ECE Communication Networks 1
Computer Project 2, Due Date: Dec 7th, 2006
Fall 2006

Overview

In this project you will form a team of 2 or 3 students (you may choose your team member/members). Your task is to explore the behavior of medium access control mechanisms using simulations and analysis.

Project Description

One of the most important functions of the link layer is that of medium access control. Most medium access control mechanisms are based upon the notion that two communicators sending packets at the same time causes a receiver to be unable to decipher either of the packets (this is perhaps a questionable assumption, but we will not consider advanced physical layer methods that exploit the capture effect or multi-user detection).

Your task is to explore the behavior of several medium access control mechanisms for allowing a group of N transmitters (all within communication range of each other) to communicate in a given period of time (say, 1 second). Suppose that each communicator transmits a packet of (deterministic) duration $1/\mu$ seconds. Explore the following mechanisms for managing the simultaneous transmissions:

1. **Ideal Synchronized Time-division:** In this scheme, each of the N transmitters follows a perfect global clock. Explain how each transmitter should be scheduled to transmit by devising a bootstrapping protocol to assign a schedule to each transmitter. In particular, explain the maximum N that can be supported for such a scheme (in relation to $1/\mu$).

2. **Non-ideal Synchronized Time-division:** In this scheme, each of the N transmitters follows a global clock, but the clock experiences *drift* as time elapses. You should research models for clock drift and apply a suitable clock drift model to each of the N transmitters. Using this model for non-ideal clock synchronization, devise your own strategy to optimize the number of transmitters that can reliably be identified after 100 time intervals have elapsed (to allow the effect of clock drift to manifest itself).

3. **Unsynchronized Methods:** In the extreme, it might not be possible to have global clocks on the transmitters. Instead, one might only have a local clock able to tell when a set amount of time (possibly fixed or random) has expired. Using this model, devise a strategy for allowing as many nodes to transmit as possible (with the smallest average amount of collisions) per unit interval of time. Note, it may be desirable to explore different distributions describing transmission times.

What to Turn In

You must evaluate your methods using both analysis and simulations. In order to do this project correctly, you need to implement a simulation environment in Matlab (or your favorite language) that allows for you to experiment with medium access control.

Your report should discuss your methodologies, how you implemented your simulation framework, and what techniques you used to validate the above hypotheses.