SFWE 410/510: Cloud-native
COURSE SYLLABUS

Course Description

Design and implementation of distributed systems based on a cloud-native approach with up-to-date software architecture and relevant development frameworks. Topics include inter-module communication, asynchronous processing, security, concurrency, parallelism, and an overview of contemporary enterprise technology and challenges.

Course Prerequisites

Advanced standing and successful completion of SFWE 405/505 or CSE/CS equivalents that teach Spring framework and RestAPI, and capbility to

- write an enterprise program in Java EE/Spring
- connect to a database over JPA
- develop applications in Maven, Eclipse, or IntelliJ IDEA
- use JUnit and Git

.

Instructor and Contact Information

Instructor Name: Tomas Cerny
Email: tcerny@gmail.com
Office: Old Engineering Blg 122
Office Hours: TBD

Appointments can be made outside of normal office hours by contacting the instructor(s) to schedule a time that is mutually convenient.

Course Objectives

During this course students will:

1. Design and implementation of distributed systems based on a cloud-native approach with up-to-date software architecture and relevant development frameworks.
2. Explore topics that include inter-module communication, asynchronous processing, security, concurrency, and parallelism.
3. Complete an overview of contemporary enterprise technology and challenges.

Expected Learning Outcomes

Upon completion of this course, you should be able to:

1) Explain the structure and benefits of microservice architecture (MSA).
a. [ABET Student Outcomes 1,2 and 7]
2) Describe and follow the latest standards for enterprise system development and design.
a. [ABET Student Outcome 6]
3) Employ advanced software engineering techniques in the construction of distributed systems.
a. [ABET Student Outcome 1,2]
4) [Graduate student only] Teach your peers a new technology or framework you experimented with and assess their capability to use it and basic knowledge

Textbooks & Software

Required Textbooks (2)

- Carnell, J., & Sánchez, I. H. (2021). *Spring microservices in action* (2nd ed.). Manning Publications.

Course Outline

- Week 1: Introduction to Microservices
- Week 2: Developing Cloud Native Applications
- Week 3: Microservice Architecture and Microservice Development
- Week 4: DevOps And Docker
- Week 5: Spring Cloud Configuration
- Week 6**: Learning Assessment and Project Review I**
- Week 7: Service Discovery
- Week 8: Resiliency
- Week 9: API Gateway
- Week 10: Microservice Security
- Week 11: **Learning Assessment and Project Review II**
- Week 12: Event-Driven Architecture With Spring Cloud Stream
- Week 13: Log Aggregation And Spring Cloud Sleuth
- Week 14: Deploying Microservices
- Week 15: **Final Exam**
  Comprehensive in-class test - date to be found at **Final Exam Regulations and Schedule**.

Course Schedule

Course Schedule		
Week	**Readings and Learning Activities**	**Evaluated Assignments Due**
1	• Spring Microservices in Action, Chapter 1 • Contextual understanding of microservice architecture: Current and future directions • Lesson 1.1: Introduction to Microservices	• Assignment 1.1: • Open Forum 1.1 • Quiz 1.1: Chapter 1
2	• Spring Microservices in Action, Chapter 2 • The Twelve-Factor App • Lesson 2.1: Developing Cloud Native Applications	• Assignment 2.1: • Open Forum 2.1 • Quiz 2.1: Chapter 2
3	• Spring Microservices in Action, Chapter 3 • Detection in Microservices Through Static Analysis: A Case Study • Lesson 3.1: Microservice Development	• Assignment 3.1: • Open Forum 3.1 • Quiz 3.1: Chapter 3 ○
4	• Spring Microservices in Action, Chapter 3 (DevOps) • Spring Microservices in Action, Chapter 4 • Lesson 4.1: DevOps and Docker	• Assignment 4.1: • Quiz 4.1: Chapters 3 and 4
5	• Spring Microservices in Action, Chapter 5 • Lesson 5.1: Spring Cloud Configuration	• Assignment 5.1: • Quiz 5.1: Chapter 5
6	• Review assigned readings for Weeks 1–5.	• Semester Project Checkpoint 1 • Quiz 6.1 • Midterm Exam I
7	• Spring Microservices in Action, Chapter 6	• Assignment 7.1

	• Lesson 7.1: Spring Cloud Configuration	• Quiz 7.1: Chapter 6
8	• Spring Microservices in Action, Chapter 7 • Lesson 8.1: Resilience	• Assignment 8.1: • Quiz 8.1: Chapter 7
9	• Spring Microservices in Action, Chapter 8 • Lesson 9.1: API Gateway	• Assignment 9.1 • Quiz 9.1: Chapter 8
10	• Spring Microservices in Action, Chapter 9 • Lesson 10.1: Microservice Security	• Assignment 10.1: • Open Forum 10.1 • Quiz 10.1: Chapter 9
11	• Review Weeks 1–10 reading and viewing materials.	• Semester Project Checkpoint 2 • Midterm Exam II
12	• Spring Microservices in Action, Chapter 10 • Lesson 12.1: Event-Driven Communication	• Assignment 12.1 • Quiz 12.1: Chapter 10
13	• Spring Microservices in Action, Chapter 11 • Lesson 13.1: Distributed Tracing	• Assignment 13.1: • Quiz 13.1: Chapter 11
14	• Spring Microservices in Action, Chapter 12 • Lesson 14.1: Deploying Microservices	• Assignment 14.1 • Assignment 14.2 • Semester Project Checkpoint 3 • Quiz 14.1: Chapter 12
15	• Review Weeks 1–14 reading and viewing materials.	• Final Exam

Required Software

You will either need to install or create an account for the following software – links and instructions are available in the ***Start Here*** module of the D2L course site.

- **Integrated Development Environment (IDE) -** You will need a Java IDE of your choice for code development.
- **PostgreSQL** – Install PostgreSQL.
- **VisualParadigm -** Install community edition.

Assignments and Examinations

Homework

There will be regular homework assignments on the topics covered each week, with approximately 14 homework assignments to be completed individually (not on a team basis). There will also be module-based discussion board prompts that each student is required to participate in and will be graded for.

Presentation demo [graduate students only]

A presentation demo will align with the textbook and the topics it covers. Each student will pick a chapter and present the chapter demo of running examples from the book. The student is in charge of assignments for other students, including grading them.

Semester Project

The team project is expected to be aligned to the topic leading to decentralized system development or research in related domains resulting in a submitted research paper. Students are allowed to use libraries, tools, and other JARs, it must be Maven-based, tested with JUnit tests, and use GIT from the beginning.

Team Component - The semester project is a team-based project. Teams will be formed consisting of 4-5 students. Each team will be given a high-level software product description and a preliminary list of system-level requirements. The team must develop a middleware connected to the database, providing REST API and automated testing infrastructure. There will be three iterations when the team defends their project progress accomplishments.
Individual Components - In addition to the team portions of the project, you will be required to write a 2-page individual reflection of your experience working on the team, developing the requirements and test plan for the product the team was given, and also any lessons learned that you personally had working on the project.

Team Participation (part of the Individual Components) - Over the course of working on the semester team project, you will be required to individually submit 3 team evaluations for all deliverables for the semester project. Every team member is expected to contribute equally to the project (measured by GIT version control). If there are team dynamics that are preventing a collaborative working environment, it is best to inform the instructor ahead of time so that adjustments can be made to facilitate effective teaming and communication amongst the team. ***Your individual final team project grade will be factored by the average score of all team members' inputs from these evaluations and the measurable contributions to the project (i.e., git history, verbal or written reports from other team members). Failure to submit a team evaluation will result in the loss of 10 points from your personal team semester project score***.

Project iterations (each includes a team presentation)

Iteration 1 (5 points)

30% of the project

Iteration 2 (5 points)

30% of the project

Iteration 3 (10 points)

40% of the project

Knowledge Checks

There might be online quizzes, and knowledge check questions with the completion of each module. There will be approximately eight knowledge checks that will be factored into your grade. Knowledge checks are an individual assessment of your understanding of the concepts and knowledge covered in a given module.

Midterms/Exam

There will be three midterms/exams. All will be comprehensive and timed, administered by a proctor in the classroom or online (for online students), and will be available during the class or regularly scheduled exam time. Online students will be provided with information on how to access the exam on the specified date in the course calendar. ***Note: The instructor will give students ample notice of the format, time, and any resulting stipulations about where and how the exam will be administered.***

Grade Distribution, Scale & Policies

The grading distribution for course assignments is as follows:

Assignments/Labs:	25% (20% for grads)
Topic presentation (grad only)	5% (grads only)
Knowledge Checks/Quizzes:	5%

Midterm I:	15%
Midterm II:	15%
Exam:	20%
Semester Project (see semester project for details):	20%
Total	**100%**

Grading Scale

The following scale will be used to award final grades for undergraduate students.

A	90-100%
B	80-89%
C	70-79%
D	60-69%
E	less than 60%

The following scale will be used to award final grades for graduate students.

A	92-100%
B	84-91%
C	76-83%
D	68-75%
E	less than 68%

Incomplete (I) or Withdrawal (W):

Requests for incomplete (I) or withdrawal (W) must be made in accordance with University policies, which are available at http://catalog.arizona.edu/policy/grades-and-grading-system#incomplete and http://catalog.arizona.edu/policy/grades-and-grading-system#Withdrawal respectively.

Student Appeals Policy

The instructor will make every attempt to provide timely feedback on all assignments, knowledge checks, exams, and projects.

You can dispute any grade that you receive within three days days from the time the grade was awarded. If you feel that you have received an unfair assessment of your performance on any given homework assignment, knowledge check, exam, or final project, please reach out to the course instructor either in person, via email, or over Zoom as soon as possible. Be prepared to provide substantiated claims for your dispute, including any evidence that would support a re-evaluation of your grade.

Late Work Policy

Homework/ Knowledge Checks/ Projects: All homework, knowledge checks, and elements of the semester project are due at the time that is specified in the course schedule and/or D2L content pages. *Late homework and projects will not be accepted without prior approval by the instructor and will receive 0 points.*

Exams: If a student misses a midterm/exam, the score will be calculated as an average from the other two midterms/exam. Students cannot miss more than one midterm to earn a passing grade. Please note that students must contact the instructor well in advance and provide *written* documentation for the reason that he/she will not be able to attend the regularly scheduled exam. It is up to the discretion of the instructor to accept the justification provided by the student.

Code of Academic Integrity and Honor Code

Any violation of academic integrity will result in an F in the course; students are advised to self-assess them at https://deanofstudents.arizona.edu/policies/code-academic-integrity
Plagiarism or any form of cheating involves a breach of student-teacher trust. This means that any work submitted under your name is expected to be your own, neither composed by anyone else as a whole or in part nor handed over to another person for complete or partial revision. Be sure to document all ideas that are not your own. Instances of plagiarism or any other act of academic dishonesty will be reported to the Honor Council and may result in failure of the course. Not understanding plagiarism is not an excuse. I expect you, as a University of Arizona student, to be intimately familiar with the Honor Code at
https://law.arizona.edu/sites/default/files/Honor_Code_2015.pdf
Few examples (read well):

- Using a source fragment other than the course textbook, the course website, or your professor to obtain credit for an assignment, project, or exam.
- Copying another student's work. Simply looking over someone else's source code is copying.
- Providing your work for another student to copy.
- Collaboration on any assignment, unless the work is explicitly given as collaborative work. Any discussion of an assignment or project is considered collaboration.
- Using notes or books during an exam.
- Giving another student answers during an exam.
- Reviewing a stolen copy of an exam.
- Plagiarism.
- Studying tests or using assignments from previous semesters, except when provided by the professor.
- Providing someone with tests or assignments from previous semesters.

- Taking an exam for someone else.
- Turning in someone else's work as your own work.
- Studying a copy of an exam prior to taking a make-up exam.
- Providing a copy of an exam to someone who is going to take a make-up exam.
- Giving test questions to students in another class.
- Reviewing previous copies of the instructor's tests without permission from the instructor.

Course Behavior Policy

To foster a positive learning environment, students and instructors have a shared responsibility. We want a safe, welcoming, and inclusive environment where all of us feel comfortable with each other and where we can challenge ourselves to succeed. To that end, our focus is on the tasks at hand and not on extraneous activities (e.g., texting, chatting, reading a newspaper, making phone calls, web surfing, etc.).

University Policies

Links to the following UA policies are available at, https://academicaffairs.arizona.edu/syllabus-policies:

- Absence and Class Participation Policies
- Threatening Behavior Policy
- Accessibility and Accommodations Policy
- Code of Academic Integrity
- Nondiscrimination and Anti-Harassment Policy
- Subject to Change Statement