EE/CS 450 Introduction to Computer Networks

Lectures: Wednesdays 2 – 4.50 PM, SCI 352 Discussion: Fridays 11 – 11:50 AM, SLH 100

Instructor

Bhaskar Krishnamachari Assistant Professor, Electrical Engineering <u>bkrishna@usc.edu</u> Office Hours EEB 342 Wednesday: 11:15 AM – 12:15 PM Thursday: 2 PM – 4 PM + after class for 15 minutes

Teaching Assistant

Onur Senel <u>senel@usc.edu</u> Office Hours EEB 201 Monday 2 PM – 4 PM Tuesday 2 PM – 4 PM

Introduction

Welcome. The recent advances in Information Technology have relied crucially upon the development of scalable, robust, computer networks – in particular the Internet. The engineering concepts pertaining to such networks are the subject of this course.

We will begin with an introduction to some of the basics of networking, in particular the idea of layered architectures. We will discuss the OSI seven-layered model and the corresponding Internet model. We will then proceed with our study in a bottom-up fashion, starting from the types and characteristics of transmission media used in local networks, moving on to error correction and medium access issues at the link layer, routing and switching mechanisms at the network layer, end-to-end quality of service issues at the transport layer, and finally discuss some of the application layer protocols. Time permitting, we will conclude the course with a brief introduction to some of the fundamental tools used to analyze networks, such as Graph Theory and Queuing Theory.

Course Outline + Tentative Schedule Dates are subject to change

- 1. Introduction (Classes: 8/28, 9/4, Quiz: 9/11, Homework due: 9/11)
 - Basic Networking terms and concepts
 - Bandwidth-delay product
 - Topologies
 - Packet switching
 - Layering and network architecture: OSI and the Internet models

2. Physical Layer, Link layer (9/4, 9/11, 9/18, Quiz: 9/25, Homework Due: 9/25)

- Transmission media
- Framing
- Error detection
- ARQ
- Medium access: Aloha and Ethernet, Token Rings

3. Network Layer (9/25, 10/2, 10/9, Quiz:10/9, Homework Due: 10/16)

- Repeaters/hubs, Bridges/switches, routers and gateways
- ATM
- Switching hardware
- Intradomain routing: distance-vector and link-state routing, IP addressing
- Interdomain routing: BGP
- Multicast routing: DVMRP, PIM

MID-TERM EXAM - covers units 1, 2, 3 (tentatively scheduled for 10/23, in class)

4. Transport Layer, Congestion Control & QoS (10/16, 10/30, 11/6, Quiz: 11/6, Homework

Due: 11/13)

- TCP
- UDP
- Queuing & scheduling disciplines
- TCP congestion control
- QoS issues and techniques, RSVP

5. Application Layer (11/13, 11/20, 11/27, Quiz: 11/20, Homework Due: 11/27)

- DNS, SMTP, HTTP, SNMP, RTP
- Network security: DES, RSA, PGP, firewalls, IPSEC, certificates

6. Analysis Techniques (Time Permitting) (11/27, 12/4, Quiz: 12/4)

- Graph Theory
- Queuing Theory

FINAL EXAM - covers units 4, 5, 6 (as per university schedule)

Books

<u>Required:</u> Larry L. Peterson and Bruce S. Davie, *Computer Networks: A Systems Approach*, Second Edition, Morgan Kaufmann Publishers, 2000.

Recommended References:

1. S. Keshav, An Engineering Approach to Computer Networking: ATM Networks, the Internet, and the Telephone Network, Addison-Wesley, 1997.

2. B. Forouzan et al., Data Communications and Networking, Second Edition, McGraw Hill.

Policies and Procedures

- ? Academic Integrity: You are encouraged to work together on homework assignments and to study for quizzes and exams together. For informational purposes, *we ask you to identify which students you worked with on each homework assignment*. However, *you may not copy other students' homework solutions blindly*; besides being a violation of the campus code of conduct, such a practice will be detrimental to your quiz and exam performance. Quizzes and Exams are to be completed individually; no aids of any kind (including calculators!) are permitted. Any violation of this policy will be handled according to the USC campus code.
- ? **Discussion Board, Office Hours, and Email:** All questions about homework/quiz/exam problems and solutions should be posted to the TotalE discussion board. This will be the fastest way to get an answer to a question electronically. If you have questions that would prefer to have answered in person, you should come to one of the posted office hours.

Email should be used only for personal academic concerns. Once the course discussion board is set up, *Email should not be used* for questions related to homework/quiz/exam problems or solutions.

? **Homework:** Homework when due should be submitted in the lecture session. If you are unable to make it to the lecture session, you must send your homework in to class with another student. The solution to homework assignments will be provided shortly after they are due. For this reason, *absolutely no late homeworks will be accepted, for any reason. Homeworks will not be accepted in electronic format.*

On each assignment, please write your full name (given and family names) clearly in the top right-hand corner of the paper. On each numerical homework problem, please box your final answer. And don't forget to list other students you worked with on the homework!

- ? **Quizzes:** A short quiz will be given in class approximately once every two weeks. Each quiz will cover the material covered in the previous two weeks. Only your best four best quizzes will count towards your final grade. No makeups will be provided for missed quizzes.
- ? **Exams:** There will be only two exams in this course; each counts as 30% of your final course grade. The second exam will be given at the university appointed time for the final exam, but it will NOT be cumulative (i.e. it will not explicitly cover material included in the first exam). If you miss one of the exams with either a certified medical excuse or prior approval from me (given only under dire circumstances) then you will be given a makeup exam. If you miss an exam without prior approval or a certified medical excuse, a zero will be averaged into your grade.
- ? Absences: It is important for you to attend all lectures. Since the course may cover material that does not appear in the textbook, it is imperative that you take good notes. In case of unavoidable absences, it is your responsibility to make sure that you obtain notes from one of your classmates. In case of a missed quiz or exam, see the appropriate section above. Out of courtesy and consideration to your classmates and to minimize disruption please arrive in class on time.

? Calculation of Course Grade: A weighted average grade will be calculated as follows: Homework – 20%, Quizzes (best 4) – 20%, Exam I – 30%, Exam II – 30%. A weighted grade of 96% or higher is guaranteed a course grade of A+, 90% or above is guaranteed an A, 80% or above is guaranteed at least a B, 70% or above is guaranteed at least C.

There will be a "gray area" of several points below the specified numerical cut off grades within which a +/- system will be used. +/- grades will be assigned taking into account factors such as your class participation, and whether your exam/quiz performance has been improving or declining.

Note: I will not curve grades in this course. It is theoretically possible for everyone in the class to get an A. Your performance depends only on how you do, not on how everyone else in the class does. It is therefore in your best interest to help each other out in every legal way possible.

? **Seating:** Over the course of the semester, I will make an effort to get to know each of you by name. In order to facilitate this, I ask that you retain the same seat for the duration of the semester. If you are unhappy with the seat you chose on the first day of class, then please position yourself in a better seat by the second class. I will compile a seating chart for my reference on that day.