

SWE 443 Software Architectures Spring 2024 Syllabus

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Class Hours: Wednesday, 4:30-7:10 pm
Class Location: Merten Hall 1200
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)

Text

The text is available via GMU library in addition to the bookstore or 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 one-page at a time view from the library access.

- *Software Architect's Handbook*, Joseph Ingeno, Packt Publishing, Aug 2018 (Required)

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 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 in the first ten minutes of class. 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 are closed-book, closed notes, no access to other web sites, and no other assistance allowed. Quizzes submitted after the ten minute limit will be assessed a 10% late penalty unless an accommodation is already in place.

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.

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: 15%
- Group Project: 30%
- Mid-Term: 20%
- Final Exam: 25%

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 4:00 pm 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.

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.

Recordings

I will often record classes for the use of students who can 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, research 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.

Office of Disabilities

If you need academic accommodations, please see me and contact the Disability Resource Center (DRC) at 993-2474. All academic accommodations must be arranged through the DRC and you must inform me, in writing, at the beginning of the semester. All academic accommodations must be arranged through that office. Please note that accommodations **MUST BE MADE BEFORE** assignments or exams are due. I cannot adjust your grade after the fact.

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 Honor Code. In this course, all quizzes and exams carry with them an implicit statement that it is the sole work of the author, unless joint work is explicitly authorized. When joint work is authorized, all contributing students must be listed on the submission and must not include students who did not participate. Any deviation from this 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.

Weekly Schedule

Unless otherwise stated, all assignments are due at **4 pm before the class** in which they are assigned.

To help you manage your schedule and time to complete the individual assignments in this course along with the group project, the class schedule is provided below. If you have a question or concern or encounter a problem about an assignment, please contact me immediately so we can discuss and work out a resolution.

For reading assignments:

- SAH: Software Architect’s Handbook (Chapter titles follows the chapter number with SA for "Software Architecture")
- Supplemental: Additional materials beyond the information in SAH will be provided in the weekly folder (including links to external sources or videos).

Class	Date	Reading	Topic	Notes
1	1/17	SAH: Ch. 1 (The Meaning of SA) SAH: Ch. 2 (SA in an Organization) – stop at “Project Management”, read section on “Software Risk Management”	Overview: Syllabus, Schedule, Project Meaning of Software Architecture (SA) SA in Organization Architecture in Agile (supplemental) Team Formations (supplemental) Technical: HTML	- Welcome! - Post an Introduction to yourself
2	1/24	SAH: Ch. 3 (Understanding the Domain) - stop at “Requirements Engineering” SAH: Ch. 12 (Documenting and Reviewing SAs) – stop at “Reviewing software architectures”	Understanding the Domain - Domain Driven Design Documenting Software Architectures - Architecture Views - UML - C4 (supplemental) Technical: Github and Maven	- Groups Formed with scenario - Quizzes Start
3	1/31	SAH: Ch. 3 (Understanding the Domain) - “Requirements Engineering” to end SAH: Ch. 4 (Software Quality Attributes)	Understanding the Domain - Requirements - User Stories (supplemental) Software Quality Attributes Technical: Spring Framework and Spring Boot	- Current Topics Post Due
4	2/7	SAH: Ch. 5 (Designing SAs) - excluding “Architecture Development Method” SAH: Ch. 7 (SA Patterns) - Skip “Event Driven Architecture” and stop at “Command Query Responsibility Separation”	Designing Software Architectures Software Architecture Patterns I: - Layered - Model-Views Technical: Thymeleaf	- Sprint 1 Review

5	2/14	SAH: Ch. 6 (Software Development Principles and Practices) – stop at “Helping Your Team Succeed”	Software Development Principles/Practices Technical: JPA	- Current Topics Review 1 Due
6	2/21	SAH: Ch. 8 (Architecting Modern Applications) – Stop at “Serverless Architecture”	Architecting Modern Applications - Monolithic - Microservices - Microservices Patterns (supplemental) Technical: Microservices Code	- Sprint 2 Review - Design Method - Component Diagrams - Class Diagrams
7	2/28	SAH: Ch. 9 (Cross-Cutting Concerns) SAH: Ch. 12 (Documenting and Reviewing SAs) - “Reviewing software architectures”	Cross-Cutting Concerns AOP and Spring (supplemental) Reviewing Software Architectures (in class exercise) Mid-Term Review	- Prepare for Architecture Review - Current Topics Review 2 Due - Posting of Review on Other Group (After class)
	3/6	Spring Break		
8	3/13	Mid-Term		
9	3/20	SAH: Ch. 7 (SA Patterns) - “Event Driven Architecture” and “Command Query Responsibility Separation”	Software Architecture Patterns II: - Event Driven - CQRS	- Sprint 3 Review with Revised Component and Remaining UML
10	3/27	SAH: Ch. 7 (SA Patterns) - “Service Oriented Architecture	Software Architecture Patterns III: - SOA - Pipe and Filter pattern Others	
11	4/3	SAH: Ch. 8 (Architecting Modern Applications) – “Server-Less Architecture” and Cloud native Applications” SAH: Ch. 10 (Performance Considerations) - stop at “Server Side Caching”	Architecting Modern Applications Server-Less and Cloud Native Performance	- Sprint 4 Review
12	4/10	SAH: Ch. 11 (Security Considerations) SAH: Ch. 13 (DevOps and SA)	Security DevOps	
13	4/17	SAH: Ch. 14 (Architecting Legacy Applications) SAH: Ch. 16 (Evolutionary Architecture)	Architecting Legacy Applications Evolutionary Architecture	
14	4/24		Group Presentations Final Review Material	- Final Submission - Presentation Slide Deck
	5/1		Final Exam	