Course Syllabus

Course: CPSC 4440/6440, Cloud Computing Architecture

Term: Spring 2022 (Section 001)

Meeting time and location:

- Time: **Mon & Wed 4:00-5:15pm ET**
- Location: **McAdams Hall 114**
- Modality: **In-Person with online synchronous (Zoom) accommodation as necessary**

The Class Schedule can be found here. Be sure to check this frequently as it is subject to change.

Instructional Staff

Professor Mitch Shue, (**mshue@clemson.edu (mailto:mshue@clemson.edu)**), McAdams 226C, Phone: 703.608.5266.

- Office hours: Office hours will be via Zoom and scheduled via email

Teaching Assistant (TA) - Nikhil Suresh, (**nsuresh@g.clemson.edu (mailto:nsuresh@g.clemson.edu)**)

- Office hours: **Mon and Wed, 6-7:30pm ET via Zoom**. See the link by clicking Zoom in the navigation panel.

If the instructor is late, please wait 15 minutes.

Course Description

This course covers the history and background of cloud computing, the essential technical knowledge needed to build applications in the cloud, and the hardware and software systems for architecting a cloud application environment. The course will utilize cloud services. Students will learn cloud computing skills and use these skills in a project based on a real-world problem.

Prerequisites

Students should have completed a course in Computer Networks (e.g, CPSC 3600, ECE 4380) and be comfortable reading and modifying scripts using common scripting languages (e.g., Bash, Python, Java).

Course Topics

Business Aspects of Cloud Computing

- Introduction to Cloud Computing
- Using a Cloud Platform
- Security and Compliance
- Cloud Financials
- Migrating to the Cloud

Cloud Technical Essentials

- History of Cluster, Grid, and Cloud Computing
- Virtualization
- Infrastructure: Compute, Storage, and Networking
- Security
- Identity and Access Management
- Databases
- Management Tools

Cloud Architecting

- Cloud Basic Knowledge
- Basic Cloud Services
- Designing a Cloud Environment
- Making a Cloud Environment Highly Available
- Automating and Decoupling Cloud Infrastructure
- Designing Web-Scale Media Hosting
- Well-Architected Framework
- Troubleshooting
- Large-Scale Design Patterns and Case Studies
- Cloud Computing Individual and/or Group project

Course Components and Grading

Grades will be based on the following distribution:

- **Attendance, Quizzes, Labs, Homework: 10%**

- **Midterm Exam - Cloud Foundations: 25%**
- **Midterm Project: 10%**
- **Lab Exam: 15%**
- **Final Project: 15%**
- **Final Exam - Comprehensive w/emphasis on Cloud Architecting: 25%**

Much of this class is taught through hands-on exercises during the class period. Attendance and participation in class activities is expected.

CPSC 4440: Letter grades are assigned by points earned according to the standard scale (i.e. A: 90-100, B: 80-89, C: 70-79, D: 60-69, F: 0-59).

CPSC 6440: **Graduate students will have an additional technology project, 3-page paper, or presentation** worth 10% of the grade, and the grade will be calculated on 110% as A: 99-110, B: 88-98; C: 77-87; F 0-76.

Learning Objectives

4000-level learning outcomes: Students having taken this course should:

1. Be able to explain the tradeoffs of cloud computing and on-premise enterprise applications.
2. Identify and explain the functions of the main components of an enterprise data center and its primary technologies.
3. Be able to identify and explain the function of core cloud computing technologies and services, such as virtualization, computing instances, virtual private clouds, storage, database, and identity and authentication management.
4. Be able to use online tools to build cloud computing solutions for several common application patterns, including web-tier applications and high availability solutions for computing, database, storage, and network systems.
5. Be able to explain the tradeoffs of block versus object storage, the storage lifecycle, and how to select storage technologies that meet application requirements.
6. Formulate cloud solutions to several common types of application and enterprise problems.
7. Understand and analyze cost tradeoffs for different cloud architecture options.
8. Develop an implementation of a substantial cloud system solution using core services.

6000-level learning outcomes: In addition to 4000-level learning outcomes, students having taken this course should:

1. Develop, alone or with a teammate, an implementation of a cloud system solution that uses cloud technologies beyond the core services, analyze the tradeoffs, and explain the technology choices.
2. Make a presentation on a cloud technology beyond the core services.

Course Materials

You are required to have a laptop with you for this class.

General Laptop and Networking Requirements

- Functioning webcam and microphone, if possible
- Modern browser software; preferably a recent version of Chrome, Safari, Firefox, Edge, or Opera, but NOT Internet Explorer
- Reliable internet connection capable of supporting online learning activities if you are remote. If your internet connection is unreliable, contact **ithelp@clemson.edu (mailto:ithelp@clemson.edu)** or visit **https://ccit.clemson.edu/support/ (https://ccit.clemson.edu/support/)** and ask for assistance.

Please be sure to **install a SSH client on your laptop**. We will use SSH to connect to various AWS resources.

There is no required textbook for this class. Course materials will also come from assigned and optional readings. You are responsible for all assigned reading materials and anything presented in lectures.

The course is based on two (2) Amazon Web Services (AWS) Academy courses:

- AWS Cloud Foundations (ACF)
- AWS Cloud Architecting (ACA)

While the content is focused on AWS, the concepts are widely applicable to other cloud providers, including Microsoft Azure and Google Cloud Platform (GCP).

We will be using materials and lab exercises found on the AWS Academy Canvas system. Unfortunately, there is still no integration available to connect our Canvas to theirs. The student experience is not as nice as it could be.

I have enrolled you in these classes on the AWS Academy Canvas. **You will have to establish login credentials on the AWS Academy Canvas, since there is no Clemson single sign-on (SSO) available at this time.**

You will also have access to a free AWS Academy Learner Lab which will allow you to build persistent environments and projects in AWS over the course of the semester.

Attendance and Inclement Weather Policy

Attendance (including online) in class is expected. You are expected to be well prepared for — and to routinely attend — all classes except when extenuating circumstances intervene.

In-class labs can be completed outside of class, but you will not have access to the instructor for help in that case. If you are ill or have an urgent life event, please do not attend class, but send email to the

course instructor and TA describing your situation.

If there is inclement weather, please watch for University class cancellations. If the University if not closed but there is inclement weather, please use your good judgement in deciding if you can attend. Send email to the course instructor and TA describing your situation. Any exam, quiz, or in-class lab assignment that was scheduled at the time of a class cancellation due to inclement weather will be given at the next class meeting unless contacted by the instructor.

Any exam that was scheduled at the time of a class cancellation due to inclement weather, University power outage, etc. will be given at the next class meeting unless contacted by the instructor. Any assignments due at the time of a class cancellation due to inclement weather will be due at the next class meeting unless the instructor contacts students. Any extension or postponement of assignments or exams must be granted by the instructor via email or Canvas within 24 hours of the weather-related cancellation.

COVID-19 (In-Person and Hybrid Classes)

https://www.clemson.edu/covid-19/index.html (https://www.clemson.edu/covid-19/index.html)

The University will continue to work with government officials on guidance and will evaluate the prevalence of COVID-19 in areas throughout the state to update this guidance as conditions change.

Collaboration Policy

In and out of class assignments are opportunities for learning and discovery. Collaboration between students on assignments in this class is permitted. Collaboration includes students working together to gain an understanding of course concepts, active discussions with the instructor and other people to learn about course material, and other activities in which a student is actively seeking to learn and understand the topics covered in the course.

As has always been the case, however, plagiarism is not allowed. Taking assignments from other classmates or downloading completed papers from websites is not allowed. These are activities that are simply meant to earn a score, not understand the course material. If you collaborate with other students in class or use sources other than those provided for everyone in the course (e.g., instructor, recommended textbook, the course web site, or the lectures) to help yourself learn and understand, then you must give appropriate credit to those collaborators and/or sources. As long as you acknowledge the collaboration that occurred, your grade will not be affected nor will you be charged with academic misconduct. On the other hand, a failure to acknowledge collaborations or give appropriate credit to sources of help (other than course materials or personnel as noted above) will be treated as plagiarism.

In general, collaboration is permitted on labs, homework and exercises and on out of class projects with the consideration that all collaboration is to be acknowledged as above. However, in-class exams and quizzes are to be taken on your own with no help from any friends, electronics, or notes.

Academic Integrity

As members of the Clemson University community, we have inherited Thomas Green Clemson's vision of this institution as a "high seminary of learning." Fundamental to this vision is a mutual commitment to truthfulness, honor, and responsibility, without which we cannot earn the trust and respect of others. Furthermore, we recognize that academic dishonesty detracts from the value of a Clemson degree. Therefore, we shall not tolerate lying, cheating, or stealing in any form.

All infractions of academic dishonesty by undergraduates must be reported to Undergraduate Studies for resolution through that office. In cases of plagiarism instructors may use the Plagiarism Resolution Form.

See the **Undergraduate Academic Integrity Policy (https://www.clemson.edu/academics/integrity/)** website for additional information and **the current catalog (https://catalog.clemson.edu/index.php?catoid=33)** for the policy.

For graduate students, see the current **graduate student handbook (https://www.clemson.edu/graduate/students/policies-procedures/index.html)** for all policies.

Student Accessibility Services

Clemson University values the diversity of our student body as a strength and a critical component of our dynamic community. Students with disabilities or temporary injuries/conditions may require accommodations due to barriers in the structure of facilities, course design, technology used for curricular purposes, or other campus resources. Students who experience a barrier to full access to this class should let the instructor know and make an appointment to meet with a staff member in Student Accessibility Services as soon as possible. You can make an appointment by calling 864-656-6848, by emailing **studentaccess@lists.clemson.edu, (mailto:studentaccess@lists.clemson.edu)** or by visiting Suite 239 in the Academic Success Center building. Appointments are strongly encouraged – drop-ins will be seen, if at all possible, but there could be a significant wait due to scheduled appointments. Students who have accommodations are strongly encouraged to **request, obtain, and send these (https://www.clemson.edu/academics/studentaccess/register.html)** to their instructors via SAS as early in the semester as possible so that accommodations can be made in a timely manner. It is the student's responsibility to follow this process each semester.

You can access further information at the **Student Accessibility website (https://www.clemson.edu/academics/studentaccess/index.html)**. Other information is at the

university's **Accessibility Portal (https://www.clemson.edu/accessibility/index.html)** .

Title IX

The Clemson University Title IX statement: Clemson University is committed to a policy of equal opportunity for all persons and does not discriminate on the basis of race, color, religion, sex, sexual orientation, gender, pregnancy, national origin, age, disability, veteran's status, genetic information or protected activity in employment, educational programs and activities, admissions and financial aid. This includes a prohibition against sexual harassment and sexual violence as mandated by Title IX of the Education Amendments of 1972. This **Title IX policy (http://www.clemson.edu/campus-life/campus-services/access/title-ix/)** is located on the Campus Life website. Ms. Alesia Smith is the Clemson University Title IX Coordinator, and the Executive Director of Equity Compliance. Her office is located at 223 Brackett Hall, 864.656.0620. Remember, email is not a fully secured method of communication and should not be used to discuss Title IX issues.

Emergency Preparedness Statement

Emergency procedures have been posted in all buildings and on all elevators. Students should be reminded to review these procedures for their own safety. All students and employees should be familiar with guidelines from the Clemson Police Department. **Visit here for information about safety. (https://www.clemson.edu/cusafety/EmergencyManagement/)**

Academic Continuity Plan

Clemson has developed an Academic Continuity Plan for academic operations. Should university administration officially determine that the physical classroom facility is not available to conduct classes in, class will be conducted in a virtual (online) format. The University issues official disruption notifications through email /www /text notification/Social Media.

When notified, use one of the following links to navigate to Clemson Canvas where you will find important information about how we will conduct class:

- Primary access link: www.clemson.edu/canvas
- Secondary access link, if needed: https://clemson.instructure.com/

You can also use the Canvas Student App.

Our activities for teaching and learning will occur through our Canvas course. This includes: posting of a Canvas module with lecture materials, assignments, and further instructions.

Changes to Syllabus

Lecture topics and assignments are subject to change. The course syllabus is a general plan for the course; deviations to the class may be necessary and will be announced to class by the instructor.

Copyright Statement

Materials in courses should be considered to be copyrighted. They are intended for use only by students registered and enrolled in a particular course and only for instructional activities associated with and for the duration of the course. They may not be retained in another medium or disseminated further. They are provided in compliance with the provisions of the Teach Act. Students must seek permission from instructors to record any class activity, including lectures, discussions, and presentations. Students should be reminded to refer to the Use of Copyrighted Materials and “Fair Use Guidelines” policy on the Clemson University website for additional information (link https://clemson.libguides.com/copyright).