

# CS 485/ECE 440/CS 585 Computer Networks, Fall 2012

**Instructor:** Jed Crandall, jedcrandall@gmail.com

*Never hesitate to email me directly about anything. If you're emailing me something about a group assignment, always cc the members of your group unless there's some reason for privacy.*

**Office and office hours:** FEC 335, Tuesdays and Thursdays from 9:30am to 11:00am.

## Reasons to drop this class right now:

- ***The class is at 8:00am, and attendance is mandatory and affects your grade.***
- ***The class is in a lab format.*** That means that more often than not I will show up to class and rather than giving a lecture, I'll say, "Work on your lab assignment."
- ***You won't finish any of the lab assignments.*** Few things make me more unhappy than hearing, "But I'm done with the lab so I don't have anything to do." When a student says that, I hear, "I only care about getting a good grade and I'm unwilling to take pride in my work and keep improving my lab because I know it's already good enough for an A." There's always more to be done, you might think about adding a compelling visualization, having someone read a draft and suggest improvements to you, or running some additional experiments to tie up loose ends. If you really care about learning about networks then your work is never done (but you do still need to submit it before the deadline).
- ***The class is taught by me.*** I don't do traditional networking research and I've never published a paper in INFOCOM, MOBICOM, SIGCOMM, or IMC. My research in the area of network security is about network protocol implementations and scientific ways of measuring network anomalies. The anomalies I'm interested in typically don't conform to the RFCs and aren't in any textbooks. For this reason this class will focus heavily on the low-level implementation basics of network protocols, and not on the high-level, theoretical, performance-centric research that typically makes up a networking textbook. If you prefer a more traditional networking class that covers traffic shaping, different physical layer technologies, ATM networks, *etc.* (e.g., because you want to work at one of the national labs on supercomputers or you want to work for a company like Cisco) the ECE department offers this same class in the spring.

**Prerequisites:** None formally, having taken CS 341 (Computer Organization and Design) before this class is recommended but not strictly necessary. We won't use any assembly or computer architecture material in this class, but when I discuss systems issues such as context switches or kernel vs. user space I will generally be assuming that all students understand these things as they would coming out of CS 341 and entering CS 481.

**TAs:** Your TAs are Geoffrey Alexander ([alexandg@cs.unm.edu](mailto:alexandg@cs.unm.edu)) and Stephen Harding ([stharding@cs.unm.edu](mailto:stharding@cs.unm.edu)). Both of them will have office hours on Mondays, Wednesdays and Fridays, 10:00am to 11:00am. Geoff will be in FEC 126 (on the first floor, in the hallway that goes back to the elevator), and Stephen will be in FEC 301A (third floor, back in the corner in the southeast part of the

building).

**Mailing lists:** There are two mailing lists, one required and one optional. See the course website for details.

**Course website:** <http://www.cs.unm.edu/~crandall/netsfall12/>

I'll post lots of important stuff here, like the lab assignments, links to the mailing lists and Google calendar, grades, etc.

**Required text:** The only required text is *Understanding Linux Network Internals* by Christian Benvenuti. We'll also use a lot of online resources such as Wikipedia and the RFCs. "The only laws on the Internet are assembly and RFCs" (see Phrack 65). We should all get in the habit of reading assembly and RFCs, but for this class it will be sufficient to instead read the Linux kernel network stack C source code and Wikipedia, respectively. The Benvenuti book is required because it will tell you what's in the Linux network stack source code.

If you'd prefer to have an academic textbook to read from, *Computer Networks: A Systems Approach* by Peterson and Davie is a good one. *Computer Networking* by Kurose and Ross is also pretty good.

**Class meeting time and place:** Tue/Thur 8:00am to 9:15am, in CEC B146 (the lab in the basement of the Centennial Engineering Center). Attendance is required, and we will be taking roll all semester.

**Grading:** The final grade will be calculated as 50% labs, 20% attendance, 10% homeworks, 10% midterm, and 10% final. The points for each will be added up and divided into the total possible before weighting, so a 100-point lab does not necessarily contribute the same amount to your grade as a 100 point final. I reserve the right to curve the overall grades at the end of the semester (up, never down) if I don't feel that they reflect the amount of effort students put into the class. The overall grade will be out of 100, weighted as described above. For letter grade purposes, below 60 is an F, 60 and up is a D, 65 and up is a C-, 70 and up is a C, 75 and up is a C+, 80 and up is a B-, 82 and up is a B, 85 and up is a B+, 87 and up is an A-, and 90 and up is an A. I only give A+'s in extreme circumstances.

*Note: The grading standards on the midterm and final are different for undergraduates (ECE 440 and CS 485) and graduates (CS 585). It's likely that there will be separate tests for undergraduate vs. graduate. For the final project, which will be the last lab and worth twice as much as other labs, the grading standard will also be different for undergraduate vs. graduate.*

**Labs:** There will be 3 labs, with the third being a final project and worth twice as much as either of the first two. Probably, the first lab will be an individual effort, the second a group effort, and the final project optionally an individual or group effort.

You will be using tools such as Wireshark and virtual machines. Programming is encouraged---C, Perl, and Python are recommended. You may use other scripting languages (e.g., Ruby), but keep in mind that we won't be able to help you as well in languages we don't know as we can in languages we do. Silly fairy tail languages such as LOLCODE or Java are strongly discouraged and will not be supported in the lab environment. Be sure to start early on the lab assignments and get the help you need to get them done.

Late assignments will be accepted only in special circumstances (medical, etc.).

For lab writeups, English spelling and grammar will affect your grade. The TAs and I are willing to help with English during office hours, but not via email or during class, i.e., if you want one of the three of us to help you correct the English grammar in your writeup you must come to office hours. There are also various University resources for helping students with English writing. The lab writeups I ask for will typically be one or two pages including figures, so that you can focus on doing an

excellent job of presenting new information to me and not lots and lots of pages of things I already know.

Each lab will have a societal impact component to it that will also be part of your writeup. More details will be in the lab assignment handout.

**Attendance:** I will be taking attendance every day of the semester. Your grade for attendance will be the fraction of regularly scheduled lecture periods for which you are present. I may mark you as not present, without immediately notifying you, for any of the following reasons:

- If you don't show up to class that day.
- If you're more than five minutes late.
- If you leave early.
- If you're using any computer (even a personal computer) for things not related to this class (e-mail, Facebook, etc.).

I'll drop up to two "not present" days at the end of the semester. Things like medical emergencies, attending conferences, etc., may be considered excused absences (*i.e.*, not count against your grade) if you contact me about them in a timely manner.

**Homeworks:** There will be four relatively light homework assignments throughout the semester.

**Midterm:** The midterm will be on Tuesday, 25 September in class at the regular time. It may be curved.

**Final:** The final will be on Thursday, 6 December in class at the regular time. It may be curved.

**UNM statement of compliance with ADA:** "Qualified students with disabilities needing appropriate academic adjustments should contact the professor as soon as possible to ensure your needs are met in a timely manner. Students must inform the professor of the disability early in the class so appropriate accommodations can be met. Handouts are available in alternative accessible formats upon request."

### **Cheating and collaboration, personal statements:**

You and your group members are expected to do your own lab setups, collect your own data, and write your own lab writeups. Sharing of source code, configuration files, etc., is encouraged. This is not a programming class, so feel free to grab source code from any place you can find it. Everything you write in the English language, and all ideas that you present as your own in the experimental setup and discussion, however, needs to be original material by you. *If you copy and paste any material (English text, figures, etc.) from any source you must clearly delineate it and attribute it properly to its source. Representing the work and materials of others as your own will not be tolerated in this class. Anything that is a full sentence or more that was not written originally by you has to be in quotes or indented in italics with a reference to clearly indicate where the material came from.*

Each lab assignment will have specific instructions about what is acceptable in terms of cheating and collaboration. Be sure to read it, and if you don't understand it ask me questions.

Each test will state at the top what materials you're allowed to use (book, notes, etc.). Not noticing, for example, that the top of the test says that it's not open notes is not an excuse. Anything not specified as open is closed. In other words if the test instructions don't say "open-iPod" you should assume that the test is closed-iPod, and if the test instructions don't say "open-cheat-sheet-on-the-inside-of-your-water-bottle-label", assume that the test is closed-cheat-sheet-on-the-inside-of-your-water-bottle-label.

All university policies regarding these matters will be strictly enforced. Typically I'll give the cheating

parties a 0 on the assignment, but I may pursue further action in some cases.

Some lab assignments will be group efforts. I expect everybody to contribute, if some group members do all the work and others slack off, I consider that a fault of each and every member of the group individually. Doing all the work yourself is not an alternative to showing leadership. Every group member will attach a personal statement to the final submitted lab writeup stating their contributions. All members of the group must be given a chance to see the personal statements of the other group members before submitting. If another group member claims a contribution that they didn't actually make, your two options are (1) ask them to change their personal statement, or (2) tell me about it privately. Personal statements should answer the following questions:

1. What tangible contributions did you make (source code, writing, implementation, experimental testing, etc.)? “Tangible” means that if I ask you to show it to me you can show it to me.
2. What ideas did you contribute to the experimental design?
3. In what instances did you show leadership for the group (motivating people to work, helping them learn something, organizing meetings, etc.)?

If your personal statement is misleading in any way, that can be considered cheating, so make sure your personal statement is truthful. I reserve the right to call any student into my office and ask them questions about their personal statement and technical questions about the lab itself before giving a grade for the personal statement.

### **My expectations of you as students**

- **Be studious:** I'm fairly old-fashioned, I expect students to come to class, to come on time, to stay on task, to take the time to make sure they understand things well, *etc.*
- **Take responsibility for your own learning:** you're either registered for a 400-level class or for a graduate class, at a major research institution. If you find that coming to the regularly scheduled class time is a waste of time, then you're not taking responsibility for your own learning. Don't expect me to spoon-feed you information that is already well-known, you don't want to pay ~\$750 in tuition for me to tell you what's in a ~\$60 textbook that you could read yourself if you wanted to. My job is to teach you how to learn things that nobody knows yet, which is why we'll focus on experimental methodology a lot in this class. A good philosophical approach for you to take in this class is to “teach the teacher.”
- **Do only excellent work:** anything worth doing is worth doing well. In terms of your grade, you'll be much better off doing solid experiments that are very simple than to try to do complicated experiments with flawed methodologies. Keep your projects and writing simple and make sure everything you do is excellent and technically sound.
- **Show leadership and be a mentor:** don't think that this class is only about computer networks. If someone in your group is not as strong as you are in networking or programming, help them learn and motivate them to get things done instead of doing everything yourself.

### **Material to be covered:**

We'll try to stick to the staples of networking protocols and abstractions that are typical to the Internet: ARP, TCP/IP, UDP, sockets, and routing algorithms (both link state and distance vector). We'll be applying this knowledge to try to learn new things that aren't in the book and that nobody knows yet. For the first lab we'll be looking at Linux's TCP Cubic implementation and for the second we'll look at dynamic routing algorithms (specifically BGP). If you have a specific interest you'd like us to talk about in class, you don't understand the background material as well as you'd like to, or you have any

other suggestions for lectures or class discussions please let me know.

The class will also have a heavy focus on societal impact issues, which will be part of the labs and will also be discussed regularly in class. These issues will include laws and regulations in the U.S. and overseas, Internet surveillance, Internet censorship, ethical disclosure of vulnerabilities, network neutrality, the history of the Internet, the impact of man-in-the-middle attacks, and many other topics.

## Homework assignment #1:

This assignment is due to me by email ([jedcrandall@gmail.com](mailto:jedcrandall@gmail.com)) before 11:59pm on Wednesday, 22 August 2012 (if you're reading this on the first day of class, that means tomorrow).

First, you should join the class mailing list by following the link on the course web page. You should get a confirmation email. Then you should make sure that you have a valid CS account so that you can log into the lab machines.

Then, you should send me an email with answers to the following questions, where your answers can range from a sentence to a paragraph (or more, if you like).

1. Did you join the nets mailing list and then confirm that you have a CS account to log into the lab machines? Did you also join the nets-chat mailing list? Why or why not?
2. Who are you? What is your major? Where are you from? What should I know about you? What's something interesting about you? 你最喜欢的中国菜是什么? 你是不是捣蛋鬼?
3. Why are you taking this class? What do you hope to learn this semester in this class?

If you're willing to attach a picture to the email, please attach a picture of yourself to help me learn everybody's name (so I know by name who to punish if I see you do something bad ;-).