header.

No.	Time	Source	Destination	Protocol	Length	Info
195	06:44:25.770633	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=160849 Ack=1 Win=17520 Len=1460 [TCP segment of a reas...
196	06:44:25.771531	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=162309 Ack=1 Win=17520 Len=1460 [TCP segment of a reas...
197	06:44:25.772405	192.168.1.102	128.119.245.12	TCP	326	1161 → 80 [PSH, ACK] Seq=163769 Ack=1 Win=17520 Len=272 [TCP segment of a r...
198	06:44:25.867638	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=159389 Win=62780 Len=0
199	06:44:25.867722	192.168.1.102	128.119.245.12	HTTP	104	POST /ethereal-labs/lab3-1-reply.htm HTTP/1.1 (text/plain)
200	06:44:25.959852	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=162309 Win=62780 Len=0
201	06:44:26.018268	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=164041 Win=62780 Len=0
202	06:44:26.026211	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=164091 Win=62780 Len=0
203	06:44:26.031556	128.119.245.12	192.168.1.102	HTTP	784	HTTP/1.1 200 OK (text/html)
204	06:44:26.168471	192.168.1.100	192.168.1.1	SSDP	174	M-SEARCH * HTTP/1.1

Packet 199 Details:

- Frame 199: 104 bytes on wire (832 bits), 104 bytes captured (832 bits)
- Ethernet II, Src: Actionte_8a:70:1a (00:20:e0:8a:70:1a), Dst: LinksysG_da:af:73 (00:06:25:da:af:73)
- Internet Protocol Version 4, Src: 192.168.1.102, Dst: 128.119.245.12
 - 0100 = Version: 4
 - ... 0101 = Header Length: 20 bytes (5)
 - Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
 - Total Length: 90
 - Identification: 0x1e9a (7834)
 - Flags: 0x4000, Don't fragment
 - Time to live: 128
 - Protocol: TCP (6)
 - Header checksum: 0xa471 [validation disabled]
 - [Header checksum status: Unverified]
 - Source: 192.168.1.102
 - Destination: 128.119.245.12
- Transmission Control Protocol, Src Port: 1161, Dst Port: 80, Seq: 164041, Ack: 1, Len: 50
 - Source Port: 1161
 - Destination Port: 80
 - [Stream index: 0]
 - [TCP Segment Len: 50]
 - Sequence number: 164041 (relative sequence number)
 - [Next sequence number: 164091 (relative sequence number)]
 - Acknowledgment number: 1 (relative ack number)
 - 0101 = Header Length: 20 bytes (5)
 - Flags: 0x018 (PSH, ACK)
 - Window size value: 17520
 - Control: 0000000000000000

Packet 199 Hex: 0010 00 5a 1e 9a 40 00 80 06 a4 71 c0 a8 01 86 00 77 -Z..@...-q...f..

Packet 199 ASCII: Frame (104 bytes) Reassembled TCP (164090 bytes)

Destination (p.dst), 4 bytes Packets: 213 - Displayed: 213 (100.0%) Profile: Default

3) If you have been able to create your own trace, answer the following question: What is the IP address and TCP port number used by your client computer (source) to transfer the file to gaia.cs.umass.edu?

The source IP address for my client computer is 192.168.10.2 and the source TCP port is 3901.

The image shows a Wireshark packet capture analysis of a TCP connection. The packet list at the top shows several packets, with packet 165 highlighted. The packet details pane shows the structure of the selected packet, which is a TCP segment. The packet bytes pane shows the raw data of the packet.

No.	Time	Source	Destination	Protocol	Length	Info
160	22:04:19.504354	192.168.10.2	128.119.245.12	TCP	1514	3901 → 80 [ACK] Seq=145943 Ack=1 Win=65536 Len=1460 [TCP segment of a reas...
161	22:04:19.504406	128.119.245.12	192.168.10.2	TCP	54	80 → 3901 [ACK] Seq=1 Ack=81002 Win=173696 Len=0
162	22:04:19.504431	192.168.10.2	128.119.245.12	TCP	1514	3901 → 80 [PSH, ACK] Seq=147403 Ack=1 Win=65536 Len=1460 [TCP segment of a ...]
163	22:04:19.504431	192.168.10.2	128.119.245.12	TCP	1514	3901 → 80 [ACK] Seq=148863 Ack=1 Win=65536 Len=1460 [TCP segment of a reas...
164	22:04:19.504434	192.168.10.2	128.119.245.12	TCP	1514	3901 → 80 [ACK] Seq=150323 Ack=1 Win=65536 Len=1460 [TCP segment of a reas...
165	22:04:19.504434	192.168.10.2	128.119.245.12	HTTP	1294	POST /wireshark-labs/lab3-1-reply.htm HTTP/1.1 (text/plain)
166	22:04:19.508299	128.119.245.12	192.168.10.2	TCP	54	80 → 3901 [ACK] Seq=1 Ack=83163 Win=182528 Len=0
167	22:04:19.508334	128.119.245.12	192.168.10.2	TCP	54	80 → 3901 [ACK] Seq=1 Ack=89003 Win=178560 Len=0
168	22:04:19.508351	128.119.245.12	192.168.10.2	TCP	54	80 → 3901 [ACK] Seq=1 Ack=91923 Win=182528 Len=0

Frame 165: 1294 bytes on wire (10352 bits), 1294 bytes captured (10352 bits) on interface 0

Ethernet II, Src: Tp-LinkT_01:1c:8a (18:d6:c7:61:1c:8a), Dst: AsustekC_c6:cb:00 (1c:b7:2c:c6:cb:00)

Internet Protocol Version 4, Src: 192.168.10.2, Dst: 128.119.245.12

0100 = Version: 4

.... 0101 = Header Length: 20 bytes (5)

> Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)

Total length: 1280

Identification: 0x511e (20766)

> Flags: 0x4000, Don't fragment

Time to live: 128

Protocol: TCP (6)

Header checksum: 0x0000 [validation disabled]

[Header checksum status: Unverified]

Source: 192.168.10.2

Destination: 128.119.245.12

Transmission Control Protocol, Src Port: 3901, Dst Port: 80, Seq: 151783, Ack: 1, Len: 1240

Source Port: 3901

Destination Port: 80

[Stream index: 6]

[TCP Segment Len: 1240]

Sequence number: 151783 (relative sequence number)

[Next sequence number: 153023 (relative sequence number)]

Acknowledgment number: 1 (relative ack number)

0010 05 00 51 1e 40 00 80 06 00 00 c0 a8 0a 02 80 77 --Q-@-...-...-w

0020 f5 0c 0f 3d 00 50 31 37 c4 fc 92 81 a1 3a 50 18 --...P17...-P-

0030 01 00 45 21 00 00 6f 6e 64 65 72 6c 61 6e 64 2c --E!-on derland,

0040 20 74 68 6f 75 67 68 20 73 68 65 20 6b 6e 65 77 though she knew

0050 20 73 68 65 20 68 61 64 20 62 75 74 20 74 6f 20 she had but to

0060 6f 70 65 6e 20 74 68 65 6d 20 61 67 61 69 6e 2c open the m again,

Frame (1294 bytes) Reassembled TCP (153022 bytes)

Source [p.src], 4 bytes

Packets: 265 - Displayed: 206 (77.7%) - Dropped: 0 (0.0%) Profile: Default

- 4) 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 of the TCP SYN segment used to initiate the TCP connection is 0. The flags field in the TCP SYN segment has the SYN bit set to 1, which identifies the segment as a SYN segment.

tcp-ethereal-trace-1

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Apply a display filter: <Ctrl>

No.	Time	Source	Destination	Protocol	Length	Info
1	06:44:20.570381	192.168.1.102	128.119.245.12	TCP	62	1161 → 80 [SYN] Seq=0 Win=16384 Len=0 MSS=1460 SACK_PERM=1
2	06:44:20.593553	128.119.245.12	192.168.1.102	TCP	62	80 → 1161 [SYN, ACK] Seq=0 Ack=1 Win=5840 Len=0 MSS=1460 SACK_PERM=1
3	06:44:20.593646	192.168.1.102	128.119.245.12	TCP	54	1161 → 80 [ACK] Seq=1 Ack=1 Win=17520 Len=0
4	06:44:20.596856	192.168.1.102	128.119.245.12	TCP	619	1161 → 80 [PSH, ACK] Seq=1 Ack=1 Win=17520 Len=565
5	06:44:20.612118	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [PSH, ACK] Seq=566 Ack=1 Win=17520 Len=1460
6	06:44:20.624318	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=566 Win=6788 Len=0
7	06:44:20.624407	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=2026 Ack=1 Win=17520 Len=1460
8	06:44:20.625071	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=3486 Ack=1 Win=17520 Len=1460
9	06:44:20.647675	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=2026 Win=8760 Len=0
10	06:44:20.647786	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=4946 Ack=1 Win=17520 Len=1460

Destination: 128.119.245.12

Transmission Control Protocol, Src Port: 1161, Dst Port: 80, Seq: 0, Len: 0

Source Port: 1161

Destination Port: 80

[Stream index: 0]

[TCP Segment Len: 0]

Sequence number: 0 (relative sequence number)

[Next sequence number: 0 (relative sequence number)]

Acknowledgment number: 0

0111 = Header Length: 28 bytes (7)

Flags: 0x002 (SYN)

0000 = 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

[Expert Info (Chat/Sequence): Connection establish request (SYN): server port 80]

[Connection establish request (SYN): server port 80]

[Severity level: Chat]

[Group: Sequence]

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

[TCP Flags:S.]

Window size value: 16384

0020 f5 0c 04 89 00 50 ad d8 01 f4 00 00 00 00 70 02P.....

0030 40 00 f6 e9 00 00 02 04 05 b4 01 01 04 02@.....

Sequence number (tcp.seq), 4 bytes

Packets: 215 · Displayed: 215 (100.0%)

Profile: Default

- 5) 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?

The sequence number of the SYNACK segment sent by gaia.cs.umass.edu to the client computer in reply to the SYN is 0. The value of the ACK field in the SYNACK segment is 1. gaia.cs.umass.edu determined the ACK value in the SYNACK segment by incrementing sequence number 0 that was received from the client computer to the ACK value 1. The 10-bit flags field in the TCP SYNACK segment has bit 0 set, which indicates that this is a SYN segment, and bit 3 set, which indicates that this is an ACK segment as well.

tcp-ethereal-trace-1

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Apply a display filter: <Ctrl> Expression...

No.	Time	Source	Destination	Protocol	Length	Info
1	06:44:20.570381	192.168.1.102	128.119.245.12	TCP	62	1161 → 80 [SYN] Seq=0 Win=16384 Len=0 MSS=1460 SACK_PERM=1
2	06:44:20.593553	128.119.245.12	192.168.1.102	TCP	62	80 → 1161 [SYN, ACK] Seq=0 Ack=1 Win=5840 Len=0 MSS=1460 SACK_PERM=1
3	06:44:20.593646	192.168.1.102	128.119.245.12	TCP	54	1161 → 80 [ACK] Seq=1 Ack=1 Win=17520 Len=0
4	06:44:20.596858	192.168.1.102	128.119.245.12	TCP	619	1161 → 80 [PSH, ACK] Seq=1 Ack=1 Win=17520 Len=565
5	06:44:20.612118	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [PSH, ACK] Seq=566 Ack=1 Win=17520 Len=1468
6	06:44:20.624518	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=566 Win=6788 Len=0
7	06:44:20.624487	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=2026 Ack=1 Win=17520 Len=1468
8	06:44:20.625071	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=3486 Ack=1 Win=17520 Len=1468
9	06:44:20.647675	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=2026 Win=6760 Len=0
10	06:44:20.647786	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=4946 Ack=1 Win=17520 Len=1468

Destination: 192.168.1.102

Transmission Control Protocol, Src Port: 80, Dst Port: 1161, Seq: 0, Ack: 1, Len: 0

Source Port: 80

Destination Port: 1161

[Stream index: 0]

[TCP Segment Len: 0]

Sequence number: 0 (relative sequence number)

Next sequence number: 0 (relative sequence number)

Acknowledgment number: 1 (relative ack number)

0111 = Header Length: 28 bytes (7)

Flags: 0x012 (SYN, ACK)

0000 = 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

[Expert Info (Chat/Sequence): Connection establish acknowledge (SYN+ACK): server port 80]

[Connection establish acknowledge (SYN+ACK): server port 80]

[Severity level: Chat]

[Group: Sequence]

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

[TCP Flags:A..S.]

Window size value: 5840

0020 01 66 00 50 04 89 b4 a2 74 1b 0d d6 01 f5 70 12 -f-P...4-t....p-

0030 16 d0 77 4d 00 00 02 04 05 b4 01 01 04 02 ...wll.....

Sequence number (tcp.seq), 4 bytes

Packets: 213 - Displayed: 213 (100.0%)

Profile: Default

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.

The screenshot shows the tcp-ethereal-trace-1 application. The top pane displays a list of network packets. The bottom pane shows a detailed view of a selected TCP segment (Sequence number: 1).

Packet List:

No.	Time	Source	Destination	Protocol	Len	Info
1	00:44:20.578881	192.168.1.102	128.119.245.12	TCP	62	1161 → 80 [SYN] Seq=0 Win=16384 Len=0 MSS=1460 SACK_PERM=1
2	00:44:20.595553	128.119.245.12	192.168.1.102	TCP	62	80 → 1161 [SYN, ACK] Seq=0 Ack=1 Win=5840 Len=0 MSS=1460 SACK_PERM=1
3	00:44:20.593646	192.168.1.102	128.119.245.12	TCP	54	1161 → 80 [ACK] Seq=1 Ack=1 Win=17520 Len=0
4	00:44:20.599858	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	00:44:20.611218	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [PSH, ACK] Seq=566 Ack=1 Win=17520 Len=1468 [TCP segment of a reassembled PDU]
6	00:44:20.624318	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=566 Win=6788 Len=0
7	00:44:20.624487	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=2026 Ack=1 Win=17520 Len=1468 [TCP segment of a reassembled PDU]
8	00:44:20.625071	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=5486 Ack=1 Win=17520 Len=1468 [TCP segment of a reassembled PDU]
9	00:44:20.647675	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=2026 Win=8768 Len=0
10	00:44:20.647788	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=4940 Ack=1 Win=17520 Len=1468 [TCP segment of a reassembled PDU]
11	00:44:20.648538	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=6486 Ack=1 Win=17520 Len=1468 [TCP segment of a reassembled PDU]
12	00:44:20.694466	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=5486 Win=11880 Len=0
13	00:44:20.694568	192.168.1.102	128.119.245.12	TCP	1281	1161 → 80 [PSH, ACK] Seq=7866 Ack=1 Win=17520 Len=1147 [TCP segment of a reassembled PDU]

Source Port: 1161
Destination Port: 80
[Stream index: 0]
[TCP Segment Len: 565]
Sequence number: 1 (relative sequence number)
[Next sequence number: 566 (relative sequence number)]
Acknowledgment number: 1 (relative ack number)
0101 = Header length: 20 bytes (5)
Flags: 0x01E (PSH, ACK)
Window size value: 17520
[Calculated window size: 17520]
Window size scaling factor: -2 (no window scaling used)
Checksum: 0x1fbd [unverified]
[Checksum Status: Unverified]
Urgent pointer: 0
[SEQ/ACK analysis]
[Timestamps]
TCP payload (565 bytes)
[Reassembled PDU in frame: 109]
TCP segment data (565 bytes)

Packet 109 (00:44:20.647788): 48 70 1f bd 00 00 50 4f 53 54 20 2f 05 78 68 05 Op=... [PSH, ACK] Seq=1

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)? At what time was each segment sent? When was the ACK for each segment received? 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? What is the EstimatedRTT value (see Section 3.5.3, page 242 in text) after the receipt of each ACK? Assume that the value of the EstimatedRTT is equal to the measured RTT for the first segment, and then is computed using the EstimatedRTT equation on page 242 for all subsequent segments. You should have a table that looks like this.

The frame numbers for the first 6 segments in the TCP connection are 4, 5, 7, 8, 10, 11, and the respective sequence numbers of the first six segments in the TCP connection are 1, 566, 2026, 3486, 4946, and 6406. The time for each segment since the capture started, when ACK was received, RTT value, and EstimatedRTT value after ACK receipt is:

Packet Number #	1	2	3	4	5	6
Time Sent	0.026477	0.041737	0.054026	0.05469	0.077405	0.078157
Time The Ack Received	0.053937	0.077294	0.124085	0.169118	0.217299	0.267802
SampleRTT	0.02746	0.035557	0.070059	0.114428	0.139894	0.189645
EstimatedRTT	0.02746	0.028472	0.03367	0.043765	0.055781	0.072514

$$\text{EstimatedRTT} = (1 - \alpha) \cdot \text{EstimatedRTT} + \alpha \cdot \text{SampleRTT}$$

The following shows the seqno for the first six TCP segments -

The screenshot displays the Wireshark network protocol analyzer interface. The top menu bar includes File, Edit, View, Go, Capture, Analyze, Statistics, Telephony, Wireless, Tools, and Help. The toolbar contains various icons for file operations, capture control, and analysis. The main display area is divided into three panes:

- Packet List:** Shows a list of captured packets. Packet 200 is highlighted, indicating it is the selected packet. It is a TCP segment from 192.168.1.102 to 192.168.1.100, with a sequence number of 1101 and a window size of 17920. The segment is marked as "ACK" and "RST".
- Packet Details:** Provides a hierarchical view of the selected packet's structure. It shows the Ethernet II header, Internet Protocol Version 4 header, and the reassembled TCP segment. The TCP segment details include the sequence number (1101), window size (17920), and the fact that it is a reassembled segment.
- Packet Bytes:** Displays the raw data of the selected packet in hexadecimal and ASCII. The data is shown in a table format, with the first column being the offset and the second column being the hexadecimal representation. The ASCII column shows the corresponding text, which appears to be a mix of control characters and printable text.

The status bar at the bottom indicates that the current packet is a TCP segment (164090 bytes) and that the display is showing 213 packets (100.0%).

tcp-ethereal-trace-1

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Apply a display filter: Expression

No.	Time	Source	Destination	Protocol	Length	Info
1	00:44:20.578361	192.168.1.102	128.119.245.12	TCP	62	1101 → 80 [SYN] Seq=0 win=16384 len=0 MSS=1460 SACK_PERM=1
2	00:44:20.593553	128.119.245.12	192.168.1.102	TCP	62	80 → 1101 [SYN, ACK] Seq=0 Ack=1 Win=65536 Len=0 MSS=1460 SACK_PERM=1
3	00:44:20.593646	192.168.1.102	128.119.245.12	TCP	54	1101 → 80 [ACK] Seq=1 Ack=1 Win=17520 Len=0
4	00:44:20.598050	192.168.1.102	128.119.245.12	TCP	518	1101 → 80 [PSH, ACK] Seq=1 Ack=1 Win=17520 Len=505 [TCP segment of a reassembled PDU]
5	00:44:20.612110	192.168.1.102	128.119.245.12	TCP	1514	1101 → 80 [PSH, ACK] Seq=566 Ack=1 Win=17520 Len=1400 [TCP segment of a reassembled PDU]
6	00:44:20.624310	128.119.245.12	192.168.1.102	TCP	60	80 → 1101 [ACK] Seq=1 Ack=566 Win=6780 Len=0
7	00:44:20.624407	192.168.1.102	128.119.245.12	TCP	1514	1101 → 80 [ACK] Seq=2026 Ack=1 Win=17520 Len=1468 [TCP segment of a reassembled PDU]
8	00:44:20.625871	192.168.1.102	128.119.245.12	TCP	1514	1101 → 80 [ACK] Seq=5486 Ack=1 Win=17520 Len=1468 [TCP segment of a reassembled PDU]
9	00:44:20.647675	128.119.245.12	192.168.1.102	TCP	60	80 → 1101 [ACK] Seq=1 Ack=2026 Win=8700 Len=0
10	00:44:20.647786	192.168.1.102	128.119.245.12	TCP	1514	1101 → 80 [ACK] Seq=4946 Ack=1 Win=17520 Len=1468 [TCP segment of a reassembled PDU]
11	00:44:20.648558	192.168.1.102	128.119.245.12	TCP	1514	1101 → 80 [ACK] Seq=6406 Ack=1 Win=17520 Len=1468 [TCP segment of a reassembled PDU]
12	00:44:20.694466	128.119.245.12	192.168.1.102	TCP	60	80 → 1101 [ACK] Seq=1 Ack=3486 Win=11680 Len=0
13	00:44:20.694566	192.168.1.102	128.119.245.12	TCP	1281	1101 → 80 [PSH, ACK] Seq=7808 Ack=1 Win=17520 Len=1147 [TCP segment of a reassembled PDU]

Transmission Control Protocol, Src Port: 1101, Dst Port: 80, Seq: 1, Ack: 1, Len: 505

Source Port: 1101
Destination Port: 80
[Stream index: 0]
[TCP Segment Len: 505]
Sequence number: 1 (relative sequence number)
[Next sequence number: 566 (relative sequence number)]
Acknowledgment number: 1 (relative ack number)
0101 = Header length: 20 bytes (5)
Flags: 0x01E (PSH, ACK)
Window size value: 17520
[Calculated window size: 17520]
[Window size scaling factor: -2 (no window scaling used)]
Checksum: 0x1fbd [unverified]
[Checksum Status: Unverified]
Urgent pointer: 0
[SEQ/ACK analysis]
[Timestamps]
TCP payload (505 bytes)
[Reassembled PDU in frame: 109]
TCP segment data (505 bytes)

0010 75 0c 04 00 00 50 0d 06 01 72 34 a2 7a 1a 50 18P.....a.t.P:
0020 44 70 1f bd 00 00 50 4f 53 54 20 2f 65 74 60 65 Dp....PO ST /ethe
0030 72 65 61 6c 2d 6c 61 62 73 2f 6c 61 62 33 2d 31 real-lab s/lab3-1
0040 2d 72 65 70 6c 70 2e 60 74 6d 20 40 54 54 50 2f -reply.h to HTTP/
0050 31 2e 31 8d 0a 40 6f 73 74 5a 20 67 61 00 61 2e I.I /Box t: gala.
0060 63 73 2e 73 6d 61 73 73 2e 65 64 75 0d 0a 55 73 cs.umass .edu /Us
0070 65 72 2d 41 67 65 6e 74 3a 20 4d 6f 7a 69 6c 6c er-Agent : Mozilla
0080 61 2f 35 2e 50 20 28 57 69 6e 64 6f 77 73 3b 20 a/5.0 (u indows;
0090 55 3b 20 57 69 5e 64 6f 77 73 20 4e 54 20 35 2e Uj Windo ws NT 5.
00a0 31 3b 20 65 6e 3d 55 53 3b 20 72 76 3a 31 2e 30 Ij en-US ; rv:1.0
00b0 2e 32 29 20 47 65 63 6b 6f 2f 32 30 30 33 30 32 .2) Gecko o/200302
00c0 30 30 20 4e 65 74 73 63 61 70 65 2f 37 2e 30 32 00 Netsc ape/7.02
00d0 8d 0a 41 63 63 65 70 74 3a 20 74 65 70 74 2f 70 -Accept : text/x

Sequence number (tcp.seq),

Packets: 213 · Displayed: 213 (100.0%) Profile: Defai

tcp-ethereal-trace-1

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Apply a display filter:

No.	Time	Source	Destination	Protocol	Length	Info
1	00:44:20.578381	192.168.1.102	128.119.245.12	TCP	62	1101 → 80 [SYN] Seq=0 Win=16384 Len=0 MSS=1460 SACK_PERM=1
2	00:44:20.593553	128.119.245.12	192.168.1.102	TCP	62	80 → 1101 [SYN, ACK] Seq=0 Ack=1 Win=65536 Len=0 MSS=1460 SACK_PERM=1
3	00:44:20.593648	192.168.1.102	128.119.245.12	TCP	54	1101 → 80 [ACK] Seq=1 Ack=1 Win=17520 Len=0
4	00:44:20.596058	192.168.1.102	128.119.245.12	TCP	610	1101 → 80 [PSH, ACK] Seq=1 Ack=1 Win=17520 Len=505 [TCP segment of a reassembled PDU]
5	00:44:20.612110	192.168.1.102	128.119.245.12	TCP	1514	1101 → 80 [PSH, ACK] Seq=566 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
6	00:44:20.624310	128.119.245.12	192.168.1.102	TCP	60	80 → 1101 [ACK] Seq=1 Ack=566 Win=6790 Len=0
7	00:44:20.624487	192.168.1.102	128.119.245.12	TCP	1514	1101 → 80 [ACK] Seq=2026 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
8	00:44:20.625871	192.168.1.102	128.119.245.12	TCP	1514	1101 → 80 [ACK] Seq=5486 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
9	00:44:20.647675	128.119.245.12	192.168.1.102	TCP	60	80 → 1101 [ACK] Seq=1 Ack=2026 Win=8700 Len=0
10	00:44:20.647786	192.168.1.102	128.119.245.12	TCP	1514	1101 → 80 [ACK] Seq=4946 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
11	00:44:20.648558	192.168.1.102	128.119.245.12	TCP	1514	1101 → 80 [ACK] Seq=6406 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
12	00:44:20.694466	128.119.245.12	192.168.1.102	TCP	60	80 → 1101 [ACK] Seq=1 Ack=3486 Win=11680 Len=0
13	00:44:20.694566	192.168.1.102	128.119.245.12	TCP	1281	1101 → 80 [PSH, ACK] Seq=7808 Ack=1 Win=17520 Len=1147 [TCP segment of a reassembled PDU]

Transmission Control Protocol, Src Port: 1101, Dst Port: 80, Seq: 566, Ack: 1, Len: 1460

Source Port: 1101
Destination Port: 80
[Stream index: 0]
[TCP Segment Len: 1460]
Sequence number: 566 (relative sequence number)
[Next sequence number: 2826 (relative sequence number)]
Acknowledgment number: 1 (relative ack number)
0101 = Header length: 20 bytes (5)
Flags: 0x01E (PSH, ACK)
Window size value: 17520
[Calculated window size: 17520]
[Window size scaling factor: -2 (no window scaling used)]
Checksum: 0x3be5 [unverified]
[Checksum Status: Unverified]
Urgent pointer: 0
[SEQ/ACK analysis]
[Timestamps]
TCP payload (1460 bytes)
[Reassembled PDU in frame: 139]
TCP segment data (1460 bytes)

0010 75 0c 04 09 00 50 0a 06 0a 2a 34 a2 7a 1a 50 18P...a.t.P:
0020 44 70 3b e5 00 00 43 0f 6e 74 65 6e 74 3d 54 79 Bp[...Co ntent-Ty
0030 70 65 1a 20 66 75 6c 74 69 70 61 72 74 2f 66 6f pe: mult ipart/fo
0040 72 6d 2d 64 01 74 61 3b 20 62 6f 75 6e 64 61 72 re-data: boundar
0050 70 3d 2d 2d 2d 2d 2d 2d 2d 2d 2d 2d 2d 2d 2d 2d y-----
0060 2d 2d 2d 2d 2d 2d 2d 2d 2d 2d 2d 2d 2d 2d 2d 2d -----265
0070 30 50 11 39 31 50 39 31 35 37 32 34 0d 0a 43 6f 00191691 5724 Co
0080 6e 74 65 6e 74 2d 4c 65 6e 87 74 08 3a 20 31 36 nteot-Le ngth: 16
0090 33 34 31 31 0d 0a 0a 0a 2d 2d 2d 2d 2d 2d 2d 2d 3411-----
00a0 2d 2d 2d 2d 2d 2d 2d 2d 2d 2d 2d 2d 2d 2d 2d 2d -----
00b0 2d 2d 2d 2d 2d 32 36 35 30 30 31 39 31 36 39 31 -----265 00191691
00c0 35 37 32 34 0d 0a 43 6f 6e 74 65 6e 74 2d 44 69 5724 Co ntent-DI
00d0 73 70 6f 73 69 74 69 6f 6e 3a 20 66 6f 72 6d 2d spositio n: fore-

Sequence number (tcp.seq),

Packets: 213 · Displayed: 213 (100.0%) Profile: Defai

tcp-ethereal-trace-1

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Apply a display filter:

No.	Time	Source	Destination	Protocol	Length	Info
1	00:44:20.578361	192.168.1.102	128.119.245.12	TCP	62	1101 → 80 [SYN] Seq=0 win=16384 len=0 MSS=1460 SACK_PERM=1
2	00:44:20.593553	128.119.245.12	192.168.1.102	TCP	62	80 → 1101 [SYN, ACK] Seq=0 Ack=1 Win=65536 Len=0 MSS=1460 SACK_PERM=1
3	00:44:20.593648	192.168.1.102	128.119.245.12	TCP	54	1101 → 80 [ACK] Seq=1 Ack=1 Win=17520 Len=0
4	00:44:20.596058	192.168.1.102	128.119.245.12	TCP	610	1101 → 80 [PSH, ACK] Seq=1 Ack=1 Win=17520 Len=505 [TCP segment of a reassembled PDU]
5	00:44:20.612118	192.168.1.102	128.119.245.12	TCP	1514	1101 → 80 [PSH, ACK] Seq=566 Ack=1 Win=17520 Len=1400 [TCP segment of a reassembled PDU]
6	00:44:20.624318	128.119.245.12	192.168.1.102	TCP	60	80 → 1101 [ACK] Seq=1 Ack=566 Win=6790 Len=0
7	00:44:20.634487	192.168.1.102	128.119.245.12	TCP	1514	1101 → 80 [ACK] Seq=2026 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
8	00:44:20.625871	192.168.1.102	128.119.245.12	TCP	1514	1101 → 80 [ACK] Seq=3486 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
9	00:44:20.647675	128.119.245.12	192.168.1.102	TCP	60	80 → 1101 [ACK] Seq=1 Ack=2026 Win=8700 Len=0
10	00:44:20.647786	192.168.1.102	128.119.245.12	TCP	1514	1101 → 80 [ACK] Seq=4946 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
11	00:44:20.648538	192.168.1.102	128.119.245.12	TCP	1514	1101 → 80 [ACK] Seq=6406 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
12	00:44:20.694466	128.119.245.12	192.168.1.102	TCP	60	80 → 1101 [ACK] Seq=1 Ack=3486 Win=11680 Len=0
13	00:44:20.694566	192.168.1.102	128.119.245.12	TCP	1281	1101 → 80 [PSH, ACK] Seq=7808 Ack=1 Win=17520 Len=1147 [TCP segment of a reassembled PDU]

Transmission Control Protocol, Src Port: 1101, Dst Port: 80, Seq: 2026, Ack: 1, Len: 1460

Source Port: 1101
Destination Port: 80
[Stream index: 0]
[TCP Segment Len: 1460]
Sequence number: 2026 (relative sequence number)
[Next sequence number: 3486 (relative sequence number)]
Acknowledgment number: 1 (relative ack number)
0101 = Header length: 20 bytes (5)
Flags: 0x010 (ACK)
Window size value: 17520
[Calculated window size: 17520]
[Window size scaling factor: -2 (no window scaling used)]
Checksum: 0xb58e [unverified]
[Checksum Status: Unverified]
Urgent pointer: 0
[SEQ/ACK analysis]
[Timestamps]
TCP payload (1460 bytes)
[Reassembled PDU in frame 139](#)
TCP segment data (1460 bytes)

```

0010  75 0c 04 09 00 50 01 06 00 00 34 a2 7a 1a 50 10  ....P...a.t.P.
0020  44 70 09 0e 00 00 04 0a 0d 0a 57 65 20 61 72 65  Dp-----We are
0030  20 6e 6f 77 20 74 72 79 69 6e 67 20 74 6f 20 72  now try ing to r
0040  65 6c 65 61 73 65 20 61 6c 6c 20 6f 75 72 20 62  elease a ll our b
0050  6f 6f 6b 75 20 6f 6e 65 20 6d 6f 6e 74 68 20 69  ooks one month i
0060  6e 20 61 64 76 61 6e 65 65 6d 8a 6f 66 20 74 68  n advanc e of th
0070  65 20 6f 66 66 69 63 69 61 6c 20 72 65 6c 65 61  e offici al relea
0080  73 65 20 64 61 74 65 75 2c 20 66 6f 72 20 74 69  se dates , for ti
0090  6d 65 20 66 6f 72 20 62 65 74 74 65 72 20 65 64  ee for b etter ed
00a0  69 74 69 6e 67 2e 20 20 57 65 00 00 60 61 76 65  iting. We have
00b0  20 74 68 69 73 20 61 73 28 61 20 6f 6f 61 6c 20  this as a goal
00c0  74 6f 20 61 63 63 6f 6d 70 6c 69 73 68 20 62 79  to accom plish by
00d0  20 74 68 65 20 65 6e 64 20 6f 66 20 74 68 65 20  the end of the

```

Sequence number (tcp.seq),

Packets: 213 · Displayed: 213 (100.0%)

Profile: Defai

tcp-ethereal-trace-1

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Apply a display filter: Expression

No.	Time	Source	Destination	Protocol	Length	Info
1	00:44:20.578381	192.168.1.102	128.119.245.12	TCP	62	1101 → 80 [SYN] Seq=0 Win=16384 Len=0 MSS=1460 SACK_PERM=1
2	00:44:20.593553	128.119.245.12	192.168.1.102	TCP	62	80 → 1101 [SYN, ACK] Seq=0 Ack=1 Win=65536 Len=0 MSS=1460 SACK_PERM=1
3	00:44:20.593648	192.168.1.102	128.119.245.12	TCP	54	1101 → 80 [ACK] Seq=1 Ack=1 Win=17520 Len=0
4	00:44:20.596058	192.168.1.102	128.119.245.12	TCP	810	1101 → 80 [PSH, ACK] Seq=1 Ack=1 Win=17520 Len=505 [TCP segment of a reassembled PDU]
5	00:44:20.612118	192.168.1.102	128.119.245.12	TCP	1514	1101 → 80 [PSH, ACK] Seq=566 Ack=1 Win=17520 Len=1400 [TCP segment of a reassembled PDU]
6	00:44:20.624318	128.119.245.12	192.168.1.102	TCP	60	80 → 1101 [ACK] Seq=1 Ack=566 Win=6780 Len=0
7	00:44:20.624497	192.168.1.102	128.119.245.12	TCP	1514	1101 → 80 [ACK] Seq=2026 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
8	00:44:20.825871	192.168.1.102	128.119.245.12	TCP	1514	1101 → 80 [ACK] Seq=3486 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
9	00:44:20.847675	128.119.245.12	192.168.1.102	TCP	60	80 → 1101 [ACK] Seq=1 Ack=2026 Win=8760 Len=0
10	00:44:20.847786	192.168.1.102	128.119.245.12	TCP	1514	1101 → 80 [ACK] Seq=4946 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
11	00:44:20.848538	192.168.1.102	128.119.245.12	TCP	1514	1101 → 80 [ACK] Seq=6406 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
12	00:44:20.894466	128.119.245.12	192.168.1.102	TCP	60	80 → 1101 [ACK] Seq=1 Ack=3486 Win=11680 Len=0
13	00:44:20.894566	192.168.1.102	128.119.245.12	TCP	1281	1101 → 80 [PSH, ACK] Seq=7806 Ack=1 Win=17520 Len=1147 [TCP segment of a reassembled PDU]

Transmission Control Protocol, Src Port: 1101, Dst Port: 80, Seq: 3486, Ack: 1, Len: 1460

Source Port: 1101
Destination Port: 80
[Stream index: 0]
[TCP Segment Len: 1460]
Sequence number: 3486 (relative sequence number)
[Next sequence number: 4946 (relative sequence number)]
Acknowledgment number: 1 (relative ack number)
0101 = Header length: 20 bytes (5)
Flags: 0x010 (ACK)
Window size value: 17520
[Calculated window size: 17520]
[Window size scaling factor: -2 (no window scaling used)]
Checksum: 0x6001 [unverified]
[Checksum Status: Unverified]
Urgent pointer: 0
[SEQ/ACK analysis]
[Timestamps]
TCP payload (1460 bytes)
[Reassembled PDU in frame 139](#)
TCP segment data (1460 bytes)

```

0010  75 0c 04 09 00 50 0a 06 0f 52 34 92 74 1a 50 18  ....P...a.t.P
0020  44 70 0d 01 00 00 20 73 6f 6d 65 20 65 09 67 68  Dp....s one eigh
0030  74 20 74 65 78 74 0d 0a 66 60 6c 65 73 20 70 65  t text.. files pe
0040  72 20 6d 6f 6e 74 6d 1a 20 20 74 68 75 73 20 75  e month: thus u
0050  70 70 09 6e 67 20 6f 75 72 20 70 72 6f 64 75 63  pping ou r produc
0060  74 69 70 69 74 79 20 66 72 6f 6d 20 24 32 20 6d  tivity f rum $2 e
0070  09 6c 6c 09 6f 6e 2e 0d 8a 0d 8a 54 68 65 20 47  illion. ... The n
0080  6f 61 6c 20 6f 66 20 5b 72 6f 6a 65 63 74 28 47  oal of P roject B
0090  75 74 65 6e 62 65 72 67 28 69 73 28 74 6f 28 47  utenberg is to G
00a0  69 76 65 20 41 77 61 79 20 4f 6e 65 20 54 72 69  live Away One Tr1
00b0  6c 6c 69 6f 6e 20 45 74 65 70 74 0d 8a 46 69 6c  illion Et ext..Fl1
00c0  65 73 20 62 79 20 74 68 65 20 44 65 63 65 6d 62  es by th e Decemb
00d0  65 72 20 33 31 2c 20 32 30 30 31 2e 20 20 5b 31  er 31, 2 001. [1

```

Sequence number (tcp.seq), ... Packets: 213 · Displayed: 213 (100.0%) Profile: Defai

tcp-ethereal-trace-1

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Apply a display filter:

No.	Time	Source	Destination	Protocol	Length	Info
1	00:44:20.578381	192.168.1.102	128.119.245.12	TCP	62	1101 → 80 [SYN] Seq=0 win=16384 len=0 MSS=1460 SACK_PERM=1
2	00:44:20.593553	128.119.245.12	192.168.1.102	TCP	62	80 → 1101 [SYN, ACK] Seq=0 Ack=1 Win=65536 Len=0 MSS=1460 SACK_PERM=1
3	00:44:20.593648	192.168.1.102	128.119.245.12	TCP	54	1101 → 80 [ACK] Seq=1 Ack=1 Win=17520 Len=0
4	00:44:20.596058	192.168.1.102	128.119.245.12	TCP	810	1101 → 80 [PSH, ACK] Seq=1 Ack=1 Win=17520 Len=505 [TCP segment of a reassembled PDU]
5	00:44:20.612118	192.168.1.102	128.119.245.12	TCP	1514	1101 → 80 [PSH, ACK] Seq=566 Ack=1 Win=17520 Len=1400 [TCP segment of a reassembled PDU]
6	00:44:20.624318	128.119.245.12	192.168.1.102	TCP	60	80 → 1101 [ACK] Seq=1 Ack=566 Win=6780 Len=0
7	00:44:20.624487	192.168.1.102	128.119.245.12	TCP	1514	1101 → 80 [ACK] Seq=2026 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
8	00:44:20.625871	192.168.1.102	128.119.245.12	TCP	1514	1101 → 80 [ACK] Seq=5488 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
9	00:44:20.647675	128.119.245.12	192.168.1.102	TCP	60	80 → 1101 [ACK] Seq=1 Ack=2026 Win=8700 Len=0
10	00:44:20.647786	192.168.1.102	128.119.245.12	TCP	1514	1101 → 80 [ACK] Seq=4946 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
11	00:44:20.648538	192.168.1.102	128.119.245.12	TCP	1514	1101 → 80 [ACK] Seq=6406 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
12	00:44:20.694466	128.119.245.12	192.168.1.102	TCP	60	80 → 1101 [ACK] Seq=1 Ack=3486 Win=11680 Len=0
13	00:44:20.694566	192.168.1.102	128.119.245.12	TCP	1281	1101 → 80 [PSH, ACK] Seq=7808 Ack=1 Win=17520 Len=1147 [TCP segment of a reassembled PDU]

Transmission Control Protocol, Src Port: 1101, Dst Port: 80, Seq: 4946, Ack: 1, Len: 1460

Source Port: 1101
Destination Port: 80
[Stream index: 0]
[TCP Segment Len: 1460]
Sequence number: 4946 (relative sequence number)
[Next sequence number: 6406 (relative sequence number)]
Acknowledgment number: 1 (relative ack number)
0101 = Header length: 20 bytes (5)
Flags: 0x010 (ACK)
Window size value: 17520
[Calculated window size: 17520]
[Window size scaling factor: -2 (no window scaling used)]
Checksum: 0x980e [unverified]
[Checksum Status: Unverified]
Urgent pointer: 0
[SEQ/ACK analysis]
[Timestamps]
TCP payload (1446 bytes)
Reassembled PDU in frame: 139
TCP segment data (1460 bytes)

```

0010  75 0c 04 09 00 50 0a 06 15 46 34 a2 7a 1a 50 18  ....P...a.t.P.
0020  44 70 90 0e 00 00 0f 06 20 62 6f 6f 6b 73 0d 0a  Dp...of books..
0030  61 6e 64 0d 0a 47 45 54 20 4e 45 57 20 47 55 54  and GET NEW GUT
0040  20 66 6f 72 20 67 65 6e 65 72 61 6c 20 69 6e 66  for gen eral inf
0050  6f 72 6d 61 74 80 6f 6e 6d 0a 61 6e 64 0d 0a 6d  ormati on and M
0060  47 45 54 20 47 35 54 2a 20 66 6f 72 20 6e 65 77  GET GUT* for new
0070  73 6c 65 74 74 65 72 75 2e 0d 0a 0d 0a 2a 2a 40  aletters .....!
0080  6e 66 6f 72 6d 61 74 69 6f 6e 20 70 72 65 70 61  nformati on prepa
0090  72 65 64 20 62 79 20 74 68 65 20 50 72 6f 6a 65  red by t he Proje
00a0  63 74 20 47 75 74 65 6e 62 65 72 67 20 6c 65 67  ct Guten berg leg
00b0  61 6c 20 61 64 76 69 73 6f 72 2a 2a 0d 0a 28 54  al advi s or*** (T
00c0  60 72 65 65 20 50 61 67 65 73 29 0d 0a 0d 0a 0d  hree Pag es) ....
00d0  0a 2a 2a 2a 53 54 41 52 54 2a 2a 54 48 45 20 53  ***STAR ***THE S

```

Sequence number (tcp.seq), Packets: 213 · Displayed: 213 (100.0%) Profile: Defai

tcp-ethereal-trace-1

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Apply a display filter: Expression:

No.	Time	Source	Destination	Protocol	Length	Info
1	00:44:20.578381	192.168.1.102	128.119.245.12	TCP	62	1101 → 80 [SYN] Seq=0 win=16384 len=0 MSS=1460 SACK_PERM=1
2	00:44:20.593553	128.119.245.12	192.168.1.102	TCP	62	80 → 1101 [SYN, ACK] Seq=0 Ack=1 Win=65536 Len=0 MSS=1460 SACK_PERM=1
3	00:44:20.593648	192.168.1.102	128.119.245.12	TCP	54	1101 → 80 [ACK] Seq=1 Ack=1 Win=17520 Len=0
4	00:44:20.596058	192.168.1.102	128.119.245.12	TCP	610	1101 → 80 [PSH, ACK] Seq=1 Ack=1 Win=17520 Len=505 [TCP segment of a reassembled PDU]
5	00:44:20.612118	192.168.1.102	128.119.245.12	TCP	1514	1101 → 80 [PSH, ACK] Seq=566 Ack=1 Win=17520 Len=1400 [TCP segment of a reassembled PDU]
6	00:44:20.624318	128.119.245.12	192.168.1.102	TCP	60	80 → 1101 [ACK] Seq=1 Ack=566 Win=6780 Len=0
7	00:44:20.624487	192.168.1.102	128.119.245.12	TCP	1514	1101 → 80 [ACK] Seq=2026 Ack=1 Win=17520 Len=1400 [TCP segment of a reassembled PDU]
8	00:44:20.825871	192.168.1.102	128.119.245.12	TCP	1514	1101 → 80 [ACK] Seq=5400 Ack=1 Win=17520 Len=1400 [TCP segment of a reassembled PDU]
9	00:44:20.847675	128.119.245.12	192.168.1.102	TCP	60	80 → 1101 [ACK] Seq=1 Ack=2026 Win=8700 Len=0
10	00:44:20.847786	192.168.1.102	128.119.245.12	TCP	1514	1101 → 80 [ACK] Seq=4946 Ack=1 Win=17520 Len=1400 [TCP segment of a reassembled PDU]
11	00:44:20.848538	192.168.1.102	128.119.245.12	TCP	1514	1101 → 80 [ACK] Seq=6400 Ack=1 Win=17520 Len=1400 [TCP segment of a reassembled PDU]
12	00:44:20.694466	128.119.245.12	192.168.1.102	TCP	60	80 → 1101 [ACK] Seq=1 Ack=3486 Win=11600 Len=0
13	00:44:20.694566	192.168.1.102	128.119.245.12	TCP	1281	1101 → 80 [PSH, ACK] Seq=7808 Ack=1 Win=17520 Len=1147 [TCP segment of a reassembled PDU]

Transmission Control Protocol, Src Port: 1101, Dst Port: 80, Seq: 6400, Ack: 1, Len: 1400

Source Port: 1101
Destination Port: 80
[Stream index: 0]
[TCP Segment Len: 1400]
Sequence number: 6400 (relative sequence number)
[Next sequence number: 7808 (relative sequence number)]
Acknowledgment number: 1 (relative ack number)
0101 = Header length: 20 bytes (5)
Flags: 0x010 (ACK)
Window size value: 17520
[Calculated window size: 17520]
[Window size scaling factor: -2 (no window scaling used)]
Checksum: 0x9583 [unverified]
[Checksum Status: Unverified]
Urgent pointer: 0
[SEQ/ACK analysis]
[Timestamps]
TCP payload (1400 bytes)
[Reassembled PDU in frame: 139]
TCP segment data (1400 bytes)

```

0010  75 0c 04 09 00 50 01 06 1a 72 34 a2 7a 1a 50 18  ....P...a.t.P
0020  44 70 95 83 00 00 20 55 6e 69 74 65 64 28 53 74  Dp....United St
0030  61 74 65 73 20 63 6f 70 79 72 69 67 68 74 8d 0a  ates cop yright
0040  6f 6e 20 6f 72 20 06 0f 72 20 74 08 09 73 20 77  on or fo r this w
0050  6f 72 6b 2c 20 73 6f 20 74 60 05 20 58 72 6f 6a  ork, ac the Prof
0060  69 63 74 20 28 61 6e 04 20 70 6f 75 21 29 20 63  ect (and you) c
0070  61 6e 20 63 6f 70 79 20 61 6e 64 0d 0a 64 89 73  an copy and dis
0080  74 72 69 62 75 74 65 20 69 74 20 69 6e 20 74 68  tribute It in th
0090  65 20 55 6e 69 74 65 64 20 53 74 61 74 65 73 20  e United States
00a0  77 69 74 68 6f 75 74 20 70 65 72 6d 69 73 73 69  without permissi
00b0  6f 6e 20 61 6e 64 0d 0a 77 69 74 68 6f 75 74 20  on and without
00c0  70 61 79 69 6e 67 20 63 6f 70 79 72 69 67 68 74  paying c opyright
00d0  20 72 6f 79 61 8c 74 69 65 73 2e 20 20 53 78 65  royalty es. Spe

```

Sequence number (tcp.seq), Packets: 213 · Displayed: 213 (100.0%) Profile: Defai

The following shows the time delta since the capture started for the first 6 TCP segments –

tcp-ethereal-trace-1

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Apply a display filter: <Ctrl-F> Expression...

No.	Time	Source	Destination	Protocol	Length	Info
1	00:44:20.578981	192.168.1.102	128.119.245.12	TCP	62	1161 → 80 [SYN] Seq=0 Win=16384 Len=0 MSS=1460 SACK_PERM=1
2	00:44:20.595553	128.119.245.12	192.168.1.102	TCP	62	80 → 1161 [SYN, ACK] Seq=0 Ack=1 Win=5840 Len=0 MSS=1460 SACK_PERM=1
3	00:44:20.593646	192.168.1.102	128.119.245.12	TCP	54	1161 → 80 [ACK] Seq=1 Ack=1 Win=17520 Len=0
4	00:44:20.596850	192.168.1.102	128.119.245.12	TCP	619	1161 → 80 [PSH, ACK] Seq=1 Ack=1 Win=17520 Len=569 [TCP segment of a reassembled PDU]
5	00:44:20.612118	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [PSH, ACK] Seq=569 Ack=1 Win=17520 Len=1468 [TCP segment of a reassembled PDU]
6	00:44:20.624318	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=566 Win=6788 Len=0
7	00:44:20.624487	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=2026 Ack=1 Win=17520 Len=1468 [TCP segment of a reassembled PDU]
8	00:44:20.625071	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=5400 Ack=1 Win=17520 Len=1468 [TCP segment of a reassembled PDU]
9	00:44:20.647675	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=2026 Win=8760 Len=0
10	00:44:20.647706	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=4040 Ack=1 Win=17520 Len=1468 [TCP segment of a reassembled PDU]
11	00:44:20.648538	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=6486 Ack=1 Win=17520 Len=1468 [TCP segment of a reassembled PDU]
12	00:44:20.694466	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=5400 Win=11880 Len=0
13	00:44:20.694568	192.168.1.102	128.119.245.12	TCP	1261	1161 → 80 [PSH, ACK] Seq=7866 Ack=1 Win=17520 Len=1147 [TCP segment of a reassembled PDU]

▼ Frame 4: 619 bytes on wire (4952 bits), 619 bytes captured (4952 bits) on interface 0
 Encapsulation type: Ethernet (1)
 Arrival Time: Aug 21, 2004 06:44:20.596850000 Pacific Daylight Time
 [Time shift for this packet: 0.000000000 seconds]
 Epoch Time: 1093095860.596850000 seconds
 [Time delta from previous captured frame: 0.003212000 seconds]
 [Time delta from previous displayed frame: 0.003212000 seconds]
 [Time since reference or first frame: 0.028477000 seconds]
 Frame Number: 4
 Frame Length: 619 bytes (4952 bits)
 Capture Length: 619 bytes (4952 bits)
 [Frame is marked: False]
 [Frame is ignored: False]
 [Protocols in frame: eth:ethertype:ip:tcp]
 [Coloring Rule Name: HTTP]
 [Coloring Rule String: http || tcp.port == 80 || http2]
 Ethernet II, Src: Actionte_8a:70:1a (00:20:e0:8a:70:1a), Dst: Linksys_6:da:a1:f3 (00:06:25:da:a1:f3)
 Internet Protocol Version 4, Src: 192.168.1.102, Dst: 128.119.245.12
 Transmission Control Protocol, Src Port: 1161, Dst Port: 80, Seq: 1, Ack: 1, Len: 569
 Source Port: 1161
 Destination Port: 80

0000 00 06 25 da af 73 00 20 e8 8a 70 1a 00 00 45 00 --S--s--p--E-
 0010 00 54 1e 21 40 00 00 00 a2 e7 c0 a0 01 66 80 77 -]-@------fw
 0020 75 0c 04 09 00 30 0d d6 01 f5 34 a2 7a 1a 50 18 ----P-----tP
 0030 44 70 1f bd 00 00 50 4f 55 54 20 2f 05 74 00 05 Dp---PD ST /eth
 0040 72 05 01 6c 2d 0c 01 02 75 2f 0c 01 02 35 2d 32 real-lab a/labS-1
 0050 2d 72 05 70 0c 70 2e 00 74 6d 20 48 54 54 30 2f -reply.h to HTTP/
 0060 31 2e 31 0d 0a 48 0f 75 74 5a 20 07 01 00 01 2e 1.1:Mes t: gaia.
 0070 63 73 2e 79 6d 01 73 75 2e 05 04 75 00 0a 55 73 cs.uconn .edu-US
 0080 65 72 2d 41 67 05 6e 74 3a 20 48 6f 7a 09 5c 6c er-Agent : Mozilla
 0090 61 2f 35 2e 30 20 28 57 69 6e 64 6f 77 73 30 20 a/S.0 (Windows)
 0100 55 30 28 57 69 6e 64 6f 77 73 20 4e 54 20 35 2e Uj Windows NT 5.
 0110 31 30 20 65 6e 2d 55 53 3b 20 72 76 3a 31 2e 30 kj en-US ;rv:1.0
 0120 2e 32 29 20 47 05 63 4b 6f 2f 32 30 30 35 30 32 .2) Gecko/200302

Time relative to time reference or first frame (frame.0) Packets: 213 / Displayed: 213 (100.0%) Profile: Default

tcp-ethereal-trace-1

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Apply a display filter: <Ctrl>F

No.	Time	Source	Destination	Protocol	Length	Info
1	00:44:20.578881	192.168.1.102	128.119.245.12	TCP	62	1161 → 80 [SYN] Seq=0 Win=16384 Len=0 MSS=1460 SACK_PERM=1
2	00:44:20.595553	128.119.245.12	192.168.1.102	TCP	62	80 → 1161 [SYN, ACK] Seq=0 Ack=1 Win=5840 Len=0 MSS=1460 SACK_PERM=1
3	00:44:20.593646	192.168.1.102	128.119.245.12	TCP	54	1161 → 80 [ACK] Seq=1 Ack=1 Win=17520 Len=0
4	00:44:20.596850	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	00:44:20.612118	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	00:44:20.624318	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=566 Win=6788 Len=0
7	00:44:20.624487	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	00:44:20.625071	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=5400 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
9	00:44:20.647675	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=2026 Win=8760 Len=0
10	00:44:20.647706	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=4040 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
11	00:44:20.648538	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]
12	00:44:20.694466	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=5400 Win=11800 Len=0
13	00:44:20.694508	192.168.1.102	128.119.245.12	TCP	1281	1161 → 80 [PSH, ACK] Seq=7866 Ack=1 Win=17520 Len=1147 [TCP segment of a reassembled PDU]

▼ Frame 5: 1514 bytes on wire (12112 bits), 1514 bytes captured (12112 bits) on interface 0

Encapsulation type: Ethernet (1)

Arrival Time: Aug 21, 2004 06:44:20.612118000 Pacific Daylight Time

[Time shift for this packet: 0.000000000 seconds]

Epoch Time: 1093095860.612118000 seconds

[Time delta from previous captured frame: 0.015260000 seconds]

[Time delta from previous displayed frame: 0.015260000 seconds]

[Time since reference or first frame: 0.041737000 seconds]

Frame Number: 5

Frame Length: 1514 bytes (12112 bits)

Capture Length: 1514 bytes (12112 bits)

[Frame is marked: False]

[Frame is ignored: False]

[Protocols in frame: eth:ethertype:ip:tcp]

[Coloring Rule Name: HTTP]

[Coloring Rule String: http || tcp.port == 80 || http2]

▼ Ethernet II, Src: Actionte_8a:70:1a (00:20:e0:8a:70:1a), Dst: Linksys_6:da:a:f:73 (00:06:25:da:a:f:73)

▼ Internet Protocol Version 4, Src: 192.168.1.102, Dst: 128.119.245.12

▼ Transmission Control Protocol, Src Port: 1161, Dst Port: 80, Seq: 566, Ack: 1, Len: 1460

Source Port: 1161

Destination Port: 80

```

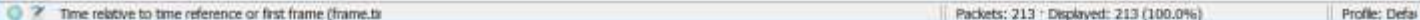
0000  00 06 25 da af 73 00 20 e0 8a 70 1a 00 00 45 00  ..S...g...E-
0010  05 dc 1e 22 40 00 00 00 9f 67 c0 a0 01 66 80 77  ...@...g...fw
0020  75 0c 04 09 00 00 02 d6 04 2a 34 a2 7a 1a 50 18  ...P...A...t:P
0030  44 70 3b e3 00 00 43 0f 6e 74 65 6e 74 2d 54 79  Dp...Content-Ty
0040  70 65 3a 20 6d 75 6c 74 09 70 61 72 74 2f 66 6f  pe: multipart/fo
0050  72 64 2d 64 01 74 61 3b 28 62 6f 75 6e 64 01 72  re-data; boundar
0060  79 3d 2d 2d 2d 2d 2d 2d 2d 2d 2d 2d 2d 2d 2d 2d  y.....
0070  2d 2d 2d 2d 2d 2d 2d 2d 2d 2d 2d 2d 2d 2d 2d 2d  ....285
0080  30 30 31 39 31 36 39 31 35 37 32 34 0d 8a 43 6f  00191691 5724--Co
0090  6e 74 65 6e 74 2d 4c 65 6e 67 74 68 3a 20 31 36  ntent-Le ngth: 16
00a0  33 34 31 31 0d 8a 0d 8a 2d 2d 2d 2d 2d 2d 2d 2d  3411.....
00b0  2d 2d 2d 2d 2d 2d 2d 2d 2d 2d 2d 2d 2d 2d 2d 2d  ....
00c0  2d 2d 2d 2d 2d 32 36 35 30 30 31 39 31 36 39 31  ....265 00191691

```

Time relative to time reference or first frame (frame.0)

Packets: 213 · Displayed: 213 (100.0%)

Profile: Defai



tcp-ethereal-trace-1

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Apply a display filter: <Ctrl-F> Expression: OK Cancel

No.	Time	Source	Destination	Protocol	Length	Info
1	00:44:20.578881	192.168.1.102	128.119.245.12	TCP	62	1161 → 80 [SYN] Seq=0 Win=16384 Len=0 MSS=1460 SACK_PERM=1
2	00:44:20.595553	128.119.245.12	192.168.1.102	TCP	62	80 → 1161 [SYN, ACK] Seq=0 Ack=1 Win=5840 Len=0 MSS=1460 SACK_PERM=1
3	00:44:20.593646	192.168.1.102	128.119.245.12	TCP	54	1161 → 80 [ACK] Seq=1 Ack=1 Win=17520 Len=0
4	00:44:20.596850	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	00:44:20.612118	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [PSH, ACK] Seq=566 Ack=1 Win=17520 Len=1468 [TCP segment of a reassembled PDU]
6	00:44:20.624318	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=566 Win=6788 Len=0
7	00:44:20.624487	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=2026 Ack=1 Win=17520 Len=1468 [TCP segment of a reassembled PDU]
8	00:44:20.625071	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=5486 Ack=1 Win=17520 Len=1468 [TCP segment of a reassembled PDU]
9	00:44:20.647675	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=2026 Win=8768 Len=0
10	00:44:20.647706	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=4040 Ack=1 Win=17520 Len=1468 [TCP segment of a reassembled PDU]
11	00:44:20.648538	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=6486 Ack=1 Win=17520 Len=1468 [TCP segment of a reassembled PDU]
12	00:44:20.694466	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=5486 Win=11888 Len=0
13	00:44:20.694568	192.168.1.102	128.119.245.12	TCP	1281	1161 → 80 [PSH, ACK] Seq=7866 Ack=1 Win=17520 Len=1147 [TCP segment of a reassembled PDU]

▼ Frame 8: 1514 bytes on wire (12112 bits), 1514 bytes captured (12112 bits) on interface 0
 Encapsulation type: Ethernet II
 Arrival Time: Aug 21, 2004 06:44:20.625071000 Pacific Daylight Time
 [Time shift for this packet: 0.000000000 seconds]
 Epoch Time: 1093095860.625071000 seconds
 [Time delta from previous captured frame: 0.000664000 seconds]
 [Time delta from previous displayed frame: 0.000664000 seconds]
 [Time since reference or first frame: 0.054698000 seconds]
 Frame Number: 8
 Frame Length: 1514 bytes (12112 bits)
 Capture Length: 1514 bytes (12112 bits)
 [Frame is marked: False]
 [Frame is ignored: False]
 [Protocols in frame: eth:ethertype:ip:tcp]
 [Coloring Rule Name: HTTP]
 [Coloring Rule String: http || tcp.port == 80 || http2]
 Ethernet II, Src: Actionte_8a:70:1a (00:20:e0:8a:70:1a), Dst: Linksys_6:da:a:f73 (00:06:25:da:a:f73)
 Internet Protocol Version 4, Src: 192.168.1.102, Dst: 128.119.245.12
 Transmission Control Protocol, Src Port: 1161, Dst Port: 80, Seq: 5486, Ack: 1, Len: 1468
 Source Port: 1161
 Destination Port: 80

0000 00 06 25 da af 73 00 20 e0 8a 70 1a 00 00 45 00 --S--s--p--E-
 0010 05 dc 1e 24 40 00 00 00 9f 65 c0 a0 01 66 80 77 ---S---p---fw
 0020 75 0c 04 09 00 30 0d d6 0f 32 34 a2 7a 1a 50 38 ----P---(a)t:P
 0030 44 70 dd 02 00 00 20 73 6f 6d 65 20 05 08 67 63 Dp---s one eigh
 0040 74 20 74 05 78 74 0d 0a 66 09 6c 65 73 20 70 05 t text: files pe
 0050 72 20 dd 6f 6e 74 63 3e 20 20 74 08 75 75 20 75 r eenth: thus u
 0060 70 70 09 6e 07 20 6f 75 72 20 70 72 6f 64 75 63 pping do r produc
 0070 74 09 70 69 74 79 20 66 72 6f 6d 20 24 32 20 6d tivity f rom \$2 m
 0080 69 6c 6c 69 6f 6e 2e 0d 8a 0d 8a 54 68 65 20 47 lllion.---The 6
 0090 6f 63 6c 20 6f 66 20 50 72 6f 6a 65 63 74 20 47 oal of P roject 6
 0100 75 74 65 6e 62 65 72 67 20 69 73 20 74 6f 20 47 utenberg: is to 6
 0110 69 76 65 20 41 77 61 79 20 4f 6e 65 20 54 72 69 five Awey: One Tri
 0120 6c 6c 69 6f 6e 20 45 74 65 70 74 0d 8a 46 69 6c lllion Et ext:Fil

Time relative to time reference or first frame (frame 1) Packets: 213 / Displayed: 213 (100.0%) Profile: Defai

tcp-ethereal-trace-1

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Apply a display filter: <Ctrl>F

Expression: *

OK Cancel

No.	Time	Source	Destination	Protocol	Length	Info
1	00:44:20.578881	192.168.1.102	128.119.245.12	TCP	62	1161 → 80 [SYN] Seq=0 Win=16384 Len=0 MSS=1460 SACK_PERM=1
2	00:44:20.595553	128.119.245.12	192.168.1.102	TCP	62	80 → 1161 [SYN, ACK] Seq=0 Ack=1 Win=5840 Len=0 MSS=1460 SACK_PERM=1
3	00:44:20.593646	192.168.1.102	128.119.245.12	TCP	54	1161 → 80 [ACK] Seq=1 Ack=1 Win=17520 Len=0
4	00:44:20.596850	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	00:44:20.612118	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [PSH, ACK] Seq=566 Ack=1 Win=17520 Len=1468 [TCP segment of a reassembled PDU]
6	00:44:20.624318	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=566 Win=6788 Len=0
7	00:44:20.624487	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=2026 Ack=1 Win=17520 Len=1468 [TCP segment of a reassembled PDU]
8	00:44:20.625071	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=5400 Ack=1 Win=17520 Len=1468 [TCP segment of a reassembled PDU]
9	00:44:20.647675	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=2026 Win=8760 Len=0
10	00:44:20.647790	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=4940 Ack=1 Win=17520 Len=1468 [TCP segment of a reassembled PDU]
11	00:44:20.648538	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=6486 Ack=1 Win=17520 Len=1468 [TCP segment of a reassembled PDU]
12	00:44:20.694466	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=5486 Win=11880 Len=0
13	00:44:20.694568	192.168.1.102	128.119.245.12	TCP	1281	1161 → 80 [PSH, ACK] Seq=7866 Ack=1 Win=17520 Len=1147 [TCP segment of a reassembled PDU]

▼ Frame 10: 1514 bytes on wire (12112 bits), 1514 bytes captured (12112 bits) on eth0
 Encapsulation type: Ethernet (1)
 Arrival Time: Aug 21, 2004 05:44:20.647790000 Pacific Daylight Time
 [Time shift for this packet: 0.000000000 seconds]
 Epoch Time: 1093095860.647790000 seconds
 [Time delta from previous captured frame: 0.000110000 seconds]
 [Time delta from previous displayed frame: 0.000110000 seconds]
 [Time since reference or first frame: 0.077495000 seconds]
 Frame Number: 10
 Frame Length: 1514 bytes (12112 bits)
 Capture Length: 1514 bytes (12112 bits)
 [Frame is marked: False]
 [Frame is ignored: False]
 [Protocols in frame: eth:ethertype:ip:tcp]
 [Coloring Rule Name: HTTP]
 [Coloring Rule String: http || tcp.port == 80 || http2]
 Ethernet II, Src: Actionte_8a:70:1a (00:20:e0:8a:70:1a), Dst: Linksys_6:da:a:f73 (00:06:25:da:a:f73)
 Internet Protocol Version 4, Src: 192.168.1.102, Dst: 128.119.245.12
 Transmission Control Protocol, Src Port: 1161, Dst Port: 80, Seq: 4940, Ack: 1, Len: 1468
 Source Port: 1161
 Destination Port: 80

0000 00 06 25 da af 73 00 20 e0 8a 70 1a 00 00 45 00 --S--s--p--E-
 0010 05 dc 1e 25 40 00 00 00 9f 64 c0 a0 01 66 80 77 ---S---d---fw
 0020 75 0c 04 09 00 30 0d d6 15 46 34 a2 7a 1a 50 38 ----P---PAtP)
 0030 44 70 90 0a 00 00 6f 66 20 62 6f 6f 73 0d 0a Dp---of books--
 0040 61 6a 64 0d 0a 47 45 54 20 4e 45 57 20 47 55 54 and---GET NEW OUT
 0050 20 60 6f 72 20 67 65 6e 65 72 61 0c 20 69 6e 68 for gen eral inf
 0060 6f 72 6d 61 74 60 6f 6e 60 0a 61 6e 64 0d 0a 4d oration ---and--M
 0070 47 45 54 20 47 55 54 2a 20 60 6f 72 20 6e 65 77 GET OUT* for new
 0080 73 6c 65 74 74 65 72 75 2e 0d 0a 0d 0a 2a 2a 49 slotters: ---*I
 0090 6e 66 6f 72 60 61 74 69 6f 6e 20 70 72 65 70 61 nformati on prepe
 0100 72 65 64 20 62 70 70 74 68 65 20 50 72 6f 6a 65 red by t he Proje
 0110 63 74 20 47 75 7a 65 6e 62 65 72 67 20 6c 65 67 ct Guten berg leg
 0120 61 6c 20 61 64 76 69 75 6f 72 2a 2a 0d 0a 20 54 al advis or---T

Time relative to time reference or first frame (frame.1s) Packets: 213 / Displayed: 213 (100.0%) Profile: Defai

tcp-ethereal-trace-1						
File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help						
Apply a display filter: <Ctrl-F>						
Time		Type	Time (format as specified)	Fields	Enter a field ...	Occurs in
No.	Time	Source	Destination	Protocol	Len	Info
1	00:44:20.578981	192.168.1.102	128.119.245.12	TCP	62	1161 → 80 [SYN] Seq=0 Win=16384 Len=0 MSS=1460 SACK_PERM=1
2	00:44:20.593553	128.119.245.12	192.168.1.102	TCP	62	80 → 1161 [SYN, ACK] Seq=0 Ack=1 Win=5840 Len=0 MSS=1460 SACK_PERM=1
3	00:44:20.593046	192.168.1.102	128.119.245.12	TCP	54	1161 → 80 [ACK] Seq=1 Ack=1 Win=17520 Len=0
4	00:44:20.596850	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	00:44:20.612118	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [PSH, ACK] Seq=566 Ack=1 Win=17520 Len=1468 [TCP segment of a reassembled PDU]
6	00:44:20.624318	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=566 Win=6788 Len=0
7	00:44:20.624487	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=2026 Ack=1 Win=17520 Len=1468 [TCP segment of a reassembled PDU]
8	00:44:20.625071	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=3406 Ack=1 Win=17520 Len=1468 [TCP segment of a reassembled PDU]
9	00:44:20.647675	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=2026 Win=8768 Len=0
10	00:44:20.647706	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=4040 Ack=1 Win=17520 Len=1468 [TCP segment of a reassembled PDU]
11	00:44:20.648538	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=6486 Ack=1 Win=17520 Len=1468 [TCP segment of a reassembled PDU]
12	00:44:20.694466	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=3486 Win=11880 Len=0
13	00:44:20.694568	192.168.1.102	128.119.245.12	TCP	1281	1161 → 80 [PSH, ACK] Seq=7866 Ack=1 Win=17520 Len=1147 [TCP segment of a reassembled PDU]
Frame 11: 1514 bytes on wire (12112 bits), 1514 bytes captured (12112 bits)						
Encapsulation type: Ethernet (1)						
Arrival Time: Aug 21, 2004 06:44:20.648538000 Pacific Daylight Time						
[Time shift for this packet: 0.000000000 seconds]						
Epoch Time: 1093095860.648538000 seconds						
[Time delta from previous captured frame: 0.000752000 seconds]						
[Time delta from previous displayed frame: 0.000752000 seconds]						
[Time since reference or first frame: 0.078157000 seconds]						
Frame Number: 11						
Frame Length: 1514 bytes (12112 bits)						
Capture Length: 1514 bytes (12112 bits)						
[Frame is marked: False]						
[Frame is ignored: False]						
[Protocols in frame: eth:ethertype:ip:tcp]						
[Coloring Rule Name: HTTP]						
[Coloring Rule String: http tcp.port == 80 http2]						
Ethernet II, Src: Actionte_8a:70:1a (00:20:e0:8a:70:1a), Dst: LinksysG_daia:f7:73 (00:06:25:daia:f7:73)						
Internet Protocol Version 4, Src: 192.168.1.102, Dst: 128.119.245.12						
Transmission Control Protocol, Src Port: 1161, Dst Port: 80, Seq: 6486, Ack: 1, Len: 1468						
Source Port: 1161						
Destination Port: 80						
0000	00 06 25 da af 73 00 20	e8 8a 70 1a 00 00 45 00	..S...g...E-			
0010	05 dc 1e 20 40 00 00 00	9f 63 c0 a8 01 66 80 77	...@...c...fw			
0020	75 0c 04 09 00 30 0d d6	1a fa 34 a2 7a 1a 50 38P...t:P/			
0030	44 70 95 83 00 00 20 55	6e 69 74 65 64 20 53 74	Dp... United St			
0040	61 74 65 73 20 63 6f 70	70 72 69 67 68 74 6d 8a	ates cop yright			
0050	6f 6e 20 6f 72 20 06 6f	72 20 74 68 69 75 20 77	on or fo r this w			
0060	6f 72 6b 2c 20 73 6f 20	74 68 65 20 50 72 6f 6a	ork, so the Proj			
0070	65 63 74 20 28 61 6e 64	20 79 6f 75 21 29 20 63	ect (and you) c			
0080	61 6e 20 63 6f 70 79 20	61 6e 64 6d 8a 64 69 73	an copy and dis			
0090	74 72 69 62 75 74 65 20	69 74 20 69 6e 20 74 68	tribute It in th			
00a0	65 20 55 6e 69 74 65 64	20 53 74 61 61 74 65 73	e United States			
00b0	77 69 74 68 6f 75 74 20	70 65 72 6d 69 73 73 69	without permissi			
00c0	6f 6e 20 61 6e 64 6d 8a	77 69 74 68 6f 75 74 20	on and without			
Time relative to time reference or first frame (frame.1s)						
Packets: 213 · Displayed: 213 (100.0%)					Profile: Defai	

The following shows the time when the ACK was received from the server to client for the first 6 segments -

tcp-ethereal-trace-1

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Apply a display filter: <Ctrl-F>

No.	Time	Source	Destination	Protocol	Length	Info
1	00:44:20.578981	192.168.1.102	128.119.245.12	TCP	62	1161 → 80 [SYN] Seq=0 Win=16384 Len=0 MSS=1460 SACK_PERM=1
2	00:44:20.595553	128.119.245.12	192.168.1.102	TCP	62	80 → 1161 [SYN, ACK] Seq=0 Ack=1 Win=5840 Len=0 MSS=1460 SACK_PERM=1
3	00:44:20.593646	192.168.1.102	128.119.245.12	TCP	54	1161 → 80 [ACK] Seq=1 Ack=1 Win=17520 Len=0
4	00:44:20.596850	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	00:44:20.612118	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [PSH, ACK] Seq=566 Ack=1 Win=17520 Len=1468 [TCP segment of a reassembled PDU]
6	00:44:20.624318	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=566 Win=8768 Len=0
7	00:44:20.624407	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=2026 Ack=1 Win=17520 Len=1468 [TCP segment of a reassembled PDU]
8	00:44:20.625071	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=5400 Ack=1 Win=17520 Len=1468 [TCP segment of a reassembled PDU]
9	00:44:20.647675	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=2026 Win=8768 Len=0
10	00:44:20.647706	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=4040 Ack=1 Win=17520 Len=1468 [TCP segment of a reassembled PDU]
11	00:44:20.648538	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=6486 Ack=1 Win=17520 Len=1468 [TCP segment of a reassembled PDU]
12	00:44:20.694466	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=5400 Win=11800 Len=0
13	00:44:20.694568	192.168.1.102	128.119.245.12	TCP	1281	1161 → 80 [PSH, ACK] Seq=7666 Ack=1 Win=17520 Len=1147 [TCP segment of a reassembled PDU]

▼ Frame 6: 60 bytes on wire (480 bits), 60 bytes captured (480 bits) on interface 0
 Encapsulation type: Ethernet (1)
 Arrival Time: Aug 21, 2004 06:44:20.624318000 Pacific Daylight Time
 [Time shift for this packet: 0.000000000 seconds]
 Epoch Time: 1093095860.624318000 seconds
 [Time delta from previous captured frame: 0.012200000 seconds]
 [Time delta from previous displayed frame: 0.012200000 seconds]
 [Time since reference or first frame: 0.053937000 seconds]
 Frame Number: 6
 Frame Length: 60 bytes (480 bits)
 Capture Length: 60 bytes (480 bits)
 [Frame is marked: False]
 [Frame is ignored: False]
 [Protocols in frame: eth:ethertype:ip:tcp]
 [Coloring Rule Name: HTTP]
 [Coloring Rule String: http || tcp.port == 80 || http2]
 Ethernet II, Src: LinksysG_dslaf73 (00:06:25:d0af:73), Dst: Actiontec_Ba701a (00:20:e0:8a:70:1a)
 Internet Protocol Version 4, Src: 128.119.245.12, Dst: 192.168.1.102
 Transmission Control Protocol, Src Port: 80, Dst Port: 1161, Seq: 1, Ack: 566, Len: 0
 Source Port: 80
 Destination Port: 1161

```

0000  00 20 e0 8a 70 1a 00 06 25 d0 af 73 00 00 45 00  ...p...X...E-
0010  00 20 e0 8a 70 1a 00 06 b3 cb 08 77 f5 0c c0 ad  <Xr@-7...q...
0020  01 00 00 50 04 80 34 a2 76 1a 02 d6 04 2a 50 10  <fP...t...*P\
0030  1a 7c 9e 30 00 00 da 12 00 00 47 a5             <|>@....>@:
  
```

Time relative to time reference or first frame (frame.0)

Packets: 213 · Displayed: 213 (100.0%)

Profile: Defa

tcp-ethereal-trace-1

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Apply a display filter: <Ctrl>F

No.	Time	Source	Destination	Protocol	Length	Info
1	00:44:20.578881	192.168.1.102	128.119.245.12	TCP	62	1161 → 80 [SYN] Seq=0 Win=16384 Len=0 MSS=1460 SACK_PERM=1
2	00:44:20.595553	128.119.245.12	192.168.1.102	TCP	62	80 → 1161 [SYN, ACK] Seq=0 Ack=1 Win=5840 Len=0 MSS=1460 SACK_PERM=1
3	00:44:20.593046	192.168.1.102	128.119.245.12	TCP	54	1161 → 80 [ACK] Seq=1 Ack=1 Win=17520 Len=0
4	00:44:20.596850	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	00:44:20.612118	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [PSH, ACK] Seq=566 Ack=1 Win=17520 Len=1468 [TCP segment of a reassembled PDU]
6	00:44:20.624318	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=566 Win=6788 Len=0
7	00:44:20.624487	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=2026 Ack=1 Win=17520 Len=1468 [TCP segment of a reassembled PDU]
8	00:44:20.625071	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=5400 Ack=1 Win=17520 Len=1468 [TCP segment of a reassembled PDU]
9	00:44:20.647675	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=2026 Win=8768 Len=0
10	00:44:20.647738	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=4040 Ack=1 Win=17520 Len=1468 [TCP segment of a reassembled PDU]
11	00:44:20.648538	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=6486 Ack=1 Win=17520 Len=1468 [TCP segment of a reassembled PDU]
12	00:44:20.694466	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=5486 Win=11880 Len=0
13	00:44:20.694568	192.168.1.102	128.119.245.12	TCP	1281	1161 → 80 [PSH, ACK] Seq=7866 Ack=1 Win=17520 Len=1147 [TCP segment of a reassembled PDU]

▼ Frame 9: 60 bytes on wire (480 bits), 60 bytes captured (480 bits) on interface 0
 Encapsulation type: Ethernet (1)
 Arrival Time: Aug 21, 2004 06:44:20.647675000 Pacific Daylight Time
 [Time shift for this packet: 0.000000000 seconds]
 Epoch Time: 1093095860.647675000 seconds
 [Time delta from previous captured frame: 0.022684800 seconds]
 [Time delta from previous displayed frame: 0.022684800 seconds]
 [Time since reference or first frame: 0.077294800 seconds]
 Frame Number: 9
 Frame Length: 60 bytes (480 bits)
 Capture Length: 60 bytes (480 bits)
 [Frame is marked: False]
 [Frame is ignored: False]
 [Protocols in frame: eth:ethertype:ip:tcp]
 [Coloring Rule Name: HTTP]
 [Coloring Rule String: http || tcp.port == 80 || http2]

▼ Ethernet II, Src: LinksysG_dslaf73 (00:06:25:d0af:73), Dst: Actiontec_Ba701a (00:20:e0:8a:70:1a)
 ▼ Internet Protocol Version 4, Src: 128.119.245.12, Dst: 192.168.1.102
 ▼ Transmission Control Protocol, Src Port: 80, Dst Port: 1161, Seq: 1, Ack: 2026, Len: 0
 Source Port: 80
 Destination Port: 1161

0000 00 20 e0 8a 70 1a 00 06 25 d0 af 73 00 00 45 00 ...p...X...E-
 0010 00 20 e0 8a 70 1a 00 06 b5 c0 00 77 f5 0c c0 ad <X&@-7-...q...
 0020 01 00 00 50 04 80 34 a2 76 1a 02 d6 00 de 50 10 <fP...t...P
 0030 22 38 50 c0 00 00 07 9a 00 00 3a 38 ?B.....<0

Time relative to time reference or first frame (frame.0) Packets: 213 · Displayed: 213 (100.0%) Profile: Default

tcp-ethereal-trace-1

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Apply a display filter: <Ctrl-F>

No.	Time	Source	Destination	Protocol	Length	Info
1	00:44:20.578981	192.168.1.102	128.119.245.12	TCP	62	1161 → 80 [SYN] Seq=0 Win=16384 Len=0 MSS=1460 SACK_PERM=1
2	00:44:20.595553	128.119.245.12	192.168.1.102	TCP	62	80 → 1161 [SYN, ACK] Seq=0 Ack=1 Win=5840 Len=0 MSS=1460 SACK_PERM=1
3	00:44:20.593046	192.168.1.102	128.119.245.12	TCP	54	1161 → 80 [ACK] Seq=1 Ack=1 Win=17520 Len=0
4	00:44:20.596850	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	00:44:20.612118	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [PSH, ACK] Seq=566 Ack=1 Win=17520 Len=1468 [TCP segment of a reassembled PDU]
6	00:44:20.624318	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=566 Win=6788 Len=0
7	00:44:20.624487	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=2026 Ack=1 Win=17520 Len=1468 [TCP segment of a reassembled PDU]
8	00:44:20.625071	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=5400 Ack=1 Win=17520 Len=1468 [TCP segment of a reassembled PDU]
9	00:44:20.647675	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=2026 Win=8760 Len=0
10	00:44:20.647706	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=4040 Ack=1 Win=17520 Len=1468 [TCP segment of a reassembled PDU]
11	00:44:20.648538	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=6406 Ack=1 Win=17520 Len=1468 [TCP segment of a reassembled PDU]
12	00:44:20.694488	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=3486 Win=11880 Len=0
13	00:44:20.694588	192.168.1.102	128.119.245.12	TCP	1261	1161 → 80 [PSH, ACK] Seq=7666 Ack=1 Win=17520 Len=1147 [TCP segment of a reassembled PDU]

Frame 12: 60 bytes on wire (480 bits), 60 bytes captured (480 bits) on interface 0
 Encapsulation type: Ethernet (1)
 Arrival Time: Aug 21, 2004 06:44:20.694460000 Pacific Daylight Time
 [Time shift for this packet: 0.000000000 seconds]
 Epoch Time: 1093095860.694460000 seconds
 [Time delta from previous captured frame: 0.045528000 seconds]
 [Time delta from previous displayed frame: 0.045920000 seconds]
 [Time since reference or first frame: 0.124885000 seconds]
 Frame Number: 12
 Frame Length: 60 bytes (480 bits)
 Capture Length: 60 bytes (480 bits)
 [Frame is marked: False]
 [Frame is ignored: False]
 [Protocols in frame: eth:ethertype:ip:tcp]
 [Coloring Rule Name: HTTP]
 [Coloring Rule String: http || tcp.port == 80 || http2]
 Ethernet II, Src: LinksysG_dslaf73 (00:06:25:d0af:73), Dst: Actiontec_Ba701a (00:20:e0:8a:70:1a)
 Internet Protocol Version 4, Src: 128.119.245.12, Dst: 192.168.1.102
 Transmission Control Protocol, Src Port: 80, Dst Port: 1161, Seq: 1, Ack: 3486, Len: 0
 Source Port: 80
 Destination Port: 1161

0000 00 20 e0 8a 70 1a 00 06 25 d0 af 73 00 00 45 00 ...p...X...E-
 0010 00 20 e0 8a 70 1a 00 06 b3 c9 00 77 f5 0c c8 ad <XtB-7...q...
 0020 01 00 00 50 04 00 34 a2 76 1a 02 d6 0f 92 50 10 <P...t...P
 0030 2d a0 7f e4 00 00 7b ec 00 00 5f 333

Time relative to time reference or first frame (frame.1)

Packets: 213 · Displayed: 213 (100.0%) Profile: Default

tcp-ethereal-trace-1

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Apply a display filter: <Ctrl>F

No.	Time	Source	Destination	Protocol	Length	Info
4	00:44:20.596858	192.168.1.102	128.119.245.12	TCP	610	1161 → 80 [PSH, ACK] Seq=1 Ack=1 Win=17520 Len=505 [TCP segment of a reassembled PDU]
5	00:44:20.612118	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [PSH, ACK] Seq=566 Ack=1 Win=17520 Len=1488 [TCP segment of a reassembled PDU]
6	00:44:20.624316	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=566 Win=0 Len=0
7	00:44:20.624487	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	00:44:20.625671	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=5488 Ack=1 Win=17520 Len=1488 [TCP segment of a reassembled PDU]
9	00:44:20.647675	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=2026 Win=0 Len=0
10	00:44:20.647786	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=4946 Ack=1 Win=17520 Len=1468 [TCP segment of a reassembled PDU]
11	00:44:20.648536	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]
12	00:44:20.694466	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=3486 Win=0 Len=0
13	00:44:20.694506	192.168.1.102	128.119.245.12	TCP	1201	1161 → 80 [PSH, ACK] Seq=7856 Ack=1 Win=17520 Len=1147 [TCP segment of a reassembled PDU]
14	00:44:20.739499	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=8046 Win=0 Len=0
15	00:44:20.787688	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=6406 Win=17520 Len=0
16	00:44:20.836183	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=7866 Win=28448 Len=0

▼ Frame 14: 60 bytes on wire (480 bits), 60 bytes captured (480 bits) on interface 0
 Encapsulation type: Ethernet (1)
 Arrival Time: Aug 21, 2004 06:44:20.739499000 Pacific Daylight Time
 [Time shift for this packet: 0.000000000 seconds]
 Epoch Time: 1093695860.739499000 seconds
 [Time delta from previous captured frame: 0.044933000 seconds]
 [Time delta from previous displayed frame: 0.044933000 seconds]
 [Time since reference or first frame: 0.168118000 seconds]
 Frame Number: 14
 Frame Length: 60 bytes (480 bits)
 Capture Length: 60 bytes (480 bits)
 [Frame is marked: False]
 [Frame is ignored: False]
 [Protocols in frame: eth:ethertype:ip:tcp]
 [Coloring Rule Name: HTTP]
 [Coloring Rule String: http || tcp.port == 80 || http2]
 Ethernet II, Src: LinksysG_dslaf73 (00:06:25:d0af:73), Dst: Actiontec_Ba701a (00:20:e0:8a:70:1a)
 Internet Protocol Version 4, Src: 128.119.245.12, Dst: 192.168.1.102
 Transmission Control Protocol, Src Port: 80, Dst Port: 1161, Seq: 1, Ack: 4946, Len: 0
 Source Port: 80
 Destination Port: 1161

0000 00 20 e0 8a 70 1a 00 06 25 d0 af 73 00 00 45 00 ...p...X...s...E-
 0010 00 20 e0 8a 70 1a 00 06 b3 c0 00 77 f5 0c c0 ad ...X...7...q...+
 0020 01 00 00 50 04 00 34 a2 76 1a 02 d6 15 ae 50 10 ...F...4...t...FP...
 0030 39 03 de 03 00 00 04 3c 00 00 d8 3a 00 00 00 00 9...n...+...+...

Time relative to time reference or first frame (frame.14) Packets: 213 · Displayed: 213 (100.0%) Profile: Default

tcp-ethereal-trace-1

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Apply a display filter: <Ctrl>F

No.	Time	Source	Destination	Protocol	Length	Info
4	00:44:20.596858	192.168.1.102	128.119.245.12	TCP	610	1161 → 80 [PSH, ACK] Seq=1 Ack=1 Win=17520 Len=505 [TCP segment of a reassembled PDU]
5	00:44:20.612118	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [PSH, ACK] Seq=546 Ack=1 Win=17520 Len=1488 [TCP segment of a reassembled PDU]
6	00:44:20.624316	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=566 Win=0 Len=0
7	00:44:20.624487	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	00:44:20.625671	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=5486 Ack=1 Win=17520 Len=1488 [TCP segment of a reassembled PDU]
9	00:44:20.647675	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=2026 Win=0 Len=0
10	00:44:20.647786	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=4946 Ack=1 Win=17520 Len=1468 [TCP segment of a reassembled PDU]
11	00:44:20.648536	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]
12	00:44:20.664466	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=3486 Win=0 Len=0
13	00:44:20.694506	192.168.1.102	128.119.245.12	TCP	1201	1161 → 80 [PSH, ACK] Seq=7866 Ack=1 Win=17520 Len=1147 [TCP segment of a reassembled PDU]
14	00:44:20.739499	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=4946 Win=0 Len=0
15	00:44:20.787688	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=6406 Win=0 Len=0
16	00:44:20.836183	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=7866 Win=0 Len=0

Frame 15: 60 bytes on wire (480 bits), 60 bytes captured (480 bits) on interface 0
 Encapsulation type: Ethernet (1)
 Arrival Time: Aug 21, 2004 06:44:20.787688000 Pacific Daylight Time
 [Time shift for this packet: 0.000000000 seconds]
 Epoch Time: 1093095868.787688000 seconds
 [Time delta from previous captured frame: 0.048181000 seconds]
 [Time delta from previous displayed frame: 0.048181000 seconds]
 [Time since reference or first frame: 0.217295000 seconds]
 Frame Number: 15
 Frame Length: 60 bytes (480 bits)
 Capture Length: 60 bytes (480 bits)
 [Frame is marked: False]
 [Frame is ignored: False]
 [Protocols in frame: eth:ethertype:ip:tcp]
 [Coloring Rule Name: HTTP]
 [Coloring Rule String: http || tcp.port == 80 || http2]
 Ethernet II, Src: LinksysG_dslaf73 (00:06:25:d0af:73), Dst: Actiontec_Ba701a (00:20:e0:8a:70:1a)
 Internet Protocol Version 4, Src: 128.119.245.12, Dst: 192.168.1.102
 Transmission Control Protocol, Src Port: 80, Dst Port: 1161, Seq: 1, Ack: 6406, Len: 0
 Source Port: 80
 Destination Port: 1161

0000 00 20 e0 8a 70 1a 00 06 25 d0 af 73 00 00 45 00 ...p...X...s...E-
 0010 00 20 e0 8a 70 1a 00 06 b5 c7 06 77 f5 0c c8 ad ...X...7...q...+
 0020 01 00 00 50 04 80 34 a2 76 1a 02 d6 1a fa 50 10 ...P...4: t...+P...
 0030 44 70 3d 6c 00 00 8a f5 00 00 b5 20 ...Dp]l...j...+...

Time relative to time reference or first frame (frame.15) Packets: 213 · Displayed: 213 (100.0%) Profile: Default

No.	Time	Source	Destination	Protocol	Length	Info
4	00:44:20.598858	192.168.1.102	128.119.245.12	TCP	619	1101 → 80 [PSH, ACK] Seq=1 Ack=1 Win=17520 Len=565 [TCP segment of a reassembled PDU]
5	00:44:20.612118	192.168.1.102	128.119.245.12	TCP	1514	1101 → 80 [PSH, ACK] Seq=566 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
6	00:44:20.624318	128.119.245.12	192.168.1.102	TCP	60	80 → 1101 [ACK] Seq=1 Ack=566 Win=0 Len=0
7	00:44:20.624407	192.168.1.102	128.119.245.12	TCP	1514	1101 → 80 [ACK] Seq=2026 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
8	00:44:20.625671	192.168.1.102	128.119.245.12	TCP	1514	1101 → 80 [ACK] Seq=5480 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
9	00:44:20.647675	128.119.245.12	192.168.1.102	TCP	60	80 → 1101 [ACK] Seq=1 Ack=2026 Win=0 Len=0
10	00:44:20.647786	192.168.1.102	128.119.245.12	TCP	1514	1101 → 80 [ACK] Seq=4946 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
11	00:44:20.648538	192.168.1.102	128.119.245.12	TCP	1514	1101 → 80 [ACK] Seq=6406 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
12	00:44:20.694466	128.119.245.12	192.168.1.102	TCP	60	80 → 1101 [ACK] Seq=1 Ack=3486 Win=0 Len=0
13	00:44:20.694506	192.168.1.102	128.119.245.12	TCP	1201	1101 → 80 [PSH, ACK] Seq=7866 Ack=1 Win=17520 Len=1147 [TCP segment of a reassembled PDU]
14	00:44:20.739499	128.119.245.12	192.168.1.102	TCP	60	80 → 1101 [ACK] Seq=1 Ack=8046 Win=0 Len=0
15	00:44:20.787688	128.119.245.12	192.168.1.102	TCP	60	80 → 1101 [ACK] Seq=1 Ack=6406 Win=17520 Len=0
16	00:44:20.838183	128.119.245.12	192.168.1.102	TCP	60	80 → 1101 [ACK] Seq=1 Ack=7866 Win=20440 Len=0

<p>Frame 16: 60 bytes on wire (480 bits), 60 bytes captured (480 bits) on interface 0</p> <p>Encapsulation type: Ethernet (1)</p> <p>Arrival Time: Aug 21, 2004 06:44:20.838183000 Pacific Daylight Time</p> <p>[Time shift for this packet: 0.000000000 seconds]</p> <p>Epoch Time: 1093095866.838183000 seconds</p> <p>[Time delta from previous captured frame: 0.050583000 seconds]</p> <p>[Time delta from previous displayed frame: 0.050583000 seconds]</p> <p>[Time since reference or first frame: 0.267882000 seconds]</p> <p>Frame Number: 16</p> <p>Frame Length: 60 bytes (480 bits)</p> <p>Capture Length: 60 bytes (480 bits)</p> <p>[Frame is marked: False]</p> <p>[Frame is ignored: False]</p> <p>[Protocols in frame: eth:ethertype:ip:tcp]</p> <p>[Coloring Rule Name: HTTP]</p> <p>[Coloring Rule String: http tcp.port == 80 http2]</p> <p>Ethernet II, Src: LinksysG_dslr173 (00:06:25:d0:af:73), Dst: Actiontec_Ba701a (00:20:e0:8a:70:1a)</p> <p>Internet Protocol Version 4, Src: 128.119.245.12, Dst: 192.168.1.102</p> <p>Transmission Control Protocol, Src Port: 80, Dst Port: 1101, Seq: 1, Ack: 7866, Len: 0</p> <p>Source Port: 80</p> <p>Destination Port: 1101</p>	<p>0000 00 20 e0 8a 70 1a 00 06 25 d0 af 73 00 00 45 00 ...p...X..s..E-</p> <p>0010 00 20 e0 8a 70 1a 00 06 25 d0 af 73 00 00 45 00 ...p...X..s..E-</p> <p>0020 01 00 00 00 04 00 34 a2 76 1a 02 d0 20 ae 50 10 ...P...t...IP.</p> <p>0030 4f d3 4c 50 00 00 03 c0 00 00 63 ad ...IP.......</p>
--	---

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

The length of each of the first six TCP segments are:

- Segment 1 – 565 bytes
- Segment 2 – 1460 bytes
- Segment 3 – 1460 bytes
- Segment 4 – 1460 bytes
- Segment 5 – 1460 bytes
- Segment 6 – 1460 bytes

The image shows a Wireshark packet capture analysis of a TCP connection. The top pane displays a list of 16 packets. The middle pane shows the details of packet 11, a TCP segment with sequence number 6406 and length 1460. The bottom pane shows the raw packet data in hexadecimal and ASCII.

No.	Time	Source	Destination	Protocol	Length	Info
4	00:44:20.596858	192.168.1.102	128.119.245.12	TCP	610	1161 → 80 [PSH, ACK] Seq=1 Ack=1 Win=17520 Len=563 [TCP segment of a reassembled PDU]
5	00:44:20.612118	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [PSH, ACK] Seq=566 Ack=1 Win=17520 Len=1468 [TCP segment of a reassembled PDU]
6	00:44:20.624318	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=566 Win=0 Len=0
7	00:44:20.624487	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	00:44:20.625671	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=3486 Ack=1 Win=17520 Len=1468 [TCP segment of a reassembled PDU]
9	00:44:20.647675	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=2026 Win=0 Len=0
10	00:44:20.647786	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=4946 Ack=1 Win=17520 Len=1468 [TCP segment of a reassembled PDU]
11	00:44:20.648738	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]
12	00:44:20.694466	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=3486 Win=0 Len=0
13	00:44:20.694506	192.168.1.102	128.119.245.12	TCP	1201	1161 → 80 [PSH, ACK] Seq=7866 Ack=1 Win=17520 Len=1147 [TCP segment of a reassembled PDU]
14	00:44:20.739499	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=4946 Win=0 Len=0
15	00:44:20.787688	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=6406 Win=0 Len=0
16	00:44:20.836183	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=7866 Win=0 Len=0

Coloring Rule String: http || tcp.port == 80 || http2]

Ethernet II, Src: Achionix_8a:70:1a (00:20:a0:8a:70:1a), Dst: LinksysB_data:73 (00:0c:29:dac4:73)

Internet Protocol Version 4, Src: 192.168.1.102, Dst: 128.119.245.12

Transmission Control Protocol, Src Port: 1161, Dst Port: 80, Seq: 6406, Ack: 1, Len: 1460

Source Port: 1161

Destination Port: 80

[Stream index: 0]

[TCP Segment Len: 1460]

Sequence number: 6406 (relative sequence number)

[Next sequence number: 7866 (relative sequence number)]

Acknowledgment number: 1 (relative ack number)

0101 ... = Header length: 20 bytes (5)

Flags: 0x018 (ACK)

Window size value: 17520

[Calculated window size: 17520]

[Window size scaling factor: -2 (no window scaling used)]

Checksum: 8a9583 [unverified]

[Checksum Status: Unverified]

Urgent pointer: 0

[SEQ/ACK analysis]

[Timestamps]

TCP payload (1460 bytes)

[Reassembled PDU in frame: 110]

TCP segment data (1460 bytes)

```

0020 75 0c 04 09 00 50 0d 0b 1a 72 34 92 74 1a 58 10  ....4 t P
0030 44 70 95 83 00 00 20 55 6e 69 74 65 64 20 53 74  Op... United St
0040 61 74 65 73 20 63 6f 70 79 72 69 67 68 74 8d 0a  ates cop right
0050 6f 6e 20 6f 72 20 66 6f 72 20 74 68 69 73 20 77  on or fo r this w
0060 6f 72 6b 2c 20 73 6f 20 74 68 65 20 50 72 6f 6a  ork, so the Prof
0070 65 63 74 20 28 61 6a 04 20 79 6f 75 21 20 20 63  ect (and you) c
0080 61 6e 20 63 6f 78 79 20 61 6e 64 6d 6a 64 69 73  an copy and dia
0090 74 72 60 82 75 74 65 20 60 74 20 69 6e 20 74 68  tribute it in th
00a0 65 20 55 6e 69 74 65 64 20 53 74 61 74 65 73 20  e United States
00b0 77 69 74 68 6f 75 74 20 70 65 72 6d 69 73 73 69  without permissi

```

TCP Segment Len (tcp.len)

Packets: 213 · Displayed: 213 (100.0%)

Profile: Defai

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?

The minimum amount of available buffer space advertised at the receiver for the entire trace is a window size of 5840 bytes. No, the lack of receiver buffer space never throttles the sender, which can be observed by viewing the window size for each of the packets in the RTT Graph shown below. In the RTT graph below, the window size never drops after reaching a maximum window size of 62780 bytes.

tcp-ethereal-trace-1

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Apply a display filter: <Ctrl-F>

Expression: *

OK Cancel

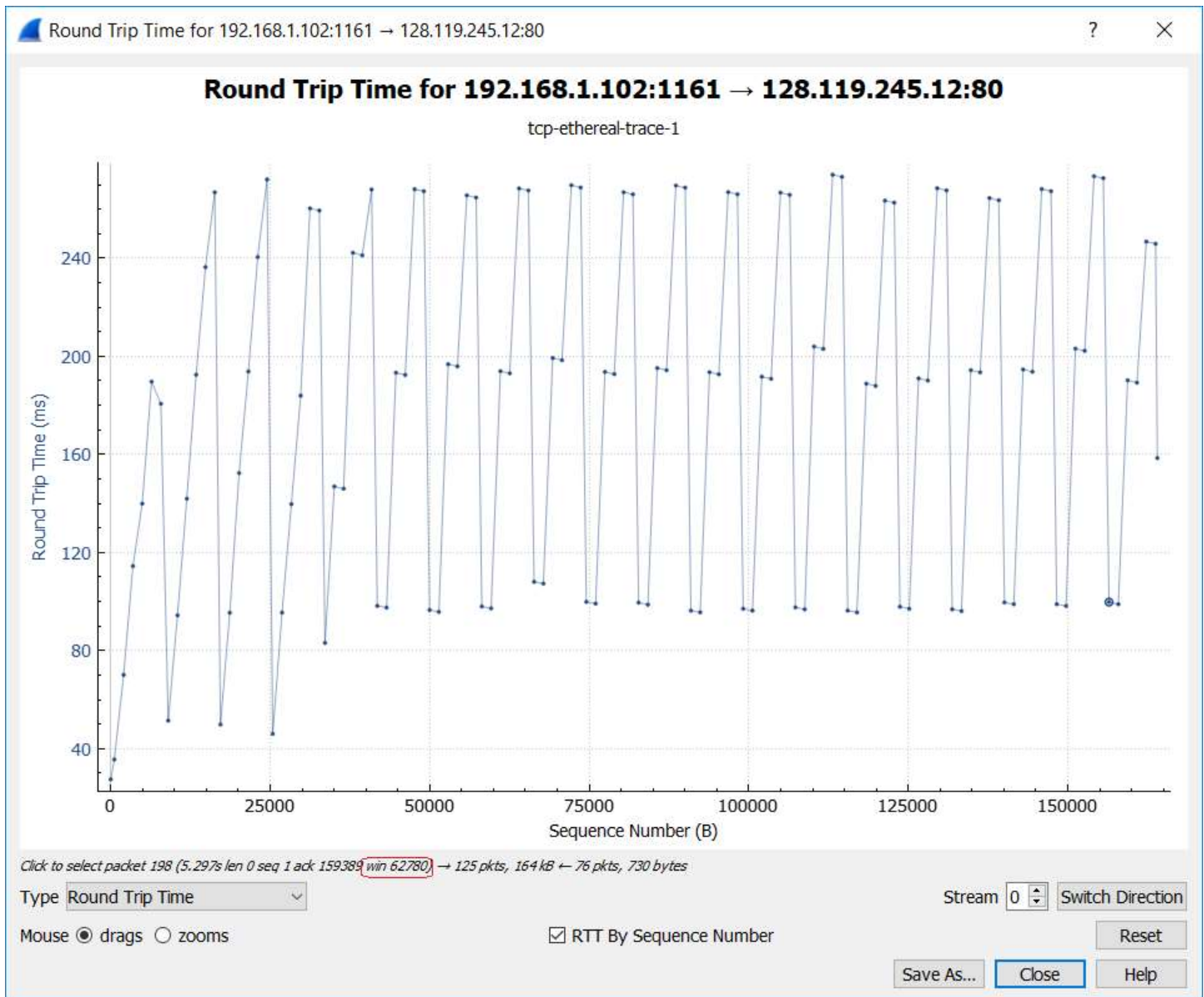
No.	Time	Source	Destination	Protocol	Length	Info
1	00:44:20.578881	192.168.1.102	128.119.245.12	TCP	42	1161 → 80 [SYN] Seq=0 Win=16384 Len=0 MSS=1460 SACK_PERM=1
2	00:44:20.593553	128.119.245.12	192.168.1.102	TCP	42	80 → 1161 [SYN, ACK] Seq=0 Ack=6 Win=5840 Len=0 MSS=1460 SACK_PERM=1
3	00:44:20.593646	192.168.1.102	128.119.245.12	TCP	54	1161 → 80 [ACK] Seq=1 Ack=1 Win=17520 Len=0
4	00:44:20.596850	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	00:44:20.612118	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [PSH, ACK] Seq=566 Ack=1 Win=17520 Len=1468 [TCP segment of a reassembled PDU]
6	00:44:20.624318	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=566 Win=6788 Len=0
7	00:44:20.624487	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=2026 Ack=1 Win=17520 Len=1468 [TCP segment of a reassembled PDU]
8	00:44:20.625071	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=5406 Ack=1 Win=17520 Len=1468 [TCP segment of a reassembled PDU]
9	00:44:20.647675	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=2026 Win=8768 Len=0
10	00:44:20.647788	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=4940 Ack=1 Win=17520 Len=1468 [TCP segment of a reassembled PDU]
11	00:44:20.648538	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=6486 Ack=1 Win=17520 Len=1468 [TCP segment of a reassembled PDU]
12	00:44:20.694466	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=5486 Win=11880 Len=0
13	00:44:20.694568	192.168.1.102	128.119.245.12	TCP	1201	1161 → 80 [PSH, ACK] Seq=7666 Ack=1 Win=17520 Len=1147 [TCP segment of a reassembled PDU]
14	00:44:20.759499	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=4940 Win=14600 Len=0
15	00:44:20.787688	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=6486 Win=17520 Len=0
16	00:44:20.838183	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=7666 Win=20448 Len=0
17	00:44:20.875180	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=9012 Win=23568 Len=0

[Frame is marked: False]
 [Frame is ignored: False]
 [Protocol in frame: ethertype:ip:tcp]
 [Coloring Rule Name: HTTP]
 [Coloring Rule String: http || tcp.port == 80 || http2]

> Ethernet II, Src: Linksys0:daia:f73 (00:06:25:daia:f73), Dst: Actionte_8a:70:1a (00:08:00:8a:70:1a)
 > Internet Protocol Version 4, Src: 128.119.245.12, Dst: 192.168.1.102
 > Transmission Control Protocol, Src Port: 80, Dst Port: 1161, Seq: 0, Ack: 1, Len: 0
 Source Port: 80
 Destination Port: 1161
 [Stream Index: 0]
 [TCP Segment Len: 0]
 Sequence number: 0 (relative sequence number)
 [Next sequence number: 0 (relative sequence number)]
 Acknowledgment number: 1 (relative ack number)
 #111 = Header length: 28 bytes (?)
 > Flags: 0x012 (SYN, ACK)
 Window size value: 5840
 [Calculated window size: 5840]
 Checksum: 8c77ad [unverified]
 [Checksum Status: Unverified]
 Urgent pointer: 0
 > Options: (8 bytes), Maximum segment size, No-Operation (NOP), No-Operation (NOP), SACK permitted
 > [SEQ/ACK analysis]
 > [Timestamps]

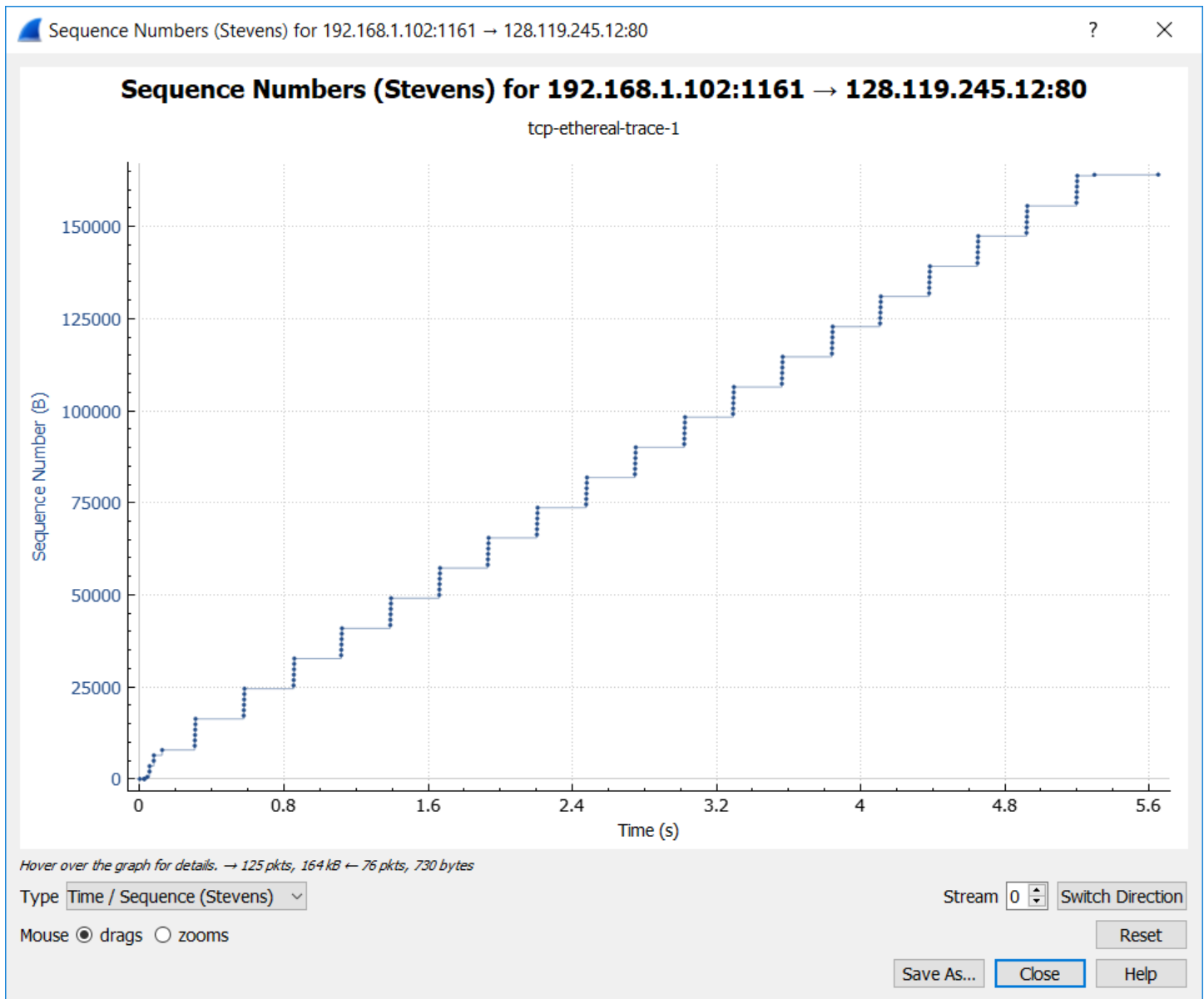
0000 00 20 c0 8a 70 1a 00 06 25 da af 73 00 00 45 00 - - p - - 8 : s - E -
 0010 00 30 00 00 40 00 37 06 0c 36 00 77 f5 0c c0 a8 - 0 - 6 7 - 6 a - - -
 0020 01 66 00 50 04 39 34 a2 74 19 05 06 01 f5 70 12 - P - 4 : t - - - p -
 0030 77 4d 00 00 02 04 05 04 01 01 04 02 - - - - - - - - - -

The scaled window size (if scaling has been used) (tcp.window) Packets: 213 / Displayed: 213 (100.0%) Profile: Defa



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

No, there are no retransmitted segments in the trace file. I verified this by manually viewing all of the sequence numbers in each of the TCP packets sent from the client to server. If there was a retransmission, then the client would send a TCP packet with a sequence number that is less than any previous TCP segments' sequence numbers. I also verified this by observing that the Sequence Numbers graph below never decreases, which verifies that the sequence number transmitted from client to server never decreases.



- 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 (see Table 3.2 on page 250 in the text).

The receiver typically acknowledges 1460 bytes in an ACK. Since the ACK value is the number of bytes received since the last ACK, I determined the amount of acknowledged data by calculating the difference $ACK_n - ACK_{n-1}$, whereas the first ACK is just 1 based on a typical 3-way handshake.

One case where the receiver is ACKing every other segments is TCP Frame No 52, which acknowledges 2352 (= 1460 + 892) bytes. In this case, client sent 1460 bytes in TCP frame no 46 and 892 bytes in TCP frame no 47. When TCP frame 52 arrived, the server received an in-order segment with the expected sequence number and all data up to the expected sequence number were already acknowledged, so the server performed a delayed ACK that lasted 77.277 ms (= (1.117097000 - 1.039820000) * 1000) but could have waited up to 500 ms. TCP frame 52 is ACKing the TCP frame no 46 and 47, so TCP segment 52 is ACKing every other segment in this case.

TCP Frame No	ACK value	ACK data
3	1	1
6	566	565
9	2026	1460

12	3486	1460
14	4946	1460
15	6406	1460
16	7866	1460
17	9013	1147
24	10473	1460
25	11933	1460
26	13393	1460
27	14853	1460
28	16313	1460
29	17205	892
36	18665	1460
37	20125	1460
38	21585	1460
39	23045	1460
40	24505	1460
41	25397	892
48	26857	1460
49	28317	1460
50	29777	1460
51	31237	1460
52	33589	2352

The image shows a Wireshark packet capture of a TCP connection. The packet list at the top shows a series of ACKs from the client (192.168.1.102) to the server (128.119.245.12). The selected packet (No. 52) is a TCP segment with the following details:

- Source Port: 80
- Destination Port: 1161
- Sequence number: 1 (relative sequence number)
- Acknowledgment number: 33589 (relative ack number)
- Window size: 62700
- Flags: RST, ACK, FIN

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

If the throughput for the TCP connection is bytes transferred per unit of time, then throughput can be calculated as $\text{throughput_rate} = (\text{total_length}) / (\text{time_elapsed})$. Total length would be calculated as $\text{total_length} = \text{TCP_segmentN_ack} - \text{TCP_segment1_seqno}$, where TCP_segmentN_ack is the ACK value of the last TCP segment sent by the server minus the sequence number of the first TCP segment sent by the client. The time elapsed would be calculated as $\text{time_elapsed} = \text{TCP_segmentN_time} - \text{TCP_segment1_time}$, where TCP_segmentN_time is the time elapsed since the capture first started for the last TCP segment and TCP_segment1_time is the time elapsed since the capture first started for the first TCP segment. Therefore, the throughput is 30222.75 bytes per second.

$$\text{throughput_rate} = (\text{TCP_segmentN_ack} - \text{TCP_segment1_seqno}) / (\text{TCP_segmentN_time} - \text{TCP_segment1_time})$$

$$\text{throughput_rate} = (164091 - 1) \text{ bytes} / (5.455830000 - 0.026477000) \text{ seconds}$$

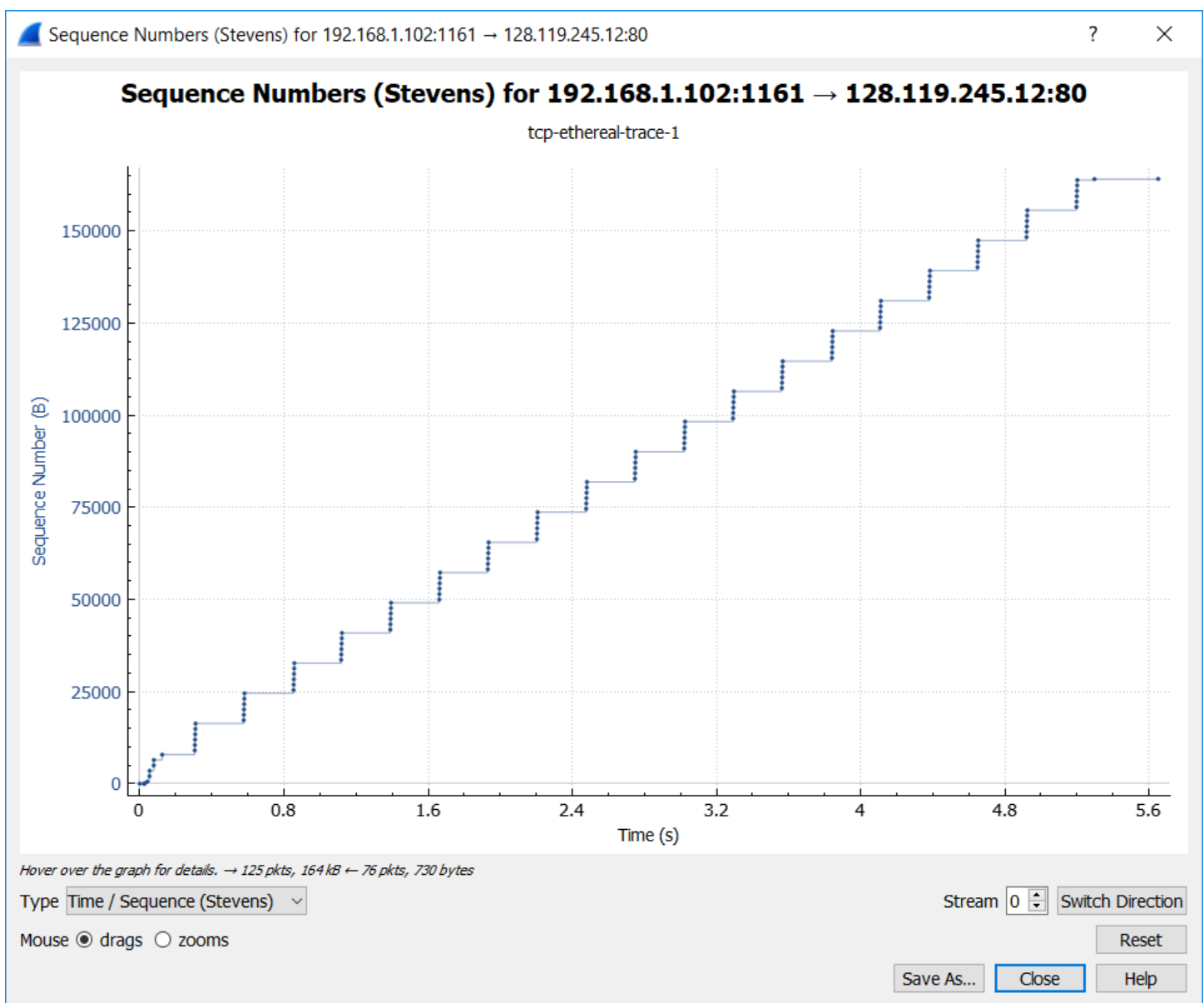
Total_length = 164090 bytes
Time_elapsed = 5.429353 seconds

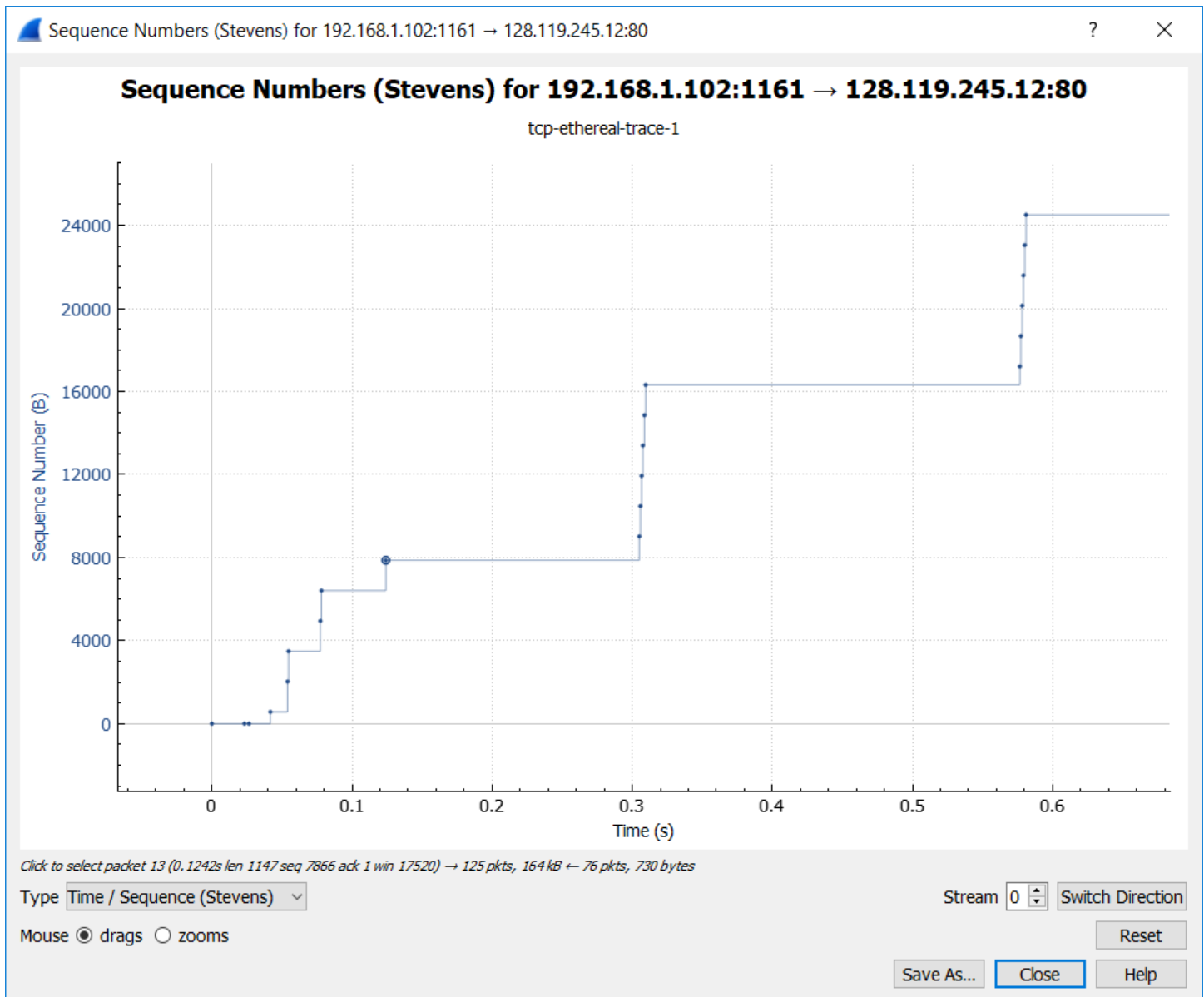
$$\begin{aligned} \text{throughput_rate} &= 164090 \text{ bytes} / 5.429353 \text{ s} \\ &= 30222.753981920129341378245253164 \text{ bytes per second} \\ &= 241782.03185536103473102596202531 \text{ bps} \\ &= 241.78203185536103473102596202531 \text{ Mbps} \end{aligned}$$

- 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 TCP's slowstart phase begins after sending the first TCP segment at 0.02648s and ends after sending packet 13 around 0.1242s. Congestion avoidance takes over around 0.3s where we see 5 TCP packets transmitted.

The measured data differs from the ideal behavior of TCP that is in the text because we do not observe the typical exponential increase in CWND that's described in the text. We do not see normal control flow behavior using the author's trace. The slow-start phase should have exponential growth in control flow, which should be followed by the congestion avoidance and fast recovery phases that should have the CWND drop down in half and proceed with linear growth in control flow. In this case, it appears as if there is only linear growth. The measured data transmits in batches of 6 packets even though the window size in the ACK packets are typically much greater than the number of packets transmitted, which is unlike the expected method of transmission described in the text where slow-start should transmit with exponentially increasing CWND.



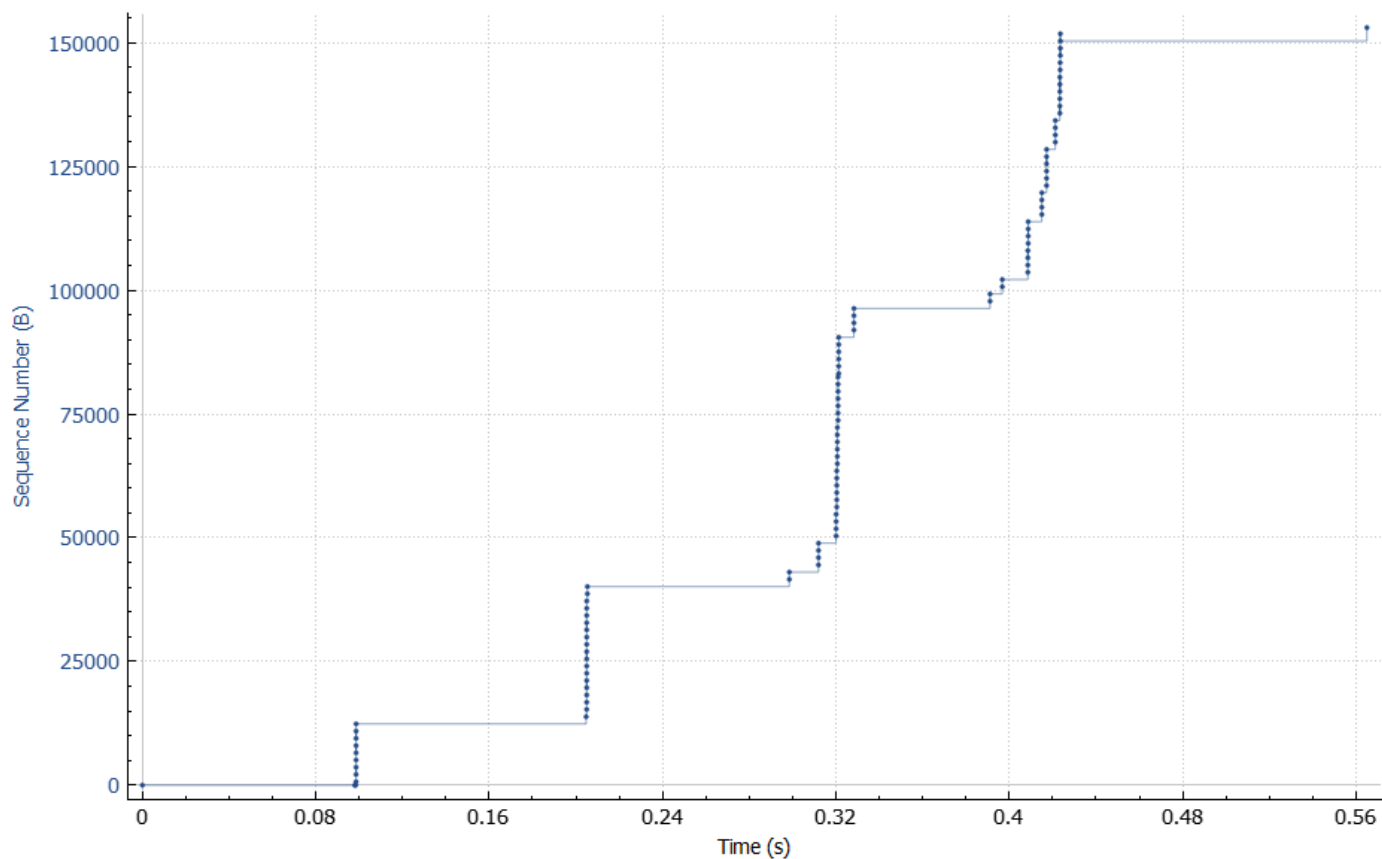


14) Answer Question 13 for the trace that you captured when you transferred a file from your **own** computer to gaia.cs.umass.edu.

The TCP's slowstart phase begins after sending the first TCP segment at 0.10s and ends after sending packet 13 around 0.33s. Congestion avoidance takes over at this point after 0.33s. The measured data is more in line with the ideal behavior of TCP that is in the text because we observed the exponential increase in CWND until CWND equals the SSTHRESH around 0.33s. At around 0.10s, 8 TCP packets are transmitted. At around 0.22s, 16 TCP packets are transmitted. At around 0.32s, 32 TCP packets are transmitted. This doubling in CWND size matches what is described in the text. After 0.33s, the TCP connection likely transitions from slow-start to congestion avoidance and the control flow rate becomes linear.

Sequence Numbers (Stevens) for 192.168.10.2:3901 → 128.119.245.12:80

wireshark-traces-2.pcapng



Hover over the graph for details. → 109 pkts, 153 kB ← 46 pkts, 777 bytes

Type Time / Sequence (Stevens) ▾

Stream 6 ▾ Switch Direction

Mouse ☒ drags ☐ zooms

Reset

Save As...

Close

Help