CS 43: Computer Networks
Course Introduction

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What This Class Is About

• How networks (focus on the Internet) work
• How applications that use networks work
  • HTTP, DNS, Email, etc.
• How to write programs that communicate over networks
• How different protocols, policies, and mechanisms interact to provide an effective communication medium
Instructor: Kevin Webb

• http://www.cs.swarthmore.edu/~kwebb/

• Please call me Kevin (or Professor Webb)

• Research: Control platforms for networks, CS Education
Instructor: Kevin Webb


• Please call me Kevin (or Professor Webb)

• Research: Control platforms for networks, CS Education

• Hobbies: Building stuff, cactus/fruit plants, PC games
Office Hours

• Tuesday 10:30 AM – 11:30 AM
• Thursday 2:35 PM (after class) – 4:10 PM
  • NOTE: Faculty dept. meeting at 4:15 on Thursdays

• By appointment, and you're welcome to stop by when door is open

• 255 Science Center
Resources

• EdSTEM Q&A Forum, Github Enterprise
  • https://edstem.org/us/courses/17340/discussion/
  • https://github.swarthmore.edu

• Slides & audio recordings on course website

• Lab sections:
  • Science Center 240
  • Friday 2:15-3:45, Friday 4:00-5:30
Email Policy

• For public questions: use EdSTEM!
  • Your classmates benefit from your questions
  • Your classmates can answer your questions
  • I will check the forum frequently

• For private questions: use email

• I will attempt to respond to within 24 hours (usually more quickly)
How does this class work?

• This class is designed a bit differently from what you might normally be used to:
  • Class will be centered around you
  • Requires your participation

• Ever considered why we have lectures?
Traditional Lectures:

• Roughly one millennium old
Traditional Lectures:

- Little opportunity for expert feedback
- Might as well skip class and watch video lectures!
  - (I am not actually suggesting this. Please attend your classes!)
Interactive Classes with Peer Instruction

• You do the “easy” part before class.
  - Textbook, videos, website
  - First Exposure

  - In class quiz
  - Gauge understanding

  - Instruction
  - Fill in gaps, explore details, add context, provide feedback

  - Exam
  - Show Knowledge Mastery

• Class is reserved for interactive, customized experiences

• Research on how people learn:
  • Everyone constructs their own understanding
  • To learn, YOU must actively work with a problem and construct your own understanding of it
Clickers!

• Lets you vote on questions in real time.

• Like pub trivia, but the subject is always networks.

• You NEED one of these for the course!
Peer Instruction

- Short quiz at the beginning of class
- During class: pose carefully designed questions
  - Solo vote: Think for yourself and select answer
  - Discuss: Analyze problem in teams of 3
    - Practice analyzing, talking about challenging concepts
    - Reach consensus
    - If you have questions, raise your hand and I’ll come over
- Group vote: Everyone in group votes
  - You must all vote the same to get your point
- Class wide discussion:
  - Led by YOU (students) – tell us what you talked about in discussion that everyone should know!
Why Peer Instruction?

• You get a chance to think.
• I get feedback as to what you understand.
• It’s less boring!
• Research shows it promotes more learning than traditional lectures.
Giving out Candy

• To people willing to
  • Ask a question
  • Share an explanation
  • Summarize what their group talked about

• Your explanations are CRITICAL for fellow students’ learning
Clicker Registration

• [https://forms.gle/axs7yhLSDbYpyH5S6](https://forms.gle/axs7yhLSDbYpyH5S6)

• Please register ASAP
Example Question

• Individual vote

• Group discussion / group vote
  • Room should be LOUD

• Class discussion
How many of the following...

A: 0  
B: 1  
C: 2  
D: 3  
E: 4
(Question hidden for comedic effect)
Grading

• 5% Reading Quizzes
• 5% Class participation
• 25% Midterm Exam
• 30% Final Exam
• 35% Programming Assignments
Grading

• 5% Reading Quizzes
• 7.5% Class participation
• 25% Midterm Exam
• 30% Final Exam
• 37.5% Programming Assignments

For this credit, you need to be present and responding via clicker. NOT graded for correctness.

I'll drop three no-shows, no questions asked.
• Computer Networks: A Systems Approach
• https://book.systemsapproach.org/
Policies

• Collaboration
  • You may discuss approaches, not solutions
  • You must submit your own work
  • Exams will include questions on programming

• Cheating
  • Zero tolerance for cheating, don’t do it!

• Lab Lateness
  • 2 days of extra (at the granularity of days)
  • Let me know after you’ve submitted
Tentative Schedule

• Midterm – March 15, in class

• Final - TBD

• Labs
  • Out on Fridays (lab section)
  • Due on Thursdays
Administrative Questions?

• All of this info (should be) on class website

• Feel free to ask on discussion board
What is the goal of a network?

• Allow devices communicate with one another and coordinate their actions to work together.

• Piece of cake, right?
A “Simple” Task

• Send information from one computer to another
  • Endpoints are called hosts
    • Could be computer, iPod, cell phone, etc.
  • The plumbing is called a link
    • Many different physical technologies: Ethernet, wireless, cellular, etc.
Not Really So Simple...
Not Really So Simple...
Not Really So Simple...

Diagram shows a network with the following nodes:
- AT&T
- Quest
- Sprint
- Cogent
- Swat
- Google
Not Really So Simple...
Not Really So Simple...
We only need...

- Manage complexity and scale up
  - Layering abstraction: divide responsibility
  - Protocols: standardize behavior for interoperability
We only need...

• Manage complexity and scale up

• Naming and addressing
  • Agreeing on how to describe/express a host, application, network, etc.
We only need...

• Manage complexity and scale up

• Naming and addressing

• Moving data to the destination
  • Routing: deciding how to get it there
  • Forwarding: copying data across devices/links
We only need...

- Manage complexity and scale up
- Naming and addressing
- Moving data to the destination
- Reliability and fault tolerance
  - (How) can we guarantee that the data arrives?
  - How do we handle link or device failures?
We only need...

- Manage complexity and scale up
- Naming and addressing
- Moving data to the destination
- Reliability and fault tolerance
- Resource allocation
  - How do we share the network’s capacity?
We only need...

• Manage complexity and scale up
• Naming and addressing
• Moving data to the destination
• Reliability and fault tolerance
• Resource allocation

(Lots of others too.)
Pull back the curtain on the Internet
Why should you care?

• To know how the Internet works
  • What may be wrong with your networks
  • When was the last time you went 24 hours without going online?

• Network programmers in demand
  • How many applications aren't online these days?
The Internet is Exciting!

• Rapid growth and success.
  • 1977: 111 machines on Internet
  • 1981: 213
  • 1983: 562
  • 1986: 5000
  • 1989: 10,000
  • 1992: 1,000,000
  • 2001: 150 – 175 million
  • 2002: > 200 million
  • 2011: > 2 billion (~1B are phones/tablets)
Global Internet Device Sales

Source: Gartner, IDC, Strategy Analytics, Company Filings, BI Intelligence Estimates
The Internet is Exciting!

• Rapid growth and success.
The Internet is Exciting!

• Rapid growth and success.

• We’re here at the beginning.
  • Most of the growth happened in our lifetime.
  • Still TONS of untapped potential.

Google

Founded 1998

Facebook

Founded 2004
The Internet is Exciting!

• Rapid growth and success.
• We’re here at the beginning.
• Communication is empowering.
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• Rapid growth and success.

• We’re here at the beginning.

• Communication is empowering.

(Late 60s)
TODO List

• See EdSTEM: how to choose lab 1 partners

• Complete Lab 0!

• Register your clicker!

• Please let me know about:
  • Your preferred name/pronouns, if different than roster information
  • Academic accommodations