CAS 735

(Micro)service-oriented architectures
Fall 2025

McMaster University
ENGINEERING
Computing & Software

INSTRUCTORS

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  - Office hours: by appointment, via MS Teams

GENERAL INFORMATION

CALENDAR DESCRIPTION

The design of distributed applications triggers software architectures challenges at different levels. This course will focus on the definition of "business-oriented services" at the architectural level, from their inception to their deployment into a production environment. This class aims to cover selected topics related to (micro-)service-oriented architectures, architectural patterns for distributed applications, service portfolio management and operational deployment of distributed systems. Students will be exposed to the technical dimension of such systems and state-of-the-art research in this domain. The course assumes a pre-existing knowledge of how to design and test pieces of software (e.g., undergrad course on these topics).

LEARNING OBJECTIVES

This course build upon undergrad knowledge on software engineering to properly address the challenges associated to microservices architectures. At the end of the course, students should:

- **Know and understand**:
  - How to design a system as a set of independent microservices;
  - The strengths and limitations associated to this architectural paradigm;
  - The status of the state-of-the-art in the field.
- **Be able to**:
  - Implement a set of microservices according to best practices;
  - Use state-of-practice tools to support architecture implementation;
  - Audit an existing architecture and provide recommendations for maintenance

COURSE PAGE

The course uses *Avenue To Learn* for pedagogical material:

- https://avenue.cllmcmaster.ca/d2l/home/709120

SCHEDULE

Lectures start on the second Monday of the Fall semester (September 8th), from 1:00 PM to 3:20 PM. According to McMaster's policies, lectures are "in-person" ones. Check Mosaic for room location on campus.

- Participation in class is not monitored.
  - However, attending lectures is a key factor for succeeding in the course.
- The course will not be live-streamed except for the invited lectures.
- For logistics reasons, some lectures/appointments might happen on MS Teams.
- No sessions will be video recorded.

USAGE OF GENERATIVE AI

As this course only evaluates the architectural part of the projects delivered by students, students are permitted to use AI tooling in this course, for their coding assignments only.

Examples:

- **You can use** ChatGPT or Copilot to generate the boilerplate code that connects to your database, or the dependency management configuration you are using.
- **You cannot use** ChatGPT or Copilot to design the REST interface of a service or the data structures to be used as data transfer objects between services.

In the context of CAS 735, it using tools like ChatGPT or any other tool to do software design tasks or write reports on your behalf will be treated as academic dishonesty. In alignment with McMaster academic integrity policy, it "*shall be an offence knowingly to … submit academic work for assessment that was purchased or acquired from another source*". This includes work created by generative AI tools. Also, stated in the policy is the following, "*Contract Cheating is the act of "outsourcing of student work to third parties*'" (Lancaster & Clarke, 2016, p. 639) with or without payment." **Using Generative AI tools is a form of contract cheating**. Charges of academic dishonesty will be brought forward to the Office of Academic Integrity.

TEXTBOOK AND COURSE MATERIAL

No textbook is mandatory for this course: course material (PDF version of lecture slides) will be available on the Avenue page and are sufficient for the new content covered in the course.

The following books are "recommended" books that complement the course material:

- Building microservices (Sam Newman)
- Microservice architecture (Nadadreishvili *et al*)
- The DevOps handbook (Kim et al)
- Implementing Domain-driven Design (Vaugh Vernon)
- Spring microservices in action (Carnell *et al*)

ONLINE COMPONENT & COMMUNICATION

The course uses Avenue as the main website to make available lecture material and assignments. To store code, we will use GitHub.

We will use MS Teams as the one and only communication media to support interaction between students and course staff. The MS Teams channels and direct messages will be monitored during "regular" working hours (9 AM – 6 PM, weekdays only) to respect the staff's work-life balance. The staff will try to answer your questions promptly and within a maximum of two business days.

Particularly, email communication will not be processed

To properly communicate during the course:

- If your question/comment is general and applies to multiple students, please start a conversation in the relevant public channel in the CAS 735 team;
- If your question/comment is related to your particular case, open a direct message discussion with the instructor. Based on the contents of your message, you might be redirected to a public channel.

COURSE CONTENTS

OUTLINE

The course will tentatively cover the following topics. The course focuses on two types of classroom activities: classical lectures (L), workshops (W), and demos (D)

Date	Topic	Kind
01/09/25	**Labor Day – No Lecture**	
08/09/25	Welcome to CAS 735: From Objects to (micro-)Services	*L*
15/09/25	Intro to Domain-Driven Design and Event Storming	*L; W*
22/09/25	Message-driven API: Technical Walkthrough	*L; D*
29/09/25	Designing REST APIs: Challenges & Pitfalls	*L; W*
06/10/25	Hexagonal Architectures to implement reusable services	*L; D*
13/10/25	**Reading Week – No Lecture**	
20/10/25	Dealing with Persistent data and Containerization	*L; D*
27/10/25	**Project review & demo #1 (by appointment)**	
03/11/25	Patterns for (micro-)service architectures	*L; W*
10/11/25	*Paper presentation by students*	*n/a*
17/11/25	*Paper presentations by students*	*n/a*
24/11/25	*Technical topic presentations by students*	*n/a*
01/12/25	**Project review & demo #2 (by appointment, on Zoom)**	
08/12/25	**Project finalization (unsupervised)**	

- The instructor reserves the right to modify this tentative planning during the term, especially after recess week.
- If any type of modification becomes necessary, reasonable notice and communication with the students will be given, with an explanation and the opportunity to comment on changes.

GRADING & EVALUATION

The course contains three (3) assignments: a paper presentation (30%), a project (60%), and a technical presentation (10%). 50% of the final grade is individual. Important milestones are below:

Assignment	Kind	Weight	Start date	Delivery date
Project proposal	*Group*	5%	02/09/2025	22/09/2025
Project review #1	*Individual*	20%	27/10/2025	
Paper presentation	*Individual*	30%	02/09/2025	[10|17]/11/2025
Technical Topic pres.	*Group*	10%	24/11/2025	
Project review #2	*Group*	10%	01/12/2025	
Project Delivery	*Group*	25%	23/09/2025	15/12/2025

- Assignments documents are delivered thanks to Avenue. Code is hosted on GitHub.

- Assignments are graded on a [0,100] scale.
- Deliveries are expected at 23:59 (Toronto time).
    - **As the course emphasizes principles like continuous delivery, there is no credit for deliveries handed in after the deadline**. This is non-negotiable.
- The instructor reserves the right to modify this planning during the term. If any type of modification becomes necessary, reasonable notice and communication with the students will be given, with an explanation and the opportunity to comment on changes.
- The instructor reserves the right to conduct any accommodated examination orally.

ACADEMIC INTEGRITY & PLAGIARISM[1]

You are expected to exhibit honesty and use ethical behaviour in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity.

Individual assignments must be solved by one person only, **any** outside source, including asking other people or using any books or information found on the web, **has** to be documented. In compliance with the senate regulations on academic integrity, I remind you that: **People who let other people copy are as guilty as the ones who copy.** You can consult outside sources, meaning textbooks or the web, but **any** use of an outside source **must** be documented.

Similarly, group assignments must be solved by group members only, and the University policies also apply (see "*Advisory Statements*" below).

MAPPING TO PROGRAM LEARNING OBJECTIVES

Attribute	Description	Evaluation			
		R	T	P	E
Breadth of Knowledge	The students should attain a mature understanding of their chosen subfield of computing that has significant breadth.	✓	✓		✓
Depth of Knowledge	The students should attain a mature understanding of their chosen subfield of computing that has significant depth.		✓	✓	✓
Research Project	The students should be able to independently pursue an important major research project in their chosen subfield of computing. *(PhD only: … that requires overcoming great intellectual and technological challenges)*	✓			
Communication	The students should be able to effectively communicate their work orally and in writing		✓		

[1] *Adapted from Dr. Jacques Carette outline for SFWRENG 3GB3 – Fall 2021*

ADVISORY STATEMENTS

ACADEMIC INTEGRITY

You are expected to exhibit honesty and use ethical behaviour in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity. **It is your responsibility to understand what constitutes academic dishonesty.**

Academic dishonesty is to knowingly act or fail to act in a way that results or could result in unearned academic credit or advantage. This behaviour can result in serious consequences, *e.g.* the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: "*Grade of F assigned for academic dishonesty*"), and/or suspension or expulsion from the university. For information on the various types of academic dishonesty please refer to the **Academic Integrity Policy**, located at https://secretariat.mcmaster.ca/university-policies-proceduresguidelines/

The following illustrates only three forms of academic dishonesty:

- plagiarism, *e.g.* the submission of work that is not one's own or for which other credit has been obtained.
- improper collaboration in group work.
- copying or using unauthorized aids in tests and examinations.

AUTHENTICITY / PLAGIARISM

Some courses may use a web-based service (Turnitin.com) to reveal authenticity and ownership of student submitted work. For courses using such software, students will be expected to submit their work electronically either directly to Turnitin.com or via an online learning platform (e.g. Avenue to Learn, etc.) using plagiarism detection (a service supported by Turnitin.com) so it can be checked for academic dishonesty.

Students who do not wish their work to be submitted through the plagiarism detection software must inform the Instructor before the assignment is due. No penalty will be assigned to a student who does not submit work to the plagiarism detection software. **All submitted work is subject to normal verification that standards of academic integrity have been upheld** (e.g., on-line search, other software, etc.). For more details about McMaster's use of Turnitin.com please go to www.mcmaster.ca/academicintegrity.

COURSES WITH AN ON-LINE COMPONENT

Some courses may use on-line elements (*e.g.* e-mail, Avenue to Learn, LearnLink, web pages, capa, Moodle, ThinkingCap, etc.). Students should be aware that, when they access the electronic components of a course using these elements, private information such as first and last names, user names for the McMaster e-mail accounts, and program affiliation may become apparent to all other students in the same course. The available information is dependent on the technology used. Continuation in a course that uses on-line elements will be deemed consent to this disclosure. If you have any questions or concerns about such disclosure please discuss this with the course instructor.

ONLINE PROCTORING

Some courses may use online proctoring software for tests and exams. This software may require students to turn on their video camera, present identification, monitor and record their computer activities, and/or lock/restrict their browser or other applications/software during tests or exams. This software may be required to be installed before the test/exam begins.

CONDUCT EXPECTATIONS

As a McMaster student, you have the right to experience, and the responsibility to demonstrate, respectful and dignified interactions within all of our living, learning and working communities. These expectations are described in the Code of Student Rights & Responsibilities (the "Code"). All students share the responsibility of maintaining a positive environment for the academic and personal growth of all McMaster community members, **whether in person or online**.

It is essential that students be mindful of their interactions online, as the Code remains in effect in virtual learning environments. The Code applies to any interactions that adversely affect, disrupt, or interfere with reasonable participation in University activities. Student disruptions or behaviours that interfere with university functions on online platforms (e.g. use of Avenue 2 Learn, WebEx or Zoom for delivery), will be taken very seriously and will be investigated. Outcomes may include restriction or removal of the involved students' access to these platforms.

ACADEMIC ACCOMMODATION OF STUDENTS WITH DISABILITIES

Students with disabilities who require academic accommodation must contact Student Accessibility Services (SAS) at 905-525-9140 ext. 28652 or sas@mcmaster.ca to make arrangements with a Program Coordinator. For further information, consult McMaster University's Academic Accommodation of Students with Disabilities policy.

REQUESTS FOR RELIEF FOR MISSED ACADEMIC TERM WORK

In the event of an absence for medical or other reasons, students should review and follow the Policy on Requests for Relief for Missed Academic Term Work.

ACADEMIC ACCOMMODATION FOR RELIGIOUS, INDIGENOUS OR SPIRITUAL OBSERVANCES (RISO)

Students requiring academic accommodation based on religious, indigenous or spiritual observances should follow the procedures set out in the RISO policy. Students should submit their request to their Faculty Office **normally within 10 working days** of the beginning of term in which they anticipate a need for accommodation or to the Registrar's Office prior to their examinations. Students should also contact their instructors as soon as possible to make alternative arrangements for classes, assignments, and tests.

COPYRIGHT AND RECORDING

Students are advised that lectures, demonstrations, performances, and any other course material provided by an instructor include copyright protected works. The Copyright Act and copyright law protect every original literary, dramatic, musical and artistic work, **including lectures** by University instructors.

The recording of lectures, tutorials, or other methods of instruction may occur during a course. Recording may be done by either the instructor for the purpose of authorized distribution, or by a student for the purpose of personal study. Students should be aware that their voice and/or image may be recorded by others during the class. Please speak with the instructor if this is a concern for you.

EXTREME CIRCUMSTANCES

The University reserves the right to change the dates and deadlines for any or all courses in extreme circumstances (e.g., severe weather, labour disruptions, etc.). Changes will be communicated through regular McMaster communication channels, such as McMaster Daily News, Avenue to Learn and/or McMaster email.