

Department of Computer Science and Engineering
National Sun Yat-sen University
First Semester of 2024 PhD Qualifying Exam

Subject: Computer Networks

Date: January 15 (Mon.), 2024

1. A link layer network protocol performs a retransmission and creates, say, 3 copies of the same packet. This will make TCP become confused in some of the ways we have seen already, and produces a series of duplicate ACKs from the receiver. This is enough to trigger a spurious fast retransmission. How can you suppress spurious retransmissions in such cases? (10 points)
2. Why is TCP performance more affected by losses over high-delay and high-speed network paths (Long-Fat Pipes)? (5%)
3. Which are the main factors leading to TCP throughput degradations over wireless links (e.g., satellite networks)? (5%)
4. Please describe how *cwnd* is incremented respectively in both phases of slow start and congestion avoidance. (5%)
5. There are two indications of packet loss: a timeout occurring and the receipt of duplicate ACKs. For both cases, the congestion window size (*cwnd*) increasing or decreasing? Please explain them. In the case of receipt of the duplicate ACKs which tell us a packet may possibly have been lost, why don't we perform slow start in this situation? (10%)
6. TCP is reliable for data packets, but is not for ACK packet. Why cannot unreliable ACKs affect the data delivery reliably? (5%)
7. If a host A receives two SYN packets from the same port of 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. (10%)
8. You are hired to design a reliable byte-stream protocol that uses a sliding window (like TCP). This protocol will run over a 1-Gbps network. The RTT of the network is 50 ms, and the maximum segment lifetime is 60 seconds. How many bits would you include in the AdvertisisedWindow and SequenceNum fields of your protocol header? 1 Gbits/sec = 125 MBytes/sec (10%)
9. Consider a reliable data transfer protocol that uses only negative acknowledgments. Suppose the sender sends data only infrequently. Would a NAK-only protocol be preferable to a protocol that uses ACKs? Why? Now suppose the sender has a lot of data to send and the end-to-end connection experiences few losses. In the second case, would NAK-only protocol be preferable to protocol that uses ACKs? Why? (10%)
10. In general, a bridge (i.e., layer 2 switch) can have one port to connect to a network segment. But now if a bridge has two ports on the same physical network carelessly, how might the bridge detect and correct this? (i.e., design a protocol to detect and fix this problem) (5%)
11. How does TCP increase the performance of interactive traffic transmission? Please describe the key ideas of these schemes. (5%)

12. Why can not CSMA/CD be used in wireless channels? However, CSMA/CA is suitable. Please describe your reasons. (5%)
13. Link layer provides reliability service. Why do we still need reliability service in the end-to-end layer (i.e., transport layer)? Can any one of both be disabled? What is the effect if you do disable it? (5%)
14. What difference between “link-state” routing protocol and “distance-vector” routing protocol? (5%)
15. Summarize the two key ideas of SDN (Software-Defined Network). (5%)