CS 6480: Advanced Computer Networks

Administrative Details and Syllabus
Fall 2023
Syllabus and schedule is preliminary and subject to change.

August 8, 2023

Course Information

Description. CS 6480 is a graduate level course on computer networking with a systems-research emphasis. The course involves a taught component, two lab assignments and a term course project. The taught component of the course will focus on advanced networking topics, largely by studying research papers related to trends and emerging topics in computer networking. Topically the course will touch on a broad range of topics including network function virtualization and network programmability, mobile and wireless networks, networked systems and network security, and network management and measurement. The lab assignments will be broadly focused on network programmability and with a specific aim of providing hands-on exposure to networking software stacks. The two lab assignments will respectively deal with network orchestration and radio access network programmability. Term course projects will be expected to address a real networking problem and to form the basis for a possible conference/workshop paper or poster submission. Projects will be chosen from a wide range of networking related topics and can include analysis, measurement, simulation or implementation.

The course is suitable for Masters and PhD students (and strong undergraduate students) wishing to gain hands-on exposure to network systems and/or students wanting to explore or engage in networking related research.

Objectives. There are three objectives for this course. First is to give students hands-on exposure to cutting edge networking and systems technologies in the context of a number of different tools/environments that might be used for networking and systems research. Second is to introduce students to emerging networking research and technology trends by studying networking and systems research papers. Third is to give students a flavor of networking research by having them engage in a small research project.

Prerequisites. B- or better grade for CS 4480, or instructor permission. (In essence this implies mastery of basic computer networking topics such as those covered in: *Computer Networking: A Top-Down Approach (7th Edition) by James F. Kurose and Keith W. Ross, Pearson.*, or earlier versions of the book.)

Instructor. Prof. Kobus Van der Merwe. *Email:* kobus@cs.utah.edu. *Office:* 3490D MEB.

Meetings. The course is designated as **In Person** on a Monday/Wednesday class schedule. Specifically our regular meeting time is on **Mondays and Wednesdays from 4:35-5:55 PM in WEB L126**. Additional meetings will be arranged during the course of the term for the instructor and/or mentors to meet with project groups. **Class attendance is required for the course.**

Course Materials

Textbook. We will not be using a textbook for this course, in stead relying on papers and online resources. A useful reference textbook is *Computer Networking: A Top-Down Approach (7th Edition)* by James F. Kurose and Keith W. Ross, Pearson.

Website. The course public website is `http://www.eng.utah.edu/~cs6480/`. In Canvas the course is at `https://utah.instructure.com/courses/884883`. We will use Canvas as the primary course information repository, including lecture schedule, assignments, links to course handouts etc.

Lecture notes and supplementary material. The instructor will make use of supplementary materials, including slides and other materials. Material used during lectures will be posted in Canvas following the lecture. However, such documents may not completely represent the material covered in the class.

Student Evaluation

Grading. Grading for the course will be based on: Course Project (30%), Project Presentation (10%), Lab Assignments (25%), Homework Assignments (25%), and Course Participation (in class and on Canvas) (10%). (This breakdown is subject to change.)

Scale for assigning letter grades. 100-93 → A, 92-90 → A-, 89-87 → B+, 86-83 → B, 82-80 → B-, 79-77 → C+, 76-73 → C, 72-70 → C-, 69-67 → D+, 66-63 → D, 62-60 → D-, 59-0 → E.

Appeals. *Students who wish to appeal a grade must do so within one week of receiving the grade.*

Submitting assignments. All written assignments will be submitted through Canvas.

Late submissions. No late submissions will be allowed.

Lab assignments. There are two goals associated with the lab assignments. The first is to give students some experience with "tools" that are useful in networking and systems research. The second is to give students hands-on exposure to some of the focus areas of the course.

Two equally weighted lab assignments are currently planned: (i) Network Function Virtualization. (ii) Radio Access Network programmability.

Homework assignments. "Default" homework assignments will consist of (a) summaries of papers assigned for reading and (b) summaries of class discussion of those papers. These default homework assignments will be due in a two step process as follows: First, summaries of papers are due *before* the class in which the paper is discussed. Second, the summary of the class discussion of the paper will be due before the next scheduled class. A LaTeX template will be provided for these assignments.

The purpose of these default homework assignments is for **you** to develop an understanding of the technologies, systems, protocols etc., involved, to make associations with related work in the area and, critically, to explore and develop possible future work ideas. I.e., in a nutshell, to experience and develop a "research workflow". As such, **the homework summaries should reflect your understanding of the paper**. It is not acceptable to turn in a summary if you have not made an honest effort to read the paper. Nor is it acceptable to simply copy text from the paper to make up your summary, or to copy responses from generative AI tools such as ChatGPT.[1] Note that we will discuss and explore use of tools like ChatGPT as part of a research workflow in class.

[1] At this point acceptable use of generative AI tools in research is still a "developing" topic. E.g., see statement and references from the UofU VPR office: `https://integrity.research.utah.edu/ai-research-statement.php`.

Other homework assignments will be posted in Canvas as needed.

Course projects. Course projects present a significant part of the course. Projects should address a significant networking problem and be done in groups of two. Individual projects or groups of no more than three will also be allowed with instructor permission. In the latter case the scope of the problem being addressed will be expected to be adjusted proportionally. A list of possible projects will be made available for students to choose from. The list will take the form of a brief project description, some pointers to start exploring related work and the names of individuals willing to act as mentors for the project. Mentors are typically the originators of the idea and students are expected to meet with them during the execution of the project.

With instructor approval, students can also suggest and work on their own project ideas.

The final project deliverable will be a short paper in conference/workshop style that, as a minimum, presents a clear problem definition and motivation, related work, proposed solution and some initial results and/or steps towards a solution. As such the project report paper should be suitable for submission to a workshop or a poster session at a conference. While actual submission of the project work to a workshop or conference is not a requirement, the paper should be written to "fit" an actual workshop or conference call for papers (CFP).

Finally, at the end of the semester each project group will be expected to briefly present their project in class.

Getting Help

Instructor office hours. Instructor will have regular weekly office hours. (Which will be posted in Canvas.) Additional office hours are available by appointment. (Please send email to the instructor to schedule a meeting.)

Communication. For questions outside of class, students are encouraged to use email or the Canvas discussions function. If your question is of a general nature, i.e., something that your fellow students might benefit from knowing, or might be able to answer for you, please make use of the Canvas discussions function. Otherwise, please feel free to send email to the instructor.

The instructor will also use Canvas to send urgent messages to the class (e.g., corrections to assignments or changes in due dates etc).

Course Guidelines

Behavior in class. Students are expected to maintain professional behavior in class according to the University of Utah Student Code, which is available here:

`http://www.regulations.utah.edu/academics/6-400.html`

Students should read the Code carefully and know what their responsibilities are. According to Faculty Rules and Regulations, it is the faculty responsibility to enforce responsible classroom behavior, beginning with verbal warnings and progressing to dismissal from class and a failing grade. Students have the right to appeal such action to the Student Behavior Committee.

Working together. Students are encouraged to discuss assignments with fellow classmates, however, each student is responsible for completing his/her own assignment. *Cheating is:* sharing code or other electronic files either by copying, retyping, looking at, or supplying a copy of a file. *Cheating is not:* discussing concepts, answering questions about concepts or clarifying ambiguities, helping someone understand how to use the computer systems or basic tools (e.g., using the POWDER platform), or helping with high-level design issues or general debugging.

Except when explicitly designated otherwise, each assignment is to be done individually. For all assignments, the solution submitted by each student will be checked against the solutions of other students for anomalies. If an anomaly is found that cannot be explained satisfactorily, the students involved will fail the course.

Academic Misconduct and Use of Generative AI. It is expected that students will adhere to generally accepted standards of academic honesty, including but not limited to refraining from cheating, plagiarizing, misrepresenting one's work, and/or inappropriately collaborating. This includes the use of generative AI tools without citation, documentation, or authorization. Students will also be expected to adhere to the prescribed professional and ethical standards of the profession/discipline for which the student is preparing. Any student who engages in academic dishonesty or who violates the professional and ethical standards for the profession/discipline for which the student is preparing, may be subject to academic sanctions as per the University of Utah's Student Code :

`https://regulations.utah.edu/academics/6-410.php`

Students are required to adhere to the School of Computing academic misconduct policy, which is available here:

`https://www.cs.utah.edu/undergraduate/current-students/policy-statement-on-academic-misconduct/`

Any student found cheating will fail the entire course.

College of Engineering guidelines. Information on withdrawing from courses, appealing grades, and more, see the College of Engineering Academic Affairs website:

`https://www.price.utah.edu/students/academic-affairs`

Students with disabilities. The University of Utah seeks to provide equal access to its programs, services and activities for people with disabilities. If you will need accommodations in class, please follow instructions from the Center for Disability and Access website:

`https://disability.utah.edu`

The center will work with you and the instructor to make arrangements for accommodations.

Syllabus

Below are the key topics we plan to cover in this course and the approximate number of lectures planned for each.

Getting Started (2 lectures)

- Course overview, administrative details.
- Course project: Expectations and possible project topics.
- How to read a paper.

Network Function Virtualization, Network Programmability (8 lectures)

- Containers//Microservices//Network Function Virtualization//Network Orchestration
- Software defined networking//Data plane programmability
- Research topics on network function virtualization and network programmability
- Lab Assignment 1: Network Function Virtualization

Network Architectures and Protocols (8 lectures)

- Mobile network architecture//Radio Access Network programmability
- Research topics on network architectures and protocols
- Lab Assignment 2: Radio Access Network programmability

Network Measurement and Management (8 lectures)

- The need for network measurement and management.
- Research topics in network measurement and management.

Project presentations (2 lectures)

- In class project presentations.