

Homework 1

Due: 27 September 2012, 4pm

Question 1 - Layering

- a. Why are networked systems layered? What are the advantages of layering? Are there any disadvantages?
- b. TCP provides a useful service abstraction, what is it? Why do we also have UDP, instead of just building all applications on top of TCP?
- c. Describe an analogy between the layered system in networking and the postal system. How would you divide the postal system into layers? What are the services each of these layers provide? When is there multiplexing and demultiplexing, encapsulation, aggregation? (Don't write more than a page!)

Question 2 - Link Layer Design

You are designing a link layer protocol for a link with bandwidth of 1 Gbps (10^9 bits/s), over a fiber link with length of 800 km. Assume the speed of light in this medium is 200,000 km/s. (In these types of questions, beware of bits and bytes!)

- a. What is the propagation delay in this link?
- b. What is the transmission delay for a 2,000 byte frame in this link?
- c. If your protocol will be a sliding window protocol, how many bits do you need to represent the sequence numbers in the protocol, with the 2,000-byte frame? (Assume that the receiver window will be as large as the sender window. Also assume that the ack is so small that its transmission delay – but *not* its propagation delay – is negligible).
- d. You design your protocol to have a header + trailer of 100 Bytes, and thus a payload of 1900 bytes. If there are no losses, and the window is always full, what is the throughput seen by the network layer?
- e. What is the difference in your performance if you set the receiver window to be 1? What about if you set the receiver window to be twice the sender window?

Ethernet

- a. Why is a non-switched 10 Mbps Ethernet limited to 2,500m?

- b. Ethernet is also limited to 1,024 hosts. What happens when we increase the number of hosts in the same Ethernet segment?
- c. What is the difference between an Ethernet repeater, an Ethernet bridge, and an Ethernet switch?
- d. What is the difference (in terms of traffic in the network) if I have two Ethernet segments connected by a learning bridge, and by a non-learning bridge?