

ECE 435 – Network Engineering

Lecture 1

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Barrows 123, Wed 10:00am

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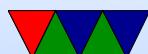
Introduction

- Distribute and go over syllabus
- Web-page, with lecture notes and assignments:
https://web.eece.maine.edu/~vweaver/classes/ece435_2026s/
- Also in QR code



ECE435 – Office Hours

- Prof. Vince Weaver
- Office Location: 203 Barrows
- Office Hours: 1pm-2pm Tues/Thurs
- Can also e-mail for appointments
- Or drop in if door open



Syllabus – Textbook

- (optional) Tanenbaum “Computer Networks”



Syllabus – Hardware

- Will be helpful to have a device with network connection (Ethernet, wifi) for some homeworks
- Raspberry Pi is great because if you mess things up you can just pop in a new SD card
- Laptop or desktop is fine too.
- Easiest with Linux.
Windows with Linux compatibility?
Mac OS?
- I can provide account on a machine if needed



ECE435 Grading – Homeworks

- Homeworks, 50%
- Roughly 10 total, lowest dropped
- Generally will be due on Friday by beginning of class
- Will usually have at least a week to do them.
- Submission by e-mail, grades sent in response to that e-mail
- Will send out e-mail when posted on website



ECE435 Homework Coding

- First few will have some coding, that drops off as the semester progresses
- Will involve some C coding, and maybe Linux command line
- Don't panic and drop the course! The coding isn't too bad.
- Lab: no dedicated lab.



ECE435 Grading – Exams

- Midterm, 10%
- Final, 15% (8am this year :()



ECE435 Grading – Project

- Project, 20%
- Involves using what we learn to do a networking-related project
- Can work in groups
- Open-ended, any language you want
- Presentation last week of class
- Writeup at the end
- More details as we get closer.



ECE435 Grading – Other

- Class participation, 5%
- Class notes will be posted on the website.



ECE435 Grading – Late Work

- Late work penalty
please turn in work, even if late, even if incomplete.
homework grade adds up
- I generally don't give exceptions unless for something extreme, so if just a few days late just turn it in and take the hit
- I drop the lowest homework grade



ECE435 Syllabus – Other

- COVID policy – please don't come to class if you're super sick (and mask if possible if regular sick)
- Code Help
 - If you have questions often the most efficient way is to send me your code to look at via e-mail
 - Sending me the actual code is best and will get better results than sending screenshots
- Standard UMaine boilerplate stuff



ECE435 — Academic Honesty

- I hate to dwell on this but it comes up more than you'd think
- **For coding assignments please only submit code you wrote yourself**
- Do not turn in as yours other people's code, either from this class, copied off the internet, or via AI
- Do not share your code with others in the class, even after the submission deadline. If you share your code and the person you shared with submits it too, **you both**



will face consequences

- The minimal consequence for this is a zero on the assignment. Note: a zero for cheating will not be dropped as part of the “lowest homework grade is dropped”



ECE435 — Academic Honesty Part 2

- Note that this doesn't mean you can't get help. The following are allowed
 - You can always ask me (the professor) for help
 - You can always discuss and ask for high-level help from others about the assignment (just don't copy code)
 - You can even ask someone to look at your code to spot errors you might be missing (ideally do this without sending it to them)



Notes on the Class

- Note: not a lab class.
Programming routers with serial ports and subnetting not as key anymore
- Networking vaguely static from 1990s to ~5 years ago
- Lots has been changing recently, hard to keep up
- Used to be pretty open, now a lot happens inside of big companies, mostly google
- I often get really knowledgeable people in this class. If I make a mistake, let me know



- I'll try not to make too many digressions about what the internet was like back in the late 1990s



Networking

In this class we will cover

- Computer Networks
- Computer Security



What is a Computer Network?

- A group of computers, connected so they can communicate
- Probably familiar with the Internet, which is a network of networks.



How can they be connected together?

- Wire (Ethernet, telephone, powerlines)
- Fiber Optic
- Wirelessly: radio, microwave, infrared, laser
- Sound?
- Barbed Wire? Wet string? Carrier Pigeons?



Why have networks?

- Resource sharing (printer, fileserver, etc.)
- Communication (e-mail, text messaging, video-conferencing, etc)
- Entertainment/Gaming/Streaming
- Operating system/Security Updates
- Shopping
- Accessing Info



Why have network to your home?

- Older books would actually spell this out because back in the day people needed convincing to connect to the internet



Network Concerns that we'll Discuss

- Reliability
 - What makes a reliable network?
- Security
 - Is security a network-related problem? It makes local security issues exploitable world-wide...
- Expense
- Speed
 - Latency vs Bandwidth
- Addressing (how to find a machine)



- Error correction
- Scalability
 - Trouble that appears as networks get bigger
- Standards
 - How do two computers understand each other? Who defines the rules?
- Privacy
 - Encryption? Trust? Authority? Tracking?
- Complexity
 - A lot of networking used to be easy and hands-on
 - Things are now fast at the expense of understandability



Some Network terms

- Client/Server
- Broadcast vs point-to-point
- Wide area network, local area network
- Bandwidth vs Latency.
1Gbps might be fast, but what if 100ms latency?
- Connection oriented vs packet based (Switched phone vs VOIP)
- Topology (star, ring, cube, mesh, hypercube)



OSI Reference Model

- Open Systems Interconnection (1984)
- ISO 7498 Standard
- Aside on OSI/IOS/ISO
 - ISO is “International Organization for Standards”
 - So why not IOS? Is it French? No in France it's OIN
 - According to Wikipedia ISO is short for “equal” and so the acronym can be same around world
 - OSI using same letters is coincidence



OSI Reference Model (continued)

- Many thought this would be the standard, but didn't end up that way
- Everyone still talks about it anyway
- Various layers each a new layer of abstraction.
- Layers should be independent.
- Layering violations (implementations interacting with layers not immediately above or below) should be avoided



OSI Breakdown

1. Physical – **bits**: the raw bits. How 0 and 1 encoded, electrons or photons, etc.
pins, volts, timing, frequency
topology, how wires laid out
bandwidth
2. Data Link – **frames**: Transforms raw line to one that handles errors,
breaks up data into frames, etc.
Unique identity for each device on network



Flow control, error handling

3. Network – **packets**: management of subnet. How packets routed from one network to another, addressing. (routing: what is routing?)
4. Transport – **end-to-end delivery**
 - accepts a stream of bytes from above and make it suitable for the network layer.
 - Gets back split up packets and turns it back into a total message.
 - flow control, reliable delivery, error correction



5. Session – allows different machines to have sessions between them. session management, synchronization. Lets different apps share one connection to the network.
6. Presentation – syntax of data being transmitted. Char encoding, compression, encryption
7. Application – high level protocol, like webserver (http), ssh, etc.



8th layer

- The user?
- Political? Financial? Government?



Summary

	OSI	TCP/IP
7	Application	Application
6	Presentation	
5	Session	
4	Transport	Transport
3	Network	Internet
2	Data Link	Host-to-network
1	Physical	Host-to-network



Layering

- Why is it good?

Abstraction. Easier to do one layer and do it right.
Should the webserver be aware if it is serving over
copper vs fiber?

- Counterpoint: RFC 3439: “Layering considered harmful”
 (“considered harmful” is a Dijkstra meme)



Results

- OSI (theoretical) never caught on for various reasons
- TCP/IP (practical) did, but has its own limitations which we'll discuss later



This year's Plan

- We'll start at the top and work our way down.
Either way has issues



Coding

- Have you written a network program?
- How do you write a network program?
- We'll use C

