

Network Simulations (Spring 2019)

Instructor: Dr Sameer Qazi

Thursdays: 6-9 pm

Course Description:

This is an advanced level networking course for computer networking students who have ideally taken Network Performance Analysis course or developed sufficient maturity level to learn the pre-requisite knowledge on their own. It is ideal for students who are research students or wish to pursue a research career ahead in their lives related to Computer Networks field.

Pre-requisite knowledge highly preferred but not mandatory:

Advanced Communications Networks (knowledge of general protocols, especially the TCP/IP protocol stack, QoS, architectures of computer networks)

Network Performance Analysis (knowledge of different technical algorithmic aspects of the network like queueing theory, routing and switching concepts, traffic scheduling etc)

Good/Reasonable command of :

Matlab (writing m files and process vectors and matrices, mostly using inbuilt functions)

Ns3 (make and run a specified network and collect data/metrics of interest) which will be **post-processed in Matlab**,

C programming (reading and writing trace files), pattern searching languages (awk/sed/perl)

Syllabus outline and learning objectives:

We start with an exhaustive study about peer to peer networks (overlay networks) which is driving advanced level networking research in the modern era. We will chiefly be interested first in the architectures, including methods for data placement and search mechanisms in content distribution networks, provision of routing resilience through overlay networks, topology formulation and estimation.

In the second phase we will cover aspects of network dynamics such as topology and traffic analysis, (Network Tomography) and related research literature on theory of linear models.

Finally we will cover some aspects of theory of prediction and statistical estimation theory (both time based/ space based), convex optimization theory, signal processing theory (time based/frequency based) as applied in modern research literature to solve problems as non-intrusive application detection, prediction of network faults/anomalies, optimizing network utilization and performance prediction.

Course Materials:

There are no prescribed Text books, photocopied excerpts will be provided or book chapters or web references will be recommended where required. Research papers discussed in lectures, will form part of the curriculum as we progress. Students can then search for related papers to further polish their concepts using internet. Some Assignments will be small research implementation tasks to be performed on Matlab primarily. Some tasks may involve implementation of small network in NS-3 (Already covered by students in Network Performance Analysis course covered in Fall 16) to generate data whose post-processing task may still be covered in Matlab.

Although majority of lectures may be delivered in conventional classroom setting. It will be necessary for students to bring laptops with Matlab installed when practical demonstration of taught algorithms will be made through provision of networking datasets to students.

Mode of sessionals/exams

Like advanced level courses at international universities this course will mainly be driven by students in the form of implementing small research problems. After covering preliminary material in classroom in the form of lectures slides from leading research literature. The selected research literature (papers) will form part of the syllabus.

Assignments: Students will be asked to re-implement/duplicate the research results of any one paper (or have a choice from a pool of research papers) to be submitted as assignments or projects.

Semester Project: Students may work as groups or individually depending on scope of research problem they select as semester research project.

Exams: Exams will partially have written conceptual problems as well as some tasks to be performed on Matlab. Final exam and some quizzes may be conducted in computer labs on Matlab. This may be day/time other than class timings depending on availability of computer labs. For class activities students may bring their own laptops.