Computer Science 6650 Scalable Distributed Systems

Graduate Course, Khoury College of Computer Sciences
Northeastern University,
Spring 2026 Semester

We acknowledge that the land on which we gather is the unceded territory of the Coast Salish Peoples, including the territories of the xʷməθkʷəy̓əm (Musqueam), Sḵwx̱wú7mesh (Squamish), and səlilwətaɬ (Tsleil-Waututh) Nations.

Instructor: Yvonne Coady (m.coady@northeastern.edu)
Office Hour: 3-4pm Pacific Time Mondays
(Teams link on Canvas!)

Teaching Team: Additional mock interviews will be scheduled with:
Hazel Chen (chen.zihe@northeastern.edu)
Mansi Modi (modi.mans@northeastern.edu)

Covers the essential elements of distributed, concurrent systems and builds upon that knowledge with engineering principles and practical experience with state-of-the-art technologies and methods for building scalable systems. Scalability is an essential quality of internet-facing systems and requires specialized skills and knowledge to build systems that scale at low cost.

NOTE: as an asynchronous online course, we do not meet in a group, but all materials are available on Canvas. All students are expected to view any/all videos and references, and attend mock interviews weekly as scheduled. You should allocate a **minimum of 20 hours a week for this course**. There are many challenges in setting scalable software up on a cloud, and giving yourself enough time is absolutely key!

Course Outcomes

- Exhibit proficiency in the design, implementation of scalable system software.
- Demonstrate the ability to systematically test and analyze system infrastructure software.
- Read, discuss, and extract key ideas from both theoretical and applied research papers published at computing conferences.

Recommended resources (there is no textbook for the course, but these are epic!)

- Distributed Systems for Fun and Profit, Mikito Takada, (online)
- Building Microservices, 2nd Edition, Sam Newman and Associates (online)
- Designing Data-Intensive Applications: The Big Ideas Behind Reliable, Scalable, and Maintainable Systems, Martin Kleppmann, O'Reilly 2017

Course Schedule (subject to adjustment!)

Week	Work Due (by Monday 9AM)	% of Grade	Topics
1	-	-	*Introduction and Fundamentals*
2	**Homework 1**	**5%**	*Containers and Concurrency*
3	**Homework 2**	**5%**	*Architecture and Infrastructure*
4	**Homework 3**	**5%**	*Fundamentals of Distributed Systems*
5	**Homework 4**	**5%**	*Scalable Service Design*
6	**Homework 5**	**5%**	*Load Testing and Threads*
7	**Homework 6**	**5%**	*Project Proposals*
8	**Midterm Mastery**	**15%**	*Tradeoffs in Scalability*
9	**Homework 7**	**5%**	*Asynchronous and Serverless Systems*
10	**Homework 8**	**5%**	*Deployment and Observabiltiy*
11	**Homework 9**	**5%**	*Replication, Partitioning, Consistency*
12	**Homework 10**	**5%**	*Tradeoffs with Data Storage*
13	**Final Mastery**	**15%**	*Practical Considerations*
14	**Final Project Due**	**20%**	*Poster, Presentation, Report*

Course Assessment

There are four methods of assessment in this course.

- **Homework (50%)** consist of assignments and reviews that will enable you to do a "deep dive" into each part of your project. Assignments will be reviewed in mandatory "mock interviews", conducted weekly with the teaching team.

- **Midterm and Final Masteries (30%)** will be a presentation of the work you have done so far, identifying any obstacles you may have encountered. This will include a detailed interview involving your code and your understanding of the concepts involved.

- **Final Project (20%)** work includes a project proposal, a written report, several presentations and a final presentation on the last day of the course. Your final deliverable will include a poster, a blog report/paper, your code repository and a presentation.

We will use the following scale to convert numerical scores into letter grades:

A	93.00% – 100.00%
A-	90.00% – 92.99%
B+	86.00% – 89.99%
B	82.00% – 85.99%
B-	77.00% – 81.99%
C+	73.00% – 76.99%
C	69.00% – 72.99%
C-	65.00% – 68.99%
F	Less than 65.00%

Course Pedagogy

Your time in mock interviews will be devoted to small groups, and Team Based Learning activities. In Computer Science, we seldom get anything right on the first try. We see how an attempt turned out, and we try again. Often, any solution to a problem has a series of trade-offs, all of which must be considered! Our activities will reflect this approach as well; so please be prepared to present and discuss your solutions, even if you're not sure that your answer is "right"!

When you come to an interview, we ask that you be fully present. No phones are permitted in the interviews. Your camera must be on at all times. Please be respectful of your fellow students and teaching team by participating attentively and non-disruptively.

To create and preserve an atmosphere that optimizes teaching and learning, all participants share a responsibility in creating a civil and non-disruptive forum for the discussion of ideas. Students are expected to conduct themselves at all times in a manner that does not disrupt the group. Your comments to others should be constructive and free from harassing statements.

In order for this course to be a meaningful learning experience, you will need to come to each interview well-prepared, with all assigned readings and videos complete, as well as your individual work finished to the best of your ability. This emphasis on pre-interview work is the reason why our interviews are only 1 hour each week. If you do not complete the pre-interview work, you will have a hard time following and contributing, which will make it that much harder for you to successfully complete the course. Please be prepared to spend a minimum of 20-25 hours per week on this course!

Course Forum

We have a **Canvas** page, on which we will post all assessments, class materials, pre-class readings, pre-class videos, and grades. We will also use **Piazza** for forum postings. The AWS Learner Lab is also used for assignments and coding.

Textbook: Students are not required to purchase a textbook for this course, but many resources will be posted on Canvas. While these are not the only resources available on the web, these are the ones that I will be assigning and have identified as being most useful to students. I also encourage students to share resources that they find useful so that we can (if appropriate) add them to this list.

Course Discussions: Canvas and Piazza will be used for class discussion and course announcements. It also provides students with a platform for getting you help fast and efficiently from classmates. Rather than emailing questions, please consider posting your questions on Piazza.

Course Policies

Accommodations

The goal is that every student should be able to participate in this course. If you require any special accommodations, let me know immediately so that we can work out appropriate arrangements.

Students who have disabilities who wish to receive academic services and/or accommodations should visit the Disability Access Services (DAS) (https://disabilityaccessservices.sites.northeastern.edu/) or call (844) 688-6287.

If you have already done so, please provide your letter from the DAS to the instructor early in the semester to arrange those accommodations.

Attendance and Participation

It is expected that you attend every interview and participate. If you must miss an interview for any reason (e.g., illness, family emergency, religious observance), contact your instructor by email. Regardless of the reason, it is your responsibility to catch up on the material you have missed, and obtain the notes from a group member.

Students who are absent repeatedly from interviews will be evaluated to ascertain their ability to achieve the course objectives and to continue in the course.

Assessments

All assessments that must be uploaded are due at **9AM** on Monday. The course assessments are due before interviews so that you have time to *prepare to present to your TA*, and complete all of the readings in preparation for the next interview.

Late Penalties

Any assessment that is late will be subject to a 50% penalty. You are allowed *one* exception to this policy, where you are allowed a reasonable extension to any assessment, with no penalty, provided you have a doctor's note or some other compelling reason. Additional exceptions will only be given under extenuating circumstances. Note that the Late Penalty only applies to Homework.

Scheduling Meetings

At any time during the course, if you have any concerns, contact me by email, and we will set up a one-on-one meeting at a mutually convenient time.

Technology

We are **not** holding the class remotely, as it is an "asynchronous" offering, but a Teams link for office hours has been posted. Teams links for mock interviews have also been posted.

AI Tools

In this course, you will undertake a project that demonstrates your expertise in software and community partnership. We recognize the role that AI tools play in advancing productivity and aiding the writing process, and as such, you are encouraged to leverage these tools to enhance your work. AI tools, including but not limited to ChatGPT, can serve as valuable aids in generating ideas, refining arguments, and providing insights. However, it's important to

emphasize that these tools should be used to support your efforts, *not replace* them. While AI can help, your unique intellectual contributions are crucial to the success of your project. We invite you to actively explore and experiment with AI tools, and we encourage you to share innovative ways to leverage these tools with your peers. In particular, we expect to discuss exactly when these tools fail, and the ramifications of using them recklessly!

Mock Interview Conduct

To create and preserve an atmosphere that optimizes teaching and learning, all participants share a responsibility in creating a civil and non-disruptive forum for the discussion of ideas. Students are expected to conduct themselves at all times in a manner that does not disrupt teaching or learning.

Specifically, all students will do the following when they enter a mock interview:

- Turn off ALL notifications on your phone and your computer
- Put your phone away (e.g. in your bag) so that it is not visible to you
- On your computer, close all apps that you do not need to be sharing

Your comments to others must be constructive and free from harassing statements. You are encouraged to disagree with other students and the instructor, but such disagreements need to respectful and be based upon facts and documentation, rather than prejudices and personalities. The TA reserves the right to interrupt conversations that deviate from these expectations.

Repeated unprofessional or disrespectful conduct may result in a lower grade or more severe consequences.

Title IX Policy

Northeastern University and its faculty are committed to creating a safe and open learning environment for all students. If you or someone you know has experienced discrimination (including discrimination based on sex, gender, gender identity, gender expression, sexual orientation, pregnancy or pregnancy related condition, race, religion, national origin, disability status, veteran status etc.), or sexual violence (including sexual harassment, sexual assault, dating/domestic violence, or stalking), please know that help and support are available. Northeastern strongly encourages all members of the community to take action, seek support, and report incidents of discrimination, harassment, and sexual violence to the Office for University Equity and Compliance (OUEC) through the Online Reporting Form.

Please be aware that faculty members are Mandatory University Reporters who are required to disclose information about alleged discrimination, harassment, and sexual violence to the OUEC. If the OUEC receives a report, a member of their office will reach out to offer information about available rights, support resources and pathways towards a resolution as a member of the campus community. Community members are not required to respond to this outreach.

If you, or another community member you know wishes to speak to a confidential resource who does not have this reporting responsibility, please contact any of the following confidential resources. These confidential resources are not required to report allegations of discrimination to the University without your signed release.

- Find@Northeastern: Offers 24/7 mental health support via phone at 877.233.9477 (in the U.S.) or +1.781.457.7777 (outside the U.S.).

- Sexual Violence Resource Center: The SVRC provides confidential, trauma-informed support services to Northeastern students who have experienced any form of sexual violence (i.e., sexual assault, sexual harassment, sexual exploitation, domestic/dating violence, and/or stalking). Request services online at bit.ly/svrequestform.
- Confidential Resource Advisor: The CRA provides confidential, restorative informed support services to Northeastern students who have been accused of sexual or identity-based harm. Request services online at bit.ly/svrequestform.
- Pregnant / parenting students: Please know that the OUEC, housing the University's Title IX Coordinator, can work with students who are pregnant and/or parenting to ensure they have equal access to education programs and activities. For additional support, please contact OUEC (ouec@northeastern.edu).

Please visit ouec.northeastern.edu for a complete list of reporting options and support resources both on- and off-campus and contact the OUEC (ouec@northeastern.edu) at any time.

Wellness and Mental Health Support

As a graduate student, you may experience a range of challenges including significant stress, difficult life events, mood changes, excessive worry, or problems with eating and/or sleeping. If you or anyone you know is struggling, we strongly encourage you to seek support.

Northeastern University provides several services and resources to support the overall wellness of students. To access support, you can book a Wellness Consultation with a Wellness Program Specialist. During this session, you can discuss your concerns and receive guidance on the next steps, along with access to resources that promote mental health and overall well-being.

Students in need of immediate support can access Find@Northeastern for free 24/7 mental health support at 855.229.8797 (Canada) and +1.781.457.7777 (International) or Here2Talk, a free 24/7 counselling service for all post-secondary students in BC at: 604-642-5212 or toll free at 1-877-857-3397.

Collaboration and Academic Honesty

Computer science, both academically and professionally, is a collaborative discipline. In any collaboration, however, all parties are expected to make their own contributions and to generously credit the contributions of others. In our class, therefore, collaboration on assessments is encouraged, but you as an individual are responsible for understanding all the material in the assignment and doing your own work. Always strive to do your best, give generous credit to others, start early, and seek help early from both you professors and classmates.

The following rules are intended to help you get the most out of your education and to clarify the line between honest and dishonest work. The professor reserves the right to ask you to verbally explain the reasoning behind any answer or code that you turn in and to modify your project grade based on your answers. It is vitally important that you turn in work that is your own.

If you have had a substantive discussion of any assessment (homework) with a classmate, then be sure to cite them in your report. If you are unsure of what constitutes “substantive”, then ask us or err on the side of caution. You will not be penalized for working together. You must not copy answers or code from another student either by hand or electronically. Another way to think about it is that you should be talking English with one another, not code. The following rules apply to anything you hand in for a grade.

- You may not copy anyone else's code or solution under any circumstances. This includes online sources.
- You may not permit any other student to see any part of your program or solution.
- You may not permit yourself to see any part of another student's program or solution.
- You may consult online resources as part of your course work, but you may not copy code or solutions from online sources. If you get an idea of how to solve a programming problem from an online source, include a short citation in a code block at the top of your code file.

As with all other courses at Northeastern, you are expected to adhere to the university's academic integrity policy (https://osccr.sites.northeastern.edu/academic-integrity-policy/).

If you are unsure about the plagiarism policy, **please ask me!**

Feedback

Feedback is always welcome!

Your opinions are very important to us. All students are strongly encouraged to use the Teacher Rating and Course Evaluation (TRACE) system, at https://www.northeastern.edu/trace/, to complete your course evaluations. A reminder about TRACE should arrive via email about two weeks before the end of the course.

Thank you for taking this course, and entrusting us to shape your education here at Northeastern. I am SO excited to serve as your instructor for your BSDS class!