

Communication Networks  
The University of Kansas EECS 780  
Spring 2009

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Department of Electrical Engineering & Computer Science  
Information Technology & Telecommunications Research Center  
The University of Kansas



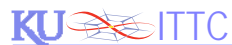
*jpgs@eecs.ku.edu*

*<http://www.ittc.ku.edu/~jpgs/courses/nets>*

21 January 2009

rev. 9.1

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Communication Networks  
AE.1 Administrivia

AE.1 Administrivia

AE.1.1 Schedule

AE.1.2 Prerequisites and description

AE.1.3 Instructor information and correspondence

AE.1.4 Grading and student expectations

AE.2 Ethics and academic integrity

AE.3 Course outline

21 January 2009

KU EECS 780 – Comm Nets – Administrivia

NET-AE-2

## Communication Networks

### AE.1.1 Schedule

#### AE.1 Administrivia

##### AE.1.1 Schedule

##### AE.1.2 Prerequisites and description

##### AE.1.3 Instructor information and correspondence

##### AE.1.4 Grading and student expectations

#### AE.2 Ethics and academic integrity

#### AE.3 Course outline

## Course Information

### High-Level Schedule

- **Lecture:** 4 Regents Center – Edwards Campus
  - Wed. 18:10 – 21:00
- **Discussion:** 368 Regnier – Edwards Campus
  - or different room as posted
  - meets *occasionally* as needed
    - labs sessions and help not scheduled as part of lecture
    - rescheduled lectures and review sessions
    - do not come unless we've explicitly scheduled a session!
  - Mon. 19:10 – 21:00
- **21 Jan. – 13 May**
  - three sectional exams plus final (13 May)
  - no class 18 Mar. due to spring break

## Course Information

### Cancellation and Rescheduling

- Cancellation due to weather
  - official closings unlikely
    - follow media announcements
  - if I can't make it from Lawrence
    - email to class list by 15:00
    - phone message with Edwards reception +1 913 897 8400
- Rescheduling due to my travel
  - I try *very hard* to avoid rescheduling class
  - project meetings & conferences sometimes interfere
  - this is the cost of an instructor who is active in research
  - rescheduled lectures held Mon. during discussion period

## Communication Networks

### AE.1.2 Prerequisites and Description

- AE.1 Administrivia
  - AE.1.1 Schedule
  - AE.1.2 Prerequisites and description
  - AE.1.3 Instructor information and correspondence
  - AE.1.4 Grading and student expectations
- AE.2 Ethics and academic integrity
- AE.3 Course outline

## Communication Networks

### EECS 780 Student Requirements

- Graduate students
- Undergraduate students
  - senior standing *required*
  - B average *required*

## Communication Networks

### EECS 780 Prerequisites

- Basic working knowledge of:
  - computer systems
  - Internet
  - probability and statistics (EECS 461 equivalent)
  - programming skills (EECS 168 equivalent)
- EECS780 is an introductory networking course
  - but *intensive* in *breadth and depth* of material
  - lectures may seem like “drinking from a fire hose”
    - ask questions and keep it interactive; I’ll adapt
    - much of the lecture notes for reference
      - you don’t need to memorise long lists of nitty details

## Networking Courses

### MSIT Edwards Courses

- **EECS 780:**           **Communication Networks**  
*spring at Edwards*
  - only *one* of {EECS 563 | EECS 663 | EECS 780} for credit
  - prerequisite for...
- **EECS 881:**           **High-Speed Networking**  
*fall in even numbered years at Edwards*
- **EECS 882:**           **Mobile and Wireless Networking**  
*fall in odd numbered years at Edwards*
- **EECS 712:**           **Network Security**

## Networking Courses

### Selected Lawrence Networking Courses

- **EECS 563:**           **Introduction to  
Communication Networks**  
*fall in Lawrence*
- **EECS 766:**           **Resource Sharing for Broadband  
Access Networks**
- **EECS 745:**           **Implementation of Networks**
- **EECS 864:**           **Multiwavelength Optical Networks**
- **EECS 888:**           **Internet Routing Architectures**
- **EECS 983:**           **Resilient and Survivable Networking**  
*spring in even numbered years Lawrence*

## Communication Courses

### Selected Lawrence Communications Courses

- EECS 861: Random Signals and Noise
- EECS 862: Digital Communication Systems
- EECS 863: Analysis of Comm. Networks
- EECS 865: Wireless Communication Systems
- EECS 869: Error Control Coding
- EECS 964: Simulation of Comm. Systems
- EECS 965: Detection and Estimation Theory
- EECS 967: Mathematical Optimization with Communications Applications
- EECS 969: Information Theory

## Communication Networks

### Official EECS 780 Course Description

Comprehensive in-depth coverage of communication networks with emphasis on the Internet and the PSTN (wired and wireless). Extensive examples of protocols and algorithms are presented at all levels, including: client/server and peer-to-peer applications; session control; transport protocols, the end-to-end arguments and end-to-end congestion control; network architecture, forwarding, routing, signalling, addressing, and traffic management; quality of service, basic queuing (basic M/M/1 and Little's law) and multimedia applications; LAN architecture, link protocols, access networks and MAC algorithms; physical media characteristics and coding; network security and information assurance; network management.

Prerequisites: Basic working knowledge of computer systems, the Internet, and probability and statistics; basic programming skills.

*Credit may be received for only one of EECS 563, EECS 663, or EECS 780*

## Communication Networks

### Summary of EECS 780 Course Description

- Introductory intensive graduate-level course
  - concepts and examples of systems and protocols
  - mostly non-mathematical
  - some basic queuing theory
- Emphasis on
  - Internet
  - PSTN (public switched telephone network)
  - introduction to mobile and wireless networks
- Top-down approach
  - generally following the structure of *Kurose and Ross*
  - additional material from *Sterbenz and Touch*
  - additional material from class notes and readings

## Communication Networks

### AE.1.3 Instructor Information, Correspondence

- AE.1 Administrivia
  - AE.1.1 Schedule
  - AE.1.2 Prerequisites and description
  - AE.1.3 Instructor information and correspondence
  - AE.1.4 Grading and student expectations
- AE.2 Ethics and academic integrity
- AE.3 Course outline

## Instructor Information Background

- Dr. James P.G. Sterbenz
  - current positions
    - Associate Professor, KU Lawrence, US
    - Visiting Professor of Computing, Lancaster University, UK
  - past research and management positions
    - UMass, BBN Technologies, GTE Laboratories, IBM Research
  - academic background
    - D.Sc., Washington University in St. Louis, 1991
  - research interests
    - survivable and resilient networking
    - autonomic, programmable, and active networks
    - mobile wireless networking
    - high-speed networking and system architecture

## Instructor Information Contact Modes

- Web: check the class Web pages first
  - important announcements at top of 2008 page
  - detailed schedule
- Email: generally the best means of communication
  - many issues and questions can be quickly resolved
  - use to arrange other appointments
- Interactive
  - skype chat
  - phone
- Office hours
  - face-to-face contact

## Instructor Information

### Office Hours

- Wed. 16:00 – 18:00
  - unless advised otherwise due to meetings or travel
- 125U Regents Center
- Or by appointment
  - email, chat, or call to arrange in advance
  - chat or call before dropping in unless already on campus
  - Wed: typically on Edwards campus in afternoon
  - MTTFF: typically in Lawrence if not travelling
    - 145 Nichols: research office
    - 3036 Eaton: teaching and undergraduate advising office

## GTA Information

### Background and Office Hours

- Egemen K. Çetinkaya
  - PhD student, University of Kansas EECS
- Office hours: Wed. 17:00 – 18:00
  - Regnier 368 (lab room) or Regnier 125U (instructor office)
  - unless advised otherwise due to meetings or travel
- Contact information
  - email
    - [ekc@ittc.ku.edu](mailto:ekc@ittc.ku.edu)
  - phone
    - 248 Nichols office: +1 785 864 7450
    - mobile: +1 785 550 4654

## Instructor and GTA Information

Contact: Email Address

- Email: *jpgs@eecs.ku.edu* OR *ekc@ittc.ku.edu* *only*
  - begin subject with *exact string* "EECS780 -"
    - email to other addresses will likely be misfiltered and *unread*
    - no space between "EECS" and "780"
    - blank space between "780" and hyphen
  - I generally check email daily
    - email is *unreliable*; retry if no reply within 48 hours
    - if quick reply is needed feel free to skype chat or phone

## Instructor Information

Contact: Email Address

- Email with *meaningful* subject lines
  - bad
    - Subject: Hi!
    - Subject: regarding class
  - good
    - Subject: EECS780 - need help understanding AIMD



## Electronic Mail

### Netiquette: Content and Attachments

- Content issues
  - use meaningful subject lines
  - spellcheck (most modern clients do this)
  - *think* before you send
- Simple emails should not be sent as attachments
  - e.g. MS-Word document containing “where are you now?”
- Do not send very large attachments unless
  - receiver is able to handle them (broadband access)
  - small enough to pass relay & server limits (typ. <10 MB)

## Electronic Mail

### Netiquette: Professionalism

- Email is like conversation, writing, and attire
  - adapt style to context
  - academic and professional is more formal than with friends
- Style
  - plain text, no embedded images
  - limit jargon and emoticons to someone you know well
  - proofread and think before you send
- Proofread and *think before you send!*

## Electronic Mail

### Netiquette: Professionalism

- Avoid free email accounts
  - e.g. hotmail, yahoo
- Gives you a very unprofessional appearance
  - frequently auto-append advertisements
- Frequently spam-blocked
- Use academic or corporate email addresses
  - for professional correspondence

## Electronic Mail

### Netiquette: Professionalism Examples

To: James Sterbenz <jpgs@eeecs.ku.edu>  
From: Ima <cool\_dude@stupidmail.com>  
Subject: need a job!!!

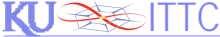
*What's wrong?*

*i'm new at KU and really like it ☺  
i'm interested in everything and  
am bombing this email to all KU  
professors. i've stopped by your offic  
in Eaton but your never there!!! ☺  
do you even have office hours  
dude? LOL! Just tell me when I can  
dropby too learn what you do  
**RU THERE????!***

*cu later,  
ima*

Get your free email at [Stupidmail.com!](http://Stupidmail.com)

**Eat at Joe's: 1234 Mass. Lawrence, KS**

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## Electronic Mail

### Netiquette: Professionalism Examples

To: [James Sterbenz](mailto:jpgs@eecs.ku.edu) <jpgs@eecs.ku.edu>  
From: [Ima](mailto:cool_dude@stupidmail.com) <cool\_dude@stupidmail.com>  
Subject: need a job!!!

*i'm new at KU and realy like it ☺  
i'm interested in **everything** and  
am bombing this email to all KU  
professors. i've stopped by your offic  
in Eaton but your never there!!! ☺  
do you even have office hours  
dude? LOL! Just tell me when I can  
dropby too learn what you do  
**RU THERE????!***

*cu later,  
ima*

Get your free email at [Stupidmail.com!](http://Stupidmail.com)  
**Eat at Joe's: 1234 Mass. Lawrence, KS**

To: [James Sterbenz](mailto:jpgs@eecs.ku.edu) <jpgs@eecs.ku.edu>  
From: [Ima Student](mailto:student@eecs.ku.edu) <student@eecs.ku.edu>  
Subject: Interest in ResiliNets group

Dear Professor Sterbenz,


I am a new M.S. student in the EECS department with interests in networking. I have looked at your Web pages and read the SUMOWIN paper. I am very interested in this research and will come to the next ResiliNets group meeting on Friday. I would like to discuss the possibility of you becoming my advisor and want to understand if there are any funding opportunities.

Sincerely,  
Ima Student

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Ima Student                   EECS, Univ. of Kansas  
student@eecs.ku.edu        +1 785 555 1212

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## Student Information

### Introductions

- Brief Introductions around the room
  - say who you are and why you are here
- Photos to help me learn your names

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## Student Information

### Contact and Background

- Roster information to be filled in pass-around sheet
  - full name, nickname
  - employer if not full-time student
  - email for class distribution list
    - preferred and mandatory *eeecs.ku.edu* address
  - phone numbers will only be used for urgent matters
    - day and evening
  - degree (BS, MS, PhD)
    - major (IT, CS, CoE, EE)
    - focus area if MSIT (Internet Engr., Info. Sec., Software Engr.)
    - option if MS (course, project, thesis)
    - advisor name (“none” if you don’t have one yet)

## Course Information

### Correspondence to Class

- Course information and notes
  - <http://www.ittc.ku.edu/~jjpgs/courses/nets>
    - notes for each lecture will be posted in PDF
      - check for 2008 date and version on first page
    - navigate to subpage for Spring 2008 specific information
      - schedule and deadlines
  - <http://www.ittc.ku.edu/~jjpgs/courses>
    - generic information
  - check *regularly* for updates
    - readings and assignments in schedule table in sub-page
    - “last updated” on bottom of page

## Course Information

### Correspondence to Class

- Class email list
  - all students are *required* by EECS to use *eeecs.ku.edu* email
    - I'm willing to use other email addresses...
    - ...but only if they are relatively reliable
      - many free email accounts are not!
      - if there are problems I'll change your entry to a *.ku.edu* address
  - check email regularly
  - check email every afternoon before class
- Telephone
  - I'll only phone you if *urgent*

## Instructor Information

### Contact: Phone and Chat

- Contact information
  - phone
    - Edwards office: +1 913 897 8538
    - Lawrence Nichols office: +1 785 864 7890
    - Lawrence Eaton office: +1 785 864 8846
    - only if *urgent* (consider  $\Delta$ time) +1 508 944 3067
    - don't call me at home unless *emergency*
  - skype: *jpgsterbenz*
    - ok to use chat *judiciously* when email not appropriate
      - send meaningful introduction message!
    - don't use voice unless prearranged by chat
      - I frequently am not in a position to use headset/microphone

## Communication Networks

### AE.1.4 Grading and Student Expectations

#### AE.1 Administrivia

AE.1.1 Schedule

AE.1.2 Prerequisites and description

AE.1.3 Instructor information and correspondence

AE.1.4 Grading and student expectations

#### AE.2 Ethics and academic integrity

#### AE.3 Course outline

## Course Information

### Textbooks and Reading

- Required textbooks: you need them *now*
  - Kurose & Ross: *Computer Networking*, 4th ed.
    - if you bought a used copy you'll need to buy a content license
  - Sterbenz & Touch: *High-Speed Networking*
    - also used as main textbook in EECS 881
- Supplementary textbooks and monographs
  - provide alternative, in-depth, or background coverage
  - Reserve in Edwards and Spahr libraries
- Additional papers (a few are required reading)
  - supplement books
  - experience that will help you write papers

## Course Information

### Reading

- How hard is this class?
  - not a “killer class” in terms of homework and projects
  - but it is intellectually challenging with significant reading
- Required readings are *mandatory*
  - the textbooks are not just a reference
  - you won’t be able to use it on exams
- Reading *must* be done *before* corresponding class
  - you are *doomed* if you get behind on the reading
  - you are responsible for *all* required reading
    - may be on exams *even if not covered in lecture*
    - contributes to your class participation grade

## Course Information

### Grades

- Grades: modified curve grouped by mode
  - based only on merit; *not* on:
    - employer reimbursement or lack thereof
    - immigration status or potential visa invalidation
    - probationary status at KU
  - qualitative meaning
    - A: exceptional exam results and outstanding term paper
    - B: mastery of material and solid term paper  
*this is the basic expectation for a graduate student*
    - C: slacking but know basic material and marginal paper
    - D: very poor performance on exams or paper
    - F: nonperformance on exams or paper  
*academic misconduct regardless of other grades*

## Course Information

### Grade Contribution

- Relative grade contribution
  - 40% section exams
    - two at 13.33% each
    - third at 13.33% will be first half of final exam period
  - 15% comprehensive portion of final exam
  - 15% term paper
    - significant extra credit for *publishable* paper
  - 20% homework and Wireshark exercises
  - 10%: class participation
    - *this can make a letter difference in your final grade*
  - mandatory academic integrity quiz in second class
    - must be made up if you miss this class

## Course Information

### Exam Schedule and Weight

- Section exams: 40%
  - tentative schedule *subject to change*
    - academic integrity quiz on 30 Jan. (required to pass course)
    - exam 1 on 04 Mar.
    - exam 2 on 22 Apr. (I will be attending INFOCOM 2009)
    - exam 3 on 13 May (portion of final exam period)
- Final exam: 15%
  - comprehensive covering entire course
  - synthesis of multiple sections
  - portion of final exam period

## Course Information

### Exam Characteristics

- Closed book, no electronic devices
  - notify me *in advance* if you know you must miss
  - you will probably have to take the exam in advance
- Exams test *understanding of concepts*
  - not memorisation of facts that could be looked up
  - not focused on the ability to solve problems
  - this will be new to some of you!
- More exam information on  
<http://www.ittc.ku.edu/~jpgs/courses/exams.html>

## Course Information

### Exam Questions

- Exams consist of two types of questions
  - sufficient space given to properly and fully answer
- Short answer example (several per page):
  - example question:  
*Compare the functionality of the link and transport layers.*

## Course Information

### Exam Questions

- Exams consist of two types of questions
  - sufficient space given to properly and fully answer
- Short answer example (several per page):
  - example question:  
Compare the functionality of the link and transport layers.
- Long answer example (one per page):
  - example exam question:  
Sketch and label a packet flow diagram for stop-and-wait, go-back- $n$ , and selective repeat. Explain the advantages and disadvantages of each scheme.

## Course Information

### Exam Answers

- Answers must legibly fit in space provided
  - sufficient space given to properly and fully answer
  - be brief; points will be *deducted* for irrelevant information
    - and you will have a hard time finishing the exam
  - writing on back of page & deep into margins will be ignored

## Course Information

### Exam Answers: How to answer

- Example question:  
Compare the functionality of the link and transport layers.

## Course Information

### Exam Answers: How to Answer

- Example question:  
Compare the functionality of the link and transport layers.
  - example correct answer (1 minute to write):  
Both the link and transport layer transfer data; the link layer hop-by-hop and the transport layer end-to-end.

## Course Information

### Exam Answers: How Not to Answer

- Example question:

Compare the functionality of the link and transport layers.

- example correct answer (1 minute to write):

Both the link and transport layer transfer data; the link layer hop-by-hop and the transport layer end-to-end.

- example poor answer (10 minutes to write):

The link layer is layer 2 in the OSI model, shown in the figure. Examples of link layer protocols include Ethernet, 802.11, SONET, and HDLC. 802.11 was developed in as a replacement for Ethernet, and thus has similar frame structure, shown in Figure 2. Note that 802.11 has more MAC address fields than Ethernet. The reason for the additional address fields has to do with the operation of the 802.11 MAC. Actually I really don't know the answer to this question, but I did memorise a bunch of stuff on some of these protocols, so I hope that if I write enough that I will get some credit for this question and that if I bomb you with information you will find some reason to give me credit on this problem and so I'm just going to keep writing until time is called on this

## Course Information

### Homework Assignments and Lab Exercises

- 20% of grade on homework and laboratory exercises
  - homework assignments give you problem solving experience
  - laboratory exercises give you practical experience
- Slacking on either will also hurt your exam scores

## Course Information

### Homework Assignments

- You *must* solve homework assignments individually
  - you may discuss problems and solution strategies
    - but should not walk away from discussion with written notes
    - nor engage in group homework solving
  - you must not use (illegal) copies of the solution manual
- Homework problem
  - show your work; answers alone will receive no credit
  - show all units, e.g.  $10 \text{ [Mb/s]} \cdot 5 \text{ [\mu s]} = 5 \text{ [b]}$
  - when asked explain *how* you reached your answer
- Homework submission requirements
  - [www.ittc.ku.edu/~jpgs/course/homework.html](http://www.ittc.ku.edu/~jpgs/course/homework.html)

## Course Information

### Homework Assignment Submission

- Due at the beginning of class on the due date
  - usually Wed. – late assignments generally *not* accepted
    - unless prearranged, e.g. due to illness or business travel
- Submit homework either by:
  - bring hardcopy to class; keep a copy for yourself
  - email to [ekc@ittc.ku.edu](mailto:ekc@ittc.ku.edu) and cc: to [jpgs@eecs.ku.edu](mailto:jpgs@eecs.ku.edu)
    - Subject: line *must* begin with the *exact string* "EECS780 - assignment " followed by assignment number
    - homework as MIME attachment in PDF
      - if you can't generate PDF *now* is the time to gain the capability

## Course Information

### Laboratory Exercises

- Laboratory exercises to gain practical experience
  - Wireshark laboratories for protocol analysis
    - download Wireshark *now* for Kurose labs: [www.wireshark.org](http://www.wireshark.org)
    - must *explain* what you did and not only submit screen shots
  - socket programming exercise
    - code *must* be commented and submitted electronically
  - introduction to network simulation with ns-3
    - scripts *must* be commented and submitted electronically
  - hands-on router configuration and TCP tracing
- You *must* solve laboratory assignments individually
  - unless otherwise instructed for group labs

## Course Information

### Laboratory Exercise Submission

- Due at the beginning of class on the due date
  - usually Wed. – late assignments generally *not* accepted
    - unless prearranged, e.g. due to illness or business travel
- Submit by email to [ekc@ittc.ku.edu](mailto:ekc@ittc.ku.edu) and cc: to [jpgs@eeecs.ku.edu](mailto:jpgs@eeecs.ku.edu)
  - Subject: line *must* begin with the *exact string* "EECS780 - laboratory" followed by the lab type
  - report as MIME attachment in PDF
  - code as MIME attachment in plain text

## Course Information

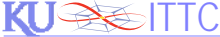
### Term Paper

- 15% of grade based on term paper
- Purpose and scope:
  - research area of communication networks beyond class
  - technical in nature
    - may lead to MS thesis or PhD dissertation
    - may even lead to publication (significant extra credit)
  - either a
    - paper survey
    - based on an implementation or simulation project
  - gain technical writing and presentation experience

## Course Information

### Term Paper Submission

- Submit by term paper milestones to [jpgs@eecs.ku.edu](mailto:jpgs@eecs.ku.edu) and cc: to [ekc@ittc.ku.edu](mailto:ekc@ittc.ku.edu)
  - Subject: line *must* begin with the *exact string* "EECS780 - term paper" followed by the milestone type
  - as MIME attachment in PDF
  - final presentation as MIME attachment in PowerPoint or PDF
- Submission requirements and templates at [www.ittc.ku.edu/~jpgs/courses/writing-guide.html](http://www.ittc.ku.edu/~jpgs/courses/writing-guide.html)


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## Course Information

### Term Paper Milestones and Tentative Schedule

Milestone	Details	Due date
Two ideas	2 ideas with 2 <i>complete</i> references each	16 Feb.
Proposal	Proposal with 5 <i>complete</i> references	09 Mar.
Outline	Draft outline with <i>no</i> body text and more refs.	30 Mar.
Draft paper	Mostly complete draft paper	29 Apr.
Presentation	Presentation to class and discussion	06 May
Final paper	Complete polished paper	07 May

- Series of milestones
  - flow control process and allow us to discuss progress
    - you will not do well if you wait until the last minute
  - timely submission part of final paper grade
  - milestones not meeting basic requirements not accepted

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## Course Information

### Sources of Literature: Library

- The Library
  - big building with books and paper journals: *use it!*
- Physically browsing is a wonderful way to brainstorm
  - Spahr Engineering Lib. TK numbers most relevant
  - Anschutz (science) Lib. QA and QC numbers most relevant
  - Edwards Library very small collection
- Online resources at [www.ku.edu/libraries](http://www.ku.edu/libraries)
  - selected journals
  - access to archived books and journals
  - interlibrary loan

<http://www.ittc.ku.edu/~jpgs/courses/source-cite.html>

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## Course Information

### Sources of Literature: Web

- The Web
  - source for journal papers
    - ACM Digital Library, IEEE (subscription through library)
    - individual and project Web pages
  - source for information on research projects
  - source for other information
    - wikipedia: incredibly useful as *launching point* to other work
      - rarely appropriate to cite wikipedia pages
    - non-refereed reports and information
  - compare to a street corner bulletin board: *use with care*
  - use Web citations *very* judiciously
    - reports with many URL refs will not get an acceptable grade!

## Course Information

### Class Participation

- 10% of grade is based on class participation
  - insightful questions and comments on lectures
  - evidence that reading has been done *before* lecture
  - brownie points
    - find bug in lecture note or book; make a good suggestion
    - email reminder with *exact* Subject: EECS780 - brownie point
- Interactive class is better for all of us
  - questions, comments, arguments
  - blurt it out; don't wait: you don't need to raise your hand
  - this may be a cultural shift for some of you; get used to it
- Reminder: reading *before* class essential

## Course Information

### Etiquette

- Try to be on time
  - I understand that we are all commuting, but...
  - *consistent* late arrivals are disruptive
- Inform me in advance if you need to miss class
  - we accommodate working professionals
  - we'll arrange to make up missed material
- No audible mobile phone or pagers
  - if it doesn't vibrate, turn it off!
- University does not tolerate class disruption
  - protests, sit-ins, heckling, etc. (I guess)

## Communication Networks

### AE.2 Ethics and Academic Integrity

- AE.1 Administrivia
  - AE.1.1 Schedule
  - AE.1.2 Prerequisites and description
  - AE.1.3 Instructor information and correspondence
  - AE.1.4 Grading and student expectations
- AE.2 Ethics and academic integrity
- AE.3 Course outline

## Academic Integrity and Plagiarism

### Reading the Riot Act

- Apologies to those that already know this
  - ... especially who've heard it from me before
- Opportunity to learn for those who:
  - are inexperienced in writing
  - come from an environment or culture of tolerance
- Warning of the consequences
  - ignorance will not be an excuse
  - ask me if you have *any* question about this
- Applies to
  - copying homework and lab exercises
  - cheating on exams
  - plagiarism on term paper and presentation

## Academic Integrity and Plagiarism

### Referencing and Citations

- All sources *must* be properly referenced and cited
    - authors, "paper name", *journal*, date, publisher, page-range
      - also URL if from obscure source (e.g. university tech reports)
      - see course Web page or for examples
- James P.G. Sterbenz, Rajesh Krishnan, *et al.*,  
"Survivable Mobile Wireless Networks: Issues, Challenges, and Research Directions",  
*Proceedings of the ACM Wireless Security Workshop (WiSE) 2002* at MobiCom,  
Atlanta GA, Sep. 2002, pp. 31–40.
- Cite whenever
    - work is related or ideas are used
    - text is quoted or paraphrased
    - diagrams are reproduced or incorporated (even if redrawn)

## Academic Integrity and Plagiarism

### Proper Quoting and Paraphrasing

- Quoting text or paraphrasing
  - “quotation marks” for sentence or less
  - blockquote for multiple sentences
- Beware of read-then-write in two windows
  - *never ever* cut-and-paste
  - take intermediate notes from which you write

## Academic Integrity and Plagiarism

### Excessive Quoting and Paraphrasing

- Quoting is *rarely* needed
  - example: quoting or paraphrasing definition or principle
- Sequence of quotes *doesn't* show understanding
  - not a shortcut to English writing skills
    - better to be in your *own* imperfect English
  - papers with excessive quotes will not receive decent grade
    - even if properly quoted

## Academic Integrity and Plagiarism

### Detection and Sanctions

- Plagiarism is remarkably easy for me to detect
  - inconsistent writing styles and language use
  - technical depth beyond the supposed author
  - inconsistent terminology
- Tools: Web makes both plagiarism & detection easier
  - Google on suspicious phrases
  - automated tools match and highlight with fuzzy searches
- Plagiarism will result in **F** for *course*
  - and possible further sanctions
  - it is highly unlikely that you will get away with it!
    - but students still try every semester; *you have been warned*

## Academic Integrity and Plagiarism

### Academic Integrity Quiz

- Homework this week: read
  - <http://www.ittc.ku.edu/~jggs/courses/academic-integrity.html>
  - <http://www.ittc.ku.edu/~jggs/courses/source-cite.html>
- You *must understand* this material
  - ask me if you have *any* question
  - goal is for new students to learn
- Next week: academic integrity quiz

## Communication Networks

### AE.3 Course Outline

- AE.1 Administrivia
- AE.2 Ethics and academic integrity
- AE.3 Course outline
  - I. Upper layers
  - II. Lower layers
  - III. Special topics

## EECS 780 Outline

### I: Upper Layers

- I: Upper layers
  - HA: Network history and architecture
  - AL: Application layer
  - TL: Transport layer
- II: Lower layers
- III: Special topics

## EECS 780 Outline

### HA: Network History and Architecture

- Understanding of where we are and how we got here
  - essential to understand *why* things are as they are
  - historical development of each
  - structure and architecture
- PSTN: public switched telephone network
  - traditionally voice over wired infrastructure
  - evolving for wireless, mobility, and data
- Internet
  - has become the global information infrastructure
- Other networks: SCADA, military, etc.

## EECS 780 Outline

### AL: Application Layer

- Distributed applications are the reason for networks
  - structure and operation of applications
  - characteristics: delay, bandwidth, loss tolerance
  - utility curves based on latency
- Information access applications
  - file transfer, Web and HTTP, netnews, P2P file sharing, ...
- Telepresence applications
  - email, chat, conferencing
- Distributed computing and storage
  - remote login, P2P file swarming, NAS, SANs

## EECS 780 Outline

### TL: Transport Layer

- Transport layer provides end-to-end communication
  - to distributed applications
- End-to-end vs. hop-by-hop communication
  - the end-to-end arguments
- Transport functions and mechanisms
  - framing and multiplexing
  - transfer modes and state management
  - reliability and error control
  - transmission (flow and congestion) control
- Internet transport protocols
  - TCP and UDP

## EECS 780 Outline

### II: Lower Layers

I: Upper layers

II: Lower layers

NL: Network layer

NR: Network routing

LL: Link layer and LANs

PL: Physical layer

III: Special topics

## EECS 780 Outline

### NL: Network Layer

- Network provides infrastructure to create E2E paths
  - addressing to identify network components
  - routing to discover end-to-end paths
  - forwarding through switches and routers
  - signalling for network control
  - traffic management
- Signalling paradigms
  - connection-oriented vs. connectionless
- Switch and router design
- PSTN addressing
- Internet protocols: DNS, IP, ICMP, DHCP, NAT

## EECS 780 Outline

### NR: Network Routing

- Network provides infrastructure to create E2E paths
  - addressing
  - routing to discover end-to-end paths
  - forwarding, signalling, traffic management
- Routing algorithms
  - distance vector, link state, source routing, DHTs
- PSTN routing architecture and algorithms
- Internet routing architecture and protocols
  - EGP: BGP
  - IGP: RIP, IGRP, EIGRP, OSPF, IS-IS
- Multicast routing algorithms

## EECS 780 Outline

### LL: Link Layer and LANs

- Links provide the connection between components
  - framing and delineation
  - error control
- LANs (local area networks)
  - topologies: point-to-point, ring, shared medium
  - multiplexing and switching
  - Ethernet and SONET
- Link layer components
  - hubs and layer 2 switches
- Residential broadband
  - HFC and DSL

## EECS 780 Outline

### PL: Physical Layer

- Physical layer responsible for information transfer
  - bits in a wire as electrons and photons
  - signals and transmission
- Physical media
  - wire, fiber, free-space wireless
- Performance characteristics
  - delay, attenuation, frequency response
- Line coding
  - analog and digital

## EECS 780 Outline

### III: Special Topics

I: Upper layers

II: Lower layers

III: Special topics

MW: MAC, mobile, and wireless

MS: Multimedia applications and session control

TQ: Traffic management and QoS

IS: Information security

NM: Network management

## EECS 780 Outline

### MW: MAC, Mobile, and Wireless

- Medium access control (MAC)
  - arbitrates access to shared medium
  - needed for free-space wireless and other shared media
- MAC algorithms
  - channel partitioning, random access, coordinated access
- Wireless networks
  - 802.11, 802.16, 802.15, sensor networks
- Mobile networks
  - mobile IP
  - MANETs: mobile ad hoc networks
  - mobile cellular telephony

## EECS 780 Outline

### MS: Multimedia Applications & Session Control

- Multimedia applications
  - applications that stream audio and video media
  - VoIP: voice over IP
- Session control
  - coordinates multiple end-to-end transport flows
  - SIP: session initiation protocol and H.323
- Multimedia transport
  - additional timing and synchronisation
  - RTSP: real-time streaming protocol for media control
  - RTP: real-time transport protocol

## EECS 780 Outline

### TQ: Traffic Management and QoS

- Applications desire a particular service
  - in an environment of constrained network resources
  - traffic management controls and manages these resources
- Traffic characteristics and service models
  - best effort vs. guaranteed service
  - basic queueing analysis: M/M/1 and Little's theorem
  - congestion control and avoidance
  - packet scheduling disciplines
- QoS and Internet service models
  - IntServ+RSVP and DiffServ
  - SIP and RTP

## EECS 780 Outline

### IS: Information Security

- Security functions and mechanisms
  - confidentiality and encryption
  - key distribution and revocation
  - authentication
  - integrity, digests, and digital signatures
  - nonrepudiation
  - access control
- End system protection
  - firewalls, intrusion detection, anti-virus and -worm
- Resilience and survivability

## EECS 780 Outline

### NM: Network Management

- Understanding and controlling network operations
  - increasingly hard as networks become more complex
- Network management functions
  - monitoring and detection
  - network operation and engineering
- Internet management protocols
  - MIBs (management information bases)
  - SNMP (simple network management protocol)

# EECS 780

## Communication Networks

- And now, the course begins...