CSCI3124 Intro. to Cloud Computing – 2025 Winter
Term Project

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Overview

The technology of cloud computing changes more quickly than most other technology in software development, in fact this is part of why companies have flocked to putting their software in the cloud. They can ride this wave of technological advancement to keep their software on the cutting edge. The services and technologies you learn during this course will be deprecated, changed, or expanded upon within only a few years. **For this reason, the most critical skill for you to develop in this course is your ability to dive into a cloud provider's service offerings, to learn what they have available, and how the services you are interested in work.** To work in the field of cloud computing you must be confident that you can jump right in, figure services and tools out, and adapt to the changing technical "cloudscape".

The term assignment is the primary driver for experiential learning in this course. We can only truly say you understand cloud computing once you've built and deployed working software in the cloud, which is why the term assignment is **an individual assignment to be completed by you, and you only**. To accomplish this goal will require tenacity, self-directed learning, experimentation and critical analysis. Every semester my students continue to amaze me with what they accomplish. **You've got this!**

Requirements

There are many career paths in cloud computing. From traditional app developers to data scientists, machine learning, IoT, cloud architect, cloud engineer, cloud systems administrator, and even people just interested in supporting cloud app development (DevOps). For this reason, rather than describing a project for you to implement, I am leaving the nature of your project largely up to you to decide. There will be a menu with different categories of AWS services you must select from, however what you build with these technologies is entirely up to you. Use this opportunity to gain experience with something you might want to work with further when you enter industry or to build some cool thing you can further develop and even bring to market.

No matter what services you choose from the menu, you will also need to develop the software that runs on the services you select. **You are not allowed to use existing code (not even your own code from other courses or personal projects), all code you write for this course must be original and entirely created by you for this course.** The software does not have to be a traditional web page. It could be an API, a typical 2 or 3-tier app, a website, a mobile app that talks to an API, IoT devices, GenAI applications, etc. The choices are endless, and creativity is your friend to keep you engaged and passionate about learning these difficult services.

Each category below will require you to select several items from the list of choices to include in the design and implementation of your project. Pick the things you are most interested in learning about or doing. The instructor has no preferences here, all choices are equally valid. If you select services that aren't listed here, please check with the instructor to determine which category they belong to before you proceed. Additionally, when selecting and designing your applications, it's essential to consider which AWS services you will utilize. Ensure that the chosen services are compatible with and supported by the AWS Academy Learner Lab.

AWS Service Categories Menu

Compute – Pick at least one:

- Amazon EC2
- Amazon EC2 Auto Scaling
- Amazon EC2 Image Builder
- Amazon Lightsail
- AWS App Runner
- AWS Batch
- AWS Elastic Beanstalk
- AWS Fargate
- AWS Lambda
- AWS Serverless Application Repository
- AWS Outposts
- AWS Wavelength
- Amazon Elastic Container Registry
- Amazon Elastic Container Service
- Amazon Elastic Kubernetes Service

Storage – Pick at least one:

- AWS Backup
- Amazon Elastic Block Store
- AWS Elastic Disaster Recovery
- Amazon Elastic File System
- Amazon File Cache
- Amazon FSx for Lustre
- Amazon FSx for NetApp ONTAP
- Amazon FSx for OpenZFS
- Amazon FSx for Windows File Server
- Amazon Simple Storage Service (S3)
- AWS Storage Gateway

Networking and Content Delivery – Pick at least one:

- Amazon API Gateway
- Amazon CloudFront
- Amazon Route 53
- AWS Verified Access
- Amazon VPC
- Amazon VPC Lattice
- AWS App Mesh
- AWS Cloud Map
- AWS Direct Connect
- AWS Global Accelerator
- AWS PrivateLink
- AWS Private 5G

- AWS Transit Gateway
- AWS VPN
- Elastic Load Balancing

Database – Pick at least one:

- Compare AWS database services
- Amazon Aurora
- Amazon DynamoDB
- Amazon ElastiCache
- Amazon Keyspaces (for Apache Cassandra)
- Amazon MemoryDB for Redis
- Amazon Neptune
- Amazon Relational Database Service
- Amazon RDS for Db2
- Amazon RDS on VMware
- Amazon Quantum Ledger Database (Amazon QLDB)
- Amazon Timestream
- Amazon DocumentDB (with MongoDB compatibility)
- Amazon Lightsail managed databases

Application integration – No requirement:

- AWS Step Functions
- Amazon AppFlow
- AWS B2B Data Interchange
- Amazon EventBridge
- Amazon Managed Workflows for Apache Airflow (MWAA)
- Amazon MQ
- Amazon Simple Notification Service
- Amazon Simple Queue Service
- Amazon Simple Workflow Service
- AWS AppSync
- AWS AppFabric
- Amazon Chime
- Amazon Pinpoint
- Amazon SES

Management and Governance – No requirement:

- AWS Auto Scaling
- AWS Chatbot
- AWS CloudFormation
- AWS CloudTrail
- Amazon CloudWatch
- AWS Compute Optimizer
- AWS Console Mobile Application
- AWS Control Tower

- AWS Config
- AWS Health Dashboard
- AWS Launch Wizard
- AWS License Manager
- Amazon Managed Grafana
- Amazon Managed Service for Prometheus
- AWS Organizations
- AWS OpsWorks
- AWS Proton
- Service Catalog
- AWS Systems Manager
- AWS Trusted Advisor

The services and requirements mentioned above provide all you need to develop a complete, typical 3-tier application, though your applications are not limited to this architecture. Additional services are listed in the appendix at the end of this document for your reference, especially if your application involves more tools or areas such as data analytics, Machine Learning, IoT, etc. You are welcome to explore and use these services; however, no extra marks will be awarded for doing so.

We are restricted to the services supported in the AWS Academy learner lab sandbox. Not all AWS services are supported, and sometimes they don't work as well in the sandbox as they do in the real AWS infrastructure (for example IAM is extremely limited in AWS Academy unfortunately). **Please refer to the "AWS Academy Learner Lab Supported Services" document on Brightspace to see a full list of available services and any special considerations in their use in the lab environment.** Pay particularly close attention to the necessity to use the existing LabRole IAM role created for the lab environment which grants access from one service to another within AWS.

We DON'T require students to provision their infrastructure with Infrastructure as Code (IaC). You are welcome to use IaC to provision your infrastructure, but there won't be bonus marks.

Project Deliverables & Grade Distribution

The term assignment represents a combined 20% of your overall final grade. The deliverables contain two components:

- Final Written Report – 60%
- One-on-One Video Meeting – 40%

Be aware that you do not need to submit your source code for the project.

Final Written Report

Your final report will summarize the state of your term assignment and what you have achieved. It will also include your discussion and critical analysis of the security and business consideration aspects of your project.

Please prepare a PDF document that answers these questions and provides the information requested below:

- First, introduce your project. What is it? What is it supposed to do? Give the markers the information they need to evaluate whether your choices in later questions were good choices or bad choices. In other words, give them the context of your application and what it is supposed to achieve, who its users are, and what its performance targets should be.
- Describe how you met your AWS service category requirements: you will list the services you selected, and provide a comparison of alternative services, explaining why you chose the services in your system over the alternatives.
- Describe your final architecture:
    - The architecture of your final system. You must draw the architecture diagram using the free tool https://app.diagrams.net/. You should be able to learn how to use this tool by yourself.
    - How do all of the application components fit together to deliver your application?
    - Where is data stored?
    - What programming languages did you use (and why) and what parts of your application required code?
    - How is your application deployed to the cloud?
- How does your application architecture keep data secure at all layers? If it does not, if there are vulnerabilities, please explain where your data is vulnerable and how you could address these vulnerabilities with further work. IAM is not required to be implemented for this project due to the restrictions of the AWS Academy Learner Lab, but you can explain what you can do to secure your applications and data using IAM.
    - Which security measures are used to achieve the data security described in the previous question? List them, and explain any choices you made for each mechanism (technology you used, algorithm, cloud provider service, etc.)
- An analysis of the cost metrics for operating your system. You will calculate the up-front, on-going, and additional costs to build this system in the real world. You will also explain alternative approaches that might have saved you money, or alternatively provide justification for a more expensive solution.
- How would your application evolve if you were to continue development? What features might you add next and which cloud services or solutions architectures would you use to implement those features?

The rubric of the report:

Exceptional (A+)

You provided clear, thorough, and accurate answers to all the questions, and your explanations were well-articulated. Your cloud architecture is well-structured, aligns perfectly with your explanations, and is easy to understand. We found no significant areas needing changes in your architecture, services, or security approach.

Good (B+ to A)

You delivered reasonable answers to the questions, your architecture is well defined and we understand how you achieved your project, your analysis of your architecture's quality shows that you've achieved a broad understanding of the mechanisms available to you and how to use them correctly. You showed some evidence of a thorough understanding of your project's security and business considerations.

Minimal (B-)

Your responses provide the minimum amount of information to answer the questions, but do not expand enough to demonstrate a thorough understanding of your project's cloud computing considerations. We may see evidence of poor choices in your system that reflect a lack of understanding of cloud computing considerations.

Bare Minimum (C- to C+)

Your response is an obvious minimal effort to answer the questions yet provides no detail demonstrating your understanding of cloud computing considerations in relation to your project.

Unacceptable (F)

You are missing responses to questions or have responses that do not show enough critical thought and analysis to warrant points.

One-on-One Video Meeting

The TA will schedule a one-on-one videoconference meeting with each student, lasting at about 15 minutes. **At the beginning of the video, please ensure that your student ID card is visible in front of the camera and keep your face visible throughout the entire meeting. Failing to do so will result in zero marks for the video meeting.**
During this meeting, your goal is to showcase your working application and demonstrate the successful implementation of your project. This is where you validate that your project functions as described. We won't be assessing the code quality of individual services you've implemented; rather, our focus is on the final working product. You will be expected to present the back-end implementation, AWS configuration, and the full functionality of your system in its live, working state. This is your opportunity to proudly present your creation. The marker will ask questions for clarification regarding your accomplishments.

You will spend 10 minutes presenting your project, covering the following points:

- The expected functionalities of your application and the reasons for choosing to implement this application.
- The design of your application, a diagram will be helpful.
- The AWS (or Azure, GCP) services used to implement the project and how they work together.
- The percentage of expected functionalities you have successfully accomplished.

The markers will ask follow-up questions for about 5 minutes.

The rubric of the Meeting:

5 marks:

The student clearly explains all the requested points. The application meets all the expected functionalities presented. The student answers all questions correctly and demonstrates a genuine understanding of the project.

1-4 marks:

- The presentation doesn't fully meet the requirements explained above.
- The student is unable to correctly answer some of the marker's questions.
- The student doesn't fully understand what he/she has presented.

The marker will judge based on the quality of the presentation and the question answering.

0 marks:

The student can barely present their work, cannot answer most questions, and shows little understanding of the project.

Appendix: Other AWS services you may use in your term project

Analytics:

- Amazon Athena
- Amazon CloudSearch
- Amazon DataZone
- Amazon EMR
- Amazon FinSpace
- Amazon Kinesis
- Amazon Data Firehose
- Amazon Managed Service for Apache Flink
- Amazon Kinesis Data Streams
- Amazon Kinesis Video Streams
- Amazon OpenSearch Service
- Amazon OpenSearch Serverless
- Amazon Redshift
- Amazon Redshift Serverless
- Amazon QuickSight
- AWS Clean Rooms
- AWS Data Exchange
- AWS Data Pipeline
- AWS Entity Resolution
- AWS Glue
- AWS Lake Formation
- Amazon Managed Streaming for Apache Kafka (Amazon MSK)

Machine Learning:

- Amazon Augmented AI
- Amazon Bedrock
- Amazon CodeGuru
- Amazon Comprehend
- Amazon DevOps Guru
- Amazon Forecast
- Amazon Fraud Detector
- Amazon Kendra
- Amazon Lex
- Amazon Lookout for Metrics
- Amazon Lookout for Vision
- Amazon Monitron
- Amazon PartyRock
- Amazon Personalize
- Amazon Polly
- Amazon Rekognition
- Amazon SageMaker

- Amazon Textract
- Amazon Transcribe
- Amazon Translate
- AWS DeepComposer
- AWS DeepRacer
- AWS HealthLake
- AWS HealthScribe
- AWS Panorama

Internet of things (IoT):

- AWS IoT 1-Click
- AWS IoT Analytics
- AWS IoT Button
- AWS IoT Core
- AWS IoT Device Defender
- AWS IoT Device Management
- AWS IoT Events
- AWS IoT ExpressLink
- AWS IoT FleetWise
- AWS IoT Greengrass
- AWS IoT SiteWise
- AWS IoT TwinMaker

Developer Tools:

- AWS Application Composer
- AWS Cloud9
- AWS CloudShell
- AWS CodeArtifact
- AWS CodeBuild
- Amazon CodeCatalyst
- AWS CodeCommit
- AWS CodeDeploy
- AWS CodePipeline
- Amazon Corretto
- AWS Fault Injection Service
- AWS X-Ray
- AWS Amplify

Security, identity, and compliance:

- Amazon Cognito
- Amazon Detective
- Amazon GuardDuty
- Amazon Inspector
- Amazon Macie
- Amazon Security Lake
- Amazon Verified Permissions
- AWS Artifact

- AWS Audit Manager
- AWS Certificate Manager
- AWS CloudHSM
- AWS Directory Service
- AWS Firewall Manager
- AWS Identity and Access Management
- AWS Key Management Service
- AWS Network Firewall
- AWS Resource Access Manager
- AWS Secrets Manager
- AWS Security Hub
- AWS Shield
- AWS IAM Identity Center
- AWS WAF

End User Computing:

- Amazon AppStream 2.0
- Amazon WorkSpaces
- Amazon WorkSpaces Core
- Amazon WorkSpaces Thin Client
- Amazon Workspaces Web

Media:

- Amazon Elastic Transcoder
- Amazon Interactive Video Service
- Amazon Nimble Studio
- AWS Elemental Appliances and Software
- AWS Elemental MediaConnect
- AWS Elemental MediaConvert
- AWS Elemental MediaLive
- AWS Elemental MediaPackage
- AWS Elemental MediaStore
- AWS Elemental MediaTailor