Advanced Computer Networks
Final Exam: January 11 (Wed.), 2006
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1. If a host A receives two SYN packets from the same port from remote host B, the second may be either a retransmission of the original or else, if B has crashed and rebooted, an entirely new connection request. (a) Describe the difference as seen by host A between both cases. (b) Given an algorithmic description of what the TCP layer needs to do upon receiving a SYN packet. Consider the duplicate/new cases above, and the possibility that nothing is listening to the destination port. (15%)

2. You are designing a reliable byte-stream protocol that uses a sliding window (like TCP). This protocol will run over a 10-Gbps network. The RTT of the network is 140 ms, and the maximum segment lifetime is 60 seconds. How many bits would you include in the *AdvertisedWindow* and *SequenceNum* fields of your protocol header? (10%)

3. Please show the upper bound of TCP bandwidth (bytes/sec) if no window scale factor is considered (i.e., only 16-bit window size). (6%)

4. How does TCP increase the performance of interactive traffic transmission? Please describe that as detail as possible. (7%)

5. Is it possible for the application of TELNET to have simultaneous open in TCP? Explain your reasons. (4%)

6. Can timestamp solve the *retransmission ambiguity problem*? Explain that. (4%)

7. What is the *self-clocking* behavior of TCP? (2%)

8. What is the *repacketization* in TCP protocol? (2%)

9. What is the *silly window syndrome* (SWS)? (2%)

10. (1) In TCP congestion avoidance algorithm, we want to increase congestion window size (*cwnd*) by at most one segment (i.e., maximum segment size, MSS) each round-trip time (RTT). To estimate a RTT, TCP uses the time to send and receive acknowledgments for the data in one window. Of course, TCP does not wait for an entire window of data to be sent and acknowledged before increasing *cwnd*. Instead, it adds a small increment to *cwnd* each time an acknowledgment arrives. The small increment is chosen to make the increase average approximately one MSS over an entire window. Pleas show the small increment to be $\frac{MSS^2}{cwnd}$. (2) Continue part (1). Explain why computing this increment each time an ACK arrives may not result in the correct increment. Given a more precise definition for this increment. (Hint: A given ACK can acknowledge more or less than one MSS's worth of data) (12%)

11. (1) Unlike UDP, TCP is a connection-oriented service. Two applications using TCP must establish a TCP connection with each other before they can exchange data. For a TCP connection, are all TCP segments delivered over the same path? Explain that. (2) Consider FTP as an example of TCP applications. Is it enough to setup only one TCP connection between client and server? Justify your answer. (8%)

12. When the TCP module receives incoming TCP segments from IP module, are they demultiplexed to the applications just based on the destination TCP port number? Explain that. (You must answer YES or NO first) (6%)

13. Which parameters of TCP can control the amount of data flow injected into the network? They are imposed by either the sender or the receiver. Please indicate these. (4%)

14. Receipt of the duplicate ACKs tells us a packet may be lost. The TCP does not perform slow start, but still increase the data flow (i.e., increase *cwnd*). Please describe the reasons. (5%)

15. Congestion avoidance and slow start are independent algorithms with different objectives. In practice they are implemented together. Please describe when TCP performs congestion avoidance and when it does slow start. (4%)

16. (1) What is the *point queries* in DNS? (2) If the resolver receives the IP address 140.117.176.22, what domain name will be sent to the local DNS and then resolved? (6%)

17. A sender on a TCP connection that receives a 0 advertised window periodically probes the receiver to discover when the window becomes nonzero. Why would the receiver need an extra timer if it were responsible for reporting that its advertised window had become nonzero (i.e., if the sender did not probe)? (10%)

18. Please describe the BOOTP protocol operation. (4%)

19. What is the sorcerer's apprentice bug? (4%)

20. Please compare source-based tree and group-based tree. Then give an example protocol for each multicast approach. (5%)

21. Consider the operation of NAT (Network Address Translation). Does it violate the TCP reliability? Please explain your answer. If your answer is positive, can you fix this problem? (you must answer "yes" or "no" before explaining. Otherwise, you cannot get any points in the problem). (7%)

22. Why is TCP not suitable for real-time multimedia traffic? (3%)