Tab 1

AWS CAPESTONE PROJECT

Project overview

This project demonstrates the **deployment of a production-grade Django web application** on **Amazon Web Services (AWS)**. The primary focus is not on building new application features but on designing, provisioning, and operating a **robust, scalable, secure, and observable infrastructure** suitable for real-world workloads.

The project leverages core AWS services to create a fully managed environment optimized for availability, performance, and security. It ensures the Django app is **deployed using EC2 instances**, automatically scaled with **Auto Scaling Groups**, and load-balanced through an **Application Load Balancer**. The database is hosted on **Amazon RDS**, while **Amazon S3** is used to store application logs. **IAM roles** are used for secure access between services without hardcoded credentials.

Custom domain routing is handled using **Amazon Route 53**, secured via **AWS Certificate Manager (ACM)** for HTTPS. Monitoring, logging, and alerting are achieved using **Amazon CloudWatch** and **SNS**. This setup reflects **real-world infrastructure practices**, with automated cron jobs for pushing logs to S3 and **CloudFront** used to reduce content delivery latency.

Project specification

- This project focuses on deploying a **Django web application** into a **production-ready AWS cloud infrastructure**, with a strong emphasis on scalability, security, and real-time performance.

- The Django application is hosted on **Amazon EC2** instances, running **Gunicorn** as the application server and **Nginx** as a reverse proxy. **Nginx** also handles the serving of static files directly from the server

- All EC2 instances are deployed within a **custom Amazon VPC**, inside **private subnets** for added security. Public subnets are used only for the **Application Load Balancer (ALB)**, which routes traffic securely to the EC2 instances.

- To ensure high availability and handle traffic surges, an **Auto Scaling Group (ASG)** dynamically adjusts the number of EC2 instances based on real-time metrics like CPU utilization.

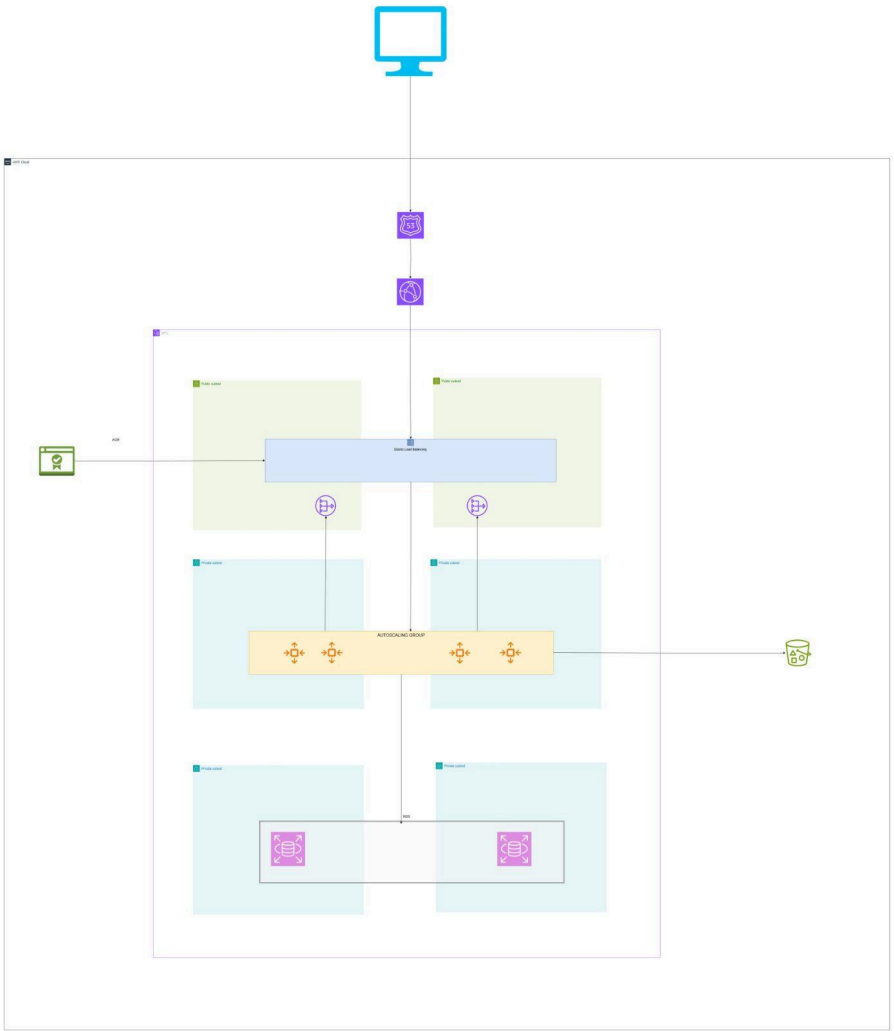
- The application connects to **Amazon RDS (MySQL)**, a fully managed, scalable, and fault-tolerant relational database service, for its backend data needs.

- All application **logs are pushed periodically to Amazon S3** using a scheduled **cron job** running on each EC2 instance. This allows for centralized, durable, and cost-effective log storage, useful for auditing, analysis, and troubleshooting.

- A **custom domain** is managed through **Amazon Route 53**, which maps the domain to the ALB. **AWS Certificate Manager (ACM)** is used to issue and manage SSL certificates, enabling secure HTTPS traffic.

- **Amazon CloudWatch** is used to monitor infrastructure and application metrics. Combined with **CloudWatch Logs** and **CloudWatch Alarms**, real-time alerts are sent via **Amazon SNS** for proactive monitoring and response.

System Architecture Diagram



Project Goals

- Host a Django app with a secure, production-grade infrastructure
- Ensure auto-scaling for high availability
- Use IAM roles and VPC endpoints for secure log storage in S3
- Monitor health and performance using CloudWatch and alerting via SNS
- Apply SSL and route traffic through a custom domain using Route 53 and ACM

AWS Service Configuration

Step 1 : VPC and subnet configuration

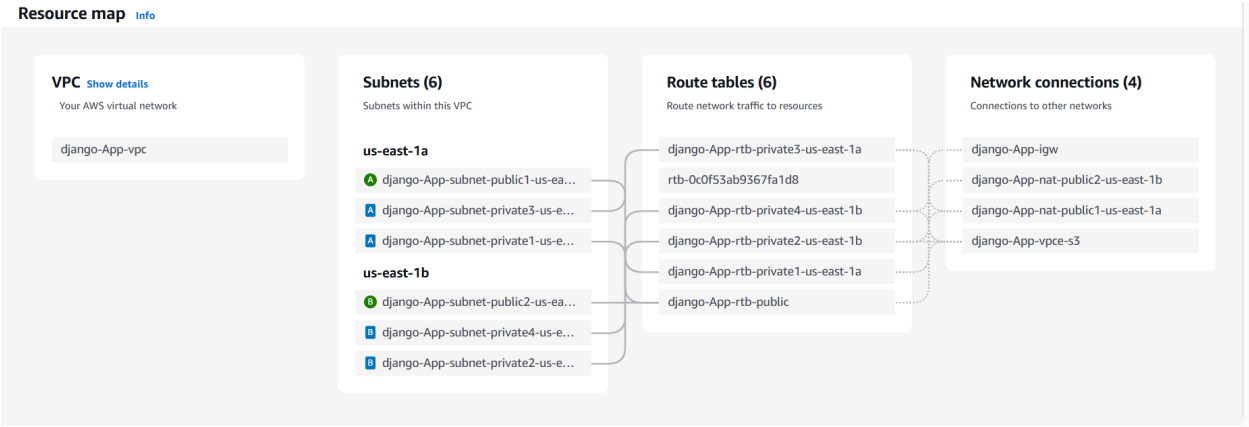
We begin by setting up a **Virtual Private Cloud (VPC)** as the foundational network infrastructure for the application deployment. The VPC is configured with a **total of six subnets**, distributed as follows:

- **2 Public Subnets**: These subnets are used to host the **Application Load Balancer (ALB)**, which acts as the public entry point to the application.
- **4 Private Subnets**: These subnets are used to deploy internal components to ensure high security. This includes:
    - **Auto Scaling Group (ASG)**: Hosts the EC2 instances running the Django application backend.
    - **Amazon RDS for MySQL**: A managed relational database service for data storage.

The EC2 instances deployed in the private subnets **do not have direct internet access**. Instead, all incoming traffic is routed through the **Application Load Balancer**, which then forwards it securely to the instances.

To allow the EC2 instances in the private subnets to access the internet (for tasks like software updates, etc.), a **NAT Gateway** is deployed in one of the public subnets. The NAT Gateway allows **outbound internet access** for instances in the private subnets while keeping them isolated from direct inbound traffic from the internet.

Additionally, a **Gateway VPC Endpoint** is configured to allow private connectivity from the EC2 instances (within the private subnets) to **Amazon S3** without traversing the public internet. This setup enhances security by ensuring log data generated by the application can be securely stored in S3.



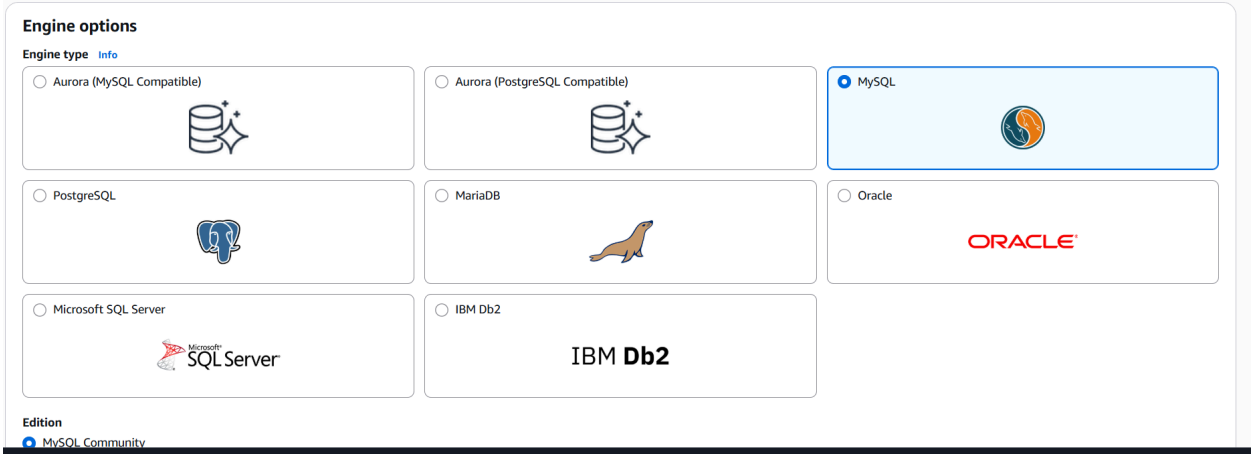
The above diagram illustrates the architectural layout of the VPC and its associated resources.

Step 2: RDS Configuration for MySQL

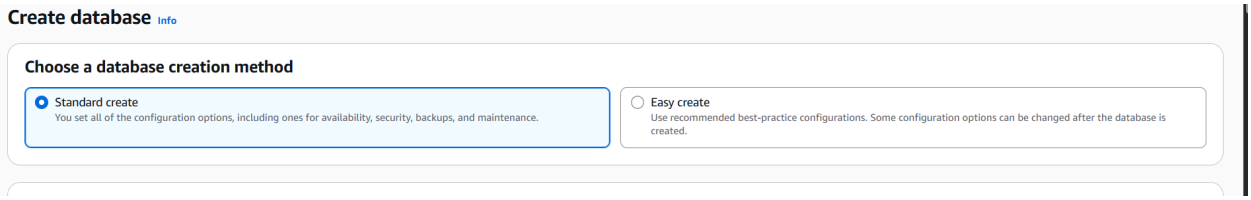
We are using **Amazon RDS** to create a managed **MySQL database** for our Django application. This setup is designed for a production-grade environment.

Steps to Create the RDS Instance:

- Go to the **AWS Management Console** → search and open **RDS** → click **"Create database"**.
- **Engine selection**:
    - Choose **MySQL** as the database engine.
    - Select the **latest version** (e.g., MySQL 8.0).

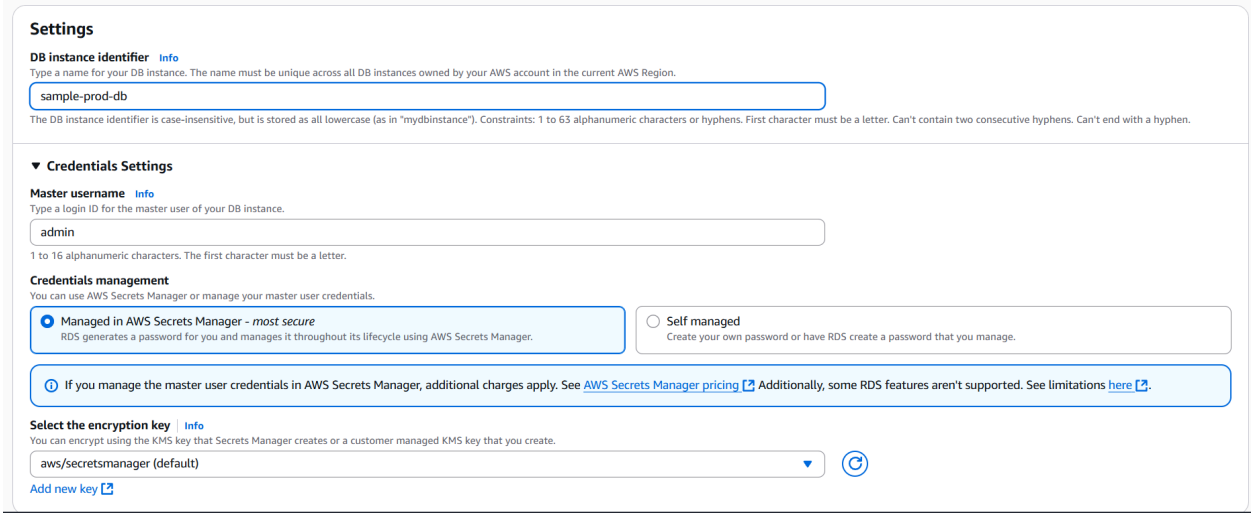


- **Database creation method**:
    - Choose **Standard Create**.



- Use the **Production template** for high availability and better performance.

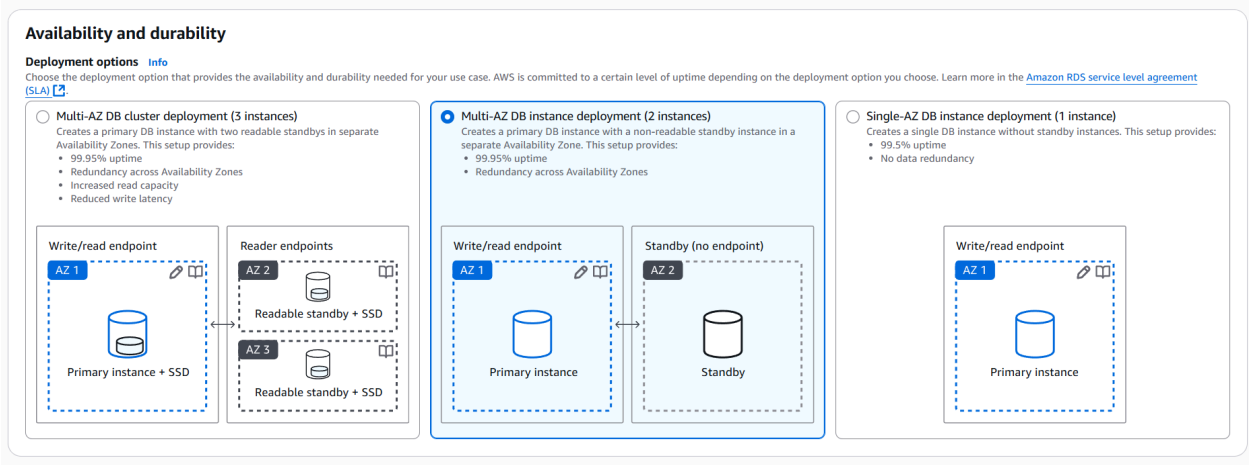
- **Settings**:
  - Set **DB instance identifier** (e.g., `sample-prod-db`).
  - Create a **Master username** and strong password. Save credentials securely.



- **Instance specifications**:
  - Select instance class (e.g., `db.t3.medium`).

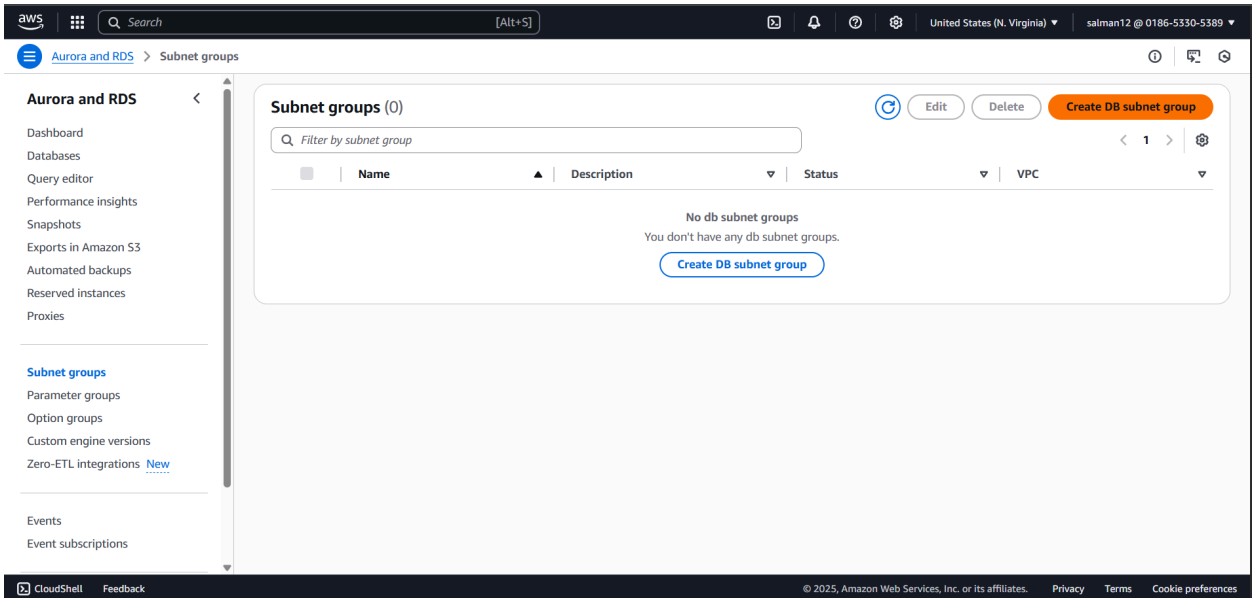
- Enable **storage autoscaling** and set **initial storage** (e.g., 20 GB).

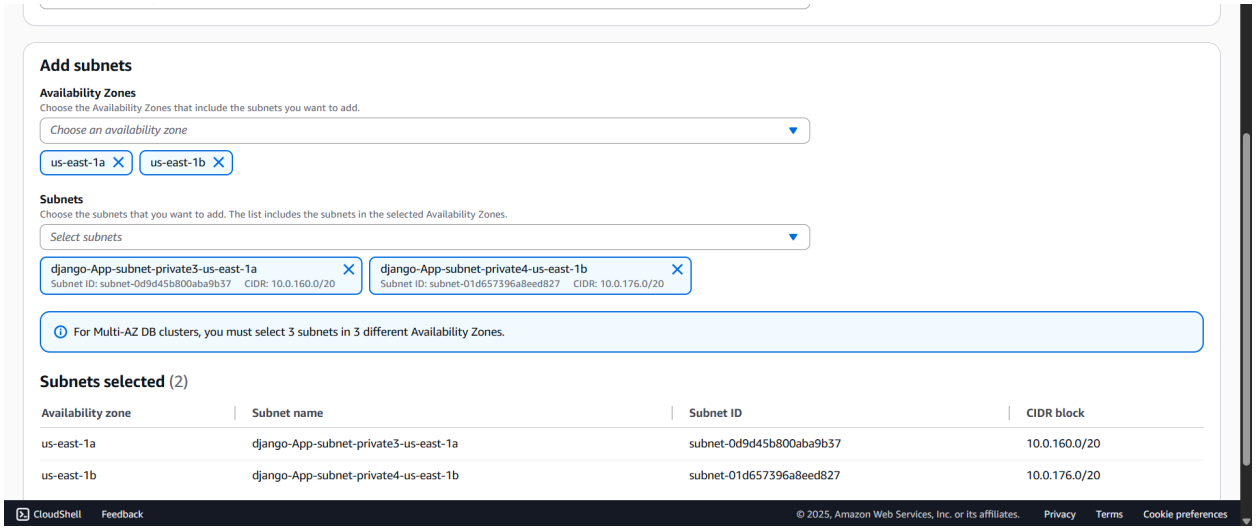
- **Availability & durability**:
  - Enable **Multi-AZ deployment** for fault tolerance.
  - Turn on **automatic backups** (e.g., 7-day retention).

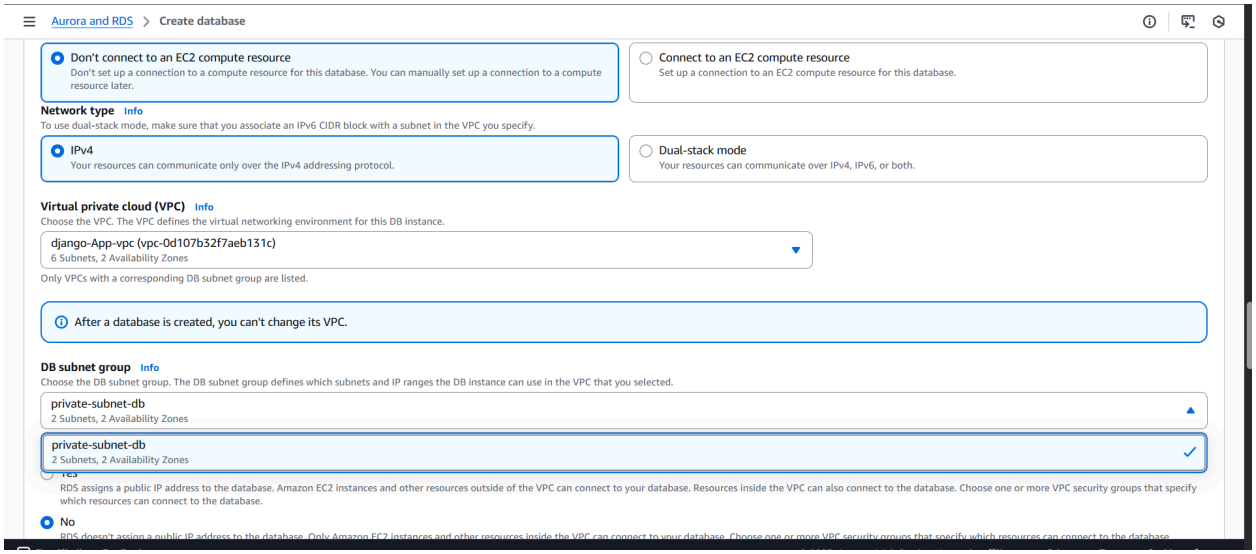


- **Connectivity**:
  - Select the same **VPC** used for your application servers.

- Use a **private subnet group** to restrict internet access.

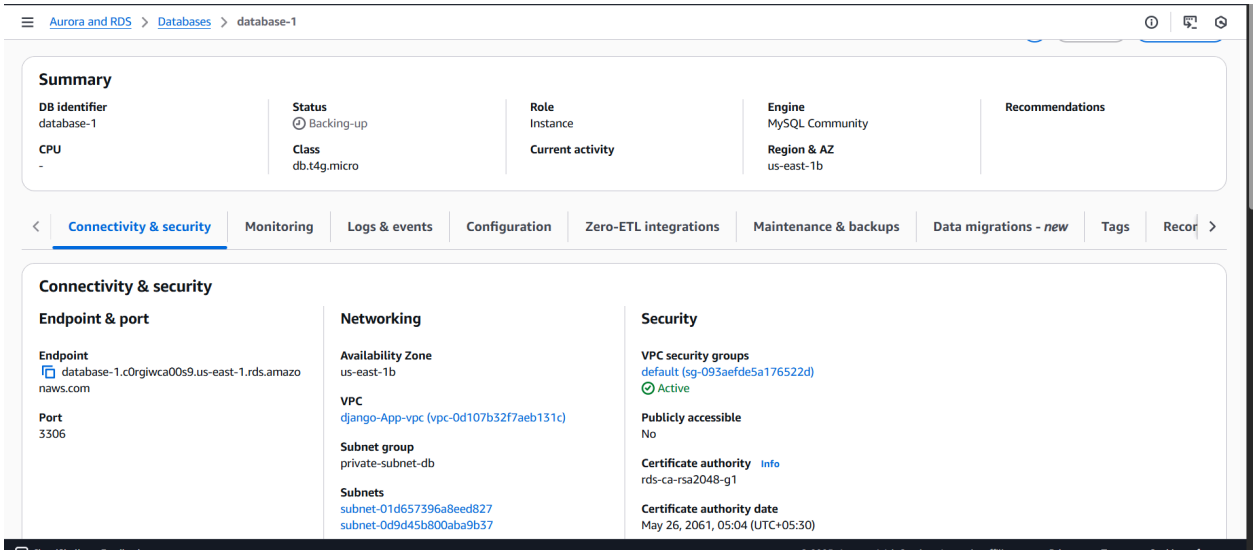






    - Configure a **security group** to allow port **3306** only from your EC2 instances.

- **Authentication**:
    - Choose **password authentication** for now.
    - IAM authentication can be added optionally.
- **Launch the database**:
    - Click **Create Database** and wait until the status becomes **Available**.
    - Copy the **endpoint URL** for use in your Django application's database settings.



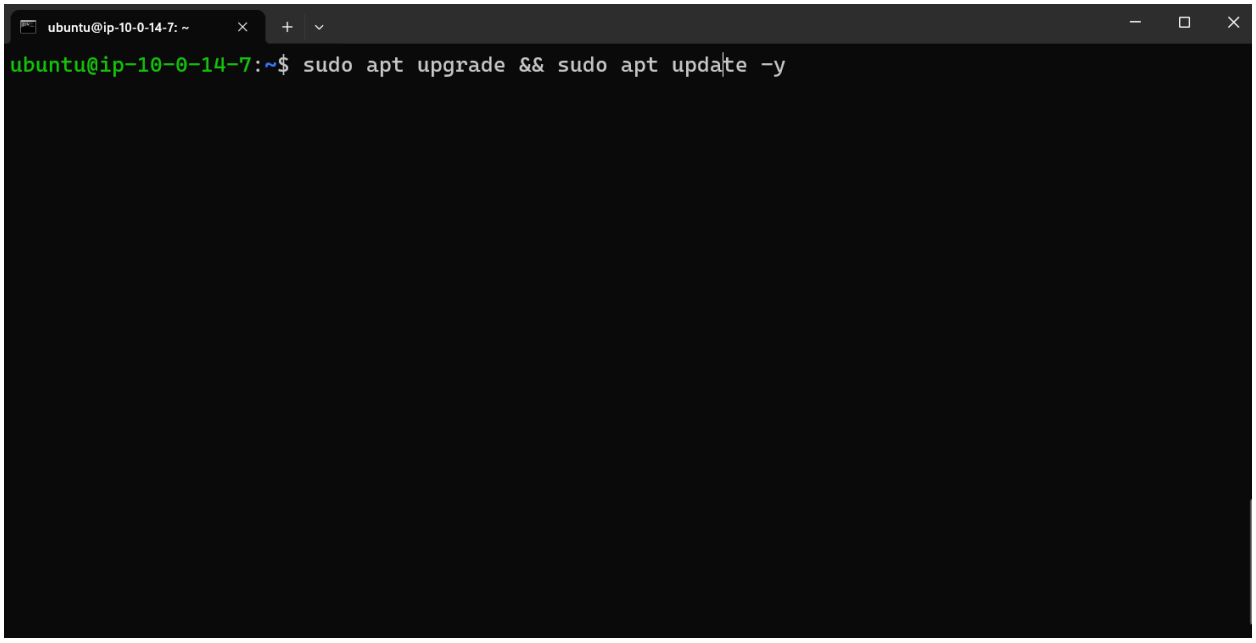
Step 3: Configuring Auto Scaling Group (ASG)

To ensure high availability and scalability of our Django application, we set up an **Auto Scaling Group (ASG)**. This setup automatically adjusts the number of EC2 instances based on demand, maintaining performance while optimizing costs.

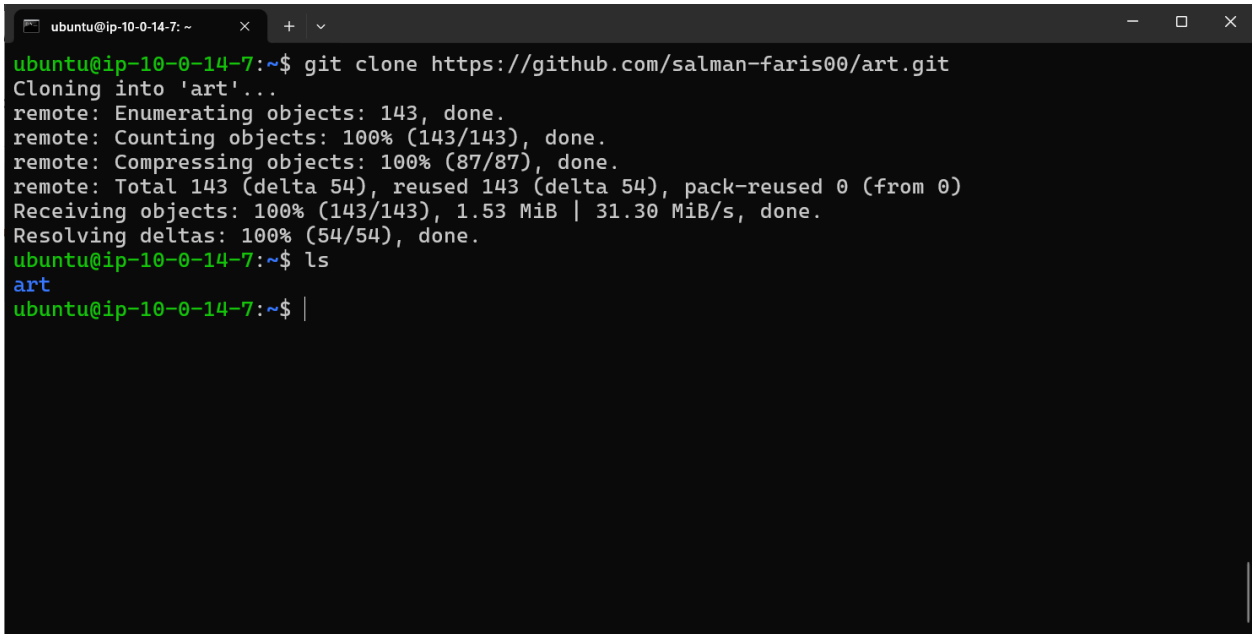
Step 3.1 Application Setup on EC2 Instance

We begin by **launching a temporary EC2 instance** with ubuntu AMI. On this instance, we perform the following tasks:

- First update the ubuntu server



- Clone the Django project from GitHub.



- After that install python and other dependencies and nginx server the command is

sudo apt install python3-pip python3-dev nginx default-libmysqlclient-dev pkg-config build-essential mysql-server -y

```
ubuntu@ip-10-0-14-7:~/art$ sudo apt install python3-pip python3-dev nginx pyhton3-venv default-libmysqlclient-dev build-
essential -y
```

This will install Python, pip, and nginx server.

- To connect the RDS MySQL database from the EC2 instance, ensure that the EC2 and RDS instances are within the same VPC and have appropriate security group settings. The security group attached to the RDS should allow inbound traffic on port `3306` from the EC2 instance's security group. Once the connectivity is ensured, connect to your EC2 instance via SSH. From the EC2 terminal, you can use the MySQL client to connect to the RDS instance using the following command:

mysql -h <rds-endpoint> -u <username> -p

```
ubuntu@ip-10-0-14-7:~/art$ sudo mysql -u admin -h database-1.c0rgiwca00s9.us-east-1.rds.amazonaws.com -p
Enter password:
Welcome to the MySQL monitor.  Commands end with ; or \g.
Your MySQL connection id is 50
Server version: 8.0.41 Source distribution

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owners.

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

mysql>
```

After successfully verifying the connection to the RDS MySQL database from the EC2 instance, we have to create a database in the RDS for our application

Using sql command:

Create database art;

(art is the database name)

```
mysql> create database art;
Query OK, 1 row affected (0.02 sec)

mysql>
```

After that exit from the database by performing ***Exit*** command.

- Now we have to create and activate python virtual environment for that run the below command
- To install virtual environment :

  sudo apt install python3-venv -y

- Then activate python venv:

```
ubuntu@ip-10-0-14-7:~/art$ python3 -m venv env
```

Now activate it

```
ubuntu@ip-10-0-14-7:~/art$ source env/bin/activate
(env) ubuntu@ip-10-0-14-7:~/art$
```

Now install all the dependencies

```
(env) ubuntu@ip-10-0-14-7:~/art$ pip install -r requirement.txt
```

After that Connecting the Django Application to the RDS Database

After applying the migrations, the next step is to connect our Django application to the MySQL database hosted in Amazon RDS.

To do this, we need to update the `DATABASES` configuration inside the `settings.py` file of our Django project.

In the `settings.py` file, locate the DATABASES section and replace the default database settings with the following:

```
DATABASES = {
    'default': {
        'ENGINE': 'django.db.backends.mysql',
        'NAME': 'art',
        'USER': 'admin',
'PASSWORD': '123456789',
'HOST': 'database-1.c0rgiwca00s9.us-east-1.rds.amazonaws.com',
'PORT': '3306',
    }
}
```

The path of this file is *~/art/art/settings.py*

There you want to give your database ie, RDS endpoint,password,username.

Then perform the command given below:

```
(env) ubuntu@ip-10-0-14-7:~/art$ python3 manage.py makemigrations
```

Since our primary focus in this project is on the infrastructure setup rather than the application development, we don't need to dive deeply into the details of this command. However, it's still necessary to run the following command to prepare the Django application's database migrations.

This command detects changes made to the models in the Django application and prepares migration files, which are required for setting up the database schema.

After generating the migration files using the `makemigrations` command, we need to apply those migrations to the database. This will create the required tables and schema in the RDS MySQL instance.

Run the following command:

```
(env) ubuntu@ip-10-0-14-7:~/art$ python3 manage.py migrate
```

This command executes the SQL statements defined in the migration files and sets up the database schema needed by the Django application.

Then also perform this command :

```
(env) ubuntu@ip-10-0-18-241:~/art$ python3 manage.py collectstatic

176 static files copied to '/home/ubuntu/art/staticfiles'.
```

Now Install the **gunicorn**

Gunicorn (Green Unicorn) is a **Python WSGI HTTP server** used to serve Python web applications like Django in a production environment. It acts as a bridge between your Django application and web servers like NGINX.

Gunicorn is:

- **Lightweight** and **easy to configure**.
- Supports **multiple workers**, allowing better handling of concurrent requests.
- Designed to work behind a **reverse proxy server** like NGINX for improved performance and security.

Gunicorn does **not serve static files**, which is why we use NGINX alongside it in production setups.

- **Installation Steps**

SSH into your EC2 instance and activate your Python virtual environment (if used). Then run:

```
(env) ubuntu@ip-10-0-14-7:~/art$ pip install gunicorn django
```

Now we installed gunicorn and django.

To confirm it was installed correctly:

```
(env) ubuntu@ip-10-0-14-7:~/art$ gunicorn --version
gunicorn (version 23.0.0)
(env) ubuntu@ip-10-0-14-7:~/art$
```

- **Test Gunicorn with Django**

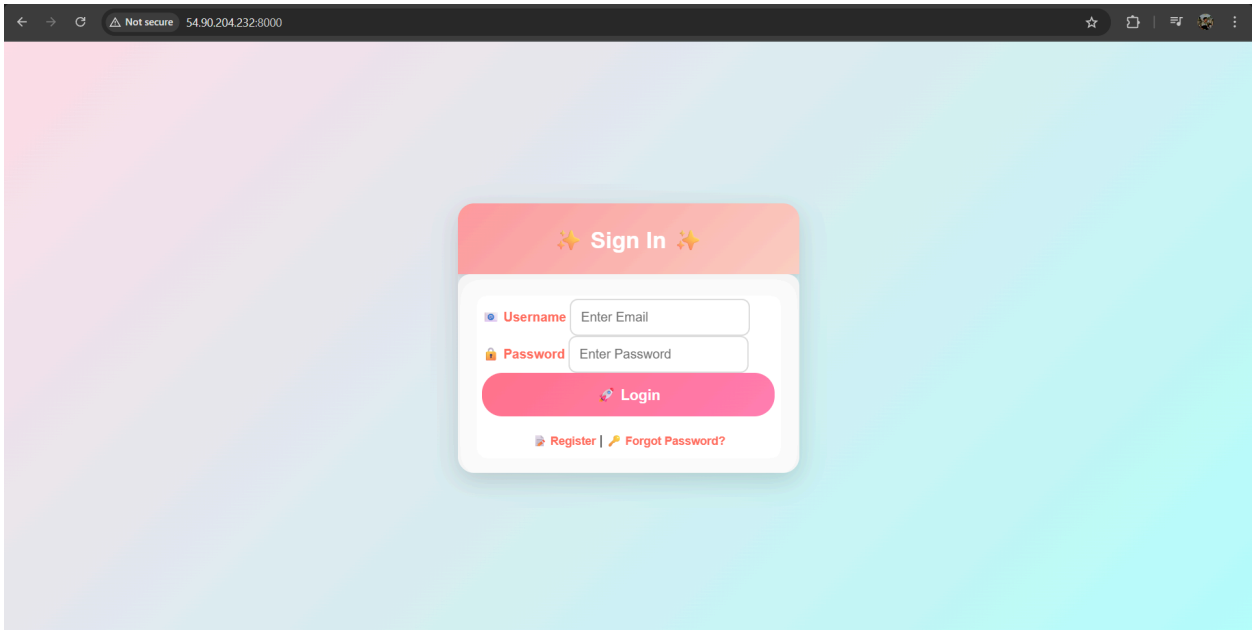
Navigate to your Django project directory (where `manage.py` is located), and run:

Gunicorn –bind 0.0.0.0:8000 art.wsgi:application

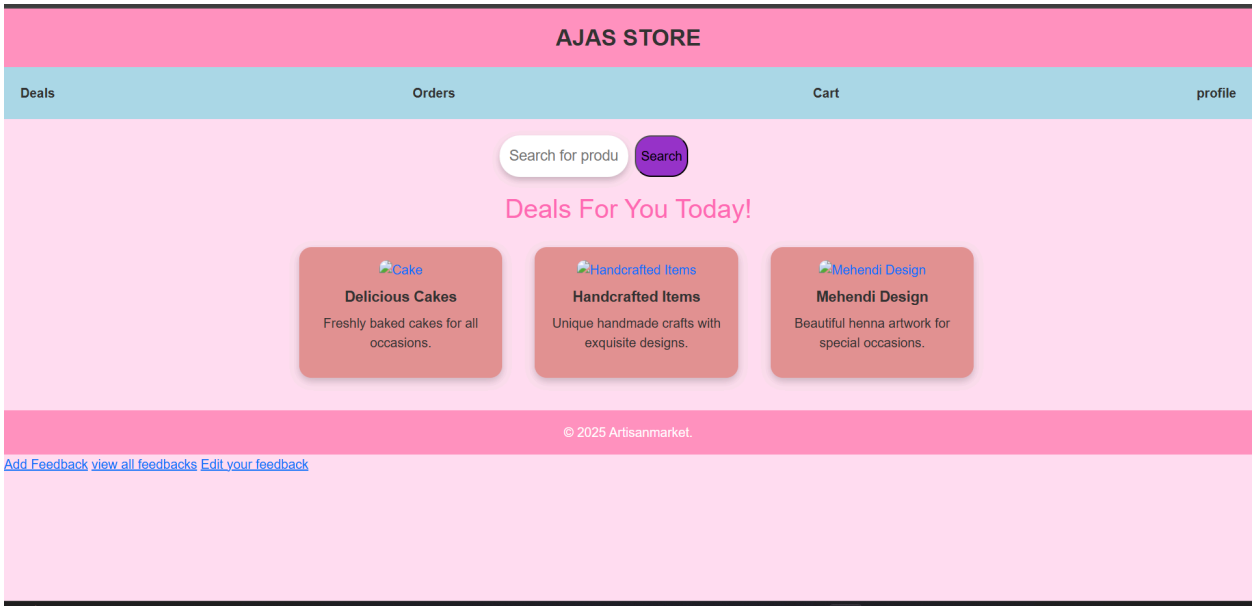
```
(env) ubuntu@ip-10-0-14-7:~/art$ gunicorn --bind 0.0.0.0:8000 art.wsgi:application
[2025-07-26 15:17:20 +0000] [3012] [INFO] Starting gunicorn 23.0.0
[2025-07-26 15:17:20 +0000] [3012] [INFO] Listening at: http://0.0.0.0:8000 (3012)
[2025-07-26 15:17:20 +0000] [3012] [INFO] Using worker: sync
[2025-07-26 15:17:20 +0000] [3013] [INFO] Booting worker with pid: 3013
```

Now access the website with your public ip along with the 8000 port number ,also update the security group of your instance open 8000 port.

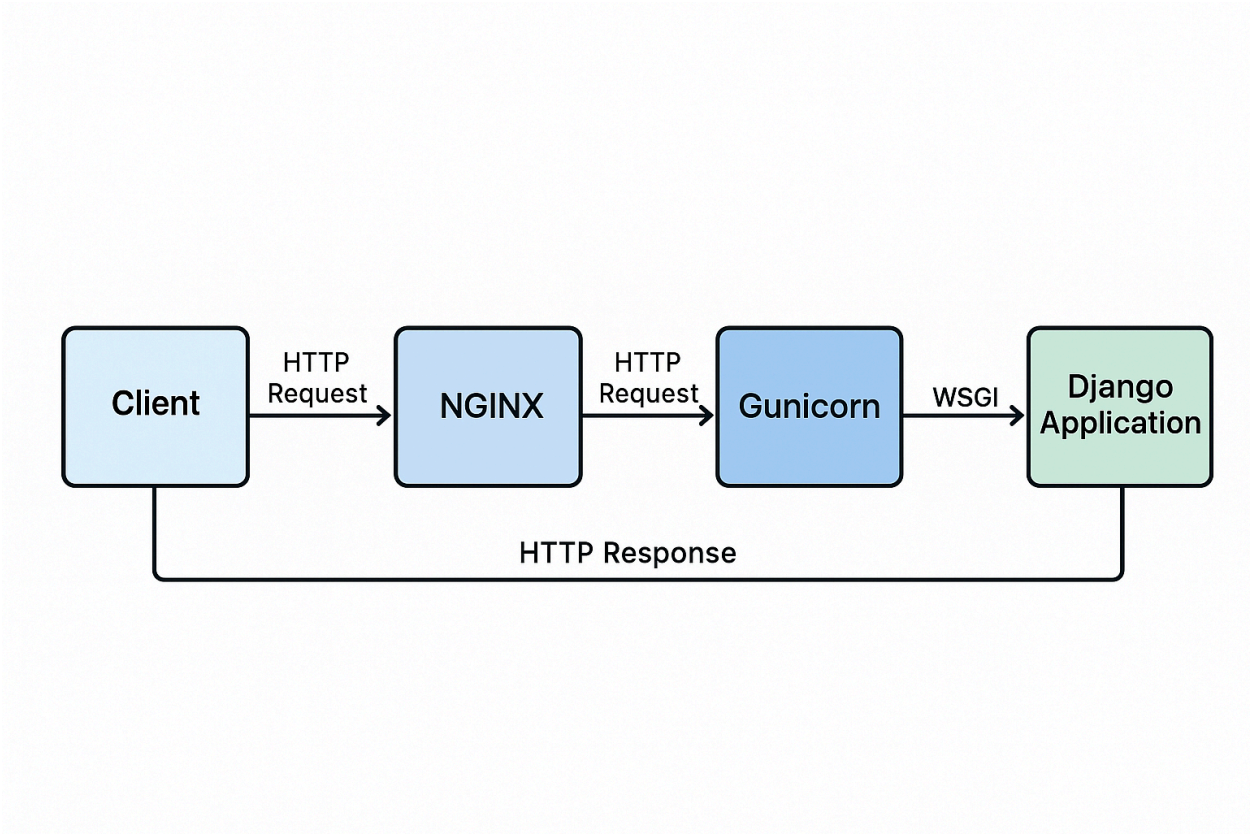
You will be getting output like this:



Now if you access the website you cant see the static files like images, this is because the gunicorn server is cant serve the static files .



For that we will be using nginx also we will configure nginx as a proxy server



Nginx is a powerful **reverse proxy** that handles HTTP requests and forwards them to Gunicorn. It also serves static files (CSS, JS, images) directly to clients, which offloads that responsibility from your Django app.

To connect nginx and gunicorn here we are using unix socket file:

A **Unix domain socket** is a special file used for **inter-process communication (IPC)** on the same server. Instead of using a network port (like `127.0.0.1:8000`), Gunicorn and Nginx communicate via a file path, like `/home/ubuntu/project/art.sock`.

Benefits of Using Unix Socket with Gunicorn and Nginx

1. Faster than TCP/IP

- **No network overhead**: Communication happens within the operating system kernel, without going through the network stack.
- Result: **Lower latency** and **faster response times** for local app-server communication.

2. More Secure

- Unlike a TCP port that can potentially be exposed to the network, a socket file **only exists on the local filesystem**.
- Only users with access to the file can use it, making it harder to attack.

3. Simpler for Local Communication

- Since both Nginx and Gunicorn run on the same machine, Unix sockets are **a perfect fit** for local-only communication.
- It avoids unnecessary complexity related to networking (IP/Port management).

4. Less Resource Consumption

- Uses **fewer system resources** than opening a TCP port.
- Helps in high-performance environments with minimal system load.

5. Easy Integration with Systemd

- Systemd service files can manage socket files cleanly.
- You can include permissions, ownership, and automatic recreation during restarts.

When Not to Use Socket Files

- If your Gunicorn server and Nginx server run on **separate machines**.

- If you need **load balancing** across multiple Gunicorn servers (use TCP/IP for that).

To **create and use a Gunicorn socket file** for your Django project, follow these detailed steps. This setup is crucial for integrating Gunicorn with Nginx as a **reverse proxy** using a **Unix socket**.

Create a systemd service file to manage Gunicorn with a socket.

sudo nano /etc/systemd/system/gunicorn.service

Paste the following configuration

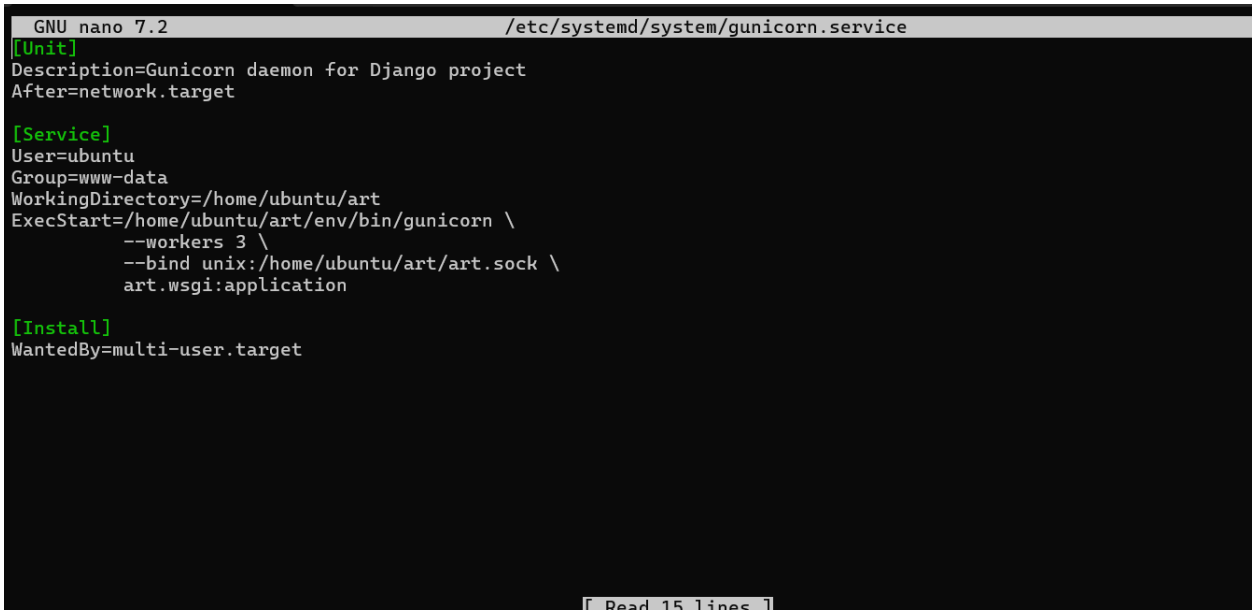
```
[Unit]

Description=Gunicorn daemon for Django project

After=network.target


[Service]

User=ubuntu

Group=www-data

WorkingDirectory=/home/ubuntu/yourproject

ExecStart=/home/ubuntu/yourproject/env/bin/gunicorn \

        --workers 3 \
```

*--bind unix:/home/ubuntu/yourproject/yourproject.sock *

yourproject.wsgi:application

[Install]

WantedBy=multi-user.target



- `WorkingDirectory`: Directory where your `manage.py` is located.
- `ExecStart`: Starts Gunicorn with 3 workers, binding it to a **Unix socket file** instead of a port.
- `--bind unix:/path/to/project.sock`: This creates a socket file that Nginx will use to communicate with Gunicorn.

Reload and Start the Gunicorn Service

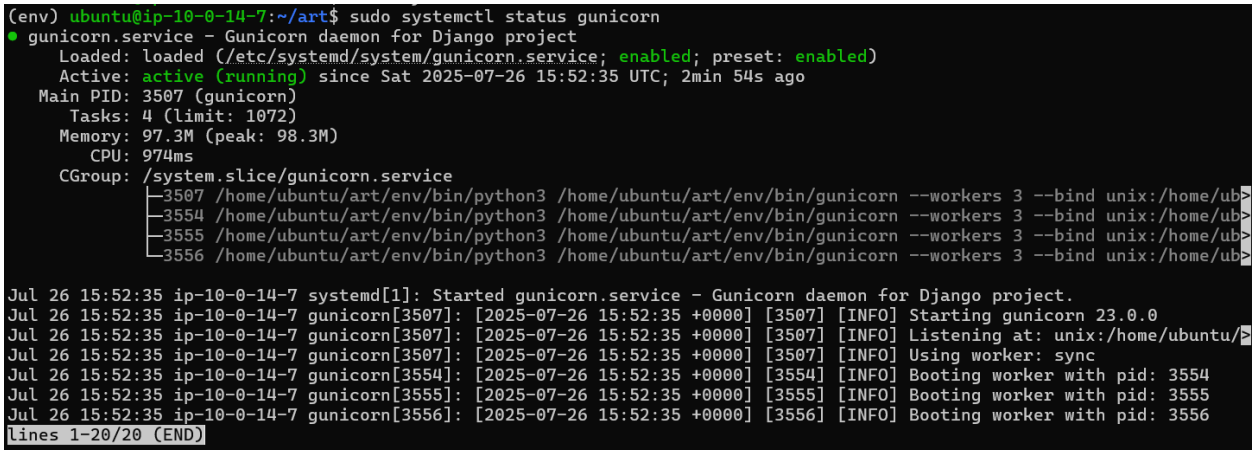
sudo systemctl daemon-reload

sudo systemctl start gunicorn

sudo systemctl enable gunicorn

To verify that the socket file is created and Gunicorn is running:

sudo systemctl status gunicorn



Configure NGINX to Use the Socket File

Edit your NGINX config

sudo nano /etc/nginx/sites-available/art

Example configuration:

```
  GNU nano 7.2                                  /etc/nginx/sites-available/art
server {
    listen 80;
    server_name 54.90.204.232;

    location = /favicon.ico { access_log off; log_not_found off; }
    location /static/ {
        alias /home/ubuntu/art/staticfiles/;
    }

    location / {
        include proxy_params;
        proxy_pass http://unix:/home/ubuntu/art/art.sock;
    }
}
```

Then enable the site and reload Nginx:

sudo ln -s /etc/nginx/sites-available/art /etc/nginx/sites-enabled

sudo nginx -t

sudo systemctl restart nginx

Now if you access your public ip you will be getting your website ,if your are getting error like 502 bad gateway

Give Permissions (If You Face 502 or Forbidden Errors)

Make sure the `ubuntu` user and `www-data` group have access to the socket file:

sudo chown ubuntu:www-data /home/ubuntu/art/art.sock

sudo chmod 770 /home/ubuntu/art/art.sock

Also ensure the parent directory is executable:

sudo chmod o+x /home

sudo chmod o+x /home/ubuntu

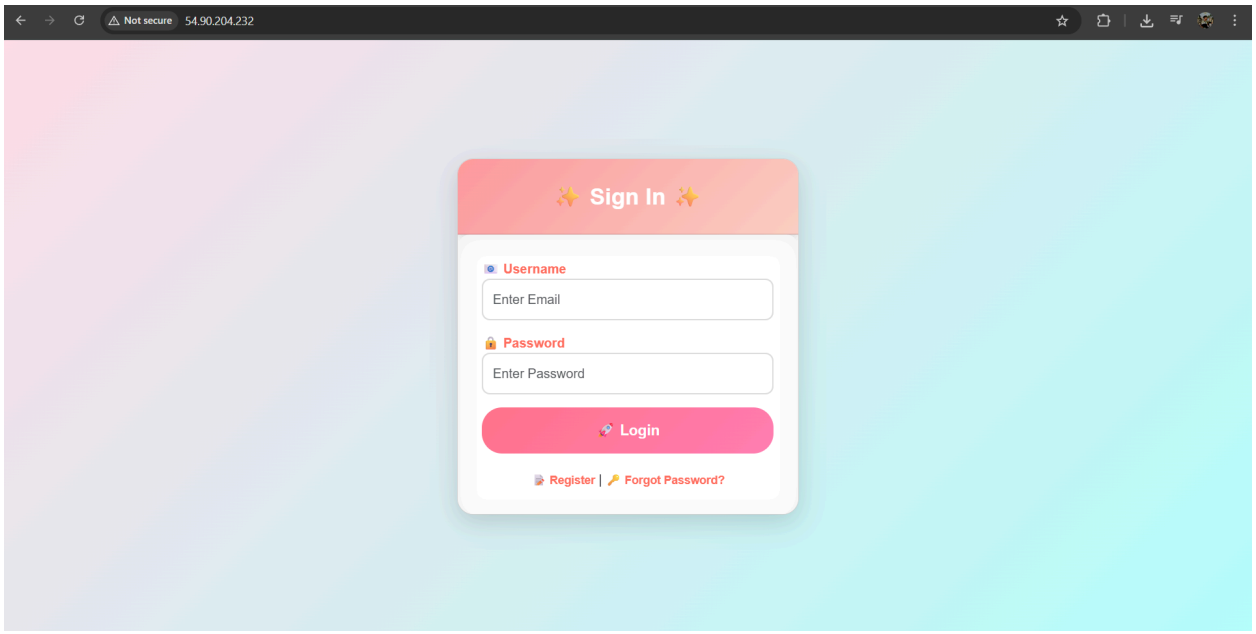
sudo chmod o+x /home/ubuntu/art

Then restart the servers:

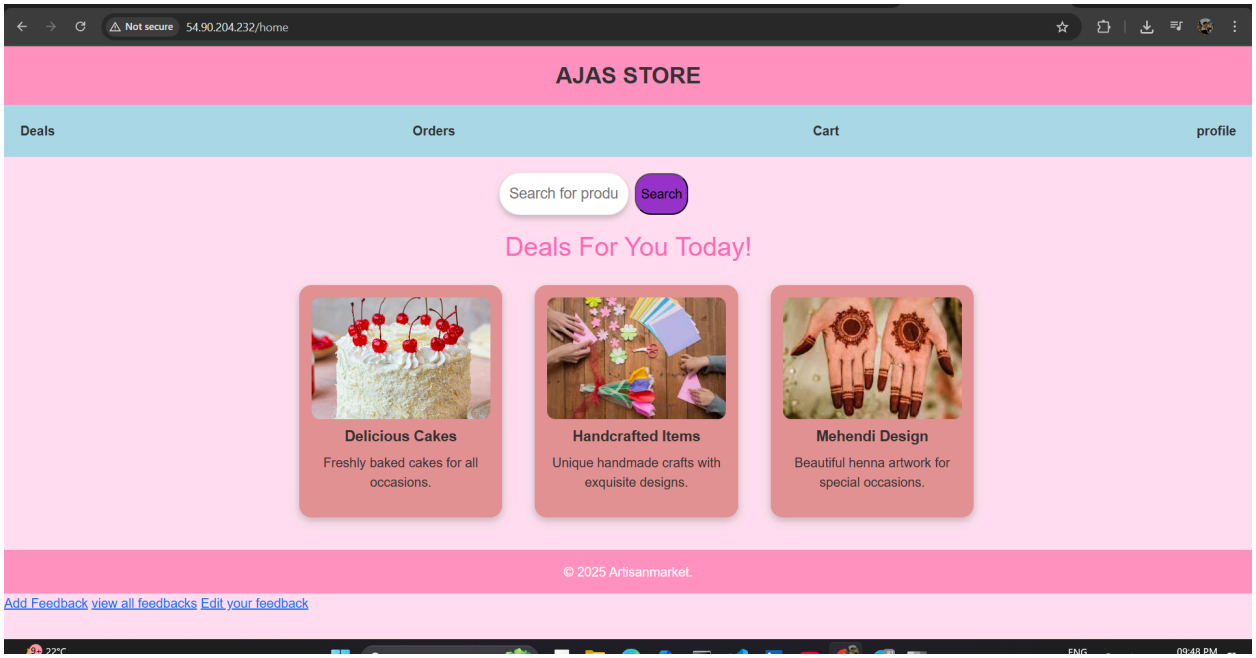
sudo systemctl restart gunicorn

sudo systemctl restart nginx

Then access the website again:



Now the nginx is also serving the staticfiles like images



Now Access the Django application using a **custom domain name** instead of the EC2 **public IP address**, by bringing DNS management from **GoDaddy** to **AWS Route 53**.

For that make some changes in nginx configuration file (/etc/nginx/sites-available/art):

```
server {
    listen 80;
    server_name 54.90.204.232;

    location = /favicon.ico { access_log off; log_not_fo
    location /static/ {
        alias /home/ubuntu/art/staticfiles/;
    }
```

Edit server_name with your custom domain:

```
server {
    listen 80;
    server_name mysample.xyz,www.mysample.xyz;

    location = /favicon.ico { access_log off; log_not_found off; }
    location /static/ {
        alias /home/ubuntu/art/staticfiles/;
    }
```

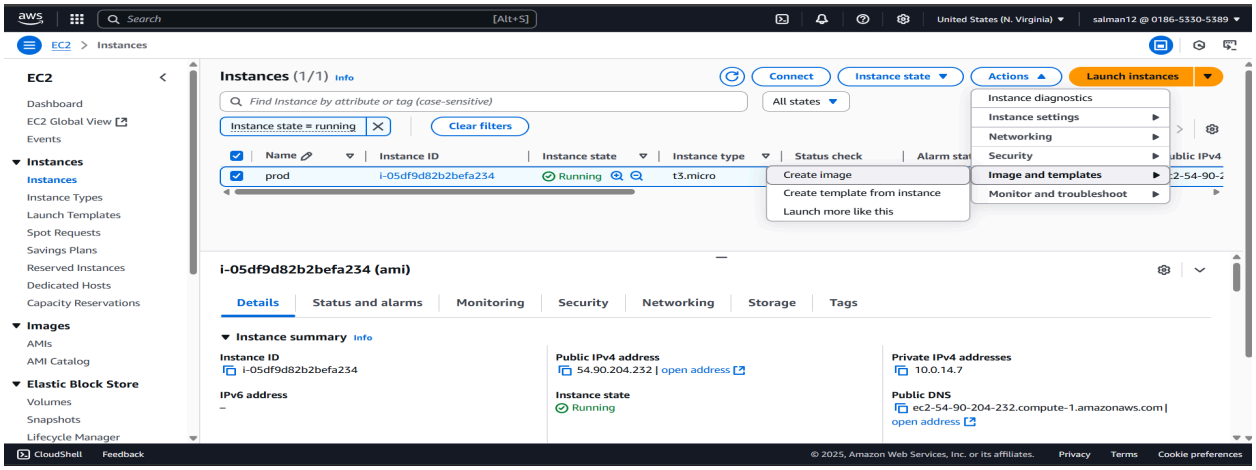
After updating the Django settings, restart and enable both **Gunicorn** and **Nginx** to apply the changes and ensure the services start automatically on boot.

To ensure high scalability and availability, we will use AWS Auto Scaling. For that, we must first **create a Launch Template**. This template will be based on the **Amazon Machine Image (AMI)** of the current EC2 instance where our Django application is configured and running successfully.

Steps:

1. Create an AMI from the current EC2 instance.

2. Use this AMI while creating the Launch Template.

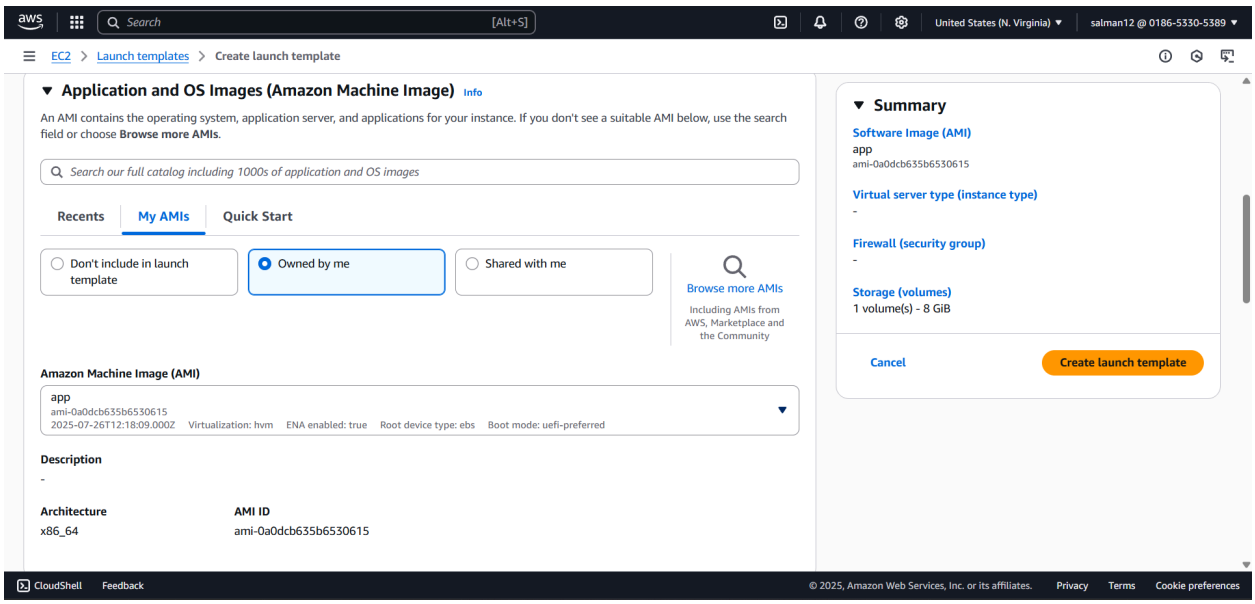


Step 3.2: Create Launch Template with IAM Role Access to S3

After creating an AMI (Amazon Machine Image) from the EC2 instance where our Django application is configured and tested, the next step is to create a **Launch Template**. This template will be used by the **Auto Scaling Group** to launch new instances automatically when needed.

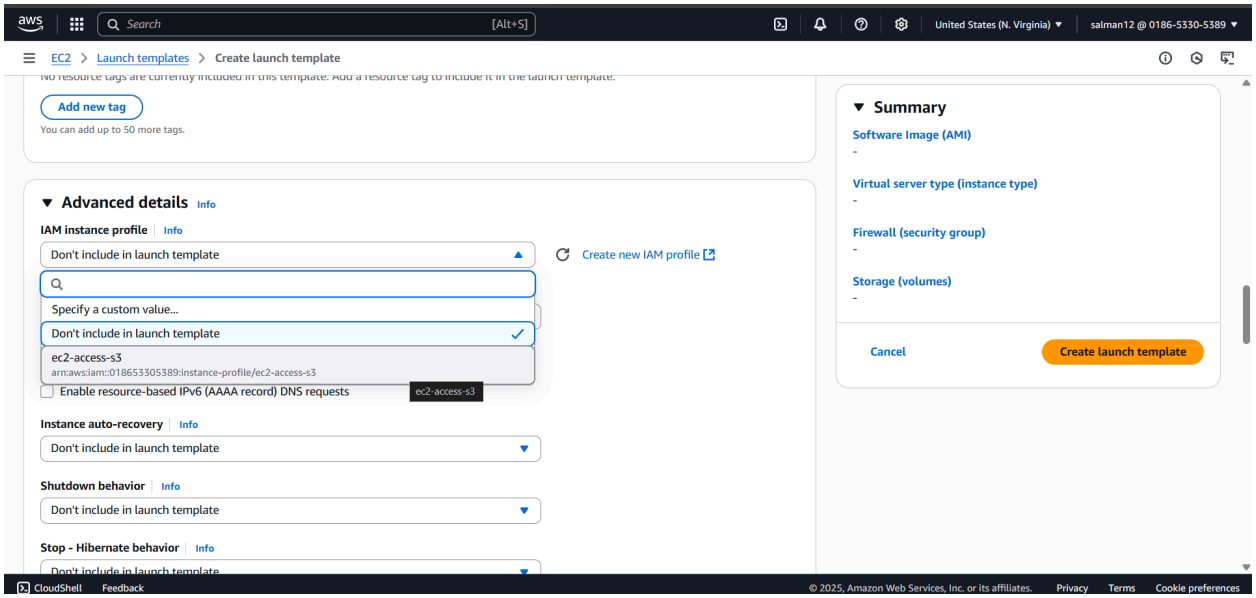
While creating the launch template, we perform the following:

- **Select the AMI**: Use the previously created AMI that contains the pre-configured Django application, Gunicorn server, and required dependencies.



- **Assign an IAM Role**: Attach an IAM role to the launch template that grants the EC2 instances permission to **write application logs to Amazon S3**. This is done securely

via a **VPC Gateway Endpoint**, ensuring the traffic does not traverse the public internet.



- **Configure Security Groups**: Apply the appropriate security group to allow communication with the Application Load Balancer and other required services.

This launch template ensures that every instance created by the Auto Scaling Group will be identical, secure, and production-ready with S3 access configured from the start.

Step 3.3: Create Auto Scaling Group and Attach Application Load Balancer

After setting up the **Launch Template** with the necessary AMI and IAM role, the next step is to create the **Auto Scaling Group (ASG)**. Auto Scaling ensures that your application is highly available and fault-tolerant by automatically launching or terminating EC2 instances based on traffic demand.

Steps to Create the Auto Scaling Group:

1. **Choose the Launch Template**
    - Start by selecting the previously created launch template.
    - This template already includes the AMI with the Django app and logging configurations, and the IAM role to access S3.
2. **Configure the VPC and Subnets**
    - Select the VPC created for this project.
    - Choose **private subnets** for instance deployment to enhance security, as application servers should not be directly accessible from the internet.

3. Attach an Application Load Balancer (ALB)

- Select an existing **Application Load Balancer** (or create one if not already done).
- The ALB will be placed in the **public subnets** to accept incoming traffic.
- Register the Auto Scaling Group with the **target group** associated with the ALB, ensuring that requests are forwarded to healthy EC2 instances in the private subnets.

Security and Availability Considerations:

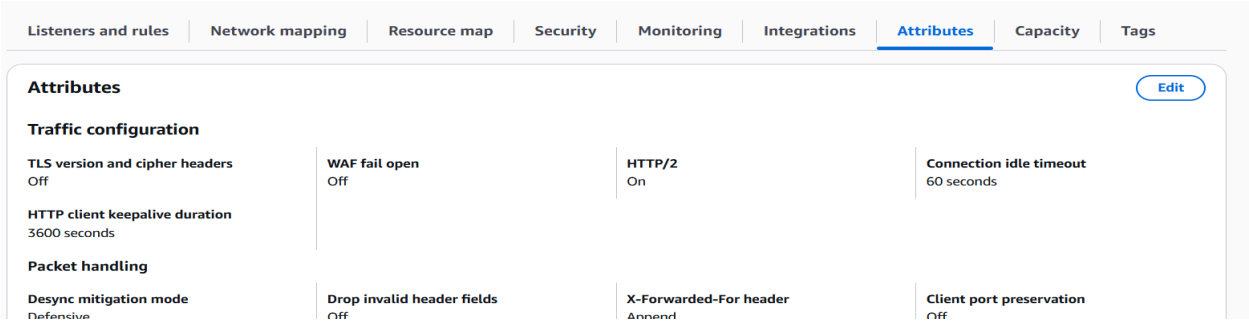
- Traffic enters via the ALB in public subnets and is routed to the EC2 instances in private subnets.
- Only the ALB can access these instances, ensuring strong **network isolation and security**.
- The IAM role attached to the launch template ensures that instances can log application data to **S3 through VPC endpoints**.

This setup ensures your Django application is **scalable**, **highly available**, and **secure**, ready to handle production workloads efficiently.

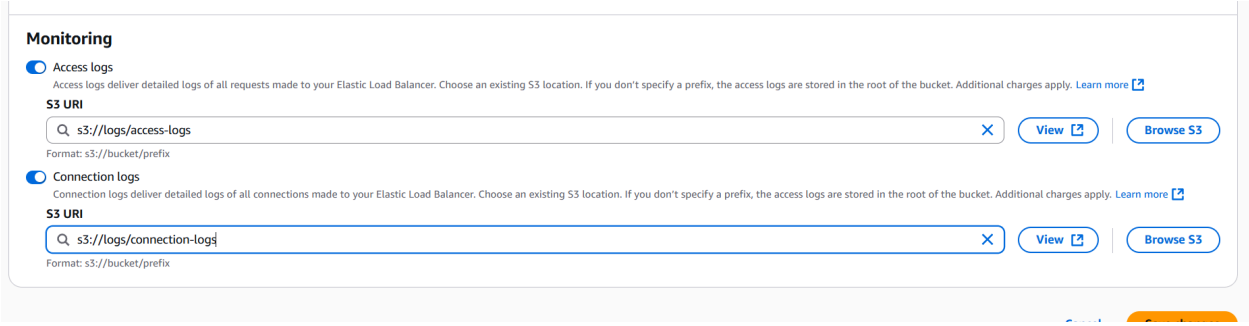
Step4: Using S3 Gateway VPC Endpoint for Secure Log Delivery

To ensure that ALB access logs are delivered to S3 **without traversing the public internet**, we use an **S3 Gateway VPC Endpoint**.

- Create a s3 bucket for collect access logs
- Goto loadbalancer → attributes→



- There turn on the access logs and select the s3 bucket



You can also give the prefix for storing access logs and connection logs

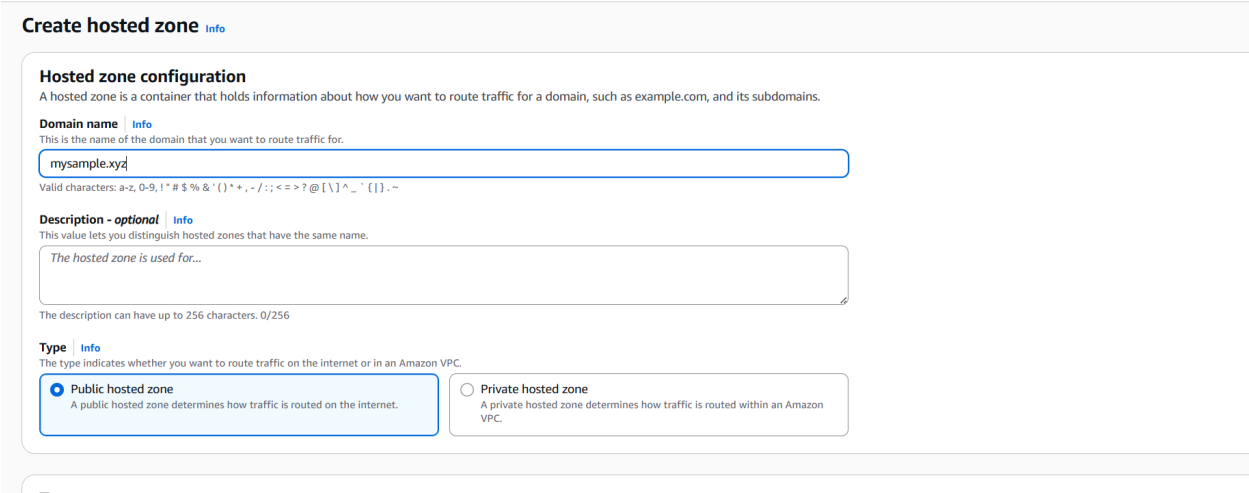
Step5 : Migrating Domain DNS from GoDaddy to Route 53

Access the Django application using a **custom domain name** instead of the EC2 **public IP address**, by bringing DNS management from **GoDaddy** to **AWS Route 53**.

Create a Hosted Zone in Route 53

1. Go to the Route 53 console.
2. Click **"Hosted Zones"** → **"Create hosted zone"**

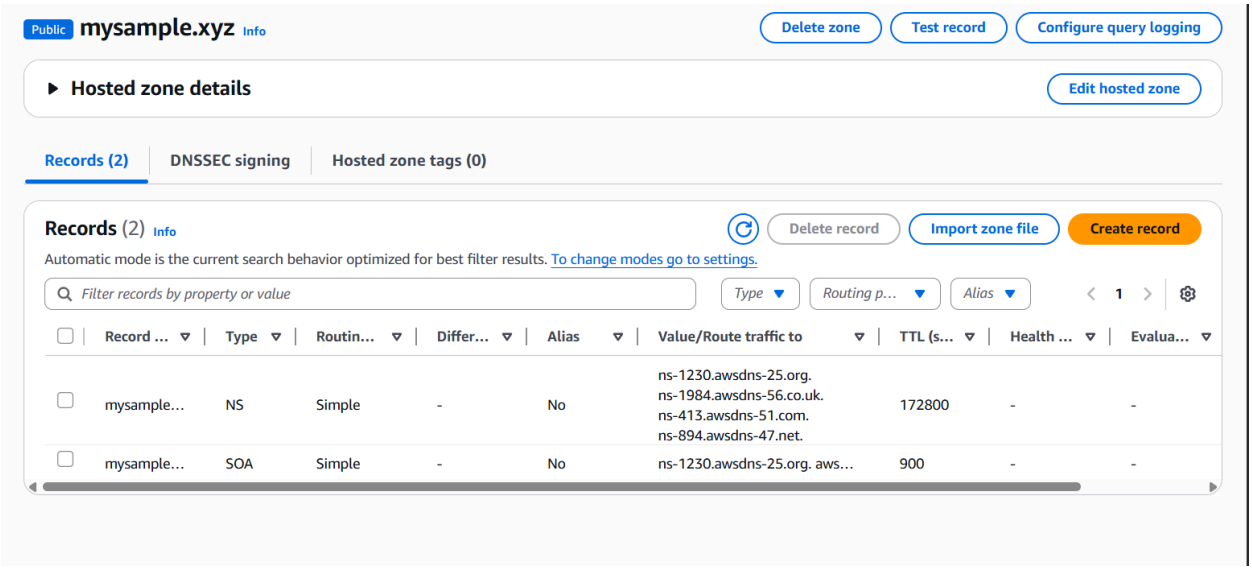
3. Enter:
    - **Domain Name**: `mysample.xyz` (your domain)
    - **Type**: Public hosted zone



4. Click **Create**

Copy the AWS Name Servers

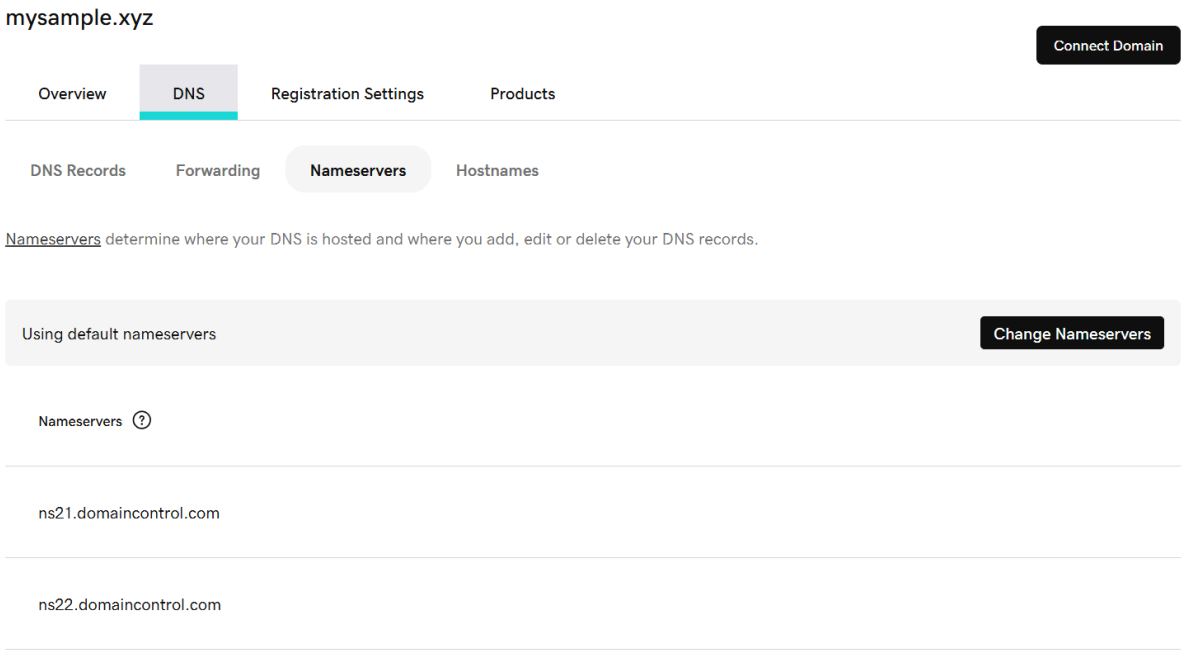
Once the hosted zone is created, you'll see 4 NS (Name Server) records like:



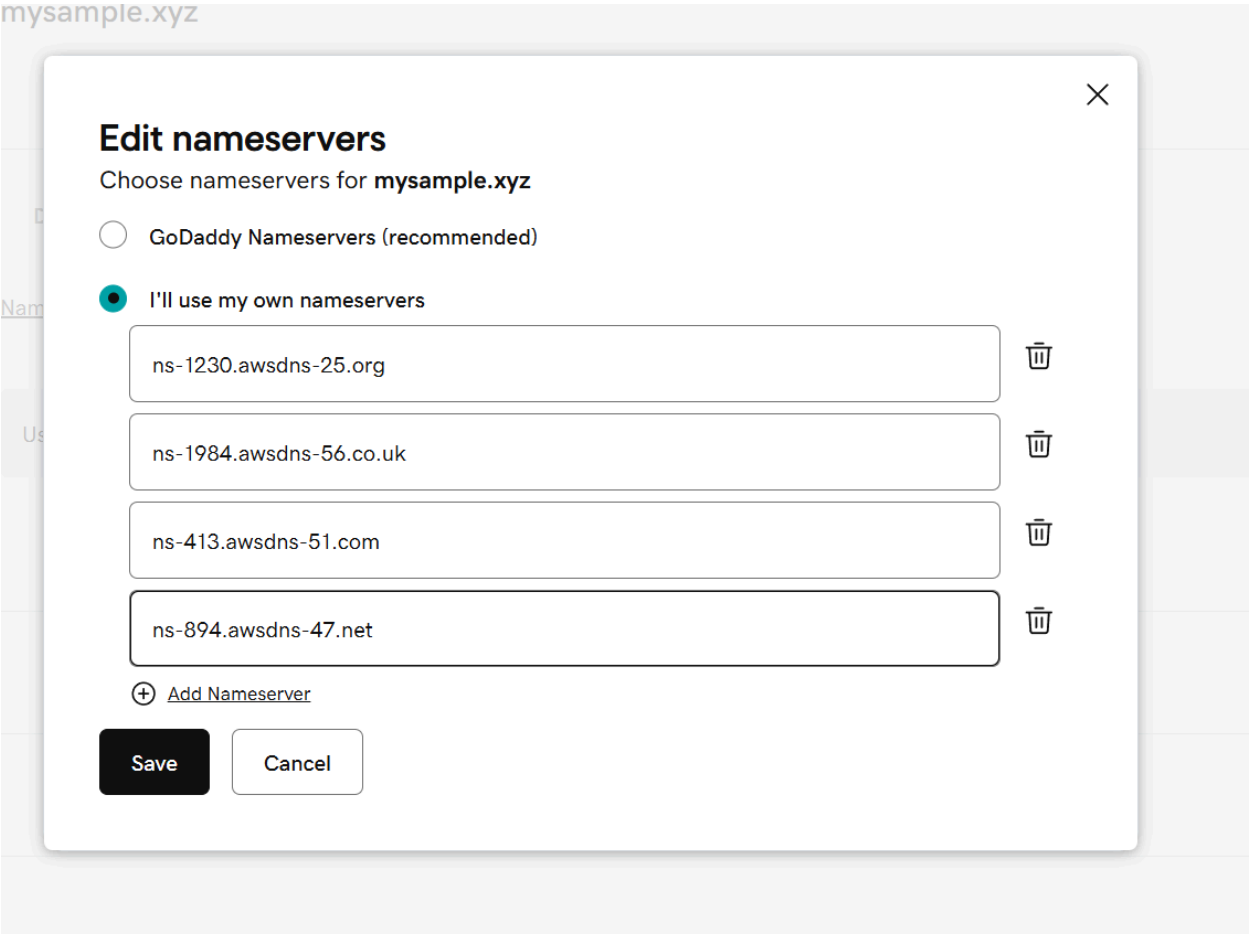
These are the **AWS Route 53 name servers** you will configure in GoDaddy.

Update Name Servers in GoDaddy

1. Log in to your GoDaddy Domain Manager.
2. Click on your domain (`mysample.xyz`)
3. Go to **DNS > Nameservers**



4. Click **Change**
5. Choose **Enter my own nameservers (advanced)**
6. Paste the **4 name servers** copied from Route 53



7. Click **Save**

Now your domain DNS is managed by AWS Route 53.

Step6 : Issuing an ACM Certificate for HTTPS (SSL)

To secure your website with **HTTPS**, you need an **SSL certificate**. AWS provides free certificates through **ACM (AWS Certificate Manager)**. These certificates are required to enable HTTPS for your domain on **CloudFront**

Step 1: Open ACM Console

1. Go to AWS Certificate Manager (ACM).

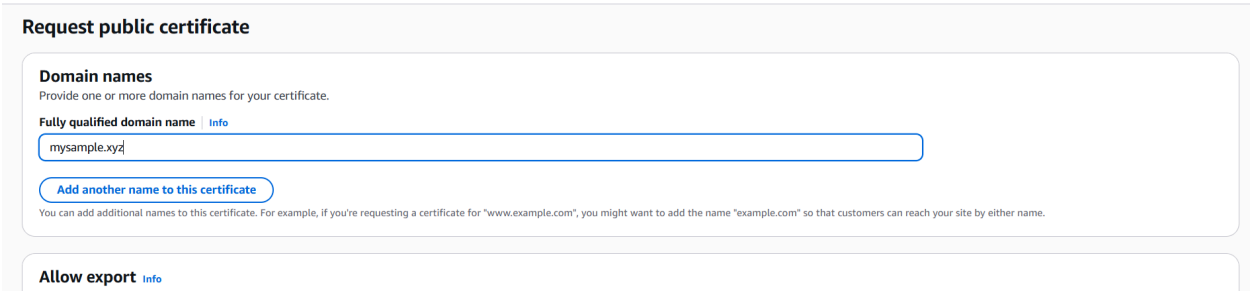
2. Make sure your region is N. Virginia (us-east-1) – required for CloudFront.

Step 2: Request a Certificate

1. Click “Request a certificate”
2. Choose Public Certificate
3. Click Next

Step 3: Add Domain Names

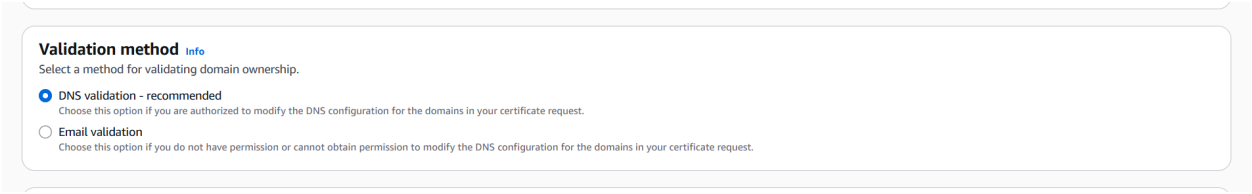
- Enter your domain name:
  `mysample.xyz`



4. Click Next

Step 4: Select Validation Method

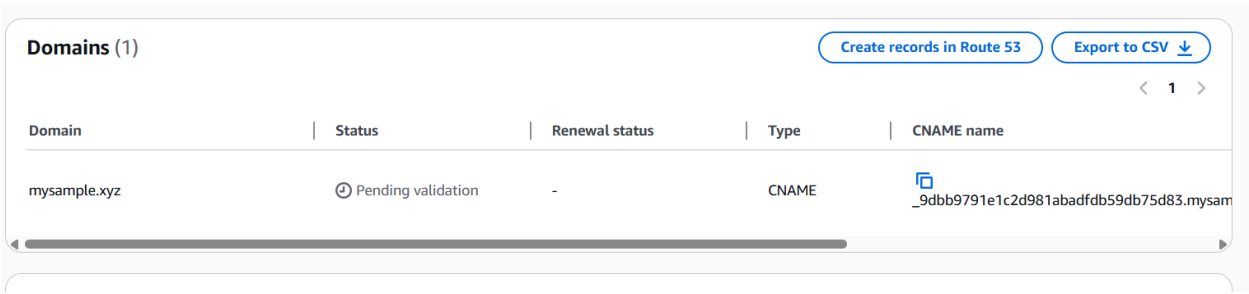
- Choose DNS validation (easier if you're using Route 53)



5. Click Next and then Request

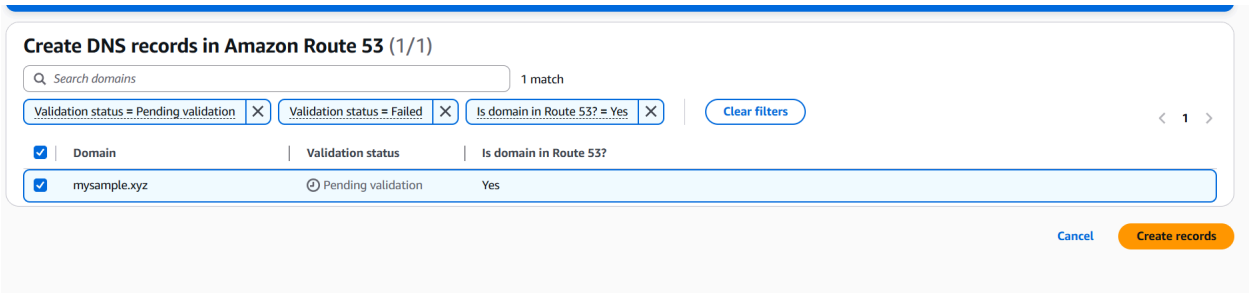
Step 5: Add DNS Validation Record

- After submitting, you'll see a CNAME record that must be added to your DNS settings.



- If your domain is managed by Route 53:

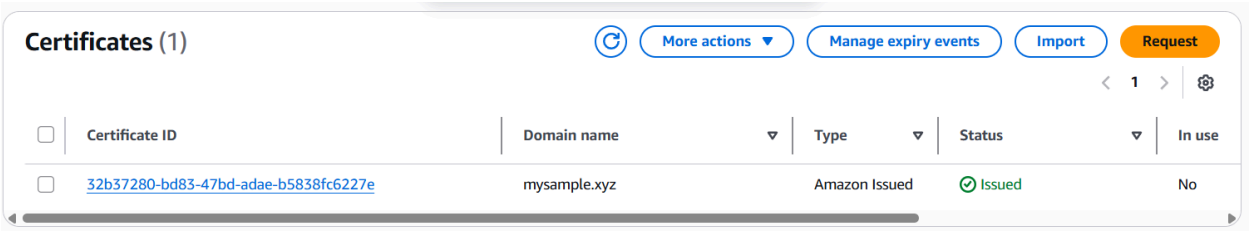
    1. Click "Create record in Route 53" → ACM will add the validation record automatically.



Step 6: Wait for Validation

- ACM will issue the certificate once the DNS record is verified (usually within a few minutes).

- The Status will change from "Pending validation" to "Issued"



- **HTTPS Listener (Add Port 443) to ALB Using ACM Certificate**

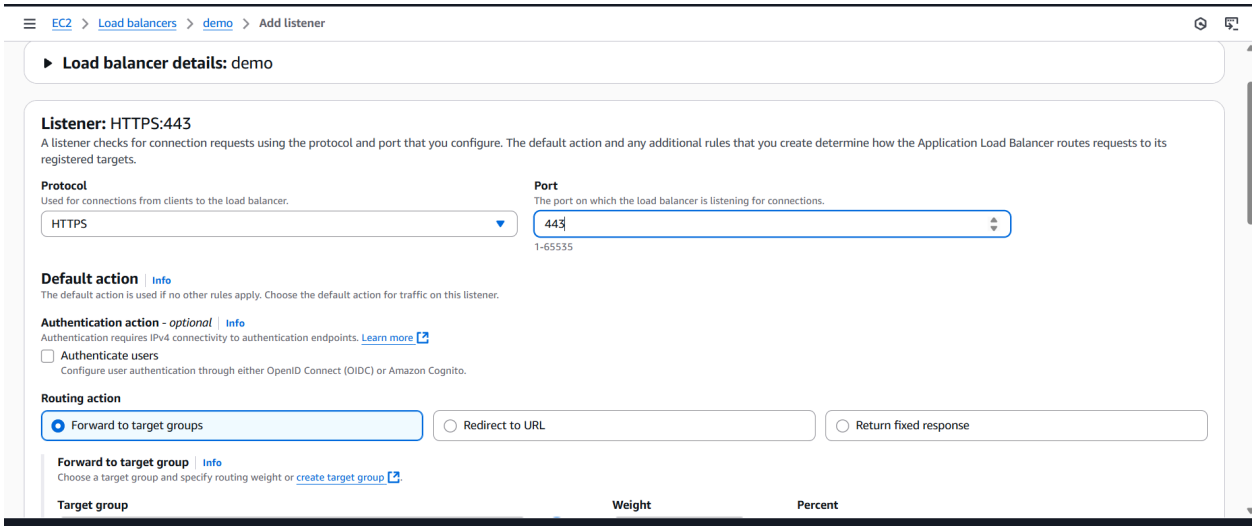
  To allow secure **HTTPS** traffic on port **443** through your **Application Load Balancer (ALB)** using an **SSL certificate** from **AWS Certificate Manager (ACM)**.

  Go to EC2 Console → Load Balancers
  Navigate to **EC2 → Load Balancers**, and select your ALB.

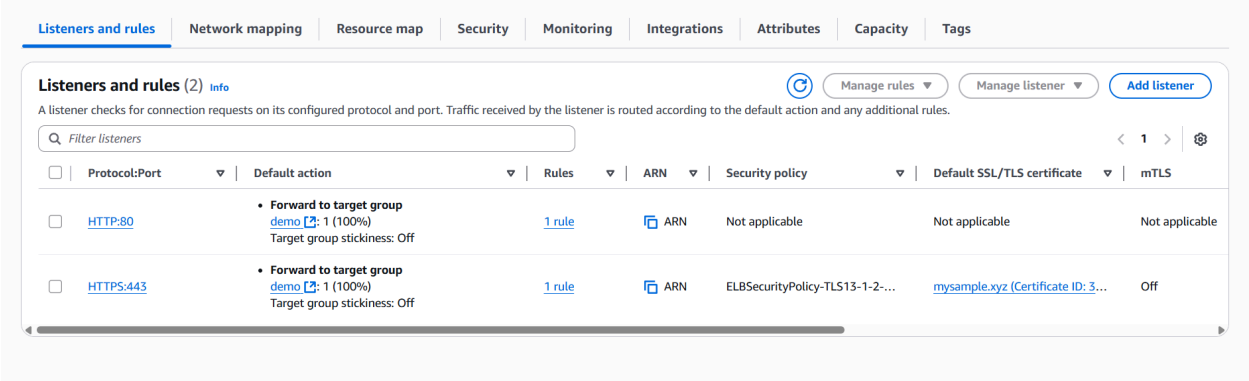
  Click on "Listeners" tab
  You'll see existing listeners (like HTTP - port 80).

  Click "Add Listener"

- **Protocol**: HTTPS
- **Port**: 443



- Now there wil be having two listeners



Step7 : Setting Up CloudFront in Front of the Load Balancer

Place Amazon CloudFront, a global content delivery network (CDN), in front of your Application Load Balancer (ALB) to:

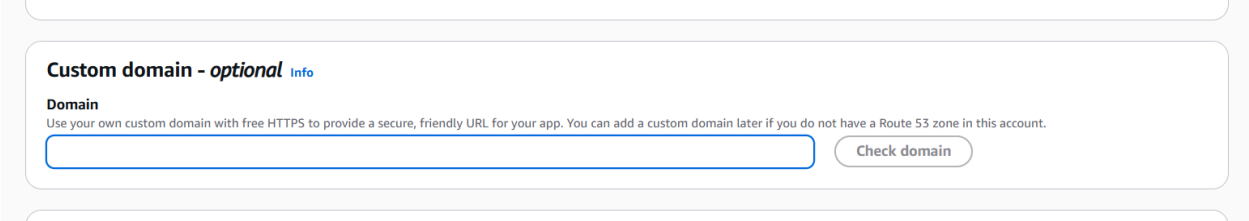
- Improve latency and performance globally
- Add an additional layer of DDoS protection (via AWS Shield)
- Enable HTTPS using Amazon Certificate Manager (ACM)
- Cache static/dynamic content efficiently

Step 1: Create a CloudFront Distribution

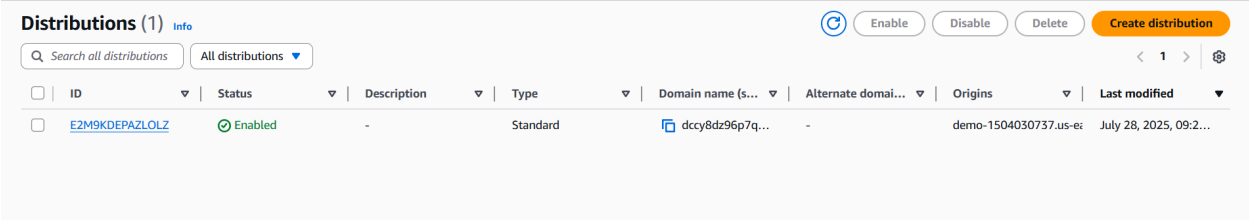
1. Go to the CloudFront Console.
2. Click Create Distribution
3. Under Origin Settings:
    - Origin domain: Paste your Load Balancer DNS name (e.g., `myapp-alb-1234567890.us-east-1.elb.amazonaws.com`)

- You can also integrate with WAF for additional security

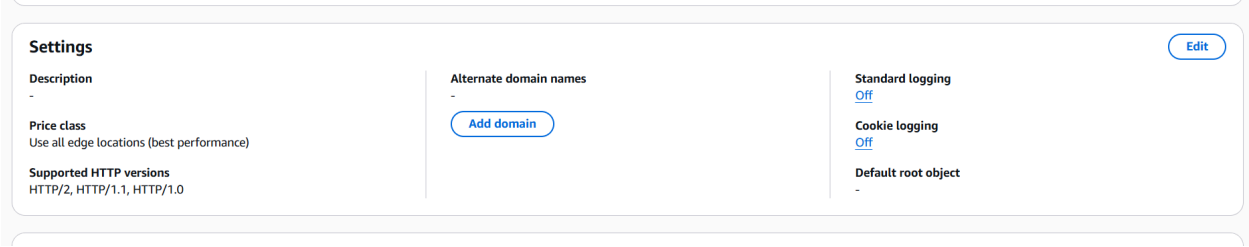
- You can also give your custom domain while creating the distribution or you can do it later



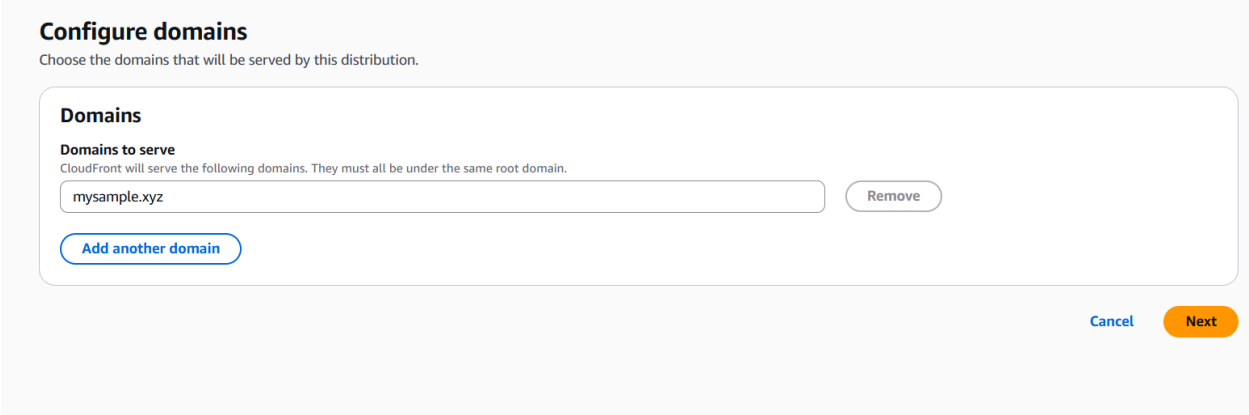
- Here we are giving the domain after the cloud front distribution
- Then create the distribution



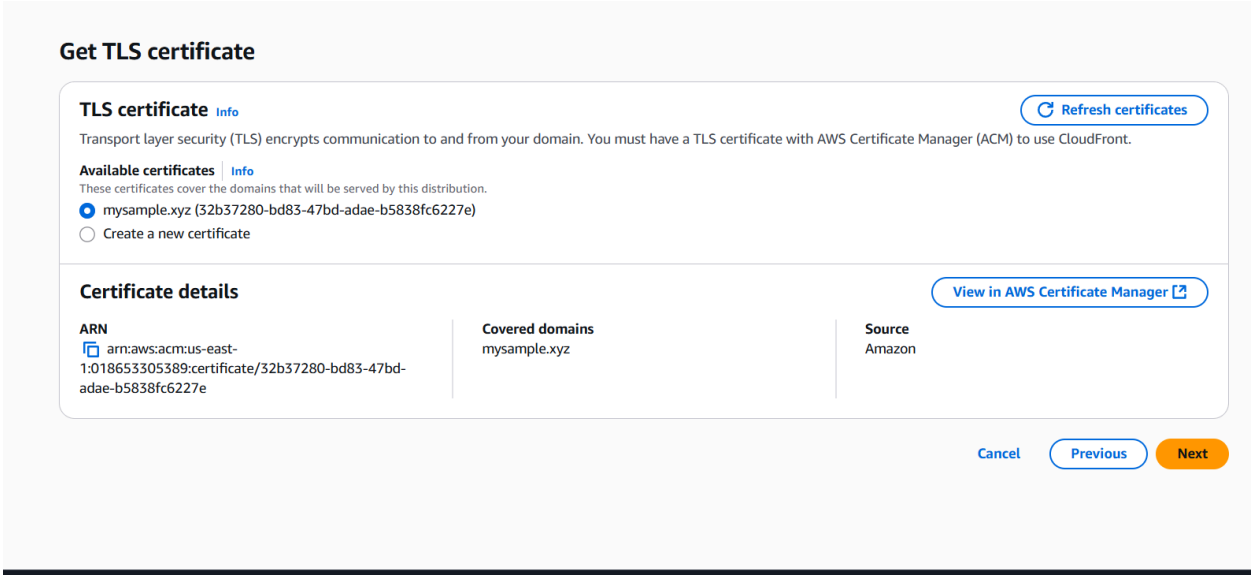
- Now get inside the distribution there you can specify your domain name by editing the alternative domain name



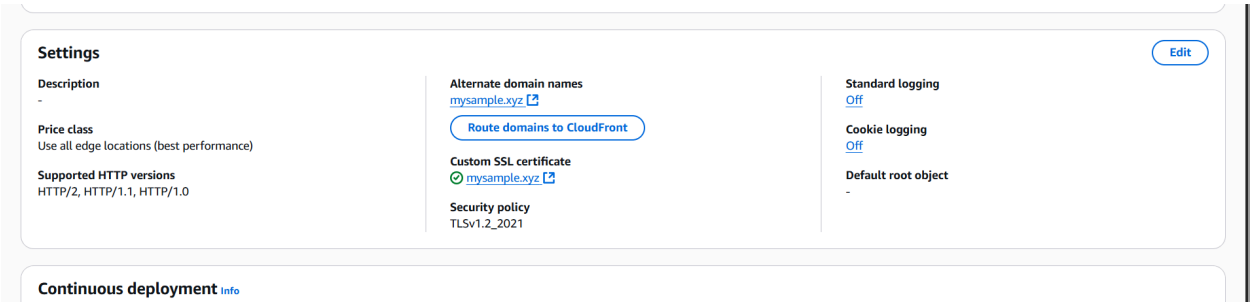
- Add domain



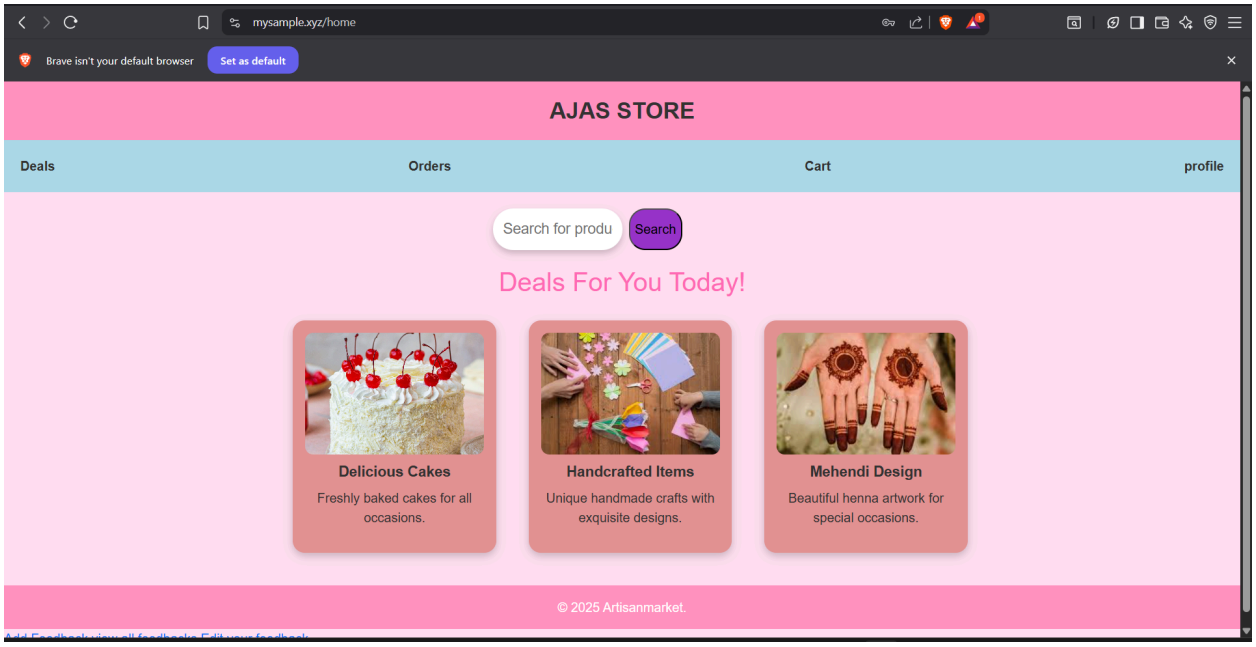
- Here we have to select the TLS/SSL certificate that we create using the ACM



- Then click add domain
- Then you can see like this



- Now if you access the domin you will be getting the website



Step8 :Monitoring with CloudWatch and SNS

In a production-grade deployment, proactive monitoring is crucial for ensuring the reliability, performance, and availability of your application. AWS provides two core services to achieve this: **Amazon CloudWatch** for monitoring metrics and logs, and **Amazon SNS (Simple Notification Service)** for sending real-time alerts.

CloudWatch Overview

Amazon CloudWatch allows you to collect, monitor, and analyze metrics across AWS services like EC2, RDS, Load Balancers, and more. With CloudWatch, you can set up custom dashboards to visualize application health, configure **alarms** to detect anomalies or failures, and dig into logs for debugging.

For example, you can create a CloudWatch alarm to monitor your **EC2 instance's CPU utilization**. If it consistently goes above 80% for a 5-minute interval, the alarm will trigger. Similarly, alarms can be created to track **memory usage**, **disk space**, or **RDS free storage space**. You can also monitor **Application Load Balancer (ALB)** health metrics to ensure traffic is properly routed to healthy targets.

Integrating SNS for Alerts

To receive alerts when an alarm is triggered, you can integrate **CloudWatch Alarms** with **Amazon SNS**. SNS is a fully managed publish/subscribe messaging service that enables you to send notifications via email, SMS, or even trigger Lambda functions.

Here's how it works:

1. You first create an **SNS topic** — a logical access point for notifications.
2. Then, subscribe your **email address or phone number** to that topic.
3. Finally, attach the SNS topic to your **CloudWatch Alarm**.

Once set up, when a defined threshold is breached (e.g., RDS storage falls below 1GB), CloudWatch sends the alarm signal to the SNS topic, which then **sends an immediate email/SMS notification** to all subscribed endpoints.

Conclusion

- This documentation has walked through the complete process of deploying a **production-grade Django application** on AWS infrastructure using best practices. We began by launching an EC2 instance and configuring it with a Django application, followed by integrating with an RDS MySQL database. We then set up **Gunicorn** as the WSGI server and used **NGINX** as a reverse proxy to efficiently serve traffic and static files. With Gunicorn sockets and systemd services, we ensured that our application starts automatically and remains stable even after reboots.
- To handle scalability and high availability, we created a **Launch Template** and set up an **Auto Scaling Group (ASG)** behind an **Application Load Balancer (ALB)**. This architecture allows automatic addition or removal of EC2 instances based on traffic, ensuring optimal resource usage and performance.
- To make the application accessible via a custom domain, we registered a domain through GoDaddy and pointed it to **Route 53** by changing the nameservers. We then issued a **free SSL certificate via AWS ACM** and routed traffic securely over

HTTPS by configuring a **CloudFront Distribution** in front of the ALB, providing better performance and security.

- In case of any issues, it's essential to check the **Security Groups** of your EC2, RDS, Load Balancer, and VPC endpoints. Ensure proper **inbound/outbound rules** are configured to allow the necessary traffic (such as ports 80, 443, and 3306).
- To keep the infrastructure reliable and proactive, we implemented monitoring using **Amazon CloudWatch**. Metrics such as CPU usage, RDS storage space, and load balancer health are tracked in real-time. Alarms are created for threshold breaches, and **Amazon SNS** is used to send notifications via email or SMS, allowing for **instant alerting** and reducing downtime risks.
- This end-to-end setup ensures your application is secure, scalable, and production-ready with observability and automation features in place.

Tab 2