Homework 2 – Internet Applications and Whirlwind Intro

Assigned: Thursday, September 16, 2010
Due: Thursday, September 30, 2010 *at the beginning of class*

Note: All homework assignments must be done on your own, and your answers should be in your own words. The lecture notes may be used, but you should not copy verbatim from either of them. *Use of previous years' assignments/solutions is **not** permitted.*

Submission: Submit this assignment either through Blackboard or as a hard-copy before class begins.

Review Questions (60 pts - 3 pts each)

1. What is phishing?
2. What is the difference between a virus and a worm?
3. What are some differences between a distribution list that is maintained by your email client and an electronic mailing list?
4. Name one site you can use to determine if an email is a hoax or not.
5. What are some differences between a wiki and a blog?
6. What are the three main components of Google Search? Briefly describe each of them.
7. What is an end system? List some examples of end systems.
8. How many bits per second are in 3 Mbps?
9. How many milliseconds are in 2.5 seconds?
10. What is a network protocol and why are protocols important?
11. Out of dial-up modems, cable modems, and DSL modems, which provide dedicated access?
12. Suppose users share a 2 Mbps link. Also suppose each user requires 1 Mbps when transmitting, but each user transmits only 30% of the time.
    a. When circuit switching is used, how many users can be supported?
    b. If packet switching is used, can more users be supported than with circuit switching? How?
13. Explain why it is more efficient to break large messages into packets when sending data in a packet-switched network than to keep the messages as single entities.
14. Explain how packets using datagram routing over a packet-switched network can arrive to the destination in a different order than they were sent.

15. Consider the delays that a *single* packet encounters from a source host to a destination host over a fixed route. List the delay components in the end-to-end delay. Which of these delays are constant (*i.e.*, do not change over time) and which are variable (*i.e.*, could change over time)?

16. What is the difference between propagation delay and propagation speed?

17. Does transmission delay occur when a packet is sent, received, or both?

18. What does the bandwidth-delay product represent?

19. List the five Internet protocol layers (top to bottom).

20. Does a distributed DoS attack use one computer or many as attackers? Explain.

Problems (40 pts)

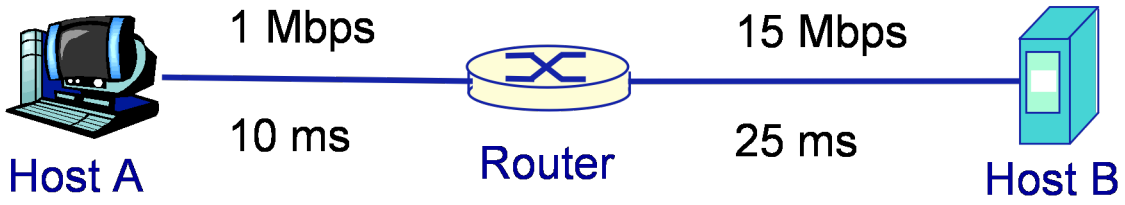
21. **[10 pts]** Consider two hosts, A and B, connected by a single link of rate R bps. Suppose that the two hosts are separated by m meters and that the propagation speed along the link is s meters/sec. Host A is to send a packet of size L bits to Host B.
    a. Express the propagation delay, d_{prop}, in terms of m and s.
    b. Determine the transmission time of the packet, d_{trans}, in terms of L and R.
    c. Ignoring processing and queuing delays, give an expression for the end-to-end delay.
    d. Suppose Host A begins to transmit the packet at time $t = 0$. At time $t = d_{trans}$, where is the last bit of the packet?
    e. Suppose d_{prop} is greater than d_{trans}. At time $t = d_{trans}$, where is the first bit of the packet (at Host A, in the network, or at Host B)?

22. **[6 pts]** Suppose two hosts, A and B, are separated by 6,250 kilometers and are connected by a direct link of $R = 5$ Mbps. Suppose the propagation speed over the link is 2.5×10^8 meters/sec.
    a. Calculate the bandwidth-delay product, $R * d_{\text{prop}}$.
    b. Consider sending a file of 750,000 bits from Host A to Host B. Suppose the file is sent continuously as one big message. What is the maximum number of bits that will be in the link at any given time?
    c. Assuming the file is sent continuously, how long does it take before the receiver has received the entire 750,000-bit file?

23. **[8 pts]** Perform a `traceroute` between a source and 1) a far-away destination and 2) a nearby destination at three different hours of the same day. Use traceroute.org if needed.
    a. Give the IP address of the source and the time of day each traceroute was run. Submit a printout of the output of the *six* traceroutes.

b. Identify any significant increases in delay from hop to hop. Which are likely to be due to propagation delay and which due to congestion? How can you tell?

24. **[16 pts]** Consider the following network. Host A sends a 1500-**byte** packet to Host B. You may assume that the transmission time for a single bit is negligible (but you must still compute transmission delays for the entire packet). **Hint:** When working this problem, don't forget to look back at your answers for Problem 21.



a. Compute the transmission delay of the packet from Host A to the router.

b. Compute the transmission delay of the packet from the router to Host B.

c. Assume Host A sends the packet at time 0. When will the *first* bit arrive at Host B? **Hint:** Remember that the network is store-and-forward.

d. Assume Host A sends the packet at time 0. When will the *last* bit arrive at Host B (*i.e.*, what is the end-to-end delay)? **Hint:** Remember that the network is store-and-forward.