Carnegie Mellon University
Master of
Software Engineering

**17-635: Software Architecture**
MW 11.00 - 12.20pm, 300 S. Craig Street Room 265
F 11.00 - 12.20pm, 300 S. Craig Street Room 265
[A3, Spring 2025, 6 Units]


| Instructor | Email | Office Location & Hours |
|---|---|---|
| Swarnalatha Ashok | swarnala@andrew.cmu.edu | SCR 273<br>By appointment<br>SCR 276 |
| Scott Pavetti | spavetti@andrew.cmu.edu | By appointment |

**Teaching Assistants**

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| Anirudh Belwadi | abelwadi@andrew.cmu.edu | TBD |
| Piyush Kautkar | pkautkar@andrew.cmu.edu | TBD |
| Ruchi Thosar | rthosar@andrew.cmu.edu | TBD |
| Bartolomeus Delphito Nugraha | bnugraha@andrew.cmu.edu | TBD |


**Course Description.** Architecture for Software Systems aims to teach you how to design, understand, and evaluate systems at an architectural level of abstraction. By the end of the course, you will be able to:

- Understand the influence of architectural drivers on software structures.
- Identify key architectural structures (styles, patterns, etc.).
- Understand how formal notations can be used to specify software architecture.
- Evaluate the fitness of an architectural design in meeting a set of system requirements and balancing quality tradeoffs.
- Understand the principles of good architectural documentation and presentation.
- Be aware of the future trends in software architecture.

**Prior Knowledge.** Students are expected to be familiar with programming in at least one, preferably object-oriented, programming language. Formal programming language training is not required. Students need not have any formal background in algorithms, data structures, analysis, or detailed design techniques and methods.

Previous coursework in computer science (such as design patterns, data structures or algorithms) is not necessary. However, students should have some experience writing small programs or software applications. Students in doubt regarding their experience should obtain

instructor's permission.

**Learning Objectives.** Architectures for Software Systems aims to teach students how to design, understand, and evaluate systems at an architectural level of abstraction. By the end of the course, students should be able to:

- Understand and specify software architecture drivers:
    - Identify constraints, functional requirements, and quality attribute requirements for designing a system.
    - Determine if a given requirement is a constraint, functional requirement, or quality attribute.
- Specify an actionable quality attribute requirement according to the 6-part scenario framework for at least the following quality attributes:
    - Scalability, Availability, Performance, Modifiability
- Define architectural structures (Static, dynamic and allocation) related to the following quality attributes:
    - Modifiability, Availability, Performance, Scalability
- Identify and apply tactics in specific contexts for the following quality attributes:
    - Modifiability, Availability, Performance, Scalability
- Understand and apply at least the following architectural patterns
    - Pipes and filters, Client server & N-tiered patterns, Layered systems, Service oriented patterns, Event-based systems
    - Identify the elements, topology, semantics, properties promoted, and properties inhibited for the above-mentioned patterns.
    - Relate architectural patterns to architectural tactics
- Document an architecture according to the "Views and Beyond" approach
    - Determine the purpose of the architectural document
    - Identify the views that are required to support the needs
    - Populate the views appropriately to achieve the intended purpose
    - Organize the document such that it supports its intended purpose
    - Review a document with respect to its fitness for purpose

**Required Textbook.** Software Architecture in Practice: Fourth Edition (SEI Series in Software Engineering), by Len Bass, Paul Clements, Rick Kazman
ISBN-10: 0136886094
ISBN-13: 978-0136886099
(Link on AmazonLinks to an external site.)
For those that prefer to read from the web: Link to O'Reilly Book CopyLinks to an external site. You'll need to sign in with your CMU credentials to get access.

**Learning Resources.** The course and all course materials will be distributed online and accessible with a CMU account via Canvas.

**Assessments.** Students learn more by applying and explaining ideas to others, thus, the course requires the following activities:

- **Class participation:** Participation in class and online discussions in Piazza will count towards this component.
- **Individual Homework Assignments:** These will be primarily application and reflection assignments based on the concepts learned throughout the course.
- **Recitation:** Participation and submissions during recitation in small groups (2-3 members) will count towards this component.

| **Assessment** | **Final Grade %** |
|---|---|
| Individual Homework Assignments | 60% |
| Recitations | 30% |
| Class participation | 10% |

## Course and Grading Policies

- **Late-work policy**: All work is expected to be handed in at the indicated due date and time. For fairness to the whole class, no late submissions or makeups will be accepted for the Recitations. The penalty for turning in Individual Homework late is 10%/day. In the first week of classes, you should receive a course schedule for each course; please use them to plan ahead. If you have any questions, you should raise them immediately rather than waiting for conflicts to arise.
- **Participation policy**. Class participation will be graded by in-class engagement, including asking relevant questions based on a critical review of required readings and lectures, preparation for any in-class exercises, and responses on the class discussion board. The lack of attendance and participation will count against your participation grade.

**Course Schedule.** The following schedule provides a general overview of topics and assignments. Please refer to the syllabus online in Canvas for specific lecture topics, reading assignments and due dates.

| Date | Topic | Assignment Assigned | Assignment Due | Readings |
|---|---|---|---|---|
| 1/13/2025 | Introduction to software architecture | | | |
| 1/15/2025 | Setting the system context | A1 | | SAP Ch 1, 2 |
| 1/17/2025 | Recitation - Setup | R0 | | |
| 1/20/2025 | MLK Day – No class | | | |
| 1/22/2025 | Architectural Drivers | | A1 | SAP Ch 3 |
| 1/24/2025 | Recitation - Drivers | R1 | | |
| 1/27/2025 | Architectural Structures | A2 | | |
| 1/29/2025 | Architectural Patterns | | | |
| 1/31/2025 | Recitation - Structures | R2 | | |
| 2/3/2025 | Modifiability | A3 | | SAP Ch 8 |
| 2/5/2025 | Performance | | A2 | SAP Ch 9 |
| 2/7/2025 | Recitation - Performance | R3 | | |
| 2/10/2025 | Availability | A4 | | SAP Ch 4 |
| 2/12/2025 | Scalability | | A3 | SAP Ch 20 |
| 2/14/2025 | Recitation - Availability | R4 | | |
| 2/17/2025 | Attribute Driven Design I | A5 | | |
| 2/19/2025 | Architecture Centric Practices | | A4 | SAP Ch 22 |
| 2/21/2025 | Recitation - Design | R5 | | |
| 2/24/2025 | Documentation | | | |
| 2/26/2025 | Architecting software with AI/LLM | | A5 | |
| 2/28/2025 | Recitation | | | |

**Accommodations for Students Disabilities.** If you have a disability and have an soft accommodations letter from the Disability Resources office, I encourage you to discuss your accommodation and needs with me as early in the semester as possible. I will work with you to ensure that accommodation is provided as appropriate. If you suspect that you may have a disability and would benefit from accommodations but are not yet registered with the Office of Disability Resources, I encourage you to contact them at access@andrew.cmu.edu.

**Academic Integrity.** Honesty and transparency are important to good scholarship. Plagiarism and cheating, however, are serious academic offenses with serious consequences. If you are discovered engaging in either behavior in this course, you will earn a failing grade on the assignment in question, and further disciplinary action may be taken.

For a clear description of what counts as plagiarism, cheating, and/or the use of unauthorized sources, please see the University's Policy on Academic Integrity.

If you have any questions regarding plagiarism or cheating, please ask me as soon as possible to avoid any misunderstandings. For more information about Carnegie Mellon's standards with respect to academic integrity, you can also check out the Office of Community Standards & Integrity website.

**Student Wellness.** As a student, you may experience a range of challenges that can interfere with learning, such as strained relationships, increased anxiety, substance use, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may diminish your academic performance and/or reduce your ability to participate in daily activities. CMU services are available, and treatment does work. You can learn more about confidential mental health services available on campus at the Counseling and Psychological Services website. Support is always available (24/7) from Counseling and Psychological Services: 412-268-2922.

**We must treat every individual with respect.** We are diverse in many ways, and this diversity is fundamental to building and maintaining an equitable and inclusive campus community. Diversity can refer to multiple ways that we identify ourselves, including but not limited to race, color, national origin, language, sex, disability, age, sexual orientation, gender identity, religion, creed, ancestry, belief, veteran status, or genetic information. Each of these diverse identities, along with many others not mentioned here, shape the perspectives our students, faculty, and staff bring to our campus. We, at CMU, will work to promote diversity, equity and inclusion not only because diversity fuels excellence and innovation, but because we want to pursue justice. We acknowledge our imperfections while we also fully commit to the work, inside and outside of our classrooms, of building and sustaining a campus community that increasingly embraces these core values. Each of us is responsible for creating a safer, more inclusive environment. Unfortunately, incidents of bias or discrimination do occur, whether intentional or unintentional. They contribute to creating an unwelcoming environment for individuals and groups at the university. Therefore, the university encourages anyone who experiences or observes unfair or hostile treatment on the basis of identity to speak out for justice and support, within the moment of the incident or after the incident has passed. Anyone can share these experiences using the following resources:

- **Center for Student Diversity and Inclusion:** csdi@andrew.cmu.edu, (412) 268-2150
- **Report-It online anonymous reporting platform:** reportit.net username**:** *tartans* password**:** *plaid*

All reports will be documented and deliberated to determine if there should be any following actions. Regardless of the incident type, the university will use all shared experiences to transform our campus climate to be more equitable and just.