

**ECE 6962-003:
Fundamentals of Wireless
Networking
-
Spring 2007**

Instructors:

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Course Information

- **Classes:** T,H 3:40 PM-5:00 PM in EMCB 114
- **Class WWW site:**
www.ece.utah.edu/~ece6962-003
- *Most of the material will be posted there!*
 - syllabus
 - TA info
 - class notes (powerpoint, pdf)
 - assignments

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Course Information (more)

Course materials:

- Text: ***Computer Networking: A Top Down Approach Featuring the Internet, 3rd Edition***, Jim Kurose & Keith Ross, Addison Wesley, 2004
- "Special Topics" material, readings
- Class notes (*modified version of slides provided by Jim Kurose & Keith Ross*)

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Course Information (more)

- Classes are mostly lecture (presentation)-based, with demos whenever feasible.
- Class attendance is mandatory. If you have to miss a class, please contact us in advance.

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Course Information

- **Who is this course for?**
MS/PhD students
- **Prerequisites (any one):**
 - *ECE 5520 Digital Communication Systems*
 - *ECE 6962 Advanced Topics in Communication*
 - *ECE 5325 Wireless Communication Systems*
 - *ECE 5510 Random Processes*
 - *ECE 5530/6530 Digital Signal Processing*
 - *ECE 6961 Software Radio*

Special permission may be given, talk to us!

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Course Information (more)

- **Grading:**

written homeworks (approx. 6-8)	15%
midterm 1	25%
midterm 2	25%
final project	30%
class participation	5%

Final grading will be on a curve with the average at B

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Course Information (more)

Two Midterm exams, closed book.

Calculators, laptop computers, tables of integrals, etc. are not permitted.

- one sheet of notes (both sides) for the first midterm exam
- two sheets for the second midterm exam.

No make up exam will be given (unless permission is granted in advance by the instructor).

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Course Information (more)

- **Final project:** work in **groups of two**, select **three papers** from an area in wireless networking (to be announced).

From those, **we will select one paper per group. Summarize the paper in a four page report (double spaced) and give a 25 minute presentation in class.**

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Course Information (more)

- **Homework policy/procedure:**
Consultation with other students on the homework is permitted, however each student must write and submit independent solutions!

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Course Information (more)

Cheating: is a serious problem and we will not tolerate it! If you use "third party" material for your homework, you have to reference it properly:

Example 1:

You find a hint (on the internet, in a book, sees it on TV...). You read it, you re-express the solution in your homework and you reference your source properly ("http://...")

Result:

You get full credit.

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Course Information (more)

Example 2:

While working on a homework problem, you find hints for a problem (on the internet, in a book, sees it on TV...). You copy it verbatim and you do not reference your source.

Result:

you will get zero credit for your assignment and we request you explain yourself.

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Course Information (more)

Example 3:

You collaborate with another students on a homework problem and your write-ups are identical.

Result: In case submitted homework that belongs to different students is identical, all students will get zero credit for their assignment and we request you explain yourselves to us.

We ask you to bring up any problems you might have in class so that we can all learn from each other!

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Course Information (more)

- in-class style: interaction, questions (*please!*)
- you are not expected to read class notes in advance, but you should print them before the class

Questions, comments, ... ???

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How does ECE 6962-003 fit in?

ECE comms.
classes:

Higher Layers:
Computer Science

Layer 1:
Physical Link

CS networking
classes:

Higher Layers

Layer 1:
ECE comms. classes

Assumption: the interface is "clean", i.e.
no information about the channel required

**Does not work w/ wireless (lossy) channels,
leads to performance degradation**

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What is this course about?

Top-Down introduction to computer networks with an
emphasis on wireless networking

- learn **principles** of computer networking
- learn methods to cope with the wireless channel
from a networking perspective
- Internet architecture/protocols as case study

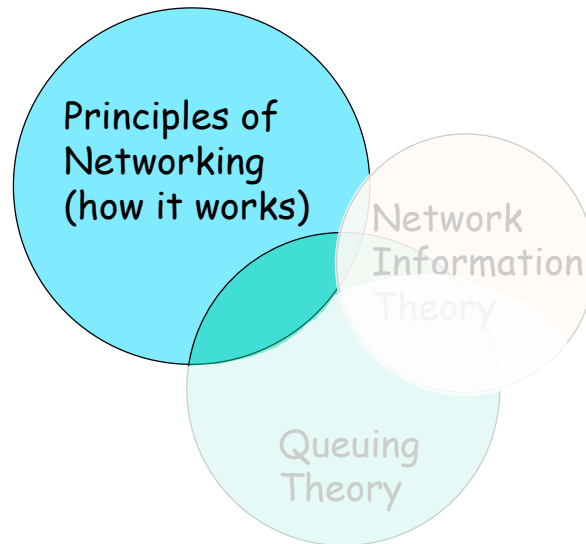
Goals:

- learn a lot (not just factoids, but principles and
practice)
- have fun (well, it should be interesting, at least)

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How do we approaching the challenge?

"Networking"

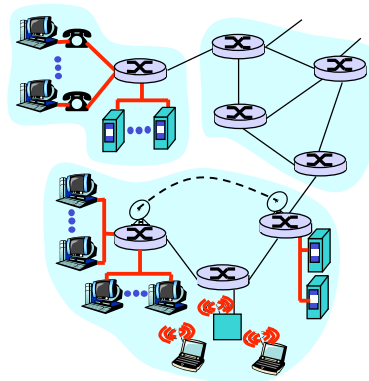


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A top-down approach:

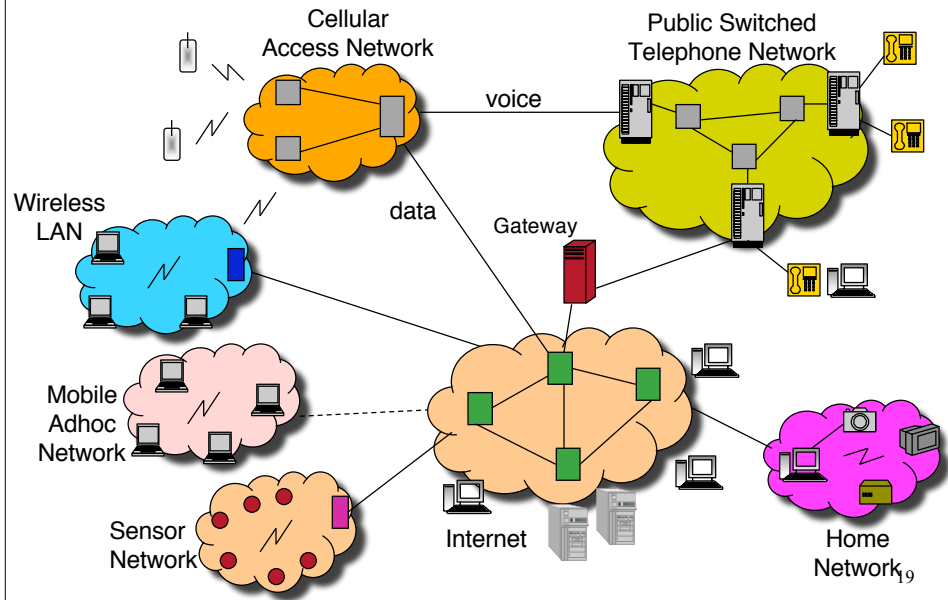
We'll cover:

- **end-system** applications, end-end transport
- **network core:** routing, hooking nets together
- **Wireless link-level** protocols, e.g., IEEE 802.11



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ECE 6962-003: Networked Systems



Course Overview:

Part 1: Introduction (text: Chapter 1)

- What is the Internet, what is a protocol?
- Network edge, network core, network access
- Delay, loss in packet-switched networks
- Protocol layers, service models

Course Overview:

Part 2: Application Layer (*text: Ch. 2*)

- Principles of network applications
- Web & HTTP
- File transfer: FTP
- Electronic mail in the Internet
- The Internet's directory service: DNS

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Course Overview:

Part 3: Transport Layer (*text Ch. 3 & handouts*)

- Transport-layer services and principles
- Multiplexing and demultiplexing applications
- Connectionless transport: UDP
- Principles of reliable data transfer
- Principles of congestion control
- TCP congestion control
- TCP over lossy (wireless) links, part 1

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Course Overview:

Part 4: Network Layer (*text: Ch. 4 & handouts*)

- Network service model
- Routing principles
- Hierarchical routing
- IP: the Internet Protocol
- Routing in the Internet
- What's inside a router?

MIDTERM 1 EXAM

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Course Overview:

Part 5: (*2 classes, text: Ch. 5 and handout*)

- Overview of issues in physical layer
- Link Layer
 - Introduction
 - Error detection and correction techniques in link layer: parity check, checksum, cyclic redundancy check (CRC)

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Course Overview:

Part 6: Distributed MAC in wireless networks (3 classes, text Ch. 5 & 6 & handout)

- slotted access/unslotted access
- ALOHA, slotted ALOHA
- slot size selection, sync/unsync slots
- (physical) carrier sensing (CS), impact of CS threshold
- hidden terminal and exposed terminal
- collision detection and avoidance
- reliability (ACK, retransmission RTS/CTS)

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Course Overview:

Part 7: Improving Wireless MAC (2 classes, text Ch. 5 & 6 & handout)

- Overcome hidden terminals (busy tone & virtual carrier sensing)
- Reduce collision probability (p-persistent protocols & backoff intervals)

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Course Overview:

Part 8: Wireless and Mobile Networks (2 classes, text Ch. 6 & handout)

- Wireless LAN 802.11b
 - physical layer
 - architecture
 - MAC protocol: Distributed Coordination Function (DCF), CSMA-CA collision avoidance (RTS, CTS)
 - 802.11 frame
- Wireless LAN 802.16 physical Layer, MAC
- BlueTooth

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Course Overview:

Part 9: Topics in Wireless MAC (2 classes, text Ch. 6 & handout)

- Priority scheduling
- Fairness
- Distributed fair scheduling
- Rate control
- Power control
- Joint power and carrier sense threshold control

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Course Overview:

Part 10: Selected Topics (*handout*)

- exploiting antenna capability in wireless networks, TCP over wireless, part 2
- Additional topics