CSCI2952-F: Distributed Systems at Scale: Microservices Management

Fall 2022

Instructor:	Theophilus A. Benson	**Time:**	Mon 3:00 - 5:30
Email:	tab@cs.brown.edu	**Place:**	ZOOM

Course Pages:

1. http://cs.brown.edu/courses/csci2952-f

Office Hours: After class, or by appointment.

Course Description This course investigates and explores an emerging paradigm for enabling distributed systems and applications at scale, Microservices. In particular, this course builds on the foundations provided by the initial distributed systems offering (i.e., CSCI 0138) and explores how these concepts are used to realize, manage, and orchestrate microservices.

Course Objectives The fundamental objective of this class is to broadly expose students to cutting edge concepts in cloud computing and microservices while simultaneously preparing students to think critically, write scientific reports, and create convincing arguments.

To this end, students will learn to read, discuss, and analyze research papers. Additionally, students will engage in hands-on execise to better understand opensource software and platforms used within the microservices ecosystem. This will take the form of (a) seminar style discussions, (b) invited lectures from industry experts, and (c) group activities. Collectively, these activities will lay the foundation for the seminar long project. In this project, students will practice both the basic research activities (literature survey, problem definition, problem execution, and evaluation) and investigate the design of novel paradigm for improving microservices management.

Upon completion students should be able to:

- articulate and discuss the design insights underlying modern distributed systems and, in general, the broader space of design choices available to modern distributed systems
- demonstrate the ability to leverage this knowledge to design and create innovative new distributed systems
- develop a deeper understanding of the opensource ecosystem which supports many emerging microservices paradigms

Grading This course will consist of projects, lectures, paper readings, and discussions – each will contribute to your grades.

- Projects: 50%
- Paper Reading Summaries (Talk summaries): 15%
- Paper Presentations (Discussion leads): 10%
- Class Discussion: 15%
- Assignments: 10%

Projects and assignments will be due at 11:59pm (midnight) on the day of the deadline. Paper summaries are due at 11:59am (noon) the day before class. Late summaries will not be accepted.

Extra-Credit There will be extracredit. To do this student will need to focus on (1) enhance a complex services to leverage patterns and combinations of dataplane approaches, or (2) writing a CSUR-style survey paper.

Workload In general, students should be prepared to spent 10-15 hours each week on readings and assignments. The course project will require an additional 10 hours each week and this will begin after the third week. In general students can expect to spent over 220 hours on this course. While the course may initially start out demanding fewer hours, towards the middle it ramps up. Distributed systems, as with most systems, is time consuming because you are designing massive systems with high levels of concurrency and complex interactions.

Late Policy For the reading summaries, there are no late days. You are allowed to miss four of these assignments. Whereas, for the project milestones and assignments, you are given a collective of three free late days. After that, each late day results in a loss of 10%.

Collaboration Policy In general, research is collaborative in nature. A key part of this seminar class requires student to engage in discussion and exchange ideas or to explore outside resources to explore and survey ideas. In part due to this collaborative nature, a clear collaboration policy is essential to avoid any miscommunication.

- **Writing Assignments:** All submitted documents but be fully created by the student. Although we encourage discussions and encourage students to use the internet for additional classification or to better understand other emerging aspects of the general space, ultimately, we require them to submit and write their own original text. Student are not to copy text, images, or other content.
- **Project:** While student may use libraries to providing supporting functionalities, they are required to write original code providing the core functionality and logic.
- **Groups or Individual:** The paper summaries and scribe notes should be written individually. Whereas the project milestones are meant to be accomplished in pre-defined groups of twos or threes.

Textbook

There is no textbook for this class. The papers are online and can be optionally accessed through ACM's digital library.

Assignments

HW #1 (Deep Dive Into Industrial Usecases). .....
HW #2 (Deep Dive into Problems (Performance issues/outages)). .....
HW #3 (Deep Dive into eBPF/Observability). .....
HW #4 Deep Dive into Kubernetes Extensions. .....

Project Milestones

Group Selection #1 ..... Week 4
Project Proposal #2 ..... Week 6
Project MidPoint Checkin #2 ..... Week 10
Project Presentation ..... Last Class
Project Workshop Writeup ..... End of Reading Period