Security & Key Pair Configuration

Here first we will cover , the setup of security groups and key pairs for deploying the vProfile application on AWS using the Lift and Shift strategy. All configurations follow AWS best practices to ensure least privilege access, security, and scalability.

---

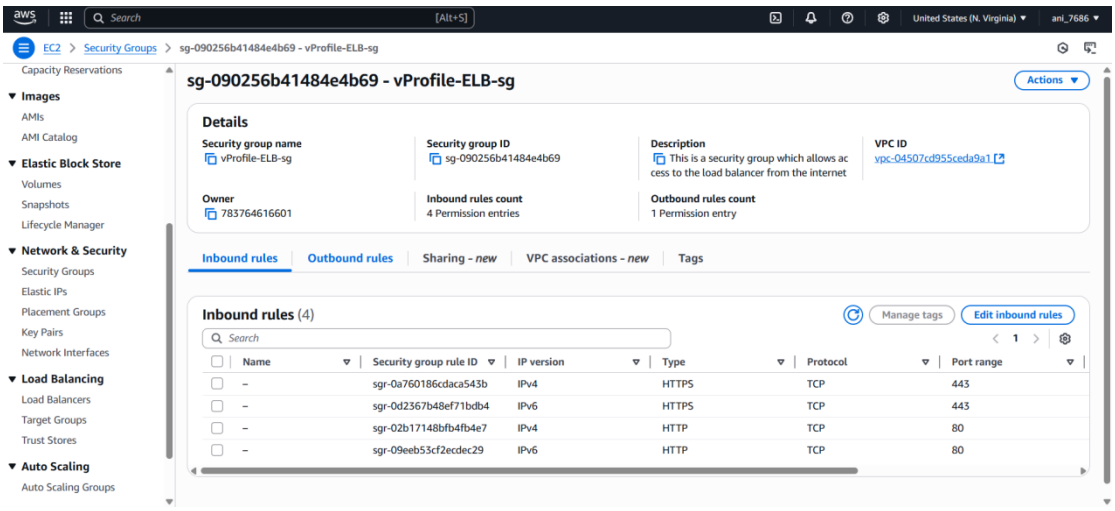
1. Security Group: `vprofile-ELB-sg` (Load Balancer)

Purpose: Allows public internet traffic to reach the Application Load Balancer.

Inbound Rules:

Protocol	Port	Source	Description
HTTP	80	Anywhere	Public access (IPv4 & IPv6)
HTTPS	443	Anywhere	Secure access (IPv4 & IPv6)

Do not modify outbound rules.



---

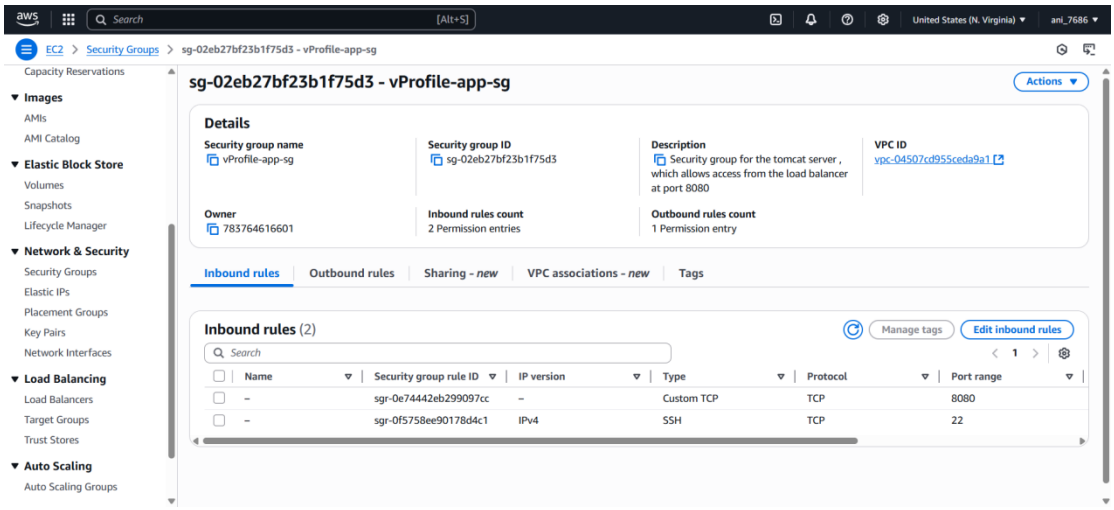
2. Security Group: `vprofile-app-sg` (Tomcat Instances)

Purpose: Allows traffic from the Load Balancer and SSH access for management.

Inbound Rules:

Protocol	Port	Source	Description
TCP	8080	vprofile-ELB-SG	Application traffic from Load Balancer
SSH	22	My IP	Admin SSH access

Update the SSH rule when your IP changes.



---

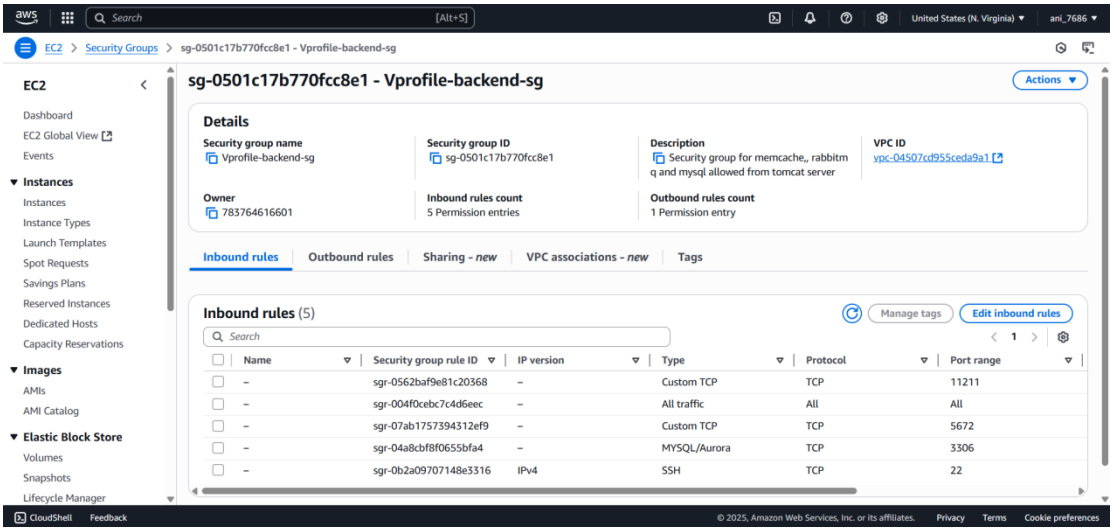
3. Security Group: `vprofile-backend-sg` (MySQL, Memcache, RabbitMQ)

Purpose: Controls backend service access from the application layer.

Inbound Rules:

Protocol	Port	Source	Service
TCP	3306	vprofile-app-sg	MySQL
TCP	11211	vprofile-app-sg	Memcached
TCP	5672	vprofile-app-sg	RabbitMQ
SSH	22	My IP	SSH access
ALL	ALL	vprofile-backend-sg	Internal backend-to-backend communication

✅ Internal traffic rule allows instances in this group to communicate freely.



Key Pair: `vprofile-prod-key`

Created in `.pem` format (for Git Bash / Terminal).

Used for secure SSH access to EC2 instances.

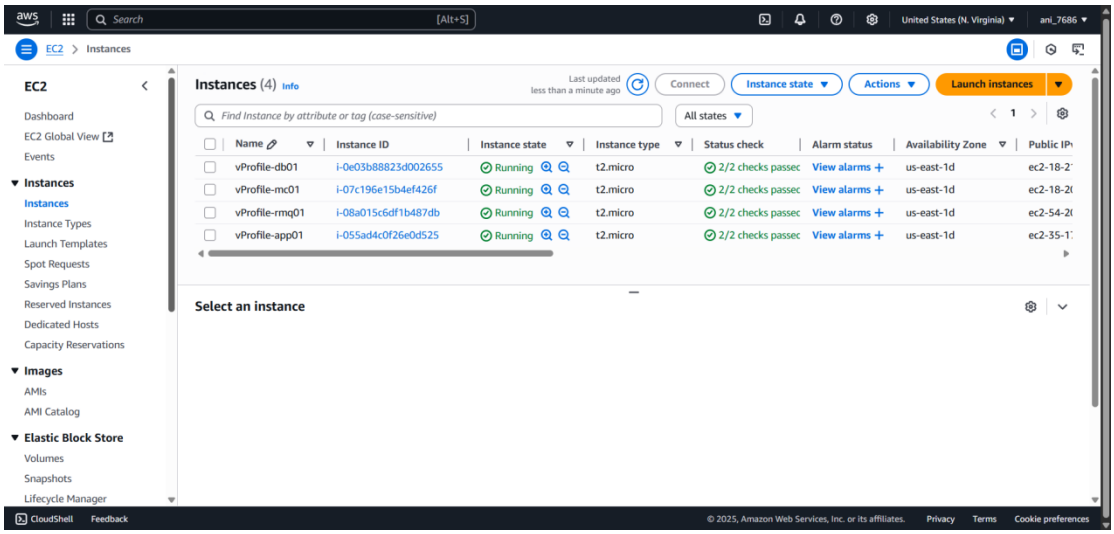
File should be kept **secure and private**.

AWS EC2 Instance Setup and Service Verification

1.) We set up **four EC2 instances**, each with specific responsibilities and services using **user data scripts**:

Instance Name	Purpose	AMI Used	Script Used	Security Group
vprofile-db01	MySQL DB	Amazon Linux 2023	mysql.sh	vprofile-backend-sg
vprofile-mc01	Memcached	Amazon Linux 2023	memcache.sh	vprofile-backend-sg
vprofile-rmq01	RabbitMQ	Amazon Linux 2023	rabbitmq.sh	vprofile-backend-sg
vprofile-app01	Tomcat Server	Ubuntu 24.04 LTS	tomcat_ubuntu.sh	vprofile-app-sg

---



Setup Steps Summary

Repository Clone:

Cloned from `https://github.com/hkhcoder/vprofile-project` into local machine.

Switched to `aws-liftandshift` branch.

User Data Scripts Used:

`mysql.sh`: Installs MariaDB, sets up DB, user, schema.

`memcache.sh`: Installs Memcached, enables remote access.

`rabbitmq.sh`: Downloads repo config, installs Erlang and RabbitMQ, configures admin user.

`tomcat_ubuntu.sh`: Installs Tomcat10 on Ubuntu via APT.

2.) Tags Added to Each Instance and Volume:

`Name`: Based on role (e.g., `vprofile-db01`)

`Project`: `vprofile`

3.) Security Group Mappings:

App SG → for Tomcat (port 8080 + SSH from IP)

Backend SG → for MySQL (3306), Memcache (11211), RabbitMQ (5672) + SSH

Load Balancer SG → for HTTP/HTTPS

4.) Post-Launch Verification

✅**vprofile-db01**:

Logged in using `ssh -i vprofile-prod-key.pem ec2-user@<db01-public-ip>`

Verified MariaDB: `systemctl status mariadb`

Logged into MySQL: `mysql -u admin -p` → DB: `accounts` → Tables verified

✅**vprofile-mc01**:

Logged in using `ssh`

Verified Memcached: `systemctl status memcached`

✅**vprofile-rmq01**:

Logged in using `ssh`

Verified RabbitMQ: `systemctl status rabbitmq-server`

✅**vprofile-app01**:

Script installs Tomcat10 on Ubuntu 24.04

Will verify in next steps after deployment

Private DNS with Route 53

To ensure our **vprofile application** in `vprofile-app01` (Tomcat instance) can reliably connect to backend services (**MySQL**, **Memcache**, and **RabbitMQ**), we use **private DNS** entries instead of hardcoding IP addresses.

Why Private DNS?

IPs can change when instances are terminated and relaunched.

Using private DNS (like `db01.vprofile.internal`) provides **dynamic resolution**.

No need to modify `application.properties` or redeploy the app when IPs change.

*** application.properties (Excerpt)

```
db01=3306
mc01=11211
rmq01=5672
```

Here, `db01`, `mc01`, and `rmq01` must resolve to the **private IPs** of the respective backend EC2 instances.

*** Steps to Create Private Hosted Zone in Route 53

1. **Navigate to Route 53 → Hosted Zones → Create Hosted Zone**

   Domain Name: `vprofile.internal`

   Type: Private Hosted Zone for Amazon VPC

   VPC Selection: Select the same VPC used for your EC2 instances

2. **Create DNS Records** for each backend service:

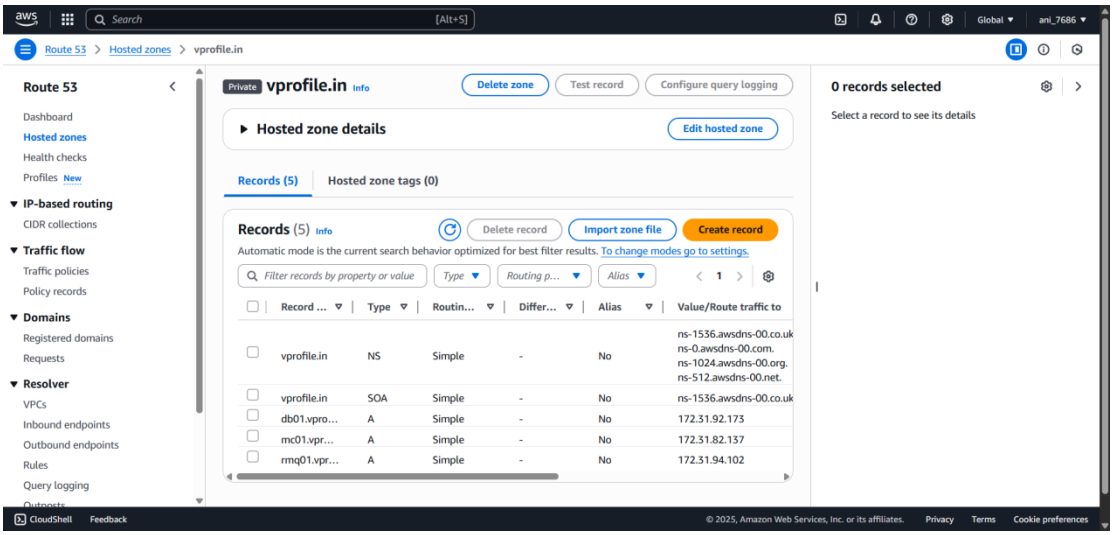
Record Name	Record Type	Value (Private IP of Instance)	Description
db01	A	Private IP of vprofile-db01	MySQL Hostname
mc01	A	Private IP of vprofile-mc01	Memcache Hostname
rmq01	A	Private IP of vprofile-rmq01	RabbitMQ Hostname

3. **Verify DNS Resolution (from app instance)**

SSH into `vprofile-app01` and test:

```
ping db01.vprofile.internal
ping mc01.vprofile.internal
ping rmq01.vprofile.internal
```

You should see the private IP resolving correctly for each.



✅Benefits

Seamless failover and recreation of instances

No need to redeploy application on IP change

Easy environment separation (e.g., `vprofile-dev.internal`, `vprofile-prod.internal`)

AWS Java Artifact Deployment using Maven, S3, and EC2 Tomcat

To build a Java application (`.war` file) using Maven on your local computer, upload it to an AWS S3 bucket, and deploy it on a Tomcat EC2 instance using AWS CLI and IAM for secure communication.

Tools & Technologies Required

Maven	Build Java project into a .war file
JDK 17	Required for Maven and Java build
AWS CLI	To interact with AWS services (S3, EC2) from the command line
S3 Bucket	Temporary storage for your artifact
IAM User	Authenticate your computer to access AWS
IAM Role	Authenticate EC2 instance to access AWS services
EC2 (Ubuntu)	Server where Tomcat is installed
Tomcat 10	Application server to run the Java app

Structure of the Process

AWS Setup

Create S3 Bucket

Create IAM User (for your local machine)

Create IAM Role (for EC2)

Local Computer Setup

Install required tools

Build artifact with Maven

Upload `.war` to S3 using AWS CLI

EC2 Server Deployment

Install AWS CLI

Download artifact from S3

Deploy to Tomcat

Security Concepts Explained

IAM vs EC2 Root User: Why We Need IAM

Common Confusion:

> "If I am root user on the EC2 instance, why do I need IAM roles?"

Being root on EC2 only gives you **local machine power**. You can install software, delete files, run services — but AWS services like **S3, DynamoDB, etc. require AWS permissions**, not Linux permissions.

Role	What it controls
Root user (Linux)	Superuser on the machine only
IAM Role (AWS)	Controls access to AWS services

Example:

You're root on EC2 but cannot run:

```
aws s3 cp s3://my-bucket/myfile.txt .
```

Unless EC2 has an IAM Role attached with `S3ReadAccess`

✅ Local Machine Needs IAM User

To push `.war` to S3, use AWS CLI with IAM User keys

✅ EC2 Instance Needs IAM Role

To download `.war` from S3 securely without hardcoding keys

Why IAM Roles Are Better:

No need to store access keys in EC2

Temporary credentials auto-rotated by AWS

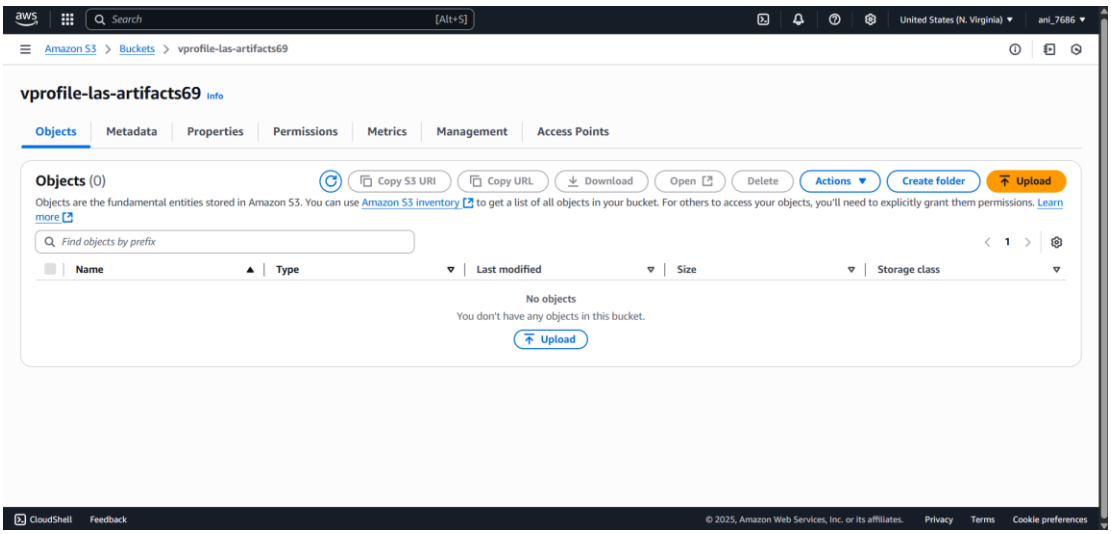
Safer and more manageable

Step-by-Step Deployment Guide

1.) AWS Setup

a. Create S3 Bucket

Go to AWS Console → S3 → Create bucket → Name: `vprofile-las-artifacts`

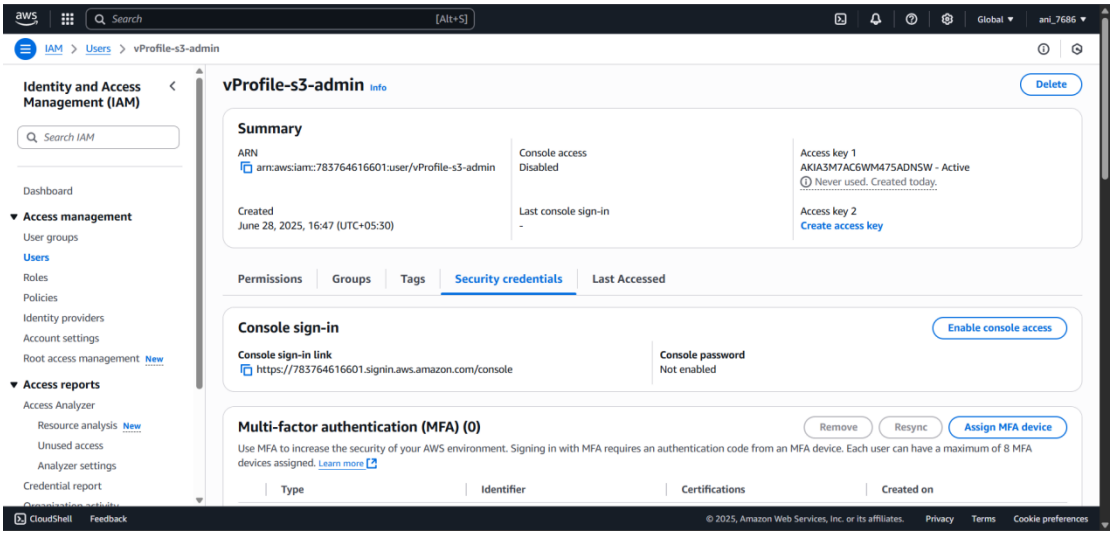


b. Create IAM User

IAM → Users → Create User → `vprofile-s3-admin`

Attach policy: `AmazonS3FullAccess`

Generate & download access keys



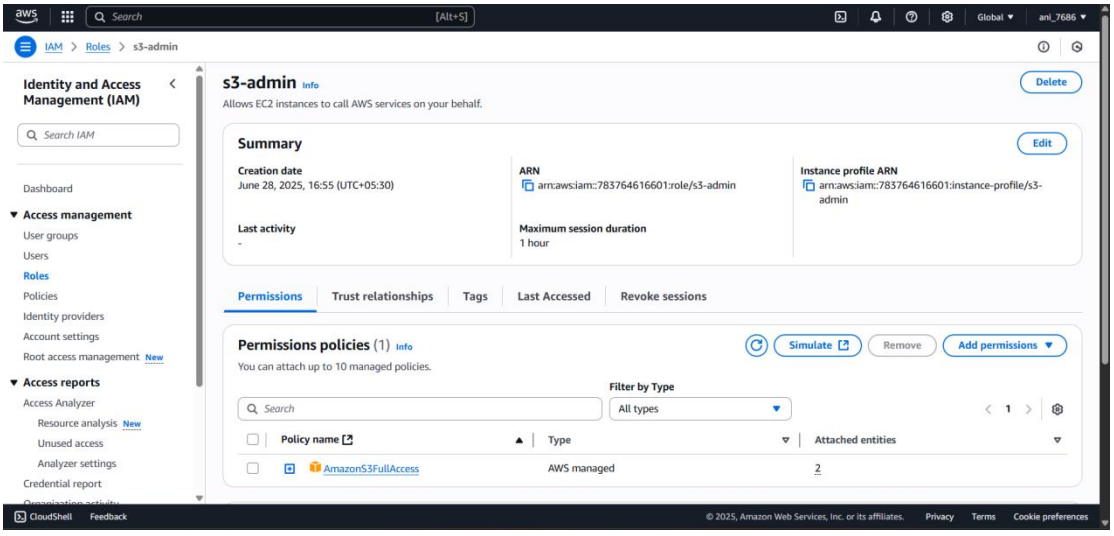
c. Create IAM Role for EC2

IAM → Roles → Create Role → Use Case: EC2

Attach policy: `AmazonS3FullAccess`

Name: `S3-admin`

Attach this role to your EC2 instance



2.) On Your Computer

a. Install Requirements

Install Maven, JDK 17, AWS CLI

b. Configure AWS CLI

```
aws configure
```

Enter your access key, secret key, region (e.g., `us-east-1`), format (e.g., `json`)

c. Update `application.properties`

Inside `src/main/resources`:

```
db.host=db01.vprofile.in
mc.host=mc01.vprofile.in
rmq.host=rmq01.vprofile.in
```

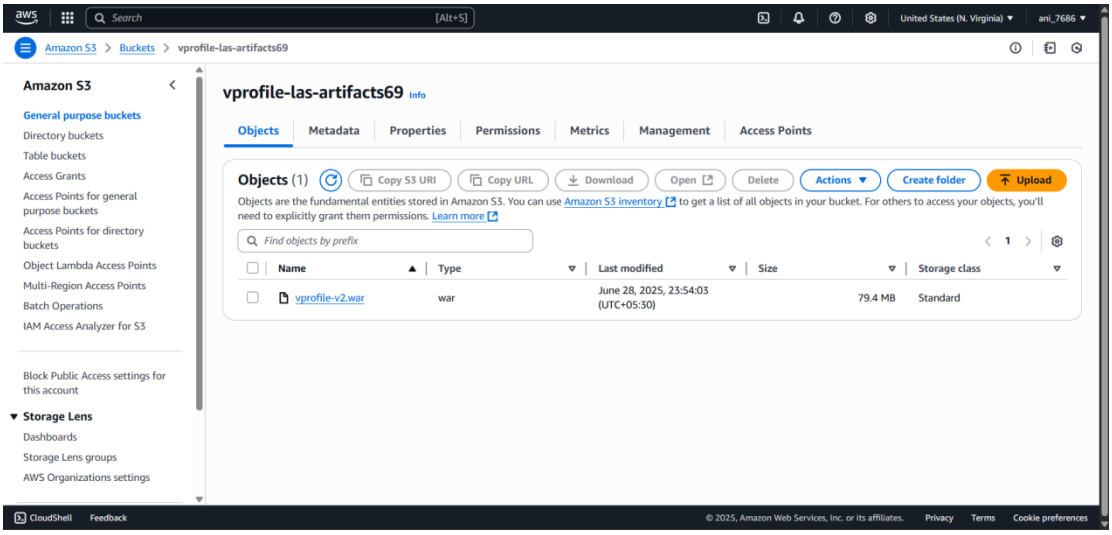
d. Build Artifact with Maven

```
mvn install
```

Output file: `target/vprofile-v2.war`

e. Upload Artifact to S3

aws s3 cp target/vprofile-v2.war s3://vprofile-las-artifacts69



3.) On EC2 Tomcat Server

a. SSH into EC2

```
ssh -i key.pem ubuntu@<your-public-ip>
```

b. Install AWS CLI

```
sudo snap install aws-cli --classic
```

c. Download Artifact from S3

```
aws s3 cp s3://vprofile-las-artifacts69/vprofile-v2.war /tmp/
```

d. Deploy to Tomcat

sudo systemctl stop tomcat10

sudo rm -rf /var/lib/tomcat10/webapps/ROOT

sudo cp /tmp/vprofile-v2.war /var/lib/tomcat10/webapps/ROOT.war

sudo systemctl start tomcat10

AWS Load Balancer and Service Validation for VProfile App

Step 1: Validate Tomcat Application on EC2 (app01)

Check Tomcat Application:

Go to EC2 instance `app01`.

Retrieve **Public IP Address**.

Security Group Configuration:

Go to `app` security group (attached to `app01`).

Edit **Inbound Rules**:

Allow **port 8080** from **Load Balancer Security Group**.

Add another rule to allow **port 8080** from **your IP** (for testing).

Test Application in Browser:

Visit: `http://<Public-IP>:8080`

You should see the **login page** of the VProfile app.

This is a temporary check. Final setup will be accessed via Load Balancer.

Step 2: Create Target Group

Navigate to EC2 > Load Balancing > Target Groups

Create a new Target Group:

Target type: **Instances**

Name: `vprofile-las-tg`

Protocol: **HTTP**

Port: **8080**

Health Check Settings:

Override default port with **8080**

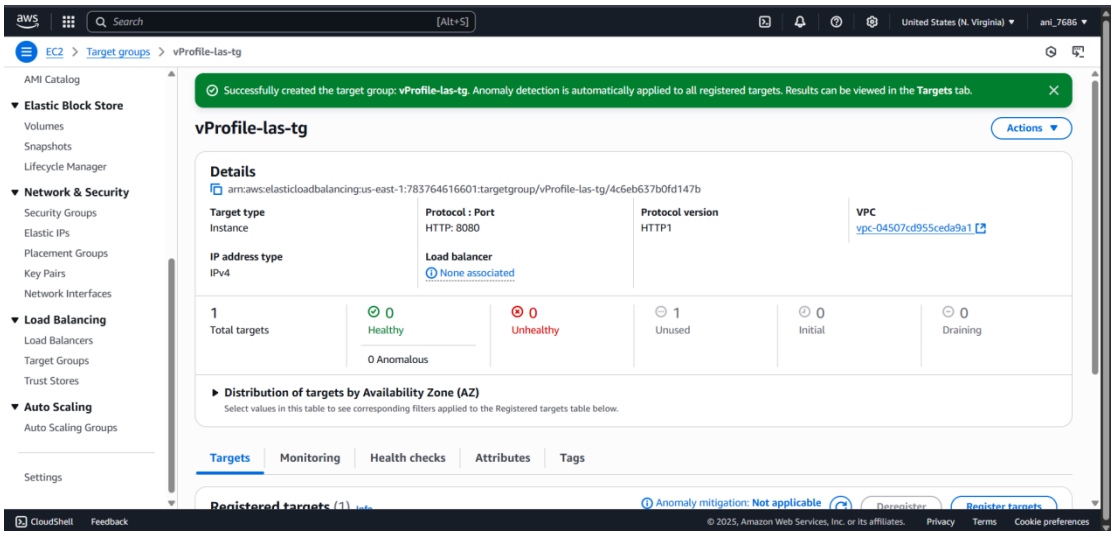
Register Target Instance:

Select instance `app01`

Confirm port: **8080**

Click: `Include as pending below`

Click: **Create Target Group**



Step 3: Create Load Balancer (Application Load Balancer)

Navigate to EC2 > Load Balancers > Create Load Balancer

Choose Application Load Balancer (ALB)

Basic Configuration:

Name: `vprofile-las-elb`

Scheme: Internet-facing

IP Type: IPv4

Network Mapping:

Select your VPC

Select all **Availability Zones** (AZs)

Security Group:

Remove default

Attach **Load Balancer Security Group**

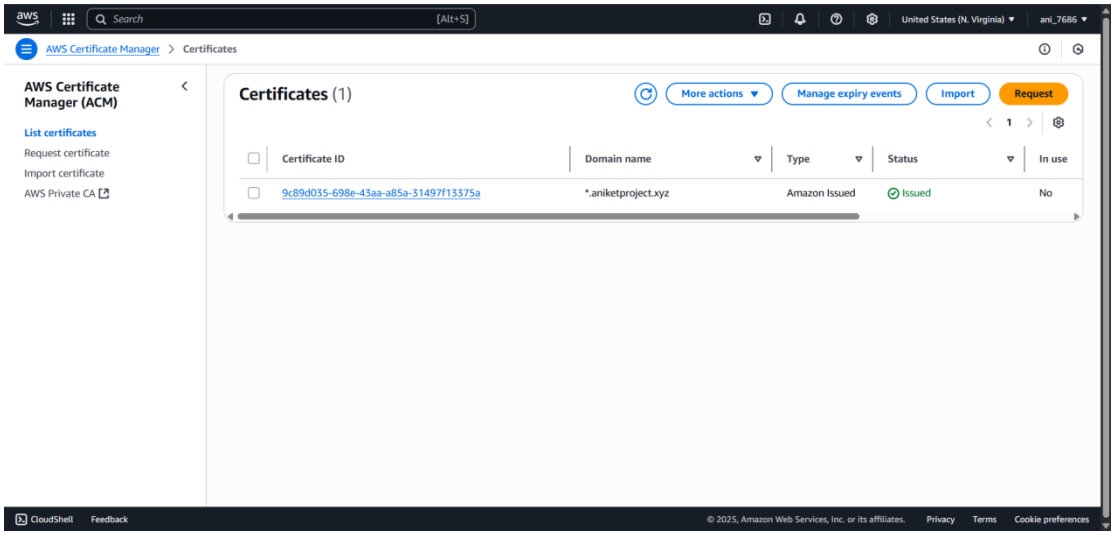
Listeners and Routing:

Listener 1: HTTP (port 80) ➔Forward to `vprofile-las-tg`

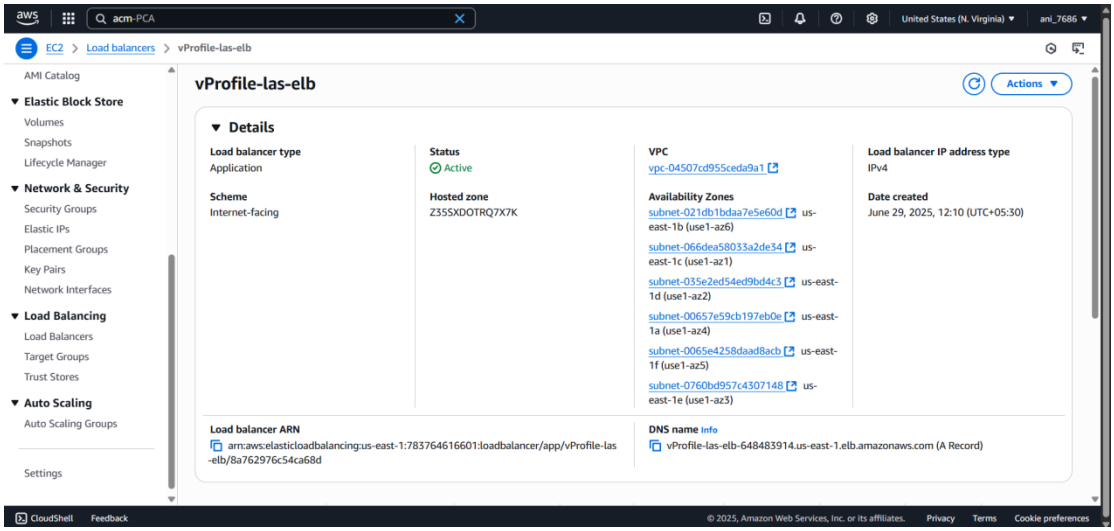
Optional: Add HTTPS (port 443) if ACM Certificate and Domain are configured

Add Listener: **HTTPS (443)**

Select **Certificate from ACM** (e.g. `vprofileapp.aniketproject.xyz`)



Create Load Balancer



What's happening in your setup:

Tomcat (your application server) is **running on port 8080** inside your EC2 instance.

Why? Because Tomcat by default runs on **8080** to avoid conflict with Apache or Nginx, which usually run on port 80.

Also, running on port 80 requires root privileges on Linux.

Load Balancer listens on:

Port 80 for **HTTP traffic**

Port 443 for **HTTPS traffic**

Load Balancer forwards the request to target group (EC2 instances) on **port 8080**

This means:

Client → sends request to LB on port 80/443

LB → forwards request to EC2 (Tomcat) on port 8080

Step 4: Domain Configuration (Optional - Only If You Own a Domain)

For domain users (e.g., GoDaddy):

Go to your **Domain Provider** (e.g., GoDaddy).

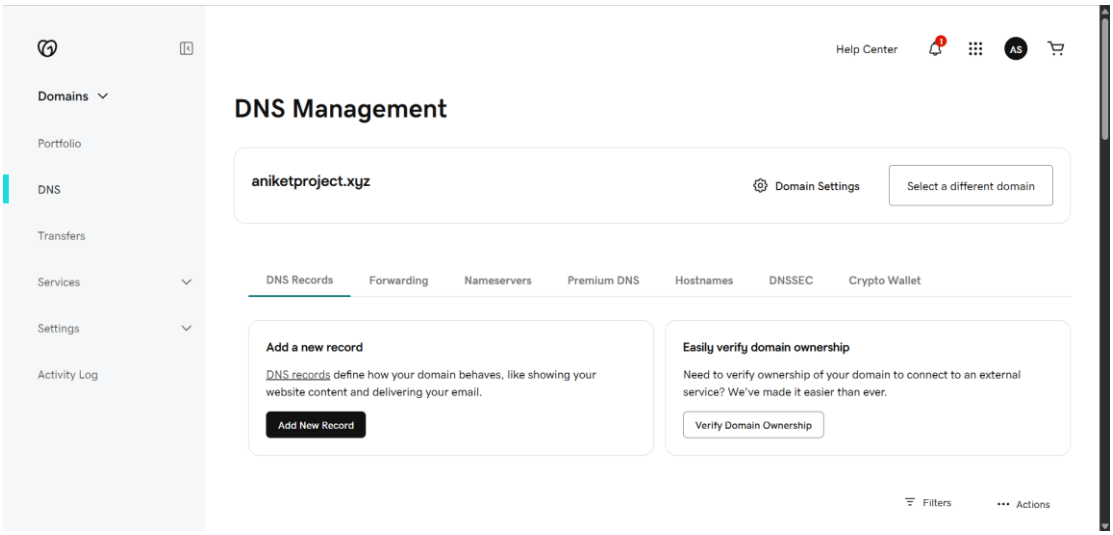
Navigate to **DNS Management**.

Create a **CNAME Record**:

Name: `vprofileapp`

Value: **Load Balancer DNS Name**

Full URL: `vprofileapp.yourdomain.com`



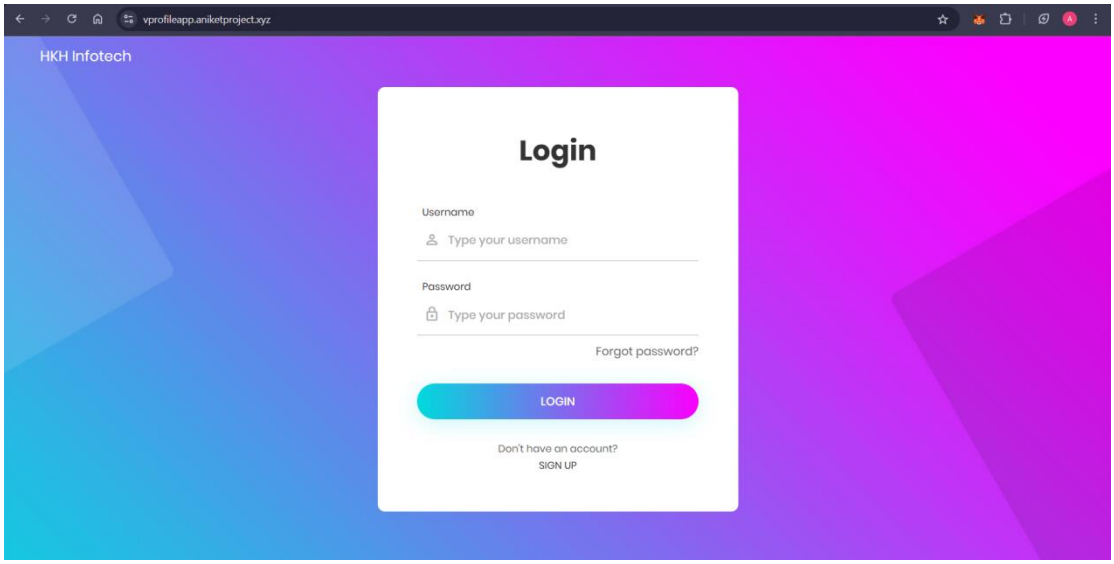
Step 5: Validate Load Balancer

Wait until Load Balancer state = **Active**

Visit:

HTTP: `http://<Load-Balancer-DNS>`

HTTPS (if configured): https://vprofileapp.aniketproject.xyz



If HTTPS is active:

Check the padlock symbol

View SSL certificate details (issued by Amazon)

Step 6: Check Target Group Health

Navigate to your **Target Group**

Go to **Targets** tab

Refresh to check health status:

Status = `healthy`

Troubleshooting Unhealthy Targets:

* Ensure Tomcat is running on `app01`

* Ensure Security Group allows port 8080 from Load Balancer SG

* Ensure Health Check is set to port **8080**

Step 7: Application Functional Validation

Visit application through **Load Balancer URL**

Login with credentials:

Username: `admin_vp`

Password: admin_vp

Verify:

DB connection: Successful login implies DB is connected

RabbitMQ: Queue should be visible after login

Memcache:

Click a user ➔shows "data from DB"

Click again ➔shows "data from cache"

Auto Scaling Setup for vProfile Application

Enable automatic scaling of application servers (Tomcat instances) based on load to ensure high availability and performance.

Step 1: Create AMI from EC2 Instance

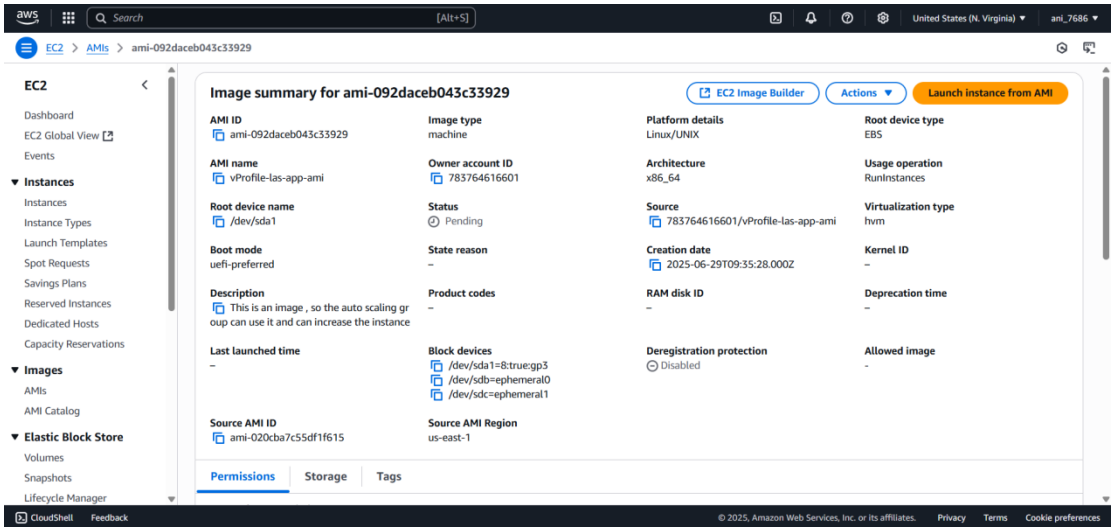
Select the `vprofile-app01` instance.

Go to `Actions > Image and Templates > Create Image`.

Name the AMI as: `vProfile-las-app-ami`

Click **Create Image**.

Why AMI? Auto Scaling launches new instances using this AMI so they are exact replicas of the current working app instance.



Step 2: Create Launch Template

Go to **Launch Templates** in EC2 console.

Click **Create Launch Template**.

Name it: `vProfile-las-app-LT`

Select the AMI created above

Instance Type: `t2.micro` or `t3.micro`

Select Key Pair: `vProfile-prod-key`

Network Settings:

Choose **App Security Group**

Tags:

`Name = vprofile-app`

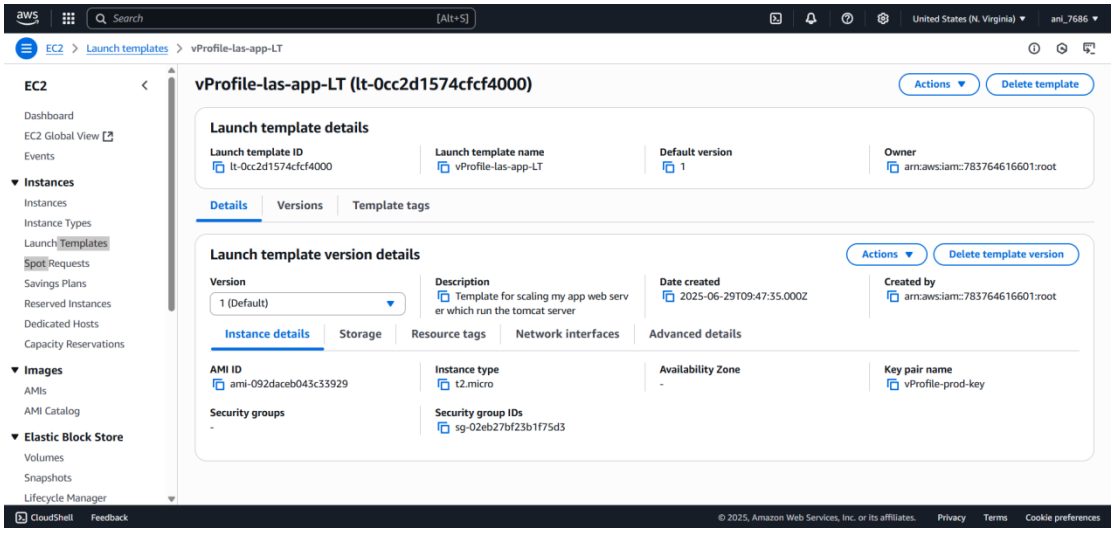
`Project = vprofile`

Enable **volume tags**

(Optional) Add IAM Role if needed

Click **Create Launch Template**

Why Launch Template? It defines how Auto Scaling should launch new instances: which AMI, what type, what SG, key pair, and so on



Step 3: Create Auto Scaling Group

Go to **Auto Scaling Groups**

Click **Create Auto Scaling Group**

Name: `vprofile-las-app-asg`

Choose Launch Template: `vprofile-las-app-LT`

Select VPC and Availability Zones

Attach to existing Load Balancer:

Select **Target Group**: `vprofile-las-tg`

Turn ON Health Checks:

Enable **Elastic Load Balancing health checks**

Configure Group Size:

Desired: 1

Min: 1

Max: 4

Scaling Policy:

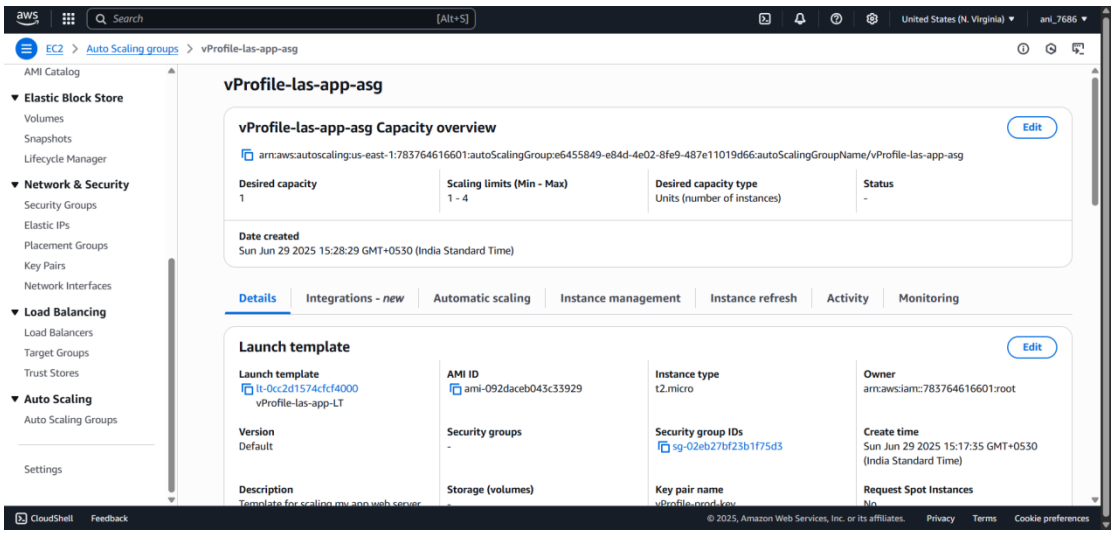
Use **Target Tracking**

Metric: CPU Utilization

Target Value: 50%

(Optional) Notification Settings via SNS

Click **Create Auto Scaling Group**



Lift-and-Shift Scope

Application was migrated **without actual data**.

No DB sync or S3 sync needed.

This was a **code and infrastructure migration only**.

This used **Infrastructure as a Service (IaaS)** — all services like DB, Memcache, etc., were installed and managed manually on EC2.

Final Architecture Review

Security Groups & Key Pairs: Created per role (app, backend, LB)

EC2 Instances: Configured with `user-data` scripts

Maven Build + S3 Upload: Java WAR built locally, uploaded to S3

Tomcat Server: Retrieved WAR from S3 and deployed

Load Balancer: ALB with HTTP(80) and HTTPS(443) endpoints

ACM Certificate: Configured for HTTPS

Target Group: Used for health checks and routing

Route 53 Private Hosted Zone: Enabled DNS resolution among services

Auto Scaling Group: Based on Launch Template and custom AMI

Stickiness: Enabled due to app-specific session handling

Summary :

This project successfully lifted and shifted a locally running Java-based application (vProfile) to the AWS cloud infrastructure, using best practices in provisioning, deployment, scalability, and security.