Xueyang (Sean) Wang
XW1154
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CS4793
Homework 04

Based on downloaded file:

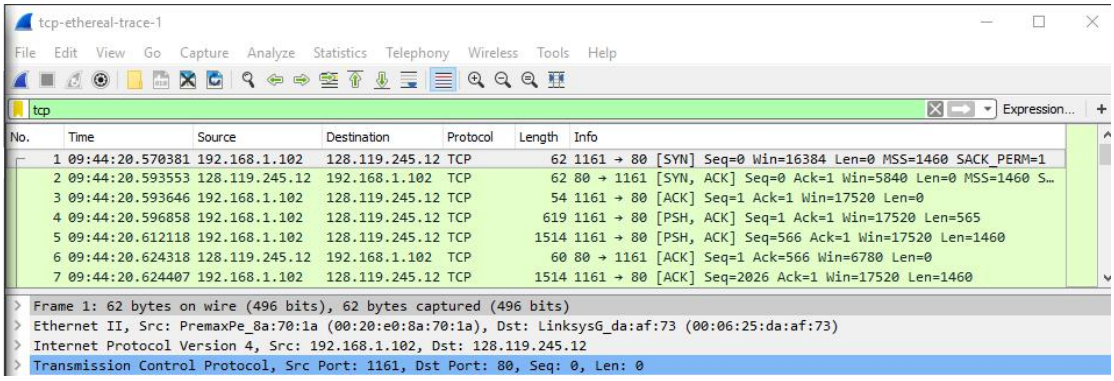


Figure 1. Given TCP capture

1. The client computer IP address is: 192.168.1.102; My client computer port number is 1161.
2. Destination computer IP address is 128.119.245.12; Its computer port number is 80.

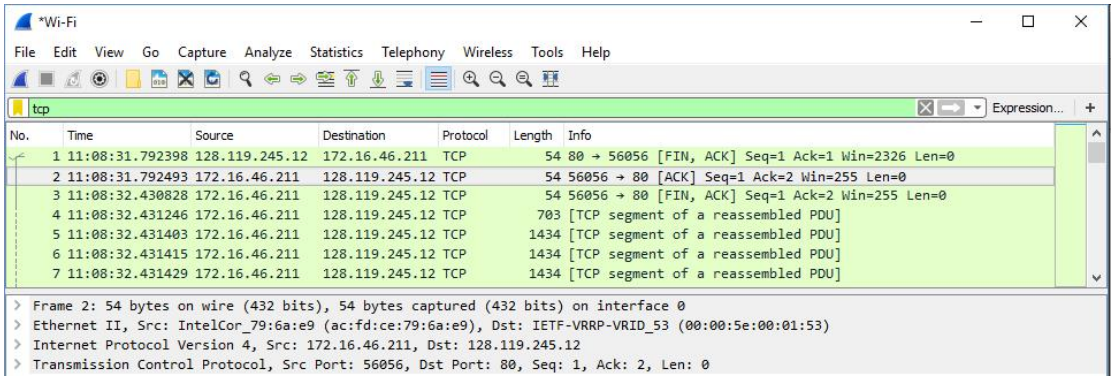


Figure 2. My TCP capture

3. My client computer IP address is: 172.16.26.211; My client computer port number is 56056.

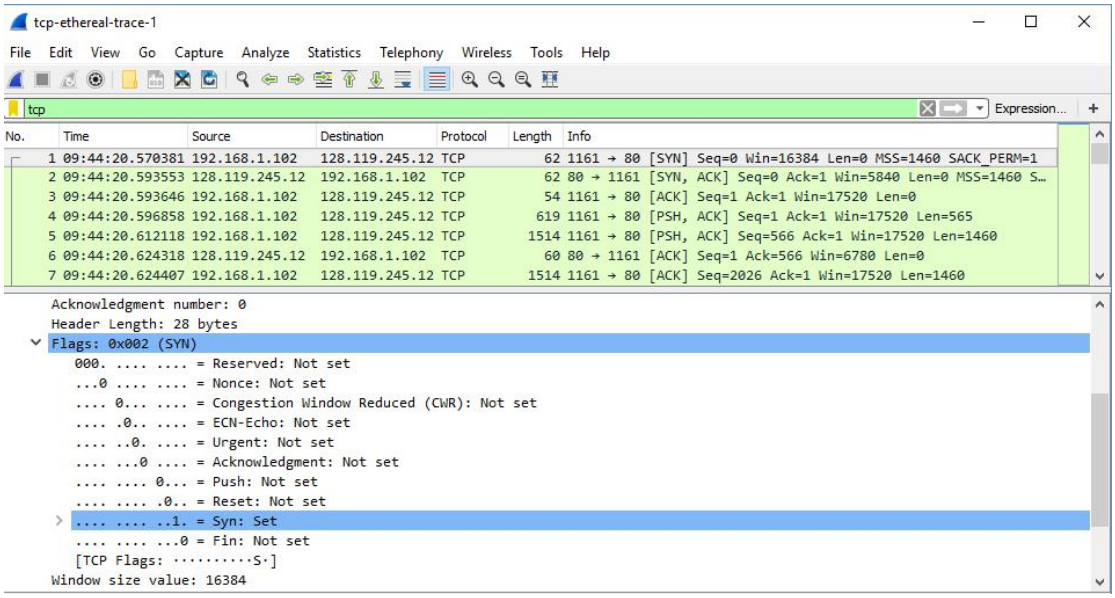


Figure 3. Seq number and indication

4. The initial sequence number is 0 (Seq=0). The SYN flag is set to 1 ([SYN]) which indicates a SYN segment.

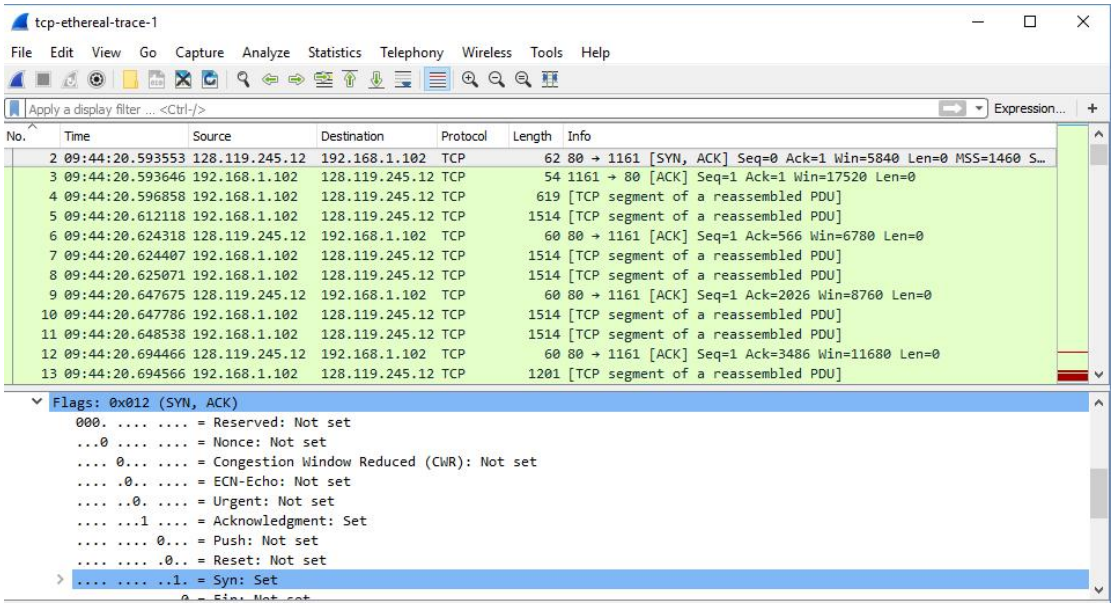


Figure 4. SYNACK pack

5. The sequence number of the SYNACK segment has the value of 0 in this trace. The value of ACK in the SYNACK is 1. The value is determined by the destination by adding 1 to the initial sequence number of SYN segment from the client computer. The SYN flag and ACK flag are set to 1. They indicate that this segment is a SYNACK segment.

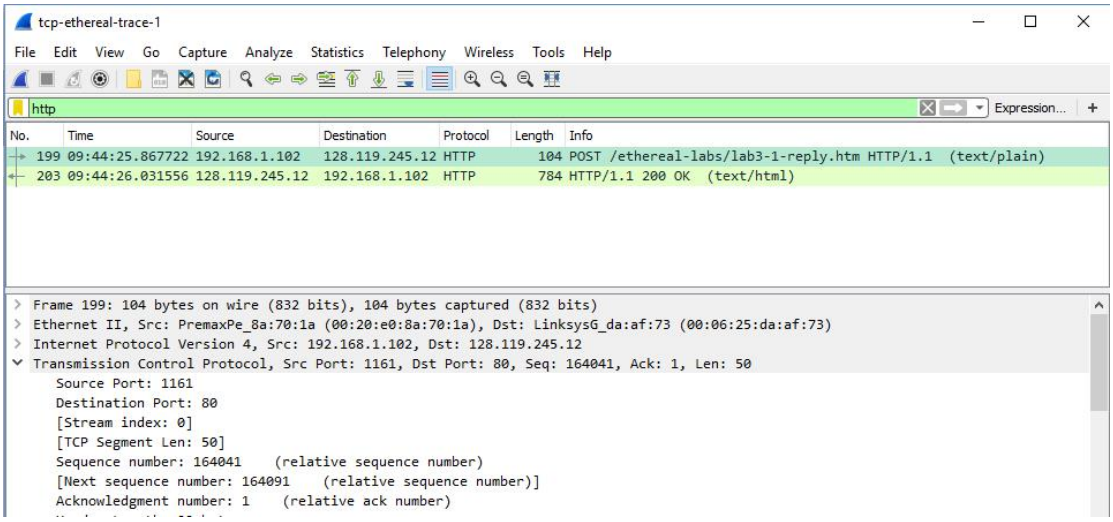


Figure 5.HTTP POST command

6. The sequence number is 164041.

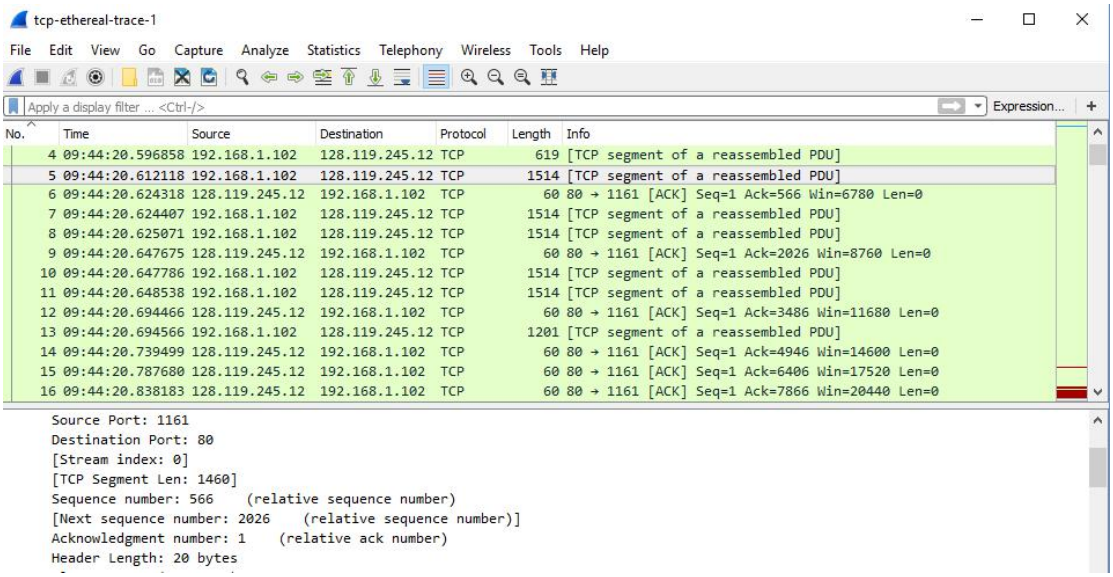


Figure 6. HTTP POST segments

7. If the HTTP POST segment is considered as the first segment, segment 1-6 are NO. 4,5,7,8,10,and 11in this trace. The ACKs are 6,9,12,14,15,and 16. By examining each TCP segment, the sequence numbers is the following:

```
Sequence number: 1    (relative sequence number)
[Next sequence number: 566    (relative sequence number)]
```

Segment 1: 1

Segment 2: 566

```
Sequence number: 2026    (relative sequence number)
[Next sequence number: 3486    (relative sequence number)]
```

Segment 3:2026

Segment 4: 3486

```
Sequence number: 4946    (relative sequence number)
[Next sequence number: 6406    (relative sequence number)]
```

Segment 5:4946

Segment 6:6406

Raw send/received time data:

```
 4 0.026477
 5 0.041737
 6 0.053937
 7 0.054026
 8 0.054690
 9 0.077294
10 0.077405
11 0.078157
12 0.124085
13 0.124185
14 0.169118
15 0.217299
16 0.267802
```

RTT data is obtained under: Transmission Control Protocol -> [SEQ/ACL analysis]

Segment Number	Sent Time	Received Time	Sample RTT(seconds)	Estimated RTT(seconds)
1(first)	0.026477	0.053937	0.02746	0.02746
2	0.041737	0.077294	0.035557	0.0285
3	0.054026	0.124085	0.070059	0.0337
4	0.054690	0.169118	0.11443	0.0438
5	0.077405	0.217299	0.13989	0.0558
6	0.078157	0.267802	0.18964	0.0725

Calculation for Estimated RTT: 0.875 * Estimated + 0.125 * Sample
#1: Segment 1 = 0.02746 secs
#2: Estimated = (0.875) * (above from above) + (0.125) * Sample RTT = 0.0285
#3: Estimated = (0.875) * (above from above) + (0.125) * Sample RTT = 0.0337
#4: Estimated = (0.875) * (above from above) + (0.125) * Sample RTT = 0.0438
#5: Estimated = (0.875) * (above from above) + (0.125) * Sample RTT = 0.0558
#6: Estimated = (0.875) * (above from above) + (0.125) * Sample RTT = 0.0725

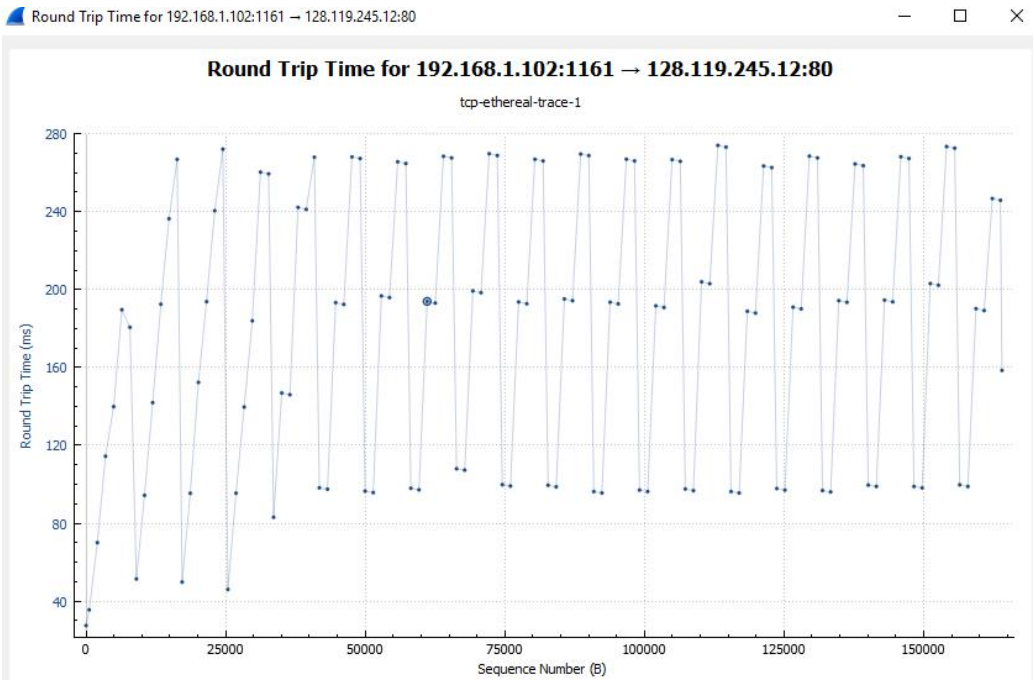


Figure 7. Round Trip Time Graph

```
Transmission Control Protocol, Src Port: 1161, Dst Port: 80, Seq:
    Source Port: 1161
    Destination Port: 80
    [Stream index: 0]
    [TCP Segment Len: 565]
    Sequence number: 1    (relative sequence number)
    [Next sequence number: 566    (relative sequence number)]
    Acknowledgment number: 1    (relative ack number)
    Header Length: 20 bytes
```

Figure 8. First TCP

```
Source Port: 1161
Destination Port: 80
[Stream index: 0]
[TCP Segment Len: 1460]
Sequence number: 566    (relative sequence number)
[Next sequence number: 2026    (relative sequence number)]
Acknowledgment number: 1    (relative ack number)
```

Figure 9. 2-6 TCP

8. The first TCP segment is 565 bytes, and the rest five TCP segments are 1460 bytes.

```
No.  Time      Source          Destination     Protocol  Length  Info
  1  0.000000  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  0.023172  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
```

Figure 10. Min. buffer space

```
200 5.389471 128.119.245.12  192.168.1.102  TCP    60 80 → 1161 [ACK] Seq=1 Ack=162309 Win=62780 Len=0
201 5.447887 128.119.245.12  192.168.1.102  TCP    60 80 → 1161 [ACK] Seq=1 Ack=164041 Win=62780 Len=0
202 5.455830 128.119.245.12  192.168.1.102  TCP    60 80 → 1161 [ACK] Seq=1 Ack=164091 Win=62780 Len=0
```

Figure .11. Max. buffer space

9. The minimum amount of buffer space is 5840 bytes, which is the first ACK. The maximum amount of buffer space is 62780 bytes. The send is never throttled due to lacking of receiver buffer space.

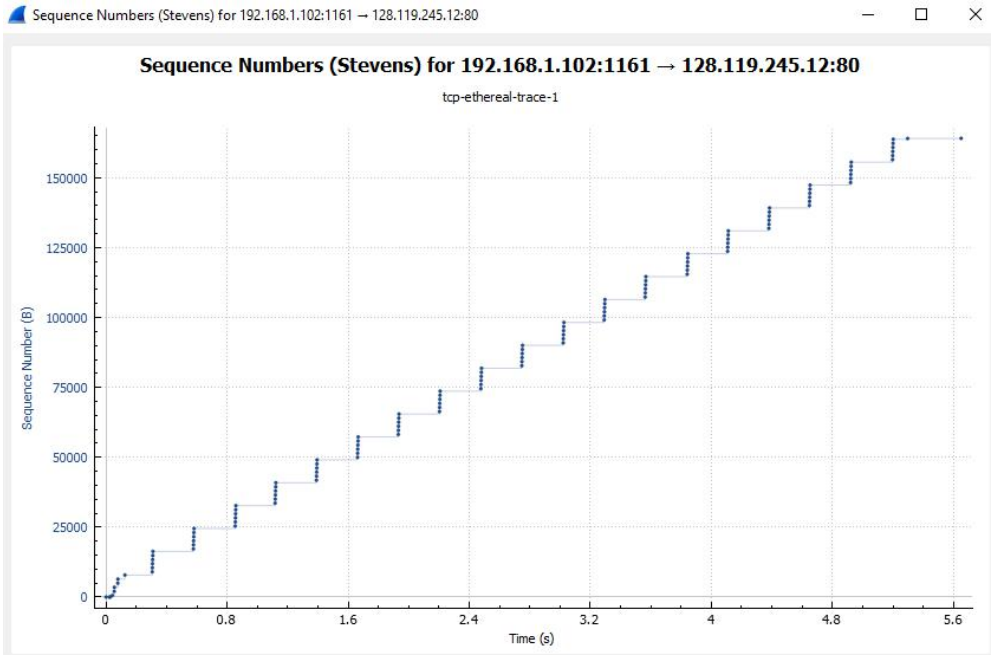
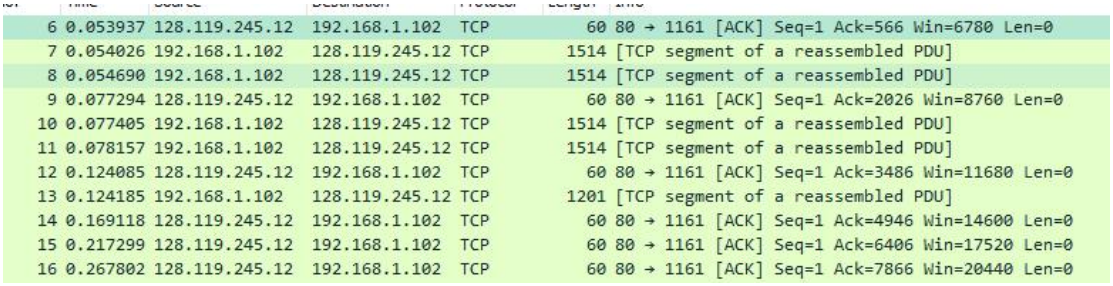


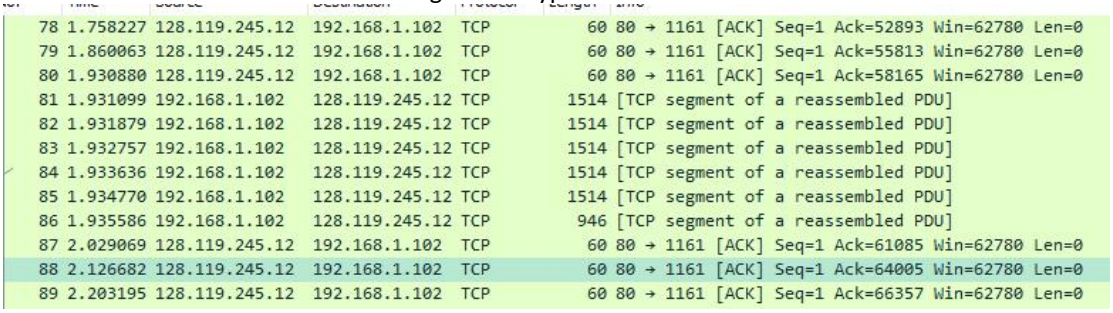
Figure 11. Time Sequence Graph

10. There are no re-transmitted segments in this file. Based on Fig. 11, all sequence is grow steadily and accordingly. If there was a re-transmission, the sequence should be smaller than previous.



6	0.053937	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=566 Win=6780 Len=0
7	0.054026	192.168.1.102	128.119.245.12	TCP	1514	[TCP segment of a reassembled PDU]
8	0.054690	192.168.1.102	128.119.245.12	TCP	1514	[TCP segment of a reassembled PDU]
9	0.077294	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=2026 Win=8760 Len=0
10	0.077405	192.168.1.102	128.119.245.12	TCP	1514	[TCP segment of a reassembled PDU]
11	0.078157	192.168.1.102	128.119.245.12	TCP	1514	[TCP segment of a reassembled PDU]
12	0.124085	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=3486 Win=11680 Len=0
13	0.124185	192.168.1.102	128.119.245.12	TCP	1201	[TCP segment of a reassembled PDU]
14	0.169118	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=4946 Win=14600 Len=0
15	0.217299	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=6406 Win=17520 Len=0
16	0.267802	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=7866 Win=20440 Len=0

Figure 12. Typical ACK data



78	1.758227	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=52893 Win=62780 Len=0
79	1.860063	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=55813 Win=62780 Len=0
80	1.930880	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=58165 Win=62780 Len=0
81	1.931099	192.168.1.102	128.119.245.12	TCP	1514	[TCP segment of a reassembled PDU]
82	1.931879	192.168.1.102	128.119.245.12	TCP	1514	[TCP segment of a reassembled PDU]
83	1.932757	192.168.1.102	128.119.245.12	TCP	1514	[TCP segment of a reassembled PDU]
84	1.933636	192.168.1.102	128.119.245.12	TCP	1514	[TCP segment of a reassembled PDU]
85	1.934770	192.168.1.102	128.119.245.12	TCP	1514	[TCP segment of a reassembled PDU]
86	1.935586	192.168.1.102	128.119.245.12	TCP	946	[TCP segment of a reassembled PDU]
87	2.029069	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=61085 Win=62780 Len=0
88	2.126682	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=64005 Win=62780 Len=0
89	2.203195	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=66357 Win=62780 Len=0

Figure 13. Example of every other received segment.

Simple calculation:

ACKs	Data	Different
1	566	566
2	2026	1460
2	3486	1460

…

11. Typical ACKs data is 1460 bytes. Through observing the files, there are cases where the receiver is ACKing ever other segment. For example, in Fig. 13, No. 80 with 2920 byes.

12. First: Find total data; Second: find total time; Third: use total time divide total data to find speed (throughput)

The last ACK is 164091 bytes; then, the total data is 164091 - 1 = 164090 byes. The whole transmission time is the difference of the time instant of the first TCP segment (0.026477 secs) and last ACK (5.455830 SECS); then, the total time is 5.455830 - 0.026477 = 5.4294 secs. Then the total speed is 164090 / 5.4294 = 30.222Kbyes/sec.