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Computer Networks
Lab 2 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?**
   The IP address used by the client computer is 192.168.1.102. The port number is 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?**
   The IP address of gaia.cs.umass.edu is 128.119.245.12. It is using port 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?**
   The IP address used by my computer is 10.204.86.241 with port number 21560.

TCP Basics

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?**
   The sequence number of the TCP SYN segment is 0. The segment contains a SYN flag which identifies it as a SYN segment.

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 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 number of the SYNACK segment sent by gaia.cs.umass.edu is 0. In the Ack field, Ack=1. The Ack value is determined by the sequence number + 1. The segment contains a (SYN, ACK) flag which identifies it as a SYNACK segment.

6. **What is the sequence number of the TCP segment containing the HTTP POST command?**
   The sequence number of the TCP segment containing the HTTP POST command is Seq=1.

7. **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?**
   The sequence number of the first six segments are 1, 566, 2026, 3486, 4946, and 6406. The estimated RTT is found with 0.875*EstimatedRTT + 0.125*SampleRTT. The initial estimated RTT is the RTT of the first segment.

Segment	**Seq#**	**Time (s)**	**ACK received (s)**	**RTT (s)**	**Estimated RTT (s)**
4	1	0.026477	0.053937	0.02746	0.02746
5	566	0.041737	0.077294	0.035557	0.0285
7	2026	0.054026	0.124085	0.070059	0.0337
8	3486	0.054690	0.169118	0.114428	0.0438
10	4946	0.077405	0.217299	0.139894	0.0558
11	6406	0.078157	0.267802	0.189645	0.0725

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

Segment	**Length**
4	565
5	1460
7	1460
8	1460
10	1460
11	1460

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 minimum amount of buffer space advertised at the receiver is 5840. The lack of buffer space does not throttle sender because the maximum length of packets in this trace is 1500 bytes.

10. **Are the 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 the trace file. I checked for ACKs being resent by the receiver.

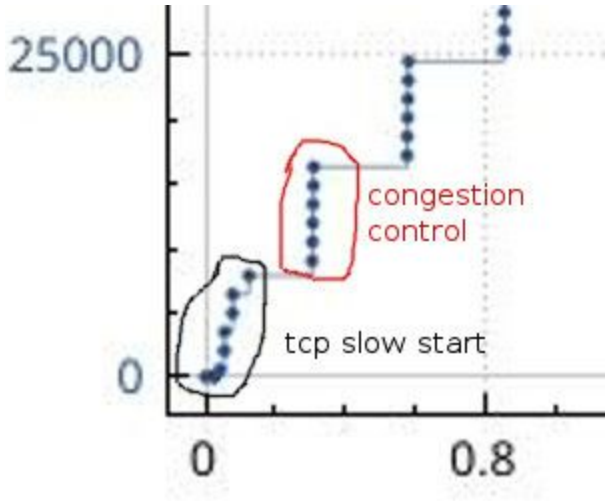
11. **How much data does the receiver typically acknowledge in an ACK? Can you identify cases where the receiver is ACKing every other received segment (see Table 3.2 on page 250 in the text).**
    The receiver typically acknowledges 2920 bytes of data. The receiver is ACKing every other segment when two segments of data from the sender are followed by an ACK from the receiver. For example, segment 4 and 5 which are from the sender are followed by segment 6 which is from the receiver, ACKing the two previous segments of data.

12. **What is the throughput (bytes transferred per unit time) for the TCP connection? Explain how you calculated this value.**
    The value of the first sequence number subtracted from the last ACK is the total number of bytes sent from sender to receiver. This value is 164090 bytes. The number of bytes transferred is then divided by the total RTT since the first frame. The RTT value is 5.455830 - 0.026477 = 5.429353. Total bytes / total RTT = 164090/5.429353 = 30222. The throughput for the TCP connection is 30222 bytes per second.

TCP Congestion Control in Action

13. **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.**

    The image below is a part of the graph from the trace. The slow start phase begins at 0 and ends just before 10 000. Congestion avoidance takes over at 10 000.



14. 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

The image below is a part of the graph from my trace. I could not identify where the slow start phase is. I could not find any exponential spread of dots.