EECS 122: Introduction to Communication Networks

Homework 6

(9 points)

Due: 1999-Oct-15-Fri (in class, or 467 Cory by 2pm)

Notes The *efficiency* of a LAN is the fraction of time that frames are being sent (successfully). The *access time* is the amount of time a station waits to start transmiting. An *active* station is one that has data to send. The *latency* of a ring is the time required for a bit to travel all the way around the ring. For the token ring problems below, neglect the time required to emit or absorb a token. (Suggestion: Read sections 4.9 and 4.10 of the textbook.)

Problem 1. Consider an 802.5 token ring with latency L in which stations are allowed to hold the token for a time no longer than H.

a) (1 point) If one station is always active and the other stations are never active, what is the efficiency of the ring?

b) (1 point) What is the best choice of H for the situation of part (a)?

c) (1 point) If N stations are active, what is the worst-case access time?

Problem 2. Consider an FDDI ring with latency L and target token rotation time TTRT, in which there is always at least one active station.

a) (1 point) What value of TTRT maximizes the efficiency? For this value of TTRT, what are the efficiency and worst-case access time?

b) (1 point) What value of TTRT minimizes the worst-case access time? For this value of TTRT, what are the efficiency and worst-case access time?

Problem 3. Consider an FDDI ring with a latency of 200 μs, and stations that each want to send one 500 byte frame every millisecond. These are delay-sensitive frames, so sending two frames every 2 ms is not sufficient.

a) (1 point) How many stations can be accomodated?

b) (1 point) Old versions of 802.5 used *delayed token release*, a strange practice in which a station does not send the token immediately after it has finished sending frames, but instead waits until all the data it sent has returned, then sends the token. If FDDI had adopted this practice, what would the answer to part (a) have been?

Problem 4. (food-for-thought) In an 802.11 wireless LAN using CSMA/CA, station *S* sends a data packet to station *R* (which is within range). Even if we assume that connectivity is symmetric (*A* can hear *B* if and only if *B* can hear *A*), and collisions are the only cause of errors, and RTS/CTS packets never collide with each other, it is still possible that *R* will fail to receive the data packet. Describe one way this might happen.

Problem 5. (food-for-thought) Devise a protocol allowing stations in a wireless LAN to form a logical ring, in which every station knows its successor. First assume that the LAN is fully connected (every station is in range of every other). Then try to devise a protocol that works for any connected LAN (where there is a path from every station to every other station, but it might require multiple hops). Finally, try to devise a protocol that adapts to changes in the topology.

Problem 6. (2 points) Consider links with a bit error rate of 10^{-10}, meaning each bit sent over the link has probability $1/10^{10}$ of getting inverted (this is a typical value for ATM links). If AAL5 is used to send 1024 byte IP packets over an uncongested path containing 20 links (assume the 19 switches cause no errors), what is the packet loss rate (the fraction of packets that get corrupted)?