

Computer Networks Qualifying Exam

Fall 2013

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Note: Please attempt all questions. Justify all your answers. This examination is closed book and notes. Please write your answers in a separate paper and number them correctly.

[1.] All the sub-questions relate to the application layer of the TCP/IP stack. [20 pts: 5 pts + 5 pts + 5 pts + 5 pts]

- a. If you want to do quality of service based packet routing/forwarding, will just assigning priorities at the application layer suffice? Explain your answer.
- b. What is the Distributed Hash Table used for in P2P networks? How is it used?
- c. If you know the canonical name of the website you want to connect to and ONLY your local DNS server is down, can you connect to the website through your browser? Please explain your answer.
- d. Define out-of-band communication. How is it used in a protocol such as FTP?

[2.] All the sub-questions relate to the transport layer of the TCP/IP stack.

- a. This question relates to congestion control and DoS in TCP. [10 pts: 5 pts + 5 pts]
 - i. What can be done in the TCP congestion control algorithm to better accommodate a high bandwidth communication over a low-bandwidth communication, when both originate from the same source?
 - ii. How can denial of service attacks be mounted on a server using the TCP-tahoe connections?
- b. Given that congestion control results in a node's traffic getting throttled, is congestion control a desirable property for an individual node transmitting large amounts of data packets? Please explain your reasoning. [10 pts]
- c. Being motivated by the idea of aware networking, a new network application programmer decides that for his video application to recover from losses over the Internet he should set the video buffer playout time exactly equal to the current average RTT to the sender. While he runs his multimedia application playing videos from all around the world, he notices that for larger RTT values his video works fine while for shorter RTT values his video misses several frames. [10 pts = 5 pts + 5 pts]
 - i. What is the mistake that he made? Explain.
 - ii. He also suggests that since there are negligible losses to a stream from a server within the US, the streaming multimedia player can get rid of the playback buffer once a US-based server is identified.
What would be your response to this suggestion? Explain.

[3.] All the sub-questions relate to the network layer of the TCP/IP stack.

- a. The IntServ protocol allows a connection in the network only when it reserves resources on all forwarding nodes on the path from the source to the destination. If the reservation is unsuccessful, then the connection is not admitted, else it is. Comment with reasons on the practical usability of this approach in the Internet. [10 pts]
- b. How does the DiffServ model address to solve the scalability issues of IntServ? [5 pts]
- c. Recall that an IPv6 datagram can be fragmented only at the time of its formation at the source S; is it possible that the IPv4 datagrams implementing the tunnel get fragmented? Justify your answer briefly with appropriate assumptions. [5 pts]
- d. How are multicast communications generally set-up in a network? Comment on the level of complexity needed to create and maintain $O(n)$ multicast connections in the network, where the number of nodes in the network is n . [15 pts = 5 pts + 10 pts]

[4.] All the sub-questions relate to the data link layer of the TCP/IP stack.

- a. Suppose you were to incorporate prioritized access for communicating nodes in an IEEE 802.11 network, what is the mechanism to provide a high priority communication greater chance of access to the network and a low priority node less chance of access? Answer in the context of the Inter-Frame Spacing, DCF Inter-Frame Spacing, and the back-off timers. [15 pts]
- b. The Ethernet protocol uses CSMA/CD mechanism to detect collisions. With today's switches do you think CSMA/CD based Ethernet is necessary? Explain. [5 pts]