CSE 123A
Computer Networks
Fall 2009

Lecture 1: Introduction and Overview

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Today: short class

- Who is your professor?
- Course overview, expectations, etc
- Simple network basics
About me…

- I work at the intersection of computer security, networking and operating systems.

- Research
  - I’m director of the Collaborative Center for Internet Epidemiology and Defenses (CCIED) ([www.ccied.org](http://www.ccied.org))
  - Also lots of work on network measurement, network management, and routing

- Policy
  - National Research Council’s Cybersecurity Research group
  - Institute for Defense Analysis’ ISAT advisory group

- Industry
  - Asta Networks
  - Netsift (UCSD-originated worm/virus defense company) -> Cisco
Course info

- Stefan Savage – Lecturer & taskmaster
  - Web: http://www.cs.ucsd.edu/~savage
  - E-mail: savage@cs.ucsd.edu
  - Office hours: M 4pm (or by appt)
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- Frank Uyeda
  - E-mail: fuyeda@cs.ucsd.edu
  - Office hours: TBD

- Course Web pages (not done yet)
  - http://www.cse.ucsd.edu/classes/fa09/cse123/
Prerequisites

- CSE120
  - I will *allow* you to take the class without this
  - However, parts of the course will undoubtedly be harder for you

- Programming
  - You *will* need to code in C and be comfortable with it. If you don’t know C, expect to learn it quickly.
Course goals

- Understand the foundations of modern networking and the practical issues in their implementation
  - Layering
  - Signaling, coding, clock recovery
  - Framing/stuffing, error detection/error correction
  - Media access protocols (e.g., Ethernet, 802.11)
  - Bridging/switching (learning bridges, spanning tree)
  - Queuing/QoS
  - Internetworking
  - Efficient reliable communication
  - Connection management
  - Flow Control
  - Congestion control
  - Routing (intradomain and interdomain, unicast/multicast)
  - Router Design
Class Overview

- **Course Material**
  - Class lectures, textbook readings, and handouts

- **Course Assignments**
  - Homework questions from book and handouts
    - Handed out on Monday, due the following Monday
  - A small number of programming projects

- **Exams**
  - Midterm (Oct 28) and Final (Dec 9th?)
  - I will be explicit about what is covered in each
Textbook

- Peterson and Davies, 

- We’ll be using this for background, to fill-in topics and occasionally for homework questions
Grading

- Homework: 25%
- Projects: 25%
- Midterm: 20%
- Final: 30%
Rules

- Written assignments are due at the **beginning** of class
- Regrades should be the **exception**
  - Addition errors (happy), significant errors in grading (fine), nit picking/grade mongering (death to you)
  - We reserve the right to **completely** regrade your assignments
  - All regrades go first to Frank first

- **No Cheating**

- Cheating means not doing the assignment yourself
  - No copying, no Google, etc. If you’re unsure, then ask
  - Ok to **talk** with other students about assignments outside of class
  - American Idol rule: if you can remember it after watching a rerun of American Idol (or equivalent) then it’s probably ok

- Don’t mess with the professor.
Some hints

- Come to lecture
  - Yes, I will distribute the lectures slides online, and yes some of the material is in the book
  - However, lecture materials are the basis for exams
- Do the homework
  - You will have a hard time with the exams without doing the homework
  - Its 25% of your grade (easily the difference between an A and C)
Some hints II

- Ask questions
  - In class, via e-mail and at office hours
  - Inevitably you won’t understand something… that’s my fault, but you need to help

- Start assignments early
  - There is a statistical relationship between when you start and what grade you get.

- Sleep from time to time
At the end of this course, you will...

- You will understand how network-based communication takes place
  - Fundamental problems
  - Established design principles
  - Standard protocols and implementations

- Understand most of what’s actually happening when you download a Web page
Simple Communication Model

- **Hosts**: endpoints that communicate
  - e.g. workstation, server, cell phone
- **Links**: transmission medium (a bit pipe)
  - e.g. Ethernet, 802.11, DSL, Cable Modem, Carrier Pigeon

**Basic Metrics**
- Bandwidth, delay, overhead, error rate and message size
Network metrics

- **Bandwidth**
  - Data transmitted at a rate of $R$ bits/sec
    - Abbreviations: Kbps = Kilobits per second, Mbps = Megabits per second
    - (careful about capitalization of “B”, MBps = Mega\text{bytes} per second)

- **Delay or Latency**
  - Takes $D$ seconds for a bit of data to propagate down link
  - Sometimes used to mean “round-trip time” from one host to another and back again

- **Overhead**
  - Takes $O$ secs for CPU to process message and put it on link

- **Error rate**
  - Bit error: Probability that a bit will not arrive intact
  - Message error: Probability that a group of bits will be corrupted

- **Message size**
  - Size $M$ of data being transmitted
How long to send a message?

- Transmit time $T = \frac{M}{R} + D$
  - 10Mbps Ethernet LAN ($M=1$KB)
    » $\frac{M}{R}=1$ms, $D \sim=5$us
  - 155Mbps cross country ATM link ($M=1$KB)
    » $\frac{M}{R} = 50$us, $D \sim= 40-100$ms

- $R*D$ is called the *bandwidth delay product*
  - How many bits can be “stored” be stored in transit
Connecting links

- **Routers/Switches**: moves bits between links
  - *Circuit switching*: guaranteed channel for a session (Telephone system)
  - *Packet switching*: statistical multiplexing of independent pieces of data (Internet)
Putting this all together

- ROUGHLY, what happens when I click on a Web page from UCSD?

My computer → Internet → www.yahoo.com
Web request (HTTP)

- Turn click into HTTP request

GET http://www.yahoo.com/r/mp HTTP/1.1
Host: www.yahoo.com
Connection:keep-alive
Name resolution (DNS)

- Where is www.yahoo.com?

My computer (132.239.9.64) → Local DNS server (132.239.51.18)

What’s the address for www.yahoo.com

Oh, you can find it at 64.58.76.177
Data transport (TCP)

- Break message into packets (TCP segments)
- Should be delivered reliably & in-order

GET http://www.yahoo.com/r/mp HTTP/1.1
Host: www.yahoo.com
Connection: keep-alive
...

“and let me know when they got there”
Global Network Addressing

- Address each packet so it can traverse network and arrive at host

My computer (132.239.9.64)

www.yahoo.com (64.58.76.177)
Network Routing

- Each router forwards packet towards destination
**Link management (Ethernet)**

- Break message into frames
- Media Access Control (MAC)
  - Can I send now? Can I send now?
- Send frame
Physical layer

- 2.4Ghz Radio
  - DS/FH Radio
  - (1-11Mbps)

- 802.11b Wireless Access Point

- Cat5 Cable (4 wires)
  - 100Base TX Ethernet
  - 100Mbps

- Ethernet switch/router
  - To campus backbone

- 62.5/125um 850nm MMF
  - 1000BaseSX Ethernet
  - 1000Mbps
For Next Time...

- Decide if you’re dropping the class or not
- Read Peterson & Davies Chap1 (you can skip 1.4 though)

- We’re going to cover protocols and layering in more depth
Questions

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