THE CATHOLIC UNIVERSITY OF AMERICA

College of Engineering, Physics, and Computing
Computer Science Department
CSC 410/510, Section 1
Fundamentals of Cloud Computing
3 Credits
Spring 2026

COURSE SPECIFICS

Course Description

Overview of the field of Cloud Computing, its enabling technologies, main building blocks, and hands-on experience through projects utilizing public cloud infrastructures, such as Amazon Web Services (AWS) and Microsoft Azure. Cloud computing services are being adopted widely across a variety of organizations in many domains. Simply, cloud computing is the delivery of computing as a service over a network, whereby distributed resources are rented, rather than owned, by an end user as a utility.

Instructor Information

- Richard Kelley, Ph.D.
- kelleyrc@cua.edu
- 202-319-6942

- Course announcements will be posted to Brightspace and may also be sent via email to your CUA email address. Questions for the instructor should be posted on Brightspace for discussion or sent directly to the instructor, as appropriate. Additional details can be found on the course webpage: https://richardkelley.io/DA510.

Class Meetings

- Friday
- 5:10pm to 7:40pm
- McCort-Ward 208

Office Hours

- Pangborn 324
- Wednesday, 10am

Teaching Assistants

- N/A

Prerequisites

- CSC 323: Introduction to Computer Networks
- CSC 363: Software Engineering

Enduring Questions

- N/A

Cultivating Virtues

- N/A

COURSE GOALS

Objectives

In this course, students will:

- Study the foundations and history of cloud computing.
- Learn about virtualization and containerization.
- Learn about cloud networking, storage, and security.
- Study cloud application architecture and operations.
- Learn principles of cloud programming and APIs.
- Study databases and data management in a cloud context, including for machine learning applications.

Outcomes

Successful completion of this course will enable students to:

- Describe core concepts, service models, deployment models, and major historical and ethical dimensions of cloud computing.
- Explain and apply the principles of virtualization and containerization, including how to deploy and manage VMs and containers.
- Configure fundamental cloud networking, storage, and identity-access components that support secure and scalable systems.
- Design, automate, and operate resilient cloud architectures using IaC, CI/CD, monitoring, and cost-optimization practices.

- Use cloud provider SDKs, CLIs, APIs, and serverless tools to programmatically build and manage cloud applications.
- Select, deploy, and integrate cloud-native database services into applications based on workload and architectural needs.

INSTRUCTIONAL DELIVERY

Location and Instruction Mode list and definitions are available at Enrollment Service webpage

- **Course Location:** Main Campus
- **Instructional Modes:** Synchronous

CONTINGENCY PLANNING

In the event that the university as a whole, or this course in particular, must shift to entirely online course delivery, the following adjustments will be made to the mode of instruction, assignments, and assessments in this course: assignments and exams will be submitted electronically and lecture and discussion will be conducted online as needed.

INSTRUCTIONAL METHODS AND COURSE REQUIREMENTS

Required Materials

There is no required textbook for the course. Readings for each week will be posted on the course website.

Recommended Materials

Recommended reading will be posted to the course website.

Class Policies

- Attendance
    - Instruction will be provided in-person in class. Attendance is required for exams and expected for lectures. If extenuating circumstances arise that prevent you from attending a lecture, let the instructor know in advance if possible.

- Technology
    - Laptops are permitted for taking notes in class. Student recording of lectures is not permitted. The instructor may record lecture audio and may make a transcription of the recording available.

- Late Assignments and Make-Up Exams
    - Late assignments will be accepted with a reduction in the maximum number of points possible for the assignment. The maximum number of points possible will be reduced by 10% of the original total per day late.

    - Barring truly exceptional circumstances, make-up exams must be scheduled with the instructor in advance. The reason for the make-up exam must be documented in order to receive credit for the exam.

- AI Use

    - Use of AI is essential in computing, but can impair learning if not used wisely. AI use will be permitted or prohibited on a per-assignment basis. All AI use should be documented by the student for each assignment. Students will be graded based on how well they use AI for assignments that permit AI use.

Grades

- Link or attach scoring guidelines if appropriate

- Final grade will be computed based on performance on in-class quizzes, assignments, projects, and exams. These components will contribute to your final grade according to the following weights:

Component	**Weight**
Quizzes	20%
Assignments	5%
Projects	30%
Midterm Exam	20%
Final Exam	25%

- Point totals will convert to letter grades according to the following table. These intervals are closed on the left and open on the right (so earning 95% of the total

possible points in the class will get an A, but (95-x)% will earn an A- for any positive value of x).

Score	Grade
95%	A
90%-95%	A-
87%-90%	B+
83%-87%	B
80%-83%	B-
77%-80%	C+
73%-77%	C
70%-73%	C-
66%-70%	D
0%-66%	F

- Remember: *grades in Brightspace do not necessarily forecast the final course grade, as they may not reflect outstanding assignments.*

The University grading system is available:

- Undergraduate policies on grades and academic standing
- Graduate policies on grades and academic standing

Reports of grades in courses are available at the end of each term in Cardinal Students

Assessment of Learning

List major course assignments/assessments:

- Major assignments
  - Small assignments will given weekly to reinforce course material.
- Major projects
  - There will be 3 major projects.
- Major assessments (Mid-term)
  - There will be one midterm exam, on February 20, 2026.
- Major assessments (Final)
  - There will be one final exam, on our university scheduled exam date of Wednesday, May 6th 5:45-7:45 p.m.

COURSE SCHEDULE AND BIBLIOGRAPHY

Course Schedule

- **Topics:** Evolution of Cloud Computing, Cloud Service Models, Cloud Deployment Models, Ethics and Sustainability in Cloud Computing, Hardware Virtualization Principles, Deploying and Managing Virtual Machines, VM Performance and Isolation, Comparing Compute Models, Container Isolation Mechanisms, Building and Running Containers, Composing Multi-Container Applications, Kubernetes Fundamentals, Virtual Networking Constructs, Load Balancing and Traffic Distribution, Private Connectivity Solutions, Network Security Best Practices, Comparing Storage Models, Deploying Object Storage, Using Block Storage with Compute, Integrating File Storage Services, IAM Concepts and Authorization Models, Configuring Roles and Permissions, Federated Identity Integration, Shared Responsibility Model, Scalability and Elasticity Principles, High Availability and Fault Tolerance, Caching and Content Delivery, Workload-Driven Architecture Selection, Declarative IaC Fundamentals, Terraform Essentials, Native IaC Templates, IaC in CI/CD Pipelines, Continuous Integration Foundations, Continuous Delivery and Deployment, Integrating IaC and Containers in Pipelines, Securing CI/CD Pipelines, Cloud-Native Monitoring, Centralized Log Aggregation, Troubleshooting Distributed Applications, Cost Optimization Strategies, Using Provider CLIs, SDK-Based Development, REST API Interaction, Serverless vs Container Architectures, Deploying Function-Based Workloads, Building Event Pipelines, Monitoring and Optimizing Serverless Applications, Evaluating Serverless Fit, Comparing Database Models, Deploying Cloud Databases, Integrating Databases with Applications, Durability and Replication Strategies, ETL and ELT Patterns, Building Cloud Data Pipelines, Using Distributed Compute Services, Training Large Language Models. Lecture topics broken down by date can be found on the course webpage (https://richardkelley.io/DA510).

- Midterm date: Friday, February 20, 2026.
- Final exam date: Wednesday, May 6th 5:45-7:45 p.m.

Bibliography

References, supplementary readings, websites of interest
Full list can be found online at https://richardkelley.io/DA510.

UNIVERSITY POLICIES

All of Catholic University's policies are detailed at Catholic University Policy Webpage.

Academic Integrity

Academic dishonesty at The Catholic University of America is not tolerated. As such, academic integrity is not merely avoiding plagiarism or cheating, but it certainly includes those things. Academic integrity means, above all else, taking responsibility for your work, your ideas, and your effort, and giving credit to others for their work, ideas, and effort. If you submit work that is not your own – whether test answers, whole papers, or something in-between – that is considered to be academic dishonesty. University procedures related to academic dishonesty are conducted with respect and dignity, while also preserving accountability, and they presuppose that all participants will treat each other with respect and dignity.

- Undergraduate Student Academic Dishonesty Policy
- Graduate Student Academic Dishonesty Policy

Grades and Academic Standing

- Undergraduate policies on grades and academic standing
- Graduate policies on grades and academic standing

University Recording Policies

- Recording Classroom Lectures Policy
- CUA Recording Policy

Accommodations for students with disabilities

- Any student who feels they may need a reasonable accommodation based on the impact of a disability should contact the Office of Disability Support Services (Office of Disability Support Services) by emailing at CUA-DSS@cua.edu

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