CSSE 460 Computer Networks

Exam II, Winter 2009

1. **TCP multiplexing.** 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. (5 points)

The requests from A and B are passed through different sockets (port 80). For each persistent connection, the Web server creates a separate "connection socket" which is identified by a four-tuple: (source IP, source port, dest IP, dest port).

2. **TCP segment.** Name five fields that are found in TCP segment header, and give an one line summary description of the purpose of each field. (5 points)

Source Port number: source port
Destination port number: destination port
Sequence number: byte stream offset (the first byte in the segment)
Receive window: flow control
Checksum: error detection

3. **Pipelined reliable data transfer.** Recall the Go-back-N protocol.
   a) Does this protocol have a timer for each unacknowledged packet? (3 points)
   b) When a timer expires, what happens? (3 points)

   a) No. only the packet with the lowest sequence number has a timer
   b) Retransmit all sent yet unacknowledged packets in the send window

4. **TCP sequence numbers.** Host A and B are communicating over a TCP connection, and Host B has already received from A all bytes up through byte 144. Suppose that Host A then sends two segments to Host B back-to-back. The first and second segments contain 20 and 40 bytes of data, respectively. In the first segment, the sequence number is 145, source port number is 303, and the destination port number is 80. Host B sends an acknowledgement whenever it receives a segment form Host A.
   a) In the second segment sent from A to B, what are the sequence number, source port number, and destination port number? (3 points)
   b) If the first segment arrives before the second segment, in the acknowledgement of the first arriving segment, what is the acknowledge number, the source port number, and the destination port number? (3 points)
   c) If the second segment arrives before the first segment, in the acknowledgement of the first arriving segment, what is the acknowledgment number? (3 point)

   a) 165, 303, 80
   b) 165, 80, 303
   c) 145

5. **TCP congestion control.** Consider sending a large file from one host to another over a TCP connection that has no loss.
   a) Suppose TCP uses AIMD for its congestion control without slow start. Assuming CongWin increases by 1 MSS every time an ACK is received and assuming approximately constant RTT times, how long does it take for CongWin to increase from 1 MSS to 5 MSS (assuming no loss events and constant RTT)? (3 points)
   b) What is the average throughput (in terms of MSS and RTT) for this connection up through time = 4 RTT? (3 points)
   a) 4 RTT
   b) (1 + 2 + 3 + 4) MSS/4 RTT = 2.5 MSS/RTT

6. **Virtual circuit and datagram networks.** Identify three important differences between a virtual circuit network (e.g., ATM) and a datagram network (e.g., Internet). (5 points)

Virtual circuit network	datagram network
Circuit setup	No setup
Circuit teardown	No connection close
Resource reserved	No resource reserved
Routing based on circuit IDs	Routing based on destination addresses

7. **IP addressing.**
   a) Consider an IP subnet with prefix 129.17.129.97/27. Provide the range of IP addresses (of form xxx.xxx.xxx.xxx to yyy.yyy.yyy.yyy) that can be assigned to this subnet. (4 points)
   b) Suppose an organization owns the block of addresses of the form 129.17.129.97/27. Suppose it wants to create four IP subnets from this block, with each block having the same number of IP addresses. What are the prefixes (of form xxx.xxx.xxx/y) of the four IP subnets? (4 points)

   a) **129.17.129.011**00001 ➔ 129.17.129.96 to 129.17.129.127
   b) **129.17.129.01100**xxx ➔ 129.17.129.96-103/29; 129.17.129.104-111/29; 129.17.129.112-119/29' 129.17.129.120-127/29

8. **IP fragmentation.** Consider sending a 2000-byte datagram into a link with a MTU of 980 bytes. Suppose the original datagram has the identification number 227.
   a) How many fragments are generated? (3 points)
   b) For each fragment, what is its size, what is the value of its identification, fragment offset, and fragment flag? (3 points)

   a) (2000-20)/(980-20) = 3 fragments
   b) 1st fragment: 980, 227, 0, 1
      2nd fragment: 980, 227, 960/8 (=120), 1
      3rd fragment: 80, 227, 1920/8 (=240), 0