# AWS Case Study

## Building a Serverless Scalable Student Portal

## Uc3m.es

# Customer Overview

The Universidad Carlos III de Madrid (UC3M) is a leading Spanish university known for its emphasis on research, technology, and academic excellence. UC3M required a serverless, scalable, high-performance AWS infrastructure to power its student portal, which handles course registrations, educational records, and student communications.

# Customer Challenges

1. **Scalability & Performance Bottlenecks**

   o The previous system struggled to handle peak loads during student enrolment and exam periods.

   o High API latency due to inefficient database queries.

2. **Need for a Serverless Microservices Architecture**

   o The university aimed to transition to a fully serverless architecture to reduce operational overhead.

   o Required automated scaling to handle fluctuating traffic patterns efficiently.

3. **Cost Optimization**

   o Inefficient database usage and redundant storage led to higher-than-expected operational costs.

   o Pay-as-you-go pricing is required to align with fluctuating student usage.

4. **Security & Compliance**

   o The university must ensure GDPR compliance for student data storage and access control.

   o Automated security monitoring is required to detect unauthorised access.

# CloudiQS Solutions

CloudiQS designed and implemented a fully serverless AWS architecture, ensuring scalability, cost efficiency, and security compliance for UC3M.

1. Serverless & Microservices-Based Architecture

- AWS Lambda was implemented to handle all application logic in a fully managed, event-driven environment.

- Amazon API Gateway exposed secure, low-latency REST APIs for student interactions.

- AWS CloudFormation automated infrastructure deployment and ensured consistency across environments.

## 2. Database Optimization & API Performance Enhancements

- Amazon DynamoDB was selected as the primary database due to its low-latency key-value storage model.

- Global Tables in DynamoDB provided high availability and replication across regions.

- Amazon ElastiCache (Redis) was integrated to further reduce API response times by caching frequently accessed student records.

## 3. Cost Optimization & Serverless Efficiency

- Amazon S3 Intelligent-Tiering was used to optimise the cost of storing student documents and course materials.

- AWS Lambda's pay-as-you-go model eliminated unnecessary compute costs.

- AWS Cost Explorer and Budgets were configured to monitor cloud spending and set automated alerts.

## 4. Security & Compliance Enhancements

- AWS IAM & Secrets Manager implemented role-based access controls to enforce least-privilege access.

- AWS Security Hub & GuardDuty continuously monitored security risks and potential threats.

- Data encryption at rest and in transit was enforced using AWS Key Management Service (KMS).

# Architecture Review
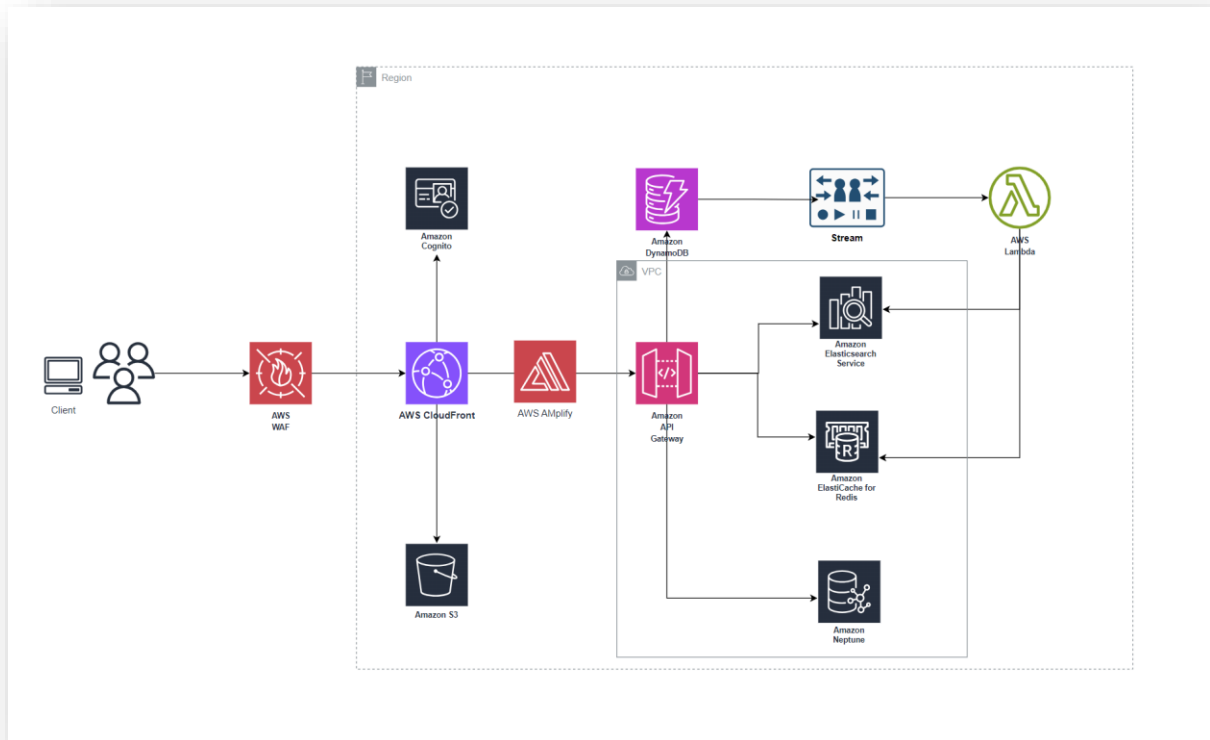


## AWS Compute

- AWS Lambda (serverless compute for microservices)

- Amazon API Gateway (secure API management)

## Networking

- AWS CloudFront (CDN to reduce latency for global student access)

## Database

- Amazon DynamoDB (low-latency, scalable NoSQL database for student records)

- Amazon ElastiCache (Redis) (API acceleration & caching)

## Storage

- Amazon S3 Intelligent-Tiering (cost-optimized object storage for documents)

## Security

- AWS IAM & Secrets Manager (secure access management)

- AWS Security Hub & GuardDuty (real-time security monitoring)

## Infrastructure Management

- AWS CloudFormation (automated infrastructure deployment)

**Cost Optimization**

- AWS Cost Explorer & Budgets (cost tracking & optimization alerts)

# Results

### Scalability & Availability

- 100% serverless architecture enabled seamless scaling, eliminating capacity planning issues.

- Global Tables in DynamoDB ensured high availability and automatic failover.

**50% Faster API Response Times**

- API performance improved from 250ms to under 100ms using DynamoDB and ElastiCache (Redis).

**35% Cost Savings**

- Reduced compute costs by eliminating EC2 instances, using AWS Lambda instead.

- Amazon S3 Intelligent-Tiering saved 25% on storage costs.

**Fully Automated Security & Compliance**

- GDPR compliance ensured through AWS IAM, Secrets Manager, and KMS encryption.

- 24/7 security monitoring implemented with Security Hub & GuardDuty.

**Improved Operational Efficiency**

- Infrastructure deployment time reduced by 70% using AWS CloudFormation.

- Automated scaling and monitoring eliminated manual maintenance efforts.

# Conclusion

CloudiQS successfully transformed UC3M's student portal into a fully serverless, cost-efficient, and highly scalable solution. By leveraging AWS Lambda, DynamoDB, API Gateway, and automated infrastructure deployment, UC3M achieved seamless performance, 35% cost savings, and complete security compliance.