A first Look at the Captured Trace

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

   - IP Address: 10.106.0.254

   - TCP Port Number: 55011

     ```
     ▶ Internet Protocol Version 4, Src: 10.106.0.254, Dst: 128.119.245.12
     ▼ Transmission Control Protocol, Src Port: 55011, Dst Port: 80, Seq: 38473, Ack: 1, Len: 1374
           Source Port: 55011
           Destination Port: 80
     ```
   -

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

   - TCP Port Number: 80

     ```
     ▶ Internet Protocol Version 4, Src: 128.119.245.12, Dst: 10.106.0.254
     ▼ Transmission Control Protocol, Src Port: 80, Dst Port: 55011, Seq: 1, Ack: 39847, Len: 0
           Source Port: 80
           Destination Port: 55011
           [Stream index: 5]
     ```
   -

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

   - IP Address: 10.106.0.254

   - TCP Port Number: 55011

4. What is th 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?

   - Sequnce Number: 0

   - The segment is identified as a SYN segment because in the flags field

     ```
           Sequence number: 0     (relative sequence number)
           [Next sequence number: 0     (relative sequence number)]
           Acknowledgment number: 0
           1011 .... = Header Length: 44 bytes (11)
     ▼ Flags: 0x0c2 (SYN, ECN, CWR)
           000. .... .... = Reserved: Not set
           ...0 .... .... = Nonce: Not set
           .... 1... .... = Congestion Window Reduced (CWR): Set
           .... .1.. .... = ECN-Echo: 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: ····CE····S·]
           Window size value: 65535
     ```
     the SYN bit is set to 1.

5. What is the sequence number of the SYNACK segment seny by gaia.cs.umass.edu to the client computer in reply to the SYN? What ist he value of the Acknowledgment 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: 0
- Acknowledgement Field: 1
- It is calculated by taking the sequence number from the SYN added with its length in bytes.
- The segment is identified by its field value, similaraly to the SYN segment, the SYN and Acknowledgement bits are set.

```
Acknowledgment number: 1    (relative ack number)
1010 .... = Header Length: 40 bytes (10)
Flags: 0x052 (SYN, ACK, ECN)
    000. .... .... = Reserved: Not set
    ...0 .... .... = Nonce: Not set
    .... 0... .... = Congestion Window Reduced (CWR):
    .... .1.. .... = ECN-Echo: 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: ·····E·A··S·]
```
-

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

- Sequence Number: 1

```
473  POST /wireshark-labs/lab3-1-reply.htm HTTP/1.1  (text/plain)
 74  80 → 55011 [ACK] Seq=1 Ack=152515 Win=183296 Len=0 TSval=1205690107 TSecr=514654087 [ETHERNET FRAME CHECK SEQUENCE I
 66  80 → 55011 [ACK] Seq=1 Ack=152922 Win=183296 Len=0 TSval=1205690153 TSecr=514654132
```
-

7. Consider the TCP segment containing the HTTP POSt as the first segment in the TCP connection. What are the sequence numbers of th first six segments in th TCP connection? At what time was each segment sent? When was the ACK for each segment received? Given the difference between when each TCP segment was seent, and when its acknowledgment was received, what is the RTT value for eeaech of the six segments? What is the EstimatedRTT value after the receipt of each ACK? Assume that the value of the Estimated RTT is equal to th measured RTT for the first segment, and then is computed using the EstimatedRTT equation

Round Trip Time for 192.168.0.7:56058 → 128.119.245.12:80
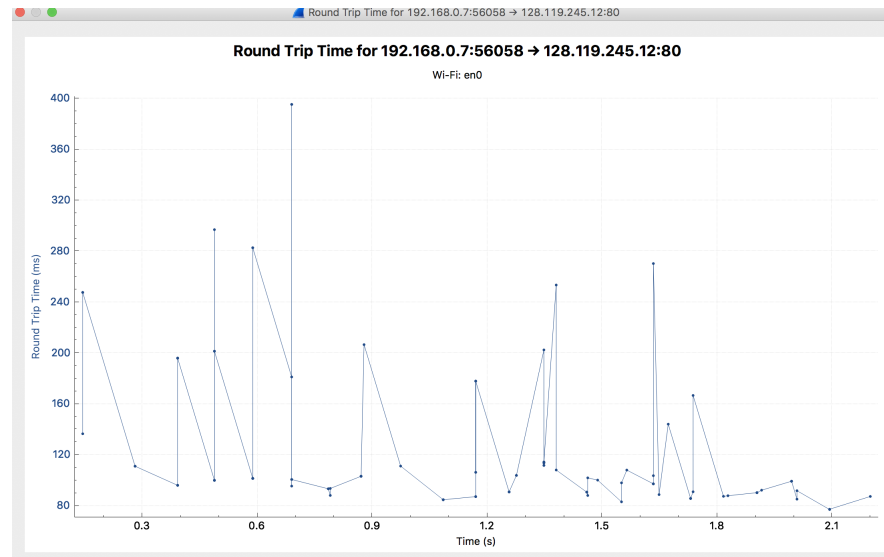
8. What is the length of each of the first TCP segments?

- The length of the TCP segment with the POST request is 881 bytes

```
▶ [Timestamps]
  TCP payload (881 bytes)
  TCP segment data (881 bytes)
```

- The length of the remaining TCP segments is 1448 bytes

```
[Frame: 6, payload: 0-1447 (1448 bytes)]
[Frame: 7, payload: 1448-2895 (1448 bytes)]
[Frame: 8, payload: 2896-4343 (1448 bytes)]
[Frame: 10, payload: 4344-5791 (1448 bytes)]
[Frame: 11, payload: 5792-7239 (1448 bytes)]
[Frame: 14, payload: 7240-8687 (1448 bytes)]
```

9. What is the minimum amount of available buffer space advertised at the recived for the entire trace? Does the lack of receiver buffer space ever throttle the sender?

- The minimum amount of available buffer space is 1431 * (128) bytes
- The lack of receiver buffer space does not throttle the sender

```
  [Stream index: 0]
  [TCP Segment Len: 0]
  Sequence number: 1      (relative sequence number)
  [Next sequence number: 1     (relative sequence number)]
  Acknowledgment number: 144801     (relative ack number)
  1000 .... = Header Length: 32 bytes (8)
▶ Flags: 0x010 (ACK)
  Window size value: 1432
  [Calculated window size: 183296]
  [Window size scaling factor: 128]
  Checksum: 0x7d61 [unverified]
  [Checksum Status: Unverified]
  Urgent pointer: 0
```

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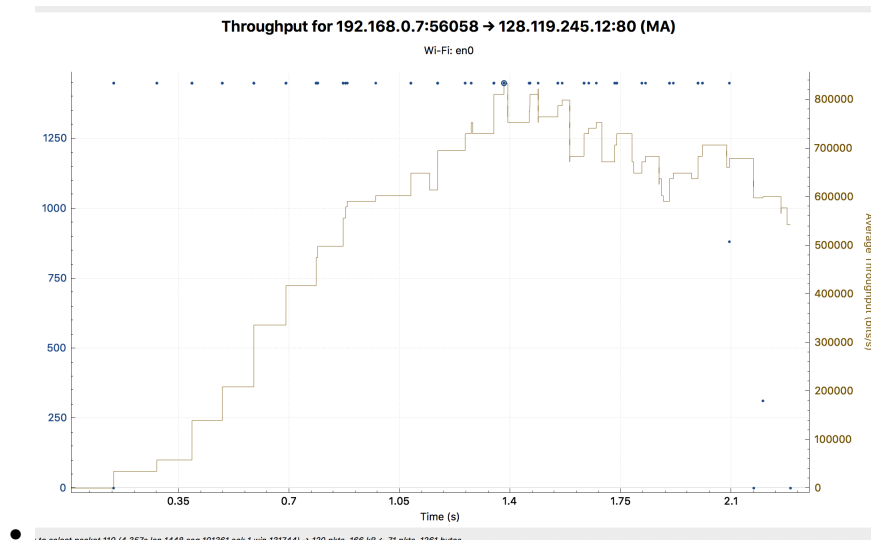
    •

11. How much data does ther eceiver typically Acknowlede in an ACK? Can you identify cases where the receiver is ACKing every other recived segment?

    •

12. What is the throughput for the TCP connection?

    • The throughput is 800k bits/s

13. Can you identify where TCP's slowstart phase begins and ends, and where congestiong avoidance takes over? Commen onw ays in which the measured data differs from the idealized behavior of TCP that we've studied in the text