

CSci 785 Wireless Network and Mobile Computing

Spring 2008, 9:30 to 10:45 AM TTH, Stevens Hall 230

Credits: 3. Class Number: 15473

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Office Hours: 11:00AM – 12:00PM, TTH. Other times by appointment.

A. Textbook:

1. W. Stallings, “**Wireless Communications and Networks**”, Prentice Hall, Second edition, 2005

B. Reference Books:

1. T.S. Rappaport, “**Wireless Communications: Principles and Practice**”, Second Edition, Prentice Hall, 2002.
2. Frank Adelstein, Sandeep Gupta, Golden Richard III, Loren Schwiebert, “**Fundamentals of Mobile and Pervasive Computing**”, McGraw-Hill Professional; First edition, 2004
3. Andrew S. Tanenbaum, “**Computer Networks**”, Prentice Hall PTR; Fourth edition, 2002.

C. Research papers, course notes for specific topics

All course materials will be distributed via Blackboard: <http://bb.ndsu.nodak.edu/>

Course Description

Mobile and wireless networks have been undergoing rapid growth in the past several years. This course covers topics ranging from physical layer to application layer in the wireless and mobile networking fields. In this course, we will explore the physical layer issues of the wireless communications, wireless cellular telephony, ad-hoc networks, wireless sensor networks, wireless mesh networks, mobile IP and multicast, wireless LAN (IEEE 802.11), security, etc.

Course Goals

The purpose of this course is that by reading the selected paper and book chapters, people gain general knowledge about wireless communication technologies, as well as the ongoing research activities. This course is designed to introduce students to the theory, design, and implementation of wireless networks. We will begin the course with fundamentals of wireless networking, and move onto the key research challenges that face us today. We will read papers to understand how other researchers are approaching these problems. We will work on a semester-long research project to implement our own ideas. At the end of the semester, we would have covered topics on networking protocols (Physical and MAC, multi-hop routing, wireless TCP, applications), mobility management, security, and sensor networking. Besides being fun, I expect the course to expose you to a hot and active research direction that you may choose to pursue in future.

Tentative Topics (Subject to change)

- 1) Course Introduction and Networking Review (Lectures 1, 2, 3)
 - Challenges in Mobile Computing
- 2) PHY layer technologies and Medium Access Control Basics (Lectures 4, 5)
 - CSMA, MACAW, 802.11 DSSS and FHSS (2 lectures)
 - TDMA regime, Bluetooth
- 3) MAC Protocol Research (Lectures 6, 7, 8)
 - Smart antennas
 - Multi-channel
 - Rate control
- 4) MAC Related Topics (Lecture 9)
 - Carrier sensing, MAC misbehavior, Broadcast Storm
- 5) Cellular Networks and WLANs (Lecture 10)
 - AP channel assignment, cellular and UCAN
- 6) Routing in Ad Hoc Networks (Lectures 11, 12)
 - Introduction and survey of ad hoc routing
 - Survey of routing protocols (continued)
- 7) Delay Tolerant Routing and Mesh Routing (Lecture 13, 14)
 - Encounter based routing, mobility patterns
 - ETT and ExOR
- 8) Sensor Networks Introduction, MAC (Lectures 15, 16)
 - Motes, TinyOS, Information Dissemination
 - SMAC, ZMAC
- 9) Sensor Network Routing and Aggregation (Lectures 17, 18)
 - Broadcast, Dissemination, and Routing
 - Aggregation, Compression
- 10) Wireless TCP (Lectures 19, 20)
 - Problems with transport over wireless, Proposed protocols
 - Receiver based TCP, Transport for sensors
- 11) Sensor Network Applications (Lecture 21)
 - PeopleNet, GenWits, Zebranet, etc.
- 12) Security (Lecture 22, 23)
 - Introduction, Issues in security
 - Secure routing, watchdog algorithms
- 13) Capacity of Wireless Networks (Lecture 24)
 - Gupta and Kumar result

Technical Paper Reading and Presentation

You are required to read a research paper in the areas of wireless networking. The papers are from top journals and conferences, like IEEE INFOCOM, ACM MobiCom, ACM MobiHoc, IEEE/ACM Transactions on Networking, IEEE Transactions on Mobile Computing, IEEE Transaction on Wireless Communications, and IEEE Transactions on Vehicle Technology. The paper list will be given later. The purpose of the Technical Paper Reading is to let students know the up-to-date research frontier in the related areas. You need to prepare a presentation and talk about the main content of the technical paper.

Grading Policy: A: 90-100; B: 80-89; C: 70-79; D: 60-69; F: 0-59.
Depending on the class average, curving may be applied to grades.

Item	Weight
Assignment and Quiz	5%
In-class group discussion	15%
Technical Paper Reading & Presentation	10%
Midterm Exam	20%
Project & Presentation	20%
Final Exam	30%

Tentative Exam Schedule (Subject to Change):

- **Mid-term Exam: Tuesday, March 11, 2008, Week 10**
- **Final Exam: Thursday, May 1, 2008, Week 17, The last class**

Project:

Each student is required to study a particular topic in depth by surveying the literature, proposing his/her approaches to a problem on the topic, and evaluating the proposed solutions through simulations and/or analytical techniques.

The project may be done individually or in teams of two students, provided that the tasks of each team member are clearly identified. Each student or team must submit a brief project proposal that outlines project objectives and work plan. Project proposals are due within *the first 9 weeks of classes*. You are encouraged to discuss project ideas with the instructor and to submit your proposal as early as possible. Please check project-guidelines to get more information about project, and check project-topics to take a look at some general areas for project topics.

Course Policy

- Students are expected to attend all classes. If a class is missed for any reason, the student is responsible for finding out the material covered, any assignment and handouts given, and any other announcements made in the class (e.g., exam date).
- Homework and other assignments should be submitted at the beginning of the class on the corresponding due date. Late work will be penalized at 10% of its full credit per day. You may discuss homework assignments with classmates but all solutions must be original and individually prepared.
- No make-up exam will be allowed except in cases of emergencies for which prior permission of the instructor must be taken.
- Cheating in an exam or an assignment (project, homework) can result in a grade of **F** in the course.

Americans with Disabilities Statement about Students with Special Needs

Any students with disabilities or other special needs, who need special accommodations in this course, are invited to share these concerns or requests with the instructor as soon as possible.

Rules

All work in this course must be completed in a manner consistent with NDSU University Senate Policy, Section 335: Code of Academic Responsibility and Conduct (<http://www.ndsu.nodak.edu/policy/335.htm>). In particular, no student may represent or imply that the work of another person is her or his own.

As a computer user, you are expected to behave in responsible ways. You should always follow computer usage policies (of NDSU and other organizations). The discussion in this class does not give your permission to violate computer usage policies.