# LAB-9

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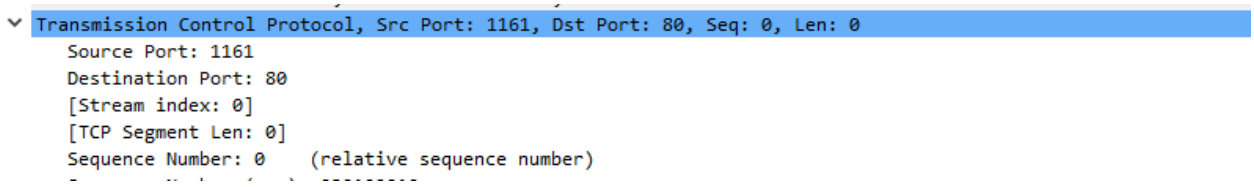
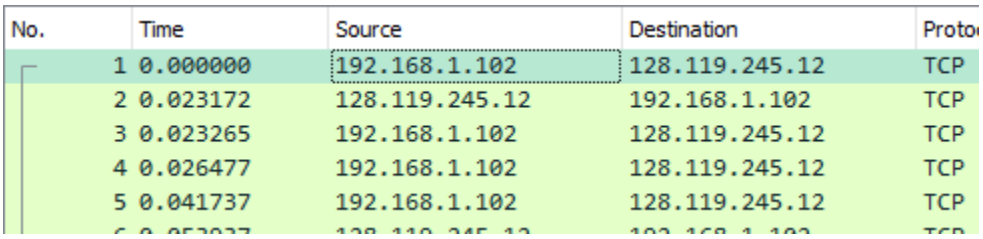
**Q1. What is the IP address and TCP port number used by the client computer (source) that is transferring the file to gaia.cs.umass.edu? To answer this question, it's probably easiest to select an HTTP message and explore the details of the TCP packet used to carry this HTTP message, using the "details 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:**

Ip address=s128.119.245.12,

Port number=1161



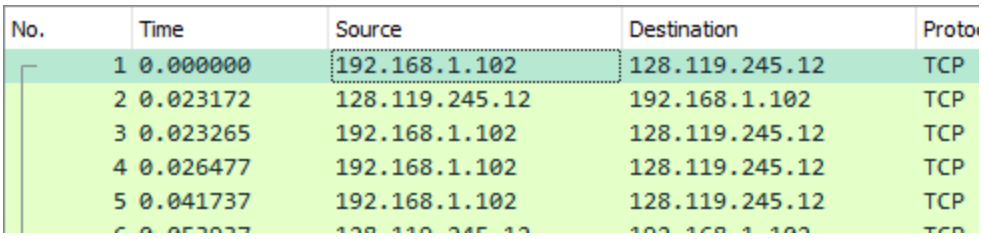



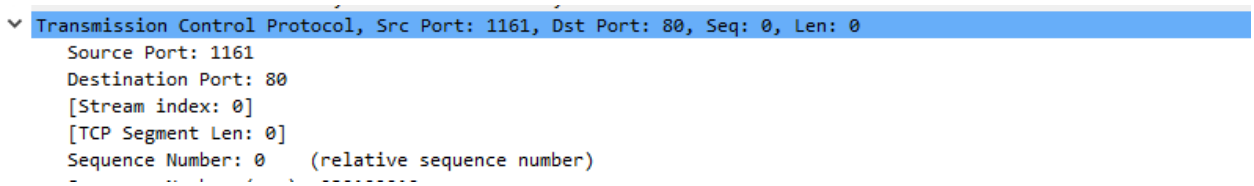

**Q2. What is the IP address of gaia.cs.umass.edu? On what port number is it sending and receiving TCP segments for this connection?**

**Solution:**

ip address of **gaia.cs.umass.edu=**128.119.245.12

sending port=80



**Q3. 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:

Ip= 192.168.18.120

Port= 51173

```
Transmission Control Protocol, Src Port: 51173, Dst Port: 80, Seq: 0, Len:
    Source Port: 51173
    Destination Port: 80
    [Stream index: 3]
    [Conversation completeness: Complete, WITH_DATA (63)]
    [TCP Segment Len: 0]
    Sequence Number: 0    (relative sequence number)
    Sequence Number (raw): 4172980462
    [Next Sequence Number: 1    (relative sequence number)]
    Acknowledgment Number: 0
    Acknowledgment number (raw): 0
    1000 .... = Header Length: 32 bytes (8)
```

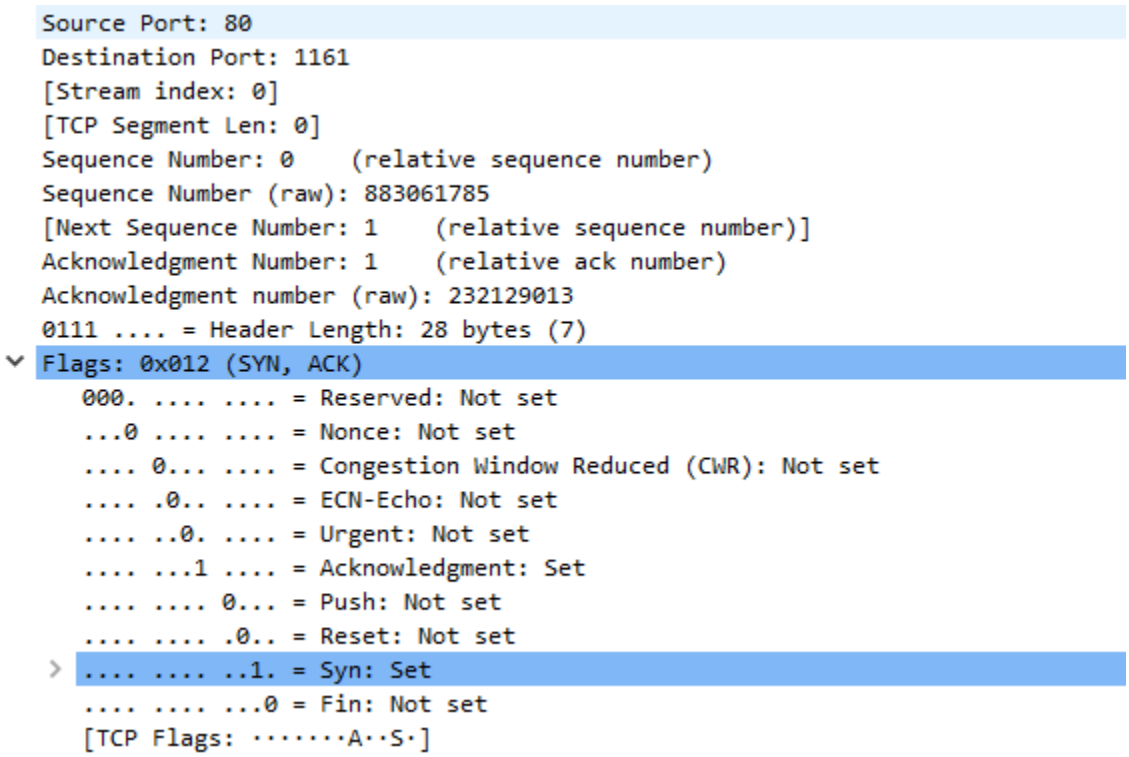
**Q4. What is the sequence number of the TCP SYN segment that is used to initiate theTCP connection between the client computer and gaia.cs.umass.edu? What is it in the segment that identifies the segment as a SYN segment?**

The Sequence Number is set as 0 .it is the initiating the TCP connection. The SYN Flag is set to 1 which identifies this segment to be a SYN segment.

```
    Sequence Number: 0    (relative sequence number)
    Sequence Number (raw): 232129012
    [Next Sequence Number: 1    (relative sequence number)]
    Acknowledgment Number: 0
    Acknowledgment number (raw): 0
    0111 .... = Header Length: 28 bytes (7)
  v 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
```

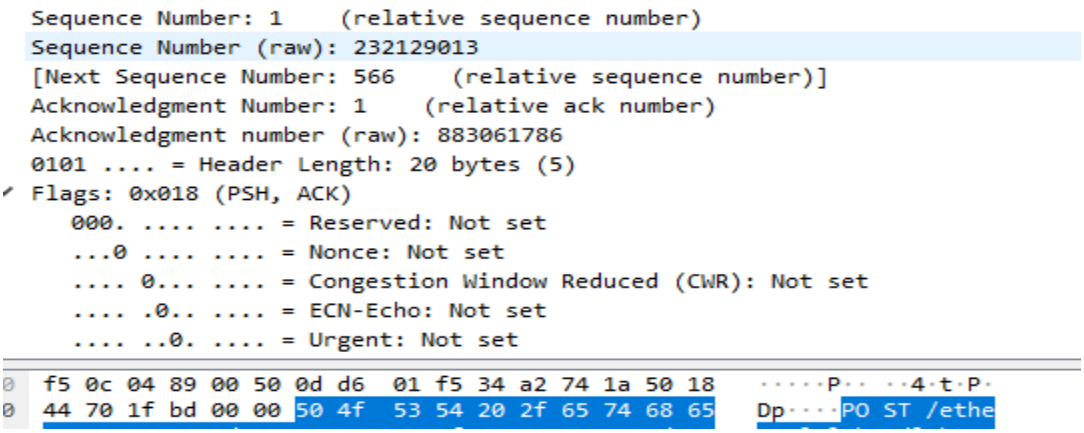
**Q5. What is the sequence number of the SYNACK segment sent by gaia.cs.umass.edu to the client computer in reply to the SYN? What is the value of the Acknowledgement field in the SYNACK segment? How did gaia.cs.umass.edu determine that value? What is it in the segment that identifies the segment as a SYNACK segment?**

The sequence of the SYNACK segment sent by gaia is 0. The Value in the Acknowledgement field is 1. Since the initial sequence number was 0, 0+1 = 1. The SYN and ACK flags are set to be 1, identifying this segment as a SYNACK segment.




**Q6. 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.**

According to packet tracer, the sequence number for the segment containing the POST command is 1



**Q7. 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.**

**Solution:**

6 Segments

```
 4 0.026477    192.168.1.102     128.119.245.12    TCP
 5 0.041737    192.168.1.102     128.119.245.12    TCP
 6 0.053937    128.119.245.12    192.168.1.102     TCP
 7 0.054026    192.168.1.102     128.119.245.12    TCP
 8 0.054690    192.168.1.102     128.119.245.12    TCP
 9 0.077294    128.119.245.12    192.168.1.102     TCP
10 0.077405    192.168.1.102     128.119.245.12    TCP
11 0.078157    192.168.1.102     128.119.245.12    TCP
```

```
> 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
> 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]
    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)
  v Flags: 0x018 (PSH, ACK)
      000. .... .... = Reserved: Not set
```

```
0000  00 06 25 da af 73 00 20  e0 8a 70 1a 08 00 45 00   ··%··s· ··p···E·
0010  02 5d 1e 21 40 00 80 06  a2 e7 c0 a8 01 66 80 77   ·]·!@··· ·····f·w
0020  f5 0c 04 89 00 50 0d d6  01 f5 34 a2 74 1a 50 18   ·····P·· ··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 54 50 2f   -reply.h tm HTTP/
```

```
 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 1161 → 80 [ACK] Seq=2026 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
 8 0.054690    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 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 1161 → 80 [ACK] Seq=4946 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
11 0.078157    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 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 1161 → 80 [PSH, ACK] Seq=7866 Ack=1 Win=17520 Len=1147 [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
```

First 6 segments are packets no.: 4, 5, 7, 8, 10, 11

First 6 acknowledgement segments are: 6, 9, 12, 14, 15, 16

| Segment No. | Sequence No. | Sent time | ACK received time | RTT |
|---|---|---|---|---|
| 1 | 1 | 0.026477 | 0.053937 | 0.027460 |
| 2 | 566 | 0.041737 | 0.077294 | 0.035557 |
| 3 | 2026 | 0.054026 | 0.124085 | 0.070059 |
| 4 | 3486 | 0.054690 | 0.169118 | 0.114428 |
| 5 | 4946 | 0.077405 | 0.217299 | 0.139894 |
| 6 | 6406 | 0.078157 | 0.267802 | 0.189645 |

EstimatedRTT = 0.875 * EstimatedRTT + 0.125 * SampleRTT

**Estimated RTT after ACK of segment 1:**

Estimated RTT = RTT for segment 1 = 0.027460

**Estimated RTT after ACK of segment 2:**

Estimated RTT = 0.875*0.027460 + 0.125*0.035557 = 0.028472125

**Estimated RTT after ACK of segment 3:**

Estimated RTT = 0.875*0.028472125 + 0.125*0.070059 = 0.03367048438

**Estimated RTT after ACK of segment 4:**

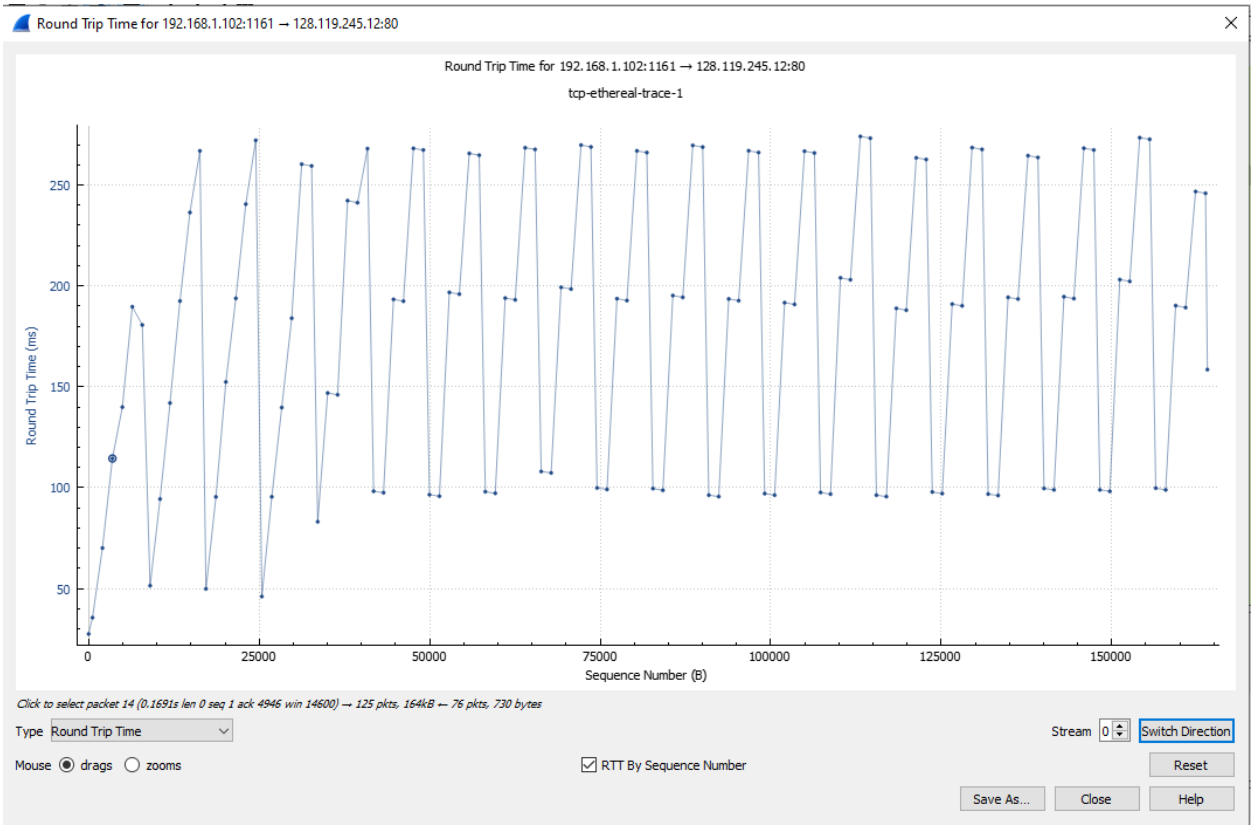
Estimated RTT = 0.875*0.03367048438 + 0.125*0.114428 = 0.04376517383

**Estimated RTT after ACK of segment 5:**

Estimated RTT = 0.875*0.04376517383 + 0.125*0.139894 = 0.0557812771

**Estimated RTT after ACK of segment 6:**

Estimated RTT = 0.875*0.0557812771 + 0.125*0.189645 = 0.07251424246



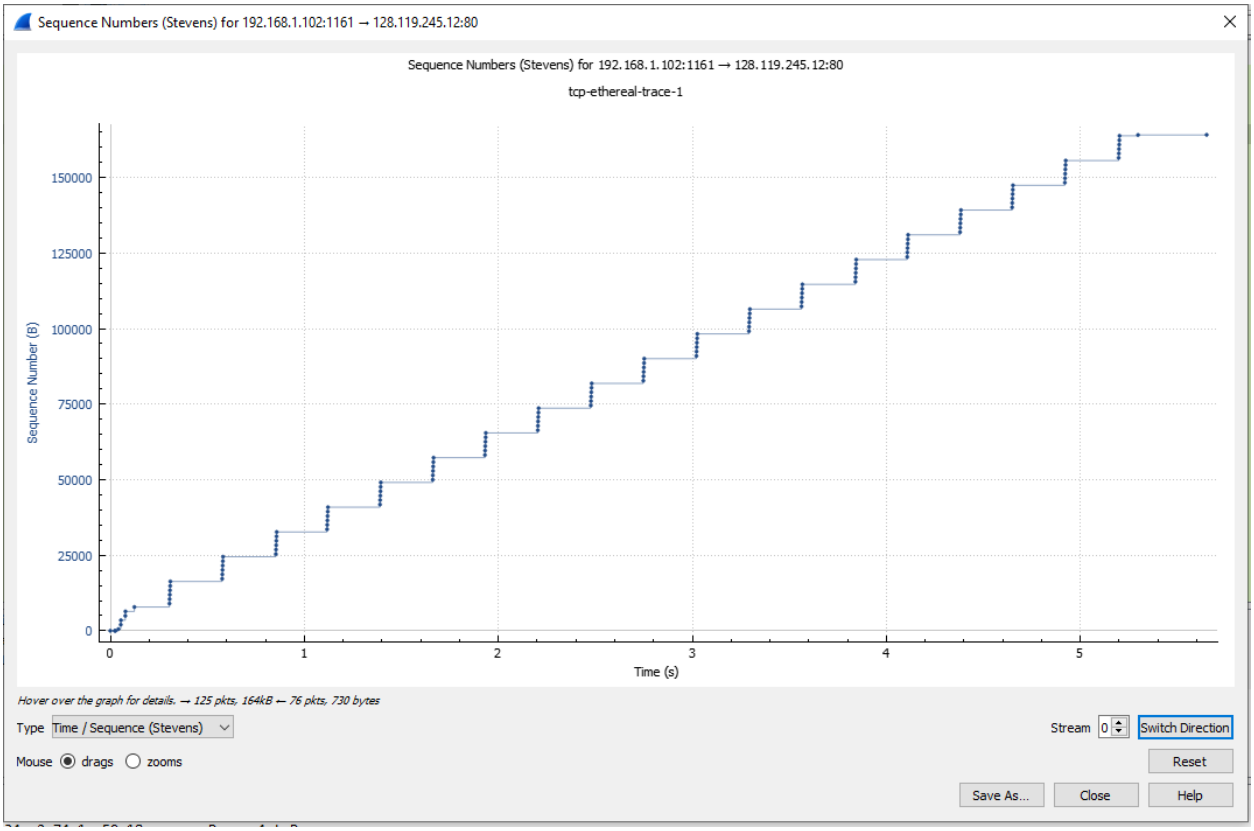

**Q8. What is the length of each of the first six TCP segments?**

| Segments | Length |
|---|---|
| 1 | 565 |
| 2 | 1460 |
| 3 | 1460 |
| 4 | 1460 |
| 5 | 1460 |
| 6 | 1460 |

```
  4 0.026477    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 0.041737    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 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 1161 → 80 [ACK] Seq=2026 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
  8 0.054690    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 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 1161 → 80 [ACK] Seq=4946 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
 11 0.078157    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]
```

**Q10. Are there any retransmitted segments in the trace file? What did you check for (in the trace) in order to answer this question?**

. No, there are no retransmitted segments in this trace file. There are two ways to find retransmitted packets. **(i)**. Packet tracer tells you if a packet is retransmitted. **(ii)**. By plotting a time-sequence graph, we can see that if there is a point where the sequence number drops, then a packet has been retransmitted, but as you can see in the graph below, sequence numbers are continuously increasing.




**Q11. 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).**

By subtracting the acknowledgment numbers between 2 messages, we can know how much data has been received. An example of acknowledging every other segment is given below and the data received between this is (2026-566) = 1460.

```
  6 0.053937     128.119.245.12     192.168.1.102      TCP       60 80 → 1161 [ACK] Seq=1 Ack=566
  7 0.054026     192.168.1.102      128.119.245.12     TCP     1514 1161 → 80 [ACK] Seq=2026 Ack=1
  8 0.054690     192.168.1.102      128.119.245.12     TCP     1514 1161 → 80 [ACK] Seq=3486 Ack=1
  9 0.077294     128.119.245.12     192.168.1.102      TCP       60 80 → 1161 [ACK] Seq=1 Ack=2026
 10 0.077405     192.168.1.102      128.119.245.12     TCP     1514 1161 → 80 [ACK] Seq=4946 Ack=1
 11 0.078157     192.168.1.102      128.119.245.12     TCP     1514 1161 → 80 [ACK] Seq=6406 Ack=1
```

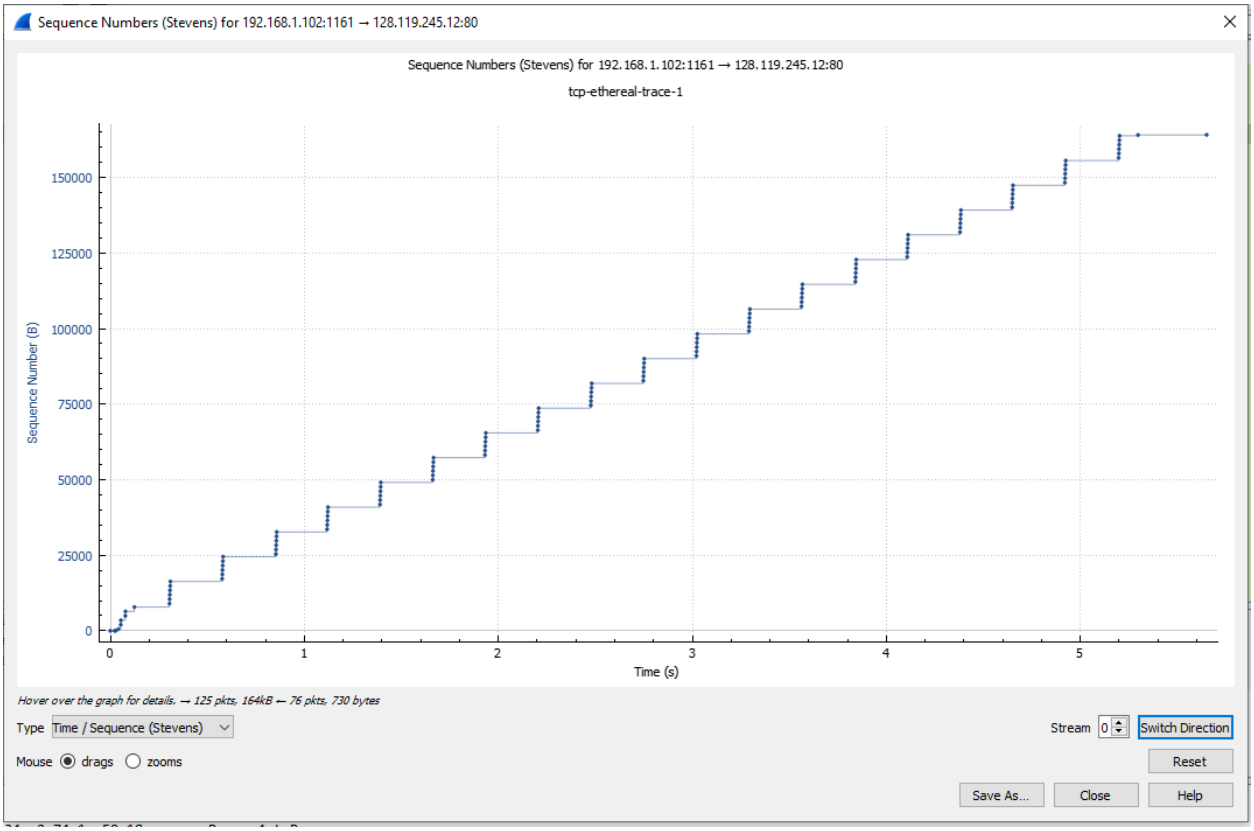
**Q12. What is the throughput (bytes transferred per unit time) for the TCP connection? Explain how you calculated this value.?**

The size of the gia.txt file is 152,138 bytes. The time taken to download the file is the time for the first TCP segment - time for the last ACK segment. So, download time = 5.455830 - 0.026477 = 5.429353. The throughput is total bytes/total time taken = 152,138/5.429353 = 28021.3867 bytes/second.

```
4 0.026477      192.168.1.102      128.119.245.12      TCP      619 1161 → 80 [PSH, ACK] Seq=1

202 5.455830    128.119.245.12     192.168.1.102       TCP      60 80 → 1161 [ACK] Seq=1 Ack=164091 Win=62780 Len=0
```

**Q13. 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 slow start phase begins and ends, and where congestion avoidance takes over? Comment on ways in which the measured data differs from the idealized behavior of TCP that we've studied in the text**




The slow start phase starts from 0 seconds and lasts till about 0.17 seconds. There is no congestion avoidance seen here since the size of the segments remains the same throughout.

**Q14. 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**