CS 4380 — Data Communications

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1 Course Summary

CS 4380 (Data Communications) is the second of a three course, senior-level sequence in telecommunications. The three course sequence satisfies the Networking area of specialization in the CoC undergraduate curriculum. In addition to undergraduates in CoC, this course also attracts some undergraduate ECE students, and a handful of graduate students. The revisions underway in CS 6380 (Computer Networks) should make 6380 the preferred option for graduate students.

This course fits into the curriculum between CS 4375 (Introduction to Telecommunication Systems), which focuses on the voice channel and traditional telephony, and CS 4804 (Computer Networking Laboratory), which focuses on transport via programming and laboratory exercises. The material in CS 4380 fills the gap between the physical transmission of information and ensuring reliable end-to-end transport. In ISO parlance, it covers the data link and network layers of the OSI model.

Telecommunications and networking attracts a large number of students, reflecting an increased emphasis in society on the information age. The area is of great practical importance; nearly every one of us makes use of networking on a daily basis, often without a second thought about the details of operation. One goal of the three course sequence is to reveal the underlying principles of operation, and convince you that there is no "magic." In addition, the subject area serves to integrate a wide range of computer science (and electrical engineering) concepts, including coding, algorithms, distributed systems, mathematical performance analysis and fault tolerance.

2 Teaching Philosophy

The purpose of this course is for you to (1) understand the fundamental problems and solution techniques involved in networking at the data link and network layers, and (2) to see how these fundamental concepts are manifest in practice, via case studies of particular protocols. This is not a course about any particular protocol or networking technology (e.g., Ethernet), rather it is about the more enduring concepts that appear in networking technology (e.g., medium access control). Case studies provide an excellent opportunity to see the messiness of principles in practice. In addition, they provide the opportunity to practice a critical skill: sifting through details for the key idea. Protocols are a great example of lots of details that can obscure a core concept.

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. By asking lots of questions, your understanding of the material will be deepened signficantly, and the course will be much more fun!

3 Teaching/Learning Goals

My primary goals for this course are for you to develop the following abilities:

1. to correctly use the core terminology of networking (protocol, service, interface, peer-to-peer communication, layering, etc.);
2. to demonstrate understanding of the fundamental problems and solution techniques that arise in the data link and networking layers;
3. to understand the details of several particular protocols, as example implementations of fundamental principles;
4. to digest descriptions of specific protocols, extracting the fundamental concepts;
5. to debug candidate solutions, to determine if they satisfy correctness criteria;
6. to assess and compare solution approaches using performance evaluation techniques;
7. to apply basic concepts of networking in new networking contexts; (aside: re-inventing the wheel is common in networking).

4 Method

- Lectures and assignments

  Most of the class time will be spent on lectures about the information content of the course, supporting primarily goals 1, 3, 4 and 6. Through a series of homework assignments, you will have the opportunity to develop the skills listed in goals 2, 5, 6 and 7.

- Textbook

  Saadawi, Ammar and Hakeem, *Fundamentals of Telecommunications Networks*, Wiley, 1994. An errata sheet for the book can be found on the Web at:

  `http://www.cc.gatech.edu/fac/Mostafa.Ammar/BOOK.html`

  If you do not know how to access this, consult the TA. There are several other textbooks that cover similar material, including:

  - Spragins, Hammond and Pawlikowski, *Telecommunications Protocols and Design*, Addison-Wesley, 1991. (Reprinted, 1992)
  - Tanenbaum, *Computer Networks* (2nd edition), Prentice-Hall, 1988.
  - Stallings, *Data and Computer Communications* (2nd edition), Macmillan, 1988.

- Teaching Assistant

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5 Grading

The tentative grading allocation is given below. This is subject to possible revision, namely to give more weight to homework and other out-of-class activities and less to the midterm and final.

Homework	30%
Midterm	30%
Final	35%
Class participation	5%

6 Schedule (tentative)

Date	Topic	Reading
Tues, Mar 28	Overview, terminology, standards	Chap 1
Thurs, Mar 30	Intro to data link layer	Chap 4
Tues, Apr 4	Errors and error control	Sect 2.9
Thurs, Apr 6	ARQ protocols (stop-and-wait)	Sect 4.5
Tues, Apr 11	ARQ protocls (go-back-N, selective reject)	Sect 4.5
Thurs, Apr 13	Flow control	Sect 4.5.3, Chap 6
Tues, Apr 18	HDLC, X.25	Sect 4.6, 4.8
Thurs, Apr 20	Catch up	
Tues, Apr 25	Midterm	
Thurs, Apr 27	Medium access control	Chap 7
Tues, May 2	Scheduling techniques	Sect 7.5, 7.6
Thurs, May 4	Random access techniques	Sect 7.4
Tues, May 9	Performance analysis	Sect 7.4
Thurs, May 11	Overview of local area networks	Chap 8
Tues, May 16	Ethernet	Sect 8.2
Thurs, May 18	Network layer overview, circuit/message/packet switching	Sect 1.5
Tues, May 23	Routing	Chap 5
Thurs, May 25	Multidestination routing	Sect 5.5
Tues, May 30	Congestion control	Chap 6
Thurs, June 1	Catch up	