ECE6110 - CAD For Computer Networks

Instructor

Dr. George F. Riley
Office: Klaus 3360
Office hours: TBD
Email: riley@ece.gatech.edu

Course Summary

ECE6110 is a graduate course which introduces students to the concepts used in simulations of computer networks. We will cover a wide range of issues in computer network simulation, and try to understand both how to create simulations and how to interpret results. We use a number of network simulation tools, including ns3, OpNet, and/or GTNetS, for out of class projects. At the completion of the semester, students will have a detailed understanding of computer network simulation and how to apply it networking research.

Teaching Philosophy

Teaching is interactive! Students are strongly encouraged to participate in class and offer opinions on the issues being discussed. I encourage (and expect) you to participate actively in the learning process. In particular, I welcome your comments and questions as we cover material in class. One-way lectures quickly becoming boring, both for you and for me. Also, I have found that students often learn more from other students comments than from the instructor! By asking lots of questions, your understanding of the material will be deepened significantly, and the course will be much more fun! From time to time there will be readings for a class session; these will be posted on the class web page below in a downloadable format. Students are expected to download and read the assigned readings before class.

Computing Resources

We have a newly installed linux-based computing cluster known as the Jinx cluster. This platform is the recommended platform for completing all of theThis platform is the recommended platform for completing all of the class projects, although you are free to use your personal laptops or desktops, as long as they have linux and appropriate libraries. The link above describes the jinx cluster and how to access it.

Textbook

There is no textbook for this class. We will use research papers as required for our reading and

discussion.

Course Outline

The list of topics to be covered is tentative, but expected to include the following:

Network Simulation Basics

- Creating topologies
- Defining data flows
- Defining queuing disciplines
- Trace file analysis methods
- Using network animation

Introduction to Simulation

- Discrete Event Simulation (DES)
- Simulating Networks with DES
- Modeling Network Elements
- Levels of abstratction

Parallel and Distributed Simulation

- Conservative vs. Optimistic Simulation Methods
- Time Management in Conservative Simulation
- Event Distribution Methods

Overview of Network Simulation Tools

- GTNetS
- ns3
- Opnet
- ns2
- SSF
- GloMoSim

Using Parallel/Distributed NS3

- Defining the topology
- Initiating multi-process simulations

Measuring Network Performance via Simulation

- Performance Metrics
- Goodput, Throughput, Loss, Delay, Jitter, etc.
- Factors Affecting Performance
- Predicting Affect of Changes

The Transmission Control Protocol (TCP)

- Modeling TCP
- Existing TCP Variations
- Factors Affecting TCP Performance
- New TCP variations
- Congestion Avoidance in TCP
- Using TCP over satellite links
- Using simulation to measure TCP performance

Multicast

- Multicast group management
- Source based trees vs. Core based trees
- Modeling multicast in network simulations
- Measuring multicast routing protocol overhead

Simulating Routing Prototocols

- Routing in Network Simulators
- Modeling EIGRP and BGP

Active Queue Management (AQM) and queueing Disciplines

- DropTail, RED, Priority, WFQ, SCFQ, others
- Implementation of active queues in network simulators
- Measuring the affect of AQM

Streaming Video/Audio Models

- Creating a MPEG video model
- Measuring MPEG performance
- Performance tradeoffs in streaming applications

Modeling Web Browsing

- Using request/response distribution models
- Using page distribution models
- Measuring HTTP Performance

Getting Help

There will be one teaching assistant for this course. He will do all grading of out of class projects and should be your first point of contact when you have questions about assignments or grading.

- Teaching Assistant: Chris Hood chood8@gatech.edu
- Office hours: TBD

Grading

Project 1	10%
Project 2	10%
Project 3	20%
Midterm	20%
Final Project	30%
Class Participation	10%
Total	**100%**

Syllabus

Day	Month	Date	Description	Handout	Due Date
Mon	Jan	5	Introduction to Network Simulation		
Wed	Jan	7	Introduction to Network Simulation (continued)		
Mon	Jan	12	Download ns-3	http://www.nsnam.org	
			ns-3 tutorial	ns-3-tutorial.pdf	
Wed	Jan	14			
Mon	Jan	19			
Wed	Jan	21			
Mon	Jan	26			
Wed	Jan	28			
Mon	Feb	2			
Wed	Feb	4			
Mon	Feb	9			
Wed	Feb	11			
Mon	Feb	16			
Wed	Feb	18			
Mon	Feb	23			
Wed	Feb	25			
Mon	Mar	2			
Wed	Mar	4			
Mon	Mar	9			
Wed	Mar	11			
Mon	Mar	16			
Wed	Mar	18			
Mon	Mar	23			

Wed	Mar	25			
Mon	Mar	30			
Wed	Mar	32			
Mon	Apr	6			
Wed	Apr	8			
Mon	Apr	13			
Wed	Apr	15			
Mon	Apr	20			
Wed	Apr	22			

Contact Information:

riley@ece.gatech.edu
School of Electrical and Computer Computing
Georgia Institute of Technology
Atlanta, GA 30332-0250

Last Modified: Aug 18, 2008