CS258   **Group Research Project**   **Dr. Moh, Fall 2007**

Project II: A Simple Simulation/Test Network Project

(Last Update: 10/11/2007)

Objective:

Based on your study in Project (I), perform a simple group (2-4 members) project on

(i)   Network simulation, using either your own simulator, NS-2, or another network simulation tool, or

(ii)   A small test network (consist of 3 or more nodes)

on **ONE** of the following network protocols (based on your Project 1):

§   _A Wireless Layer 2: 802.11 WLAN (CSMA/CA)_

§   _A MANET MAC or routing protocol_

§   _A Bluetooth protocol_

§   _A sensor network MAC protocol_

§   _A WiMAX or wireless mesh protocol ((MAC, location management, handoff, QoS, energy efficiency, etc.)_

§   _A 3G network protocol (location management, handoff, QoS, energy efficiency, etc.)_

§   _A wireless network security scheme_

Project Description I (using a simulator):

§   Install NS-2 simulator or another simulator on your computer.

§   Select a candidate network protocol. Learn and be able to change parameter values of the network protocol.

§   Learn, and be able to change input network traffic load at a source node.

§   Learn, and be able to measure queue length (queuing delay), packet loss, and/or throughput at intermediate nodes (switches, routers or base stations).

§   Learn, and be able to measure throughput, delay, and/or packet loss at receiver nodes.

§   Learn, and be able to construct a simple network (at least 10 nodes, or 3-5 nodes for mobile networks) to run your selected protocol. Also be able to change network topology such as latency (distance) and bandwidth of links, number of nodes, and their connections.

Project Description II (writing your own simulator):

Following is a description of network parameters (a-c) and performance criteria (d-e):

·   **Traffic Types** - For simplicity you may consider two (or more) of the following traffic types: Synchronous class (video and voice) and asynchronous class (data files and images). At least one traffic type should be chosen from each class.

·   **Arrival Process** - Assume constant bit rate at 1.5 M bps for video, 64 Kbps for voice, and Poisson process for data files. Choose your arrival rate and message length properly. Message length should follow exponential distribution with a proper choice of mean value.

·   **Network Description** - The transmission rate (or data rate), network length, number of stations, propagation rate, etc., should all be taken according to (or at least close to) standard, practical values for your chosen LAN protocol. You should take different values on the 2nd version.

·   **Average Delay** - Measure the mean and the variance of packet delay, which is measured from the time a packet arrives the interface and ready to be transmitted until the time it has been successfully transmitted. Alternative: **End-to-end Delay** – the time between the arrival of a

packet at the source until it reaches the destination; it would include transmission, propagation, and queuing delays experienced along the path.
- **Throughput** - Measure the successfully transmitted traffic load in bits/sec.

References:

On Simulation
- The set of handout on simulation (to be provided).
- Jerry Banks, John J. Carson, II, Barry L. Nelson, and David M. Nicol, "*Discrete-Event System Simulation*," 3rd ed., Prentice Hall, 2001.
- IEEE standards such as 802.11, 802.16, 802.15.4, etc.
- IETF RFCs and Internet Drafts for Internet-related protocols (http://www.ietf.org)

On Simulators (More may be added)
- NS-2, http://www.isi.edu/nsnam/ns/
- JavaSim, http://www.j-sim.org
- Telecom Italia Lab. JADE (Java Agent DEvelopment Framework) website, http://jade.tilab.com
- MANET: GloMoSim, http://pcl.cs.ucla.edu/projects/glomosim/
- Wireless/wireless mesh: NCTUns http://NSL.csie.nctu.edu.tw/nctuns.html
- C. Ulmer. SensorSim, http://www.craigulmer.com/research/sensorsimii
- OPNET, http://www.opnet.com/ (Commercial, with 6-month free trial for students)
- Sensor networks: TinyOS, http://www.tinyos.net/ (and many other sites on motes, smartdust, etc.)

Additional simulator links provided by Mr. Tom Belote:
- cnet (http://www.csse.uwa.edu.au/cnet/)
- NetSim (http://www.tetcos.com/software.html)
- NetScale (http://www.n2nsoft.fr/)
- Netwiser (http://bitwiserlabs.com/)

Wireless LAN Security Software
- 802.1x http://wire.cs.nthu.edu.tw/wire1x/

Deadlines:

- **Thu 9/20: Turn in a proposal (15%)** including the following information:
  1. Selected network protocol – a detailed description of the 1) protocol itself, 2) how the protocol is supported in NS-2 (object classes, commands, other protocol details), 3) what are the protocol parameters and may be varied/configured.
  2. Network topology (including sender(s), receivers, intermediate nodes)
  3. Input traffic load description, and how you vary it. This includes the mathematical formulae for the arrival process and input traffic load.
  4. Performance metrics – what you want to measure (packet loss, throughput, delay, etc.), and *how* you measure it, including the mathematical formulae for average packet delay, delay variance, packet loss, and throughput).
  5. A list of references.
- **Thu 10/2: 1st Draft (35%) Due.** Turn in a progress report, extended/modified from the proposal, including brief description of the project (protocol, simulation setting) and plot of at least one performance metric against traffic load variation.
- **Tue 10/23: Final Report and Demo (50%).** Turn in a complete report, extended from the 1st draft, including 1) detailed description of the project, 2) the protocol, 3) the simulation, (you may include some *nam* graphs), 4) all the plots and a careful discussion of simulation results, 5) references, and 6)

hard copy of your source code. You should be able to measure at least two performance metric, and vary simulation settings such as network topology, protocol parameters, etc. A demo is required in class starting 11/6.