PRESENTATION ON

“DESIGNING AND IMPLEMENTING A SCALABLE CLOUD INFRASTRUCTURE ON AWS FOR UBUNTU SERVER ADMINISTRATION IN A CENTRALIZED LARGE NETWORK"

G U I D E D B Y

Z A K I R H U S S A I N

GROUP MEMBERS

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TABLE OF CONTENT

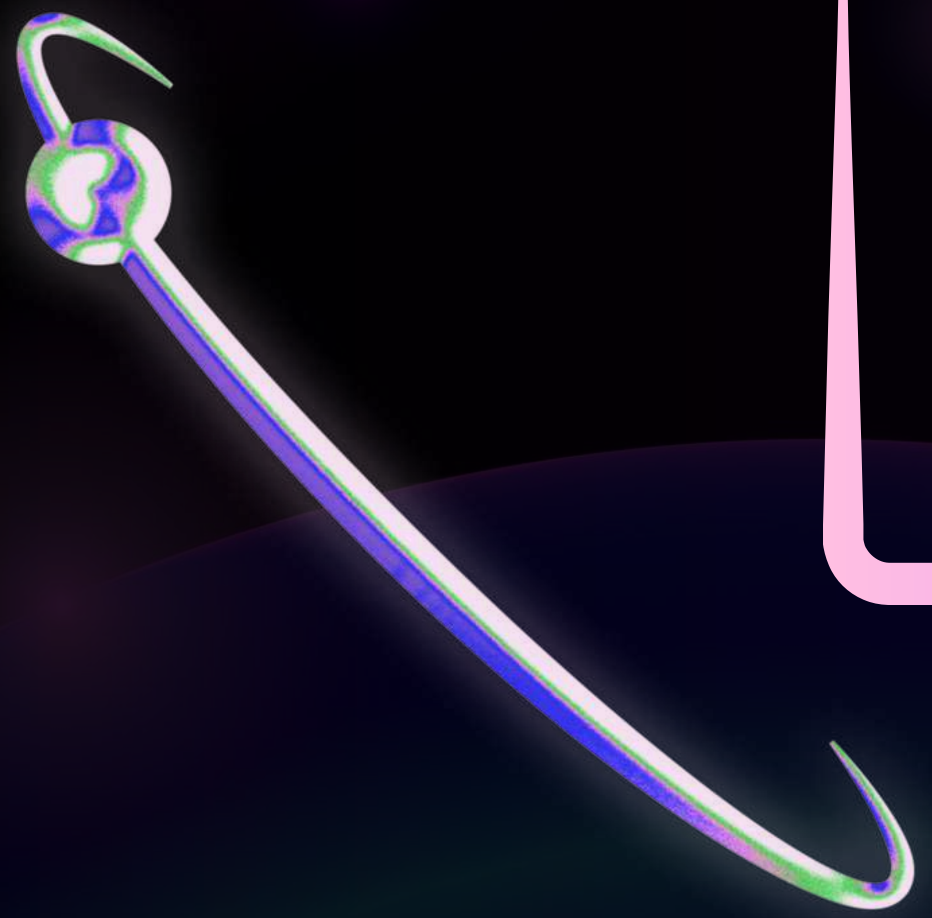
PROJECT OVERVIEW

purpose

- Design and implement a scalable AWS cloud infrastructure using Ubuntu servers.
- Support centralized administration in a large network.

Goals

- Scalability
- Centralized management
- High Availability
- Cost efficiency
- Security



PREREQUISITES

1

AWS

2

VPC

3

Elastic Load Balancing

4

Amazon cloudfront

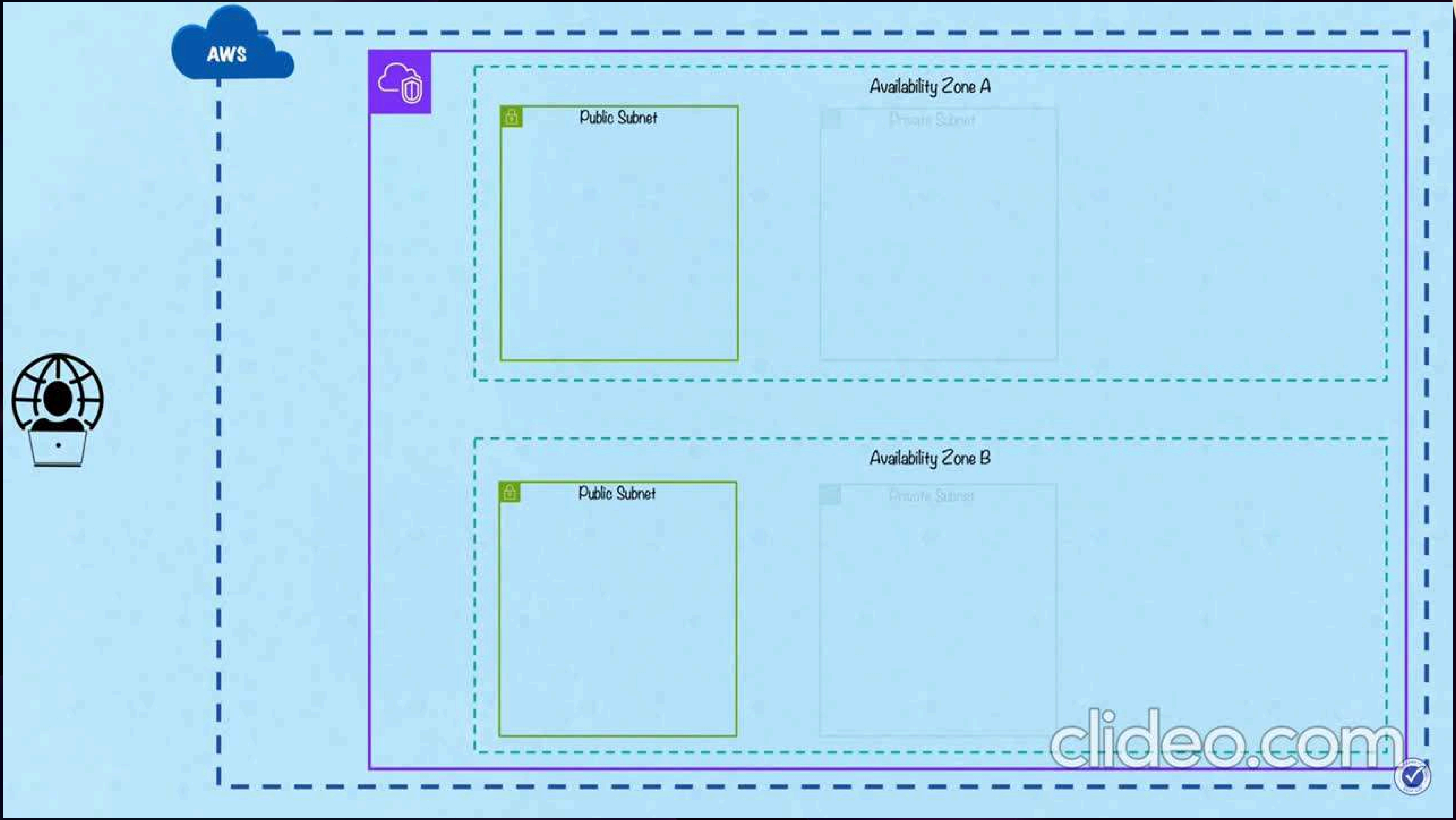
5

Amazon EC2

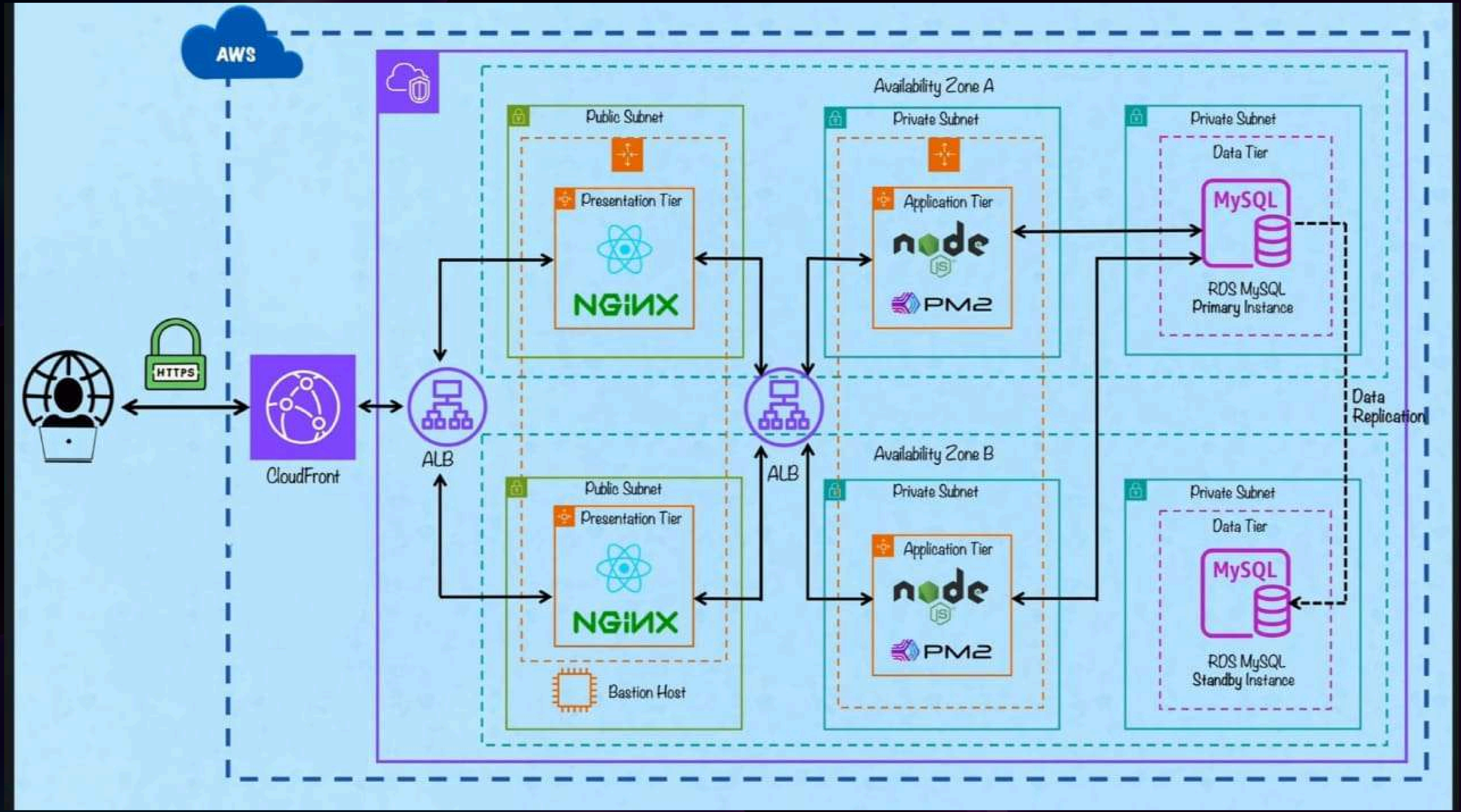
6

AWS RDS

ARCHITECTURE DESIGN



Architecture Design



ARCHITECTURE COMPONENTS

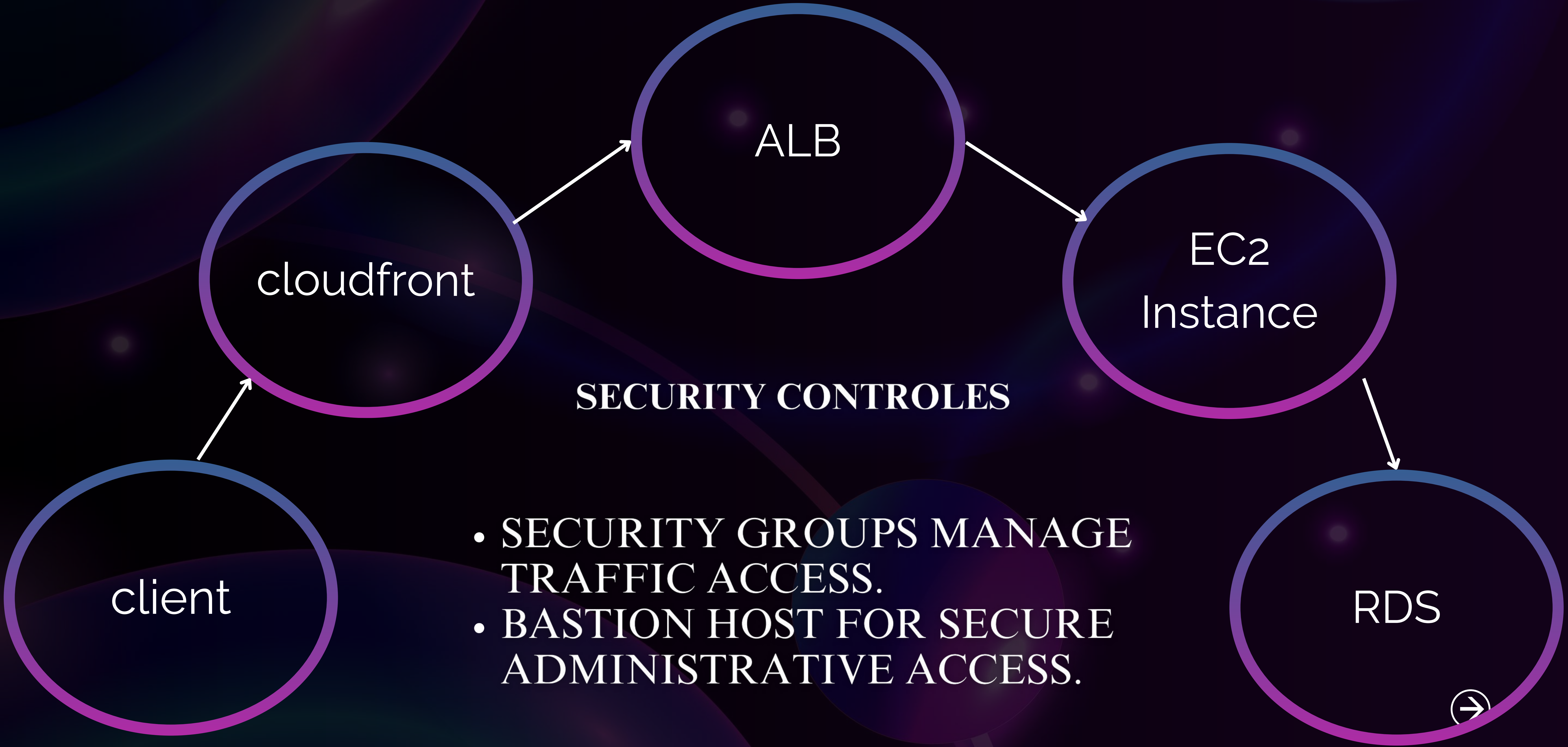
Cloudfront

Application Load Balancer

Availability zones

Subnets (private and public)

DATA FLOW



SECURITY CONTROLES

- SECURITY GROUPS MANAGE TRAFFIC ACCESS.
- BASTION HOST FOR SECURE ADMINISTRATIVE ACCESS.

STEPS AND CONFIGURATION

Step 1: Setting up VPC

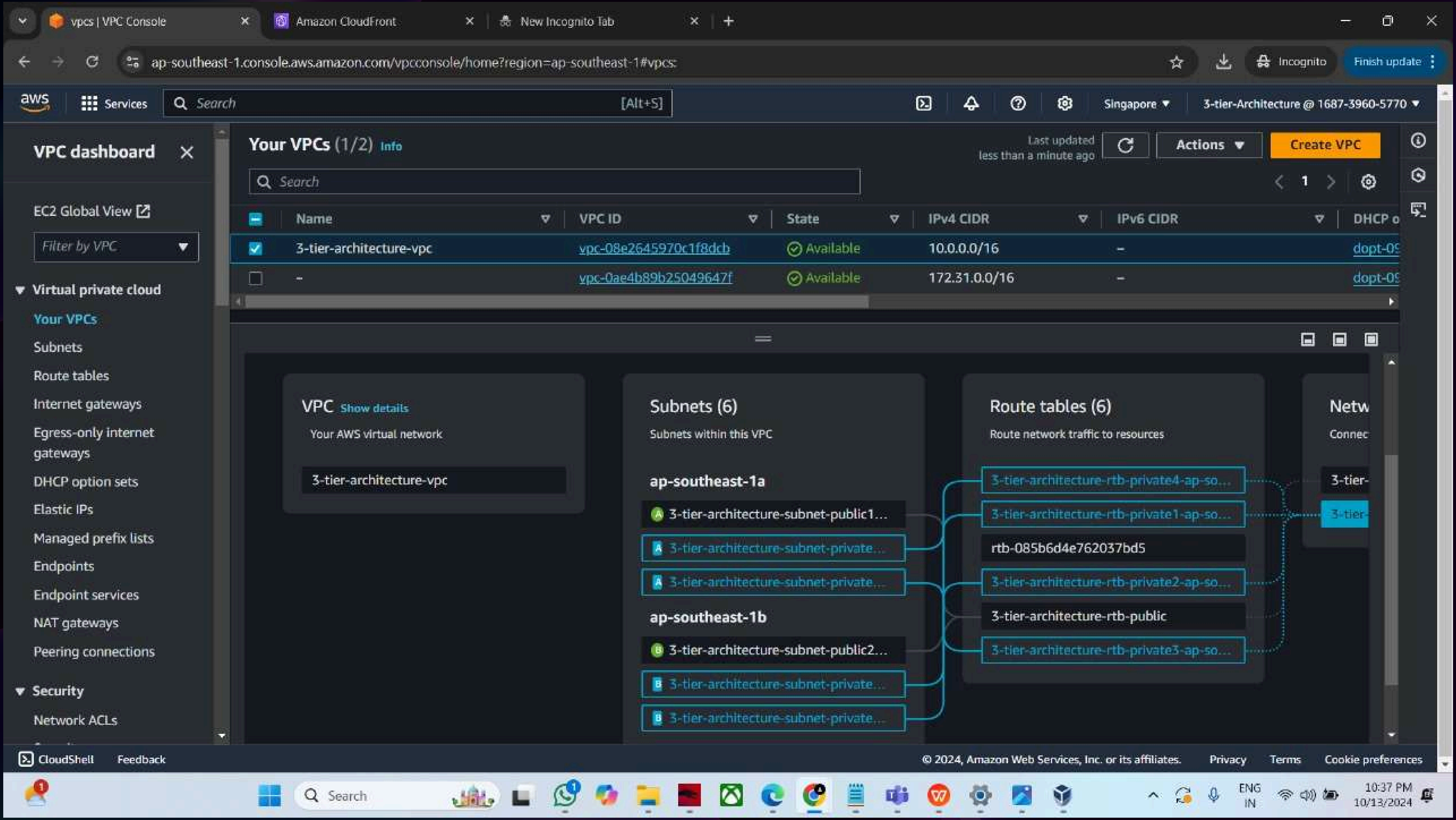
- Create VPC
- Create subnets (2 public and 4 private.)
- Create route table
- Create internet gateway and attach to vpc
- Configure Security Groups

Security Groups:

Bastion Host SG
Presentation tier ALB
Application tier ALB

Presentation tier ec2
Application tier ec2
Data-Tier

VPC setup



ap-southeast-1.console.aws.amazon.com/vpcconsole/home?region=ap-southeast-1#vpcs:

Your VPCs (1/2)

Name	VPC ID	State	IPv4 CIDR	IPv6 CIDR	DHCP o
3-tier-architecture-vpc	vpc-08e2645970c1f8dcb	Available	10.0.0.0/16	–	dopt-0
-	vpc-0ae4b89b25049647f	Available	172.31.0.0/16	–	dopt-0

VPC: 3-tier-architecture-vpc

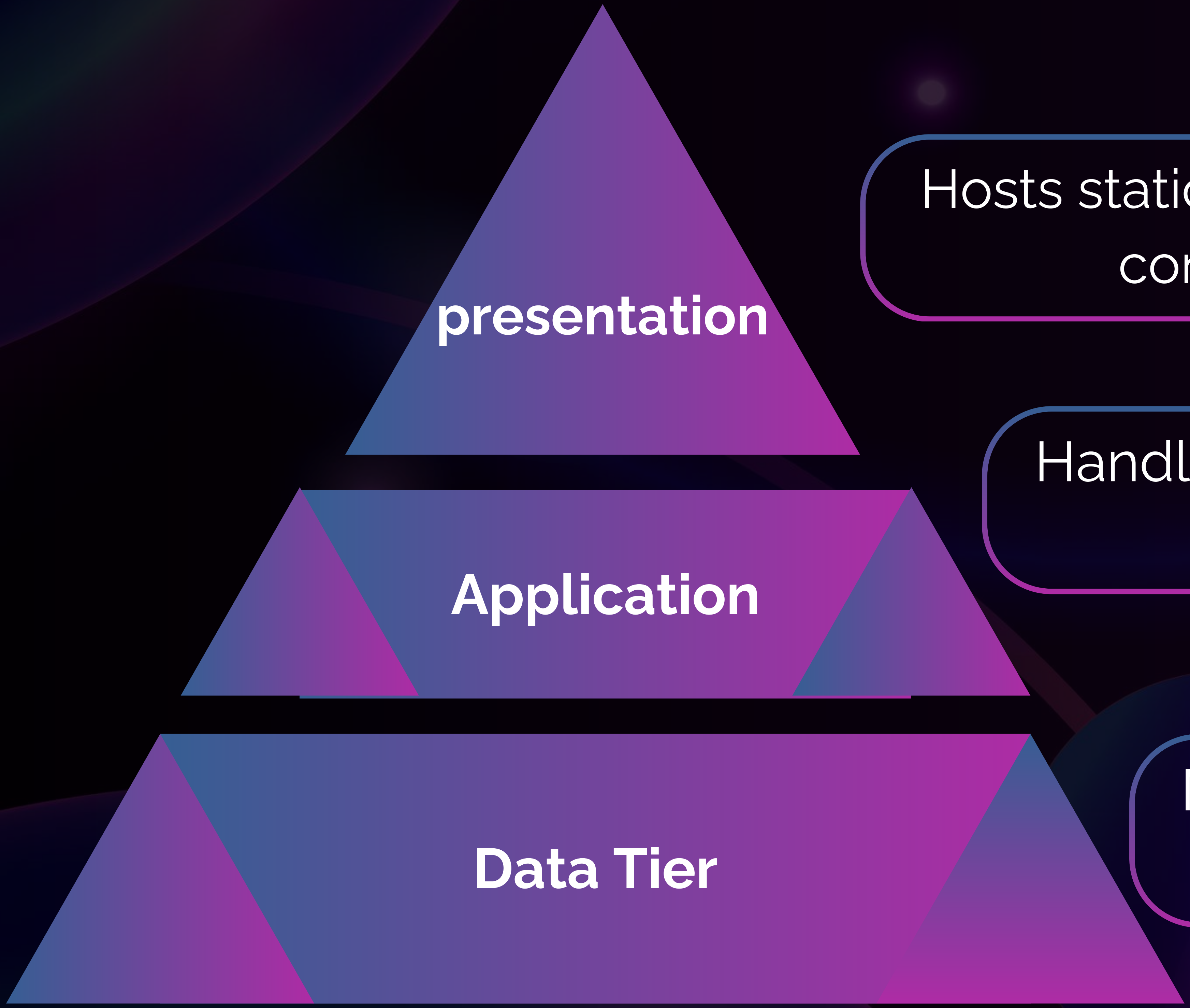
Subnets (6)

ap-southeast-1a
- 3-tier-architecture-subnet-public1...
- 3-tier-architecture-subnet-private...
- 3-tier-architecture-subnet-private...

ap-southeast-1b
- 3-tier-architecture-subnet-public2...
- 3-tier-architecture-subnet-private...
- 3-tier-architecture-subnet-private...

Route tables (6)
- 3-tier-architecture-rtb-private4-ap-so...
- 3-tier-architecture-rtb-private1-ap-so...
- rtb-085b6d4e762037bd5
- 3-tier-architecture-rtb-private2-ap-so...
- 3-tier-architecture-rtb-public
- 3-tier-architecture-rtb-private3-ap-so...

TIER BREAKDOWN



Hosts static content using NGHosts static content using NGINX.INX.

Handles dynamic requests and business logic using Node.js and PM2.

Manages data storage with MySQL and RDS.

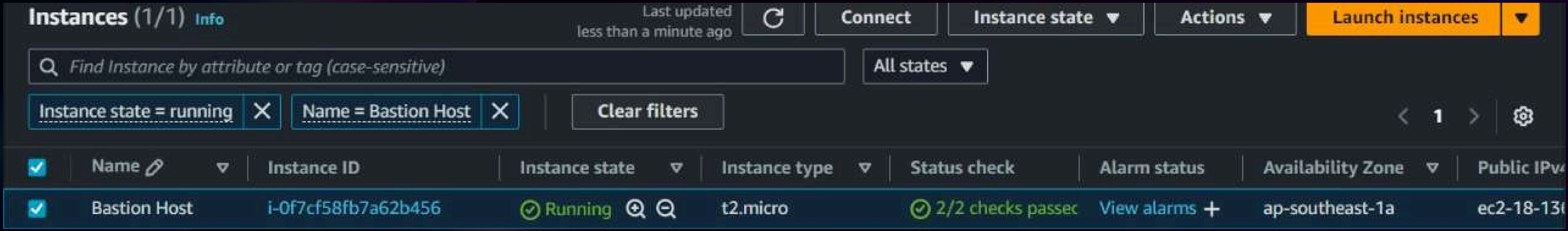
BASTION HOST

- Provides secure SSH access to instances in private subnets.
- Acts as a controlled gateway. Enhances security by preventing direct internet access to private servers

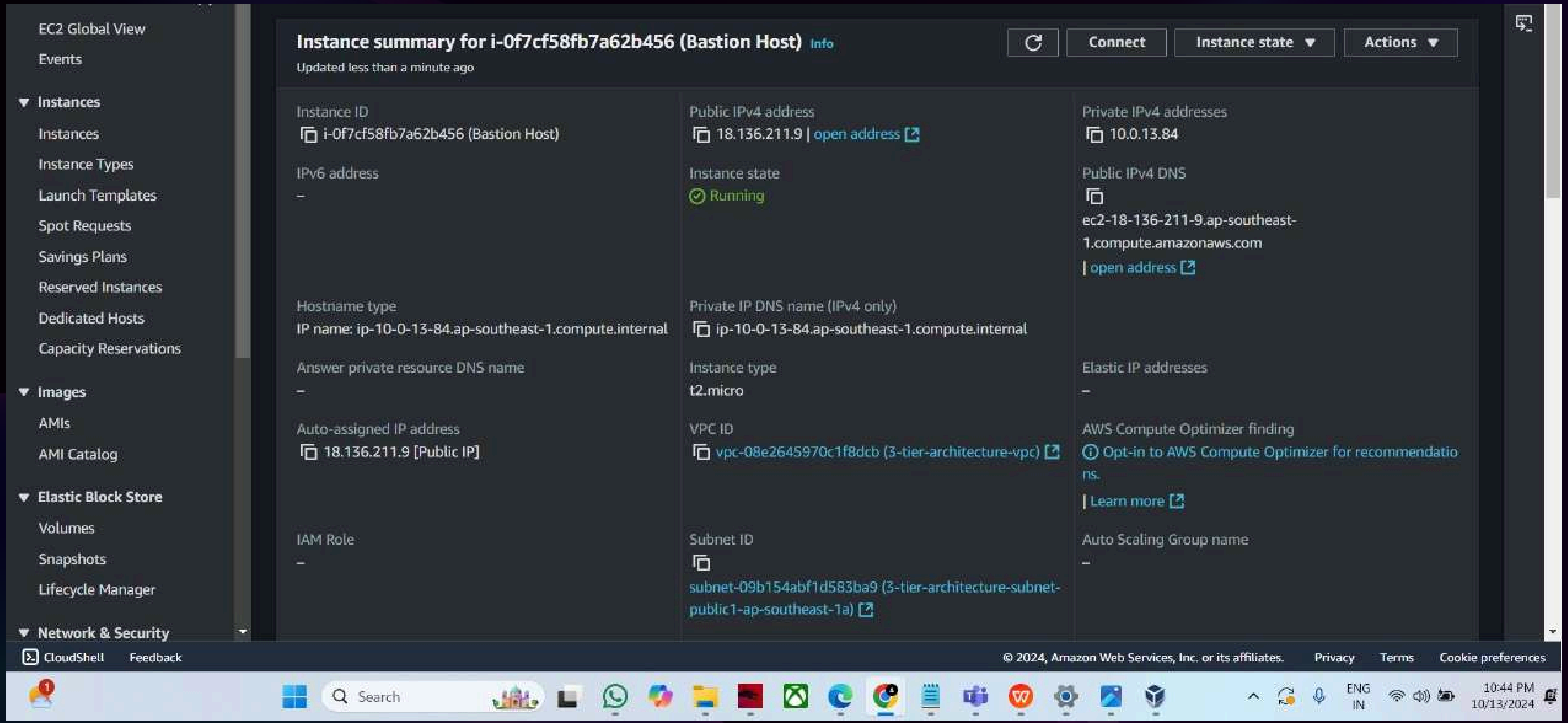
STEP 2. LAUNCHING THE BASTION HOST

- Launch Instance:
- Name: Bastion-Host
- AMI: Select Ubuntu Server.
- Instance Type: Choose based on requirements (e.g., t2.micro).
- Key Pair: Select a key pair for SSH access.
- Network Settings: Assign to public subnet and Bastion Host SG.
- Action: Click Launch Instance.

STEP 2 . LAUNCHING THE BASTION HOST



Name	Instance ID	Instance state	Instance type	Status check	Alarm status	Availability Zone	Public IPv4
Bastion Host	i-0f7cf58fb7a62b456	Running	t2.micro	2/2 checks passec	View alarms +	ap-southeast-1a	ec2-18-13



Instance summary for i-0f7cf58fb7a62b456 (Bastion Host) Info

Updated less than a minute ago

Instance ID i-0f7cf58fb7a62b456 (Bastion Host)	Public IPv4 address 18.136.211.9 | open address	Private IPv4 addresses 10.0.13.84
IPv6 address –	Instance state Running	Public IPv4 DNS ec2-18-136-211-9.ap-southeast-1.compute.amazonaws.com | open address
Hostname type IP name: ip-10-0-13-84.ap-southeast-1.compute.internal	Private IP DNS name (IPv4 only) ip-10-0-13-84.ap-southeast-1.compute.internal	
Answer private resource DNS name –	Instance type t2.micro	Elastic IP addresses –
Auto-assigned IP address 18.136.211.9 [Public IP]	VPC ID vpc-08e2645970c1f8dcb (3-tier-architecture-vpc)	AWS Compute Optimizer finding Opt-in to AWS Compute Optimizer for recommendations. | Learn more
IAM Role –	Subnet ID subnet-09b154abf1d583ba9 (3-tier-architecture-subnet-public1-ap-southeast-1a)	Auto Scaling Group name –

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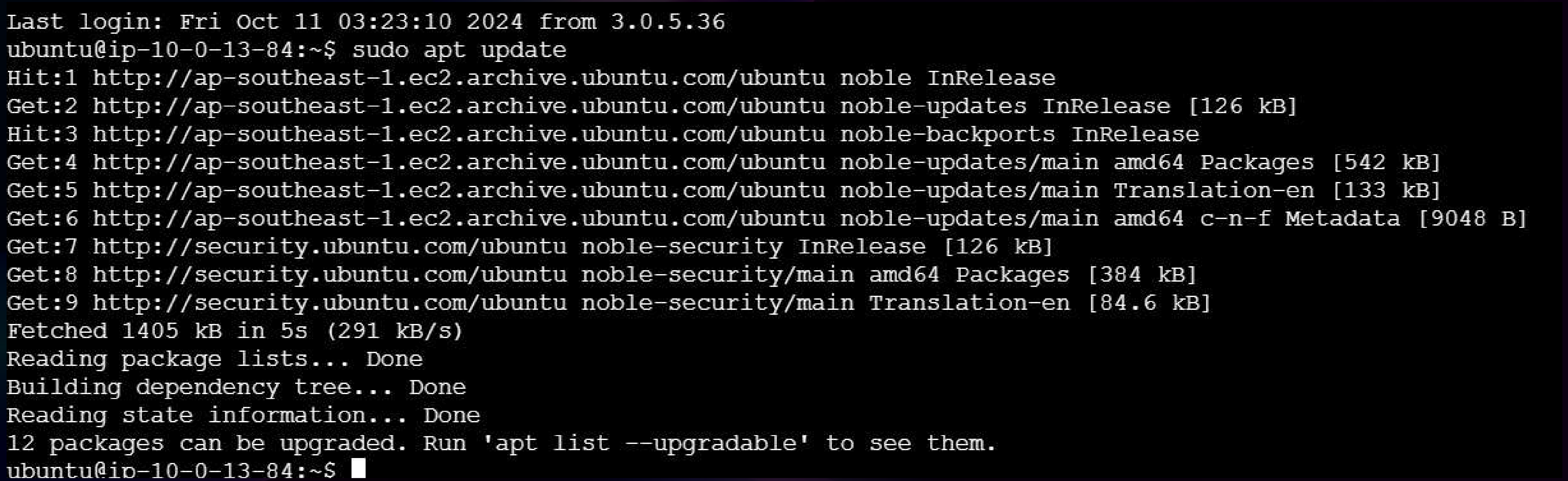
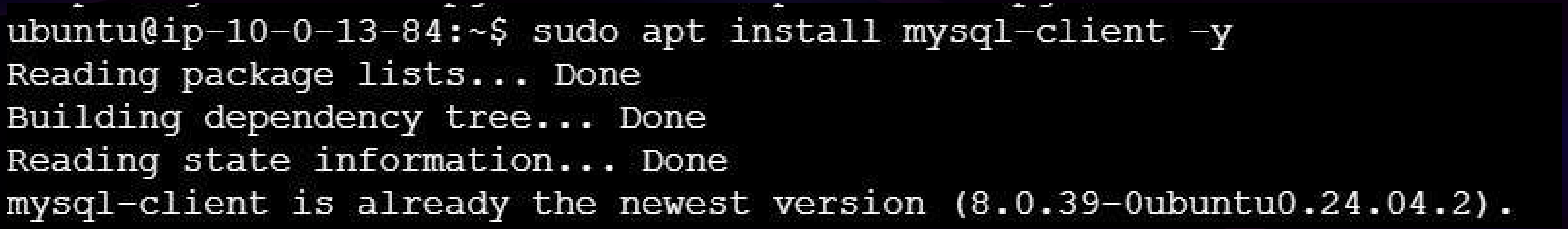
STEP 3: SETTING UP DATA TIER WITH RDS MYSQL

- Search and select RDS from AWS Dashboard.
- Create Subnet Groups:
- Define subnet group using private subnets.
- Create Database:
- Engine: Select MySQL.
- Template: Choose based on use case (e.g., Production).
- DB Name: react_node_app..
- Connect to RDS Instance:
- Use PuTTY for SSH access.

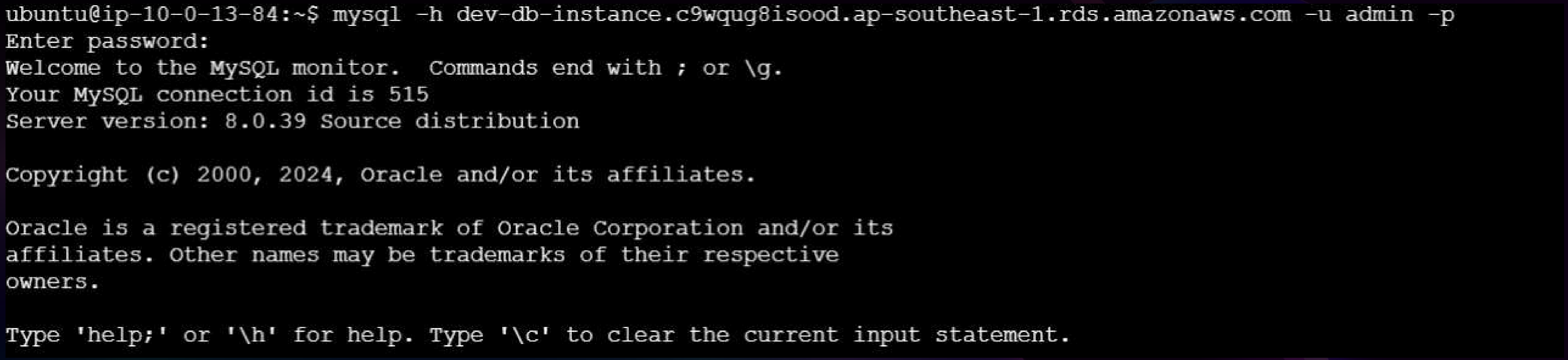
STEP 3: SETTING UP DATA TIER WITH RDS MYSQL



```
Last login: Fri Oct 11 03:23:10 2024 from 3.0.5.36
ubuntu@ip-10-0-13-84:~$ sudo apt update
Hit:1 http://ap-southeast-1.ec2.archive.ubuntu.com/ubuntu noble InRelease
Get:2 http://ap-southeast-1.ec2.archive.ubuntu.com/ubuntu noble-updates InRelease [126 kB]
Hit:3 http://ap-southeast-1.ec2.archive.ubuntu.com/ubuntu noble-backports InRelease
Get:4 http://ap-southeast-1.ec2.archive.ubuntu.com/ubuntu noble-updates/main amd64 Packages [542 kB]
Get:5 http://ap-southeast-1.ec2.archive.ubuntu.com/ubuntu noble-updates/main Translation-en [133 kB]
Get:6 http://ap-southeast-1.ec2.archive.ubuntu.com/ubuntu noble-updates/main amd64 c-n-f Metadata [9048 B]
Get:7 http://security.ubuntu.com/ubuntu noble-security InRelease [126 kB]
Get:8 http://security.ubuntu.com/ubuntu noble-security/main amd64 Packages [384 kB]
Get:9 http://security.ubuntu.com/ubuntu noble-security/main Translation-en [84.6 kB]
Fetched 1405 kB in 5s (291 kB/s)
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
12 packages can be upgraded. Run 'apt list --upgradable' to see them.
ubuntu@ip-10-0-13-84:~$
```



```
ubuntu@ip-10-0-13-84:~$ sudo apt install mysql-client -y
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
mysql-client is already the newest version (8.0.39-0ubuntu0.24.04.2).
```



```
ubuntu@ip-10-0-13-84:~$ mysql -h dev-db-instance.c9wqug8isood.ap-southeast-1.rds.amazonaws.com -u admin -p
Enter password:
Welcome to the MySQL monitor.  Commands end with ; or \g.
Your MySQL connection id is 515
Server version: 8.0.39 Source distribution

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owners.

Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.
```
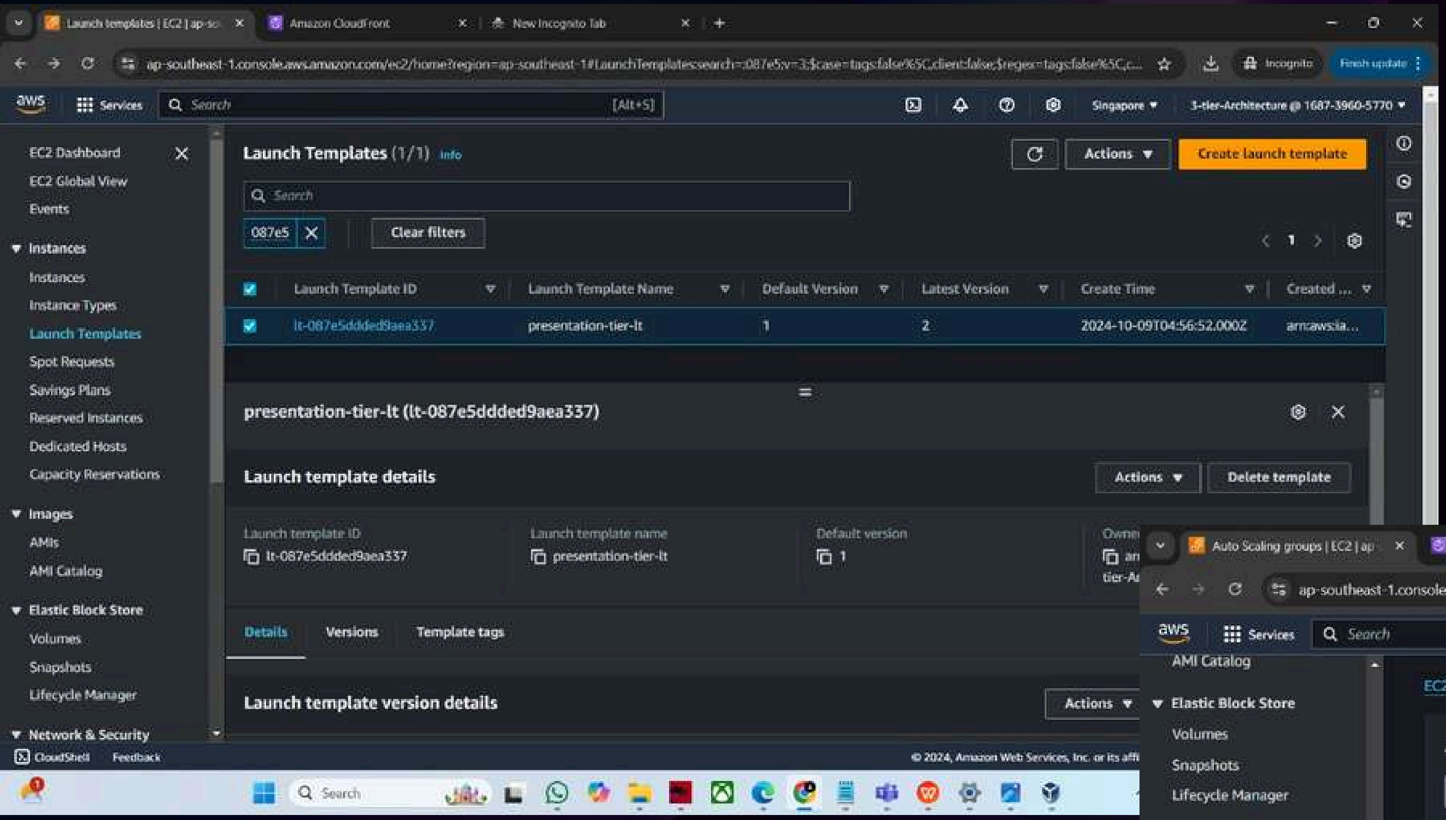

STEP 5: SETTING UP PRESENTATION TIER

- Role:
- Hosts frontend of the web application using NGINX.
- Steps:

1. Create Presentation Tier Launch Template.
2. Create Target Groups.
3. Create Application Load Balancer (ALB).
4. Create Auto Scaling Group.

STEP 5: SETTING UP PRESENTATION TIER



ap-southeast-1.console.aws.amazon.com/ec2/home?region=ap-southeast-1#LaunchTemplates:search=:087e5;v=3;$case=tags:false%5C,client:false;$regex=tags:false%5C,c...

Launch Templates (1/1)

Filter: 087e5

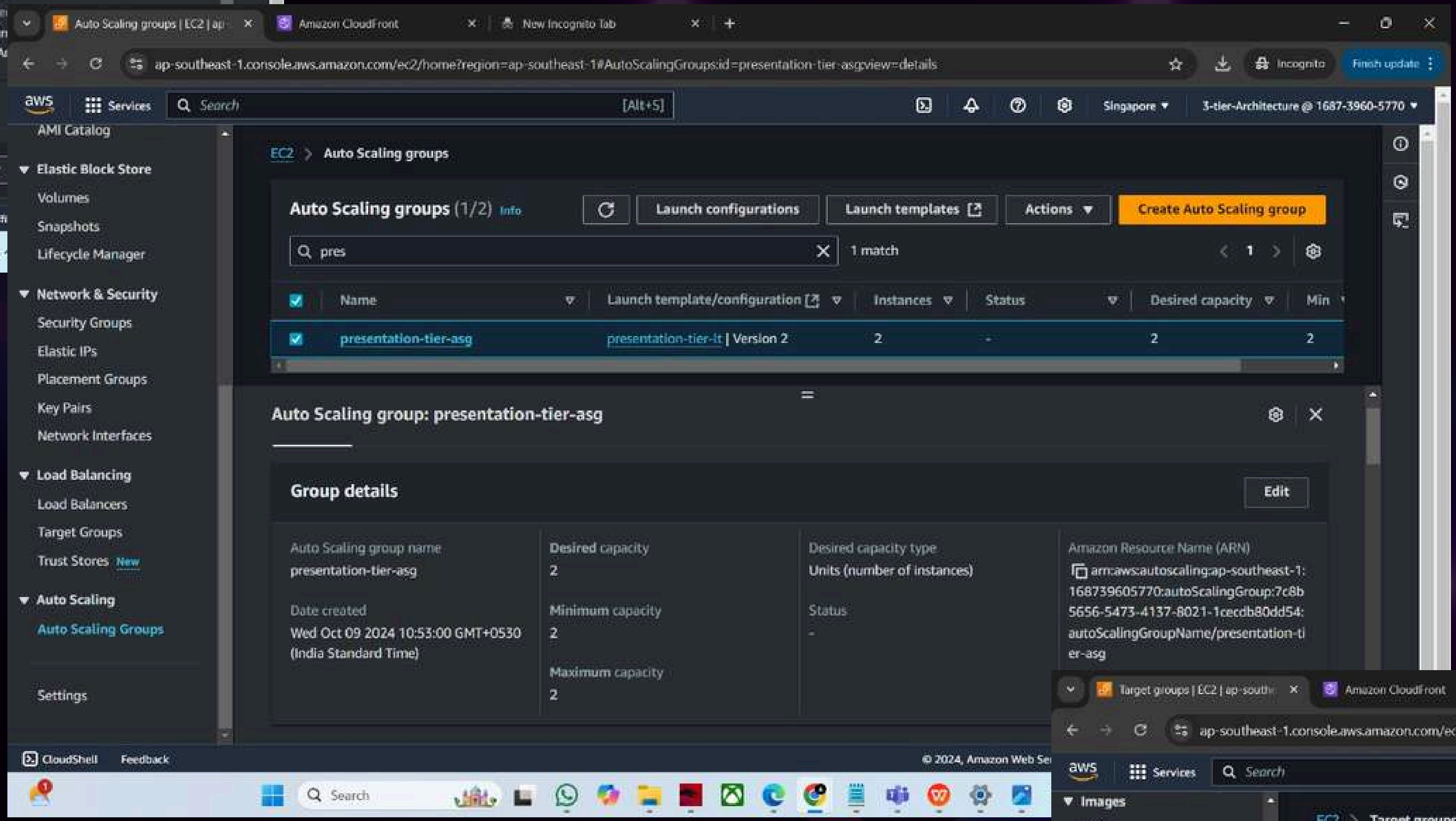
Launch Template ID	Launch Template Name	Default Version	Latest Version	Create Time	Created ...
lt-087e5ddded9aea337	presentation-tier-lt	1	2	2024-10-09T04:56:52.000Z	arn:aws:ia...

presentation-tier-lt (lt-087e5ddded9aea337)

Launch template details

Launch template ID: lt-087e5ddded9aea337
Launch template name: presentation-tier-lt
Default version: 1

Launch template version details



ap-southeast-1.console.aws.amazon.com/ec2/home?region=ap-southeast-1#AutoScalingGroups:id=presentation-tier-asg;view=details

EC2 > Auto Scaling groups

Auto Scaling groups (1/2)

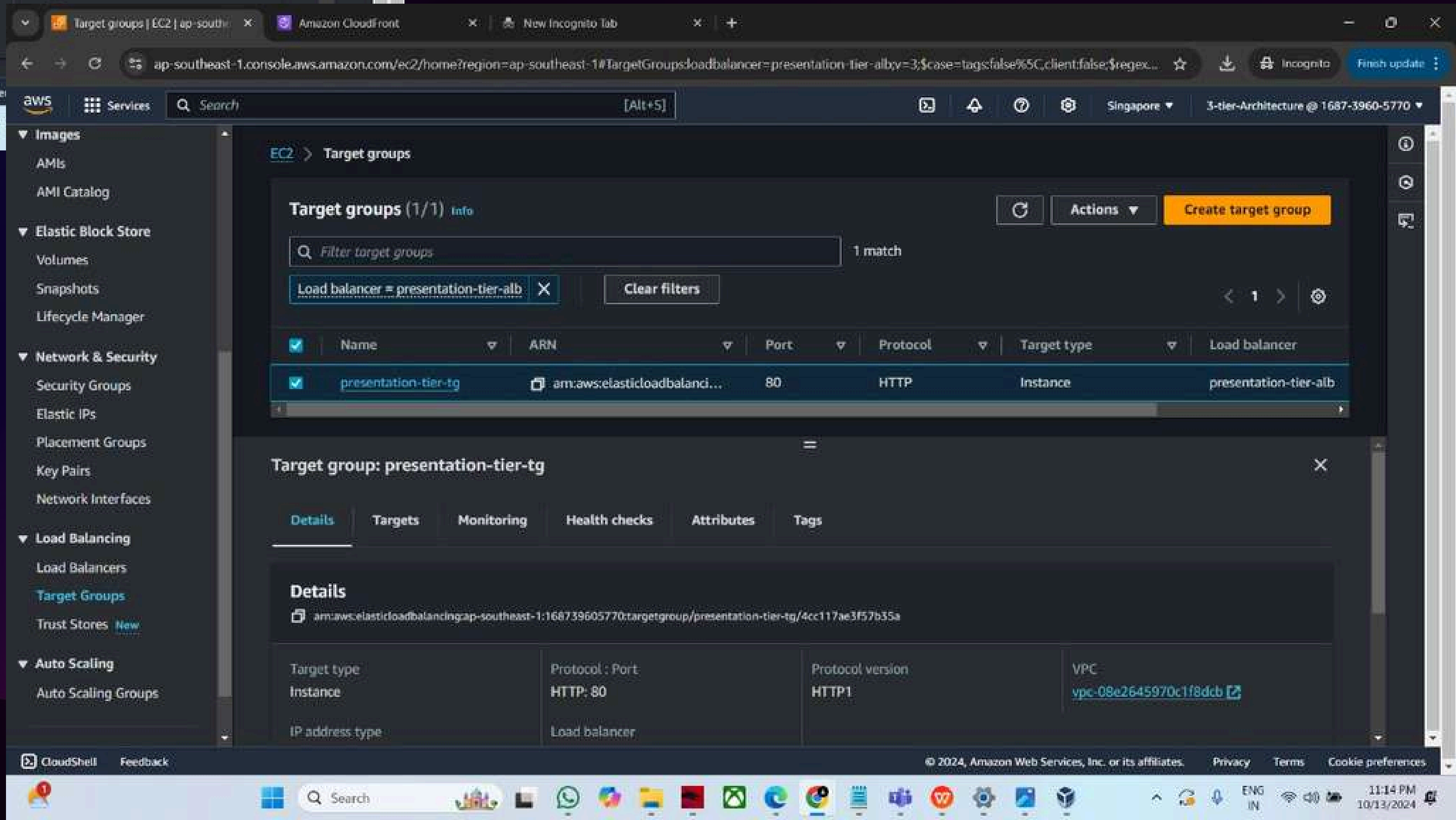
Search: pres — 1 match

Name	Launch template/configuration	Instances	Status	Desired capacity	Min
presentation-tier-asg	presentation-tier-lt | Version 2	2	-	2	2

Auto Scaling group: presentation-tier-asg

Group details

Auto Scaling group name: presentation-tier-asg
Date created: Wed Oct 09 2024 10:53:00 GMT+0530 (India Standard Time)
Desired capacity: 2
Minimum capacity: 2
Maximum capacity: 2
Desired capacity type: Units (number of instances)
Status: -
Amazon Resource Name (ARN): arn:aws:autoscaling:ap-southeast-1:168739605770:autoScalingGroup:7c8b5656-5473-4137-8021-1cecdb80dd54:autoScalingGroupName/presentation-tier-asg



ap-southeast-1.console.aws.amazon.com/ec2/home?region=ap-southeast-1#TargetGroups:loadbalancer=presentation-tier-alb;v=3;$case=tags:false%5C,client:false;$regex...

EC2 > Target groups

Target groups (1/1)

Load balancer = presentation-tier-alb — 1 match

Name	ARN	Port	Protocol	Target type	Load balancer
presentation-tier-tg	arn:aws:elasticloadbalanci...	80	HTTP	Instance	presentation-tier-alb

Target group: presentation-tier-tg

Details | Targets | Monitoring | Health checks | Attributes | Tags

Details

arn:aws:elasticloadbalancing:ap-southeast-1:168739605770:targetgroup/presentation-tier-tg/4cc117ae3f57b35a

Target type: Instance
Protocol : Port: HTTP: 80
Protocol version: HTTP1
VPC: vpc-08e2645970c1f8dcb
IP address type
Load balancer

STEP 4: SETTING UP APPLICATION TIER

- Role:

  Hosts backend Node.js applications.
- Managed via Auto Scaling Groups for scalability.
- Components:

1. Multiple EC2 instances.
2. Load balancing for traffic distribution.

STEP 5: SETTING UP APPLIACATION TIER

Steps:

1)Creating Application Tier Launch Template

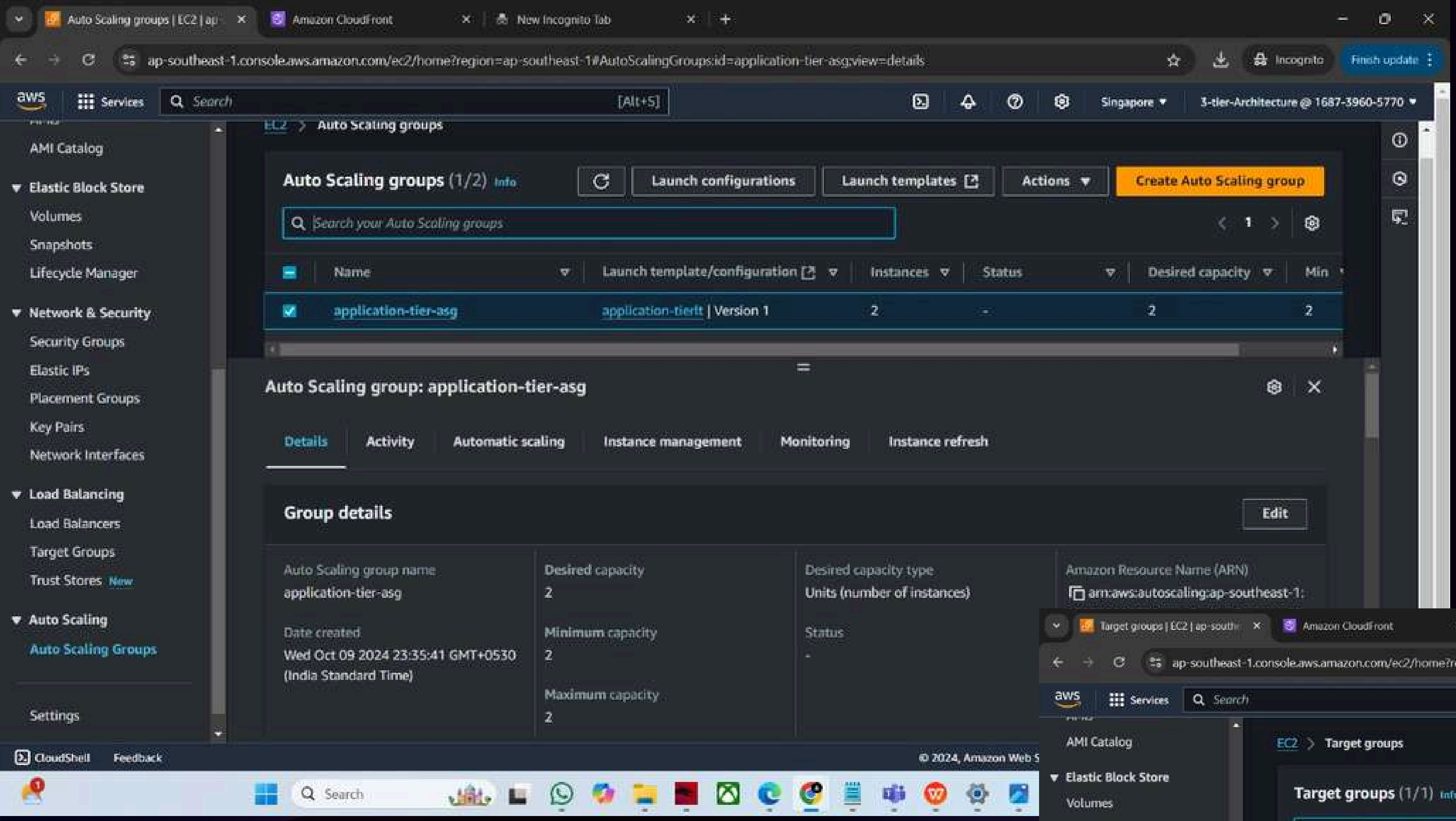
2)Creating Application Tier Target Group

3)Creating Application Tier Load Balancer

4) Creating Application Tier Auto Scaling Group

5)Node.js Application Setup

STEP 5: SETTING UP APPLIACATION TIER



EC2 > Auto Scaling groups

Auto Scaling groups (1/2) Info

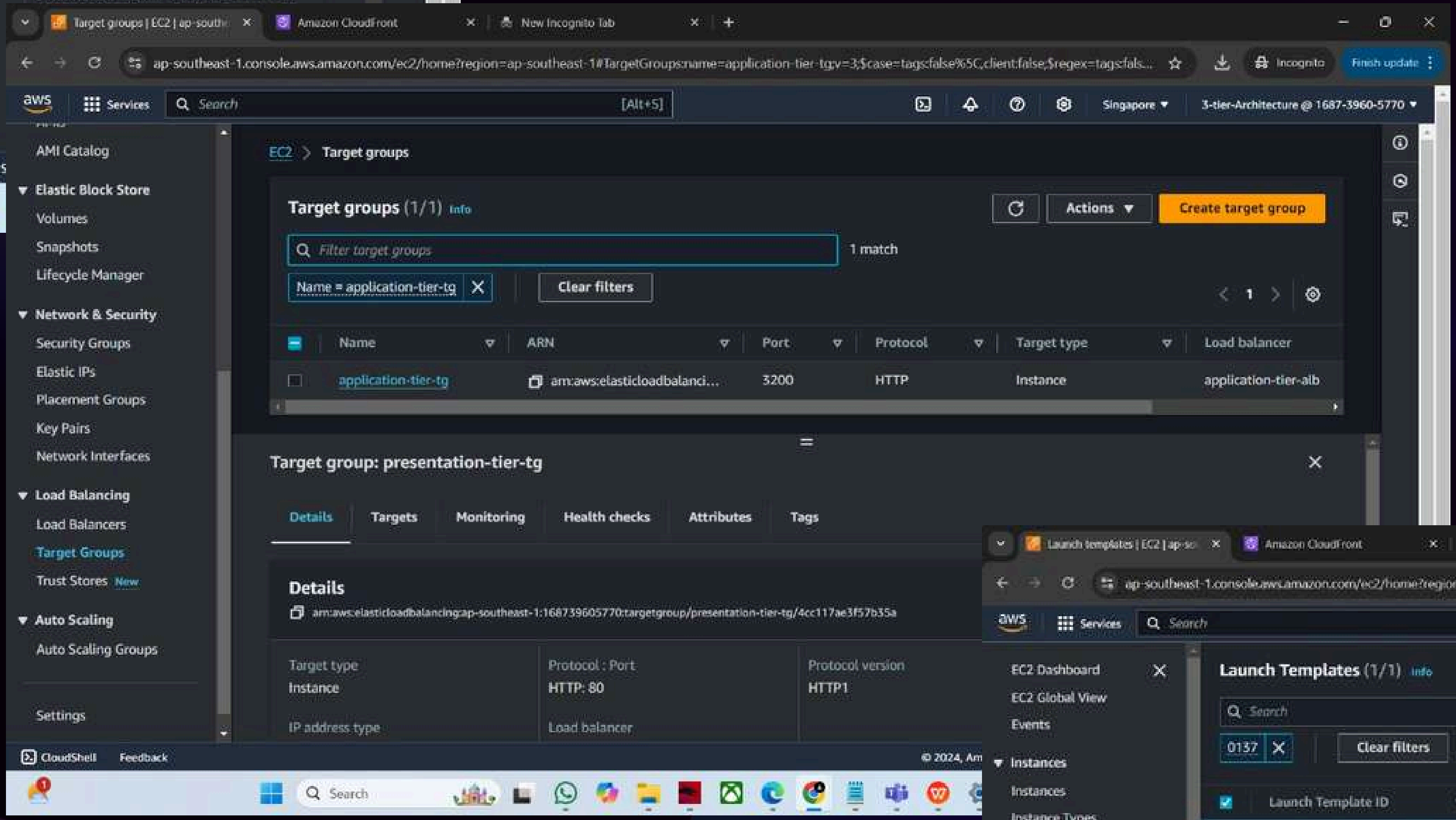
Name	Launch template/configuration	Instances	Status	Desired capacity	Min
application-tier-asg	application-tierlt | Version 1	2	-	2	2

Auto Scaling group: application-tier-asg

Details | Activity | Automatic scaling | Instance management | Monitoring | Instance refresh

Group details

Auto Scaling group name: application-tier-asg	Desired capacity: 2	Desired capacity type: Units (number of instances)	Amazon Resource Name (ARN): arn:aws:autoscaling:ap-southeast-1:
Date created: Wed Oct 09 2024 23:35:41 GMT+0530 (India Standard Time)	Minimum capacity: 2	Status: -	
	Maximum capacity: 2		



EC2 > Target groups

Target groups (1/1) Info

Name = application-tier-tg — 1 match

Name	ARN	Port	Protocol	Target type	Load balancer
application-tier-tg	arn:aws:elasticloadbalanci...	3200	HTTP	Instance	application-tier-alb

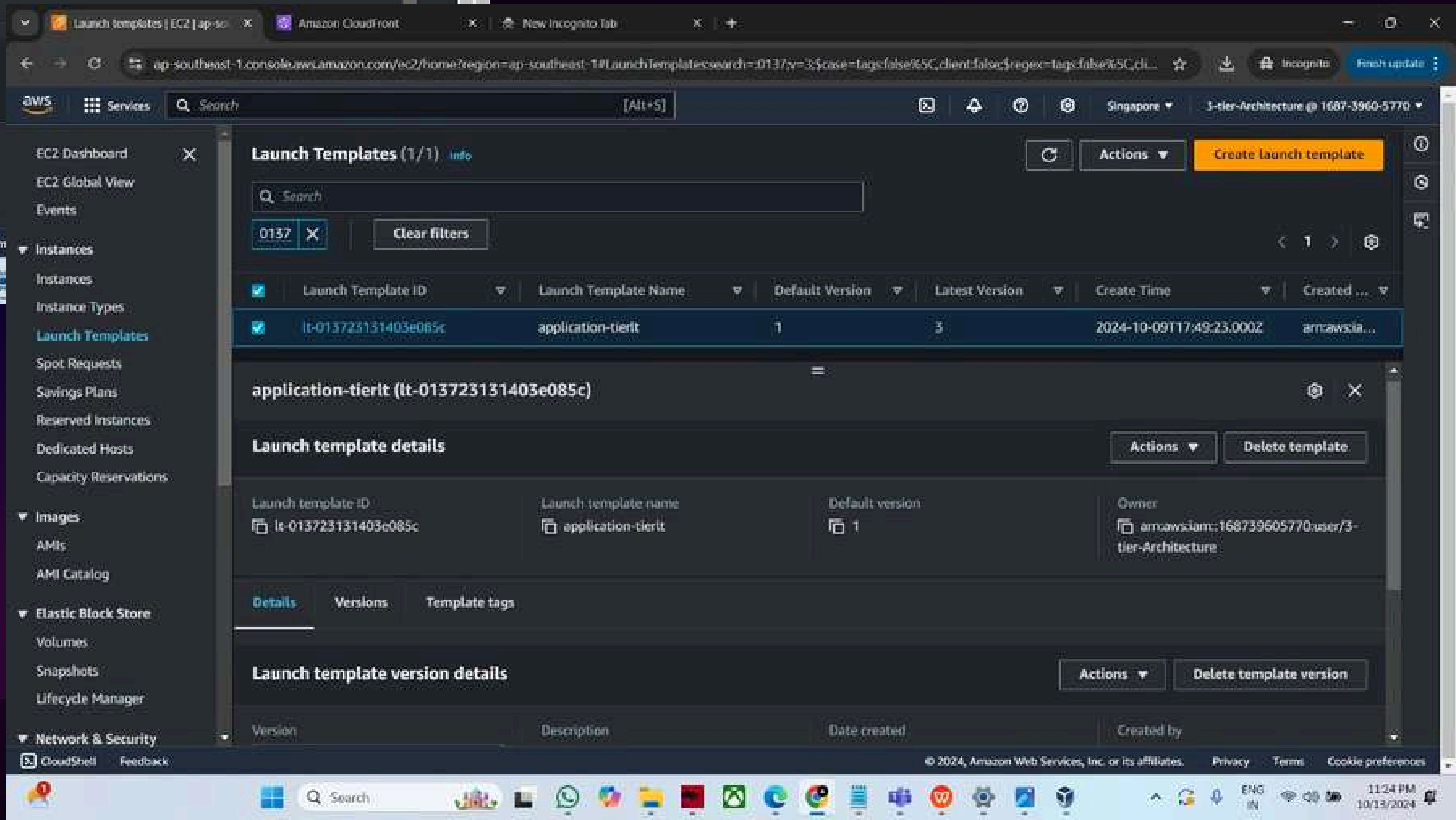
Target group: presentation-tier-tg

Details | Targets | Monitoring | Health checks | Attributes | Tags

Details

arn:aws:elasticloadbalancing:ap-southeast-1:168739605770:targetgroup/presentation-tier-tg/4cc117ae3f57b35a

Target type	Protocol : Port	Protocol version
Instance	HTTP: 80	HTTP1



Launch Templates (1/1) Info

Launch Template ID	Launch Template Name	Default Version	Latest Version	Create Time	Created ...
lt-013723131403e085c	application-tierlt	1	3	2024-10-09T17:49:23.000Z	arn:aws:ia...

application-tierlt (lt-013723131403e085c)

Launch template details

Launch template ID	Launch template name	Default version	Owner
lt-013723131403e085c	application-tierlt	1	arn:aws:iam::168739605770:user/3-tier-Architecture

Details | Versions | Template tags

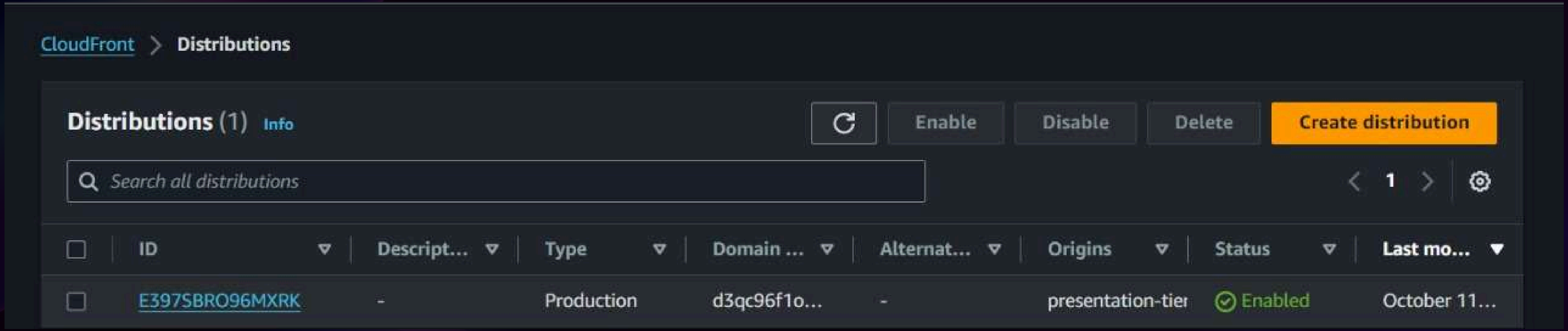
Launch template version details

Version | Description | Date created | Created by

STEP 6: CREATING CLOUDFRONT DISTRIBUTION

- Navigate to CloudFront in AWS Dashboard.
- Click Create a CloudFront distribution.
- Configure Distribution:
- Origin Domain: Specify the ALB.
- Default Cache Behavior: Define protocols.
- Distribution Settings: SSL certificates.
- Create Distribution

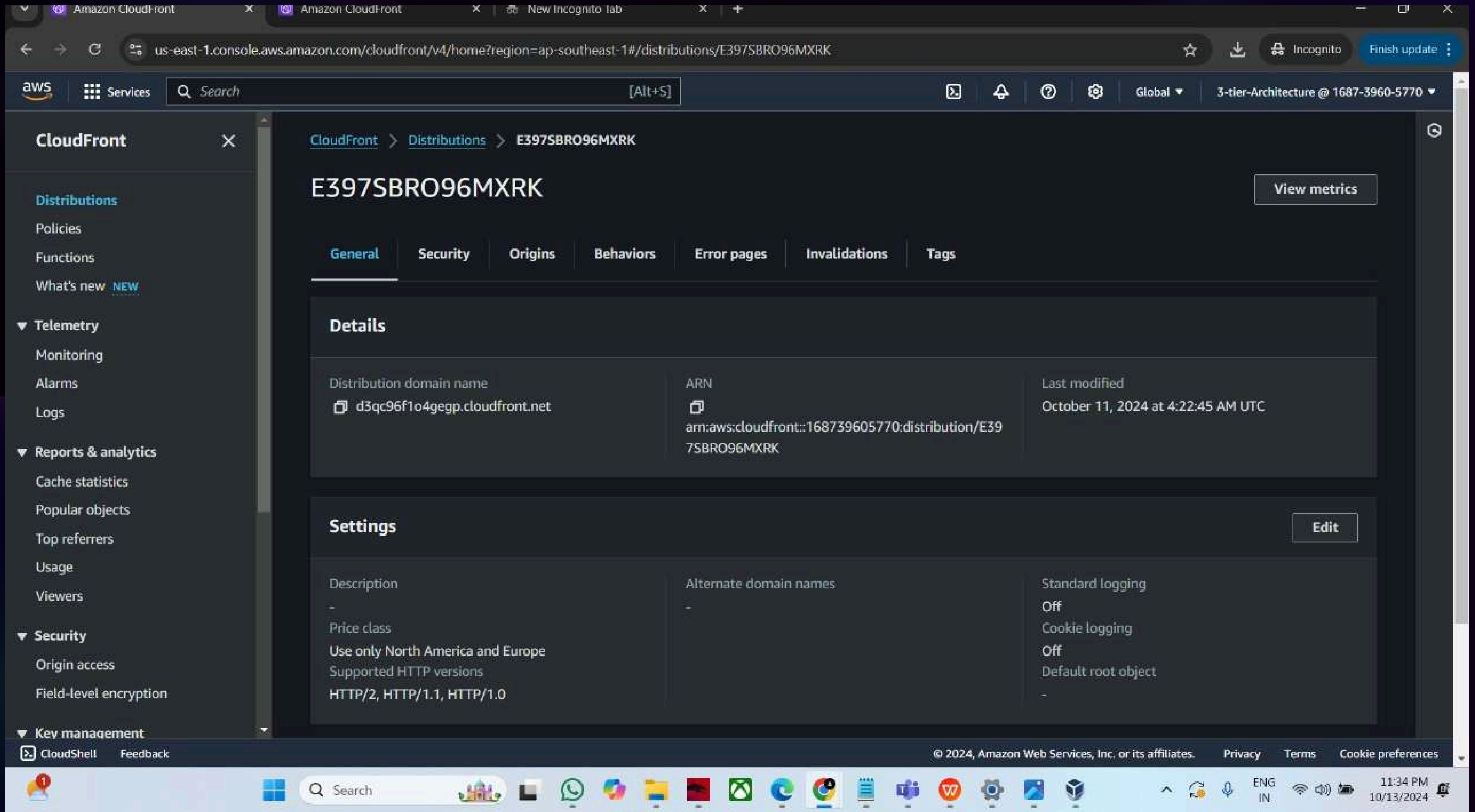
STEP 6: CREATING CLOUDFRONT DISTRIBUTION



CloudFront > Distributions

Distributions (1) Info

ID	Descript...	Type	Domain ...	Alternat...	Origins	Status	Last mo...
E397SBRO96MXRK	-	Production	d3qc96f1o...	-	presentation-tier	✓ Enabled	October 11...



us-east-1.console.aws.amazon.com/cloudfront/v4/home?region=ap-southeast-1#/distributions/E397SBRO96MXRK

CloudFront > Distributions > E397SBRO96MXRK

E397SBRO96MXRK

Details

Distribution domain name: d3qc96f1o4gegp.cloudfront.net

ARN: arn:aws:cloudfront::168739605770:distribution/E397SBRO96MXRK

Last modified: October 11, 2024 at 4:22:45 AM UTC

Settings

Description: -

Price class: Use only North America and Europe

Supported HTTP versions: HTTP/2, HTTP/1.1, HTTP/1.0

Alternate domain names: -

Standard logging: Off

Cookie logging: Off

Default root object: -

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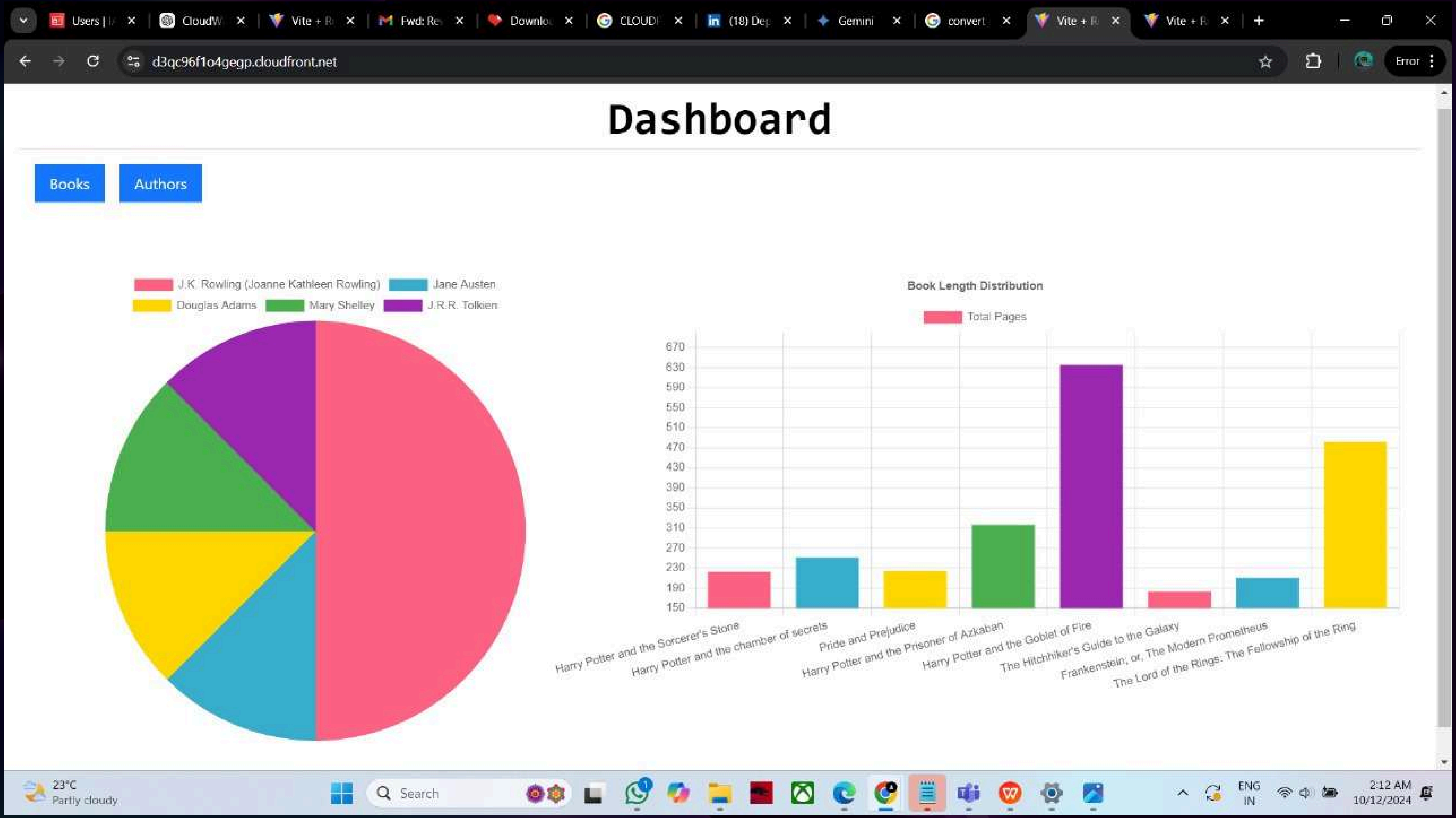
RESULT

- Successfully accomplished the task of designing and implementing a scalable cloud infrastructure on AWS.
- Achieved project goals:

1. Scalability
2. Centralized Management
3. High Availability
4. Cost Efficiency
5. Security
6. Impact:

- Robust, scalable, and secure infrastructure.
- Seamless operation of critical services in a large, centralized network.

RESULT

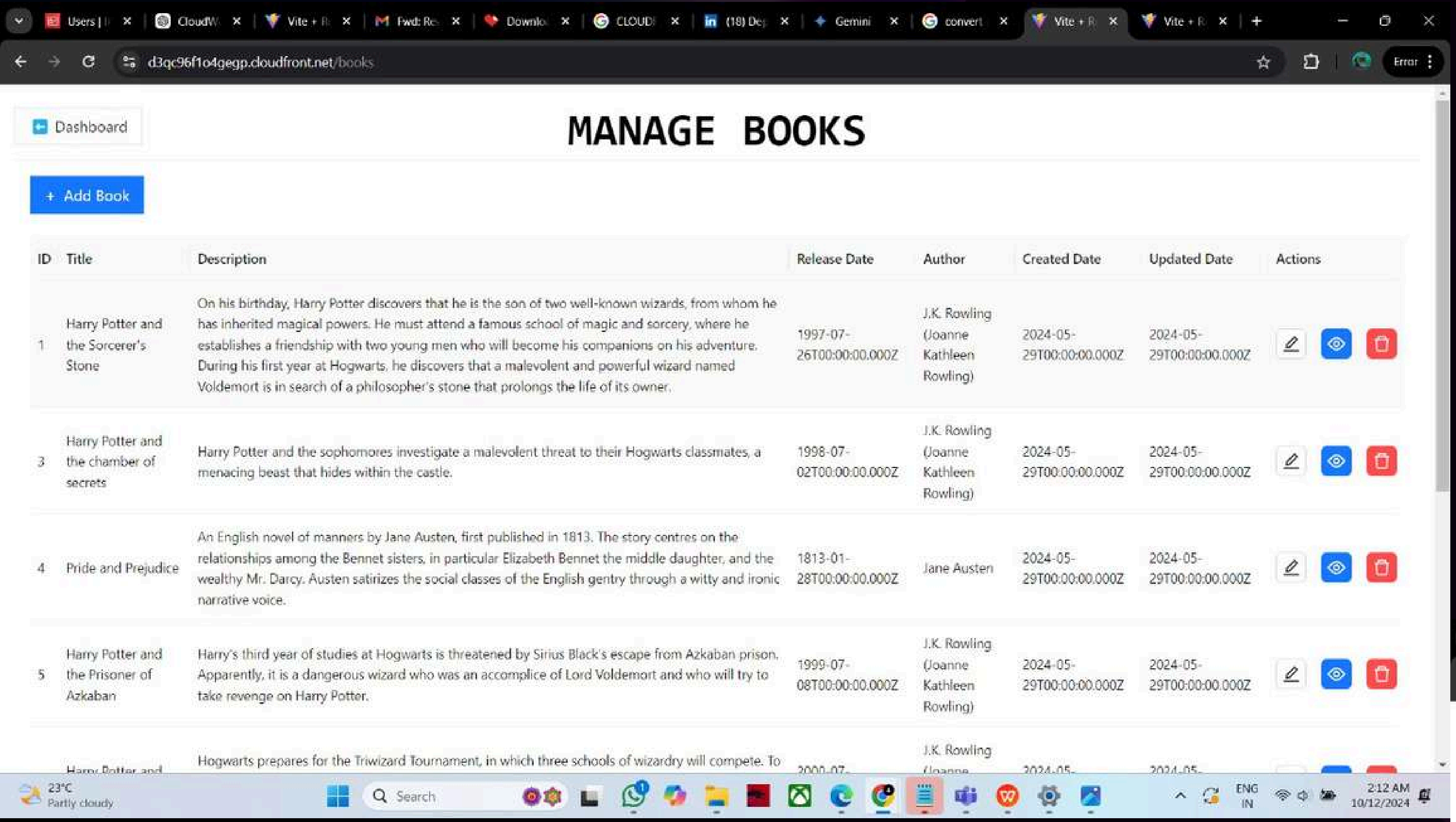

d3qc96f1o4gegp.cloudfront.net

Dashboard

Books Authors

J.K. Rowling (Joanne Kathleen Rowling)
Jane Austen
Douglas Adams
Mary Shelley
J.R.R. Tolkien
Book Length Distribution
Total Pages
670
630
590
550
510
470
430
390
350
310
270
230
190
150
Harry Potter and the Sorcerer's Stone
Harry Potter and the chamber of secrets
Pride and Prejudice
Harry Potter and the Prisoner of Azkaban
Harry Potter and the Goblet of Fire
The Hitchhiker's Guide to the Galaxy
Frankenstein; or, The Modern Prometheus
The Lord of the Rings: The Fellowship of the Ring

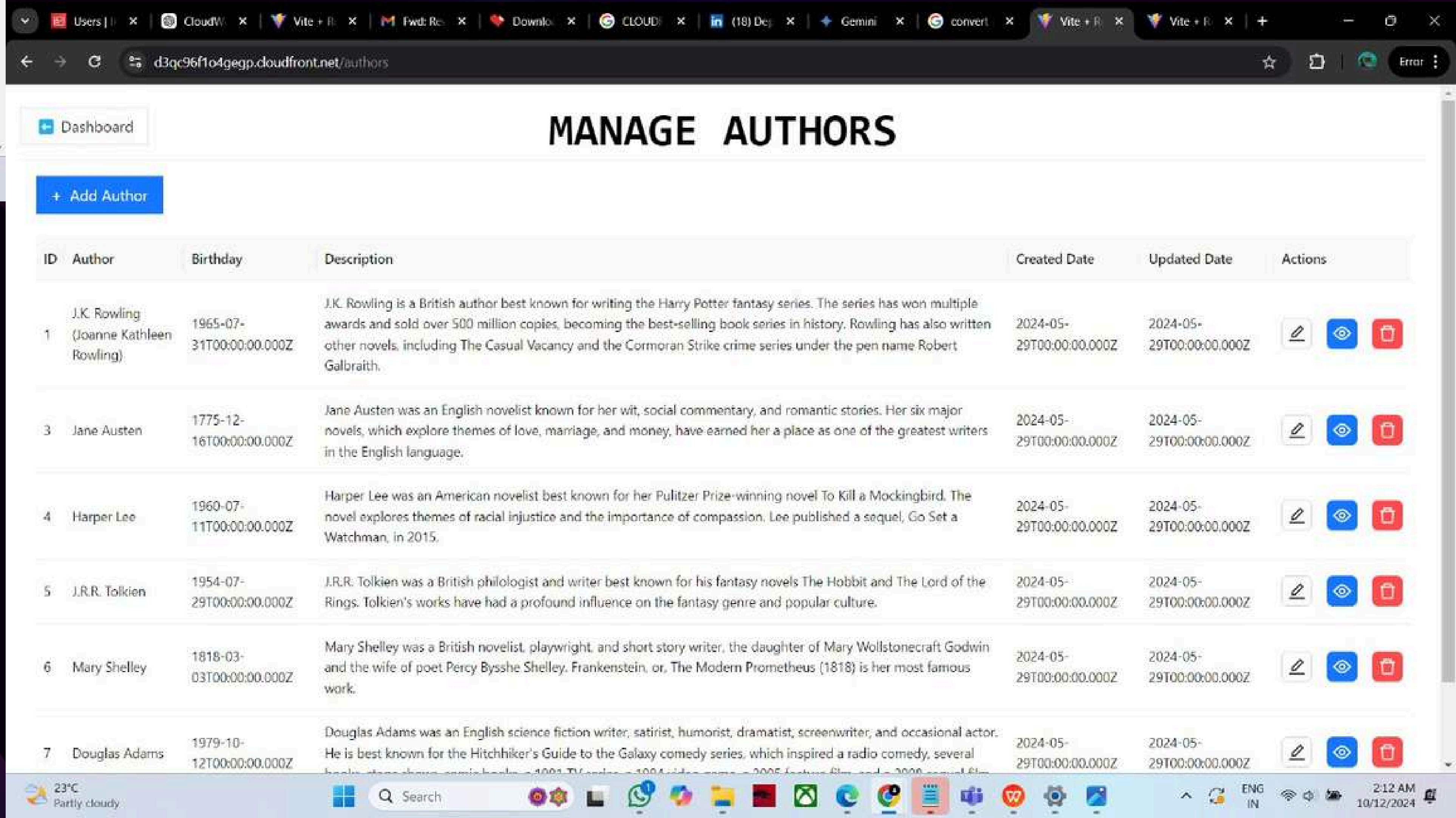
RESULT



d3qc96f1o4gegp.cloudfront.net/books

MANAGE BOOKS

ID	Title	Description	Release Date	Author	Created Date	Updated Date	Actions
1	Harry Potter and the Sorcerer's Stone	On his birthday, Harry Potter discovers that he is the son of two well-known wizards, from whom he has inherited magical powers. He must attend a famous school of magic and sorcery, where he establishes a friendship with two young men who will become his companions on his adventure. During his first year at Hogwarts, he discovers that a malevolent and powerful wizard named Voldemort is in search of a philosopher's stone that prolongs the life of its owner.	1997-07-26T00:00:00.000Z	J.K. Rowling (Joanne Kathleen Rowling)	2024-05-29T00:00:00.000Z	2024-05-29T00:00:00.000Z	
3	Harry Potter and the chamber of secrets	Harry Potter and the sophomores investigate a malevolent threat to their Hogwarts classmates, a menacing beast that hides within the castle.	1998-07-02T00:00:00.000Z	J.K. Rowling (Joanne Kathleen Rowling)	2024-05-29T00:00:00.000Z	2024-05-29T00:00:00.000Z	
4	Pride and Prejudice	An English novel of manners by Jane Austen, first published in 1813. The story centres on the relationships among the Bennet sisters, in particular Elizabeth Bennet the middle daughter, and the wealthy Mr. Darcy. Austen satirizes the social classes of the English gentry through a witty and ironic narrative voice.	1813-01-28T00:00:00.000Z	Jane Austen	2024-05-29T00:00:00.000Z	2024-05-29T00:00:00.000Z	
5	Harry Potter and the Prisoner of Azkaban	Harry's third year of studies at Hogwarts is threatened by Sirius Black's escape from Azkaban prison. Apparently, it is a dangerous wizard who was an accomplice of Lord Voldemort and who will try to take revenge on Harry Potter.	1999-07-08T00:00:00.000Z	J.K. Rowling (Joanne Kathleen Rowling)	2024-05-29T00:00:00.000Z	2024-05-29T00:00:00.000Z	
	Harry Potter and	Hogwarts prepares for the Triwizard Tournament, in which three schools of wizardry will compete. To	2000-07-	J.K. Rowling (Joanne	2024-05-	2024-05-	



d3qc96f1o4gegp.cloudfront.net/authors

MANAGE AUTHORS

ID	Author	Birthday	Description	Created Date	Updated Date	Actions
1	J.K. Rowling (Joanne Kathleen Rowling)	1965-07-31T00:00:00.000Z	J.K. Rowling is a British author best known for writing the Harry Potter fantasy series. The series has won multiple awards and sold over 500 million copies, becoming the best-selling book series in history. Rowling has also written other novels, including The Casual Vacancy and the Cormoran Strike crime series under the pen name Robert Galbraith.	2024-05-29T00:00:00.000Z	2024-05-29T00:00:00.000Z	
3	Jane Austen	1775-12-16T00:00:00.000Z	Jane Austen was an English novelist known for her wit, social commentary, and romantic stories. Her six major novels, which explore themes of love, marriage, and money, have earned her a place as one of the greatest writers in the English language.	2024-05-29T00:00:00.000Z	2024-05-29T00:00:00.000Z	
4	Harper Lee	1960-07-11T00:00:00.000Z	Harper Lee was an American novelist best known for her Pulitzer Prize-winning novel To Kill a Mockingbird. The novel explores themes of racial injustice and the importance of compassion. Lee published a sequel, Go Set a Watchman, in 2015.	2024-05-29T00:00:00.000Z	2024-05-29T00:00:00.000Z	
5	J.R.R. Tolkien	1954-07-29T00:00:00.000Z	J.R.R. Tolkien was a British philologist and writer best known for his fantasy novels The Hobbit and The Lord of the Rings. Tolkien's works have had a profound influence on the fantasy genre and popular culture.	2024-05-29T00:00:00.000Z	2024-05-29T00:00:00.000Z	
6	Mary Shelley	1818-03-03T00:00:00.000Z	Mary Shelley was a British novelist, playwright, and short story writer, the daughter of Mary Wollstonecraft Godwin and the wife of poet Percy Bysshe Shelley. Frankenstein, or, The Modern Prometheus (1818) is her most famous work.	2024-05-29T00:00:00.000Z	2024-05-29T00:00:00.000Z	
7	Douglas Adams	1979-10-12T00:00:00.000Z	Douglas Adams was an English science fiction writer, satirist, humorist, dramatist, screenwriter, and occasional actor. He is best known for the Hitchhiker's Guide to the Galaxy comedy series, which inspired a radio comedy, several	2024-05-29T00:00:00.000Z	2024-05-29T00:00:00.000Z	

CONCLUSION

- Designed and implemented a scalable AWS infrastructure using Ubuntu servers.
- Supported critical applications: web hosting, API services, data processing microservices
- Utilized AWS services: EC2, VPC, CloudFront, RDS.
- Ensured scalability, centralized management, high availability, cost efficiency, and security.

FUTURE SCOPE

- Scaling Beyond Current Needs: Explore additional services like AWS Lambda for serverless architecture.
- Automation: Implement further automation using tools like AWS CloudFormation, Ansible, or Terraform.
- Advanced Monitoring: Leverage AWS CloudWatch for more sophisticated monitoring and alerting.
- Integrating AI/ML Services: Explore integrating AWS AI/ML services (SageMaker, Rekognition) to enhance applications.
- Security Enhancements: Explore further hardening of the infrastructure, such as zero-trust architectures and continuous compliance monitoring.

QUICE RECAP

YOUR PARAGRAPH TEXTHTTPS://3-TIER-ARCHITECTURE-RECAP.S3.AP-SOUTHEAST-1.AMAZONAWS.COM/IMPLEMENTATION_VISUALS+-+MADE+WITH+CLIPCHAMP+(1).MP4

THANK YOU!