

Lecture 1:

Course Introduction

CSE 123: Computer Networks
Aaron Schulman (aka Aaron Shalev)





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 and office hours

- Instructor: [Aaron Schulman \(aka Aaron Shalev\)](#)
 - ◆ Office hours Wednesday & Friday 2-3:15pm (CSE3120)
- Project 1/2:
 - ◆ [Jamshed Ashurov](#) Mon 9:30am-10:30am and Tue 12:00-1:00pm (B270A)
- Project 3/4:
 - ◆ [Rajdeep Das](#) (TBD)
- Project management / Piazza assistant:
 - ◆ [Calvin Lee](#) Mon 2:30-3:30pm (B260A) & Fri 11:10-12:10am (B275)
- Discussion/Homework/Exams
 - ◆ [Shreyas Anantha-Ramaprasad](#) Wed and Thur 10:30am-11:30am (B270A)

Prereqs



- CSE30, CSE101, and CSE110 – **not** CSE120
 - ◆ Undergrads can't enroll without them
 - ◆ We expect it (or equivalent) even for grad students
 - ◆ Transfer students should check if C-programming was covered
- Programming experience
 - ◆ We will be assigning programming projects in C/C++
 - ◆ This course will not teach you C. The TAs/Tutors will help, but you need to learn it on your own if you don't already know.
 - ◆ We will have a C language review during this week's discussion!
 - » 12:00-12:50pm in Center 212!



Expected Outcomes

- This course *will* teach you the *fundamentals* of computer networking:
 - ◆ 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 use the web or even Zoom
- This course *will not* teach you signals and coding
 - ◆ Take an EE course to learn about physical layer modulation, encoding, etc. on different hardware technologies
- Similarly, we *will not* cover Internet apps/services
 - ◆ CSE124 covers application layer protocols, Web, etc.



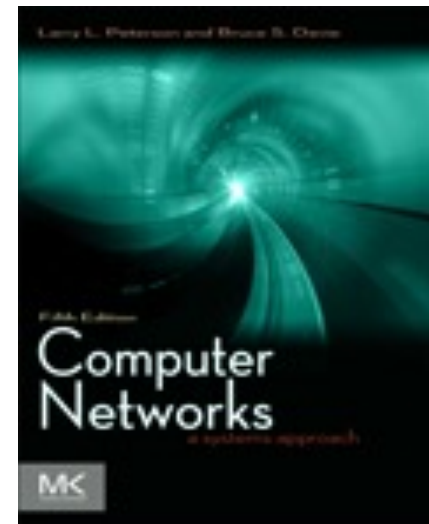
CSE 123 Class Overview

- Course material taught through class lectures, textbook readings, and discussion sections
- Course assignments are
 - ◆ Homework questions (based on lecture)
 - ◆ Four substantial programming projects
- Discussion section: ([Wednesday 12-12:50pm in Center 212](#))
 - ◆ Help you get started on the projects
 - ◆ Lecture material and homework
 - ◆ Additional networking topics
- Discussion board ([Piazza.com](#))
 - ◆ 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 four homeworks throughout the quarter
 - ◆ All will be made available on Gradescope
 - ◆ Reinforce lecture material...no better practice
 - ◆ One week to complete each
- 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 on Piazza and Discord (or whatever you use), and write up answers independently
 - ◆ Cheating is copying from other student's homeworks or solution sets, searching for answers on the Web, etc.

Projects



- There will be four programming projects
 - ◆ You will implement the core features of a computer network
 - ◆ You will have [1 – 2] weeks to complete each
 - ◆ The first will be assigned THIS WEEK, yay!
- 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 TAs will be available to help with coding
- The projects are INDIVIDUAL assignments
 - ◆ All code must be your own (**not copied from GitHub!**)
 - ◆ OK to discuss design ideas, NOT OK to share/look at code
 - ◆ Projects assigned AND SUBMITTED via private GitHub repo

Espresso Prize



Computer Facilities for Projects

- You can also use your home machine
 - ◆ The project source will work on Windows/OS X/Linux
 - » Windows folks should install Windows Subsystem for Linux (WSL)
 - ◆ Graders will test on GradeScope machines
 - ◆ If there are discrepancies between your machine and GradeScope we will try to accommodate them

Exams



- Midterm
 - ◆ Friday, May 05th
 - ◆ Covers first third to half of class
- Final
 - ◆ Thursday, June 15th
 - ◆ Covers second half of class + selected material from first part
 - » I will be explicit about the material covered
- No makeup exams, all exams held in person
 - ◆ Unless dire circumstances
- You can bring a 1-page cheat sheet to the Exams



Grading

- Homeworks: 20%
 - ◆ Think of these collectively as practice exams
- Midterm: 20%
- Final: 20%
- Projects: 40%
 - ◆ Divided evenly among the four projects

How to *Succeed* in CSE 123



- Come to or watch recorded lecture / discussion
 - ◆ Lecture material is the primary basis for exams and directly relates to the projects
- Do the homework
 - ◆ Excellent practice for the exams, and some homework problems are exercises for helping with the project
 - ◆ 20% is actually a significant fraction of your grade (easily the difference between an A and a C)
- Read the book
 - ◆ Reinforces concepts we talk about in lecture, helps with homework



How to Succeed (2)

- Ask questions in lecture, office hours, or email
 - ◆ Asking questions is the best way to clarify lecture material at the time it is being presented
 - ◆ Bring your concerns to the professor early (avoid snowball)
 - ◆ Office hours and Piazza will help with homeworks, projects
- Start the project early
 - ◆ The projects cannot be done in the last couple of days
 - ◆ **Repeat:** The projects cannot be done in the last couple of days

Canvas is your one-stop shop



- Links to all relevant course materials and cloud services
 - ◆ Course Homepage – Syllabus, Project specs, Homeworks and Announcements
 - ◆ Zoom – Remote Office Hours
 - ◆ Piazza – Project Discussion
 - ◆ Gradescope – Project/Homework/Exam Grades

Class Web Page



<http://www.cs.ucsd.edu/classes/sp23/cse123-a/>

- Serves many roles...
 - ◆ Course syllabus and schedule (updated as quarter progresses)
 - » Lecture slides
 - ◆ Project information

Questions



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



This Class in One Slide

- **Protocols & Layering**
 - ◆ Manage complexity of comm. by decomposing the tasks
 - ◆ Standardizing syntax and semantics to support interoperability
- **Naming and Numbering**
 - ◆ 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.
- **Physical Signaling**
 - ◆ How you move bits across a wire/fiber/air



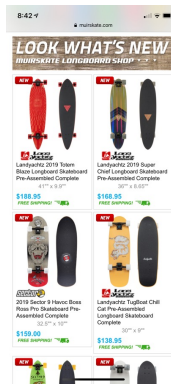
A “Simple” Task

- 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

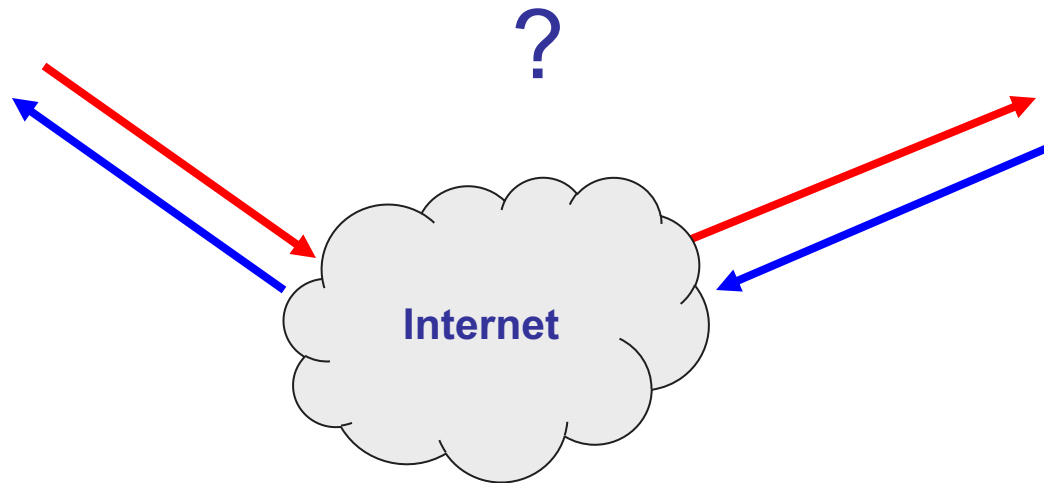


- **ROUGHLY**, what happens when I click on a Web page from UCSD?

My iPhone



www.muirskate.com





Web request (HTTP)

- Turn click into HTTP request



GET https://www.muirskate.com/ HTTP/1.1
Host: www.muirskate.com
Connection:keep-alive
...

Name resolution (DNS)



- Where is `www.muirskate.com`?

My computer
(132.239.9.64)



Where is `www.muirskate.com`?



Many hosts have it, one is `104.20.86.126`



Local DNS server
(132.239.51.18)





Data transport (TCP)

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

```
GET http://www.muirskate.com HTTP/1.1
Host: www.muirskate.com
Connection:keep-alive
...
```



“and let me know when they got there”



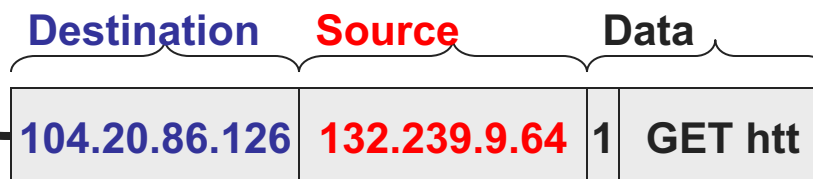
Global Network Addressing



- Address each packet so it can traverse network and arrive at destination host and return to the source host

My computer
(132.239.9.64)

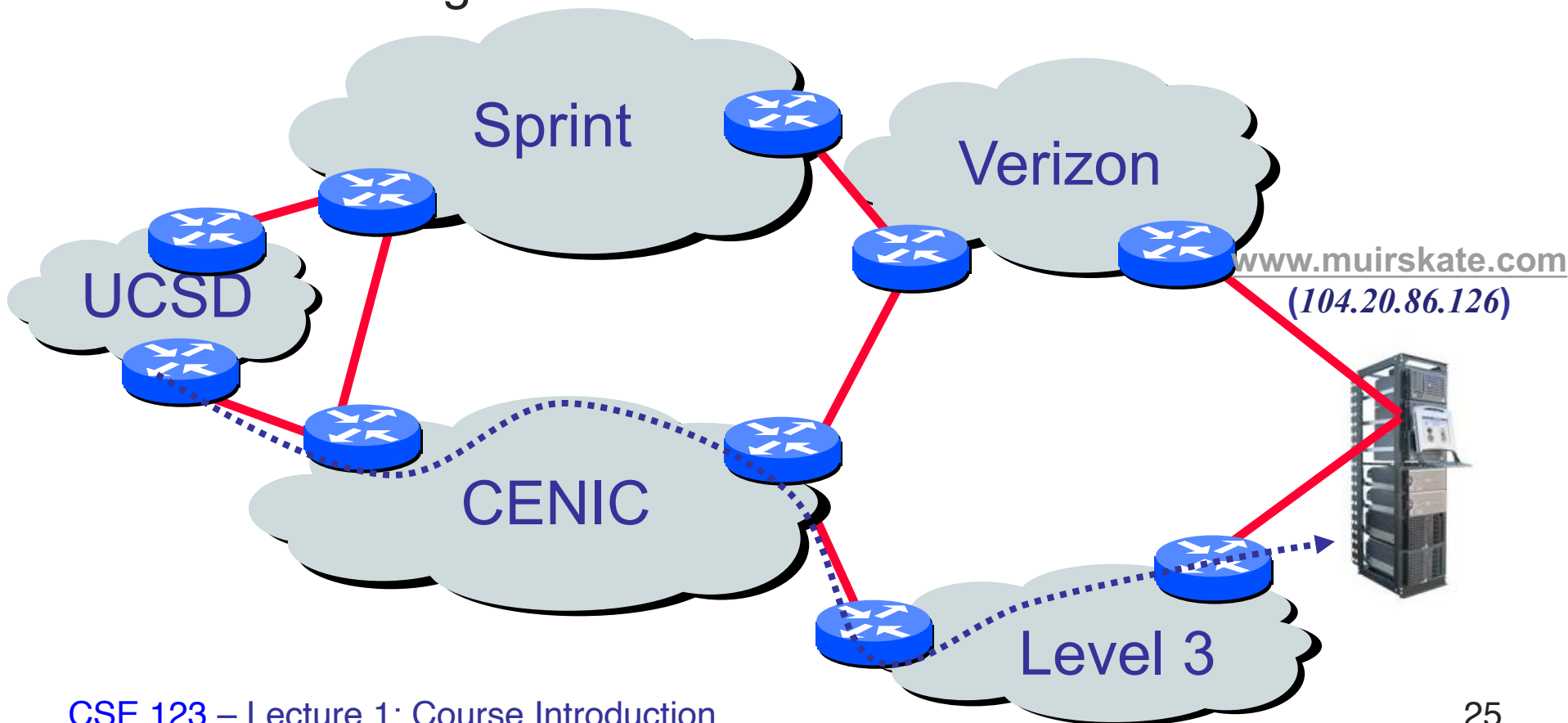
www.muirskate.com
(104.20.86.126)





Network Routing

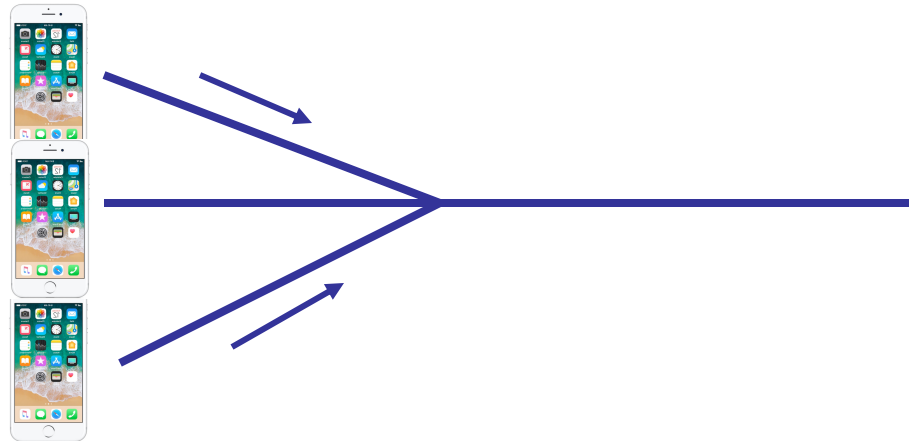
- Each router forwards packet towards destination across different organizations





Link management (WiFi)

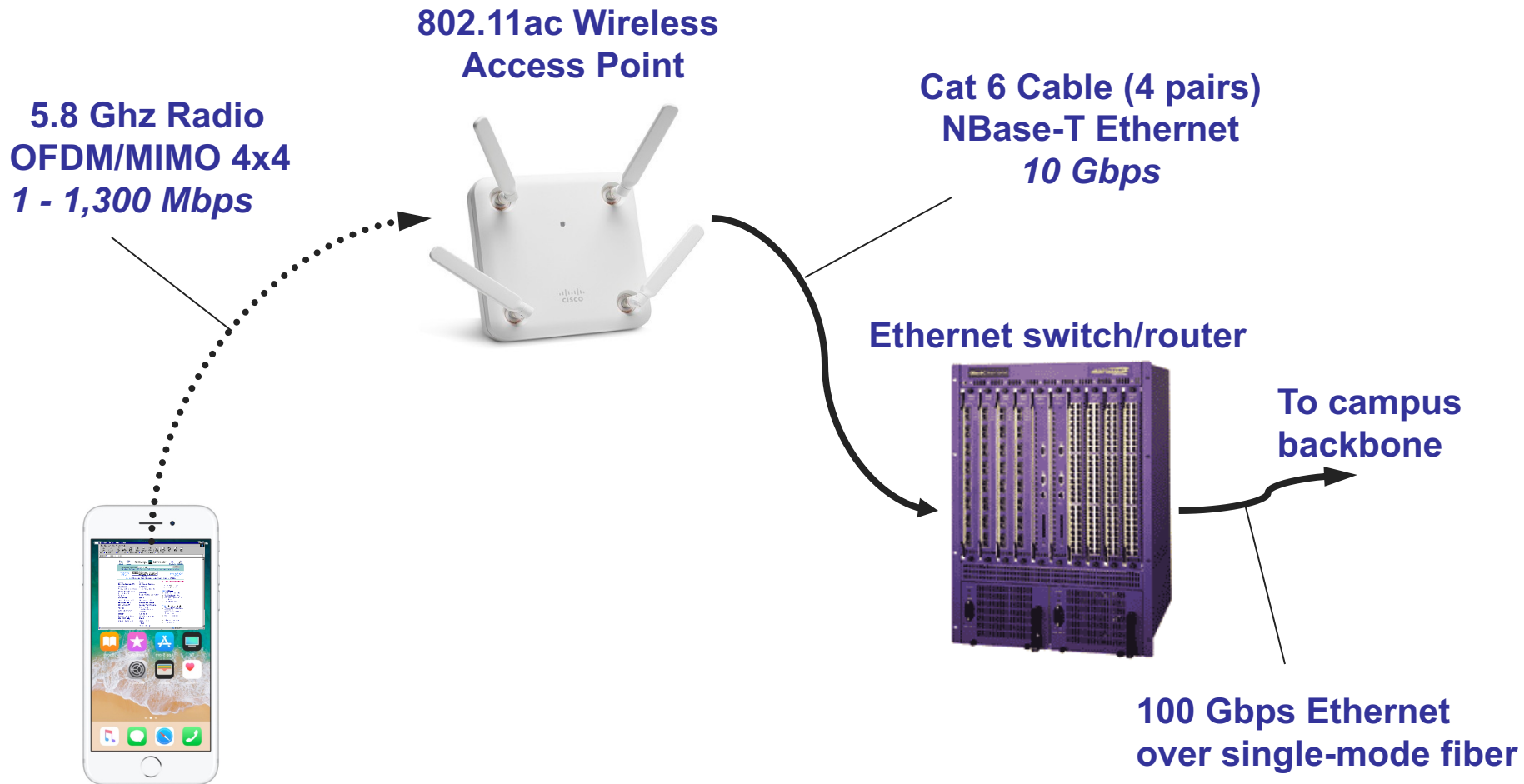
- Break stream of bits into frames
- Media Access Control (MAC)
 - ◆ Can I send now? Can I send now?



Sending frames at the same time ☹



Physical layer





For Next Class...

- Browse the course page on Canvas
- Read Chapter 1.3 and 2.3
- Next class: Layers and Framing