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**CSCE 560 Homework / Wireshark Lab 3**

**Chapter 3 – Transport Layer**

**Fall 18**

**Assigned: Monday, 22 Oct**

**Due: Wednesday, 14 Nov, 1400**

Problem 1. Chapter 3, R3

Consider a TCP connection between Host A and Host B. Suppose that the TCP segments traveling from Host A to Host B have source port number x and destination port number y. What are the source and destination port numbers for the segments traveling from Host B to Host A?

**The TCP segments traveling from Host B to Host A would have a source port of y and a destination port of x.**

Problem 2. Chapter 3, R4

Describe why an application developer may choose to run an application over UDP rather than TCP. [Provide at least three reasons.]

1. **If the application is performing multi-media streaming services, UDP is probably the best choice. The application will not be as concerned with transferring every data segment and can tolerate some packet/segment loss.**
2. **DNS – to speed up the response time of a DNS server that might receive a lot of traffic, UDP can be used. In this case, a handshake does not need to be completed for the client and host to communicate. Also, if a packet is lost or corrupted the client that is querying the DNS server can simple resend the request.**
3. **In situations where overhead is an issue, UDP is better because it requires less overhead in a few different ways. First, headers are only 8 bytes instead of 20 bytes. Additionally, UDP does not require the system to set aside memory for the send and receive buffers like TCP.**

Problem 3. Chapter 3, R6

Is it possible for an application to enjoy reliable data transfer even when the application runs over UDP? If so how?

**Yes, if the application is programmed to provide reliable data transfer services, then UDP can be used. In this case, the application is providing TCP like reliability.**

Problem 4. Chapter 3, R8

Suppose that a Web server runs in Host C on port 80. Suppose this Web server uses persistent connections, and is currently receiving requests from two different hosts: A and B. Are all of the requests being sent through the same socket at Host C? If they are being passed through different sockets, do both of the sockets have port 80? Discuss and explain.

1. Are all of the requests being sent through the same socket at Host C?

**For each persistent connection, the Host C creates a separate connection socket. Each connection socket is identified by a four-tuple. Thus the traffic from host A and host B pass through different sockets. Although both will be sent to port 80 and then forwarded to the correct persistent connection socket.**

1. If they are being passed through different sockets, do both of the sockets have port 80?

**Yes, both sockets will use port 80, but the host will send it to the correct socket depending on the source IP and source port number.**

Problem 5. Chapter 3, R14

True of False:

1. Host A is sending Host B a large file over a TCP connection. Assume Host B has no data to send to Host A. Host B will not send acknowledgements to Host A because Host B cannot piggyback the acknowledgements on data.

**False**

1. The size of the TCP RcvWindow (rwnd) never changes throughout the duration of the connection.

**False**

1. Suppose Host A is sending Host B a large file over a TCP connection. The number of unacknowledged bytes that A sends cannot exceed the size of the receive buffer.

**True**

1. Suppose Host A is sending a large file to Host B over a TCP connection. If the sequence number for a segment of this connection is m, then the sequence number for the subsequent segment will necessarily be m + 1.

**False – the next sequence number sent by Host A will be ‘m’ + the amount of data (in bytes) that was sent in the segment with ‘m’ as the sequence number.**

1. The TCP segment has a field in its header for RcvWindow (rwnd).

**True**

1. Suppose that the last SampleRTT in a TCP connection is equal to 1 sec. The current value of TimeoutInterval for the connection will necessarily be >= 1 sec.

**True [EstimatedRTT + 4 \* (SampleRTT / 2)]**

1. Suppose Host A sends Host B one segment with sequence number 38 and 4 bytes of data. Then in this same segment the acknowledgement number is necessarily 42.

**False**

Problem 6. Chapter 3, R15

Suppose Host A sends two segments back-to-back to Host B over a TCP connection. The first segment has sequence number 90; the second has sequence number 110.

a. How much data is in the first segment?

**20 bytes**

b. Suppose that the first segment is lost, but the second segment arrives at B. In the acknowledgment that Host B sends to Host A, what will be the acknowledgment number?

**ACK=91**

Problem 7. Chapter 3, R16

Consider the Telnet example discussed in Section 3.5. A few seconds after the user types the letter ‘C’ the user types the letter ‘R’. After typing the letter ‘R’ how many segments are sent and what is put in the sequence number and acknowledgment fields of the segments?

**User Types ‘R” on Host A (Seq=43, ACK=80, data=‘R’)**

**Host B ACKs receipt of ‘R’ and echoes back ‘R’ (Seq=80, ACK=44, data= ‘R’)**

**Host A ACKs receipt of echoed ‘R’ (seq=44, ACK=81)**

Problem 8. Chapter 3, P15 [Modified problem from text]

Consider the cross-country example shown in Figure 3.17. How big would the window size (number of segments) have to be for the channel utilization to be greater than 95 percent? Suppose that the size of a packet is 1,500 bytes, including both header fields and data.

**RTT = 30 milliseconds**

**Transmission Rate R=1 Gbps**

**Packet Size L = 1,500 bytes = 12,000 bits**

**Utilization = L/R / (RTT + L/R)**

**dtrans = L/R = 12,000 bits / 1 Gpbs = 12 microseconds**

**We want U to equal 95% = .95, therefore**

**U = .012 / (30 + 0.012) = 0.012 / 30.012 = 0.0004**

**If we want U to equal 95%, when we are sending ‘x’ number of 12,000 bit segments. Therefore: .95 = .012\*x / (30 + .012\*x), solving this equation for x>0, x=47,500.**

**Checking this answer:**

**U = .012 \* 47,500 / (30 + .012\*47,500) = .95.**

**Answer: The window size would have to hold at least 47,500 segments (71,250,000 bytes)**

Problem 9. Chapter 3, P26

Consider transferring an enormous file of L bytes from Host A to Host B. Assume an MSS of 536 bytes.

1. What is the maximum value of L such that TCP sequence numbers are not exhausted? Recall that the TCP sequence number field has four bytes.

**L / MSS =# of sequence numbers. Solving this equation for L gives the maximum bytes.**

**L = max sequence numbers \* MSS = 4294967295 sequence numbers \* 536 bytes**

**L = 2,302,102,470,656 bytes**

1. For the L you obtain in (a), find how long it takes to transmit the file. Assume that a total of 66 bytes of transport, network, and data-link header are added to each segment before the resulting packet is sent out over a 155 Mbps link. Ignore flow control and congestion control, so A can pump out the segments back-to-back and continuously.

**M = # of segments to be transmitted = L/MSS = 4294967296**

**Size of each segment = MSS + headers = 536 + 66 = 602**

**dtrans = M \* (L/R) = 4294967296 \* (602 / 155 Mbps)=16,681.1 seconds (about 4.6 hours)**

Problem 10. Chapter 3, P40

Consider the following plot of TCP window size as a function of time. Assuming TCP Reno is the protocol experiencing the behavior shown, answer the following questions. In all cases, you should provide a short discussion justifying your answer.

1. Identify the intervals of time when TCP slow start is operating.

**Transmission Rounds 1-6 and Transmission Rounds 23-26. We know this because the number of segments being transmitted is double each transmission round (1 segment, 2 segments, 4 segments, 8 segments, etc.)**

1. Identify the intervals of time when TCP congestion avoidance is operating.

**Transmission Rounds 6-16 and 17-22 are showing congestion avoidance. We know this because the segment size is increasing linearly (by 1) each transmission round.**

1. After the 16th transmission round, is segment loss detected by a triple duplicate ACK or by a timeout?

**We know this is the case of three duplicate ACKs because threshold is cut in half and the congestion window is set to the new threshold.**

1. After the 22th transmission round, is segment loss detected by a triple duplicate ACK or by a timeout?

**This is the case of a timeout because both the congestion window and threshold is set to 1 and “slow start” begins again.**

1. What is the initial value of Threshold (ssthresh) at the first transmission round?

**ssthresh = 1. This is clear from the graph.**

1. What is the value of Threshold (ssthresh) at the 18th transmission round?

**sshresh = 21. Following the 3 duplicate ACK event in round 16, the threshold was set to half of 42 and then the window size increases linearly.**

1. What is the value of Threshold (ssthresh) at the 24th transmission round?

**sshresh = 13. Following the timeout in round 22 the ssthresh was set to half of the current value (26).**

1. During what transmission round is the 70th segment sent?

**Answer = 7th transmission round (1+2+4+8+16+32=63). The next round transmits 33 segments (numbers 64-96) which includes the 70th segment.**

1. Assuming a packet loss is detected after the 26th round by the receipt of a triple duplicate ACK, what will be the values of the congestion window size and of Threshold (ssthresh)?

**The congestion window and ssthresh will be set to the same value, which will be half of the previous congestion window. In this case the previous value was 13.**

**Congestion window = 13/2 = 6 (or 7?).**

**ssthresh = 6 (or 7).**

Problem 11. Chapter 3, Supplemental Question 1

Visit http://www.iana.org. What are the well-known port numbers for the simple file transfer protocol (SFTP)? For the network news transfer protocol (NNTP)?

**SFTP: 22**

**NNTP: 119**