Networks
Fall 2023
Course Information
Prof. Kaplan

Be sure to read **all** of this document!

1 Introduction

Nearly all modern computing devices—servers, desktops, laptops, tablets, phones, watches, televisions, household appliances, cameras, home security systems, medical devices, speakers, cars—communicate with one another. This ubiquitous communication has only occurred within the last twenty-five years. Networked communication has a great deal to do with the broad and pervasive use of computing in nearly every aspect of our lives; computers would not be nearly as useful or used without networking.

How do two computing devices communicate? How is information signaled from one to another? What if the signal encounters interference? What if the receiver cannot keep up with the sender?

How do three, four, or a few dozen computing devices communicate? How do the signals from one not clobber the signals from another? How does a message get addressed to one, but not to all? How does a new device join the group?

How do hundred, thousands, or billions of devices communicate? How does any one send information to any other one—how do the signals make their way from one to the other, anywhere in the world? What if too many devices try to contact the same device at once? How are devices added and removed from such a massive collection?

In this course, we will develop answers to these questions within an organized framework that creates a worldwide network via a *layerd stack* of abstracted capabilities. Each layer will use one group of capabilities to build the next, ultimately providing the ability for any program to communicate with another at any location, all through use of a simple interface.

2 The topics

The basic topics are given below, roughly in the order that will we cover them. If you have no idea what some (or many) of them are, don't be alarmed—that is why you're taking this course, after all.

- **Layered network stack:** How is networked communication organized?

- **Physical layer**: How can a medium be modulated to send signals from one place to another? What if the medium is shared (e.g., radio broadcast)?

- **Data link layer**: How do sender and receiver synchronize? How are errors detected and/or corrected?

- **Network layer**: How is data divided into *packets*, and how are the packets routed to their destination? What about routing of packets between two connected local networks?

- **Transport layer:** Across multiple local networks that provide different characteristics, how do two abitrary devices establish a single connection with known characteristics?

- **Socket layer:** The interface by which connections between devices are established and bytes read and written just as they are with files.

- **Application layer:** The protocols (e.g., `http, ftp, rtp`) via which different types of applications communicate.

- **Encryption:** How data can be shared securely between any two devices and their applications.

- **Compression:** How data can be sent using fewer bits.

- **Security:** How do you trust data from devices you've never seen? How do you know the data is really coming from those devices? How do you know that your data is going where you intend it?

These topics are what we directly will be covering, but underlying it all will be the concepts of *interface*, *abstraction*, and *implementation*. The building of capabilities upon capabilities, yielding qualitatively new ones, is a central theme.

This course will be project-intensive. Much of the material will seem easy enough to comprehend when presented in class, but the only way to understand this material thoroughly is to

use it. In this case, *using* these ideas requires that you understand an existing implementation of a layer, and then modify or enhance it. Your projects will require you to understand existing code before you then write your own.

3 Lectures, labs, and help

Lecture/discussion times: This class will meet on **TTh** of each week, from **2:30 pm to 3:50 pm**, in **SCCE A131**. We will occassionally use our class time as a lab to work on projects; be sure to bring your laptop for such days (which will be announced).

Individual meetings (a.k.a., *office hours*: If you seek assistance, reinforcement, review, or other opportunities to discuss the course material or assignments, you should see me. There is a link on the course web page for scheduling a time to meet. Please use it; talking with me outside of class is one of the reasons you came to a small college.

Slack channel: We will make regular use of Slack. You will be added to the `#cosc-283-f23` Slack channel, where you will be able to send questions directly to me, to TA's, or for the whole class to see. It will also be the mechanism by which I distribute announcements quickly, send files/documents that may be immediately helpful, and try to keep a running sequence of questions and answers.

Email: Many questions simply do not need an in-person meeting, at least not initially. You should certainly feel free to send email to me with your questions or concerns. Be forewarned, however, that I do not typically respond to email quickly, so do not expect a quick turnaround. For a quicker response, Slack is likely to be better.

4 Texts and materials

The textbook for this course is *Computer Networks,* 5 sup *th edition*, by Andrew Tanenbaum and David Wetherall.[1]. All other tools for this course—all of the software and documentation—will be provided online.

5 Assignments, deadlines, and extensions

There will be a number of programming projects. The deadline for each will be stated clearly on the assignment. **Late submissions may receive failing grades**. It is too

[1] ISBN-13: 978-0132126953

important to keep moving through the assignments, so Turn in what you have, imperfect or incomplete as it may be, and do so on time so that you can move onto the next assignment.

An extension for any assignment **must be requested, in writing** (email counts as *writing*). The determination as to whether or not a particular situation merits an extension will be made on a case-by-case basis. Scheduled events are **not** sufficient reason to warrant an extension. Rather, extensions are intended for unusual circumstances that prevent you from planning your time well in order to meet the deadline.

6 Exams

There will be one final, take-home exam for this course.

7 Grading

Your final grade will be determined by my evaluation of how well you have mastered the course material at the semester's end. All of the work that you submit, as well as your participation in class, contributes to my impression of that mastery.

8 Academic dishonesty

You will be expected to do your own work on all assignments and exams in this course. While I encourage you to interact with your classmates and discuss the material and assignments, there is a limit to the specificity of such discussions. I seek to make that limit clear here.

It is acceptable to discuss any assignment for the class with a classmate. You may even discuss your approach to a particular problem, or review relevant material for a problem with another person. However, you **may not show another student your work, nor see another student's work. If in doubt, *ask me*.** If you are unusure whether or not a particular kind of communication would rise to the level of academic dishonesty, then you should contact me immediately and find out.