National University of Computer and Emerging Sciences, Karachi

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CS3001-Computer Networks

Practice Questions

1. Suppose there is exactly one packet switch between a sending host and a receiving host. The transmission rates between the sending host and the switch and between the switch and the receiving host are R1 and R2, respectively. Assuming that the switch uses store-and-forward packet switching, what is the total end-to-end delay to send a packet of length L? (Ignore queuing, propagation delay, and processing delay.

2. Which layers in the Internet protocol stack does a router process and what kind of message use in this layer? Which layers does a link-layer switch process? Which layers does a host process? Explain with the help of figure.

3. Why layering is important in internet protocol stack? Explain your answer in detail with the help of figure or analogy. Name the protocols use in each inter protocol layer?

4. Why packet delivery time varies between source and destination? Assume a fixed route.

5. Suppose there is a 10 Mbps microwave link between a geostationary satellite and its base station on Earth. Every minute the satellite takes a digital photo and sends it to the base station. Assume a propagation speed of 2.4 * 108 meters/sec.
   (a) What is the propagation delay of the link?
   (b) What is the bandwidth-delay product, R.dprop?
   (c) Let x denote the size of the photo. What is the minimum value of x for the microwave link to be continuously transmitting?

6. Suppose two hosts, A and B, are separated by 20,000 kilometers and are connected by a direct link of R = 5 Mbps. Suppose the propagation speed over the link is 2.5 *108 meters/sec.
   (a) Calculate the bandwidth-delay product, R * dprop.
   (b) Consider sending a file of 800,000 bits from Host A to Host B. Suppose the file is sent continuously as one large message. What is the maximum number of bits that will be in the link at any given time?
   (c) Provide an interpretation of the bandwidth-delay product.
   (d) What is the width (in meters) of a bit in the link? Is it longer than a football field?
   (e) Derive a general expression for the width of a bit in terms of the propagation speed s, the transmission rate R, and the length of the link m.

7. Why do HTTP, FTP, SMTP, and POP3 run on top of TCP rather than on UDP?

8. (a) How long does it take a packet of length 64Kbytes to propagate over a link of distance 3,500 km, propagation speed 2.8 x 10^8 m/s, and transmission rate 22.5 Mbps? Recalculate for distance=800m. (*1usec = 10^{-6}sec).*

   (b) Suppose Host A wants to send a large file to Host B. The path from Host A to Host B has three links, of rates R1 = 1800 kbps, R2 = 4.6 Mbps, and R3 = 1.8 Mbps. Assuming no other traffic in the network, what is the throughput for the file transfer? Approximately, how long will it take to transfer the file to Host B if the file size is 8 MB?

9. (a) What are the main components of delay when we use packet switching?
   (b) How is propagation delay affected if the length of the packet is increased?

10. **What is the difference between pull and push network protocols? Explain the difference by using two example protocols.**

11. **Suppose there are 5 users whose traffic is being multiplexed over a single link with a capacity of 1 Mbps.**

    a) Suppose each user generates 100 kbps when busy, but is only busy (i.e., has data to send) 10% of the time. Would circuit-switching or packet-switching be preferable in this scenario? Why?
    b) Now suppose that the link capacity is still 1 Mbps, but the amount of traffic each user has to send when busy is increased to 1 Mbps, and that each of the 5 users still only has data to send 10% of the time. Would circuit-switching or packet-switching be preferable in this scenario? Why?

12. **Consider distributing a file of F = 10 Gbits to N peers. The server has an upload rate of Us = 20 Mbps, and each peer has a download rate of di = 1 Mbps and an upload rate of U. For N = 10, 100, and 1,000 and U = 200 Kbps, 600 Kbps, and 1 Mbps, prepare a chart giving the minimum distribution time for each of the combinations of N and U for both client-server distribution and P2P distribution.**

13. **How does peer churning works in p2p networks? What happens if peer 15 abruptly leaves?**

14. **The Internet was originally intended for robust transfer of computer-to-computer data over long distances. Briefly explain why connectionless packet-switching was preferred to circuit-switching in the IP layer.**

15. **Consider a packet of length 1500 bytes that needs to be transmitted over a link of 3100 km with a transmission rate 3 Mbps and a propagation speed 2.5 x 10^8 m/s.**

a) **How long does a packet take to propagate over a link?**
b) **More generally, how long does it take for a packet of length L to propagate over a link of distance d, propagation speed s, and transmission rate R bps?**
c) **Does this delay depend on the packet length? Does this delay depend on transmission rate?**