

Lab_04_TCP

PB21111686_赵卓

Part1

T1. 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).

- 如图所示，在下载的tcp-ethereal-trace-1文件中找到带有HTTP信息的TCP包，可以看到client computer的ip地址为192.168.1.102，TCP端口为1161

No.	Time	Source	Destination	Protocol	Length	Info
4	2004-08-21 21:44:20.596858	192.168.1.102	128.119.245.12	TCP	619	1161 → 80 [PSH, ACK] Seq=1 Ack=1 Win=17520 Len=565 [TCP segment of a reassembled PDU]
5	2004-08-21 21:44:20.612118	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	2004-08-21 21:44:20.624318	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=566 Win=6788 Len=0
7	2004-08-21 21:44:20.624407	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	2004-08-21 21:44:20.625071	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=3486 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
9	2004-08-21 21:44:20.647675	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=2026 Win=8760 Len=0
10	2004-08-21 21:44:20.647786	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=4946 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
11	2004-08-21 21:44:20.648538	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	2004-08-21 21:44:20.694466	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=3486 Win=11680 Len=0
13	2004-08-21 21:44:20.694566	192.168.1.102	128.119.245.12	TCP	1201	1161 → 80 [PSH, ACK] Seq=7866 Ack=1 Win=17520 Len=1147 [TCP segment of a reassembled PDU]
14	2004-08-21 21:44:20.739499	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=4946 Win=14600 Len=0
15	2004-08-21 21:44:20.787680	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=6406 Win=17520 Len=0
16	2004-08-21 21:44:20.838183	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=7866 Win=20440 Len=0

> Source: Actionte_8a:70:1a (00:20:e0:8a:70:1a) Type: IPv4 (0x0800)	0000 00 06 25 da af 73 00 20 e0 8a 70 1a 08 00 45 00 ..%.s. .p...E
> Internet Protocol Version 4, Src: 192.168.1.102, Dst: 128.119.245.12	0010 02 5d 1e 21 40 00 80 06 a2 e7 c0 a8 01 66 80 77 .j-l@... ..f.w
> Transmission Control Protocol, Src Port: 1161, Dst Port: 80, Seq: 1, Ack: 1, Len: 565	0020 f5 0c 04 89 00 50 0d d6 01 f5 34 a2 74 1a 50 18P... .4.t.p
Source Port: 1161	0030 44 7e 1f bd 00 00 50 af 53 54 20 2f 65 74 68 65 20....PO ST /ethe
Destination Port: 80	0040 72 65 61 6c 2d 6c 61 62 73 2f 6c 61 62 33 2d 31 real-lab s/lab3-1
[Stream index: 0]	0050 2d 72 65 70 6c 79 2e 68 74 6d 20 48 54 54 50 2f -reply.h tm HTTP/
[Conversation completeness: Incomplete, DATA (15)]	0060 31 2e 31 0d 0a 48 6f 73 74 3a 20 67 61 69 61 2e 1.1- Hos t: gaia.
[TCP Segment Len: 565]	0070 63 73 2e 75 6d 61 73 73 2e 65 64 75 0d 0a 55 73 cs.umass .edu-Us
Sequence Number: 1 (relative sequence number)	0080 65 72 2d 41 67 65 6e 74 3a 20 4d 6f 74 69 6c 6c er-Agent ; Mozill
Sequence Number (raw): 232129013	0090 61 2f 35 2e 30 20 28 57 69 6e 64 6f 77 73 3b 20 a/5.0 (W ndows;
[Next Sequence Number: 566 (relative sequence number)]	00a0 55 3b 20 57 69 6e 64 6f 77 73 20 4e 54 20 35 2e U; Windo ws NT 5.
Acknowledgment Number: 1 (relative ack number)	00b0 31 3b 20 65 6e 2d 55 53 3b 20 72 76 3a 31 2e 30 1; en-US ; rv:1.0
Acknowledgment number (raw): 883061786	00c0 2e 32 29 20 47 65 63 6b 6f 2f 32 30 33 30 32 .2) Geck o/200302
0101 = Header Length: 20 bytes (5)	00d0 30 38 20 4e 65 74 73 63 61 70 65 2f 37 2e 30 32 08 Netsc ape/7.02
> Flags: 0x018 (PSH, ACK)	00e0 0d 0a 41 63 63 65 70 74 3a 20 74 65 78 74 2f 78 .-Accept : text/x
Window: 17520	00f0 6d 6c 2c 61 70 70 6c 69 63 61 74 69 6f 6e 2f 78 ml,appli cation/x
[Calculated window size: 17520]	0100 6d 6c 2c 61 70 70 6c 69 63 61 74 69 6f 6e 2f 78 ml,appli cation/x
[Window size scaling factor: -2 (no window scaling used)]	0110 68 74 6d 6c 2b 78 6d 6c 2c 74 65 78 74 2f 68 74 html+xml ,text/ht
Checksum: 0x1fbd [unverified]	0120 6d 6c 3b 71 3d 30 2e 39 2c 74 65 78 74 2f 70 6c ml;q=0.9 ,text/pl
[Checksum Status: Unverified]	0130 61 69 6e 3b 71 3d 30 2e 38 2c 76 69 64 65 6f 2f x-imag;im age/png;
Urgent Pointer: 0	0140 78 2d 6d 6e 67 2c 69 6d 61 67 65 2f 70 6e 67 2c x-mng,im age/png;
> [Timestamps]	0150 69 6d 61 67 65 2f 6a 70 65 67 2c 69 6d 61 67 65 image/jp eg,image
	0160 2f 67 69 66 3b 71 3d 30 2e 32 2c 74 65 78 74 2f /gif;q=0 .2,text/
	0170 63 73 73 2c 2a 2f 2a 3b 71 3d 30 2e 31 0d 0a 41 css,/*; q=0.1 ..A
	0180 63 63 65 70 74 2d 4c 61 6e 67 75 61 67 65 3a 20 ccept-La nguage:

T2. What is the IP address of gaia.cs.umass.edu? On what port number is it sending and receiving TCP segments for this connection?

- 由第一题图可知，gaia.cs.umass.edu 的ip地址为128.119.245.12；在此次连接中收发TCP段的端口为80。

T3. What is the IP address and TCP port number used by your client computer (source) to transfer the file to gaia.cs.umass.edu?

- 如图所示，从自己抓包结果可知，client computer的ip地址为192.168.156.38，tcp端口号为59017。

11	2023-10-29	14:38:50.131213	192.168.156.38	128.119.245.12	TCP	801 59017 → 80	[PSH, ACK] Seq=1 Ack=1 Win=256 Len=747 [TCP segment of a reassembled PDU]
12	2023-10-29	14:38:50.131289	192.168.156.38	128.119.245.12	TCP	1514 59017 → 80	[ACK] Seq=748 Ack=1 Win=256 Len=1460 [TCP segment of a reassembled PDU]
13	2023-10-29	14:38:50.131289	192.168.156.38	128.119.245.12	TCP	1514 59017 → 80	[ACK] Seq=2208 Ack=1 Win=256 Len=1460 [TCP segment of a reassembled PDU]
14	2023-10-29	14:38:50.131289	192.168.156.38	128.119.245.12	TCP	1514 59017 → 80	[ACK] Seq=3668 Ack=1 Win=256 Len=1460 [TCP segment of a reassembled PDU]
17	2023-10-29	14:38:50.153342	192.168.156.38	128.119.245.12	TCP	66 59028 → 80	[SYN] Seq=0 Win=64240 Len=0 MSS=1460 WS=256 SACK_PERM
21	2023-10-29	14:38:50.563639	128.119.245.12	192.168.156.38	TCP	54 80 → 59017	[ACK] Seq=1 Ack=748 Win=240 Len=0
22	2023-10-29	14:38:50.563639	128.119.245.12	192.168.156.38	TCP	54 80 → 59017	[ACK] Seq=1 Ack=3668 Win=286 Len=0
23	2023-10-29	14:38:50.563673	192.168.156.38	128.119.245.12	TCP	1514 59017 → 80	[ACK] Seq=5128 Ack=1 Win=256 Len=1460 [TCP segment of a reassembled PDU]
24	2023-10-29	14:38:50.563673	192.168.156.38	128.119.245.12	TCP	1514 59017 → 80	[ACK] Seq=6588 Ack=1 Win=256 Len=1460 [TCP segment of a reassembled PDU]
25	2023-10-29	14:38:50.563673	192.168.156.38	128.119.245.12	TCP	1514 59017 → 80	[ACK] Seq=8048 Ack=1 Win=256 Len=1460 [TCP segment of a reassembled PDU]

> Frame 11: 801 bytes on wire (6408 bits), 801 bytes captured (6408 bits) on interface \Device\NPF_{1...}	0000	5e 08 53 fa c3 50 0e 43 5a 1a fb 66 08 00 45 00	^S...P.C Z...f...E...
> Ethernet II, Src: 0e:43:5a:1a:fb:66 (0e:43:5a:1a:fb:66), Dst: 5e:08:53:fa:c3:50 (5e:08:53:fa:c3:50)	0010	03 13 a8 85 40 00 40 06 bd 0c c0 a8 9c 26 80 77	...@...&...w...
> Internet Protocol Version 4, Src: 192.168.156.38, Dst: 128.119.245.12	0020	f5 0c e6 89 00 50 ca aa 48 1c fd e5 df 8b 50 18	...P...H...P...
> Transmission Control Protocol, Src Port: 59017, Dst Port: 80, Seq: 1, Ack: 1, Len: 747	0030	01 00 6c f8 00 00 50 4f 53 54 20 2f 77 69 72 65	...1...0 ST/wire...
Source Port: 59017	0040	73 68 61 72 6b 2d 6c 61 62 73 2f 6c 61 62 33 20	shark-la bs/lab3...
Destination Port: 80	0050	31 2d 72 65 70 6c 79 2e 68 74 6d 20 48 54 54 56	l-reply. html HTTP...
[Stream index: 3]	0060	2f 31 2e 31 0d 0a 48 6f 73 74 3a 20 67 61 69 61	/1.1..Ho st: gaia...
[Conversation completeness: Incomplete (60)]	0070	2e 63 73 2e 75 6d 61 73 73 2e 65 64 75 0d 0a 43	...cs.umass.edu...C...
[TCP Segment Len: 747]	0080	6f 6e 6e 65 63 74 69 6f 6e 3a 20 6b 65 65 70 2d	...nnectio n: keep...
Sequence Number: 1 (relative sequence number)	0090	61 6c 69 76 65 0d 0a 43 6f 6e 74 65 6e 74 2d 4c	...alive...Content-L...
Sequence Number (raw): 3400157212	00a0	65 6e 67 74 68 3a 20 31 35 32 33 32 31 0d 0a 43	...length: 1 52321...C...
[Next Sequence Number: 748 (relative sequence number)]	00b0	61 63 68 65 2d 43 6f 6e 74 72 6f 6c 3a 20 6d 61	...ache-Con trol: ma...
Acknowledgment Number: 1 (relative ack number)	00c0	78 2d 61 67 65 3d 30 0d 0a 55 70 67 72 61 64 65	...x-age=0...Upgrade...
Acknowledgment number (raw): 4259700619	00d0	2d 49 6e 73 65 63 75 72 65 2d 52 65 71 75 65 73	...Insecur e-Request...
0101 = Header Length: 20 bytes (5)	00e0	74 73 3a 20 31 0d 0a 4f 72 69 67 69 6e 3a 20 68	...ts: 1...o rigin: h...
> Flags: 0x018 (PSH, ACK)	00f0	74 74 70 3a 2f 2f 67 61 69 61 2e 63 73 2e 75 6d	...http://ga ia.cs.um...
000. = Reserved: Not set	0100	61 73 73 2e 65 64 75 0d 0a 43 6f 6e 74 65 6e 74	...ass.edu...Content...
...0 = Accurate ECN: Not set	0110	2d 54 79 70 65 3a 20 6d 75 6c 74 69 70 61 72 74	...-type: m ultipart...
...0 = Congestion Window Reduced: Not set	0120	2f 66 6f 72 6d 2d 64 61 74 61 3b 20 62 6f 75 6e	.../form-da ta; bound...
...0 = ECN-Echo: Not set	0130	64 61 72 79 3d 2d 2d 2d 2d 57 65 62 4b 69 74 4e	...dary=...-Webkitr...
...0 = Urgent: Not set	0140	6f 72 6d 42 6f 75 6e 6a 61 72 79 3a 58 76 30 31	...ormBound ary4Xv01...
...0 = Acknowledgment: Not set	0150	55 37 36 33 33 77 62 51 58 4c 75 0d 0a 55 73 65	...U7633wbQ Xlu...Use...
...0 = Push: Not set	0160	72 2d 41 67 65 6e 74 3a 20 4d 6f 7a 69 6c 6c 61	...n-Agent: Mozilla...
...0 = Reset: Not set			
>1. = Syn: Set			
...0 = Fin: Not set			
[TCP Flags:S.]			
Window: 64240			
[Calculated window size: 64240]			
Checksum: 0x0014 (unverified)			

Part2

T4. 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?

- 如图所示，TCP SYN的序列号是0；在段中是flags含有的一个标志位标明这个段是SYN段。

10	2023-10-29	14:38:50.127643	192.168.156.38	128.119.245.12	TCP	66 59027 → 80	[SYN] Seq=0 Win=64240 Len=0 MSS=1460 WS=256 SACK_PERM
11	2023-10-29	14:38:50.131213	192.168.156.38	128.119.245.12	TCP	801 59017 → 80	[PSH, ACK] Seq=1 Ack=1 Win=256 Len=747 [TCP segment of a reassembled PDU]
12	2023-10-29	14:38:50.131289	192.168.156.38	128.119.245.12	TCP	1514 59017 → 80	[ACK] Seq=748 Ack=1 Win=256 Len=1460 [TCP segment of a reassembled PDU]
13	2023-10-29	14:38:50.131289	192.168.156.38	128.119.245.12	TCP	1514 59017 → 80	[ACK] Seq=2208 Ack=1 Win=256 Len=1460 [TCP segment of a reassembled PDU]
14	2023-10-29	14:38:50.131289	192.168.156.38	128.119.245.12	TCP	1514 59017 → 80	[ACK] Seq=3668 Ack=1 Win=256 Len=1460 [TCP segment of a reassembled PDU]
17	2023-10-29	14:38:50.153342	192.168.156.38	128.119.245.12	TCP	66 59028 → 80	[SYN] Seq=0 Win=64240 Len=0 MSS=1460 WS=256 SACK_PERM
21	2023-10-29	14:38:50.563639	128.119.245.12	192.168.156.38	TCP	54 80 → 59017	[ACK] Seq=1 Ack=748 Win=240 Len=0
22	2023-10-29	14:38:50.563639	128.119.245.12	192.168.156.38	TCP	54 80 → 59017	[ACK] Seq=1 Ack=3668 Win=286 Len=0
23	2023-10-29	14:38:50.563673	192.168.156.38	128.119.245.12	TCP	1514 59017 → 80	[ACK] Seq=5128 Ack=1 Win=256 Len=1460 [TCP segment of a reassembled PDU]
24	2023-10-29	14:38:50.563673	192.168.156.38	128.119.245.12	TCP	1514 59017 → 80	[ACK] Seq=6588 Ack=1 Win=256 Len=1460 [TCP segment of a reassembled PDU]
25	2023-10-29	14:38:50.563673	192.168.156.38	128.119.245.12	TCP	1514 59017 → 80	[ACK] Seq=8048 Ack=1 Win=256 Len=1460 [TCP segment of a reassembled PDU]

Sequence Number: 0 (relative sequence number)	0000	5e 08 53 fa c3 50 0e 43 5a 1a fb 66 08 00 45 00	^S...P.C Z...f...E...
Sequence Number (raw): 242810402	0010	00 34 a8 84 40 00 40 06 bf ec c0 a8 9c 26 80 77	...4...@...&...w...
[Next Sequence Number: 1 (relative sequence number)]	0020	f5 0c e6 93 00 50 0e 78 fe 22 00 00 00 00 02	...P...X..."......
Acknowledgment Number: 0	0030	fa f0 ae 4d 00 00 02 04 05 b4 01 03 03 08 01 01	...M...
Acknowledgment number (raw): 0	0040	04 02	..
1000 = Header Length: 32 bytes (8)			
> Flags: 0x002 (SYN)			
000. = Reserved: Not set			
...0 = Accurate ECN: Not set			
...0 = Congestion Window Reduced: 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: 64240			
[Calculated window size: 64240]			
Checksum: 0x0014 (unverified)			

T5. 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?

- SYNACK的序列号是0；Acknowledgement filed的值为1；gaia.cs.umass.edu 根据上次收到的TCP segment的序列号加1得到；在段中是flags含有的两个标志位一起标明这个段是SYNACK段。

28	2023-10-29 14:38:50.565161	128.119.245.12	192.168.156.38	TCP	66 80 → 59028 [SYN, ACK] Seq=0 Ack=1 Win=29200 Len=0 MSS=1460 SACK_PERM WS=128
29	2023-10-29 14:38:50.565197	192.168.156.38	128.119.245.12	TCP	54 59028 → 80 [ACK] Seq=1 Ack=1 Win=65536 Len=0
30	2023-10-29 14:38:50.565397	192.168.156.38	128.119.245.12	TCP	801 59028 → 80 [PSH, ACK] Seq=1 Ack=1 Win=65536 Len=747 [TCP segment of a reassembled PDU]
31	2023-10-29 14:38:50.565462	192.168.156.38	128.119.245.12	TCP	1514 59028 → 80 [ACK] Seq=748 Ack=1 Win=65536 Len=1460 [TCP segment of a reassembled PDU]
32	2023-10-29 14:38:50.565462	192.168.156.38	128.119.245.12	TCP	1514 59028 → 80 [ACK] Seq=2208 Ack=1 Win=65536 Len=1460 [TCP segment of a reassembled PDU]
33	2023-10-29 14:38:50.565462	192.168.156.38	128.119.245.12	TCP	1514 59028 → 80 [ACK] Seq=3668 Ack=1 Win=65536 Len=1460 [TCP segment of a reassembled PDU]
34	2023-10-29 14:38:50.565462	192.168.156.38	128.119.245.12	TCP	1514 59028 → 80 [ACK] Seq=5128 Ack=1 Win=65536 Len=1460 [TCP segment of a reassembled PDU]
35	2023-10-29 14:38:50.565462	192.168.156.38	128.119.245.12	TCP	1514 59028 → 80 [ACK] Seq=6588 Ack=1 Win=65536 Len=1460 [TCP segment of a reassembled PDU]
36	2023-10-29 14:38:50.565462	192.168.156.38	128.119.245.12	TCP	1514 59028 → 80 [ACK] Seq=8048 Ack=1 Win=65536 Len=1460 [TCP segment of a reassembled PDU]
37	2023-10-29 14:38:50.565462	192.168.156.38	128.119.245.12	TCP	1514 59028 → 80 [ACK] Seq=9508 Ack=1 Win=65536 Len=1460 [TCP segment of a reassembled PDU]
38	2023-10-29 14:38:50.565462	192.168.156.38	128.119.245.12	TCP	1514 59028 → 80 [ACK] Seq=10968 Ack=1 Win=65536 Len=1460 [TCP segment of a reassembled PDU]
39	2023-10-29 14:38:50.565462	192.168.156.38	128.119.245.12	TCP	1514 59028 → 80 [ACK] Seq=12428 Ack=1 Win=65536 Len=1460 [TCP segment of a reassembled PDU]
40	2023-10-29 14:38:50.906119	192.168.156.38	20.189.173.12	TLSv1.2	144 Application Data
41	2023-10-29 14:38:50.906173	192.168.156.38	20.189.173.12	TLSv1.2	1218 Application Data
42	2023-10-29 14:38:50.927720	128.119.245.12	192.168.156.38	TCP	54 80 → 59017 [ACK] Seq=1 Ack=12428 Win=65536 Len=0

Sequence Number: 0 (relative sequence number)
Sequence Number (raw): 4108916085
[Next Sequence Number: 1 (relative sequence number)]
Acknowledgment Number: 1 (relative ack number)
Acknowledgment number (raw): 2018183051
1000 = Header Length: 32 bytes (8)
▼ Flags: 0x012 (SYN, ACK)
000. = Reserved: Not set
...0 = Accurate ECN: Not set
...0 = Congestion Window Reduced: 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: 29200
[Calculated window size: 29200]
Checksum: 0xb003 (verified)

0000 0e 43 5a 1a fb 66 5e 08 53 fa c3 50 08 00 45 04 00 34 00 00 40 00 20 06 88 6d 80 77 f5 0c c0 a8 0020 9c 26 00 50 e6 94 f4 e9 15 75 78 4b 07 8b 80 12 0030 72 10 b9 83 00 00 02 04 05 b4 01 01 04 02 01 03 0040 03 07 ..

T6. 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.

- 如图，包含HTTP POST指令的TCP段的序列号为1。

11	2023-10-29 14:38:50.131213	192.168.156.38	128.119.245.12	TCP	801 59017 → 80 [PSH, ACK] Seq=1 Ack=1 Win=256 Len=747 [TCP segment of a reassembled PDU]
12	2023-10-29 14:38:50.131289	192.168.156.38	128.119.245.12	TCP	1514 59017 → 80 [ACK] Seq=748 Ack=1 Win=256 Len=1460 [TCP segment of a reassembled PDU]
13	2023-10-29 14:38:50.131289	192.168.156.38	128.119.245.12	TCP	1514 59017 → 80 [ACK] Seq=2208 Ack=1 Win=256 Len=1460 [TCP segment of a reassembled PDU]
14	2023-10-29 14:38:50.131289	192.168.156.38	128.119.245.12	TCP	1514 59017 → 80 [ACK] Seq=3668 Ack=1 Win=256 Len=1460 [TCP segment of a reassembled PDU]
17	2023-10-29 14:38:50.153342	192.168.156.38	128.119.245.12	TCP	66 59028 → 80 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 WS=256 SACK_PERM
21	2023-10-29 14:38:50.563639	128.119.245.12	192.168.156.38	TCP	54 80 → 59017 [ACK] Seq=1 Ack=748 Win=240 Len=0
22	2023-10-29 14:38:50.563639	128.119.245.12	192.168.156.38	TCP	54 80 → 59017 [ACK] Seq=1 Ack=3668 Win=286 Len=0
24	2023-10-29 14:38:50.563673	192.168.156.38	128.119.245.12	TCP	1514 59017 → 80 [ACK] Seq=5128 Ack=1 Win=256 Len=1460 [TCP segment of a reassembled PDU]
25	2023-10-29 14:38:50.563673	192.168.156.38	128.119.245.12	TCP	1514 59017 → 80 [ACK] Seq=6588 Ack=1 Win=256 Len=1460 [TCP segment of a reassembled PDU]
26	2023-10-29 14:38:50.563673	192.168.156.38	128.119.245.12	TCP	1514 59017 → 80 [ACK] Seq=8048 Ack=1 Win=256 Len=1460 [TCP segment of a reassembled PDU]
27	2023-10-29 14:38:50.563673	192.168.156.38	128.119.245.12	TCP	1514 59017 → 80 [ACK] Seq=9508 Ack=1 Win=256 Len=1460 [TCP segment of a reassembled PDU]
28	2023-10-29 14:38:50.565161	128.119.245.12	192.168.156.38	TCP	66 80 → 59028 [SYN, ACK] Seq=0 Ack=1 Win=29200 Len=0 MSS=1460 SACK_PERM WS=128
29	2023-10-29 14:38:50.565197	192.168.156.38	128.119.245.12	TCP	54 59028 → 80 [ACK] Seq=1 Ack=1 Win=65536 Len=0
30	2023-10-29 14:38:50.565397	192.168.156.38	128.119.245.12	TCP	801 59028 → 80 [PSH, ACK] Seq=1 Ack=1 Win=65536 Len=747 [TCP segment of a reassembled PDU]

Transmission Control Protocol, Src Port: 59017, Dst Port: 80, Seq: 1, Ack: 1, Len: 747
Source Port: 59017
Destination Port: 80
[Stream index: 3]
[Conversation completeness: Incomplete (60)]
[TCP Segment Len: 747]
Sequence Number: 1 (relative sequence number)
Sequence Number (raw): 3400157212
[Next Sequence Number: 748 (relative sequence number)]
Acknowledgment Number: 1 (relative ack number)
Acknowledgment number (raw): 4259700619
0101 = Header Length: 20 bytes (5)
▼ Flags: 0x018 (PSH, ACK)
Window: 256
[Calculated window size: 256]
[Window size scaling factor: 1 (unknown)]

0000 5e 08 53 fa c3 50 0e 43 5a 1a fb 66 08 00 45 00 0010 03 13 a8 85 40 00 40 06 bd 0c c0 a8 9c 26 80 77 0020 f5 0c e6 89 00 50 ca aa 48 1c fd e5 df 8b 50 18 0030 01 00 6c f8 00 00 50 4f 53 54 20 2f 77 69 72 65 0040 73 68 61 72 6b 2d 6c 61 62 73 2f 6c 61 62 33 2d 0050 31 2d 72 65 70 6c 79 2e 68 74 6d 20 48 54 54 50 0060 2f 31 2e 31 0d 0a 48 6f 73 74 3a 20 67 61 69 61 0070 2e 63 73 2e 75 6d 61 73 73 2e 65 64 75 0d 0a 43 0080 6f 6e 6e 65 63 74 69 6f 6e 3a 20 6b 65 65 70 2d 0090 61 6c 69 76 65 0d 0a 43 6f 6e 74 65 6e 74 2d 4c 00a0 65 6e 67 74 68 3a 20 31 35 32 33 32 31 0d 0a 43 00b0 61 63 68 65 2d 43 6f 6e 74 72 6f 6c 3a 20 6d 61 00c0 78 2d 61 67 65 63 30 0d 0a 55 70 67 72 61 64 65 00d0 2d 49 6e 73 65 63 75 72 65 2d 52 65 71 75 65 73 00e0 74 73 3a 20 31 0d 0a 4f 72 69 67 69 6e 3a 20 68 00f0 74 74 70 3a 2f 2f 6f 61 69 61 2e 63 73 2e 75 6d 0100 61 73 73 2e 65 64 75 0d 0a 43 6f 6e 74 65 6e 74

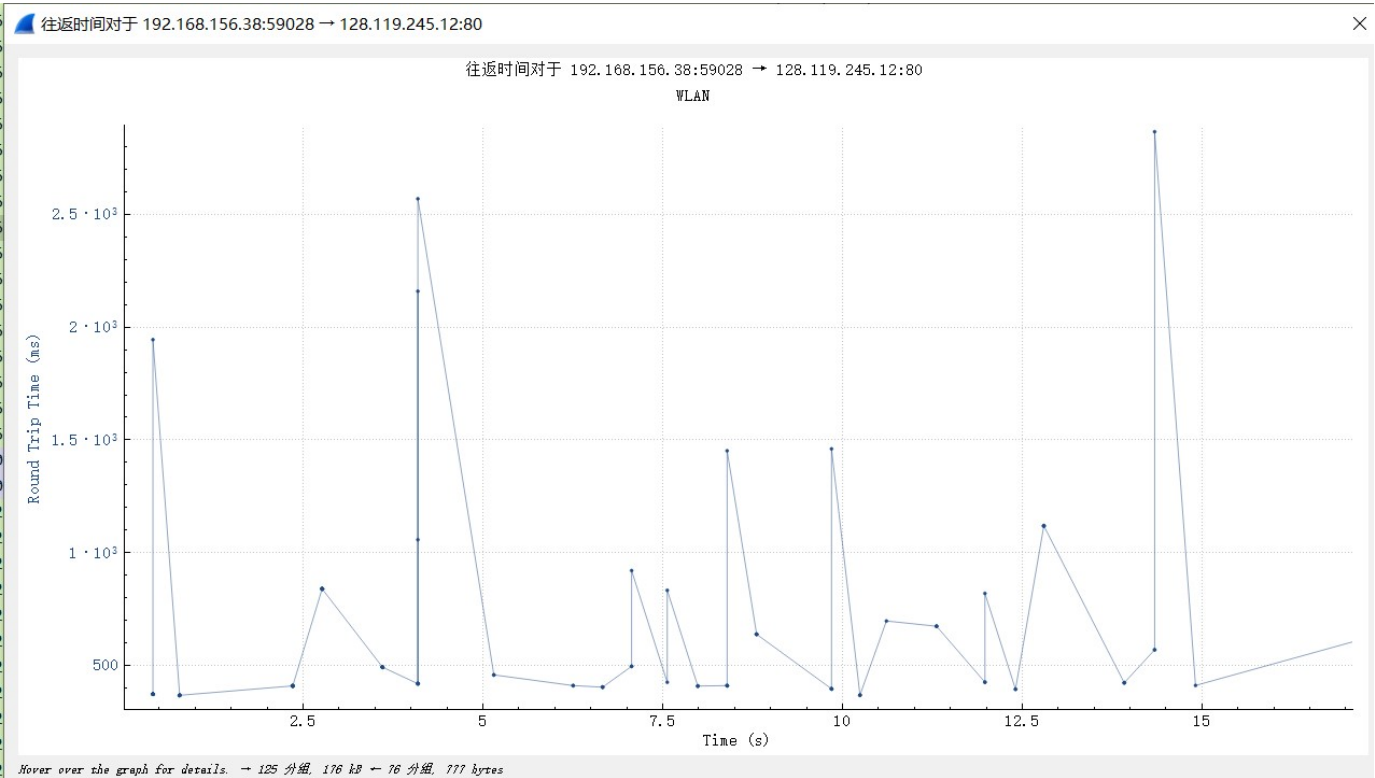
T7. Consider the TCP segment containing the HTTP POST as the first segment in the TCP connection. What are the sequence numbers of the first six segments in the TCP connection (including the segment containing the HTTP POST)? At what time was each segment sent? When was the ACK for each segment received? 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 Estimated RTT

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.

- 6个TCP序号分别为：1, 748, 2208, 3668, 5128, 6588。
发送时间分别为：Oct 29, 2023 14:38:50.565397000, Oct 29, 2023 14:38:50.565462000, Oct 29, 2023 14:38:50.565462000, Oct 29, 2023 14:38:50.565462000, Oct 29, 2023 14:38:50.565462000, Oct 29, 2023 14:38:50.565462000。
接收到ACK的时间分别为Oct 29, 2023 14:38:50.937485000, Oct 29, 2023 14:38:50.937485000, Oct 29, 2023 14:38:50.937485000, Oct 29, 2023 14:38:50.937485000, Oct 29, 2023 14:38:50.937485000, Oct 29, 2023 14:38:50.937485000。
RTT值分别为0.372088, 0.372023, 0.372023, 0.372023, 0.372023, 0.372023。
根据后五次RTT值依次更新EstimatedRTT得到的值分别为0.372289, 0.372152, 0.372152, 0.372152, 0.372152。

30	2023-10-29 14:38:50.565397	192.168.156.38	128.119.245.12	TCP	801 59028 → 80 [PSH, ACK] Seq=1 Ack=1 Win=65536 Len=747 [TCP segment of a reassembled PDU]
31	2023-10-29 14:38:50.565462	192.168.156.38	128.119.245.12	TCP	1514 59028 → 80 [ACK] Seq=748 Ack=1 Win=65536 Len=1460 [TCP segment of a reassembled PDU]
32	2023-10-29 14:38:50.565462	192.168.156.38	128.119.245.12	TCP	1514 59028 → 80 [ACK] Seq=2208 Ack=1 Win=65536 Len=1460 [TCP segment of a reassembled PDU]
33	2023-10-29 14:38:50.565462	192.168.156.38	128.119.245.12	TCP	1514 59028 → 80 [ACK] Seq=3668 Ack=1 Win=65536 Len=1460 [TCP segment of a reassembled PDU]
34	2023-10-29 14:38:50.565462	192.168.156.38	128.119.245.12	TCP	1514 59028 → 80 [ACK] Seq=5128 Ack=1 Win=65536 Len=1460 [TCP segment of a reassembled PDU]
35	2023-10-29 14:38:50.565462	192.168.156.38	128.119.245.12	TCP	1514 59028 → 80 [ACK] Seq=6588 Ack=1 Win=65536 Len=1460 [TCP segment of a reassembled PDU]

55	2023-10-29 14:38:50.937485	128.119.245.12	192.168.156.38	TCP	66 [TCP Window Update] 80 → 59028 [ACK] Seq=1 Ack=1 Win=43904 Len=0 SLE=6588 SRE=13888
56	2023-10-29 14:38:50.937485	128.119.245.12	192.168.156.38	TCP	66 80 → 59028 [ACK] Seq=1 Ack=748 Win=45312 Len=0 SLE=6588 SRE=13888
57	2023-10-29 14:38:50.937485	128.119.245.12	192.168.156.38	TCP	66 80 → 59028 [ACK] Seq=1 Ack=5128 Win=54144 Len=0 SLE=6588 SRE=13888



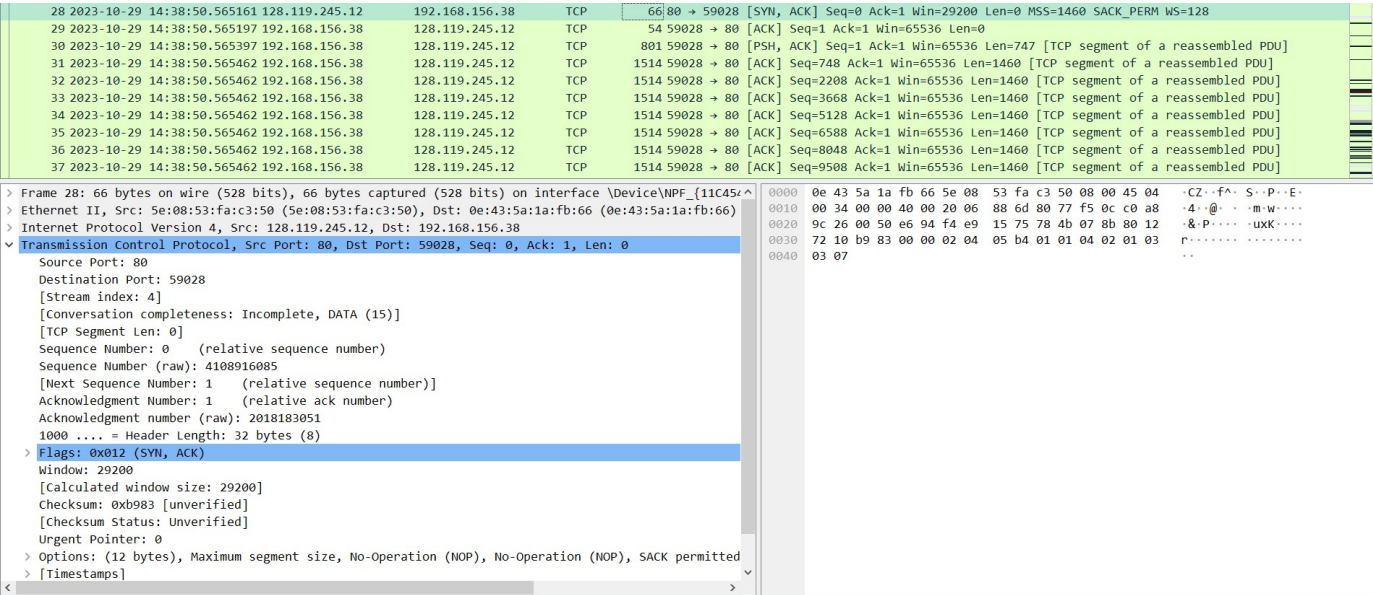
T8. What is the length of each of the first six TCP segments?

- 由上一题的图中可以看到，长度分别为747, 1460, 1460, 1460, 1460, 1460。

T9. 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?

- 可用缓存空间的最小值为29200；因此在整个捕获中缓存空间一直较大，没有限制发送方。



T10. Are there any retransmitted segments in the trace file? What did you check for (in the trace) in order to answer this question?

- 没有发生重传；可以检查发送的tcp段的序列号是否重复可以验证是否重传。

T11. 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).

- 在一个ACK中通常每次确认的数据量为1460；在确认量大于1460时，为表中第二种情况(延迟确认)，例如在56号TCP段和57号TCP段间ACK的差值为4380。

56	2023-10-29 14:38:50.937485	128.119.245.12	192.168.156.38	TCP	66 80 → 59028 [ACK] Seq=1 Ack=748 Win=45312 Len=0 SLE=6588 SRE=13888
57	2023-10-29 14:38:50.937485	128.119.245.12	192.168.156.38	TCP	66 80 → 59028 [ACK] Seq=1 Ack=5128 Win=54144 Len=0 SLE=6588 SRE=13888

T12. What is the throughput (bytes transferred per unit time) for the TCP connection? Explain how you calculated this value.

- 从图中可知发送的总字节数为153068，用总字节数除以发送用时（约0.613974s），即可得到吞吐量249306bytes/。

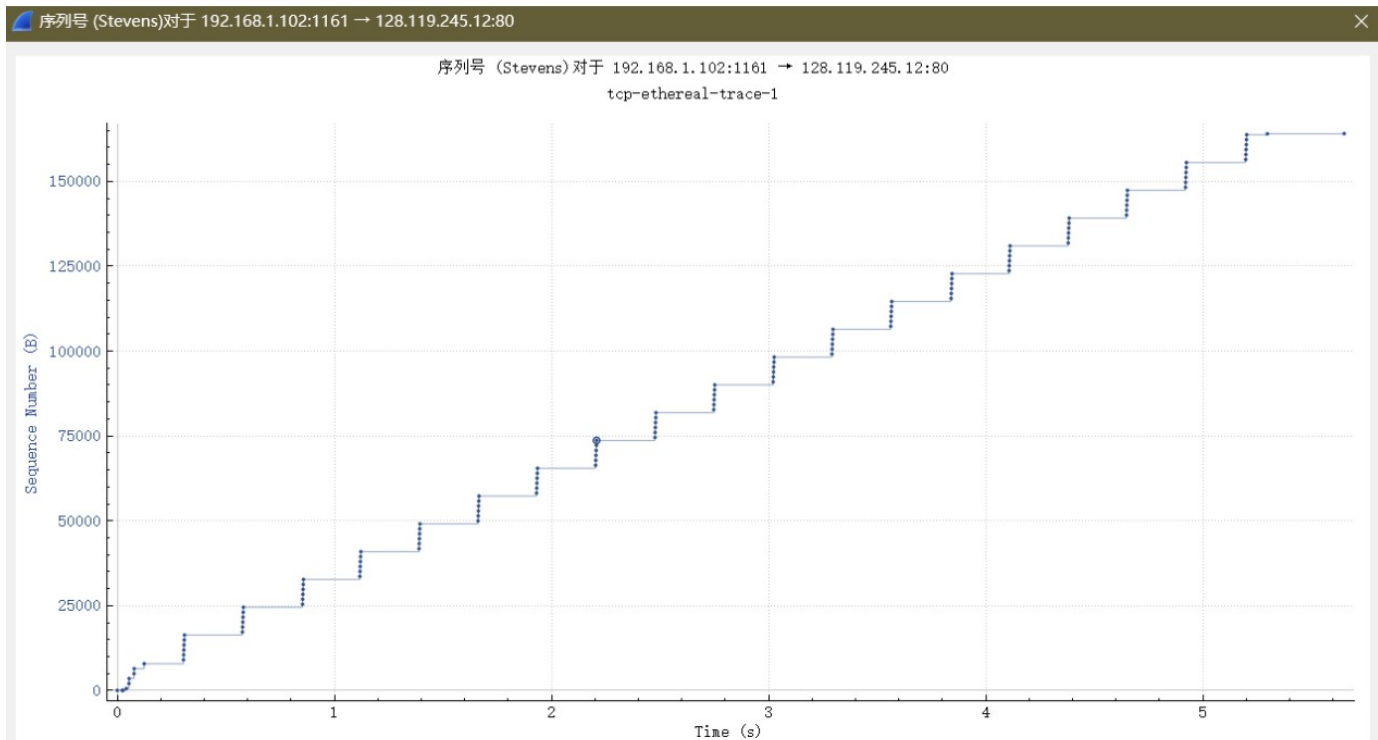
377	2023-10-29 14:39:07.361521	192.168.156.38	128.119.245.12	HTTP	535 POST /wireshark-labs/lab3-1-reply.htm HTTP/1.1 (text/plain)
381	2023-10-29 14:39:07.975495	128.119.245.12	192.168.156.38	HTTP	831 HTTP/1.1 200 OK (text/html)

> Ethernet II, Src: 0e:43:5a:1a:fb:66 (0e:43:5a:1a:fb:66), Dst: 5e:08:53:fa:c3:50 (5e:08:53:fa:c3:50) > Internet Protocol Version 4, Src: 192.168.156.38, Dst: 128.119.245.12 > Transmission Control Protocol, Src Port: 59028, Dst Port: 80, Seq: 152588, Ack: 1, Len: 481 Source Port: 59028 Destination Port: 80 [Stream index: 4] [Conversation completeness: Incomplete, DATA (15)] [TCP Segment Len: 481] Sequence Number: 152588 (relative sequence number) Sequence Number (raw): 2018335638 [Next Sequence Number: 153069 (relative sequence number)] Acknowledgment Number: 1 (relative ack number) Acknowledgment number (raw): 4108916086 0101 = Header Length: 20 bytes (5) > Flags: 0x018 (PSH, ACK) Window: 256 [Calculated window size: 65536] [Window size scaling factor: 256] Checksum: 0x62f5 [unverified] [Checksum status: Unverified] Urgent Pointer: 0 > [Timestamps] > [SEQ/ACK analysis] TCP payload (481 bytes) TCP segment data (481 bytes) > [111 Reassembled TCP Segments (153068 bytes): #30(747), #31(1460), #32(1460), #33(1460), #34(1460), > Hypertext Transfer Protocol > MIME Multipart Media Encapsulation, Type: multipart/form-data, Boundary: "----WebKitFormBoundaryGI5c	0000 5e 08 53 fa c3 50 0e 43 5a 1a fb 66 08 00 45 00 ^S...P.C Z...f...E- 0010 02 09 a9 44 40 00 40 06 bd 57 c0 a8 9c 26 80 77 ...D@...W...&w 0020 f5 0c e6 94 00 50 78 ad 5b 96 f4 e9 15 76 50 18PXM [...]vP- 0030 01 00 62 f5 00 00 61 72 73 2c 20 74 68 65 20 73ar s, the s 0040 69 6d 70 6e 65 20 61 6e 64 0d 0a 6c 6f 76 69 6e imple an d-lovin 0050 67 20 68 65 61 72 74 20 6f 66 20 68 65 72 20 63 g heart of her c 0060 68 69 6c 64 68 6f 6f 6a 3a 20 20 61 6e 64 20 68 hildhood : and h 0070 6f 77 20 73 68 65 20 77 6f 75 6c 64 20 67 61 74 ow she ould gat 0080 68 65 72 20 61 62 6f 75 74 0d 0a 68 65 72 20 6f her abou t...her o 0090 74 68 65 72 20 6c 69 74 74 6c 65 20 63 68 69 6e ther lit tle chil 00a0 64 72 65 6e 2c 20 61 6e 64 20 6d 61 6b 65 20 54 dren, an d make T 00b0 48 45 49 52 20 65 79 65 73 20 62 72 69 67 68 74 HEIR eye s bright 00c0 20 61 6e 64 20 65 61 67 65 72 0d 0a 77 69 74 68 and eag er...with 00d0 20 6d 61 6e 79 20 61 20 73 74 72 61 6e 67 65 20 many a strange 00e0 74 61 6c 65 2c 20 70 65 72 68 61 70 73 20 65 76 tale, pe rhaps ev 00f0 65 6e 20 77 69 74 68 20 74 68 65 20 64 72 65 61 en with the drea 0100 6d 20 6f 66 0d 0a 57 6f 6e 64 65 72 6c 61 6e 64 m of Wo nderland 0110 20 6f 66 20 6c 6f 6e 67 20 61 67 6f 3a 20 20 61 of long ago: a 0120 6e 64 20 68 6f 77 20 73 68 65 20 77 6f 75 6c 64 and how s he woul 0130 20 66 65 65 6c 20 77 69 74 68 20 61 6c 6c 20 74 feel wi th all t 0140 68 65 69 72 0d 0a 73 69 6d 70 6c 65 20 73 6f 72 heir...si mple sor 0150 72 6f 77 73 2c 20 61 6e 64 20 66 69 6e 64 20 61 rows, an d find a 0160 20 70 6c 65 61 73 75 72 65 20 69 6e 20 61 6c 6e pleasur e in all 0170 20 74 68 65 69 72 20 73 69 6d 70 6c 65 20 6a 6f their s imple jo 0180 79 73 2c 0d 0a 72 65 6d 65 6d 62 65 72 69 6e 67 ys,...rem embering 0190 20 68 65 72 20 6f 77 6e 20 63 68 69 6c 64 2d 6c her own child-l 01a0 69 66 65 2c 20 61 6e 64 20 74 68 65 20 68 61 70 ife, and the hap 01b0 70 79 20 73 75 6d 6d 65 72 20 64 61 79 73 2e 0d py summe r days.. 01c0 0a 0d 0a 20 20 20 20 20 20 20 20 20 20 20 20 20 ... 01d0 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20
---	--

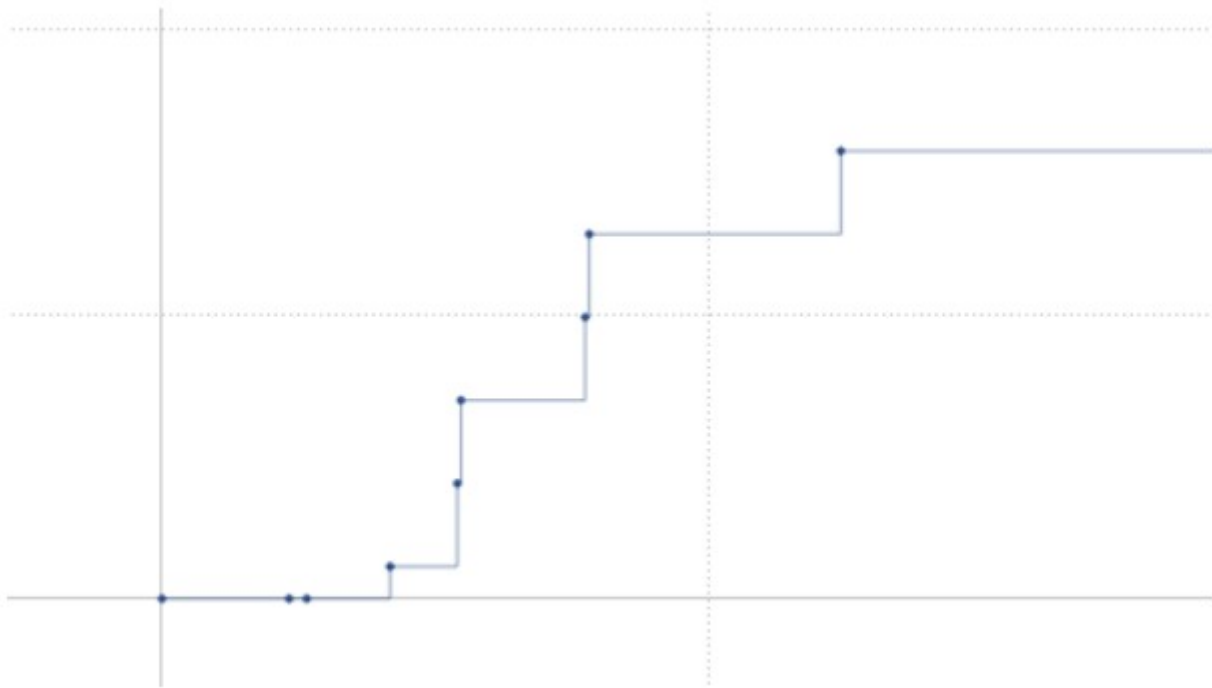
Part3

T13. 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.

- 时间序列图如下：



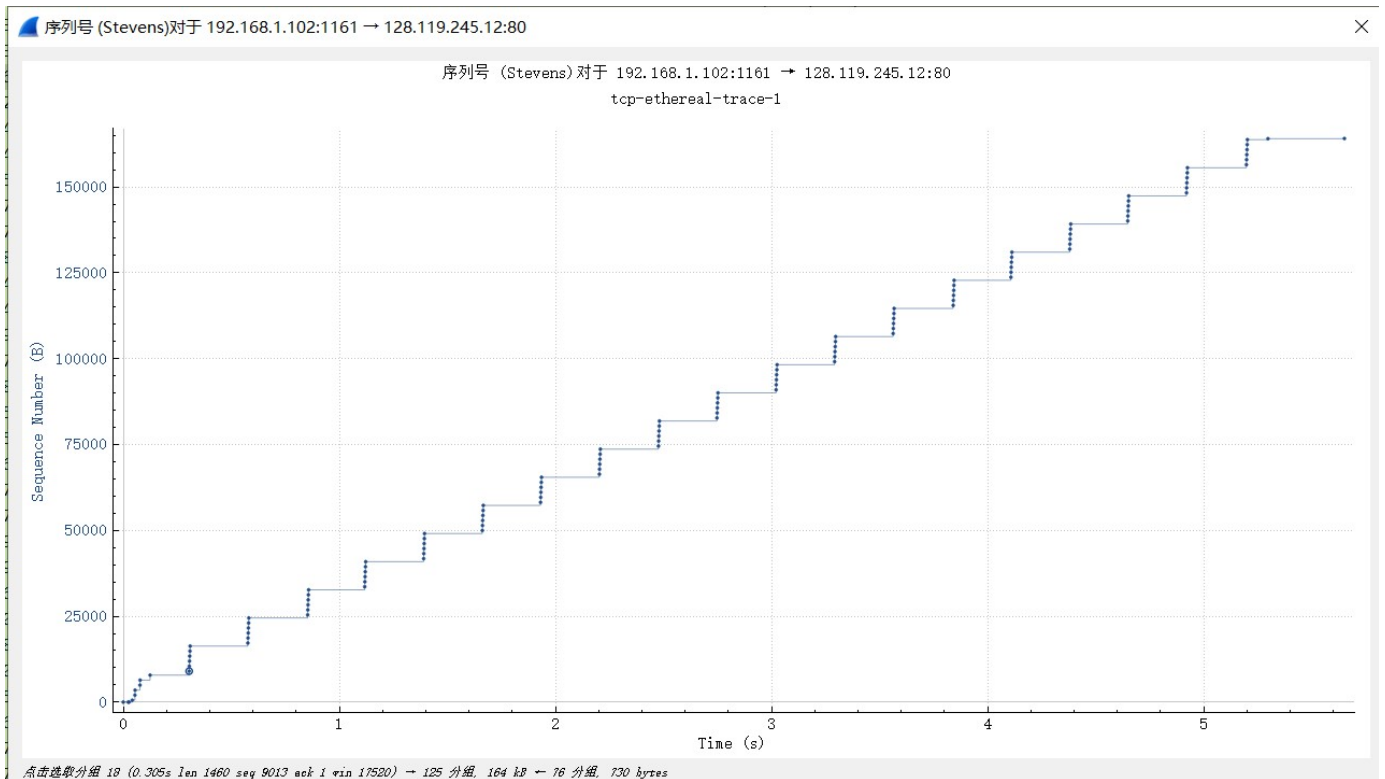
- TCP的慢启动阶段如下所示，在此之后就是拥塞控制接管：



- 在测量数据中，慢启动阶段不是理想的指数增长。

T14. 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.

- 时间序列图如下：



- tcp的慢启动阶段大约在前0.5s，在此之后就是拥塞控制接管。
- 在测量数据中，慢启动阶段不是理想的指数增长。