

CPS 706 - Wireshark TCP

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?*
 - IP address: 192.168.1.102 and TCP port number: 1161
2. *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: 128.119.245.12 and TCP port number: 80
3. *What is the IP address and TCP port number used by your client computer (source) to transfer the file to gaia.cs.umass.edu?*
 - IP address: 10.0.2.5 and TCP Port number: 57910
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?*
 - Sequence number of TCP SYN: 232129012
 - The SYN flag bit is set to 1 indicating it's a SYN segment

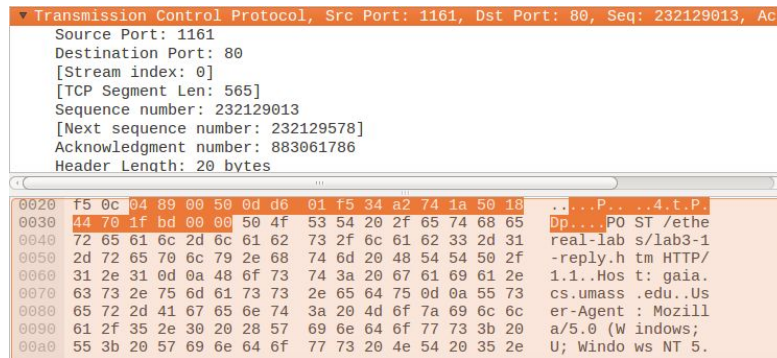
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▼ Transmission Control Protocol, Src Port: 1161, Dst Port: 80, Seq: 232129012, Len: 0
  Source Port: 1161
  Destination Port: 80
  [Stream index: 0]
  [TCP Segment Len: 0]
  Sequence number: 232129012
  Acknowledgment number: 0
  Header Length: 28 bytes
  ▼ Flags: 0x002 (SYN)
    ► .... ..1. = Syn: Set
```

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 ACK 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?*
 - Sequence number of SYNACK: 883061785
 - ACK value: 232129013 (value determined by adding 1 to the sequence number of SYN)
 - The SYN and ACK bit are set to 1 indicating it's a SYNACK segment

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▼ Transmission Control Protocol, Src Port: 80, Dst Port: 1161, Seq: 883061785, Ack: 232129013
  Source Port: 80
  Destination Port: 1161
  [Stream index: 0]
  [TCP Segment Len: 0]
  Sequence number: 883061785
  Acknowledgment number: 232129013
  Header Length: 28 bytes
  ► Flags: 0x012 (SYN, ACK)
    .... ..1 .... = Acknowledgment: Set
    .... ..0... = Push: Not set
    .... ..0.. = Reset: Not set
    ► .... ..1. = Syn: Set
```

6. What is the sequence number of the TCP segment containing the HTTP POST command?

- Sequence number of HTTP POST: 232129013



7. 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 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

Segment	Sequence Number	Time Segment Sent	Time ACK Received
1	232129013	09:44:20.596858	09:44:20.624318
2	232129578	09:44:20.612118	09:44:20.647675
3	232131038	09:44:20.624407	09:44:20.694466
4	232132498	09:44:20.625071	09:44:20.739499
5	232133958	09:44:20.647786	09:44:20.787680
6	232135418	09:44:20.648538	09:44:20.838183

Formula: $\text{EstimatedRTT} = 0.875 \times \text{EstimatedRTT} + 0.125 \times \text{SampleRTT}$

EstimatedRTT after ACK 1

- Estimated RTT = RTT of segment 1 = 0.02746

EstimatedRTT after ACK 2

- EstimatedRTT = $(0.875 \times 0.02746) + (0.125 \times 0.035557) = 0.0285$

EstimatedRTT after ACK 3

- EstimatedRTT = $(0.875 \times 0.0285) + (0.125 \times 0.070059) = 0.0337$

EstimatedRTT after ACK 4

- $\text{EstimatedRTT} = (0.875 * 0.0337) + (0.125 * 0.11443) = 0.0438$

EstimatedRTT after ACK 5

- $\text{EstimatedRTT} = (0.875 * 0.0438) + (0.125 * 0.13989) = 0.0558$

EstimatedRTT after ACK 6

- $\text{EstimatedRTT} = (0.875 * 0.0558) + (0.125 * 0.18964) = 0.0725$

1	09:44:20.570381	192.168.1.102	128.119.245.12	TCP
2	09:44:20.593553	128.119.245.12	192.168.1.102	TCP
3	09:44:20.593646	192.168.1.102	128.119.245.12	TCP
4	09:44:20.596858	192.168.1.102	128.119.245.12	TCP
5	09:44:20.612118	192.168.1.102	128.119.245.12	TCP
6	09:44:20.624318	128.119.245.12	192.168.1.102	TCP
7	09:44:20.624407	192.168.1.102	128.119.245.12	TCP

1.

Source Port: 1161				
Destination Port: 80				
[Stream index: 0]				
[TCP Segment Len: 565]				
Sequence number: 232129013				
[Next sequence number: 232129578]				
Acknowledgment number: 883061786				
Header Length: 20 bytes				
Flags: 0x018 (PSH, ACK)				

1	09:44:20.570381	192.168.1.102	128.119.245.12	TCP
2	09:44:20.593553	128.119.245.12	192.168.1.102	TCP
3	09:44:20.593646	192.168.1.102	128.119.245.12	TCP
4	09:44:20.596858	192.168.1.102	128.119.245.12	TCP
5	09:44:20.612118	192.168.1.102	128.119.245.12	TCP
6	09:44:20.624318	128.119.245.12	192.168.1.102	TCP
7	09:44:20.624407	192.168.1.102	128.119.245.12	TCP

2.

Source Port: 1161				
Destination Port: 80				
[Stream index: 0]				
[TCP Segment Len: 1460]				
Sequence number: 232129578				
[Next sequence number: 232131038]				
Acknowledgment number: 883061786				
Header Length: 20 bytes				
Flags: 0x018 (PSH, ACK)				

1	09:44:20.570381	192.168.1.102	128.119.245.12	TCP
2	09:44:20.593553	128.119.245.12	192.168.1.102	TCP
3	09:44:20.593646	192.168.1.102	128.119.245.12	TCP
4	09:44:20.596858	192.168.1.102	128.119.245.12	TCP
5	09:44:20.612118	192.168.1.102	128.119.245.12	TCP
6	09:44:20.624318	128.119.245.12	192.168.1.102	TCP
7	09:44:20.624407	192.168.1.102	128.119.245.12	TCP

3.

Source Port: 1161				
Destination Port: 80				
[Stream index: 0]				
[TCP Segment Len: 1460]				
Sequence number: 232131038				
[Next sequence number: 232132498]				
Acknowledgment number: 883061786				
Header Length: 20 bytes				
Flags: 0x010 (ACK)				

2	09:44:20.593553	128.119.245.12	192.168.1.102	TCP
3	09:44:20.593646	192.168.1.102	128.119.245.12	TCP
4	09:44:20.596858	192.168.1.102	128.119.245.12	TCP
5	09:44:20.612118	192.168.1.102	128.119.245.12	TCP
6	09:44:20.624318	128.119.245.12	192.168.1.102	TCP
7	09:44:20.624407	192.168.1.102	128.119.245.12	TCP
8	09:44:20.625071	192.168.1.102	128.119.245.12	TCP

Source Port: 1161
Destination Port: 80
[Stream index: 0]
[TCP Segment Len: 1460]
Sequence number: 232132498
[Next sequence number: 232133958]
Acknowledgment number: 883061786
Header Length: 20 bytes
Flags: 0x010 (ACK)

4.

4	09:44:20.596858	192.168.1.102	128.119.245.12	TCP
5	09:44:20.612118	192.168.1.102	128.119.245.12	TCP
6	09:44:20.624318	128.119.245.12	192.168.1.102	TCP
7	09:44:20.624407	192.168.1.102	128.119.245.12	TCP
8	09:44:20.625071	192.168.1.102	128.119.245.12	TCP
9	09:44:20.647675	128.119.245.12	192.168.1.102	TCP
10	09:44:20.647786	192.168.1.102	128.119.245.12	TCP

Source Port: 1161
Destination Port: 80
[Stream index: 0]
[TCP Segment Len: 1460]
Sequence number: 232133958
[Next sequence number: 232135418]
Acknowledgment number: 883061786
Header Length: 20 bytes
Flags: 0x010 (ACK)

5.

5	09:44:20.612118	192.168.1.102	128.119.245.12	TCP
6	09:44:20.624318	128.119.245.12	192.168.1.102	TCP
7	09:44:20.624407	192.168.1.102	128.119.245.12	TCP
8	09:44:20.625071	192.168.1.102	128.119.245.12	TCP
9	09:44:20.647675	128.119.245.12	192.168.1.102	TCP
10	09:44:20.647786	192.168.1.102	128.119.245.12	TCP
11	09:44:20.648538	192.168.1.102	128.119.245.12	TCP

Source Port: 1161
Destination Port: 80
[Stream index: 0]
[TCP Segment Len: 1460]
Sequence number: 232135418
[Next sequence number: 232136878]
Acknowledgment number: 883061786
Header Length: 20 bytes
Flags: 0x010 (ACK)

6.

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

- Length of first TCP: 565
- Length of the rest of TCP: 1,460

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?

- The buffer space is 5,840 bytes
- No, sender is never throttle due to lack of buffer space because we never filled the buffer completely

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[Stream index: 0]
[TCP Segment Len: 0]
Sequence number: 883061785
Acknowledgment number: 232129013
Header Length: 28 bytes
▶ Flags: 0x012 (SYN, ACK)
Window size value: 5840
[Calculated window size: 5840]
Checksum: 0x774d [unverified]

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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 trace file. This is true because there are no repeated sequence or acknowledgement number (sequence number are increasing)

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

- Difference between two ACKs indicate the data received
- Receiver typically acknowledge 1,460 bytes data
- There are cases where receiver is ACKing other received segment (longer ACK bytes sent - consecutive ACK)

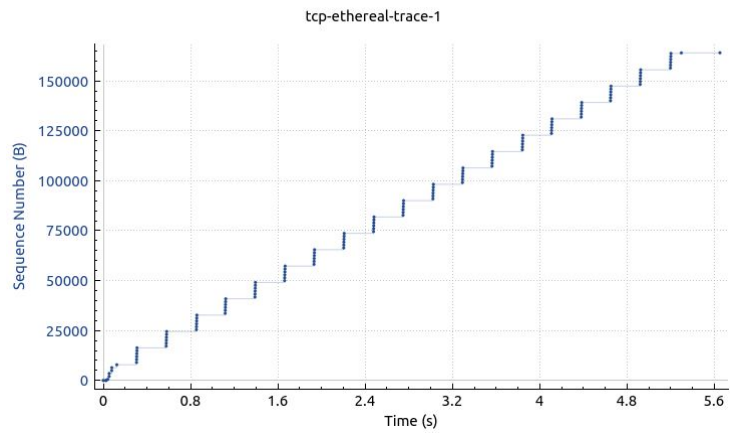
12. What is the throughput (bytes transferred per unit time) for the TCP connection? Explain how you calculated this value

- Total amount of data = sequence number of last ACK - sequence number of first TCP
 - $232293103 - 232129012 = 164,091$ bytes
- Transmission Time = last - first
 - $09:44:26.221522 - 09:44:20.570381 = 5.654839$ seconds
- Throughput
 - $164,091 / 5.654839 = 29.018$ Kbytes/sec

13. Use the Time-Sequence-Graph plotting tool to view the sequence number versus time plot of segments being sent from the client of 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

- TCP's slow start phase begins at approximately sequence number 6,500 and ends at 9,000
- Congestion avoidance takes over at 0.5 s (it reduces the amount being sent)

Sequence Numbers (Stevens) for 192.168.1.102:1161 → 128.119.245.12:80



Sequence Numbers (Stevens) for 192.168.1.102:1161 → 128.119.245.12:80

