Cloud Computing Project: Group 7

This project explores the creation of an Amazon Machine Image (AMI) from an existing EC2 instance, copying it to a different AWS region, and testing application redundancy. This project demonstrates the power of cloud computing for building scalable and resilient applications.

Team Leader:- **Arijit Dutta (22/ECE/54)**
Members:
Abhijit Nandi (22/ECE/018)   **Arghya Mandal (22/ECE/052)**
Girish Chandra Ghosh   (22/ECE/080)   **Ayan Rakesh   (22/ECE/062)**
Jinat Kaderi (22/ECE/90)   **Dipan Das (22/ECE/074)**
Nibha kumari (22/ECE/113)   **Esa Roy   (22/ECE/078)**
Prasenjit Sarkar (22/ECE/127)
Soham Chowdhury   (22/ECE/172)

Acknowledgement

What is Cloud Computing?

Cloud computing provides on-demand access to computing resources, including servers, storage, databases, networking, software, analytics, and intelligence, over the internet.

On-Demand Access

Users can access resources as needed, without the need for upfront investments or complex infrastructure management.

Shared Resources

Cloud providers pool resources and allocate them to multiple users, allowing for cost-effective utilization.

Scalability

Cloud services can easily scale up or down to meet changing demands, ensuring optimal resource utilization.

Cloud Service Models: IaaS, PaaS, SaaS

Cloud service models classify the level of service offered, determining the degree of control and responsibility shared between the provider and the user.

1	2	3

IaaS (Infrastructure as a Service)

IaaS providers offer fundamental computing resources, including servers, storage, and networking.

PaaS (Platform as a Service)

PaaS providers offer a platform for developing, running, and managing applications, including tools, middleware, and operating systems.

SaaS (Software as a Service)

SaaS providers offer fully functional software applications accessible over the internet, eliminating the need for local installation and maintenance.

Cloud Deployment Models: Public, Private, Hybrid

Cloud deployment models refer to how cloud services are deployed and managed, catering to various security and control needs.

Public Cloud

Public clouds are offered by third-party providers and are accessible to the general public.

Private Cloud

Private clouds are dedicated to a single organization and are typically hosted on-premises or in a secure data center.

Hybrid Cloud

Hybrid clouds combine public and private cloud components, enabling organizations to leverage the benefits of both models.

Introduction to Amazon Web Services (AWS)

1 AWS

Amazon Web Services (AWS) is a leading cloud provider, offering a wide range of services for businesses of all sizes.

2 Benefits

AWS Cloud is a highly scalable infrastructure, unlike on-premise data centers. You can scale everything, from storage to servers and databases. You can scale up to meet demand or downscale upon reduced demand or to minimize costs.

WHY AWS?

Amazon Web Services (AWS) is a popular cloud computing service that offers a variety of benefits, including:

1	2	3	4

Cost-effective

AWS is cost-effective and doesn't require long-term commitments. Customers pay for what they use, and their costs are automatically scaled.

Fast installation

AWS offers fast installation and removal of applications in any location.

Security and reliability

AWS has many data centers around the world that are continuously monitored and maintained. AWS also offers an end-to-end approach to security and privacy.

User-friendly

AWS offers a user-friendly programming model, architecture, database, and operating system.

Key Features Of AWS

Here are some key features of Amazon Elastic Compute Cloud

EC2

A cloud computing service that offers a variety of instance types, with different amounts of memory, storage, compute, and network capacity.

AWS Lambda

A service that allows users to execute code in response to events, such as changes to Amazon S3 buckets or updates to Amazon DynamoDB tables.

Amazon CloudWatch

Amazon CloudWatch Logs offers features like **real-time monitoring, storage and archival, and analysis and visualization of logs**.

Amazon S3

A service that offers flexible security features to block unauthorized users from accessing data. S3 also supports server-side encryption and client-side encryption. S3 Object Lambda can be used to redact sensitive information from an object in S3.
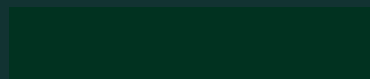
OUR PROJECT

To Create a custom AMI from an existing running EC2 instance, copy it to a different region, and test the redundancy of your application . here are the steps –

1 Create a Custom AMI from the Running EC2 Instance

2 Copy the Custom AMI to Another Region

3 Launch an Instance from the Copied AMI in the New Region

4 Test the Redundant Application

Create a Custom AMI from the Running EC2 Instance

1 Log in to the AWS Management Console.

2 In the Create Image dialog: Provide a name and description for your AMI.

3 Go to EC2 Dashboard and select Instances.

4 Click on Actions > Image and Templates > Create Image.

5 Choose the running EC2 instance that you want to create a custom AMI from.

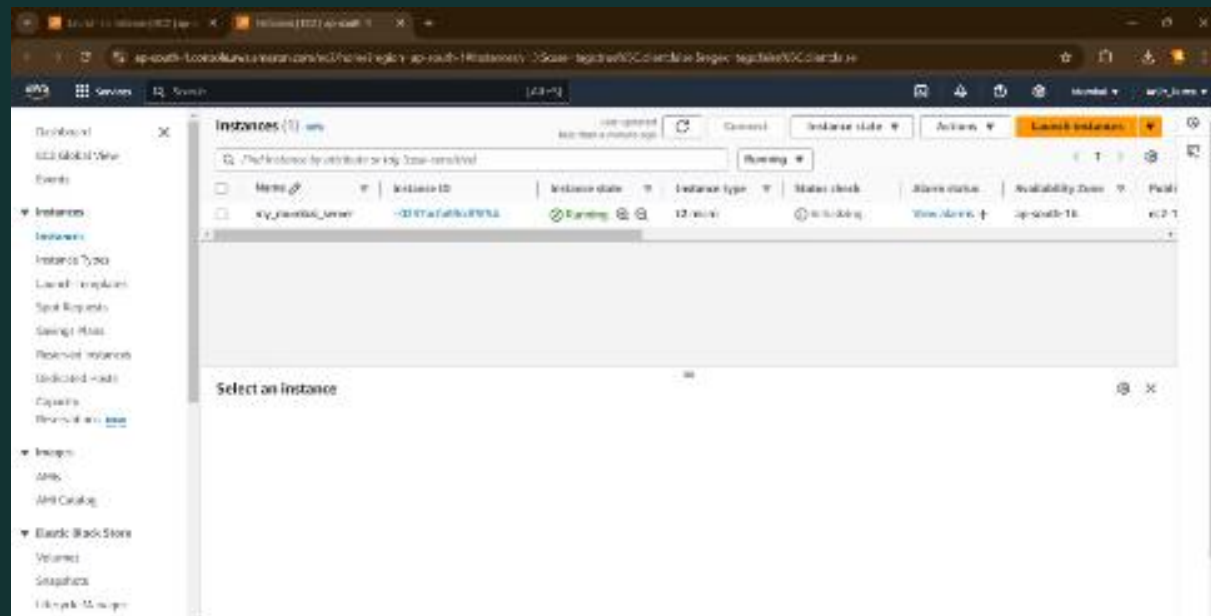6 The AMI will start being created. You can monitor the progress under the AMI section of the EC2 dashboard.

EC2

1 What is EC2?

- **EC2** stands for **Elastic Compute Cloud**.
- It's a **cloud computing service** offered by Amazon Web Services (AWS).
- EC2 allows you to rent virtual computers (called **instances**) in the cloud.
- You can use these instances to run your own software applications.

2 What is AMI?

Amazon Machine Image (AMI) is a template used to launch EC2 instances. It contains the information required to launch an instance, including:

- **Root Device:** This is the primary storage device for the instance, typically containing the operating system and software applications.

- **Launch Permissions:** These determine which AWS accounts can launch instances from the AMI.

- **Block Device Mappings:** These define the volumes that are attached to the instance, including the root device and any additional storage volumes.
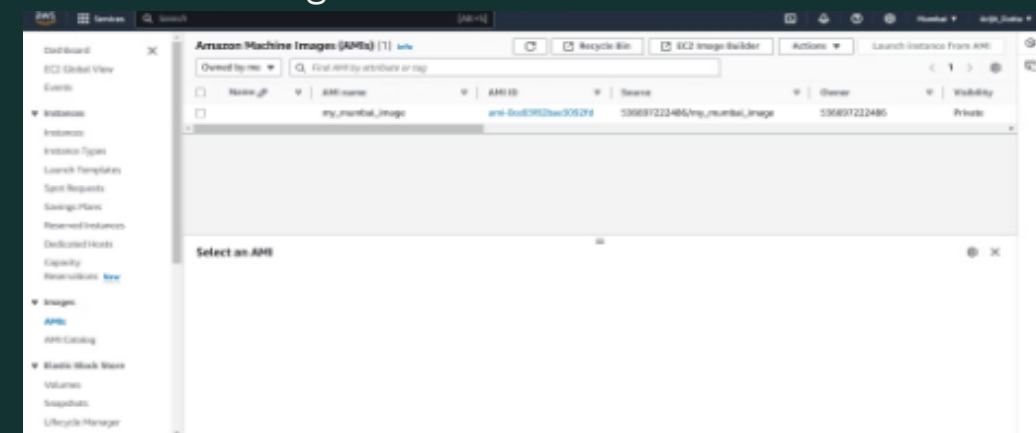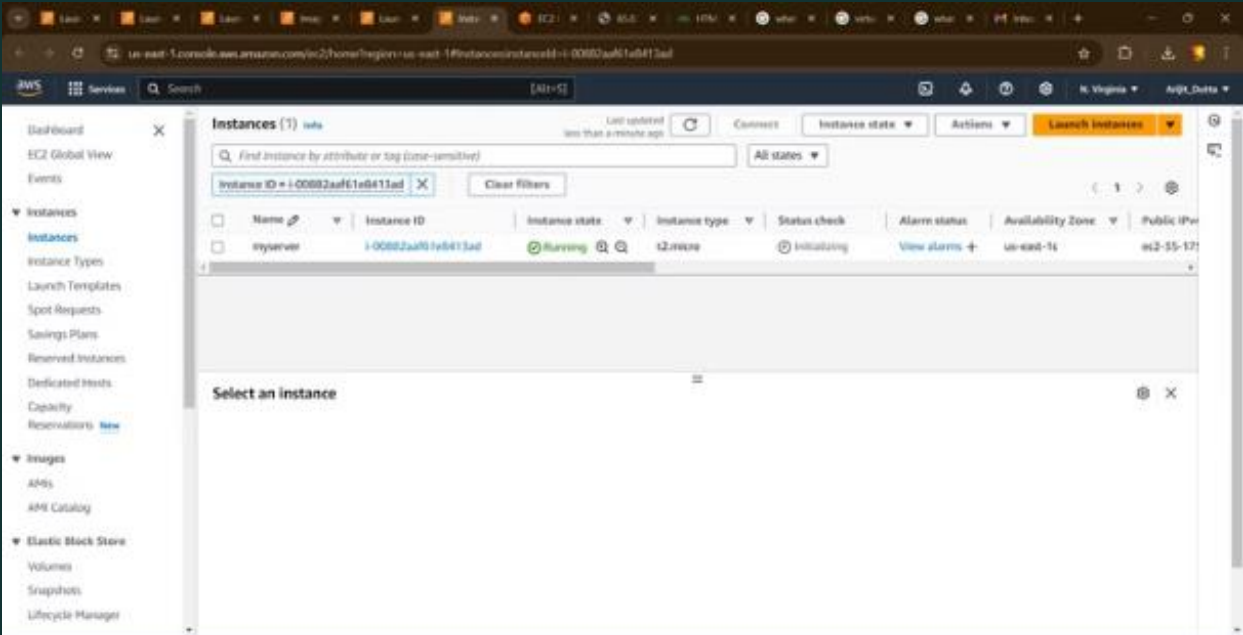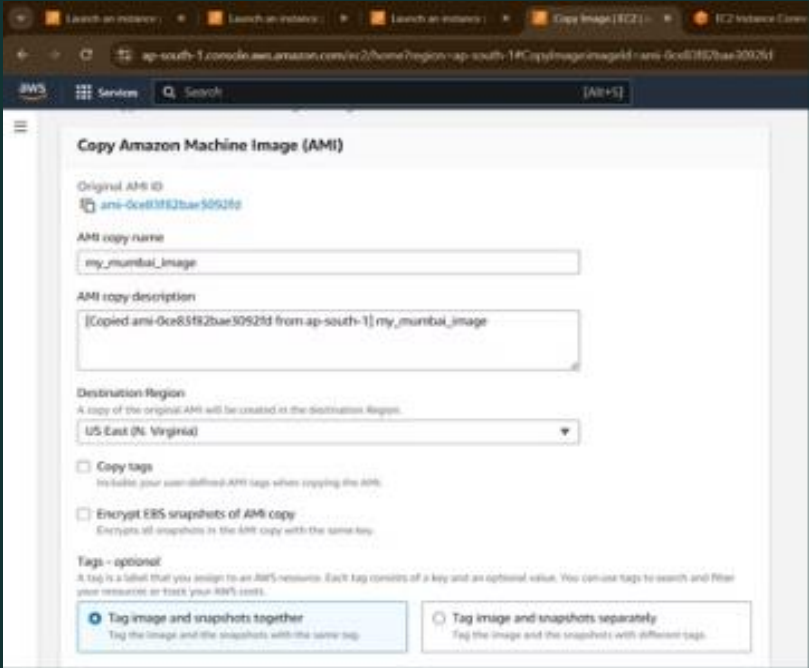
Copy the Custom AMI to Another Region

| 1 | Go to Images > AMIs in the EC2 dashboard. | 2 | Select the AMI you created from the running EC2 instance. | 3 | Click on Actions > Copy AMI |

| 4 | In the Copy AMI dialog: Choose the Destination Region where you want to copy the AMI. | 5 | Wait for the copy operation to complete. You can check the progress in the destination region's AMIs section. |

Regional

1 What is Region?

An AWS Region is a specific geographical location where AWS data centers are located.

Why are Regions Important?

1. **Data Sovereignty:** Some countries have strict data residency laws, requiring data to be stored within their borders.

2. **Latency:** Choosing a region closer to your users can significantly improve the performance of your applications.

3. **Disaster Recovery:** By distributing your resources across multiple regions, you can protect your applications from regional outages.

2 What is availability zones?

Availability Zones (AZs) are distinct locations within an AWS Region, each with independent power, cooling, and networking.

Why are Availability Zones Important?

1. **High Availability:** By distributing your resources across multiple Availability Zones, you can significantly improve the availability of your applications. If one Availability Zone fails, your application can continue to operate in another.

2. **Fault Tolerance:** AZs provide redundancy and fault tolerance. If one AZ experiences a power outage or other issue, your application can seamlessly fail over to instances in another AZ.

3. **Disaster Recovery:** AZs can be used to implement disaster recovery strategies. By replicating your data and applications across multiple AZs, you can quickly recover from major disruptions.

Launch an Instance from the Copied AMI in the New Region

54 regions worldwide
140 available in 140 countries

|			
1	Switch to the region where the AMI was copied.	**2**	Go to EC2 Dashboard > AMIs.
3	Select the copied AMI.	**4**	Click on Launch Instance.
5	Configure instance settings as needed.	**6**	Launch the instance.

Test the Redundant Application

1 After the instance is running, write out the application code on Amazon Linux CMD

2 Verify that the webpage is working correctly, just like in the original EC2 instance.

3 Perform functionality tests to ensure that the webpage is functioning as expected in the new region.
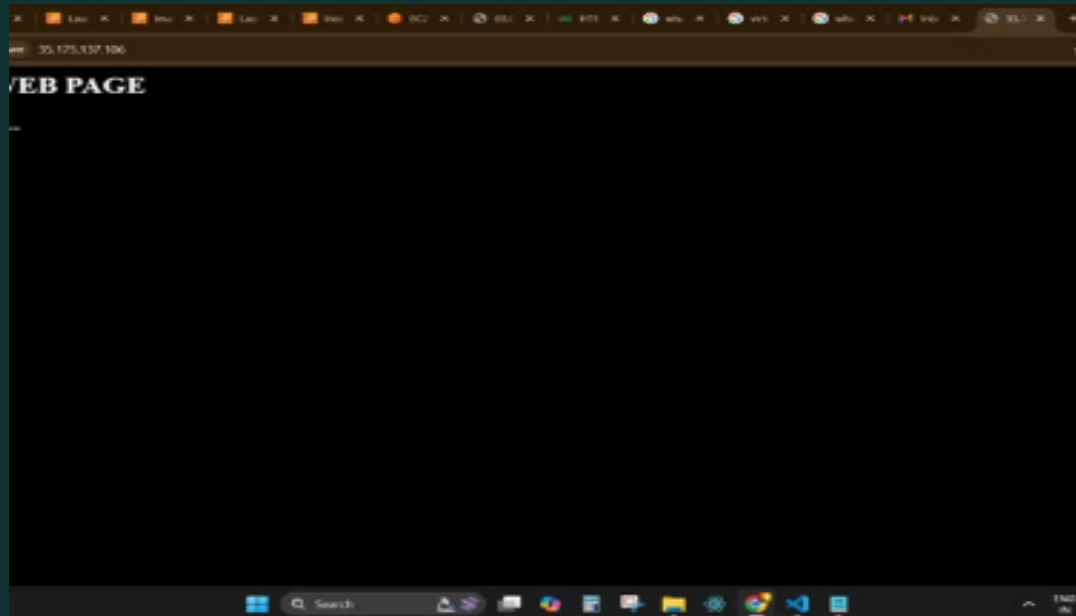
Application at Mumbai Server
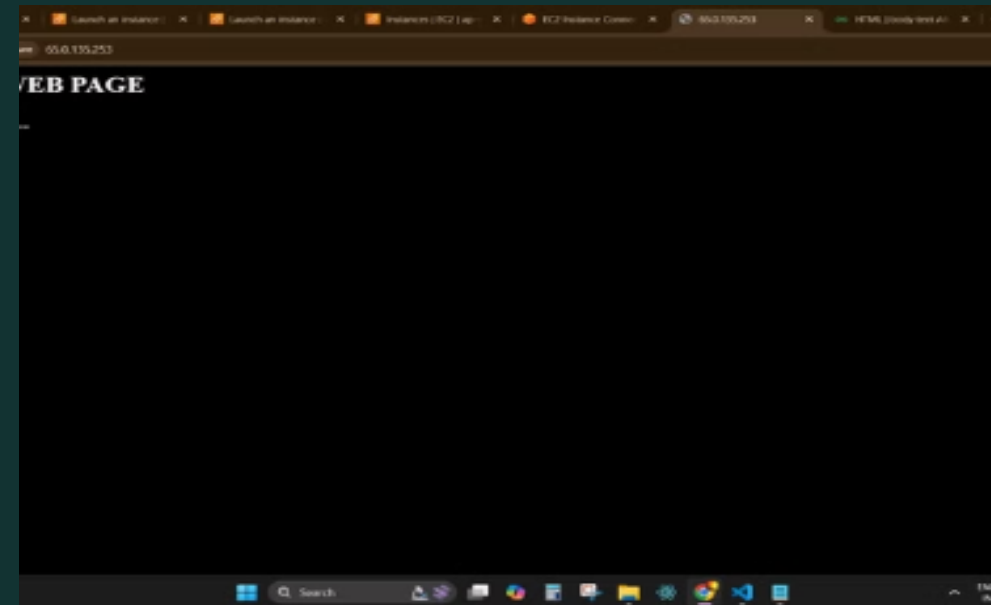
Application at N. Virginia Server

Hosting a React application using AWS EC2

1 Set up Nodejs Environment.

2 Install nodejs. inside ubuntu server

3 Setup nginx environment

4 Set all the required protocols for security group.

5 Create the react application and navigate to the directory.

6 Use file manager and client for transferring files from remote servers

**7** Start Forever run inside react install pm2 globally

1 What is React based application and Nodejs. ?

- **A React-based application is a web application built using the React JavaScript library.**

- Node.js is a free, open-source, cross-platform JavaScript runtime environment that allows developers to create web applications, servers, command line tools, and scripts

2 What is use of NGINX?

Web servers are computers built to deliver the requested webpage. To make your computer a web server, you have to install web server software, such as NGINX, XAMPP, Apache, Tornado, Caddy, or Microsoft Internet Information Services (IIS).

OUR HOSTED WEB APP
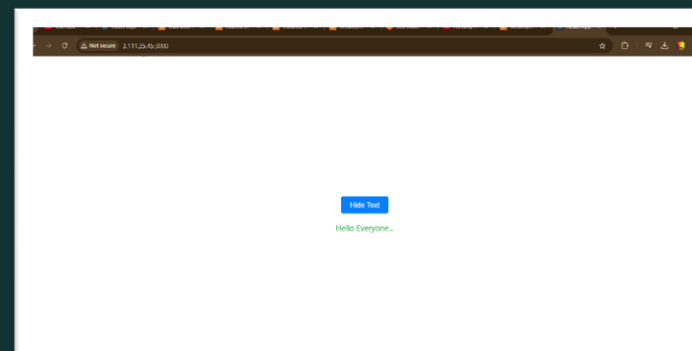
3 What is PM2?

PM2 is a production process manager for Node.js applications with a built-in load balancer. It allows you to keep applications alive forever, to reload them without downtime and to facilitate common system admin tasks.

Schematic Diagram of Machine Room Cabinet Installation

Verifying Application Redundancy Across Regions

✓

Application Availability

Verify that the application is accessible and functioning correctly in both the original and target regions.
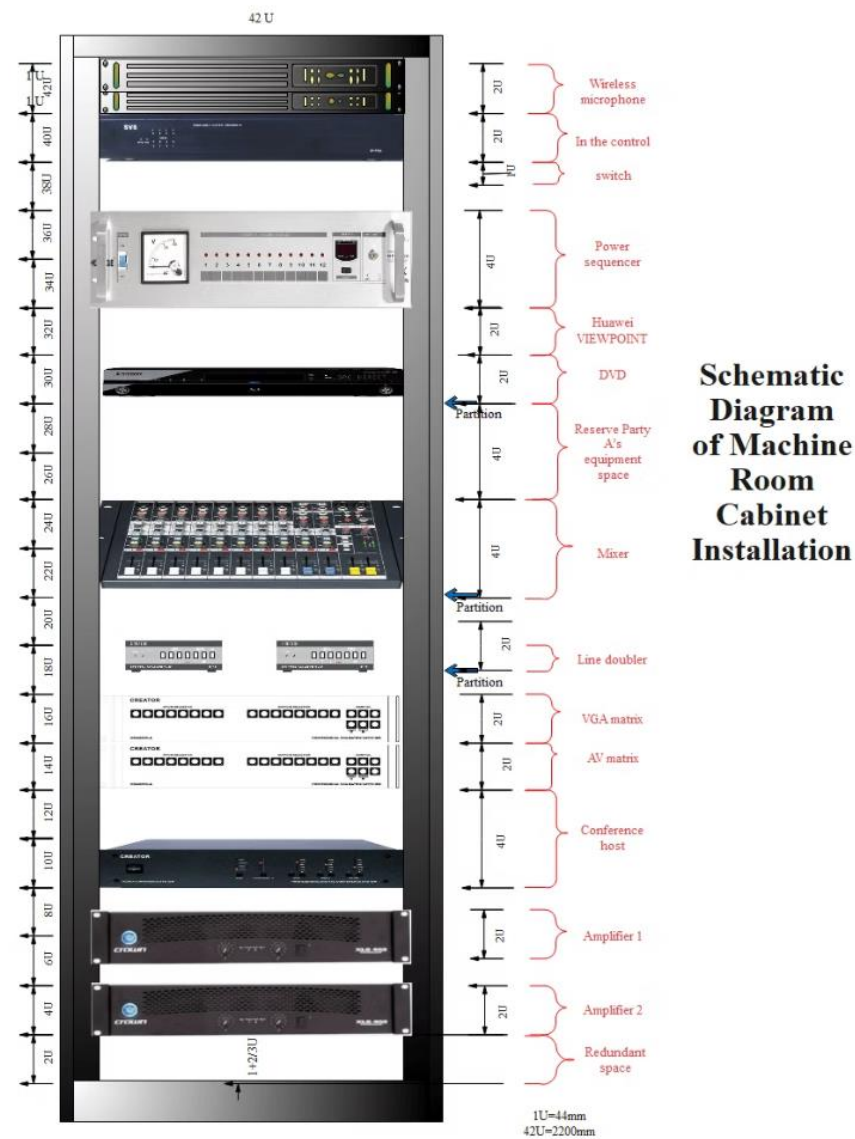
Performance Evaluation

Test the application's performance and response times in both regions, ensuring consistent user experience.

Network Connectivity

Ensure that the application's network connections are established and functioning as expected across both regions.

Challenges and Considerations

Cloud computing, while offering numerous benefits, also presents some challenges and considerations that require careful evaluation.

Security

Protecting sensitive data and ensuring compliance with security regulations is crucial in cloud environments.

Privacy

Maintaining data privacy and complying with regulations regarding personal information is essential.

Vendor Lock-In

Choosing a cloud provider that offers flexibility and avoids vendor lock-in is essential for future scalability and cost optimization.

Reliability

Ensuring service availability and uptime is crucial for business continuity and operational success.

Conclusion and Key Takeaways

1 Application Resilience

Creating and replicating AMIs across regions ensures application availability and resilience in case of failures.

2 Scalability and Cost Optimization

AMI replication allows for easy scaling of applications across regions, optimizing resource utilization and costs.

3 Best Practices

This project highlights best practices for building highly available and scalable applications in the cloud.

THANK YOU!!