



Carnegie Mellon University  
Master of  
Software Engineering

### 17-635: Software Architectures - remote section

Lectures: TR 7:00 - 8:20pm ET, Remote

Zoom link to attend live-online classes:

<https://cmu.zoom.us/j/95322536306?pwd=S3Q0Ym5melJwaEVZQjdmNTU3N3hMUT09>

Meeting ID: 953 2253 6306

Passcode: 834097

[A3, Spring 2024, 6 Units, Section D3]

<b>Instructor</b> Paulo Merson	<b>Email</b> <a href="mailto:pmerson@andrew.cmu.edu">pmerson@andrew.cmu.edu</a>	<b>Office Location &amp; Hours</b> Zoom; by appointment
<b>Teaching Assistant</b> Dhaarna Sethi	<b>Email</b> <a href="mailto:dsethi@andrew.cmu.edu">dsethi@andrew.cmu.edu</a>	<b>Office Location &amp; Hours</b> Zoom; by appointment

### Course Description

The general goal of the Software Architectures course is to give students a broad yet sound view of what is software architecture, how it is created, documented, and used in practice. This course draws fundamental concepts from a vast body of theoretical knowledge available about software architecture, and complements that with key information and best-practices to be successful working with software architecture in industrial projects at any scale. This is a lecture-based course, and students will work on several exercises with practical focus. Class size will be limited.

### Prior Knowledge

Students are expected to be familiar with programming (in any programming language). Prior experience in the development of medium- or large-scale software systems is desirable, but not required.

### Learning Objectives

Specific objectives of this class include:

- Exercise the creation and evaluation of software designs from three different perspectives: implementation units; runtime components; deployment.

- Recognize the importance of quality attributes and learn tactics and patterns that help to realize quality attribute requirements of performance, availability, usability, modifiability, and others.
- Learn how to document an architecture using multiple views, using informal notations and UML.

In support of these objectives students will be exposed to several example designs, with an opportunity to discuss the tradeoffs of key design decisions. Students will be expected to demonstrate understanding of theoretical concepts as well as the ability to make sound design decisions and communicate architectural design they create to others.

### Learning Resources

**Required textbooks** (ebooks can be purchased at [www.informit.com](http://www.informit.com), discount code: BUY2):

- L. Bass, P. Clements, R. Kazman. *Software Architecture in Practice, Fourth Edition*. Addison-Wesley, 2021.
- P. Clements, F. Bachmann, L. Bass, D. Garlan, J. Ivers, R. Little, P. Merson, R. Nord, and J. Stafford. *Documenting Software Architectures: Views and Beyond, Second Edition*. Addison-Wesley, 2010.

Lecture slides and other course materials will be distributed online and accessible with a CMU account via Canvas.

We will be using **Piazza** for asynchronous class discussion. Rather than emailing questions to the instructor, we encourage you to post your questions on Piazza.

**Use of Zoom in the Class.** In our class, we will be using Zoom. The link is available on Canvas. Please make sure that your Internet connection and equipment are set up to use Zoom and you are able to share audio and video during class meetings. (See [this page](#) for Computing Resources for information on the technology you are likely to need.) Let me know if there is a gap in your technology set-up ([pmerson@cmu.edu](mailto:pmerson@cmu.edu)) as soon as possible, and we can see about finding solutions.

*Sharing Video:* In this course, being able to see one another helps to facilitate a better learning environment and promote more engaging discussions. Therefore, our default will be to expect students to have their cameras on during lectures and discussions. However, I also completely understand there may be reasons students would not want to have their cameras on. If you have any concerns about sharing your video, please email me as soon as possible ([pmerson@cmu.edu](mailto:pmerson@cmu.edu)) and we can discuss possible adjustments. Note: You may use a background image in your video if you wish; just check in advance that this works with your device(s) and internet bandwidth.

*Technical Difficulties:* From time to time we all experience unstable internet connections, unstable computers, etc. In those cases, you may find it necessary to turn your camera off. If you experience technical difficulties during class, please let me know via private chat in Zoom prior to turning your camera off. If technical difficulties are a recurring issue, please reach out to your [HUB liaison](#) who will help you access the appropriate resources.

During our class meetings, please keep your mic muted unless you are sharing with the class or your breakout group. If you have a question or want to answer a question, please unmute your mic and speak up. Alternatively, you may use the chat or the “raise hand” feature (available when the participant list is pulled up).

### Assessments

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

- **Lectures and reading assignments:** students are expected to attend the online classes and read all texts indicated in the weekly reading assignments.
- **Class participation:** Students are stimulated to contribute questions, answers and comments during class, and participate in online discussions in Piazza.
- **Weekly quizzes:** These are short online questions derived from the reading assignments and lectures, to be answered individually.
- **Presentation:** Students will give a short presentation about a text (blog post, article, paper, book chapter, etc.) that is relevant to the class.
- **Final exam:** open book timed examination.

Assessment	Final Grade % (yes, the total is 102%)
Six weekly quizzes	54%
Presentation	10%
Class participation	8%
Final exam	30%

### 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 quizzes.
- **Participation policy.** Class participation will be graded by in-class engagement, ~~attendance and punctuality~~, asking relevant questions based on a critical review of required readings and lectures, and contributions (questions and answers) on Piazza. ~~The lack of attendance,~~

and the use of mobile devices—including phones, tablets, and laptops—for purposes other than participating in class, will count against your participation grade. Remote learning requires the use of technology. Research has shown that divided attention is detrimental to learning; I encourage you to close any windows not directly related to what we are doing while you are in class. Please turn off your phone notifications and limit other likely sources of technology disruption, so that you can fully engage with the material, each other, and me. This will create a better learning environment for everyone.

**Attendance.** Within the first week of our course, please look ahead and determine if you need to miss class for any excusable reason (religious observance, job interview, university-sanctioned event, etc.) and notify me as soon as possible. ~~You will be expected to attend all class sessions (unless otherwise discussed with the instructor); the instructor or TA will record attendance.~~ Additionally, you will be expected to participate fully in all in-class discussions, exercises, and case studies. Make meaningful contributions when and where you can. Please note that I expect that you will abide by all behaviors indicated in [The Word](#).

**Recording of Class Sessions.** All synchronous classes will be recorded via Zoom so that students in this course (and only students in the course) can watch or re-watch past class sessions. Recordings become available on Canvas usually a few hours after each class session. Recordings will live on our Canvas website. Please note that you are not allowed to share these recordings. This is to protect your FERPA rights and those of your fellow students.

### Course Schedule

The following schedule provides a general overview of topics and assignments, but it is subject to change.

Week	Topics	Assignments	Notes
1	<ul style="list-style-type: none"> <li>● Course introduction</li> <li>● History of Software Architecture</li> <li>● Architecture - motivation and definition</li> <li>● Architecture and Agile</li> <li>● Architecture drives</li> <li>● Quality attributes and QA scenarios</li> </ul>	<ul style="list-style-type: none"> <li>● Quiz week 1</li> </ul>	
2	<ul style="list-style-type: none"> <li>● Description and tactics for               <ul style="list-style-type: none"> <li>○ Performance</li> <li>○ Availability</li> <li>○ Security</li> <li>○ Usability</li> <li>○ Modifiability</li> </ul> </li> <li>● Other quality attributes</li> </ul>	<ul style="list-style-type: none"> <li>● Student presentation</li> <li>● Quiz week 2</li> </ul>	

3	<ul style="list-style-type: none"> <li>● Architecture views</li> <li>● Module views that show module decomposition</li> <li>● Module views that show module use</li> <li>● Layered style</li> <li>● MVC style</li> <li>● Data model and domain model</li> <li>● Hexagonal architecture</li> <li>● Microkernel</li> </ul>	<ul style="list-style-type: none"> <li>● Student presentation</li> <li>● Quiz week 3</li> </ul>	
4	<ul style="list-style-type: none"> <li>● Runtime (C&amp;C) views</li> <li>● Pipe-and-filter style</li> <li>● Peer-to-peer style</li> <li>● Interceptor pattern</li> <li>● REST style</li> <li>● Publish-subscribe style</li> </ul>	<ul style="list-style-type: none"> <li>● Student presentation</li> <li>● Quiz week 4</li> </ul>	
5	<ul style="list-style-type: none"> <li>● Deployment views</li> <li>● Cloud computing</li> <li>● Containerization</li> <li>● Microservice style</li> </ul>	<ul style="list-style-type: none"> <li>● Student presentation</li> <li>● Quiz week 5</li> </ul>	
6	<ul style="list-style-type: none"> <li>● Software interfaces</li> <li>● Describing behavior <ul style="list-style-type: none"> <li>○ UML sequence diagrams</li> <li>○ BPMN and UML activity diagram</li> <li>○ State machine diagram</li> </ul> </li> <li>● Template for architecture views</li> <li>● Architecture Decision Record (ADR)</li> </ul>	<ul style="list-style-type: none"> <li>● Student presentation</li> <li>● Quiz week 6</li> </ul>	
7	<ul style="list-style-type: none"> <li>● Doing architecture today; wrap-up</li> <li>● Final exam</li> </ul>		

## References

### [Software Architecture references](#)

**Accommodations for Students Disabilities.** If you have a disability and have an accommodations letter from the Disability Resources office, I encourage you to discuss your accommodations and needs with me as early in the semester as possible. I will work with you to ensure that accommodations are 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](mailto: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 Well-Being.** The last few years have been challenging. We are all under a lot of stress and uncertainty at this time. I encourage you to find ways to move regularly, eat well, and reach out to your support system or me ([pmerson@cmu.edu](mailto:pmerson@cmu.edu)) if you need to. We can all benefit from support in times of stress, and this semester is no exception.

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.

If you are worried about affording food or feeling insecure about food, there are resources on campus who can help. Email ([cmu-pantry@andrew.cmu.edu](mailto:cmu-pantry@andrew.cmu.edu)) or call (412-268-8704) the CMU Food Pantry Coordinator to schedule an appointment.

**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](mailto:csdi@andrew.cmu.edu), (412) 268-2150
- **Report-It online anonymous reporting platform:** [reportit.net](https://reportit.net) username: *tartans*  
password: *plaid*

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