

## **EE653: Cross-layer design for wireless networks**

**Instructor:** Prof. Cristina Comaniciu, B211

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Thursday: 6.15 - 8.45

**Office hours:** by appointment.

**Class web page:** <http://www.ece.stevens-tech.edu/~ccomanic/ee653.html>

**Prerequisite:** EE605 or equivalent

### **Course description:**

New heterogeneous services emerging in wireless networks require efficient resource management and quality-of-service (QoS) support at all layers of the protocol stack. As opposed to wireline networks, in which QoS can be guaranteed by independently optimizing each layer in the OSI model, in wireless networks there is a strong interconnection between layers, which makes the layered design approach inefficient.

In this course, we will outline the basic principles of cross-layer design in wireless networks, and we will discuss the tradeoffs involved. The course will first review basic network architectures such as cellular, wireless LAN's, infostations, and ad hoc networks, and will discuss the appropriate tools to provide QoS support at each layer of the protocol stack. Then, we will discuss examples of integrated design across layers for different network architectures. A very important component of this course will be the project, which will give the students the opportunity to apply their knowledge to solve specific problems related to QoS provisioning in wireless networks.

**Text book:** no textbook required.

Course notes will be available on the class web page.

### **Suggested reading:**

1. Radio resource management for wireless networks, by Jens Zander et all, Artech House Publishers, 2001.
2. Wireless Communications. Principles and Practice, T. S. Rappaport, second edition, Prentice Hall, 2002.
3. Wireless Networks: Multiuser Detection in Cross-Layer Design", by C. Comaniciu, N.B. Mandayam and H.V. Poor, Kluwer Academic Publishers, in preparation, to appear 2004.

**Course outline:**

1. Introduction to communication networks and layered network architectures
2. Principles of cross-layer design
3. Introduction to wireless communication
4. Multiuser communication in wireless systems
5. QoS support at different layers of the protocol stack with emphasis on radio resource management
6. Examples of cross-layer design for wireless networks

**Course objectives**

At the end of this course, students are expected to

- 1) understand the cross-layer design concept and the tradeoffs involved,
- 2) understand the QoS measures and the QoS provisioning tools at different layers of the protocol stack ,
- 3) be able to analyze the system performance and provide alternate design solutions and illustrate the tradeoffs,
- 4) solve specific problems involving QoS support in wireless networks, using cross-layer optimization.

**Grading:**

1. Homework: 20%
2. Paper presentations and participation to discussions 20%
3. Midterm: 30%
4. Project: 30%

**Paper presentations:**

A list of relevant research papers will be provided. Each student will present a paper to the class at a scheduled date. All students are expected to familiarize themselves with all the papers and to participate in class discussions.

**Project:**

Students are encouraged to submit project proposals. If no proposal is submitted, a list of possible topics for the project will be provided. Small groups for the project (2-3 students) are encouraged. The project will involve computer simulations. Matlab, or alternatively, C/C++, programming is required for the completion of the project.