CNT5505 Homework No. 1

(Given September 18, due September 25)

(Note: you can either do this as an individual homework or form a group of 2 to do this homework.)

1. (Problem 1, page 85) Imagine that you have trained your St. Bernard, Bernie, to carry a box of three 8-mm tapes instead of a flask of brandy. (When your disk fills up, you consider that an emergency.) These tapes each contain 7 gigabytes. The dog can travel to your side, wherever you may be, at 18km/hour. For what range of distances does Bernie have a higher data rate than a transmission line whose data rate (excluding overhead) is 150Mbps? How does your answer change if (i) Bernie’s speed is doubled; (ii) each tape capacity is doubled; (iii) the data rate of transmission line is doubled.
2. (Problem 3, page 86) The performance of a client-server system is strongly influenced by two major network characteristics: the bandwidth of the network (that is, how many bits/sec it can transport) and the latency (that is, how many seconds it takes for the first bit to get from the client to the server). Given an example of a network that exhibits high bandwidth but also high latency. Then give an example of one that has both low bandwidth and low latency.
3. (Problem 5, page 86) A factor in the delay of a store-and-forward packet-switching system is how long it takes to store and forward a packet through a switch. If switching time is 10 micro-seconds, is this likely to be a major factor in the response of a client-server system where the client is in New York and the server is in California? Assume that propagation speed in copper and fiber to be 2/3 the speed of light in vacuum.
4. (Problem 6, page 86) A client-server system uses a satellite network, with the satellite at a height of 40,000 km. What is the best-case delay in response to a request?
5. (Problem 16, page 87) A system has an n-layer protocol hierarchy. Applications generate messages of length M bytes. At each of the layers, an h-byte header is added. What fraction of the network bandwidth is filled with headers.
6. (Problem 23, page 87) An image is 1600 x 1200 pixels with 3bytes/pixel. Assume the image is uncompressed. How long does it take to transmit it over a 56-kbps modem channel? Over a 1-Mbps cable modem? Over a 10-Mbps Ethernet? Over 100-Mbps Ethernet? Over gigabit Ethernet?
7. (Problem 27, page 88) Suppose the algorithms used to implement the operations at layer k is changed. How does this impact operations at layers k-1 and k+1?
8. (Problem 28, page 88) Suppose there is a change in the service provided by layer k. How does this impact services at layers k-1 and k+1?