

Lecture 1:

Course Introduction

CSE 123: Computer Networks
Aaron Schulman





Lecture 1 Overview

- Class overview
 - ◆ Expected outcomes
 - ◆ Structure of the course
 - ◆ Policies and procedures
- A brief overview of Computer Networking
 - ◆ High-level concepts
 - ◆ An end-to-end example

Personnel



- Instructor: [Aaron Schulman](#)
 - ◆ Office hours Mondays and Fridays 11am-12:15pm in (CSE 3120)
- TA (Project 1 Lead): [Jaijun Ni](#)
 - ◆ Office hours: 9-11am Tuesday and 8-9am Wednesday (CSE B260A)
- TA (Project 2 Lead): [Qianqian Ma](#)
 - ◆ Office hours 11-1pm Friday (CSE B250A)



Prereqs

- CSE30, CSE101, and CSE110
 - ◆ Undergrads can't enroll without them
 - ◆ We expect it (or equivalent) even for grad students
- Programming experience
 - ◆ We will be assigning programming projects in C/C++
 - ◆ This course will not teach you C. The TA/Tutors will help, but you need to learn it on your own if you don't already know it.



Expected Outcomes

- This course *will* teach you the *fundamentals* of computer networks:
 - ◆ Layering, signaling, framing, MAC, switching, routing, naming, Internetworking, congestion control, router design, etc.
 - ◆ At the end of this course you should completely understand what's actually happening when you view a Web page or fire up Zoom
- This course *will not* teach you signals and coding
 - ◆ Take an EE course to learn about modulation, encoding, etc. on different hardware technologies
- Similarly, we will not cover Internet apps/services
 - ◆ CSE124 covers application layer protocols, Web, etc.

CSE 123 Class Overview



- Course material taught through class lectures, textbook readings, and discussion sections
- Course assignments are
 - ◆ Homework questions (based on lecture)
 - ◆ Two substantial programming projects (in four parts)
- Discussion section (**Wed 1-1:50pm Pepper Canyon 122**)
 - ◆ Help you get started on the projects
 - ◆ Lecture material and homework
 - ◆ Additional networking topics
- Discussion board (**Piazza**)
 - ◆ The place to ask questions about lecture, HW, projects, etc.

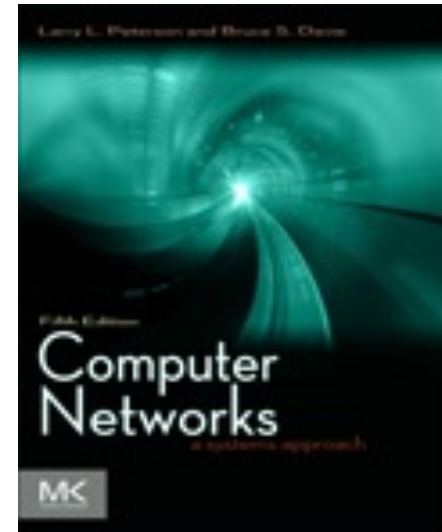
Textbook



- Peterson and Davie, *Computer Networks: A systems Approach*, Morgan Kaufmann, 5th Edition, ISBN 978-0-12-385059-1



PDF, eBook, HTML, and source! available at:
<https://github.com/SystemsApproach/book>



Homeworks



- There will be 4 homeworks throughout the quarter
 - ◆ Reinforce lecture material...no better practice
 - ◆ Assigned and collected on GradeScope
 - ◆ Grading is *completion only*; solutions available after deadline
- Collaboration vs. cheating
 - ◆ You *should* discuss homework problems with others
 - » You can learn a lot from each other
 - ◆ But there is a distinction between collaboration and cheating
 - » Rule of thumb: Discuss together ~~in library~~ over Zoom, ~~walk home~~ hang up, and only afterwards write up answers independently
 - ◆ They're not graded for correctness, so you're only cheating yourself by not trying to solve independently!

Projects



- There will be four programming projects (really two, each split in half)
 - ◆ You will have approximately two weeks to complete each
 - ◆ The first is assigned MONDAY, discussed WEDNESDAY
- The projects must be completed in C/C++
 - ◆ We will provide skeleton code for you to use
 - ◆ Your job is to fill in the interesting/hard parts
 - ◆ The TA and tutors will be available to help with coding
- The projects are INDIVIDUAL assignments
 - ◆ All code must be your own ([not copied from GitHub or generated by CoPilot/LLMs!](#))
 - ◆ OK to discuss design ideas, NOT OK to share/look at code
 - ◆ LLMs can be a friend to ask questions to
 - ◆ Projects assigned AND SUBMITTED via private GitHub repo



Development environment

- We expect you to use your own machine
 - ◆ The project source will work on Linux/Windows/OS X
 - » Windows users need Windows Subsystem for Linux (WSL)
 - ◆ Code executes in Containers/VMs, just like on GradeScope
 - ◆ TAs will address discrepancies between GradeScope and provided execution environments



Assessments

- Midterm
 - ◆ Monday February 12th
 - ◆ Covers the first half of the class
- Final
 - ◆ Friday, March 22nd (8:00-11:00am)
 - ◆ Covers last half of the class + selected material from earlier parts
 - » I will be explicit about the material covered
- All exams are in person; No makeup exams
 - ◆ Unless dire circumstances; [contact me NOW](#) if you have a conflict or OSD

Grading



- Homeworks: 10% *completion only*
- Midterm: 20%
- Final: 20%
- Projects: 50%
 - ◆ Divided evenly among the four projects

A Few Class Policies



- Regardless of modality, this class is "live"
 - ◆ In-person lectures podcast, but intended for review
 - ◆ May be one or two Zoom lectures due to instructor travel; details later
- Discussion attendance is strongly encouraged
 - ◆ The projects are involved; the TAs will use the time to get you going
- All assignments (Project & Homework) will be accepted up to 24 hours late with no penalty
 - ◆ HWs submitted via GradeScope, Projects via GitHub



How *to* Pass CSE 123

- Attend lecture / discussion
 - ◆ But, the podcast is available, and the material is in the book anyway
 - ◆ Lecture material is the basis for exams and directly relates to the projects
 - ◆ Besides, the professor thinks he's funny
- Do the homework
 - ◆ But, it's only 10% of the grade, and you can just submit random answers
 - ◆ Excellent practice for the exams, and some homework problems are exercises for helping with the project



How To Pass (2)

- Ask questions in lecture, office hours, or Piazza
 - ◆ Professor is scary, I don't want to embarrass myself
 - ◆ Asking questions is the best way to clarify lecture material at the time it is being presented
 - ◆ Office hours and Piazza will be invaluable for homeworks, projects
- Don't wait until the last couple of days to start a project
 - ◆ We'll have to do the crunch anyways, why do it early?
 - ◆ The projects cannot be done in the last couple of days
 - ◆ Repeat: The projects cannot be done in the last couple of days



Class Web Page

- Everything on the Web (wrapped in Canvas)

<http://www.cs.ucsd.edu/classes/wi24/cse123-a/>

- ◆ Course syllabus and schedule (updated as quarter progresses)
- ◆ Announcements
- ◆ Homework handouts
- ◆ Project information
- Class will be podcast
 - ◆ Lecture slides posted to website immediately after class
 - ◆ Podcast is for review, not intended as a substitute for lecture

Questions



- Before we start the material, any questions about the class structure, contents, etc.?



This Class in One Slide

- **Protocols & Layering**
 - ◆ Manage complexity by decomposing the tasks
 - ◆ Standardizing syntax and semantics to support interoperability
- **Naming**
 - ◆ Agreeing on how to describe a host, application, network, etc.
- **Switching & Routing**
 - ◆ Deciding how to get from here to there
 - ◆ Forwarding messages across multiple physical components
- **Resource Allocation**
 - ◆ Figuring out how to share finite bandwidth, memory, etc.



A “Simple” Task

- Send information from one computer to another



Host

- Endpoints are called **hosts**
 - ◆ Could be computer, iPhone, laptop, etc.
- The plumbing is called a **link**
 - ◆ We don't care what the physical technology is: Ethernet, wireless, cellular, etc.



Link



Host



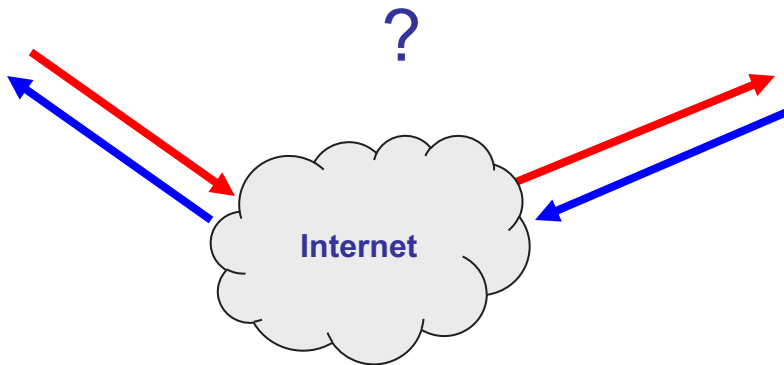
Actually Quite Complicated

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

My device



www.google.com





Web request (HTTP)

- Turn click into HTTP request





Name resolution (DNS)

- Where is `www.google.com`?

My device
(132.239.9.64)



What's the address for `www.google.com`



Local DNS server
(132.239.51.18)



Oh, you can find it at `66.102.7.104`





Data transport (TCP)

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





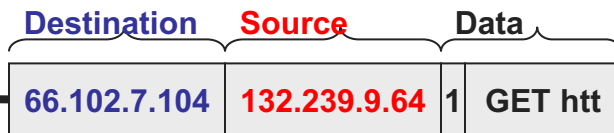
Global Network Addressing

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

My device
(132.239.9.64)



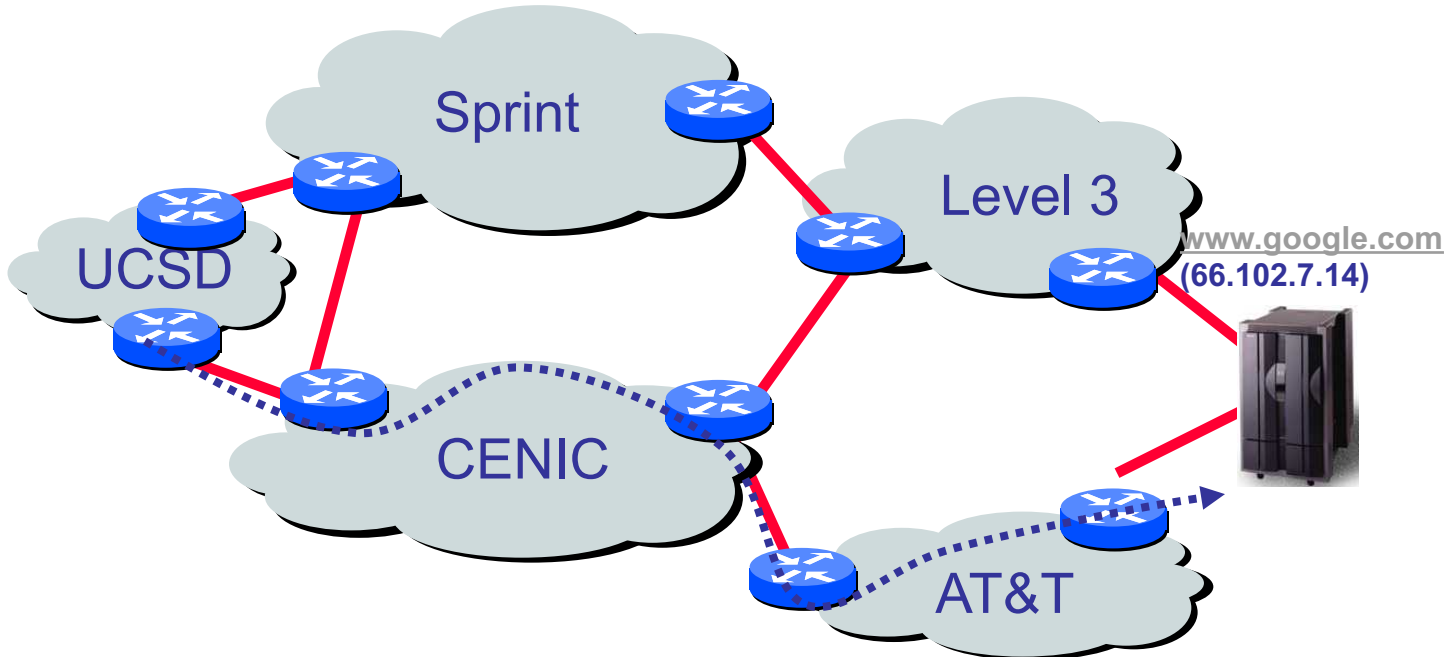
www.google.com
(66.102.7.104)





Network Routing

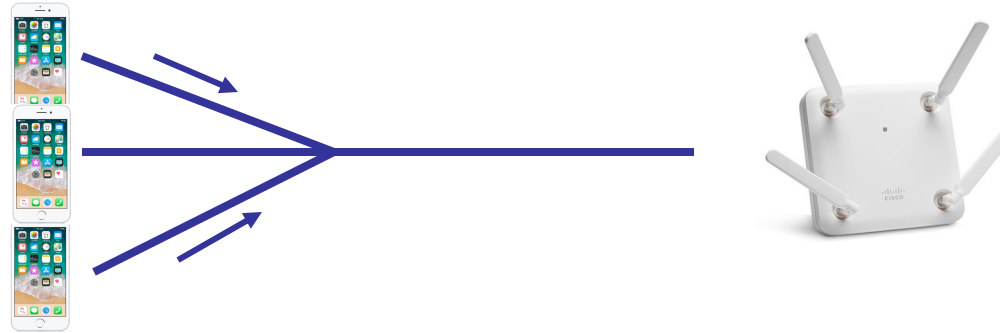
- Each router forwards packet towards destination





Link management (WiFi)

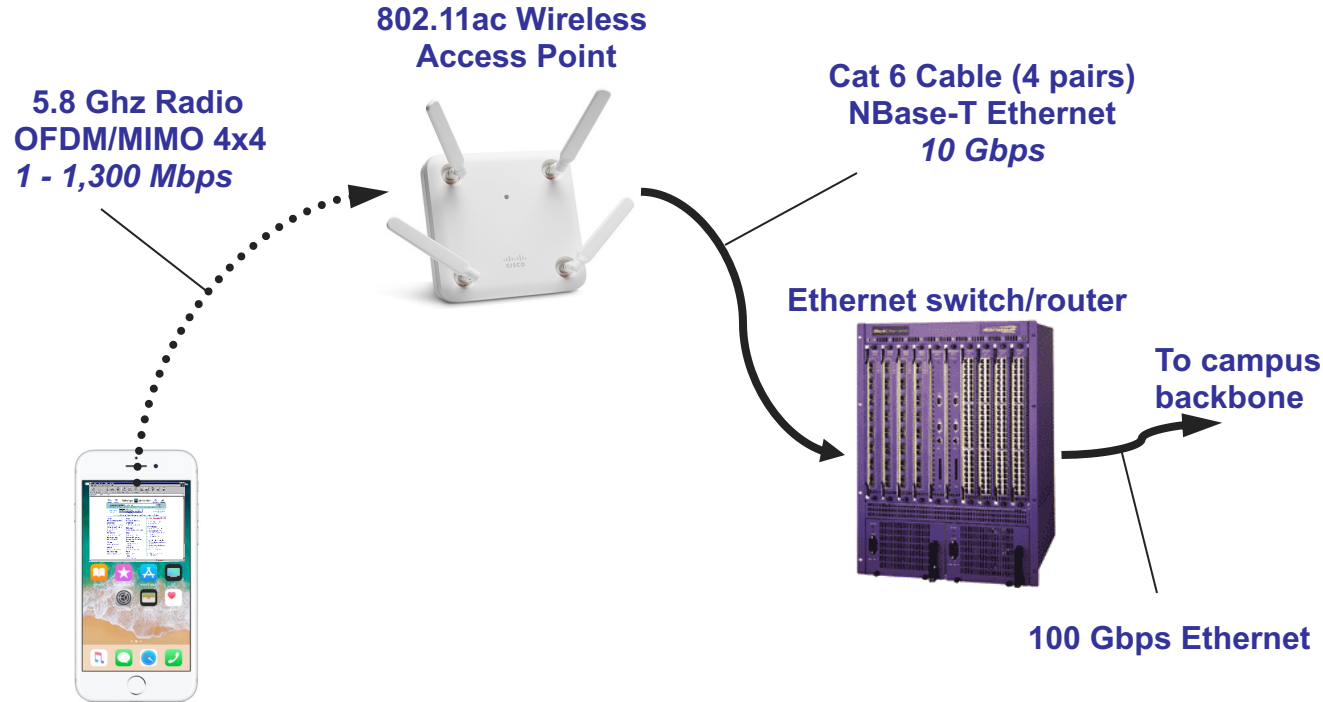
- Break message into frames
- Media Access Control (MAC)
 - ◆ Can I send now? Can I send now?



- Send frame



Physical layer





For Next Class...

- Browse the course website (also on Canvas)
 - ◆ <http://www.cs.ucsd.edu/classes/wi24/cse123-a/>
- Read Chapter 1.3 and 2.3
- Monday: Layers and Framing