SP25-CS6431J2 Cloud Computing

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CS 643 1J2 Spring 2025 - Syllabus

Instructor

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- Online office hours: Thursday, 4pm-6pm in Jersey City

Short Description

The course presents a comprehensive view of cloud computing, from platforms and services to programming and infrastructure. The topics include: cloud computing platforms, with examples from Amazon Web Services (AWS), Google Cloud, and Microsoft Azure; cloud services for data analytics, machine learning, mobile computing, IoT, edge computing, security and privacy, and devops; programming frameworks for parallel computing in the cloud; distributed storage in the cloud; and virtualization and containerization. The course includes quizzes, programming assignments, research paper presentations, and exams. The programming assignments will be done in AWS.

Learning Outcomes

Upon the successful completion of this course, the student should be able to:

- Analyze the trade-offs between deploying applications/services in the cloud and on premises
- Compare the advantages and disadvantages of different types of cloud platforms
- Deploy applications in public cloud platforms
- Program data intensive parallel applications in the cloud
- Analyze the performance, scalability, and availability of cloud systems and applications
- Identify security and privacy issues in the cloud
- Present state-of-the-art cloud research

Why Take This Course?

Cloud computing represents a major paradigm shift in computing from the era of personal computers to the era of computing as utility. Most major Internet services are already deployed in the "the cloud." We store most of our data in "the cloud" and execute most applications from "the cloud." This course is aimed at all graduate students (both M.S. and Ph.D. students) who want to learn how to design and program cloud services and applications as well as how to build and administer cloud systems. By studying real-world systems developed in industry, students will acquire cutting-edge knowledge that

may be a major advantage when searching for a job.

Lectures and Readings

There is no book required for this class. Each module is based on research papers and/or online documentation covering a specific topic (i.e., readings). The readings should be used as reference material to clarify and add details to lectures. The lecture slides will be posted before class, and the video recordings of the lectures will be posted after class.

Exams

There will two exams: a midterm, and a final exam. Both exams are closed book (i.e., papers, notes, etc.), and students are not allowed any online access during the exams. The final exam will cover only the material taught after the midterm. In case of missing an exam, a make-up may be taken only after providing written documentation to the Dean of Students.

Quizzes

There will be four in-class 15-minute quizzes during the semester to prepare students with the type of questions encountered in exams. The solutions will be discussed at the end of the quizzes.

Programming Assignments

There will be two individual programming assignments. In the first, you will learn how to use the AWS cloud and how to develop an AWS application that uses existing cloud services. In the second, you will learn how to develop AI-enabled parallel applications in the AWS cloud. The assignments must be done in Java on Amazon Linux VMs. Python could be used, upon permission from the instructor. In addition to the code submission, you will submit a demo video that shows how to compile and run the software.

Research Paper Presentations

Students will present individually one research paper. These papers cover state-of-the-art research in cloud computing. Extra-credit is available for asking good questions about the presentations.

Grading

- Midterm exam - 25%
- Final exam - 25%
- Programming Assignment 1 - 10%
- Programming Assignment 2 - 20%
- Research presentation - 10%
- Quizzes - 10%

Schedule

- **Week 1: Course overview. Introduction to Cloud Computing.**
- **Week 2: Cloud Platforms I: Infrastructure as a Service (IaaS), AWS.**
  - Programming assignment 1 handed out
  - Research papers posted
- **Week 3: Cloud Platforms II: Serverless Computing; Function as a Service (FaaS).**
  - Quiz 1
  - Choose research paper
- **Week 4: Cloud Services I: Data Analytics and Machine Learning.**
- **Week 5: Cloud Services II: Mobile, IoT, and Edge Computing.**
  - Quiz 2
  - Programming assignment 1 due
- **Week 6: Cloud Services III: Security and Privacy, Devops.**
  - Research paper drafts due
- **Week 7: Midterm**
  - Discussion of midterm solutions after the exam
- **Week 8: Research Paper Presentations**
- **Week 9: Parallel Programming in the Cloud I: Google's MapReduce, Apache's Hadoop, Yahoo's Pig Latin.**
  - Programming assignment 2 handed out
- **Week 10: Parallel Programming in the Cloud II: Apache's Spark, Storm and Zookeper.**
- **Week 11: Cloud Storage Systems I: Google's GFS and BigTable.**
  - Quiz 3
- **Week 12: Cloud Storage Systems II: Amazon's Dynamo and Other Cloud Databases.**
- **Week 13: Virtualization I: VMWare, XEN, Live VM Migration.**
  - Quiz 4
- **Week 14: Virtualization II: Containerization, Docker, Kubernetes.**
  - Programming assignment 2 due

Academic Integrity

Academic Integrity is the cornerstone of higher education and is central to the ideals of this course and the university. Cheating is strictly prohibited and devalues the degree that you are working on. As a member of the NJIT community, it is your responsibility to protect your educational investment by knowing and following the academic code of integrity policy that is found at: **NJIT Academic Integrity Code (https://t.e2ma.net/click/fw4pfmb/3yu6novf/3qgyp0x)** .

Please note that it is my professional obligation and responsibility to report any academic misconduct to the Dean of Students Office. Any student found in violation of the code by cheating, plagiarizing or using any online software inappropriately will result in disciplinary action. This may include a failing grade of F, and/or suspension or dismissal from the university. If you have any questions about the

code of Academic Integrity, please contact the Dean of Students Office at **dos@njit.edu (mailto:dos@njit.edu)** .

Modifications to Syllabus

The students will be consulted and must agree to any modifications or deviations from the syllabus throughout the course of the semester.