Instructions

Due: Monday 9/8/14 11:59PM

Read Chapter 1 and lecture slides through 9/3/14. Answer the questions below *individually*. The goal is to have you think about the problems, not cover every eventuality. Shoot for short, succinct answers that address the root of the question.

Submit your work into the Dropbox on D2L into the "Homework Assignment 1" folder. Please submit your answers as as single text file named `last_first_hw1.txt` (customized with your name). Your submissions need to follow this format to facilitate the exchange of solutions with other students for peer feedback and so they can be fed into plagiarism detection software. You will be docked half a point on the homework for incorrectly named files, or submissions in not in the `.txt` file format.

Your submission will be graded out of 10 points based on my subjective assessment of your effort. Your submission will then be given to your peers for correction and feedback. The other 10 points on your homework grade will be based on my subjective assessment of your effort in feedback given to other students. Again, please talk with me with me if you see problems, or have suggestions for improvement of this method of feedback.

Questions

1. Why are standards important for protocols?
2. What are the five layers of the Internet protocol stack? What are the principal responsibilities for each of these layers?
3. Consider a path of three links with capacities $r_1 = 1.2Mbps, r_2 = 500kbps$, and $r_3 = 1.8Mbps$. The propagation speed on each link is $2.5 \times 10^8 m/s$ and link lengths are $l_1 = 2000km, l_2 = 1200km$, and $l_3 = 700km$.
   (a) Assuming no competing traffic, what is the end-to-end delay of a $1000b$ packet transmitted over the path?
   (b) Assume no competing traffic, what is the maximum total queuing delay for any one of the three $1000b$ packets? In other words, what is the maximum time any of the packets spends in router queues?
4. Suppose there are M disjoint paths between client and server. Path $k \in [1, M]$ consists of N links with capacities $r_1^k, r_2^k, \ldots, r_N^k$. What is the achievable download rate if the client can:
   (a) Use one path at a time?
   (b) Use K paths in parallel?
5. Consider a path of L links each with loss probability p.
   (a) What is the probability that a packet transmitted by the client does not reach the server?
   (b) Assume that a client sends a message segmented into four packets. What is the probability the message will get through to the server without any retransmissions?