

15-441: Computer Networks

Peter Steenkiste and David Eckhardt

Computer Science Department
Carnegie Mellon University
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1 Organization

Instructors:

Peter Steenkiste	Dave Eckhardt
WeH 8202	WeH 3503
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Tu 10:30–noon	TBD

TAs:

Mike Cui	Josh Hailpern	Dave Murray	???? ????
TBD	TBD	WeH 3604	TBD
mcui@andrew.cmu.edu	jh@andrew.cmu.edu	dim@andrew.cmu.edu	????@andrew.cmu.edu
Mon 7–8 p.m.	Tu 7–8 p.m.	Mon 11:30–12:30 a.m.	????
Th 7–8 p.m.	Wed 7–8 p.m.	Wed 12:30–1:20 p.m.	????

Class Assistant:

Barbara Grandillo
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Lecture:

Monday & Wednesday, 13:30–14:50, Doherty Hall 1212

Web page: <http://www.cs.cmu.edu/~441>

Newsgroups: `academic.cs.15-441` `academic.cs.15-441.announce`

2 Objectives

CS 441 presents a detailed view of the technology, protocols, and software that underly computer networks. It covers both the many layers that comprise today's networks, especially the Internet, and a look forward

to emerging techniques for supporting multimedia, peer-to-peer, and mobile networking.

Being a course in computer science, much of the focus is on network software. As part of the course, you will get experience writing application programs that communicate via the Internet, as well as some of the system software that implements network protocols.

A key objective of 15-441 is to provide a significant experience with system programming, where you must write programs that are robust and that must integrate with a large, installed software base. Systems programming is very different from the application program development you have done in earlier courses:

- It is typically implemented in a low-level language, such as C, to ensure close control over system resources.
- Especially with server code, it must be designed to run indefinitely. It must reliably handle any possible error condition, and that it must manage resources such as memory carefully.
- It must be secure. Connecting a system to a network makes it vulnerable to malicious attacks initiated anywhere in the world. Poorly designed or implemented network software provides a common entry-point for attack. System software must be invulnerable such string overflow and malformed incoming messages.
- The interfaces to other parts of the system are generally specified by documented protocols.
- Networking software typically involves concurrency, including both within individual machines (multiple processes or threads), as well as among the different network components.
- An important part of system programming is to develop comprehensive test methodologies for the programs. A significant effort should be invested in writing programs that will thoroughly test the system code, including testing the handling of different error conditions.

The programming assignments are larger and more open-ended than in other courses. Doing a good job on a project requires more than just getting code that runs. It should have a good overall organization, be well implemented and documented, and be thoroughly tested.

3 Textbook

The textbook for the course is:

Larry L. Peterson and Bruce S. Davie, *Computer Networks: A Systems Approach*, third edition. Morgan-Kaufmann, 2003.

In previous years, an earlier edition of this book was used. Make sure you get the new edition.

4 Other References

If you have not taken 15-213, you may find its textbook useful for a gentle, software-focused introduction to computer architecture:

Randal E. Bryant and David R. O'Hallaron, *Computer Systems: A Programmer's Perspective*, Prentice Hall, 2003.

If you have some money to spare, or you plan to continue being involved in system programming, three books by Richard Stevens provide a wealth of useful and reliable information:

- W. Richard Stevens, *Advanced Programming in the Unix Environment*, Addison-Wesley, 1993.
- W. Richard Stevens, *TCP/IP Illustrated, Volume 1: The Protocols* Addison-Wesley, 1994.
- W. Richard Stevens, *Unix Network Programming, Volume 1: Networking APIs: Sockets and XTI*, 2nd edition Prentice-Hall, 1998.

5 Course Organization

Your participation in the course will involve five forms of activity:

1. Attending the lectures.
2. Reading the text.
3. Projects.
4. Homeworks, both written and experimental

The three projects will each involve a substantial effort in designing, implementing, and testing a program of modest complexity. You will work individually on the first project and in teams of two on the others. The homework problems will cover a broader range of networking topics. Some will involve solving problems, such as the ones at the end of each chapter of the textbook, while others will involve making measurements on actual network traffic.

6 Getting Help

If you have a question about a project handout or a technical issue, there is an excellent chance that other students in the class have the same question. Please read the `academic.cs.15-441` newsgroup to see if there has been any question-and-answer traffic related to your issue. You should also read `academic.cs.15-441.announce` regularly to keep up with official course announcements.

If you have a question you believe is particular to your circumstances and should not be posted in a public forum, send mail to `staff-441@cs.cmu.edu`, which is forwarded to the entire course staff. Questions of general interest sent to `staff-441@cs.cmu.edu` will probably be replied to via the newsgroup. If your question involves a confidential personal or academic-conduct issue, you should probably contact one of the instructors in person or send mail to both.

If you want to talk to a staff member in person, remember that our posted office hours are merely times when we intend to be available in our offices. You are also welcome to visit us outside of office hours if you need help or want to talk about the course. However, we ask that you follow a few simple guidelines:

- Professor Steenkiste normally works with his office door open and welcomes visits from students at these times. However, if his door is closed, he is busy with a meeting or a phone call and should not be disturbed.
- Professor Eckhardt is involved in teaching both 15-441 and 15-410 this semester. Therefore it is probably best if you can contact him during his posted 15-441 office hours. If your schedule does not permit this, please feel free to contact him by e-mail for an alternate time slot.
- The TAs share offices with other students. To avoid disturbing these students, please send mail or zephyr before visiting a TA outside of office hours so they can arrange to meet you.

We will use the Web as the central repository for all information about the class. The class home page is at <http://www.cs.cmu.edu/~441>.

Using the Web, you can:

- Obtain copies of any handouts or assignments. This is especially useful if you miss class or you lose your copy.
- Read clarifications and changes made to any assignments, schedules, or policies.
- Find links to any electronic data you need for your assignments

7 Policies

Working in Groups

For project assignments after the first you must work in groups of two people. Working alone requires permission from the instructors. It is up to you to form and regulate your own group. You should plan to keep the same partner for the second and third projects. All other assignments will be done individually. To collaborate effectively, you should both be involved in all of the major design decisions. You should also determine a partitioning of responsibilities so that you can both work effectively in parallel. For example, one might be responsible for generating all test code while the other is responsible for the main code. Finally, it is your responsibility to read and understand your partner's contributions. In addition to being a useful part of the group programming experience, it is possible that homework or exam questions may address parts of the code which your partner wrote.

Partner Problems

Please try to avoid having partner trouble. Seriously! Share your hopes before they turn into concerns, your concerns before they become problems, and your problems before they inflate into crises.

Also, in order for the course staff to help you and your partner work through issues, or for us to provide special treatment in response to serious partner problems, you *must* contact us *well before* the relevant due date. While some problems can never be truly solved, it is likely that your career after CMU will require

you to “involve management” to address issues with co-workers... if you find yourself in a situation which you can’t resolve, this will provide you with an opportunity to practice interacting with management.

One special case to avoid is coming to us a day or two before a major deadline to tell us that your partner has been ill for multiple weeks. We, and thus you, have many more options if you inform us *while* a problem is developing, as opposed to after the fact.

Handing in Assignments

All handins are electronic, usually consisting of one or more files that are to be copied to a specified directory. The writeup for an assignments will provide details about the handin procedure for that assignment. The date and time that the assignment is due will be listed clearly on the handout and will be strictly enforced.

Homework assignments are to be submitted electronically in plain text, PS or PDF format to the student’s personal handin directory. We encourage you to use the format that works best for you, e.g., that involves the least overhead. As long as we can understand what you wrote, you don’t need to worry about beautiful layout or font selection. **Please note that Microsoft Word is not a standardized data-interchange format.**

Penalties for Late Assignments

Late assignments will be docked 15% each day for the first three days. Assignments more than 3 days late will not be accepted (i.e. you will receive a zero grade), unless you have arranged for an extension *in advance* with the instructors. For example, suppose an assignment is due at 11:59 p.m. on Wed. If you hand it in between midnight and 11:59 p.m. Thursday, you will be docked 15%. If you turn it in between midnight and 11:59 p.m. Friday, you will be docked 30%. You won’t be able to turn it in at all after 11:59 p.m. Saturday.

Making up Exams and Assignments

Missed exams and assignments more than 3 days late can be made up, but only if you make prior arrangements with the instructors. However you must have an acceptable reason for doing so. It is your responsibility to get your assignments done on time. Be sure to work far enough in advance to avoid unexpected problems, such as illness, unreliable or overloaded computer systems, etc.

Appealing Grades

After each exam, homework, and assignment is graded, we will distribute grades by e-mail or AFS. You have seven calendar days from the grade distribution date to appeal your grade.

If you have questions about the grade you received on an assignment (homework or lab), you must write down your concern, attach it to a copy of the assignment, and hand it with the course secretary (note: do not forget to list your name!). This way, we can have the person who graded the original assignment do the

regrading. If you are still not satisfied, please come and visit Prof. Eckhardt. If you have questions about an exam grade, please visit Prof. Eckhardt directly.

Final Grade Assignment

Each student will receive a numeric score for the course, based on a weighted average of the following:

- **Projects:** The assignments will count a combined total of 45% of your score. The exact weighting of the different assignments will be determined near the end of the course based on our perception of the relative effort required. In any case, each project will count 15–20% of your score. Since small differences in scores can make the difference between two letter grades, you'll want to make a serious effort on each assignment.
- **Homeworks:** These will count a combined total of 15% of your score. Each one will be worth 2–4% of your score. Note also that doing these assignments carefully will be very helpful in preparing for the exams.
- **Exams:** There will be a midterm, counting 15%, plus a final, counting 25%, of your score.

Grades for the course will be determined by a method that combines both curving and absolute standards. The total score will be plotted as a histogram. Cutoff points are determined by examining the quality of work by students on the borderlines. Passing the course requires a passing grade on both the projects and the exams. Individual cases, especially those near the cutoff points, may be adjusted upward or downward based on factors such as attendance, class participation, improvement throughout the course, final exam performance, and special circumstances. Grades will not be “strictly curved” in the sense of there being a target number of A's, B's, etc.

Cheating

The second and third project assignments allow collaboration, but only with the other member of your project group. Each project must be the sole work of the group turning it in. Assignments will be closely monitored by automatic cheat checkers, and students may be asked to explain any suspicious similarities. For each project, we will check for similarities with projects handed both this semester and in earlier semesters. The following are guidelines on what collaboration outside of your group is authorized and what is not:

What is Cheating?

- *Sharing code or other electronic files:* either by copying, retyping, looking at, or supplying a copy of a file.
- Copying code from previous terms or other places that are not explicitly authorized in the project description.
- *Sharing written assignments:* Looking at, copying, or supplying an assignment.

What is NOT Cheating?

- Clarifying ambiguities or vague points in class handouts or textbooks.
- Helping others use the computer systems, networks, compilers, debuggers, profilers, or other system facilities.

Be sure to store your work in protected directories. With the Andrew File System, the default when creating a new directory is typically to make it readable by a large number of people. You must explicitly remove permissions to make your directory private.

The usual penalty for cheating is to be removed from the course with a failing grade. We also report cheating incidents to the Dean of Students. This causes a record of the incident to be placed in the student's permanent record.