

LAB 2

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).

Solution 1:

SRC IP – 192.168.1.102

TCP Port Number – 1161

The image shows a Wireshark packet capture window titled "tcp-ethereal-trace-1". The packet list pane displays a series of TCP packets. The first packet (No. 1) is a SYN packet from 192.168.1.102 to 128.119.245.12 on port 80. The packet details pane shows the following information:

- Frame 1: 62 bytes on wire (496 bits), 62 bytes captured (496 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
- Transmission Control Protocol, Src Port: 1161, Dst Port: 80, Seq: 0, Len: 0

The packet bytes pane shows the raw data of the packet, which is a SYN packet with a sequence number of 0 and a length of 0.

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

Solution 2:

gaia.cs.umass.edu IP address – 128.119.245.12

It is sending and receiving TCP segments on PORT – 80 (HTTP port)

tcp-ethereal-trace-1

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

No.	Time	Source	Destination	Protocol	Length	Info
1	08:44:20.570381	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	08:44:20.593553	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	08:44:20.593646	192.168.1.102	128.119.245.12	TCP	54	1161 → 80 [ACK] Seq=1 Ack=1 Win=17520 Len=0
4	08:44:20.596858	192.168.1.102	128.119.245.12	TCP	619	1161 → 80 [PSH, ACK] Seq=1 Ack=1 Win=17520 Len=565
5	08:44:20.612118	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [PSH, ACK] Seq=566 Ack=1 Win=17520 Len=1460
6	08:44:20.624318	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=566 Win=6780 Len=0
7	08:44:20.624407	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=2026 Ack=1 Win=17520 Len=1460
8	08:44:20.625071	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=3486 Ack=1 Win=17520 Len=1460
9	08:44:20.647675	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=2026 Win=8760 Len=0
10	08:44:20.647786	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=4946 Ack=1 Win=17520 Len=1460
11	08:44:20.648538	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=6406 Ack=1 Win=17520 Len=1460

> Frame 1: 62 bytes on wire (496 bits), 62 bytes captured (496 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

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

```
0000 00 06 25 da af 73 00 20 e0 8a 70 1a 08 00 45 00  ..%..s-  ..p...E-
0010 00 30 1e 1d 40 00 80 06 a5 18 c0 a8 01 66 80 77  0..@...  ....f..w
0020 f5 0c 04 89 00 50 0d d6 01 f4 00 00 00 00 70 02  ....P...  ....p-
0030 40 00 f6 e9 00 00 02 04 05 b4 01 01 04 02      @.....  ....
```

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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?

Solution 3:

No Trace provided in the material is used

SRC IP – 192.168.1.102

TCP Port Number – 1161

The image shows a Wireshark packet capture trace titled "tcp-ethereal-trace-1". The main packet list table contains 11 entries. The first entry is a SYN packet from 192.168.1.102 to 128.119.245.12 on port 80. The packet details pane shows the following information:

- Frame 1: 62 bytes on wire (496 bits), 62 bytes captured (496 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
- Transmission Control Protocol, Src Port: 1161, Dst Port: 80, Seq: 0, Len: 0

The packet bytes pane shows the raw data of the SYN packet in hexadecimal and ASCII format.

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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?

Solution 4:

Sequence number of the TCP SYN segment – 0 SYN Flag is SET in Flags identifying this is a SYN segment

The image shows a Wireshark packet capture of a TCP connection. The packet list at the top shows 11 packets. The selected packet is packet 1, a TCP SYN segment from 192.168.1.102 to 128.119.245.12. The packet details pane shows the following information:

- Frame 1: 62 bytes on wire (496 bits), 62 bytes captured (496 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
- 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)
 - Sequence number (raw): 252129012
 - [Next sequence number: 1 (relative sequence number)]
 - Acknowledgment number: 0
 - Acknowledgment number (raw): 0
 - 0111 = Header Length: 28 bytes (7)
 - Flags: 0x002 (SYN)
 - 000. = Reserved: Not set
 - ...0 = Nonce: Not set
 - 0... = Congestion Window Reduced (CWR): Not set
 - 0... = ECN-Echo: Not set
 -0. = Urgent: Not set
 -0. = Acknowledgment: Not set
 -0. = Push: Not set
 -0. = Reset: Not set**
 -1. = Syn: Set**
 -0. = Fin: Not set
 - [TCP Flags:S.]
 - Window size value: 16384

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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?

Solution 5:

Sequence number of SYNACK segment sent by gaia.cs.umass.edu to client computer in reply to SYN – 0

Acknowledgement field in the SYNACK segment – 1

gaia.cs.umass.edu determined this value by adding 1 to the initial sequence number i.e. 0 in SYN segment from client.

Both SYN & ACK are SET in the FLAGS indicating it is SYNACK segment.

The image shows a Wireshark packet capture of a TCP connection. The packet list at the top shows 11 packets. Packet 2 is the SYNACK segment from 192.168.1.102 to 128.119.245.12. The packet details pane shows the following information:

- Frame 2: 62 bytes on wire (496 bits), 62 bytes captured (496 bits)
- Ethernet II, Src: LinksysG_da:af:73 (00:06:25:da:af:73), Dst: Actionte_8a:70:1a (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: 0, Ack: 1, Len: 0
 - Source Port: 80
 - Destination Port: 1161
 - [Stream index: 0]
 - [TCP Segment Len: 0]
 - Sequence number: 0 (relative sequence number)
 - Sequence number (raw): 883061785
 - [Next sequence number: 1 (relative sequence number)]
 - Acknowledgment number: 1 (relative ack number)
 - Acknowledgment number (raw): 232129013
 - 0111 = Header Length: 28 bytes (7)
- Flags: 0x012 (SYN, ACK)
 - 000. = Reserved: Not set
 - ...0 = Nonce: Not set
 -0... = Congestion Window Reduced (CWR): Not set
 -0... = ECN-Echo: Not set
 -0... = Urgent: Not set
 -1... = Acknowledgment: Set
 -0... = Push: Not set
 -0... = Reset: Not set
 -1... = Syn: Set
 -0... = Fin: Not set
 - [TCP Flags:A..S.]
- Window size value: 5840

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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.

Solution 6 :

Sequence number of the TCP segment containing the HTTP POST command – 1

The image shows a Wireshark packet capture analysis of a network trace. The top pane displays a list of captured packets. Packet 4 is highlighted, showing a TCP segment from 192.168.1.102 to 128.119.245.12, sequence number 1, length 565 bytes. The bottom pane shows the details of this packet, including the Ethernet II header, Internet Protocol Version 4 header, and Transmission Control Protocol header. The TCP header shows the sequence number 1, acknowledgment number 1, and flags PSH, ACK. The packet content pane shows the raw data of the packet, which is an HTTP POST request to /ethtool. The POST command is highlighted in red.

tcp-ethereal-trace-1

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Apply a display filter ... <Ctrl-/>

No.	Time	Source	Destination	Protocol	Length	Info
1	08:44:20.570381	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	08:44:20.593553	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	08:44:20.593646	192.168.1.102	128.119.245.12	TCP	54	1161 → 80 [ACK] Seq=1 Ack=1 Win=17520 Len=0
4	08:44:20.596858	192.168.1.102	128.119.245.12	TCP	619	1161 → 80 [PSH, ACK] Seq=1 Ack=1 Win=17520 Len=565
5	08:44:20.612118	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [PSH, ACK] Seq=566 Ack=1 Win=17520 Len=1460
6	08:44:20.624318	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=566 Win=6780 Len=0
7	08:44:20.624407	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=2026 Ack=1 Win=17520 Len=1460
8	08:44:20.625071	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=3486 Ack=1 Win=17520 Len=1460
9	08:44:20.647675	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=2026 Win=8760 Len=0
10	08:44:20.647786	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=4946 Ack=1 Win=17520 Len=1460
11	08:44:20.648538	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=6406 Ack=1 Win=17520 Len=1460

> Frame 4: 619 bytes on wire (4952 bits), 619 bytes captured (4952 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

▼ Transmission Control Protocol, Src Port: 1161, Dst Port: 80, Seq: 1, Ack: 1, Len: 425

Source Port: 1161

Destination Port: 80

[Stream index: 0]

[TCP Segment Len: 565]

Sequence number: 1 (relative sequence number)

Sequence number (raw): 232129013

[Next sequence number: 566 (relative sequence number)]

Acknowledgment number: 1 (relative ack number)

Acknowledgment number (raw): 883061786

0101 = Header Length: 20 bytes (5)

> Flags: 0x018 (PSH, ACK)

0020 f5 0c 04 89 00 50 0d d6 01 f5 34 a2 74 1a 50 18 ...P...A.t.P.

0030 44 70 1f bd 00 00 50 4f 53 54 20 2f 65 74 68 65 ...PO ST /ethe

0040 72 65 61 6c 2d 6c 61 62 73 2f 6c 61 62 33 2d 31 ...1-ab s/lab3-1

0050 2d 72 65 70 6c 79 2e 68 74 6d 20 48 54 54 50 2f ...reply.h tm HTTP/

0060 31 2e 31 0d 0a 48 6f 73 74 3a 20 67 61 69 61 2e ...1..Hos t: gaia.

0070 63 73 2e 75 6d 61 73 73 2e 65 64 75 0d 0a 55 73 ...s.umass .edu .Us

0080 65 72 2d 41 67 65 6e 74 3a 20 4d 6f 7a 69 6c 6c ...er-Agent : Mozill

0090 61 2f 35 2e 30 20 28 57 69 6e 64 6f 77 73 3b 20 ...a/5.0 (W indows;

00a0 55 3b 20 57 69 6e 64 6f 77 73 20 4e 54 20 35 2e ...U; Windo ws NT 5.

00b0 31 3b 20 65 6e 2d 55 53 3b 20 72 76 3a 31 2e 30 ...1; en-US ; rv:1.0

00c0 2e 32 29 20 47 65 63 6b 6f 2f 32 30 30 33 30 32 ...2) Gecko o/200302

00d0 30 38 20 4e 65 74 73 63 61 70 65 2f 37 2e 30 32 ...08 Netsc ape/7.02

00e0 0d 0a 41 63 63 65 70 74 3a 20 74 65 78 74 2f 78 ...-Accept : text/x

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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. Note: Wireshark has a nice feature that allows you to plot the RTT for each of the TCP segments sent. Select a TCP segment in the “listing of captured packets” window that is being sent from the client to the gaia.cs.umass.edu server. Then select: Statistics->TCP Stream Graph>Round Trip Time Graph.

Solution 7:

1st Segment –

Sequence Number	Segment Sent Time	ACK Receive Time	RTT (seconds)	Estimated RTT (seconds)
1	0.026477	0.053937	0.02746	0.02746

$$\text{EstimatedRTT} = 0.875 * \text{EstimatedRTT} + 0.125 * \text{SampleRTT}$$

2nd Segment –

Sequence Number	Segment Sent Time	ACK Receive Time	RTT (seconds)	Estimated RTT (seconds)
566	0.041737	0.077294	0.035557	0.028472125

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3rd Segment –

Sequence Number	Segment Sent Time	ACK Receive Time	RTT (seconds)	Estimated RTT (seconds)
2026	0.054026	0.124085	0.070059	0.03367049

4th Segment –

Sequence Number	Segment Sent Time	ACK Receive Time	RTT (seconds)	Estimated RTT (seconds)
3486	0.054690	0.169118	0.114428	0.04376518

5th Segment –

Sequence Number	Segment Sent Time	ACK Receive Time	RTT (seconds)	Estimated RTT (seconds)
4946	0.077405	0.217299	0.139894	0.05

6th Segment –

Sequence Number	Segment Sent Time	ACK Receive Time	RTT (seconds)	Estimated RTT (seconds)
6406	0.078157	0.267802	0.18964	0.07

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tcp-ethereal-trace-1

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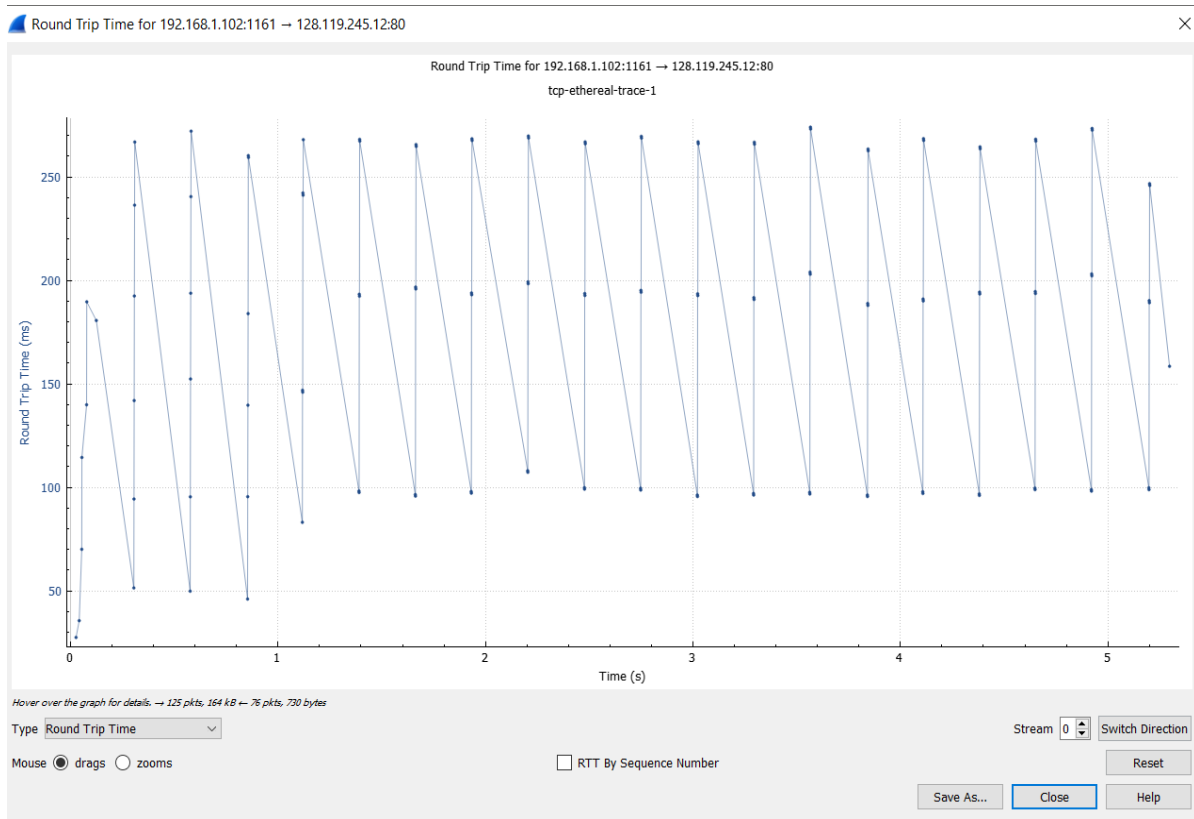
Apply a display filter... <Ctrl-F>

No.	Time	Source	Destination	Protocol	Length	Info
1	08:44:20.570381	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	08:44:20.593553	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	08:44:20.593646	192.168.1.102	128.119.245.12	TCP	54	1161 → 80 [ACK] Seq=1 Ack=1 Win=17520 Len=0
4	08:44:20.596858	192.168.1.102	128.119.245.12	TCP	619	1161 → 80 [PSH, ACK] Seq=1 Ack=1 Win=17520 Len=565
5	08:44:20.612118	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [PSH, ACK] Seq=566 Ack=1 Win=17520 Len=1460
6	08:44:20.624318	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=566 Win=6780 Len=0
7	08:44:20.624407	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=2026 Ack=1 Win=17520 Len=1460
8	08:44:20.625071	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=3486 Ack=1 Win=17520 Len=1460
9	08:44:20.647675	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=2026 Win=8760 Len=0
10	08:44:20.647786	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=4946 Ack=1 Win=17520 Len=1460
11	08:44:20.648538	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=6406 Ack=1 Win=17520 Len=1460
12	08:44:20.694466	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=3486 Win=11680 Len=0
13	08:44:20.694566	192.168.1.102	128.119.245.12	TCP	1201	1161 → 80 [PSH, ACK] Seq=7866 Ack=1 Win=17520 Len=1147
14	08:44:20.739499	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=4946 Win=14600 Len=0
15	08:44:20.787680	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=6406 Win=17520 Len=0
16	08:44:20.838183	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=7866 Win=20440 Len=0
17	08:44:20.875188	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=9013 Win=23360 Len=0
18	08:44:20.875421	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=9013 Ack=1 Win=17520 Len=1460
19	08:44:20.876194	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=10473 Ack=1 Win=17520 Len=1460
20	08:44:20.877073	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=11933 Ack=1 Win=17520 Len=1460
21	08:44:20.877952	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=13393 Ack=1 Win=17520 Len=1460
22	08:44:20.879080	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=14853 Ack=1 Win=17520 Len=1460
23	08:44:20.879934	192.168.1.102	128.119.245.12	TCP	946	1161 → 80 [PSH, ACK] Seq=16313 Ack=1 Win=17520 Len=892
24	08:44:20.926818	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=10473 Win=26280 Len=0
25	08:44:20.970545	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=11933 Win=29200 Len=0
26	08:44:21.018994	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=13393 Win=32120 Len=0
27	08:44:21.070410	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=14853 Win=35040 Len=0

> Frame 4: 619 bytes on wire (4952 bits), 619 bytes captured (4952 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
v Transmission Control Protocol, Src Port: 1161, Dst Port: 80, Seq: 1, Ack: 1, Len: 565
Source Port: 1161
Destination Port: 80
[Stream index: 0]
[TCP Segment Len: 565]

0020 f5 0c 04 89 00 50 bd d6 01 f9 34 a2 74 1a 50 18P...4.t.P.
0030 44 70 1f bd 00 00 50 4f 53 54 20 2f 65 74 68 65 Dp...PO ST /ethe
0040 72 65 61 6c 2d 6c 61 62 73 2f 6c 61 62 33 2d 31 real-lab s/lab3-1
0050 2d 72 65 70 6c 79 2e 68 74 6d 20 48 54 50 2f --reply.h tm HTTP/

RTT PLOT -



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

Solution 8 :

First Segment Length - 565 Bytes

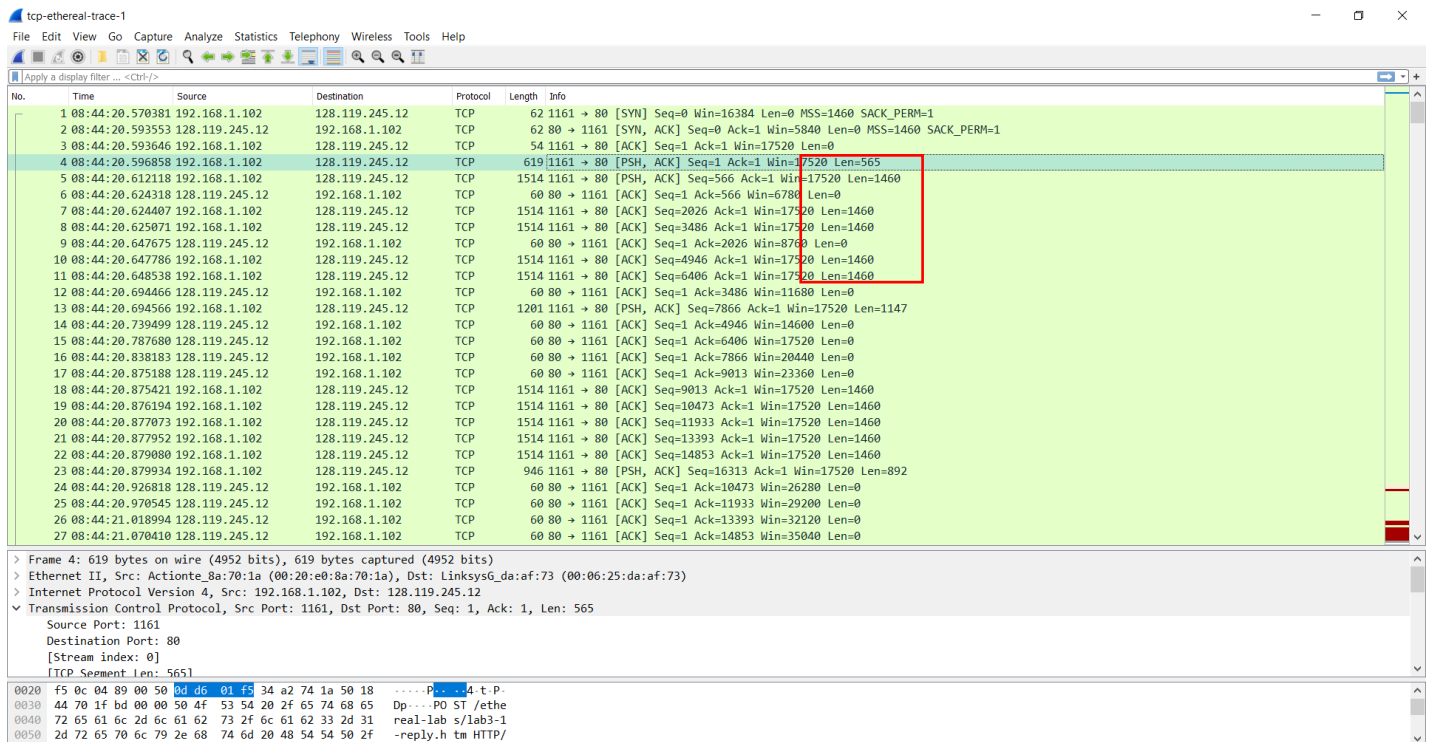
Second Segment Length - 1460 Bytes

Third Segment Length - 1460 Bytes

Fourth Segment Length - 1460 Bytes

Fifth Segment Length - 1460 Bytes

Sixth Segment Length - 1460 Bytes



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1	08:44:20.570381	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	08:44:20.593553	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	08:44:20.593646	192.168.1.102	128.119.245.12	TCP	54	1161 → 80 [ACK] Seq=1 Ack=1 Win=17520 Len=0
4	08:44:20.596858	192.168.1.102	128.119.245.12	TCP	619	1161 → 80 [PSH, ACK] Seq=1 Ack=1 Win=17520 Len=565
5	08:44:20.612118	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [PSH, ACK] Seq=566 Ack=1 Win=17520 Len=1460
6	08:44:20.624318	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=566 Win=6780 Len=0
7	08:44:20.624407	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=2026 Ack=1 Win=17520 Len=1460
8	08:44:20.625871	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=3486 Ack=1 Win=17520 Len=1460
9	08:44:20.647675	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=2026 Win=8760 Len=0
10	08:44:20.647786	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=4946 Ack=1 Win=17520 Len=1460
11	08:44:20.648538	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=6406 Ack=1 Win=17520 Len=1460
12	08:44:20.694466	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=3486 Win=11680 Len=0
13	08:44:20.694566	192.168.1.102	128.119.245.12	TCP	1201	1161 → 80 [PSH, ACK] Seq=7866 Ack=1 Win=17520 Len=1147
14	08:44:20.739499	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=4946 Win=14600 Len=0
15	08:44:20.787680	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=6406 Win=17520 Len=0
16	08:44:20.838183	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=7866 Win=20440 Len=0
17	08:44:20.875188	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=9013 Win=23360 Len=0
18	08:44:20.875421	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=9013 Ack=1 Win=17520 Len=1460
19	08:44:20.876194	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=10473 Ack=1 Win=17520 Len=1460
20	08:44:20.877073	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=11933 Ack=1 Win=17520 Len=1460
21	08:44:20.877952	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=13393 Ack=1 Win=17520 Len=1460
22	08:44:20.879080	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=14853 Ack=1 Win=17520 Len=1460
23	08:44:20.879934	192.168.1.102	128.119.245.12	TCP	946	1161 → 80 [PSH, ACK] Seq=16313 Ack=1 Win=17520 Len=892
24	08:44:20.876818	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=10473 Win=26280 Len=0
25	08:44:20.970545	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=11933 Win=29200 Len=0
26	08:44:21.018994	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=13393 Win=32120 Len=0
27	08:44:21.070410	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=14853 Win=35040 Len=0

> Frame 4: 619 bytes on wire (4952 bits), 619 bytes captured (4952 bits)
> Ethernet II, Src: Actionte_8a:70:1a (08:20:e0:8a:70:1a), Dst: LinksysG_da:af:73 (08:06:25:da:af:73)
> Internet Protocol Version 4, Src: 192.168.1.102, Dst: 128.119.245.12
v Transmission Control Protocol, Src Port: 1161, Dst Port: 80, Seq: 1, Ack: 1, Len: 565
Source Port: 1161
Destination Port: 80
[Stream index: 0]
[TCP Segment Len: 565]

0020 f5 0c 04 89 00 50 bd d6 01 f5 34 a2 74 1a 50 18P...4 t:P
0030 44 70 1f bd 00 00 50 4f 53 54 20 2f 65 74 68 65 Dp...PO ST /ethe
0040 72 65 61 6c 2d 6c 61 62 73 2f 6c 61 62 33 2d 31 real-lab s/lab3-1
0050 2d 72 65 70 6c 79 2e 68 74 6d 20 48 54 50 2f -reply.h tm HTTP/

LAB 2

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

Solution 9 :

What is the minimum amount of available buffer space advertised at the received for the entire trace – 5840 bytes.

Maximum buffer space available – 62780 bytes

No, the sender never throttles due to lack of receiver buffer space therefore increases steadily.

The image shows a Wireshark packet capture of a TCP connection. The packet list pane displays several packets, with packet 2 selected. The packet details pane shows the structure of the selected packet, which is a TCP segment. The 'Flags' field is highlighted with a red box, showing '0x012 (SYN, ACK)'. The 'Window size value' is 5840, and the 'calculated window size' is also 5840. The packet bytes pane shows the raw data of the packet.

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	08:44:20.570381	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	08:44:20.593553	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	08:44:20.593646	192.168.1.102	128.119.245.12	TCP	54	1161 → 80 [ACK] Seq=1 Ack=1 Win=17520 Len=0
4	08:44:20.596858	192.168.1.102	128.119.245.12	TCP	619	1161 → 80 [PSH, ACK] Seq=1 Ack=1 Win=17520 Len=565
5	08:44:20.612118	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [PSH, ACK] Seq=566 Ack=1 Win=17520 Len=1460
6	08:44:20.624318	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=566 Win=6780 Len=0
7	08:44:20.624407	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=2026 Ack=1 Win=17520 Len=1460
8	08:44:20.625071	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=3486 Ack=1 Win=17520 Len=1460
9	08:44:20.647675	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=2026 Win=8760 Len=0

> Frame 2: 62 bytes on wire (496 bits), 62 bytes captured (496 bits)

> Ethernet II, Src: Linksys6_da:af:73 (00:06:25:da:af:73), Dst: Actionte_8a:70:1a (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: 0, Ack: 1, Len: 0

Source Port: 80

Destination Port: 1161

[Stream index: 0]

[TCP Segment Len: 0]

Sequence number: 0 (relative sequence number)

Sequence number (raw): 883061785

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

Acknowledgment number: 1 (relative ack number)

Acknowledgment number (raw): 232129013

0111 = Header Length: 28 bytes (7)

Flags: 0x012 (SYN, ACK)

Window size value: 5840

calculated window size: 5840

Checksum: 0x774d [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 e0 8a 70 1a 00 06 25 da af 73 08 00 45 00 ...p...%..s..E:

0010 00 30 00 00 40 00 37 06 0c 36 80 77 f5 0c c0 a8 ..@.7..6.w....

0020 01 66 00 50 04 89 34 a2 74 19 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 ...wM.....

LAB 2

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
195	08:44:25.770633	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=160849 Ack=1 Win=17520 Len=1460
196	08:44:25.771531	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=162309 Ack=1 Win=17520 Len=1460
197	08:44:25.772405	192.168.1.102	128.119.245.12	TCP	326	1161 → 80 [PSH, ACK] Seq=163769 Ack=1 Win=17520 Len=272
198	08:44:25.867638	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=159389 Win=62780 Len=0
199	08:44:25.867722	192.168.1.102	128.119.245.12	TCP	104	1161 → 80 [PSH, ACK] Seq=164041 Ack=1 Win=17520 Len=50
200	08:44:25.959852	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=162309 Win=62780 Len=0
201	08:44:26.018268	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=164041 Win=62780 Len=0
202	08:44:26.026211	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=164091 Win=62780 Len=0
203	08:44:26.031556	128.119.245.12	192.168.1.102	TCP	784	80 → 1161 [PSH, ACK] Seq=1 Ack=164091 Win=62780 Len=730

> Frame 203: 784 bytes on wire (6272 bits), 784 bytes captured (6272 bits)

> Ethernet II, Src: LinksysG_da:af:73 (00:06:25:da:af:73), Dst: Actionte_8a:70:1a (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: 164091, Len: 730

Source Port: 80

Destination Port: 1161

[Stream index: 0]

[TCP Segment Len: 730]

Sequence number: 1 (relative sequence number)

Sequence number (raw): 883061786

[Next sequence number: 731 (relative sequence number)]

Acknowledgment number: 164091 (relative ack number)

Acknowledgment number (raw): 232293103

0101 = Header Length: 20 bytes (5)

> Flags: 0x018 (PSH, ACK)

Window size value: 62780

[Calculated window size: 62780]

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

Checksum: 0xa920 [unverified]

[Checksum Status: Unverified]

Urgent pointer: 0

> [SEQ/ACK analysis]

> [Timestamps]

TCP payload (730 bytes)

> Data (730 bytes)

0020 01 66 00 50 04 89 34 a2 74 1a 0d d8 82 ef 50 18 -f-P..4. t....P.

0030 f5 3c a9 20 00 00 48 54 54 50 2f 31 2e 31 20 32 -<..HT TP/1.1 2

0040 30 30 20 4f 4b 0d 0a 44 61 74 65 3a 20 53 61 74 00 OK..D ate: Sat

0050 2c 20 32 31 20 41 75 67 20 32 30 30 34 20 31 33 , 21 Aug 2004 13

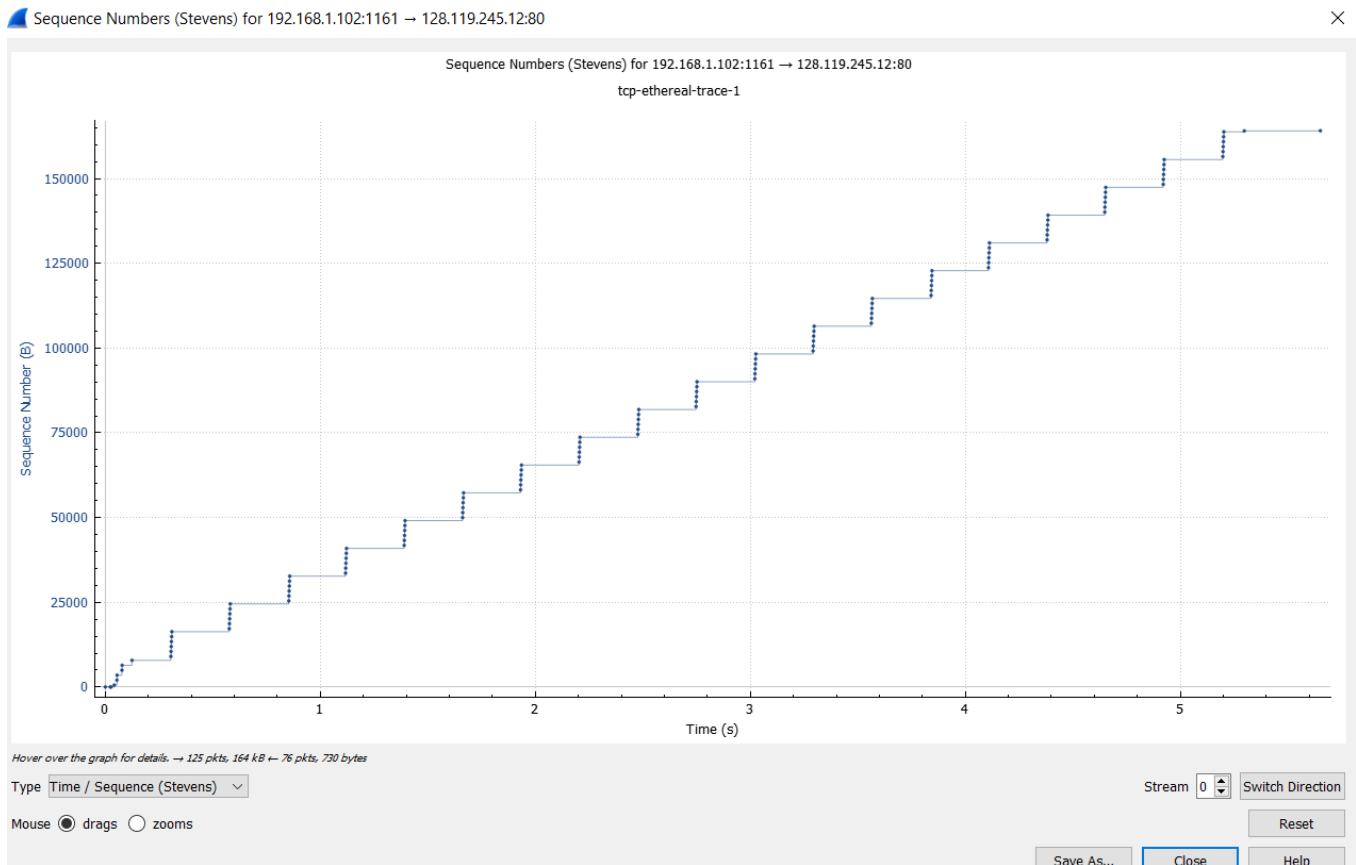
LAB 2

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

Solution 10:

No, there are No retransmitted segments in the trace files.

We can check this by analyzing the time vs sequence number graph. There is a linear or gradual increase in sequence number with respect to Time and there is not occurrence of retransmission of segments.



LAB 2

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).

Solution 11:

The Amount of data the receiver typically acknowledge in an ACK would be the difference between Two consecutive ACKs.

ACK 2 = 2026

ACK 3 = 3486

$ACK3 - ACK2 = 3486 - 2026 = 1460$ bytes of data

Can you identify cases where the receiver is ACKing every other received segment –

YES we can see the receiver ACKing every other received segment.

Taking an example of segment 88 which Acknowledges every other received segment.

The screenshot shows the Wireshark interface with a packet capture of TCP segments. The packet list pane shows several segments, with segment 88 highlighted in red. The packet details pane for segment 88 shows the following information:

- Destination Port: 1161
- [Stream index: 0]
- [TCP Segment Len: 0]
- Sequence number: 1 (relative sequence number)
- Sequence number (raw): 883061786
- [Next sequence number: 1 (relative sequence number)]
- Acknowledgment number: 64005 (relative ack number)
- Acknowledgment number (raw): 232193017
- 0101 = Header Length: 20 bytes (5)
- > Flags: 0x010 (ACK)
- Window size value: 62780
- [Calculated window size: 62780]

The packet bytes pane shows the raw data of the segment, which is a 20-byte header.

LAB 2

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

Solution 12:

Last ACK = 164091

1st Sequence Number = 1

Total Amount of data =

(Acknowledge Sequence Number of Last ACK – 1st Sequence Number)

= (164091 – 1) = 164090 bytes

Last ACK Time = 5.455830

1st Segment Time = 0.026477

Total Transmission Time = (Last ACK Time – 1st Segment Time)

= (5.455830 - 0.026477) = 5.4294 seconds

Average Throughput = Ratio of total amount data and total transmission time.

= 164090/5.4294

= 30.222 KB/s

LAB 2

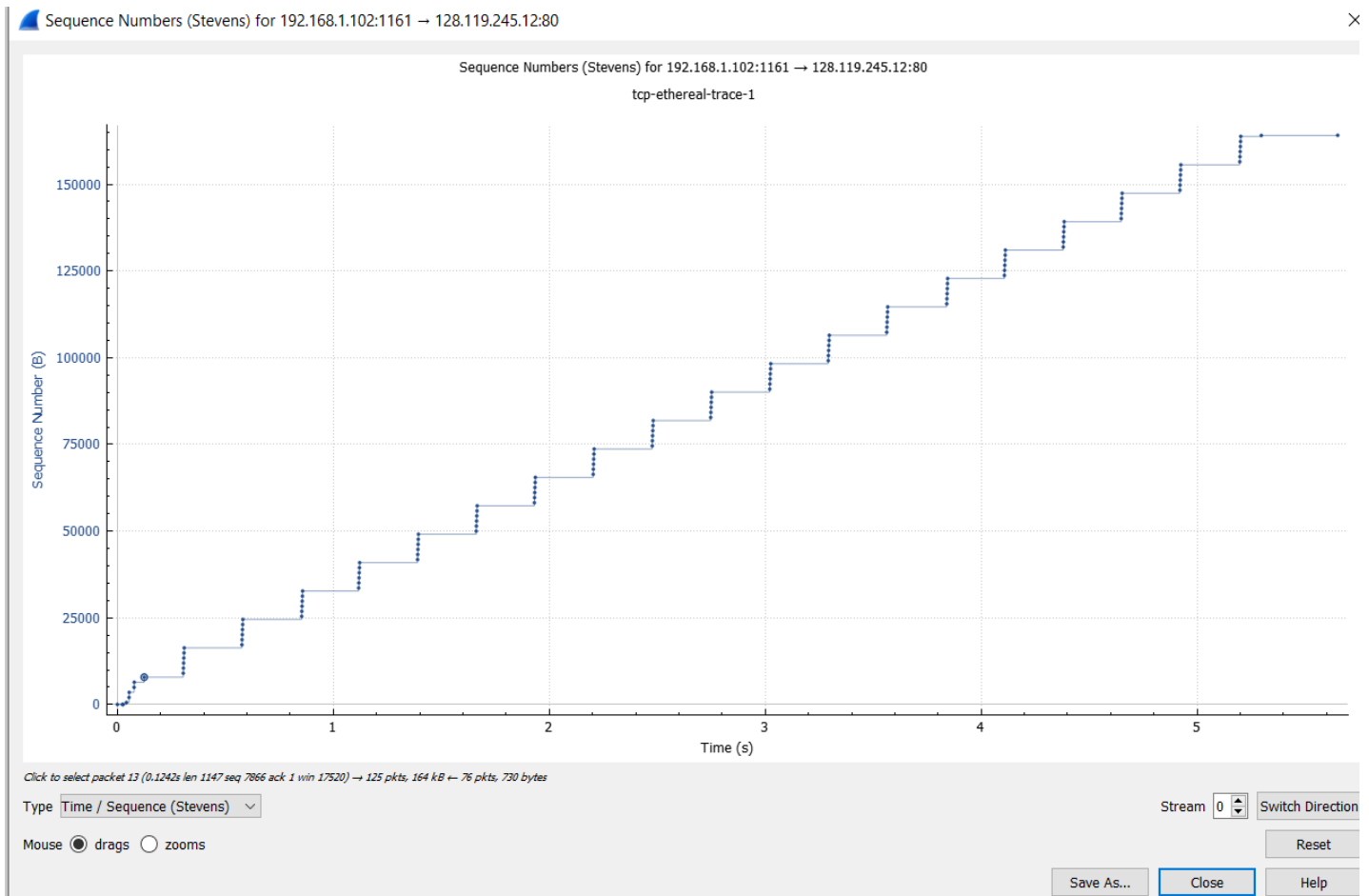
13. Use the Time-Sequence-Graph(Stevens) plotting tool to view the sequence number versus time plot of segments being sent from the client to the gaia.cs.umass.edu server. Can you identify where TCP's slowstart phase begins and ends, and where congestion avoidance takes over? Comment on ways in which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

Solution 13:

Start Time = 0 Seconds

End Time = 0.1242 Seconds

After this congestion avoidance takes over. The measured data is only using a fraction of the window size instead of the idealized one third to a half.



LAB 2

14. Answer each of two questions above for the trace that you have gathered when you transferred a file from your computer to `gaia.cs.umass.edu`

Solution 14:

N.A. – ALL the Above Questions are Answered.