SFWE 302: Software Architecture and Design
Course Syllabus

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

Course Description

At the heart of every well-engineered software system is its software architecture and design. Software architecture deals with the high-level building blocks that represent an underlying software system. These building blocks are the components (units of computation in a system), the connectors (models of the interactions between software components), and the configurations (arrangements of software components and connectors, and the rules that guide their composition).

This course will teach students how to use modern processes, methods, and tools used in architecting, modeling, and designing software systems. Students will learn the importance of developing a sound software architecture as part of the overall software design. The topics covered include:

- Comprehensive software design process
- Architecture definition and documentation
- Software quality attributes
- Architecture evaluation
- Design patterns, interface development and use of middleware
- Design of mobile, cloud-based, and distributed systems
- Scaling a software architecture and design for evolutionary development and deployment of future software features

A fundamental and experiential component of this course provides students the opportunity to work in teams on a semester long software design project that utilizes industry best practices, common software design patterns, and modeling tools. Traceability between software requirements and the resulting software designs, and ultimately code implementation, will also be part of the semester project.

Course Objectives:

During this course, students will:

1) Discover how architecture influences (and is influenced by) technical environments, project lifecycles, business profiles and practices.
2) Explore how various software quality attributes (i.e., reliability, usability, compatibility, interoperability, etc.) can influence the architecture and design of a software product.
3) Leverage appropriate software design patterns, interfaces, and practices for optimizing quality of a software product through its carefully planned architecture and design.
4) Use Agile development practices and the Unified Modeling Language (UML) in the development of a semester software design project.
5) Architect and design a software product either for a mobile, cloud, embedded, or other type of software product.
6) Investigate how to scale software systems, using evolutionary software development methodologies such as DevOps, software product lines, and/or deployment pipelines.

Expected Learning Outcomes:

Upon the completion of this course, students should be able to:

1) Develop the architectural, interface and component design elements for a comprehensive software design that meets specified design requirements. [ABET Student Outcomes 1 and 7]
2) Collaborate with other students in a team setting using industry representative team collaboration methodologies to complete the software design (i.e., a common Agile adaptation). [ABET Student Outcome 5]
3) Document a software design using Unified Modeling Language (UML) architectural views and design constructs (i.e., sequence diagrams, deployment diagrams, timing diagrams, state transition diagrams, etc.). [ABET Student Outcome 2]
4) Select standard quality attributes to influence a product's software design. [ABET Student Outcome 6]
5) Architect /design a software product for a mobile, cloud, or embedded application. [ABET Student Outcome 4]
6) Select common software design patterns used to develop software designs that meet specified requirements and quality attributes. [ABET Student Outcome 6]
7) Map allocated software requirements to appropriate portions of the semester software design project. ABET Student Outcome 1]
8) Conduct a software design review before a panel of subject matter experts in the field of software engineering. [ABET Student Outcome 3]

Course Prerequisites: Advanced standing and SFWE 301

Course Format and Teaching Methods:

This course is structured around weekly progress. It will include a combination of lectures, and small groups activities focused on experiential learning, in-class discussions, and individual assessments. The expected weekly progress is outlined in the course schedule. At a minimum it is recommended that students keep up with coursework by following the outlined course schedule on D2L. Note the **DUE DATES** on course deliverables are all posted on D2L.

This course is architected to engage and demonstrate key concepts of the materials covered using collaborative and active learning strategies. Students will watch pre-recorded lecture materials that have interactive features integrated into the materials. Interactive instructional technologies (PlayPosit, Perusall, etc.) and industry-relevant software development tools will be used to allow students to demonstrate and self-assess their progress toward and achievement of course learning outcomes. Students will break into small teams to work on activities that demonstrate the key principles covered in the lectures.

Course Computing Requirements:

This course will use commercially available Unified Modeling Language (UML) tools that are available to students enrolled in the course. License(s) and instructions on how to use the UML tool(s) will be provided by the instructor during the first few weeks of the course.

Course Communications:

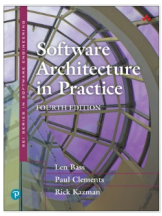
Announcements and important reminders will be regularly posted on D2L. Log in frequently to check for new announcements, reminders, and information related to the course.

You are encouraged to reach out to your instructor frequently throughout the semester via in-person lectures, email, phone call, text, office hours, or schedule an in-person or Zoom meeting. Every attempt will be made to respond to any questions or concerns that you may have within 24 hours, if possible (often sooner).

Textbooks:

The required textbooks used in this course are *(these may be available as an eBook through the University of Arizona library)*.

Software Architecture in Practice - 4th Edition
Pearson, 2020
Authors: Len Bass, Paul Clements, Rick Kazman
ISBN-13: 978-0136886099
ISBN-10: 0136886094



Optional Text:

Software Architecture: Foundations, Theory, and Practice
John Wiley & Sons, 2009.
Authors: R. N. Taylor, N. Medvidovic, and E. M. Dashofy.
ISBN-10: 0470167742
ISBN-13: 978-0470167748

Other Supplemental Readings / References:

Additional supplemental materials will be referenced and provided to students via D2L.

Course Schedule

The following table provides an outline for the topics and objectives that will be covered during each module for this course. Specific dates will be posted on D2L for any given semester.

Module	Topic	Learning Outcomes
1	Introduction to Software Design	• Describe software design engineering activities. • Compare and contrast software architecture and detailed design. • Evaluate the role of the SDLC Design phase in the production of high quality, sustainable software.
2	Understanding Software Architecture	• Explain the importance of software architectural design. • Compare and contrast different architectural views to capture a software design.
3	Software Quality Attributes	• Describe common software quality attributes. • Participate in a software quality attribute workshop (QAW) to select the quality attributes most important in a software design.
4	Software Design Patterns and Interface Design	• Connect software architectural elements to detailed design elements. • Describe basic strategies of using object-oriented design techniques. • Compare and contrast common software design patterns. • Develop software interface design solutions.
5	Documenting a Software Architecture and Design	• Describe how graphical models and UML are used to capture the design of a software system and its behavior • Capture a software design in a UML modeling tool
6	Scalable Software Architecture and Design	• Incorporate open-source or reused software into software design. • Develop a plan to scale a software system, using evolutionary software development methodologies such as DevOps, software product lines, and/or deployment pipelines.

Module	Topic	Learning Outcomes
7	Evaluating a Software Architecture and Design	• Evaluate a software architecture for a given set of attribute-specific measures for a software system. • Conduct a software architecture review with stakeholders and an evaluation team. • Map architectural and design approaches to prioritized quality attributes. • Identify sensitivity points and tradeoff points of achieving specified quality attributes.
8	Conducting a Software Design Review	• Prepare a software design presentation. • Conduct a software design review with a panel of subject matter experts. • Disposition any resulting actions from the software design review.

D2L Course Management System

This course uses the University of Arizona's D2L course management system. You are **required** to use D2L with this class and are encouraged to check our D2L class course space daily.

You are also encouraged to have D2L email forwarded to your primary University of Arizona email account. We will use D2L for course assignments, exams, content distribution, and important announcements. The University of Arizona's D2L system is available at: http://D2L.arizona.edu.

Course Assignments and Exams

There will be homework assignments aligned to the outcomes of the module and designed to assess students' progress toward the course outcomes. There will also be graded module-based discussion board prompts; student participation is required. There will be one midterm exam and a final exam. All exams will be timed and given during regularly scheduled class/exam times (or administered by a proctor if appropriate). ***Note: the instructor will give students ample notice of the format, time, and any resulting stipulations about where and how the exams will be administered.***

Final Examination:

The date and time of the final exam or project, along with links to the Final Exam Regulations can be found at https://www.registrar.arizona.edu/courses/final-examination-regulations-and-information, and Final Exam Schedule, http://www.registrar.arizona.edu/schedules/finals.htm

Grade Distribution

The grading distribution for course assignments, class participation, semester project, and exams is as follows:

Homework Assignments (x8):	25%
Class Participation (x8):	10%
Knowledge Checks:	10%
Midterm Exam (x1):	10%
Semester Project:	30%
Comprehensive Final Exam:	15%
Total	100%

Rubrics will be posted on D2L for all homework assignments.

Grading Scale and Policies:

The following scale will be used to award the final grades:

Percentage	Letter Grade
90% – 100%	A
80% – 89%	B
70% – 79%	C
60% – 69%	D
<60%	E

Homework is due at the time that it 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.

Course Time Zone:

All dates and times mentioned in this course represent Mountain Standard Time (Arizona), which is UTC-7 hours. Arizona does not observe Daylight Savings Time. You can use the following link to get the current local time in Tucson, Arizona: http://www.timeanddate.com/worldclock/city.html?n=393

Academic Policies and Institutional Resources

Academic Policies and Procedures:

As a University of Arizona student, you are expected to become familiar with and abide by the university-wide policies and procedures. You can find complete, up-to-date information at: https://academicaffairs.arizona.edu/syllabus-policies.

Course Policies

Make-up exams:

A make-up exam may only be given under extraordinary circumstances. The student requesting a make-up exam should 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.

Dispute of Grade Policy:

You can dispute any grade that you receive within two weeks that the grade has been awarded.

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.

Classroom Behavior Policy:

To foster a positive learning environment, students and the instructor 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.).

Online Collaboration/Netiquette:

In this course, you will primarily communicate with the instructor and peers through a variety of tools such as discussion forums, Jamboard, email, and other forms of web conferencing. The following guidelines will enable everyone in the course to participate and collaborate in a productive, safe environment.

- Be professional, courteous, and respectful as you would in a physical classroom.
- Online communication lacks the nonverbal cues that provide much of the meaning and nuances in face- to-face conversations. Choose your words carefully, phrase your sentences clearly, and stay on topic.
- It is expected that students may disagree with the research presented or the opinions of their fellow classmates. To disagree is fine but to disparage others' views is unacceptable. All comments should be kept civil and thoughtful. Remember that this course abides by university policies regarding disruptive behavior: http://policy.arizona.edu/education-and-student-affairs/disruptive-behavior-instructional-setting
- Compose your messages and posts in a word processing tool and check your spelling and grammar before submitting your post / email.

Statement of copyrighted materials:

All lecture notes, lectures, study guides and other course materials disseminated by the instructor to the students, whether in class or online, are original materials and reflect intellectual property of the instructor or author of those works (with the exception of other published reference materials – i.e. course textbooks). All readings, study guides, lecture notes and handouts are intended for individual use by students. You may not distribute or reproduce these materials for commercial purposes without the express written consent of the instructor. Students who sell or distribute these materials for any use other than their own are in violation of the University's Intellectual Property Policy (available at http://ogc.arizona.edu/node/16). Violations of the instructor's copyright may result in course sanctions and violate the Code of Academic Integrity.

Student Support:

The instructor is available to assist with **content-related** issues. You may, at any time, email the instructor. This course also provides an ***Ask the Instructor*** discussion forum within the D2L environment. You are encouraged to post content-related questions to this forum at any time, especially for things that will benefit all students. *(It is not recommended that you use this forum for individual questions that are specific to your work or performance in the class.)* This forum will be monitored on a regular basis and the instructor will respond in a timely fashion. It is common for other students to participate in answering questions posted in the ***Ask the Instructor*** forum. You should feel free to contribute to the solution if you can provide knowledge or guidance related to the question.

The following are guidelines for requesting support:

- **General Course Questions:** Use the ***Ask the Instructor*** discussion forum for questions regarding course materials or policy.
- **Personal Course Questions**: Email the instructor to discuss grades or personal concern.
- **D2L Support Questions**: Email mailto:d2l@arizona.edu

Accommodations for Students with Disabilities:

At the University of Arizona, we strive to make learning experiences as accessible as possible. If you anticipate or experience barriers based on disability or pregnancy, please contact the Disability Resource Center (520-621-3268, https://drc.arizona.edu/)to establish reasonable accommodations.

See http://drc.arizona.edu/instructors/syllabus-statement.

Library Support:

The University of Arizona Libraries provides the research tools you need at any time. For an abbreviated list of resources directly related to a specific course, select the **Library Tools** link (located in the Tools drop down on the left of the screen within the Course Navigation bar).

Course Grievance Policy:

In case of grievances with a course component or grading, students are encouraged to first try and resolve the issue with the instructors. If you feel the issue is not resolved satisfactorily, please send an email to https://registrar.arizona.edu/faculty-staff-resources/grading/grading-policies/grade-appeal.

Course Surveys and Evaluations:

Near the end of each semester / session, students will receive an invitation via email to complete an online course survey associated with this course administered by the Office of Instruction and Assessment thru the UA Student Course Survey (SCS) tool. Refer to the Student Support website associated with the Student Course Surveys (https://scs.arizona.edu/content/5).

Your feedback is extremely valuable and will be used to make changes and enhancements to the course to better meet student needs in the future.

Additional Resources for Students (recommended links):

- Student Assistance and Advocacy information is available at: http://deanofstudents.arizona.edu/student-assistance/students/student-assistance
- Confidentiality of Student Records: http://www.registrar.arizona.edu/ferpa/default.htm