

CN 5344

Project 2 Wireshark Lab: TCP

By Ramya Yeddula (1001234951)

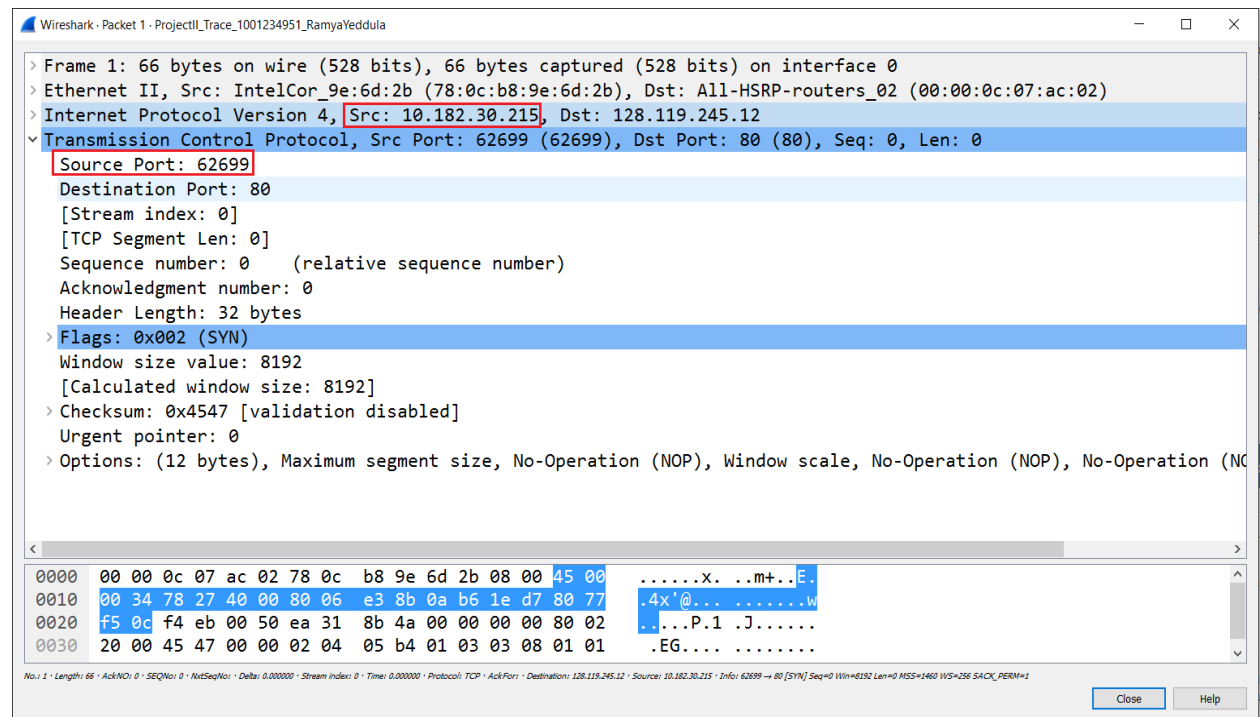
1. What is the IP address and TCP port number used by the client computer (source) that is transferring the file to gaia.cs.umass.edu?

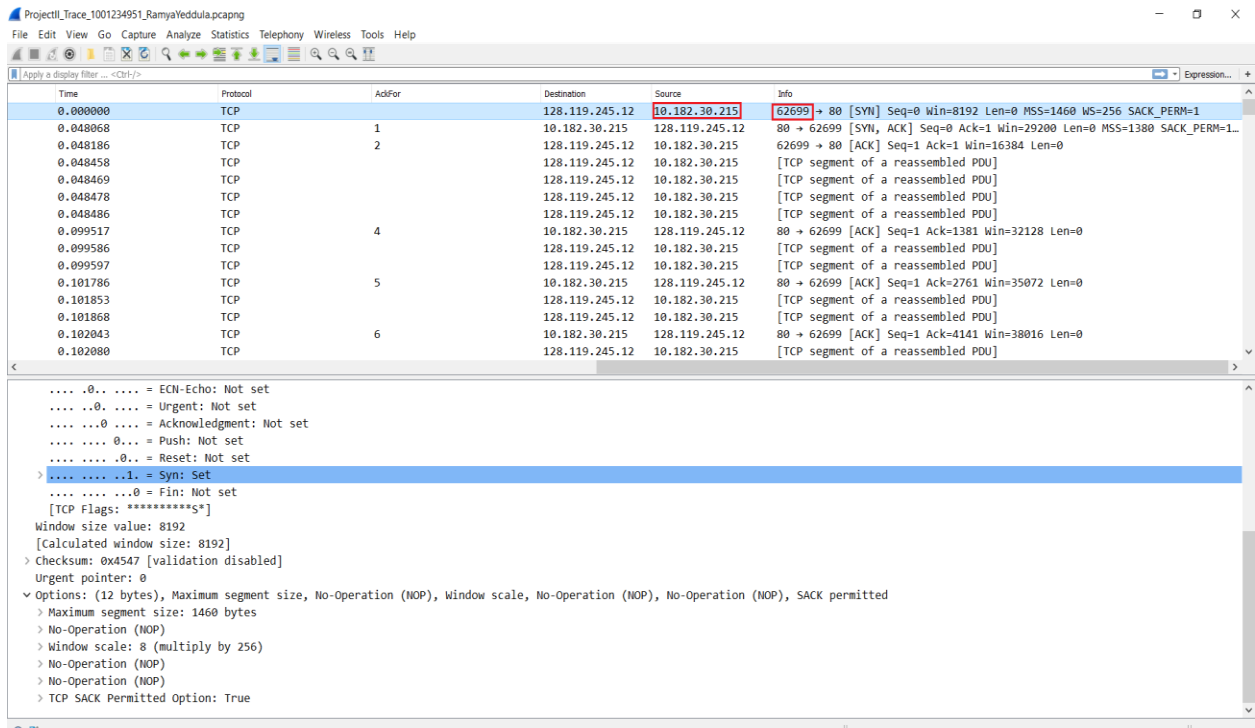
To answer this question, it's probably easiest to select an HTTP message and explore the details of the TCP packet used to carry this HTTP message, using the “details of the selected packet header window” (refer to Figure 2 in the “Getting Started with Wireshark” Lab if you're uncertain about the Wireshark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

The IP address and TCP port number used by the client computer are:

IP address: 10.182.30.215

Port number: 62699



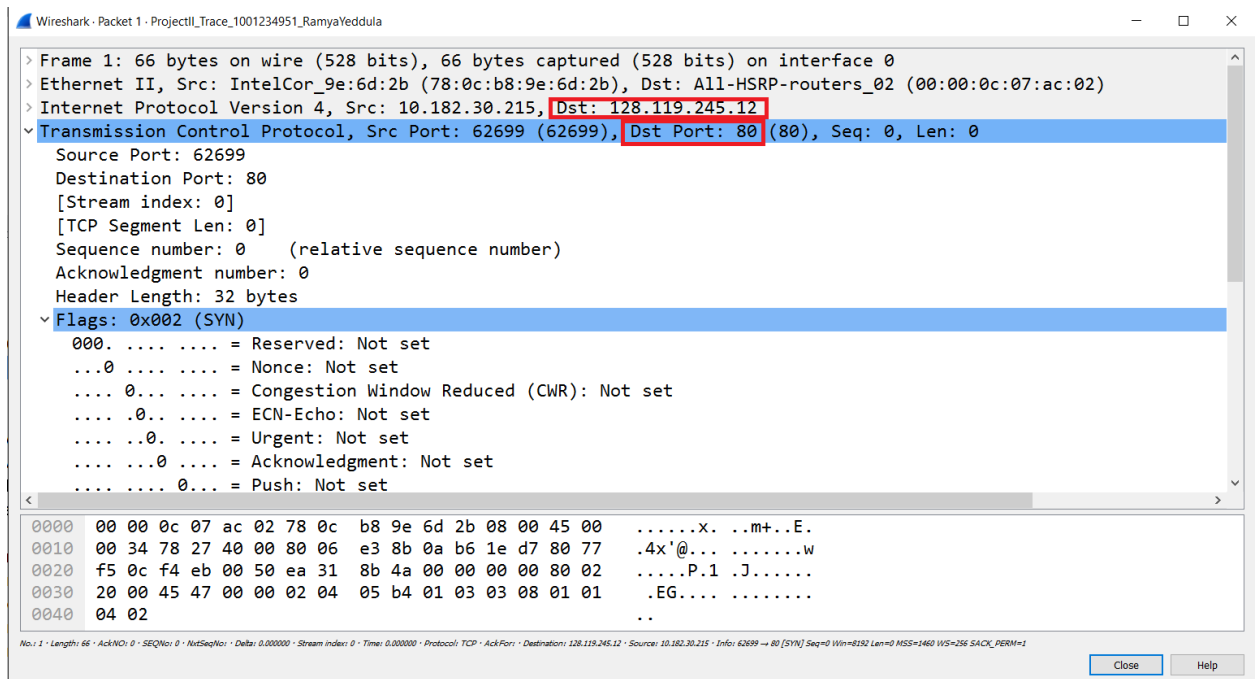


- What is the IP address of gaia.cs.umass.edu? On what port number is it sending and receiving TCP segments for this connection?

IP address and Port number of gaia.cs.umass.edu are:

IP address: 128.119.245.12

Port number: 80



ProjectII_Trace_1001234951_RamyaYeddula.pcapng

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

Time	Protocol	AckFor	Destination	Source	Info
0.000000	TCP		128.119.245.12	10.182.30.215	62699 → 80 [SYN] Seq=0 Win=8192 Len=0 MSS=1460 WS=256...
0.048068	TCP	1	10.182.30.215	128.119.245.12	80 → 62699 [SYN, ACK] Seq=0 Ack=1 Win=29200 Len=0 MSS...
0.048186	TCP	2	128.119.245.12	10.182.30.215	62699 → 80 [ACK] Seq=1 Ack=1 Win=16384 Len=0
0.048458	TCP		128.119.245.12	10.182.30.215	[TCP segment of a reassembled PDU]
0.048469	TCP		128.119.245.12	10.182.30.215	[TCP segment of a reassembled PDU]
0.048478	TCP		128.119.245.12	10.182.30.215	[TCP segment of a reassembled PDU]
0.048486	TCP		128.119.245.12	10.182.30.215	[TCP segment of a reassembled PDU]
0.099517	TCP	4	10.182.30.215	128.119.245.12	80 → 62699 [ACK] Seq=1 Ack=1381 Win=32128 Len=0
0.099586	TCP		128.119.245.12	10.182.30.215	[TCP segment of a reassembled PDU]
0.099597	TCP		128.119.245.12	10.182.30.215	[TCP segment of a reassembled PDU]
0.101786	TCP	5	10.182.30.215	128.119.245.12	80 → 62699 [ACK] Seq=1 Ack=2761 Win=35072 Len=0
0.101853	TCP		128.119.245.12	10.182.30.215	[TCP segment of a reassembled PDU]
0.101868	TCP		128.119.245.12	10.182.30.215	[TCP segment of a reassembled PDU]
0.102043	TCP	6	10.182.30.215	128.119.245.12	80 → 62699 [ACK] Seq=1 Ack=4141 Win=38016 Len=0
0.102080	TCP		128.119.245.12	10.182.30.215	[TCP segment of a reassembled PDU]
0.102095	TCP		128.119.245.12	10.182.30.215	[TCP segment of a reassembled PDU]
0.103613	TCP	7	10.182.30.215	128.119.245.12	80 → 62699 [ACK] Seq=1 Ack=5521 Win=40960 Len=0
0.103681	TCP		128.119.245.12	10.182.30.215	[TCP segment of a reassembled PDU]
0.103730	TCP		128.119.245.12	10.182.30.215	[TCP segment of a reassembled PDU]
0.148743	TCP	9	10.182.30.215	128.119.245.12	80 → 62699 [ACK] Seq=1 Ack=6901 Win=43904 Len=0
0.148900	TCP		128.119.245.12	10.182.30.215	[TCP segment of a reassembled PDU]
0.148934	TCP		128.119.245.12	10.182.30.215	[TCP segment of a reassembled PDU]
0.149232	TCP	10	10.182.30.215	128.119.245.12	80 → 62699 [ACK] Seq=1 Ack=8001 Win=46720 Len=0

.... .0.. = ECN-Echo: Not set
0. = Urgent: Not set
0. = Acknowledgment: Not set
0.. = Push: Not set
0.. = Reset: Not set
1. = Syn: Set

ProjectII_Trace_1001234951_RamyaYeddula

Packets: 213 · Displayed: 213 (100.0%) · Load time: 0:0.4

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
- a. The Sequence number of the TCP SYN is 0. (Seq=0)

Wireshark · Packet 1 · ProjectII_Trace_1001234951_RamyaYeddula

> Frame 1: 66 bytes on wire (528 bits), 66 bytes captured (528 bits) on interface 0

> Ethernet II, Src: IntelCor_9e:6d:2b (78:0c:b8:9e:6d:2b), Dst: All-HSRP-routers_02 (00:00:0c:07:ac:02)

> Internet Protocol Version 4, Src: 10.182.30.215, Dst: 128.119.245.12

> Transmission Control Protocol, Src Port: 62699 (62699), Dst Port: 80 (80), Seq: 0, Len: 0

Source Port: 62699

Destination Port: 80

[Stream index: 0]

[TCP Segment Len: 0]

Sequence number: 0 (relative sequence number)

Acknowledgment number: 0

Header Length: 32 bytes

Flags: 0x002 (SYN)

0000	00 00 0c 07 ac 02 78 0c b8 9e 6d 2b 08 00 45 00X. .m+..E.
0010	00 34 78 27 40 00 80 06 e3 8b 0a b6 1e d7 80 77	.4x'@... ..w
0020	f5 0c f4 eb 00 50 ea 31 8b 4a 00 00 00 00 80 02P.1 .J.....
0030	20 00 45 47 00 00 02 04 05 b4 01 03 03 08 01 01	.EG.... ..
0040	04 02	..

No. 1 · Length: 66 · AckNo: 0 · SeqNo: 0 · NdSeqNo: Delta: 0.000000 · Stream index: 0 · Time: 0.000000 · Protocol: TCP · AckFor: Destination: 128.119.245.12 · Source: 10.182.30.215 · Info: 62699 → 80 [SYN] Seq=0 Win=8192 Len=0 MSS=1460 WS=256 SACK_PERM=1

Close Help

Project1_Trace_1001234951_RamyaVeddula.pcapng

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

Time	Protocol	ACK/F	Destination	Source	Info
0.000000	TCP		128.119.245.12	10.182.30.215	62699 → 80 [SYN] Seq=0 Win=8192 Len=0 MSS=1460 WS=256...
0.048068	TCP	1	10.182.30.215	128.119.245.12	80 → 62699 [SYN, ACK] Seq=0 Ack=1 Win=29200 Len=0 MSS...
0.048186	TCP	2	128.119.245.12	10.182.30.215	62699 → 80 [ACK] Seq=1 Ack=1 Win=16384 Len=0
0.048458	TCP		128.119.245.12	10.182.30.215	[TCP segment of a reassembled PDU]
0.048469	TCP		128.119.245.12	10.182.30.215	[TCP segment of a reassembled PDU]
0.048478	TCP		128.119.245.12	10.182.30.215	[TCP segment of a reassembled PDU]
0.048486	TCP		128.119.245.12	10.182.30.215	[TCP segment of a reassembled PDU]
0.099517	TCP	4	10.182.30.215	128.119.245.12	80 → 62699 [ACK] Seq=1 Ack=1381 Win=32128 Len=0
0.099586	TCP		128.119.245.12	10.182.30.215	[TCP segment of a reassembled PDU]
0.099597	TCP		128.119.245.12	10.182.30.215	[TCP segment of a reassembled PDU]
0.101786	TCP	5	10.182.30.215	128.119.245.12	80 → 62699 [ACK] Seq=1 Ack=2761 Win=35072 Len=0
0.101853	TCP		128.119.245.12	10.182.30.215	[TCP segment of a reassembled PDU]
0.101868	TCP		128.119.245.12	10.182.30.215	[TCP segment of a reassembled PDU]
0.102043	TCP	6	10.182.30.215	128.119.245.12	80 → 62699 [ACK] Seq=1 Ack=4141 Win=38016 Len=0
0.102080	TCP		128.119.245.12	10.182.30.215	[TCP segment of a reassembled PDU]
0.102095	TCP		128.119.245.12	10.182.30.215	[TCP segment of a reassembled PDU]
0.103613	TCP	7	10.182.30.215	128.119.245.12	80 → 62699 [ACK] Seq=1 Ack=5521 Win=40960 Len=0
0.103681	TCP		128.119.245.12	10.182.30.215	[TCP segment of a reassembled PDU]
0.103730	TCP		128.119.245.12	10.182.30.215	[TCP segment of a reassembled PDU]
0.148743	TCP	9	10.182.30.215	128.119.245.12	80 → 62699 [ACK] Seq=1 Ack=6901 Win=43904 Len=0
0.148900	TCP		128.119.245.12	10.182.30.215	[TCP segment of a reassembled PDU]
0.148934	TCP		128.119.245.12	10.182.30.215	[TCP segment of a reassembled PDU]

....0... = ECN-Echo: Not set
....0... = Urgent: Not set
....0... = Acknowledgment: Not set
....0... = Push: Not set
....0... = Reset: Not set
....0... = Syn: Set

Project1_Trace_1001234951_RamyaVeddula

Packets: 713 · Download: 713 (100.0%) · Load time: 0:0.4

Profile: Default

- b. In the TCP segment, the SYN control bit (Check in flags portion in the figure) is set to 1, hence this identifies the segment as a SYN segment.

Wireshark · Packet 1 · Project1_Trace_1001234951_RamyaVeddula

> Frame 1: 66 bytes on wire (528 bits), 66 bytes captured (528 bits) on interface 0

> Ethernet II, Src: IntelCor_9e:6d:2b (78:0c:b8:9e:6d:2b), Dst: All-HSRP-routers_02 (00:00:0c:07:ac:02)

> Internet Protocol Version 4, Src: 10.182.30.215, Dst: 128.119.245.12

> Transmission Control Protocol, Src Port: 62699 (62699), Dst Port: 80 (80), Seq: 0, Len: 0

Source Port: 62699

Destination Port: 80

[Stream index: 0]

[TCP Segment Len: 0]

Sequence number: 0 (relative sequence number)

Acknowledgment number: 0

Header Length: 32 bytes

> Flags: 0x002 (SYN)

000. = Reserved: Not set
...0 = Nonce: Not set
...0... = Congestion Window Reduced (CWR): Not set
....0... = ECN-Echo: Not set
....0... = Urgent: Not set
....0... = Acknowledgment: Not set
....0... = Push: Not set
....0... = Reset: Not set
>0... = Syn: Set
....0... = Fin: Not set
[TCP Flags: *****S*]

Window size value: 8192
[Calculated window size: 8192]

> Checksum: 0x4547 [validation disabled]

Urgent pointer: 0

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?

- a. The Sequence number of the SYNACK segment sent by the gaia.cs.umass.edu to the client computer (10.182.30.215) in reply to the SYN is 0. (Seq = 0)

```
Wireshark - Packet 2 - Project1_Trace_1001234951_RamyaYeddula
> Frame 2: 66 bytes on wire (528 bits), 66 bytes captured (528 bits) on interface 0
> Ethernet II, Src: CiscoInc_f0:d4:80 (00:15:c7:f0:d4:80), Dst: IntelCor_9e:6d:2b (78:0c:b8:9e:6d:2b)
> Internet Protocol Version 4, Src: 128.119.245.12, Dst: 10.182.30.215
> Transmission Control Protocol, Src Port: 80 (80), Dst Port: 62699 (62699), Seq: 0, Ack: 1, Len: 0
  Source Port: 80
  Destination Port: 62699
  [Stream index: 0]
  [TCP Segment Len: 0]
  Sequence number: 0 (relative sequence number)
  Acknowledgment number: 1 (relative ack number)
  Header Length: 32 bytes
  Flags: 0x012 (SYN, ACK)
    000. .... = Reserved: Not set
    ...0 .... = Nonce: Not set
    .... 0... = Congestion Window Reduced (CWR): Not set
    .... 0.. = ECN-Echo: Not set
    .... 0. .... = Urgent: Not set
    .... 1... = Acknowledgment: Set
    .... 0... = Push: Not set
    .... 0.. = Reset: Not set
    .... 1. = Syn: Set
    .... 0... = Fin: Not set
    [TCP Flags: *****A**S*]
  Window size value: 29200
  [Calculated window size: 29200]
  Checksum: 0x87c6 [validation disabled]
  Urgent pointer: 0
  Options: (12 bytes) Maximum segment size No-Operation (NOP) No-Operation (NOP) SACK permitted No-Operation
```

- b. The value of the acknowledgement field in SYNACK segment is 1. (Ack =1)

```
Wireshark - Packet 2 - Project11_Trace_1001234951_RamyaYeddula
> Frame 2: 66 bytes on wire (528 bits), 66 bytes captured (528 bits) on interface 0
> Ethernet II, Src: CiscoInc_f0:d4:80 (00:15:c7:f0:d4:80), Dst: IntelCor_9e:6d:2b (78:0c:b8:9e:6d:2b)
> Internet Protocol Version 4, Src: 128.119.245.12, Dst: 10.182.30.215
> Transmission Control Protocol, Src Port: 80 (80), Dst Port: 62699 (62699), Seq: 0, Ack: 1, Len: 0
  Source Port: 80
  Destination Port: 62699
  [Stream index: 0]
  [TCP Segment Len: 0]
  Sequence number: 0 (relative sequence number)
  Acknowledgment number: 1 (relative ack number)
  Header Length: 32 bytes
  Flags: 0x012 (SYN, ACK)
    000. .... = Reserved: Not set
    ...0 .... = Nonce: Not set
    ... 0... = Congestion Window Reduced (CWR): Not set
    .... 0... = ECN-Echo: Not set
    .... ..0. = Urgent: Not set
    .... ...1 = Acknowledgment: Set
    .... .... 0... = Push: Not set
    .... .... .0.. = Reset: Not set
    > .... .... ..1. = Syn: Set
    .... .... ...0 = Fin: Not set
    [TCP Flags: *****A*S*]
  Window size value: 29200
  [Calculated window size: 29200]
  > Checksum: 0x87c6 [validation disabled]
  Urgent pointer: 0
  > Options: (12 bytes) Maximum segment size No-Operation (NOP) No-Operation (NOP) SACK permitted No-Operation
```

- c. The acknowledgement field contains the value of the next sequence number the gaia.cs.umass.edu is expecting to receive, since gaia.cs.umass.edu has already received a SYN segment with sequence number 0 (seq=0) from the client computer (10.182.30.215) and SYNACK segment is a reply to the SYN segment. Hence the acknowledgement field of SYNACK contains the value of the sequence number of the next segment which in this case is ACK segment whose Sequence number is 1. Here SYN segment, SYNACK segment and ACK segment together indicates three-way handshaking. Hence in this case gaia.cs.umass.edu determine that value of the acknowledgement field by adding 1 to the initial sequence number of SYN segment from the client computer (10.182.30.215).

Project1_Trace_1001234951_RamyaYeddula.pcapng

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Apply a display filter: <Ctrl-F>

Time	Protocol	Seq/Port	Destination	Source	Info
0.000000	TCP		128.119.245...	10.182.30.215	62699 → 80 [SYN] Seq=0 Win=8192 Len=0 MSS=1460 WS=256...
0.048068	TCP	1	10.182.30.2...	128.119.245.12	80 → 62699 [SYN, ACK] Seq=0 Ack=1 Win=29200 Len=0 MSS...
0.048186	TCP	2	128.119.245...	10.182.30.215	62699 → 80 [ACK] Seq=1 Ack=1 Win=16384 Len=0
0.048458	TCP		128.119.245...	10.182.30.215	[TCP segment of a reassembled PDU]
0.048469	TCP		128.119.245...	10.182.30.215	[TCP segment of a reassembled PDU]
0.048478	TCP		128.119.245...	10.182.30.215	[TCP segment of a reassembled PDU]
0.048486	TCP		128.119.245...	10.182.30.215	[TCP segment of a reassembled PDU]
0.099517	TCP	4	10.182.30.2...	128.119.245.12	80 → 62699 [ACK] Seq=1 Ack=1381 Win=32128 Len=0
0.099586	TCP		128.119.245...	10.182.30.215	[TCP segment of a reassembled PDU]
0.099597	TCP		128.119.245...	10.182.30.215	[TCP segment of a reassembled PDU]
0.101786	TCP	5	10.182.30.2...	128.119.245.12	80 → 62699 [ACK] Seq=1 Ack=2761 Win=35072 Len=0
0.101853	TCP		128.119.245...	10.182.30.215	[TCP segment of a reassembled PDU]
0.101868	TCP		128.119.245...	10.182.30.215	[TCP segment of a reassembled PDU]
0.102043	TCP	6	10.182.30.2...	128.119.245.12	80 → 62699 [ACK] Seq=1 Ack=4141 Win=38016 Len=0
0.102080	TCP		128.119.245...	10.182.30.215	[TCP segment of a reassembled PDU]
0.102095	TCP		128.119.245...	10.182.30.215	[TCP segment of a reassembled PDU]
0.103613	TCP	7	10.182.30.2...	128.119.245.12	80 → 62699 [ACK] Seq=1 Ack=5521 Win=40960 Len=0
0.103681	TCP		128.119.245...	10.182.30.215	[TCP segment of a reassembled PDU]
0.103730	TCP		128.119.245...	10.182.30.215	[TCP segment of a reassembled PDU]
0.148743	TCP	9	10.182.30.2...	128.119.245.12	80 → 62699 [ACK] Seq=1 Ack=6901 Win=43904 Len=0
0.148900	TCP		128.119.245...	10.182.30.215	[TCP segment of a reassembled PDU]

> Frame 2: 66 bytes on wire (528 bits), 66 bytes captured (528 bits) on interface 0
 > Ethernet II, Src: CiscoInc_f0:d4:80 (00:15:c7:f0:d4:80), Dst: IntelCor_9e:6d:2b (78:0c:b8:9e:6d:2b)
 > Internet Protocol Version 4, Src: 128.119.245.12, Dst: 10.182.30.215

```

0000  78 0c b8 9e 6d 2b 00 15 c7 f0 d4 80 00 00 45 00  x...m+...E.
0010  00 34 00 00 40 00 32 06 a9 b3 80 77 f5 0c 0a b6  .4..@.2. ....w....
0020  1e d7 00 50 f4 eb 01 b6 69 fa ea 31 8b 4b 80 12  ...P....i..1.K..
0030  72 10 87 c6 00 00 02 04 05 64 01 01 04 02 01 03  r.....d.....
  
```

Packets: 213 · Displayed: 213 (100.0%) · Load time: 0:0.8 · Profile: Default

- d. In the TCP segment, the SYN control bit and Acknowledgement control bit (Check in flags portion in the figure) are set to 1, hence this identifies the segment as a SYNACK segment.

Wireshark · Packet 2 · Project1_Trace_1001234951_RamyaYeddula

> Frame 2: 66 bytes on wire (528 bits), 66 bytes captured (528 bits) on interface 0
 > Ethernet II, Src: CiscoInc_f0:d4:80 (00:15:c7:f0:d4:80), Dst: IntelCor_9e:6d:2b (78:0c:b8:9e:6d:2b)
 > Internet Protocol Version 4, Src: 128.119.245.12, Dst: 10.182.30.215
 > Transmission Control Protocol, Src Port: 80 (80), Dst Port: 62699 (62699), Seq: 0, Ack: 1, Len: 0

Source Port: 80
 Destination Port: 62699
 [Stream index: 0]
 [TCP Segment Len: 0]
 Sequence number: 0 (relative sequence number)
 Acknowledgment number: 1 (relative ack number)
 Header Length: 32 bytes

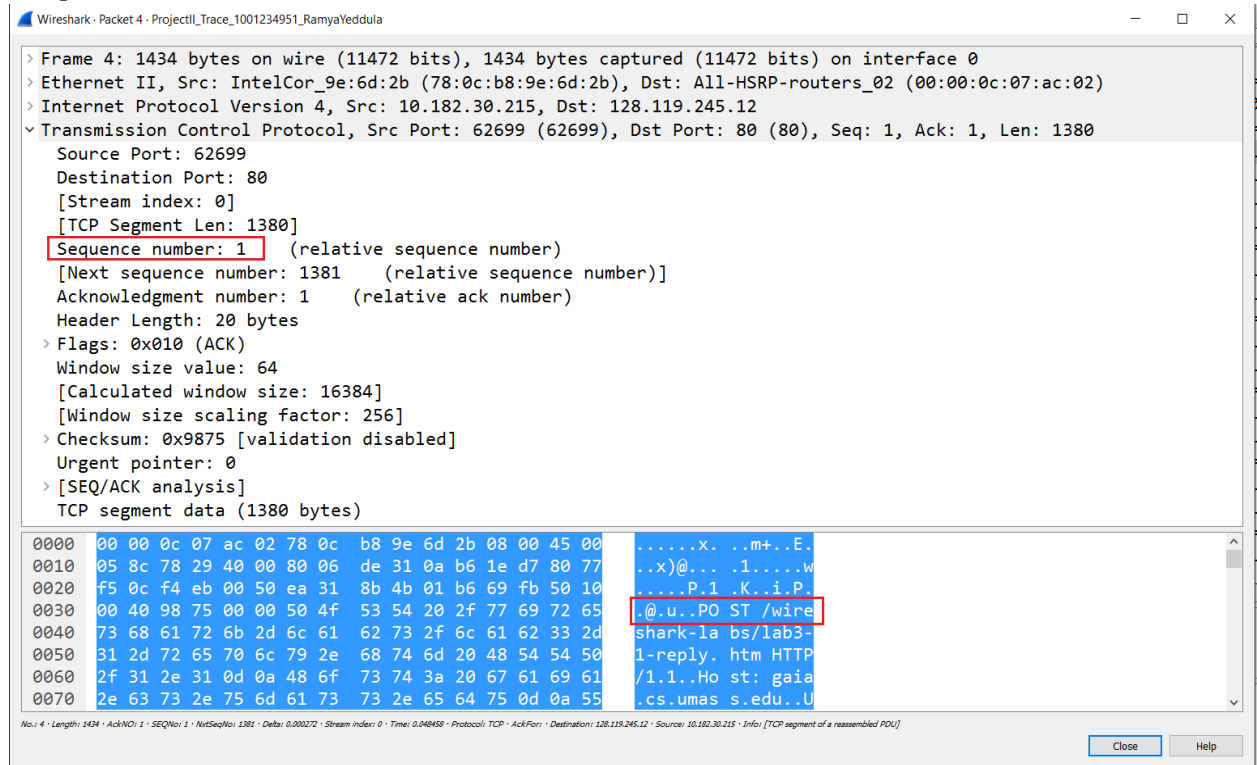
> Flags: 0x012 (SYN, ACK)

```

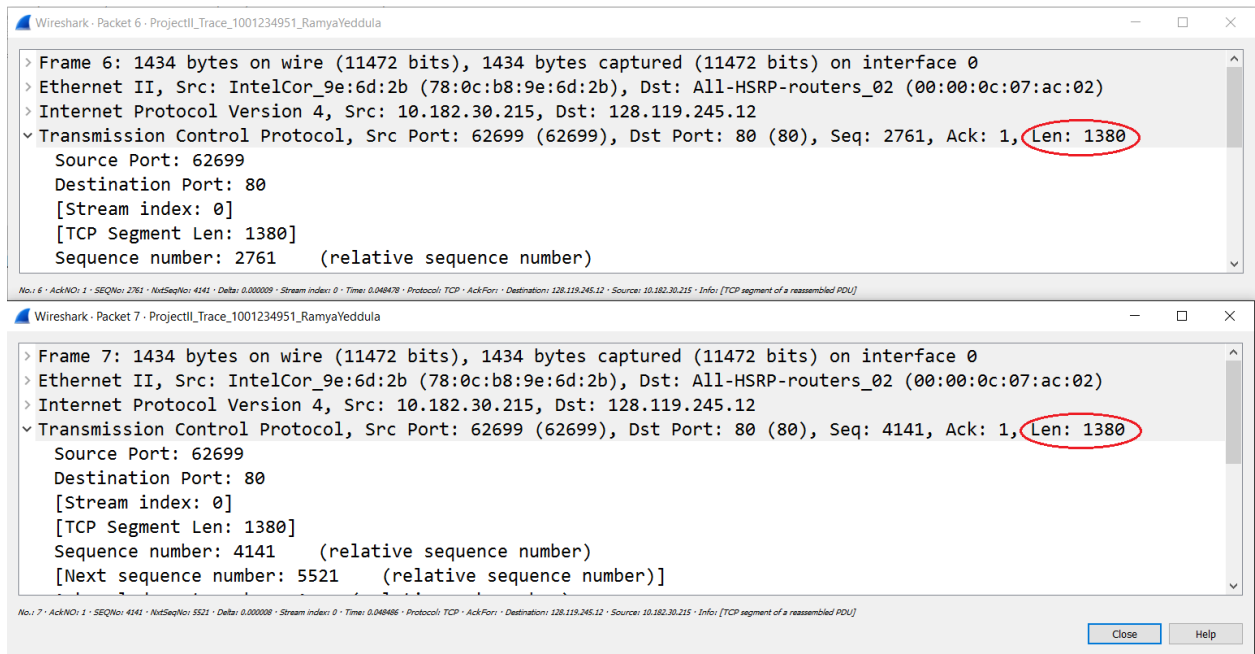
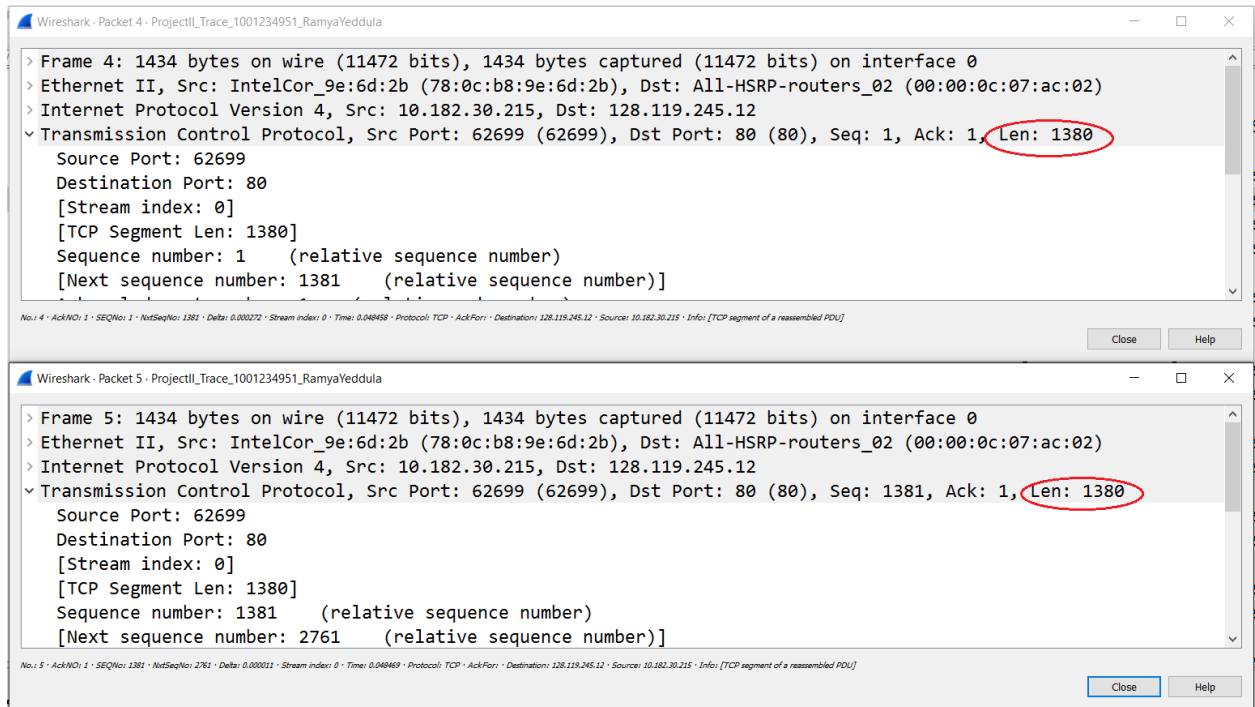
000. .... = Reserved: Not set
...0 .... = Nonce: Not set
... 0... = Congestion Window Reduced (CWR): Not set
... .0.. = ECN-Echo: Not set
... .0. = Urgent: Not set
... ..1. = Acknowledgment: Set
... ..0... = Push: Not set
... ..0.. = Reset: Not set
> ... ..1. = Syn: Set
... ..0 = Fin: Not set
[TCP Flags: *****A*S*]
Window size value: 29200
[Calculated window size: 29200]
> Checksum: 0x87c6 [validation disabled]
Urgent pointer: 0
Options: (12 bytes) Maximum segment size No-Operation (NOP) No-Operation (NOP) SACK permitted No-Operation
  
```

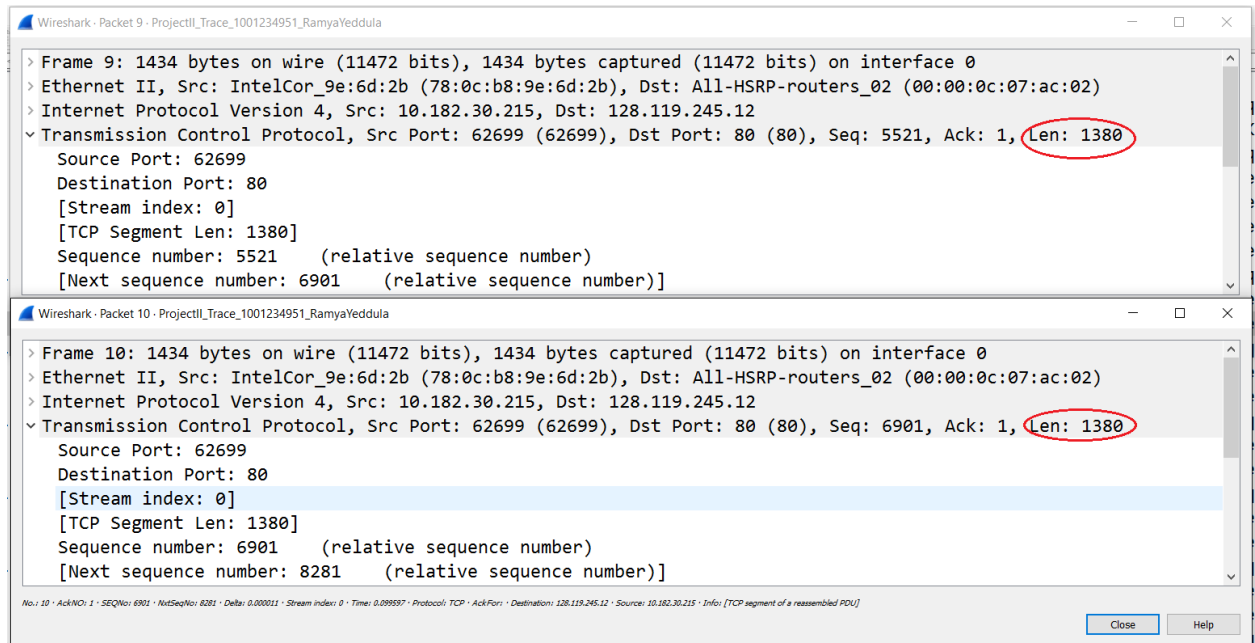

6. What is the sequence number of the TCP segment containing the HTTP POST command? Note that in order to find the POST command, you'll need to dig into the packet content field at the bottom of the Wireshark window, looking for a segment with a "POST" within its DATA field.

The sequence number of the TCP segment containing the HTTP POST command is 1.
(Seq = 1)

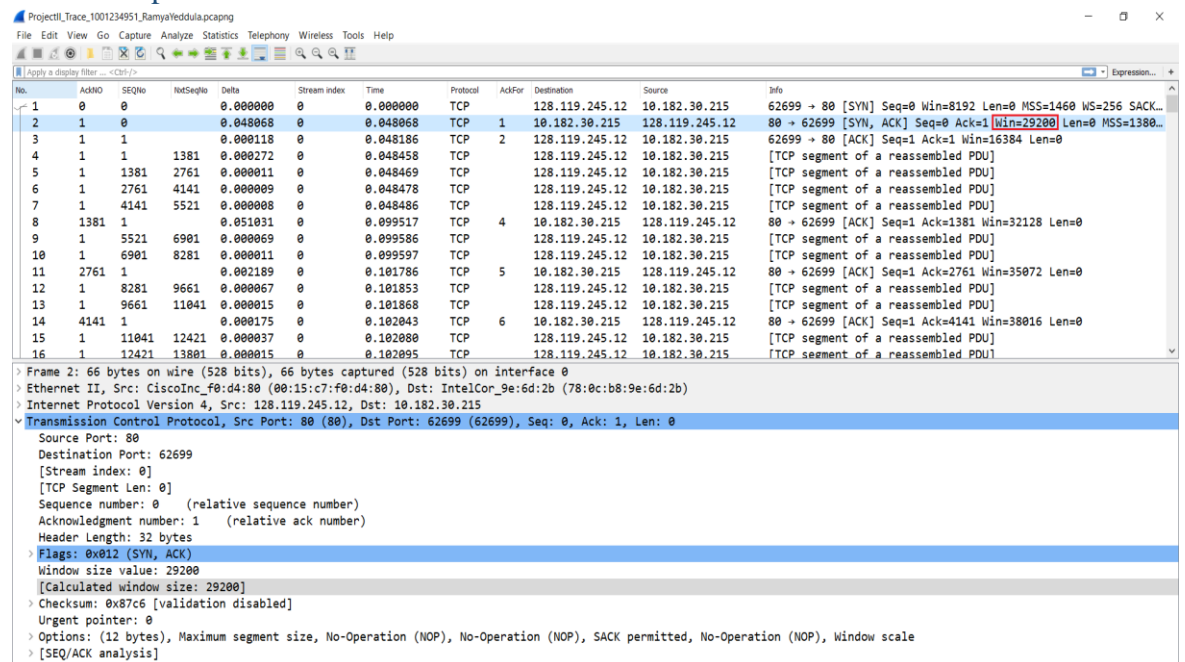


8. What is the length of each of the first six TCP segments?
Length of each of the first six TCP segments: 1380 bytes





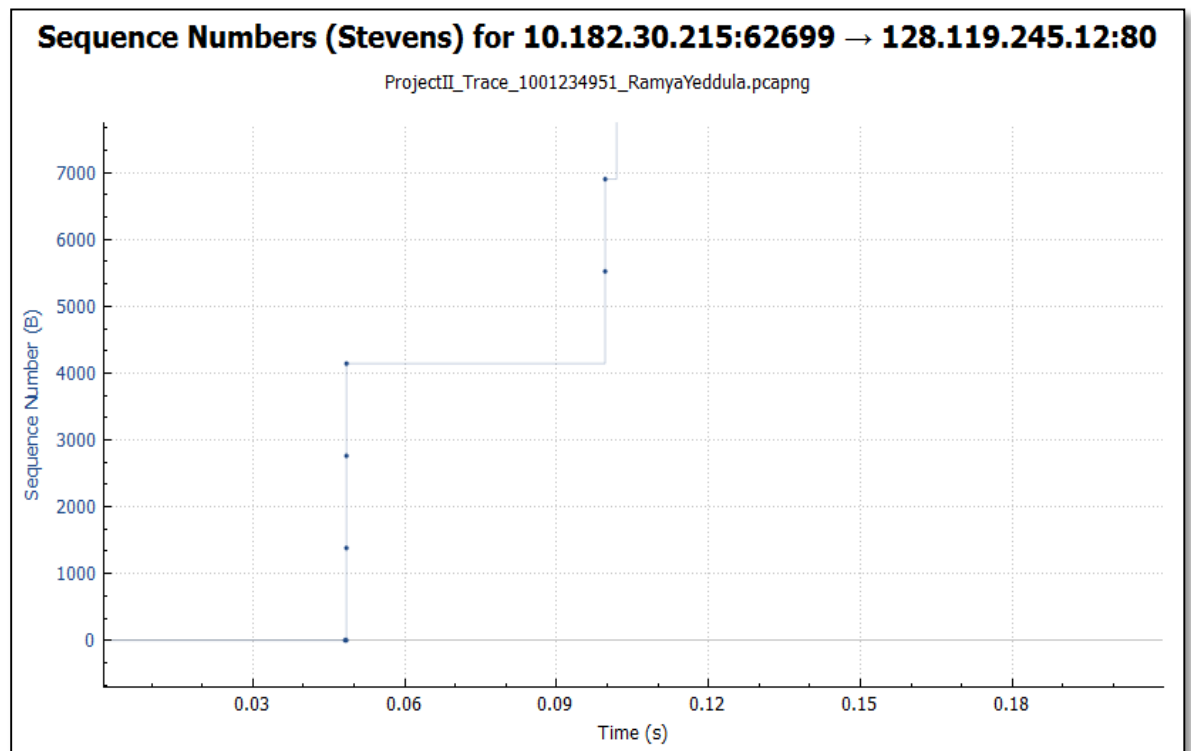
9. What is the minimum amount of available buffer space advertised at the receiver for the entire trace? Does the lack of receiver buffer space ever throttle the sender?
- a. The minimum amount of buffer space advertised at gaia.cs.umass.edu is 29200 bytes. This is shown in the first acknowledgment from gaia.cs.umass.edu which is SYNACK packet in our case.



- b. In this case, the receiver window increase steadily hence the lack of receiver buffer space never throttle the sender.

182	1117...	1	0.000437	0	0.309707	TCP	121	10.182.30.215	128.119.245.12	80 → 62699 [ACK] Seq=1 Ack=111781	Win=192000	Len=0
183	1131...	1	0.000429	0	0.310136	TCP	122	10.182.30.215	128.119.245.12	80 → 62699 [ACK] Seq=1 Ack=113161	Win=194944	Len=0
184	1145...	1	0.000449	0	0.310585	TCP	124	10.182.30.215	128.119.245.12	80 → 62699 [ACK] Seq=1 Ack=114541	Win=197888	Len=0
185	1159...	1	0.000001	0	0.310586	TCP	125	10.182.30.215	128.119.245.12	80 → 62699 [ACK] Seq=1 Ack=115921	Win=200704	Len=0
186	1173...	1	0.000002	0	0.310588	TCP	128	10.182.30.215	128.119.245.12	80 → 62699 [ACK] Seq=1 Ack=117301	Win=203648	Len=0
187	1186...	1	0.000001	0	0.310589	TCP	129	10.182.30.215	128.119.245.12	80 → 62699 [ACK] Seq=1 Ack=118681	Win=206592	Len=0
188	1200...	1	0.000387	0	0.310976	TCP	130	10.182.30.215	128.119.245.12	80 → 62699 [ACK] Seq=1 Ack=120061	Win=209536	Len=0
189	1214...	1	0.000461	0	0.311437	TCP	131	10.182.30.215	128.119.245.12	80 → 62699 [ACK] Seq=1 Ack=121441	Win=212480	Len=0
190	1228...	1	0.000001	0	0.311438	TCP	132	10.182.30.215	128.119.245.12	80 → 62699 [ACK] Seq=1 Ack=122821	Win=215424	Len=0
191	1242...	1	0.000001	0	0.311439	TCP	133	10.182.30.215	128.119.245.12	80 → 62699 [ACK] Seq=1 Ack=124201	Win=218240	Len=0

10. Are there any retransmitted segments in the trace file? What did you check for (in the trace) in order to answer this question?
- There are no retransmitted segments in this trace file between client (10.182.30.215) and destination (128.119.245.12)
 - This can be shown using Sequence Graph (Stevens) where all the sequence numbers are increasing with respect to time. If there are any retransmitted segments then in that case the sequence number of the retransmitted segment would be smaller than its neighboring segments.



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 247 in the text).

The amount of data being acknowledged is the difference between the acknowledged sequence numbers between two consecutive Acks.

The Acks between 128.119.245.12:80 to 10.182.30.215:62699 which can be seen below:

Segment Number in Trace	Acknowledged Sequence Number	Acknowledged Data
8	1381	1380
11	2761	1380
14	4141	1380
17	5521	1380
20	6901	1380
23	8281	1380
26	9661	1380
29	11041	1380
32	12421	1380
35	13801	1380
36	15181	1380

According to the trace the amount of data the receiver typically acknowledge in an ACK is 1380 bytes.

- c. According to the trace, there are some cases where the receiver is acknowledging every other segment. For example ,segment 174 has acknowledged data as 2760 bytes = $1380 * 2$

Segment Number	Acknowledged Sequence Number	Acknowledged Data
174	92461	2760
175	95221	2760
176	97981	2760

170	85561	1	0.000203	0	0.299492	TCP	94	10.182.30.215	128.119.245.12	80 → 62699 [ACK] Seq=1 Ack=85561 Win=183296 ...
171	86941	1	0.000465	0	0.299957	TCP	96	10.182.30.215	128.119.245.12	80 → 62699 [ACK] Seq=1 Ack=86941 Win=183296 ...
172	88321	1	0.000402	0	0.300359	TCP	97	10.182.30.215	128.119.245.12	80 → 62699 [ACK] Seq=1 Ack=88321 Win=183296 ...
173	89701	1	0.000928	0	0.301287	TCP	98	10.182.30.215	128.119.245.12	80 → 62699 [ACK] Seq=1 Ack=89701 Win=183296 ...
174	92461	1	0.000935	0	0.302222	TCP	102	10.182.30.215	128.119.245.12	80 → 62699 [ACK] Seq=1 Ack=92461 Win=183296 ...
175	95221	1	0.001159	0	0.303381	TCP	104	10.182.30.215	128.119.245.12	80 → 62699 [ACK] Seq=1 Ack=95221 Win=183296 ...
176	97981	1	0.000398	0	0.303779	TCP	106	10.182.30.215	128.119.245.12	80 → 62699 [ACK] Seq=1 Ack=97981 Win=183296 ...
177	102121	1	0.002090	0	0.305869	TCP	110	10.182.30.215	128.119.245.12	80 → 62699 [ACK] Seq=1 Ack=102121 Win=183296...
178	104881	1	0.000888	0	0.306757	TCP	112	10.182.30.215	128.119.245.12	80 → 62699 [ACK] Seq=1 Ack=104881 Win=183296...
179	107641	1	0.001674	0	0.308431	TCP	118	10.182.30.215	128.119.245.12	80 → 62699 [ACK] Seq=1 Ack=107641 Win=183296...
180	109021	1	0.000422	0	0.308853	TCP	119	10.182.30.215	128.119.245.12	80 → 62699 [ACK] Seq=1 Ack=109021 Win=186112...
181	110401	1	0.000417	0	0.309270	TCP	120	10.182.30.215	128.119.245.12	80 → 62699 [ACK] Seq=1 Ack=110401 Win=189056...
182	111781	1	0.000437	0	0.309707	TCP	121	10.182.30.215	128.119.245.12	80 → 62699 [ACK] Seq=1 Ack=111781 Win=192000...
183	113161	1	0.000429	0	0.310136	TCP	122	10.182.30.215	128.119.245.12	80 → 62699 [ACK] Seq=1 Ack=113161 Win=194944...
184	114541	1	0.000449	0	0.310585	TCP	124	10.182.30.215	128.119.245.12	80 → 62699 [ACK] Seq=1 Ack=114541 Win=197888...

12. What is the throughput (bytes transferred per unit time) for the TCP connection?

Explain how you calculated this value

Throughput = Total amount of data transmitted / transmission time

Total amount of data transmitted is obtained by the difference between the sequence number of the first TCP segment and the acknowledged sequence number of the last ACK.


I.e. Total amount of data transmitted = 152842 - 1 => 152841 bytes (check segment: 4 and segment: 213 in the trace)

Transmission time = 5.370484 - 0.048458 => 5.322026 (check times of segment: 4 and segment: 213 in the trace)

Throughput = 152841 bytes / 5.322026 secs => 28.7186 Kbyte/sec

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No.	ACKNO	SeqNo	NextSeqNo	Delta	Stream index	Time	Protocol	AckFor	Destination	Source	Info
1	0	0	0.000000	0	0.000000	TCP			128.119.245.12	10.182.30.215	62699 → 80 [SYN] Seq=0 Win=8192 Len=0 MSS=14...
2	1	0	0.048068	0	0.048068	TCP	1		10.182.30.215	128.119.245.12	80 → 62699 [SYN, ACK] Seq=0 Ack=1 Win=29200 ...
3	1	1	0.000118	0	0.048186	TCP	2		128.119.245.12	10.182.30.215	62699 → 80 [ACK] Seq=1 Ack=1 Win=16384 Len=0
4	1	1	1381	0.000272	0	0.048458	TCP		128.119.245.12	10.182.30.215	[TCP segment of a reassembled PDU]
5	1	1381	2761	0.000011	0	0.048469	TCP		128.119.245.12	10.182.30.215	[TCP segment of a reassembled PDU]
6	1	2761	4141	0.000009	0	0.048478	TCP		128.119.245.12	10.182.30.215	[TCP segment of a reassembled PDU]
7	1	4141	5521	0.000008	0	0.048486	TCP		128.119.245.12	10.182.30.215	[TCP segment of a reassembled PDU]

201	144901	1	0.000001	0	0.316095	TCP	155	10.182.30.215	128.119.245.12	80 → 62699 [ACK] Seq=1 Ack=144901 Win=260608...
202	146281	1	0.000000	0	0.316095	TCP	156	10.182.30.215	128.119.245.12	80 → 62699 [ACK] Seq=1 Ack=146281 Win=263552...
203	147661	1	0.000310	0	0.316405	TCP	158	10.182.30.215	128.119.245.12	80 → 62699 [ACK] Seq=1 Ack=147661 Win=266496...
204	149041	1	0.000001	0	0.316406	TCP	159	10.182.30.215	128.119.245.12	80 → 62699 [ACK] Seq=1 Ack=149041 Win=269440...
205	150421	1	0.000557	0	0.316963	TCP	161	10.182.30.215	128.119.245.12	80 → 62699 [ACK] Seq=1 Ack=150421 Win=272384...
206	151801	1	0.000001	0	0.316964	TCP	162	10.182.30.215	128.119.245.12	80 → 62699 [ACK] Seq=1 Ack=151801 Win=275200...
207	152841	1	0.000217	0	0.317181	TCP	163	10.182.30.215	128.119.245.12	80 → 62699 [ACK] Seq=1 Ack=152841 Win=278016...
208	152841	1	780	0.000686	0	0.317867	HTTP	10.182.30.215	128.119.245.12	HTTP/1.1 200 OK (text/html)
209	780	152841	0.025011	0	0.342878	TCP	208	128.119.245.12	10.182.30.215	62699 → 80 [ACK] Seq=152841 Ack=780 Win=1561...
210	152841	780	4.979586	0	5.322464	TCP		10.182.30.215	128.119.245.12	80 → 62699 [FIN, ACK] Seq=780 Ack=152841 Win...
211	781	152841	0.000171	0	5.322635	TCP	210	128.119.245.12	10.182.30.215	62699 → 80 [ACK] Seq=152841 Ack=781 Win=1561...
212	781	152841	0.000192	0	5.322827	TCP		128.119.245.12	10.182.30.215	62699 → 80 [FIN, ACK] Seq=152841 Ack=781 Win...
213	152842	781	0.047657	0	5.370484	TCP	212	10.182.30.215	128.119.245.12	80 → 62699 [ACK] Seq=781 Ack=152842 Win=2780...

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 239 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 239 for all subsequent segments.

- a. The sequence numbers of the first six segments in the TCP connection (including the segment containing the HTTP POST) are:

Segment Number from the trace	Sequence Number
4	1
5	1381
6	2761
7	4141
9	5521
10	6901

- b. The following table the time the segment was sent ,the segments was received and the RTT value for each of the six segments:

Segment Number from the trace	Sequence Number	Sent Time	Ack received Time	RTT (sec)
4	1	0.048458	0.099517	0.051059
5	1381	0.048469	0.101786	0.053317
6	2761	0.048478	0.102043	0.053565
7	4141	0.048486	0.103613	0.055127
9	5521	0.099586	0.148743	0.049157
10	6901	0.099597	0.149343	0.049746

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

where $\alpha = 0.125$

1. EstimatedRTT after the receipt of Ack of segment 4 is

$$\text{EstimatedRTT} = \text{RTT of segment 4} \Rightarrow 0.051059 \text{ seconds}$$

2. EstimatedRTT after the receipt of Ack of segment 5 is

$$\text{EstimatedRTT} = 0.875 * 0.051059 + 0.125 * 0.053317 \Rightarrow 0.0513412 \text{ seconds}$$

3. EstimatedRTT after the receipt of Ack of segment 6 is

$$\text{EstimatedRTT} = 0.875 * 0.0513412 + 0.125 * 0.053565 \Rightarrow 0.0516192 \text{ seconds}$$

4. EstimatedRTT after the receipt of Ack of segment 7 is

$$\text{EstimatedRTT} = 0.875 * 0.0516192 + 0.125 * 0.055127 \Rightarrow 0.0520577 \text{ seconds}$$

5. EstimatedRTT after the receipt of Ack of segment 9 is

$$\text{EstimatedRTT} = 0.875 * 0.0520577 + 0.125 * 0.049157 \Rightarrow 0.0516951 \text{ seconds}$$

6. EstimatedRTT after the receipt of Ack of segment 10 is

$$\text{EstimatedRTT} = 0.875 * 0.0516951 + 0.125 * 0.049746 \Rightarrow 0.05145146 \text{ seconds}$$

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No.	ACKNo	SeqNo	NextSeqNo	Delta	Stream index	Time	Protocol	ACKFor	Destination	Source	Info
1	0	0		0.000000	0	0.000000	TCP		128.119.245.12	10.182.30.215	62699 → 80 [SYN] Seq=0 Win=8192 Le...
2	1	0		0.048068	0	0.048068	TCP	1	10.182.30.215	128.119.245.12	80 → 62699 [SYN, ACK] Seq=0 Ack=1 ...
3	1	1		0.000118	0	0.048186	TCP	2	128.119.245.12	10.182.30.215	62699 → 80 [ACK] Seq=1 Ack=1 Win=1...
4	1	1	1381	0.000272	0	0.048458	TCP		128.119.245.12	10.182.30.215	[TCP segment of a reassembled PDU]
5	1	1381	2761	0.000011	0	0.048469	TCP		128.119.245.12	10.182.30.215	[TCP segment of a reassembled PDU]
6	1	2761	4141	0.000009	0	0.048478	TCP		128.119.245.12	10.182.30.215	[TCP segment of a reassembled PDU]
7	1	4141	5521	0.000008	0	0.048486	TCP		128.119.245.12	10.182.30.215	[TCP segment of a reassembled PDU]
8	1381	1		0.051031	0	0.099517	TCP	4	10.182.30.215	128.119.245.12	80 → 62699 [ACK] Seq=1 Ack=1381 Wi...
9	1	5521	6901	0.000069	0	0.099586	TCP		128.119.245.12	10.182.30.215	[TCP segment of a reassembled PDU]
10	1	6901	8281	0.000011	0	0.099597	TCP		128.119.245.12	10.182.30.215	[TCP segment of a reassembled PDU]
11	2761	1		0.002189	0	0.101786	TCP	5	10.182.30.215	128.119.245.12	80 → 62699 [ACK] Seq=1 Ack=2761 Wi...
12	1	8281	9661	0.000067	0	0.101853	TCP		128.119.245.12	10.182.30.215	[TCP segment of a reassembled PDU]
13	1	9661	11041	0.000015	0	0.101868	TCP		128.119.245.12	10.182.30.215	[TCP segment of a reassembled PDU]
14	4141	1		0.000175	0	0.102043	TCP	6	10.182.30.215	128.119.245.12	80 → 62699 [ACK] Seq=1 Ack=4141 Wi...
15	1	11041	12421	0.000037	0	0.102080	TCP		128.119.245.12	10.182.30.215	[TCP segment of a reassembled PDU]
16	1	12421	13801	0.000015	0	0.102095	TCP		128.119.245.12	10.182.30.215	[TCP segment of a reassembled PDU]
17	5521	1		0.001518	0	0.103613	TCP	7	10.182.30.215	128.119.245.12	80 → 62699 [ACK] Seq=1 Ack=5521 Wi...

Wireshark - Packet 4 - ProjectII_Trace_1001234951_RamyaVeddula

> Frame 4: 1434 bytes on wire (11472 bits), 1434 bytes captured (11472 bits) on interface 0

> Ethernet II, Src: IntelCor_9e:6d:2b (78:0c:b8:9e:6d:2b), Dst: All-HSRP-routers_02 (00:00:0c:07:ac:02)

> Internet Protocol Version 4, Src: 10.182.30.215, Dst: 128.119.245.12

```
0000 00 00 0c 07 ac 02 78 0c b8 9e 6d 2b 08 00 45 00 .....X. .m+..E.
0010 05 8c 78 29 40 00 80 06 de 31 0a b6 1e d7 80 77 ..x)@... .1....W
0020 f5 0c f4 eb 00 50 ea 31 8b 4b 01 b6 69 fb 50 10 .....P.1 .K..i.P.
0030 00 40 98 75 00 00 50 4f 53 54 20 2f 77 69 72 65 .@.u..PO ST /wire
```

No. 4 - ACKNo: 1 - SeqNo: 1381 - Delta: 0.000272 - Stream index: 0 - Time: 0.048458 - Protocol: TCP - ACKFor: - Destination: 128.119.245.12 - Source: 10.182.30.215 - Info: [TCP segment of a reassembled PDU]

Close Help

Round Trip Time for 10.182.30.215:62699 → 128.119.245.12:80

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