

# **CMPE 48A**

## **CLOUD COMPUTING**

### **TERM PROJECT**

In this project, you are expected to design, implement, and evaluate a cloud-native architecture using a commercial Cloud Service Provider (Google Cloud Platform - GCP). You will integrate containerized workloads, virtual machines, and serverless functions to create a complete, scalable, and efficient system.

#### **Scope & Requirements**

You are not required to write application code from scratch. You may reuse projects from earlier coursework or use open-source code from repositories (e.g., GitHub). However, **the entire cloud-native design and implementation must be your original work.**

Your architecture must include all of the following:

1. Containerized workloads on Kubernetes, deployed in a scalable manner (e.g., using Deployments, HPA).
2. Virtual Machines, integrated into your system and serving a functional role.
3. Serverless Functions, implemented using Google Cloud Functions.

#### **Performance Evaluation of your design**

- You must design performance tests to evaluate the behavior of your system under realistic workloads.
- Use **Locust** to simulate realistic user behavior and generate traffic.
- Identify relevant independent and dependent variables (e.g., request load, response time, CPU utilization).
- Collect and interpret metrics such as:
  - Request latency
  - Throughput (requests per second)
  - Resource usage (CPU, memory)
  - Error rates under load

## **Technical Report Requirements**

You will submit a report that documents your entire work. It should include:

- A cloud architecture diagram
- A description of each component and how they interact
- A step-by-step explanation of the deployment process
- Locust experiment design and parameter configurations
- Visualized performance results (e.g., charts, graphs)
- A clear explanation of the observed results, supported by reasoning and performance metrics
- A cost breakdown demonstrating compliance with the \$300 GCP trial budget

## **Project Deliverables**

Your submission must include:

- A fully working system deployed on GCP
- A comprehensive term project report (as described above)
- A demo video showcasing your system in action (maximum 2 minutes)
- A GitHub repository containing:
  - Application source code
  - All deployment scripts/manifests (e.g., Kubernetes YAMLS, Terraform, etc.)
  - Locust test scripts
  - A `README.md` file with clear instructions to replicate your setup

## **Cloud Platform & Budget Constraints**

- You are required to use Google Cloud Platform (GCP).
- You must stay within the \$300 free trial credit for all resources used.
- You are responsible for monitoring and optimizing your spending.

### **Bonus Challenge (Optional)**

You may earn bonus points if you use Terraform to implement your cloud infrastructure using Infrastructure as Code (IaC). This demonstrates advanced DevOps practices and improves system reproducibility.

### **Grading Criteria**

<b>Component</b>	<b>Weight</b>
Technical report content	45%
In class presentation quality	25%
GitHub repo organization and reproducibility	15%
Demo video clarity and presentation quality	15%
<b>Bonus:</b> Terraform-based deployment	+5%