



Carnegie Mellon University
Master of
Software Engineering

17-625: API Design

M, W :11am to 12.20pm, location: SCRG 265
Wednesday: 5-6.20pm (Online Recitation)
A2, Fall 2025, 6 Units

Zoom link:

Instructor	Email	Office Location & Hours
Swarnalatha Ashok Bradley Schmerl	swarnala@andrew.cmu.edu schmerl@andrew.cmu.edu	[SCRG 273], by appointment [TCS 421], by appointment

Teaching Assistants

Dejun Yang	mailto:dejuny@andrew.cmu.edu	[TBD]
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Course Description. In today's digital economy, APIs play a major role in synergizing the strengths of companies. They facilitate the implementation of co-opetition (cooperative competition) amongst businesses. The API economy thus refers to the set of business models and practices designed around the use of APIs. It involves the exposure of an organization's digital services and assets through application programming interfaces (APIs) to other businesses. APIs simplify access to the information contained in software platforms and their functionality. APIs are also used internally in companies to leverage reusable assets and services to enhance productivity. Documenting and designing APIs that are easy to use and difficult to misuse have become imperative.

In this course students will learn best practices in designing APIs using different software technology to design and implement APIs. They will get to learn some of the popularly used API technology such as REST, GraphQL and gRPC. They will also learn best practices in documenting APIs. Learning will be facilitated via lectures, flip-classrooms, and assignments. Learning will also be reinforced with many in-class and homework exercises.

Prior Knowledge. Experience in developing software using any programming language such as Python, C#, Java or C++. Basic knowledge of HTTP Protocol.

Learning Objectives. After completing this course, you will be able to:

- Understand the importance of APIs for businesses
- Learn best practices and principles in designing APIs
- Learn the importance and best practices of documenting APIs
- Design RESTful APIs using best practices and principles
- Design GraphQL APIs using best practices and principles
- Understand how Protobuf is useful in the context of designing gRPC APIs
- Design gRPC APIs using best practices and principles
- Learn how to secure APIs
- Compare various API styles and learn when to use them appropriately

Assessments. Students learn more by applying what they have learnt in class. Thus, the course requires the following activities:

- **Assignment 0:** Students will set up the environment for developing APIs and testing them.
- **Assignment 1:** Students will be given requirements to design and implement an API using RESTful style best practices and principles.
- **Assignment 2:** Students will be given requirements to design and implement an API using GraphQL style best practices and principles.
- **Assignment 3:** Students will be given requirements to design and implement an API using gRPC style best practices and principles.
- **Assignment 4:** This is a group project (3 students in each group). Students will be given a set of requirements for building APIs for a system. Given the use cases, the students will need to determine the most suitable style of API design (REST, GraphQL, gRPC) for each use case, design and implement the API. They will need to provide a report on the justification of their choice and design of the API, considering attributes such as understandability, usability, extensibility etc. The students will also need to implement and test the APIs.
- **Class participation:** This component is imperative to learning as it enriches the discussion with the students' insight, relevant experience, critical questions, and analysis of the material. The quality of contribution will contribute more than the quantity to the students' class participation grade.

Assessment	Final Grade %
Assignment 0	10%
Assignment 1	16%
Assignment 2	17%
Assignment 3	17%
Assignment 4 (group project)	35%

Class participation	5%
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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, there will be **10% penalty per day** in term of marks reduction for late submission. In the first week of classes, you should receive a course schedule for each course; please use them to plan.

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, lectures, and comments made by your peers. 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.

This semester involves regular 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. A laptop will be required for our in-person classes.

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](#), including any timely updates based on current conditions.

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. Please note that breakout rooms and recitation sessions will not be recorded. I will make recordings available on Canvas as soon as possible after each class session. Please note that you are not allowed to share these recordings. This is to protect your FERPA rights and those of your fellow students.

Students in section A1 (on CMU PITT campus) are expected to attend in-person classes. The recordings of the live classes are mainly meant for students in D1 section, who are unable to attend classes on campus.

Transferring to Fully Remote During the Semester. If the class needs to go fully remote, you will receive an email from me, and an announcement will be published on our course website on Canvas.

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.

Class	Topic and Readings	In Class Activities	Assignments & due dates
10/20	Introduction to API Economy	Class discussions	
10/22	Co-creating APIs	In-class practice exercises	
10/22	Recitation		
10/27	Best Practices and principles, documentation, and versioning in API	Class discussions	Assignment - 0: Tech familiarity (Due on 11/1)
10/29	Designing RESTful APIs	Class discussions	Assignment - 1: Design and develop a RESTful API for the specified requirement. (Due on 11/5)
10/29	Recitation		
11/3	Designing GraphQL APIs I		
11/5	Designing GraphQL APIs II	Class discussions	Assignment - 2: Design and develop a GraphQL API for the specified requirement. (Due on 11/12)
11/5	Recitation		
11/10	Securing APIs		
11/12	Serialization and Protocol Buffers	Class discussions	Assignment 4: Group project (Due on 12/6)
11/12	Recitation		
11/17	Designing gRPC		Assignment - 3: Design and develop a gRPC API

Class	Topic and Readings	In Class Activities	Assignments & due dates
			for the specified requirement. (Due on 11/24)
11/19	gRPC best practices		
11/19	Recitation		
11/24	Consuming APIs		
11/26	No Class - Thanksgiving		
12/1	Other topics (MCP/Websockets/API Gateway etc.)		
12/3	Review/Other topics		
12/3	Recitation		

Accommodation for Students Disabilities. If you have a disability and have an 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 each assessment, 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. 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) 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 based on 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.