CS 740 Advanced Computer Networks **Fall 2005**
http://www.cs.wisc.edu/∼suman/courses/740/f05

Course Description

Handed out: September 07, 2005

Overview

This course will cover the principles of networking with a focus on algorithms, protocols, and implementations for advanced networking services. We will begin with a brief retrospection on the design of the Internet, its basic mechanisms and protocols. We will examine a variety of ideas that were proposed to enhance the Internet, why some of these enhancements were successful while others were not. Subsequently we will move on to a select set of advanced topics in networking, primarily at recent and ongoing advances in "the edges" of the Internet. We will focus on:

- The "physical edge" of the Internet, i.e., access networks. In particular, we will examine how proliferation of mobile, wireless access techniques affect choice of algorithms, protocols, and their implementations.
- The "logical edge" of the Internet, i.e., overlay-based (peer-to-peer) systems. All topics in this course will be covered through research papers. In each class I will lead a discussion on one or two papers. In order to have a discussion, students will be expected to have read these papers prior to class.

Each student in the class will be expected to do a research project. Early in the semester I will discuss a number of possible projects. However, students are encouraged to define their own ideas for research projects. For each research project, a student should submit a written project plan, a summary at the end of the semester and an oral presentation on the project.

Expectations

The pre-requisite for this course is CS 640, the undergraduate-level course in computer networks. In particular I expect you to (1) already understand the basics of computer networks and (2) have experience in implementing non-trivial systems projects. If you have not taken CS 640, then, minimally, you should have taken a course that introduced you to the basics of internetworking: protocol layering and peering; the ISO seven-layer model; rudiments of IP and related protocols such as TCP, UDP, and ICMP; routing protocols and the domain name system. You should already know what RFCs and Internet-Drafts are, and have some practice in the art of reading and getting information out of them.

You should be able to design, implement and test non-trivial distributed programs in C/C++. If you are like me and tend to produce code that has a bug or eight, you should be comfortable with at least one debugger. Please not that *you* are completely responsible for these pre-requisites and they will not be covered in class.

This is a graduate course, I expect you to be motivated, eager to learn, and willing to work hard to make up for any deficiencies you may have.

After attending this course, I expect you to be able to:

- Understand the principles behind the Internet protocols
- Understand the limitations of the current Internet and its service model
- Understand the main ideas behind some of the current innovations in networking including, p2p protocols, wireless access systems, and network security
- Design, implement, and test substantial parts of network protocols.

General Information

Class Time: Monday, Wednesday, Friday 9.30-10.45am (twice a week on average) in 1257 CSS.

Final Exam: TBA.

Instructor: Suman Banerjee. Email `suman@cs.wisc.edu`. Office: CS 7391.
Office Hours: 11-12 after class on each class day. If you cannot make these office hours, please send email to arrange another time.

Teaching Assistant: TBA. Email `TBA@cs.wisc.edu`. Office: TBA. Office Hours:

(Please include the text "CS740" in the Subject line when you send an email.)

Texts and Readings: There is no required text for this course. Instead we will discuss a sequence of technical papers that will be prescribed ahead of each class. Each student will be expected to have read these papers *prior to the day they are discussed* and actively participate in the discussion. The entire reading list will be available at:
`http://www.cs.wisc.edu/~suman/courses/740/readinglist.html`

The following texts can serve as useful reference and background material for the course:

- Computer Networks: A Systems Approach (3rd Edition) by Larry Peterson and Bruce Davie. Morgan Kaufmann, 2003. ISBN: 1-55860-832-X.
- Computer Networking: A Top-Down Approach Featuring the Internet by Jim Kurose and Keith Ross, Addison-Wesley. ISBN: 0-201-61274-7.
- TCP/IP Illustrated, Volume 1 by W. Richard Stevens. Addison-Wesley. ISBN: 0-201-63346-9.

You should also form reading groups (size 3-4) where you will meet and discuss the assigned paper prior to class.

Grading: The course will have a two exams that will be held in class. Apart from that, each student will be expected to write short reviews on three or four papers. These reviews will be short (typically less than a page). Further details on this review format will be explained in class later.

There will also be a significant research project (typically in groups of two). The research project will require you to identify and define a research question that you wish to address, perform appropriate research, and present a research summary at the end of the semester through a presentation and a report. The following are the deliverables for this project:

- Problem statement (due in first week of October): clearly define the research question, relevant background and related work, and how you plan to proceed in this project.
- Interim report and meeting (due in second-week of November): a work-in-progress document describing the status of your project. It should describe your setup for experimentation, appropriate related work, and some preliminary results.
- Research summary report (due in mid December): a detailed documentation of your research work. This should be written in the style of the technical papers that we will discuss in class. Write it well, since a part of your grade will depend on how well you have written it, e.g., make sure you spell-check.
- Research presentation (in last week of classes): each group will present their research activities through a 20 minute presentation in class.

Early in the semester, I will give you some project suggestions that you can pursue. However you should feel free to define your own.

The grading criteria for this course will be as follows, but *subject to change*:

- Exam I - 15%.
- Exam II - 15%.
- Project - 45%.
- Review assignments - 20%.
- Class participation - 5%.

The class participation component is to encourage you to voice your opinions, raise questions, and actively involve in discussions in the class and in the mailing list.

Mailing List: The class mailing list is cs-740@lists.students.wisc.edu. It should be used for all course related discussions, e.g. assignments, projects, exams, or any topic related to networking. If you have questions about any aspect of this course, please post them to the mailing list before writing emails to the instructor.

Prerequisites: CS 640, its equivalent, or consent of instructor.

Collaboration and Academic Honesty: You may *discuss* assignments for general solution strategies with your classmates. But the formulation and exposition of the solutions *must* entirely be your own.