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IT 334 – DevOps Engineering on AWS Cloud

# Project – Building a Highly Available, Scalable Web Application

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**Date:**
**05/06/2024**

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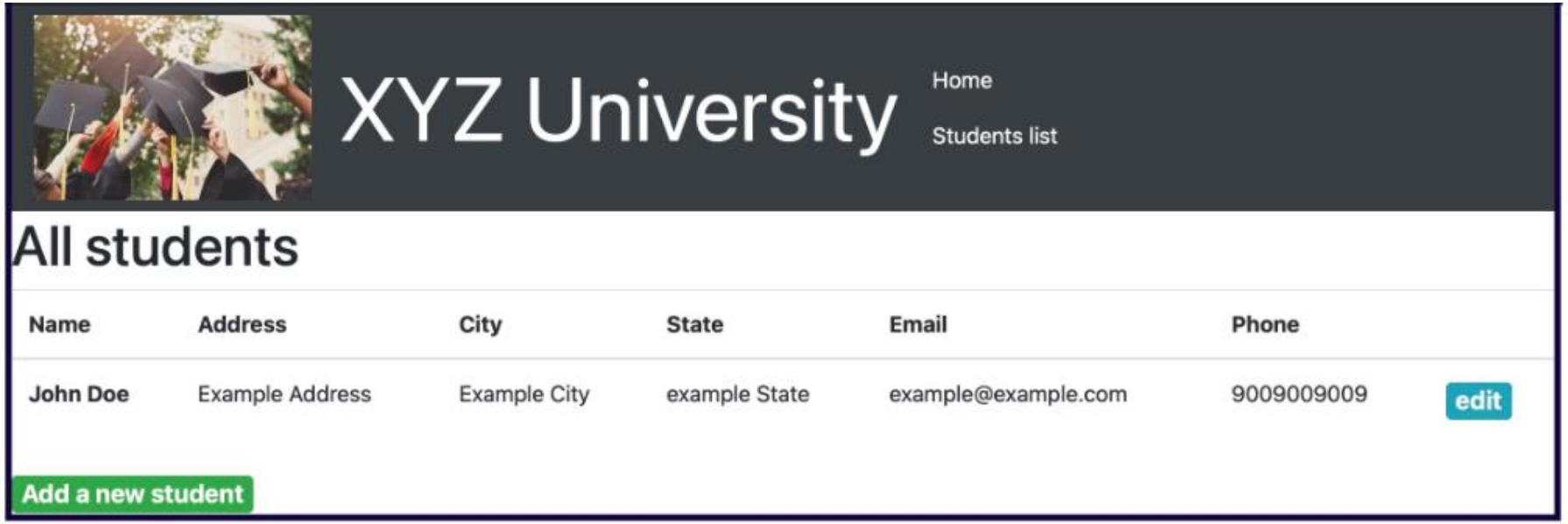
# Business scenario overview

- Example University is preparing for the new school year.  The huge volume of inquiries has resulted in complaints to the admissions department over the slowness or unavailability of their web application for student records during the peak admissions period.
- The challenge is to plan, design, build, and deploy the web application to the AWS Cloud, which should support thousands of users, and be highly available, scalable, load balanced, secure, and high performing, during the peak admissions period
- The following image shows an example of the student records web application. Users can view, add, delete, and modify student records.



# Business scenario overview

## Solution Requirements:

- **Functional:** The solution should meet the functional requirements, such as the ability to view, add, delete, or modify the student records, without any perceivable delay.
- **Load balanced:** The solution should properly balance user traffic to avoid overloaded or underutilized resources.
- **Scalable:** The solution should be designed to scale to meet the demands that are placed on the application.
- **Highly available:** The solution should be designed to have limited downtime when a web server becomes unavailable.
- **Secure:**
    1. The database should be secured and can't be accessed directly from public networks.
    2. The web servers and database can be accessed only over the appropriate ports.
    3. The web application should be accessible over the internet.
    4. The database credentials shouldn't be hardcoded into the web application.
- **Cost optimized:** The solution should be designed to keep costs low.
- **High performing:** The routine operations should be performed without a perceivable delay under normal, variable, and peak loads.

# Solution overview

## High-level Description

- We created a secure and scalable web application on AWS to make sure it can effectively manage large amounts of traffic. With the ability to view, add, delete, and alter records, this program acts as a platform for Example University's student record management.

## Design Considerations

1. **High Availability** → Multiple AZs
2. **Functionality** → Amazon EC2
3. **Scalability** → Amazon RDS and Auto Scalling
4. **Security** → VPC, Security Groups, Secrets Manager
5. **Load balancing** → Amazon ELB

## Use Cases

- Administrative Access: Faculty members can access and modify student records
- Student Information Retrieval: Students can view their personal and academic information

# Architecture diagram of the solution

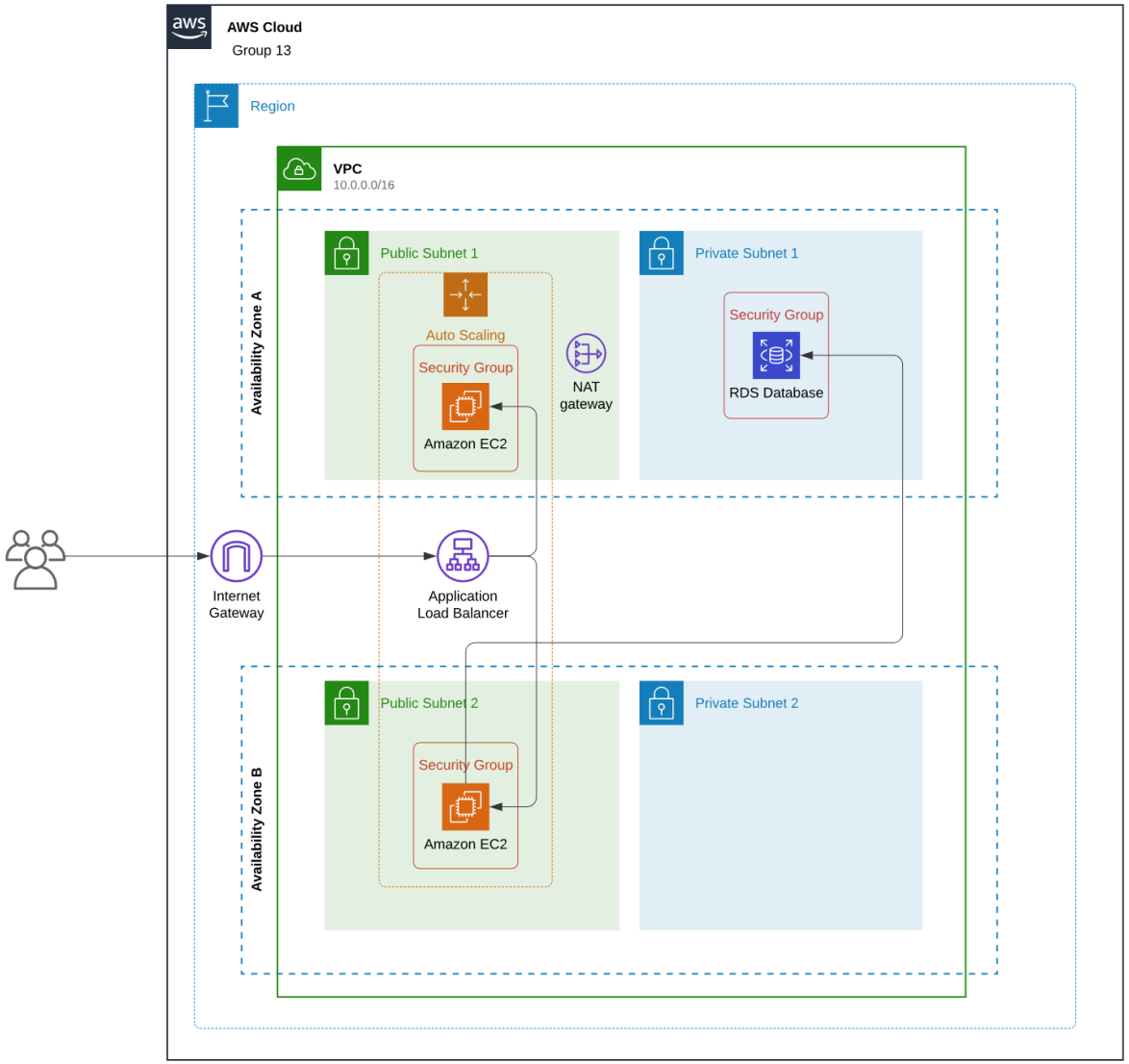



**Figure 1.**
Architecture Diagram

# Demo

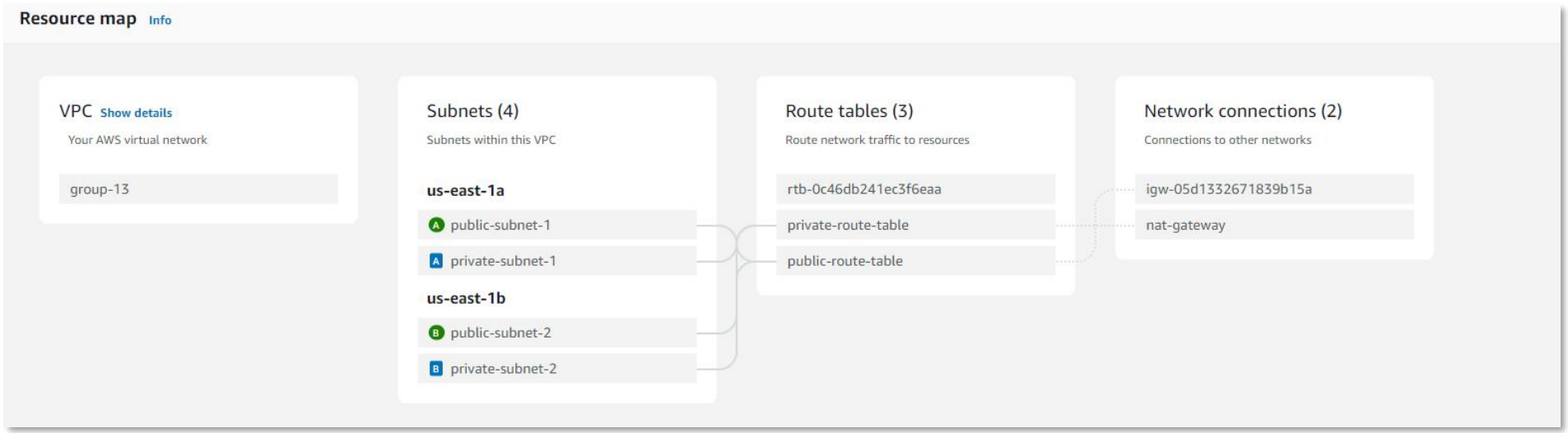



**Figure 2.** VPC Setup

# Demo

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| ☐ | aws-cloud9-Gr... | i-0f919f5aaeeba3e8b | Running | t2.micro | 2/2 checks passed | View alarms + | us-east-1a | ec2-3-93-181-218.com... | 3.93.181.218 | – |
| ☐ | My Web Server | i-0888adbd298a81add | Running | t3.micro | 2/2 checks passed | View alarms + | us-east-1a | ec2-54-91-198-177.co... | 54.91.198.177 | – |
| ☐ | Second Web S... | i-04f13164ea7045dbf | Running | t2.micro | 2/2 checks passed | View alarms + | us-east-1b | ec2-3-94-212-139.com... | 3.94.212.139 | – |

**Figure 3.** EC2 Instances

Databases (1)

Group resources | Modify | Actions | Restore from S3 | Create database

Filter by databases

1

| DB identifier | Status | Role | Engine | Region & AZ | Size | Recommendations | CPU | Current activity | Maintenance |
|---|---|---|---|---|---|---|---|---|---|
| students | Available | Instance | MySQL Community | us-east-1b | db.t3.micro | 1 Informational | 3.39% | 9 Connections | available |

**Figure 4.** RDS Database

# Demo

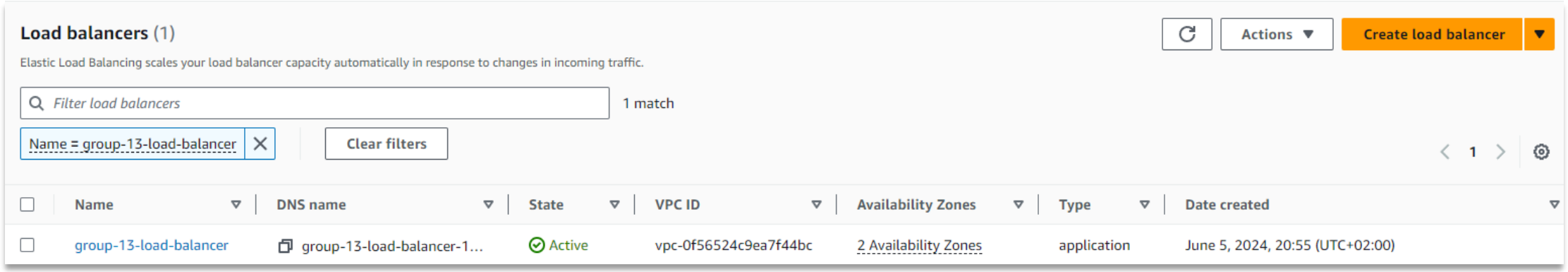
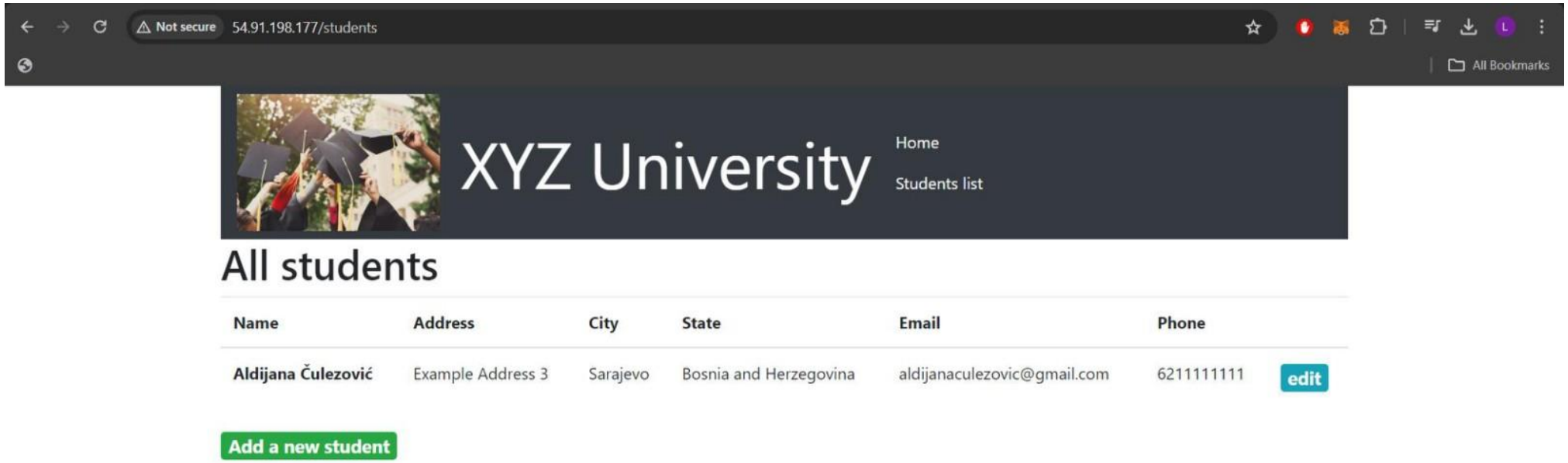


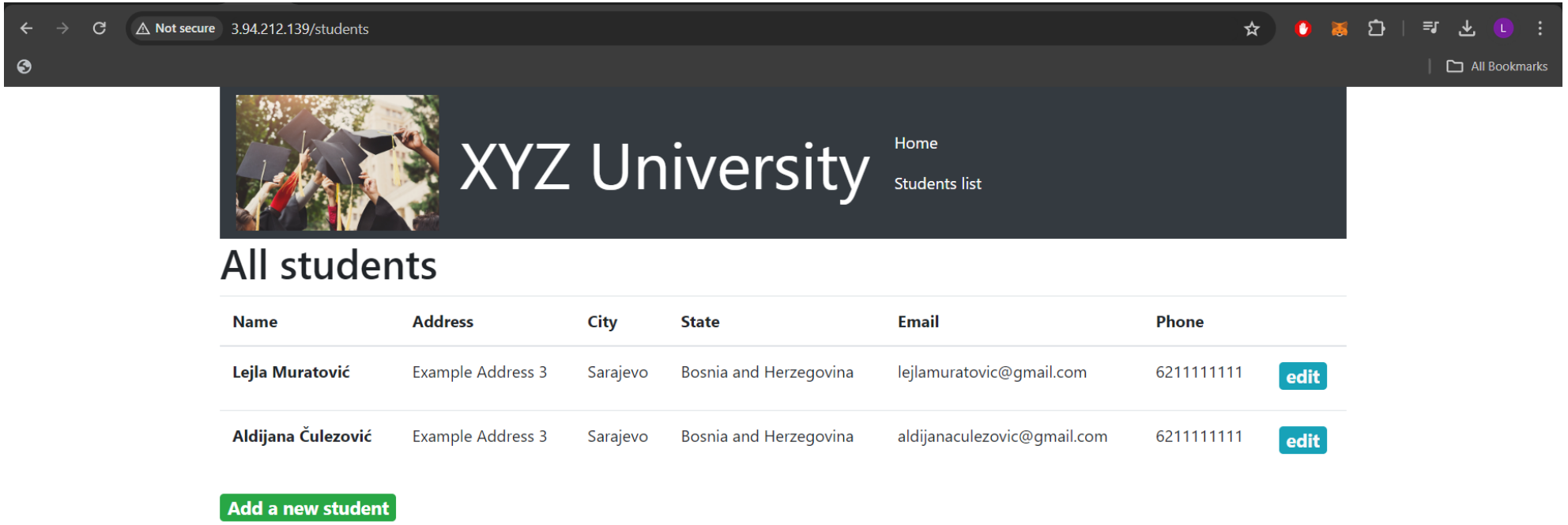

**Figure 5.** Load Balancer

# Demo: First EC2 Instance



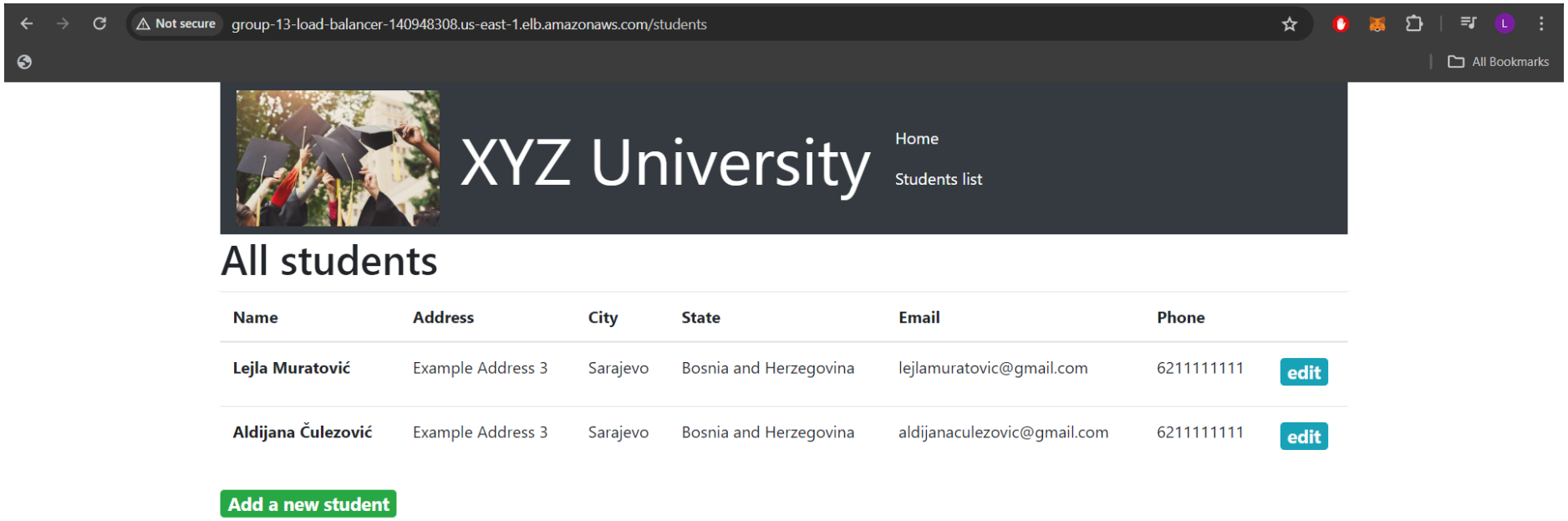

Link for first EC2 Instance: [http://54.91.198.177/](http://54.91.198.177/)

# Demo: Second EC2 Instance




Link for second EC2 Instance: [http://3.94.212.139/](http://3.94.212.139/)

# Demo: Load Balancer




Link for Load Balancer: http://group-13-load-balancer-140948308.us-east-1.elb.amazonaws.com/

# Lessons learned

## Challenges & Resources

- At first, we experienced issues with database migration as it was difficult to understand the shell commands at first, but after following the AWS Academy Cloud Architecting – Lab: Migrating a Database to Amazon RDS  we successfuly completed the task and database was migrated into the EC2 Instance.
- We also had problems understanding the steps of Load Balancer and how it actually works. We followed instructions from AWS Academy Cloud Architecting – Lab: Creating a Highly Available Environment, which helped us understand the concept and how to implement it.

## New skills

- We gained knowledge on how to use AWS services like EC2, RDS, ELB, and Auto Scaling to design and build a highly available, scalable, and secure online application. We acquired skills in setting up security groups and virtual private clouds to improve application security and guarantee data integrity. During this project, we have learned that a load balancer efficiently distributes incoming network traffic across multiple servers to ensure no single server bears too much demand.

## Next steps

- Create database backups and further scale the application.
- Secure the application by implementing HTTPS to encrypt data in transit.
- Utilize CloudWatch and CloudTrail for detailed monitoring and logging.

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# Questions?

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# THANK YOU!