

NIS/CPE 604: Analytic Methods for Networks

Course Description: This course focuses on analytical models for protocols implemented at various layers of the protocol stack, with an emphasis on performance evaluation in terms of throughput and delay for data packet networks. Topics covered include an overview of the OSI layering model, data link layer issues, medium access control, queueing models, mathematical models and optimization for routing in broadcast and point-to-point networks, and flow and congestion control.

New this semester: A project simulation component is introduced to enrich the understanding of the theoretical network models.

A discrete event driven simulator is introduced and will be used for the end of the semester projects (Students that are proficient using a different discrete event driven simulator that can be used for network simulations are welcome to use their preferred simulator for the end of the semester projects.)

Textbook: D. Bertsekas and R. Gallager, “Data Networks”, Prentice Hall, 2nd edition, 1992.

Required supplemental material: OMNET++ manual

Prerequisites: An undergraduate level knowledge of probability and stochastic processes will provide a good background for this course. Basics on probabilities and stochastic processes will be reviewed in the course. For the simulation part of the class, basic understanding of C/C++ is assumed.

Grading:

Homework: 15%; Quizzes: 15%; Forum participation and class discussions 10%; Midterm 30%; Final project 30%

Topics covered:

Week 1	Introduction to Communication Networks
Week 2	Physical Layer Overview
Week 3	Data Link Layer: Framing and Error Detection
Week 4	Data Link Layer: ARQ Protocols
Week 5	Delay analysis: Introduction to queueing models: M/M/1, M/M/m
Week 6	M/G/1 queues
Week 7	Midterm Exam
Week 8	Reservation systems, Network of queues
Week 9	Network of queues
Week 10	Medium Access Control: Contention Protocols: Aloha, Splitting Algorithms
Week 11	Medium Access Control: Carrier Sensing and Reservation Protocols
Week 12	Broadcast Routing and Graph Models
Week 13	Routing in Data Networks
Week 14	Flow and Congestion Control

