

SWE432 Software Architectures

Professor: Mike Reep, Ph.D.

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Class Hours: Tuesday/Thursday, 3:00-4:15 pm

Class Location: Horizon Hall 1008

CRN: 17438

Prerequisites: CS 321, CS 421, SWE 321, or SWE 421

Office: ENG 4417

Office Hours: Tuesday and Thursday, 10:30 – 11:30 am or by appointment (or after class)

Textbook

The text is available via GMU library (free on-line) in addition to Packt directly. However, eBook versions are often available from Packt on sale (sometime as low as for \$10) as a PDF version to avoid the section at a time view from the library access.

- *Software Architect's Handbook*, Joseph Ingenu, Packt Publishing, 2018

Catalog Description

Teaches how to design, understand, and evaluate software systems at an architectural level of abstraction.

By end of course, students will be able to:

- recognize major architectural styles in existing software systems
- describe a system's architecture accurately
- generate architectural alternatives to address a problem and choose from among them
- design a medium-size software system that satisfies a specification of requirements
- use existing tools to expedite software design
- evaluate the suitability of a given architecture in meeting a set of system requirements.

Outcomes

These additional learning outcomes provide a focus on current industry activity and the growing use of cloud infrastructure.

Students will be able to:

- explain the role and function of software architecture and the software architect in modern team environments and development methodologies

- use domain driven design to model core business concepts
- identify and write appropriate software quality attributes and requirements
- document software architectures using correctly formed and appropriate UML diagrams
- use agile approaches to complete software development projects
- design and develop code for implementing software architecture patterns
- articulate and implement the core software development principles and practices
- incorporate security considerations into software architectures
- describe the impact and adjustments in developing systems using a cloud environment
- explain approaches for modernizing legacy systems

Class Format

The class is being conducted using a hybrid approach - asynchronous for covering new material with in-person classes for a review of key points or additional material plus in-class group/individual exercises. The goal is to leverage the in-person time for gaining a better understanding of the material, the application of the material, and facilitating group project coordination.

Each week recorded videos and supplemental material(s) are provided on Blackboard for the next set of learning objectives. Reading assignments in the textbook and in the Blackboard weekly folder along with watching posted videos or links must be completed before the weekly class time period. The videos after the first week will have an embedded quiz question to encourage viewing and evaluate comprehension. These quizzes are included in the overall quiz grade for the class grade.

Exercises are a key component of most class sessions and incorporate material from the reading assignment. These will generally be small groups exercises focusing on the group project although some may be individual or full class exercises. The exercises are announced in class and points are only earned in class. The exercises are counted towards the participation grade and require watching the required videos before class plus an overall assessment of participation throughout the semester.

Discussion Board

Piazza is used to maintain informal communications between classroom sessions and allow students the opportunity to interact with each other on the group project. An "Ask the Professor" is provided for any questions or topics that may be of interest to the entire class. These types of inquiries are not accepted by email and must be posted on the Discussion Board for all to see. (Personal or sensitive topics are still handled via email.) The Blackboard Discussion will be used for graded assignments such as the current topics assignment. The Blackboard Announcements will be used for more formal notifications such as the weekly release of Lessons and schedule changes.

All electronic postings must be professional, respectful, positive and courteous. The [Core Rules of "Netiquette"](#) provide guidelines on how to carefully craft your communications in the online classroom to avoid misinterpretation.

Quizzes

We will have in-class quizzes starting the second week and these will be given in the first class for a lesson. The primary purpose of the quiz is to encourage students to complete the assigned readings and have a basic understanding of the material **prior** to the class. This approach enables us to focus on addressing questions and more complex topics plus some preparation for and doing in-class exercises based on the weekly topic. Therefore the quizzes will focus on the assigned readings for that lesson with an emphasis on the weekly learning objectives.

Quizzes are available on Blackboard in the first ten minutes of class. Quizzes submitted after the ten minute limit will be assessed a 10% late penalty unless an accommodation is already in place. Quizzes are closed-book, no access to other web sites, and no other assistance allowed. A one-page **printed** note sheet is allowed to help with the quiz. These notes will then form the basis for your own personal study guide for the exams. Failing to follow the quiz procedures will result in a zero for the quiz.

The quizzes consist of a combination of multiple-choice, true/false, and fill-in-the-blank to evaluate understanding of the terms and concepts. There are no-retakes or make-up quizzes but the lowest three scores are dropped.

Current Topics in Software Architecture

As part of the participation grade, each student is required to read a recent (last 2 years) paper or article on a topic of interest related to software architecture. You will then post a summary of the paper and an associated URL onto the associated Blackboard discussion board. The article is accompanied with an explanation of why the article was of interest and key points for the other class members to take away. The summary and explanation must be at least 200 words although more is encouraged. A rubric will be posted with the discussion thread to provide the basis for grading. You will not be able to read other students postings until you post your own.

Each student is required to read **at least two** of the posted articles and reply to the discussion thread with their own insights, ideas, commentary or questions for class consideration. These reviews are due as listed in the schedule.

Group Project

A group project is a key component of moving from theory to practice. Each group goes through the stages of software architecture from initial problem statement on to requirements, design and implementation. Software Architects must present their work products to be successful so presentations are done at the end of the semester by the entire team. Selected groups will present their material for peer-review and input as part of the in-class discussions. Each group member is expected to participate in all aspects of the effort including coding and presenting. Interim deliverables are scheduled to validate continual progress is being made.

Participation

Learning can only happen when you are playing an active role. It is important to place more emphasis on developing your insights and skills, rather than transmitting information. Knowledge is more important than facts and definitions. It is a way of looking at the world, an ability to interpret and organize future information. An active learning approach will more likely result in long-term retention and better understanding because you make the content of what you are learning concrete and real in your mind.

Although an active role can look differently for various individuals, it is expected in this class that you will work to explore issues and ideas under the guidance of the professor and your peers. You can do this by reflecting on the content and activities of this course, asking questions, striving for answers, interpreting observations, and discussing issues with your peers. A participation grade will be awarded based on attendance, classroom contributions, peer-review interactions, and the successful completion of in-class exercises throughout the semester.

NOTE: Almost every class will allocate the last section of the time period to group meetings. Therefore regular attendance is even more critical to support your fellow group members in a successful project.

Mid-Term Exam

The mid-term will focus on the course learning outcomes listed in the syllabus and the weekly learning outcomes posted in Blackboard. A laptop will be needed to complete the on-line exam during the assigned time period. A study guide will be provided prior to the previous class sessions to facilitate preparation. The exam is closed book, notes, phone, tablet or any other type of assistance.

Final Exam

The final exam will focus on the material and learning objectives since the mid-term to the extent possible. (The material builds upon the previous topics so it is not possible to completely eliminate any overlap.) A laptop will also be needed to complete the on-line exam during the assigned time period. A study guide will be provided prior to the end of the scheduled class sessions to facilitate preparation. The exam is closed book, notes, phone, tablet or any other type of assistance.

Grading

- Participation: 10%
- Quizzes: 10%
- Group Project: 40%
- Mid-Term: 20%
- Final Exam: 20%

The following scale will be applied to compute final course letter grades:

A+ ($\geq 97.0\%$) A ($\geq 92.0\%$) A- ($\geq 90.0\%$)

B+ ($\geq 87.0\%$) B ($\geq 82.0\%$) B- ($\geq 80.0\%$)

C+ ($\geq 77.0\%$) C ($\geq 72.0\%$) C- ($\geq 70.0\%$)

D ($\geq 60.0\%$) F ($< 60.0\%$)

Submission Deadlines

All assignments listed on the schedule are due by midnight that day unless otherwise noted on the schedule or assignment listing. Late submissions are subject to a 10% penalty for missing the deadline, are accepted after 48 hours with a 25% deduction and not accepted after one week without prior permission. Assignments will be submitted in Blackboard either through Discussion Board forum postings or via the Assignment feature. You are expected to verify your own Blackboard responses by returning to the appropriate place in Blackboard after the work has been posted.

Grading

If a Graduate Teaching Assistant (GTA) is assigned to the class, most project and assignment grading will be completed by them based on the rubric provided with the assignment. If you disagree with the grades assessed, contact the GTA first with the basis of your request and the grade you believe should have been assigned. If you and the GTA are unable to come to a resolution, escalate the matter to me along with the email thread for the GTA discussion.

E-mail

I will occasionally send important announcements to your Mason email account. If I am running late for the class or have some other issue that will impact the class, I will make that announcement through Blackboard. Emails sent to me should start the subject line with "SWE 443" and then include a topic. Questions about the technical material, class policies, discussions or other topics of interest to the entire class **must** be posted on the associated Piazza discussion board or *Ask the Professor* discussion board and not sent by email.

My goal is to answer emails and board postings within 1 business day. However, please note that in general I am not able to receive or respond to emails and postings during the business day. In accordance with GMU policy, all email communication will be sent only to your Mason email account.

Before sending an email, please check the following (available on the Blackboard course menu) unless the email is of a personal nature:

1. Syllabus
2. *Ask the Professor* discussion board

Feel free to respond to other students in the *Ask the Professor* forum if you know the answer.

Schedule

Every attempt is made to adhere to the original schedule. Changes are made to facilitate learning and provide opportunities to thoroughly address topics within the class. Changes are announced via Blackboard and the revised schedule is posted on the site. (For Spring 2025, changes made be made to facilitate the on-going revisions for agile-related material.)

If the University is closed for snow-days or similar situation, classes will be conducted via Zoom.

Recordings

I will often record classroom session for the use of students who can't make an individual session or for review afterwards. These are not a substitute for attending in-person classes, are not guaranteed to be available, are not edited and may have issues such as audio, readability of the slides and boards, or focus. These videos will only be posted to Blackboard.

All course materials posted to Blackboard or other course site are private to this class; by federal law, any materials that identify specific students (via their name, voice, or image) must not be shared with anyone not enrolled in this class.

Video recordings -- whether made by instructors or students -- of class meetings that include audio, visual, or textual information from other students are private and must not be shared outside the class.

Live video conference meetings (e.g. Collaborate or Zoom) that include audio, textual, or visual information from other students must be viewed privately and not shared with others in your household or recorded and shared outside the class

Technology

You will need a reliable computer, functional camera and microphone, and internet access to view course materials in Blackboard, take the quizzes and exams, complete the coding for the group project, and record assignments for the group project which captures the screen and voice.

In-Class Computer Use

Computers will be used extensively during in-class exercises, quizzes, discussions, and examples. Outside note taking and referring to class slides, their use during lectures should be minimized as a courtesy to your fellow students. Complaint(s) about specific students using computers inappropriately will result in the loss of their use during lectures.

AI Use

ChatGPT or other Generative-AI models may not be used in this course as an assistant in the project, current topics paper, or other assignments unless otherwise specifically stated by the instructors.

In terms of learning in this class and the associated software development processes, students who replace their own learning and project work with materials prepared by Generative-AI models:

- Sacrifice the opportunity to acquire the knowledge, skills, and critical thinking taught in the course.
- Risk being unable to perform to expectations in the academic environment when Generative-AI models are unavailable, such as in exams
- Ultimately endanger their employability if they are unable to produce work other than that produced by Generative-AI models

Social Media

I accept LinkedIn requests from current and former students – please be sure to include the class and year in the request. In general, I do not accept other social media requests on my personal accounts from school or work.

Religious Holidays

If you need accommodations for a religious holiday, it is your responsibility to let me know the dates of major religious holidays on which you will be absent or unavailable due to religious observances within the first two weeks of the semester. The university calendar is available at <https://ulife.gmu.edu/religious-holiday-calendar/> for your reference.

Honor Code Statement

As with all GMU courses, SWE 443 is governed by the GMU Academic Standards (more below) and the CS Department Honor Code <https://cs.gmu.edu/resources/honor-code/> (which provides technical guidance). In this course, all quizzes and exams carry with them an implicit statement that it is the sole work of the author. On the writing assignment, peer reviews are permitted but the content must be your own. When joint work is authorized, including on the group project, all contributing students must be listed on both the submission and individual sections of the assignment but must not include students who did not participate. Guidance on the group project coding will be provided in the project description and must be adhered to in order to avoid violations. Any deviation from the above guidance is considered an Honor Code violation, and as a minimum, will result in failure of the submission and as a maximum, failure of the class.

Common Policies Addendum

Academic Standards

Academic Standards exist to promote authentic scholarship, support the institution's goal of maintaining high standards of academic excellence, and encourage continued ethical behavior of faculty and students to cultivate an educational community which values integrity and produces graduates who carry this commitment forward into professional practice.

As members of the George Mason University community, we are committed to fostering an environment of trust, respect, and scholarly excellence. Our academic standards are the foundation of this commitment, guiding our behavior and interactions within this academic community. The practices for implementing these standards adapt to modern practices, disciplinary contexts, and technological advancements. Our standards are embodied in our courses, policies, and scholarship, and are upheld in the following principles:

- **Honesty:** Providing accurate information in all academic endeavors, including communications, assignments, and examinations.
- **Acknowledgement:** Giving proper credit for all contributions to one's work. This involves the use of accurate citations and references for any ideas, words, or materials created by others in the style appropriate to the discipline. It also includes acknowledging shared authorship in group projects, co-authored pieces, and project reports.
- **Uniqueness of Work:** Ensuring that all submitted work is the result of one's own effort and is original, including free from self-plagiarism. This principle extends to written assignments, code, presentations, exams, and all other forms of academic work.

Violations of these standards—including but not limited to plagiarism, fabrication, and cheating—are taken seriously and will be addressed in accordance with university policies. The process for reporting, investigating, and adjudicating violations is outlined in the university's procedures. Consequences of violations may include academic sanctions, disciplinary actions, and other measures necessary to uphold the integrity of our academic community.

The principles outlined in these academic standards reflect our collective commitment to upholding the highest standards of honesty, acknowledgment, and uniqueness of work. By adhering to these principles, we ensure the continued excellence and integrity of George Mason University's academic community.

Student responsibility: Students are responsible for understanding how these general expectations regarding academic standards apply to each course, assignment, or exam they participate in; students should ask their instructor for clarification on any aspect that is not clear to them.

Accommodations for Students with Disabilities

Disability Services at George Mason University is committed to upholding the letter and spirit of the laws that ensure equal treatment of people with disabilities. Under the administration of University Life, Disability Services implements and coordinates reasonable accommodations and disability-related services that afford equal access to university programs and activities. Students can begin the registration process with Disability Services at any time during their enrollment at George Mason University. If you are seeking accommodations, please visit <https://ds.gmu.edu/> for detailed information about the Disability Services registration process. Disability Services is located in Student Union Building I (SUB I), Suite 2500. Email: ods@gmu.edu. Phone: (703) 993-2474.

Student responsibility: Students are responsible for registering with Disability Services and communicating about their approved accommodations with their instructor in advance of any relevant class meeting, assignment, or exam.

FERPA and Use of GMU Email Addresses for Course Communication

Student privacy is governed by the Family Educational Rights and Privacy Act (FERPA) and is an essential aspect of any course. Students must use their GMU email account to receive important

University information, including communications related to this class. Instructors will not respond to messages sent from or send messages regarding course content to a non-GMU email address.

Student responsibility: Students are responsible for checking their GMU email regularly for course-related information, and/or ensuring that GMU email messages are forwarded to an account they do check.

Title IX Resources and Required Reporting

As a part of George Mason University's commitment to providing a safe and non-discriminatory learning, living, and working environment for all members of the University community, the University does not discriminate on the basis of sex or gender in any of its education or employment programs and activities. Accordingly, all

non-confidential employees, including your faculty member, have a legal requirement to report to the Title IX Coordinator, all relevant details obtained directly or indirectly about any incident of Prohibited Conduct (such as sexual harassment, sexual assault, gender-based stalking, dating/domestic violence). Upon notifying the Title IX Coordinator of possible Prohibited Conduct, the Title IX Coordinator will assess the report and determine if outreach is required. If outreach is required, the individual the report is about (the "Complainant") will receive a communication, likely in the form of an email, offering that person the option to meet with a representative of the Title IX office.

For more information about non-confidential employees, resources, and Prohibited Conduct, please see University Policy 1202: Sexual and Gender-Based Misconduct and Other Forms of Interpersonal Violence. Questions regarding Title IX can be directed to the Title IX Coordinator via email to TitleIX@gmu.edu, by phone at 703-993-8730, or in person on the Fairfax campus in Aquia 373.

Student opportunity: If you prefer to speak to someone confidentially, please contact one of Mason's confidential employees in Student Support and Advocacy (SSAC), Counseling and Psychological Services (CAPS), Student Health Services (SHS), and/or the Office of the University Ombudsperson.