

Homework #1
(Due on 12:00am, Thursday, Oct. 30th, 2014)

1. In the Internet, what are the five layers, from top to bottom, in the Internet protocol stack? Till which layer does a switch process? Please make sure you understand the concept of layering and also think about advantages and disadvantages of layering.
2. Some content providers have created their own networks. Describe Google's network. What motivates content providers to create these networks?
3. What are the four sources of packet delay? How does loss occur?
4. Circuit switching versus packet switching: Assume all traffic sources to be bursty: what switching technology is preferable? What are the advantages of the other technique?
5. In what switching technology is Frequency or Time Division Multiplexing used?
6. Suppose users share a 3 Mbps link. Also suppose each user requires 150 kbps when transmitting, but each user transmits only 10 percent of the time. (See the discussion of packet switching versus circuit switching in Section 1.3.)
 - a. When circuit switching is used, how many users can be supported?
 - b. For the remainder of this problem, suppose packet switching is used. Find the probability that a given user is transmitting.
 - c. Suppose there are 120 users. Find the probability that at any given time; exactly n users are transmitting simultaneously. (Hint: Use the binomial distribution.)
 - d. Find the probability that there are 21 or more users transmitting simultaneously.