

# **PROJECT-6**

## **DEPLOYING A PRODUCTION GRADE HIGHLY AVAILABLE & SCALABLE 3 TIER ARCHITECTURE IN AWS**

### **AWS:**

AWS (Amazon Web Services) is a cloud computing platform provided by Amazon. It offers a wide range of cloud-based services, including computing power, storage, databases, machine learning, analytics, and more. These services are designed to help businesses and individuals build, deploy, and scale applications or services without needing to maintain physical hardware.

### **KEY FEATURES OF AWS:**

1. Scalability: AWS allows you to scale resources up or down based on demand.
2. Pay-as-You-Go: You pay only for the services you use, which helps manage costs effectively.
3. Global Reach: AWS has data centers in various regions worldwide, allowing users to deploy applications closer to their end-users.
4. Security: AWS provides robust security features like encryption, access control, and compliance with various regulations.
5. Wide Range of Services: Services include:

Compute: EC2 (Elastic Compute Cloud), Lambda

Storage: S3 (Simple Storage Service), EBS (Elastic Block Store)

Databases: RDS (Relational Database Service), DynamoDB

Networking: VPC (Virtual Private Cloud), Route 53

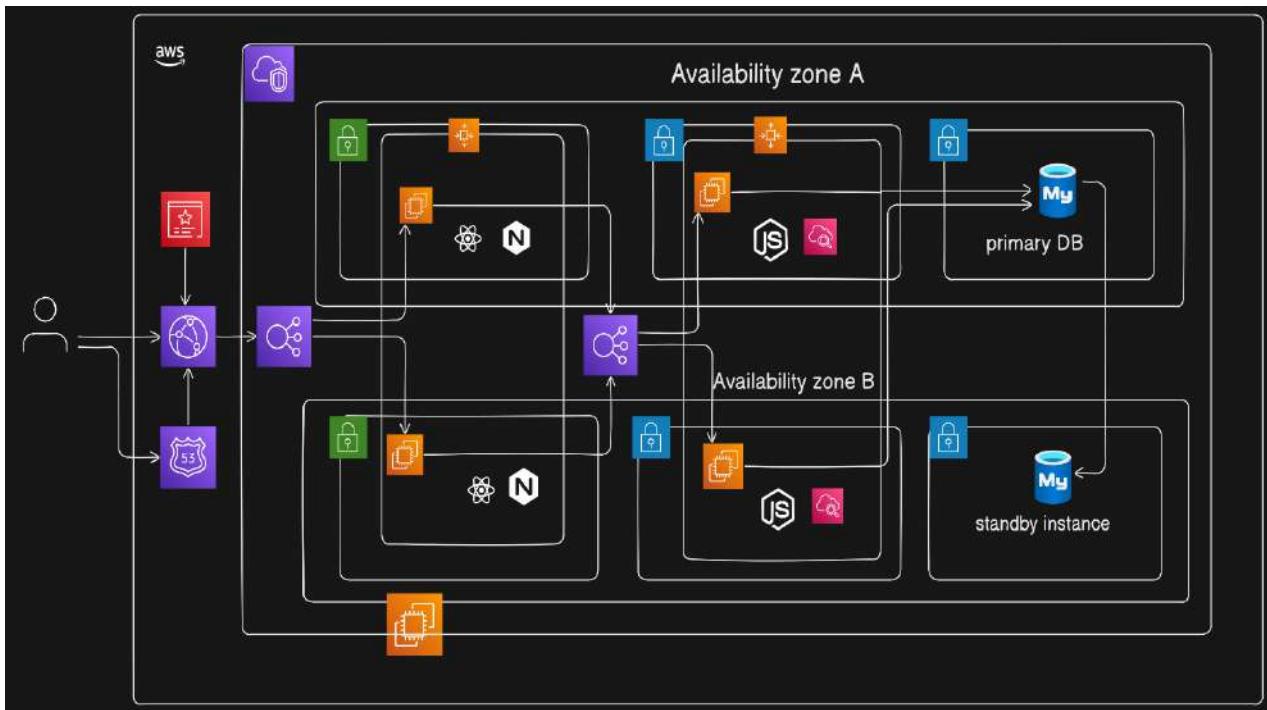
AI/ML: SageMaker, Rekognition

Developer Tools: CodeBuild, CodePipeline

Deploying a production-grade, highly available, and scalable 3-tier architecture in AWS involves setting up three distinct layers:

1. Presentation Layer (Front-End)
2. Application Layer (Back-End)
3. Data Layer (Database)

This architecture ensures scalability, fault tolerance, and high availability. Here's how you can design and deploy this architecture:



- This diagram represents a production-grade, highly available, and scalable 3-tier architecture in AWS.
- The pink cloud symbol labeled as Route 53.
- Purple hexagonal icon labeled as a load balancer.
- Orange square icons with a server symbol (representing EC2 instances).
- Green icons with a lock (representing private subnets).
- Blue database icons labeled MySQL (representing relational databases).
- Green private subnet icons indicating these databases are isolated in private subnets.
- The architecture is spread across multiple AZs (Availability Zones) to ensure fault tolerance and minimize downtime.
- Green lock icons indicate that resources are in private subnets for enhanced security.

## ROUTE 53:

Amazon Route 53 is a highly scalable and reliable Domain Name System (DNS) web service offered by AWS. Its primary purpose is to route end-user requests to the appropriate resources based on domain names (like example.com, devopsbhargavi.xyz).

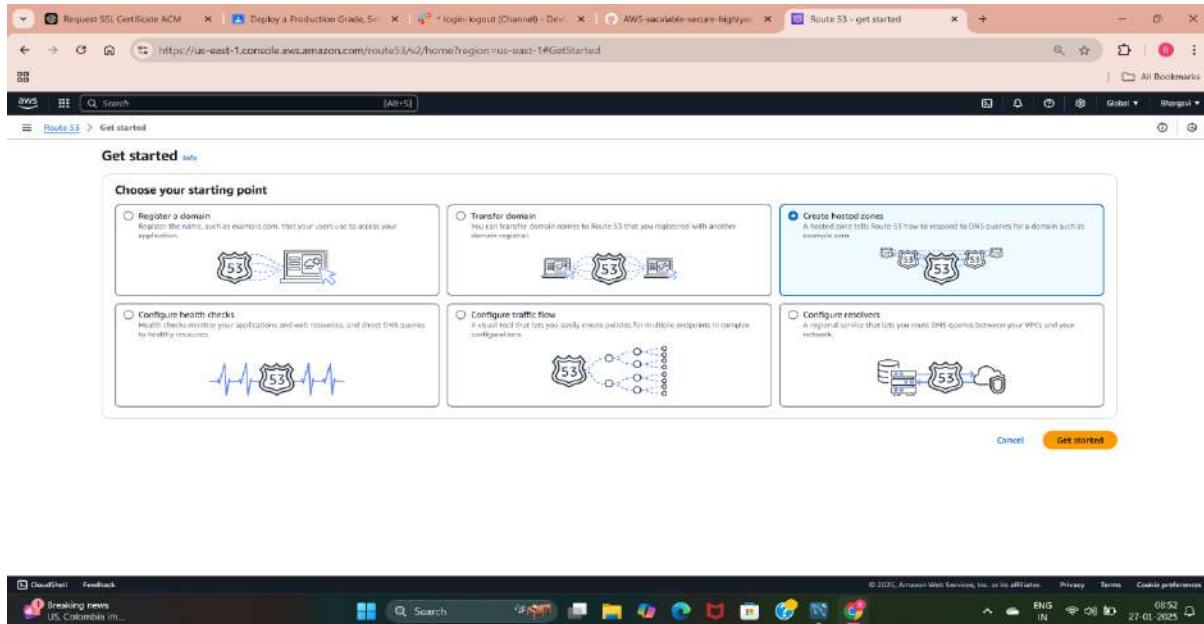
Translates human-readable domain names (e.g., www.example.com) into IP addresses that computers use to communicate (e.g., 192.168.1.1).

Routes end-user traffic to resources like web servers, load balancers, or S3 buckets using a variety of routing policies:

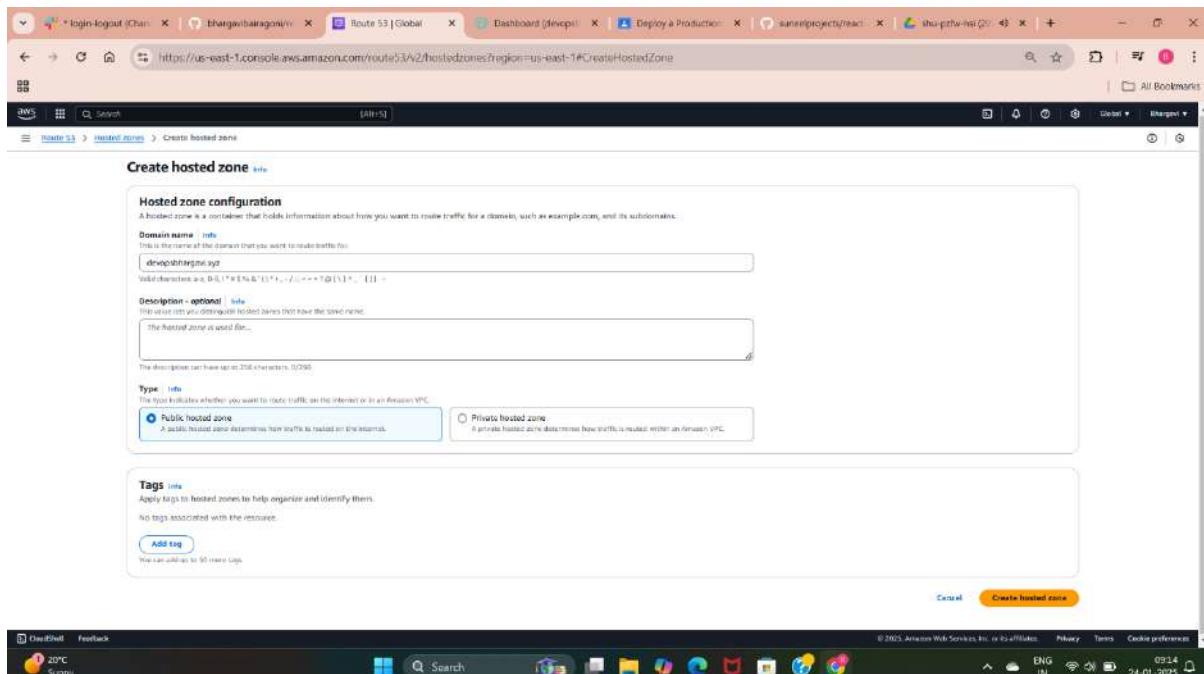
- Simple Routing: Maps one domain name to a single resource.
- Weighted Routing: Distributes traffic among multiple resources based on assigned weights.
- Latency-based Routing: Directs users to the resource with the lowest latency.
- Failover Routing: Redirects traffic to a backup resource if the primary resource fails.
- Geolocation Routing: Routes traffic based on the user's geographic location.
- Multi-Value Routing: Provides multiple healthy endpoints for DNS responses.

- Continuously monitors the health of endpoints (e.g., EC2 instances, web servers).
- Redirects traffic away from unhealthy resources automatically.
- Navigate to the AWS Management Console and open the Route 53 service.

## STEP 1: CONFIGURING ROUTE53



- Click on the "Create Hosted Zone" button.



- Fill in the following details:
- Enter the domain name you want to manage with Route 53 (e.g., devopsbhargavi.xyz).
- Select Public Hosted Zone (used for public-facing websites).
- A Public Hosted Zone allows Route 53 to route internet traffic to your resources.
- Click Create Hosted Zone to complete the setup.

## 1.1 OBTAIN THE NS RECORDS

The screenshot shows the AWS Route 53 console. On the left, there's a navigation sidebar with options like 'Route 53', 'CloudWatch Metrics', 'Hosted zones', 'Health checks', 'Profiles', 'IP-based routing', 'Traffic flow', 'Domains', 'Resolver', 'VPCs', and 'DNS Firewall'. The main area shows a success message: 'devopsbhargavi.xyz was successfully created. Now you can create records in the hosted zone to specify how you want Route 53 to route traffic for your domain.' Below this, the 'Hosted zone details' section is visible, showing 'Records (2)' and 'DNSSEC signing'. A table lists two records: 'devopsbhargavi.xyz' (NS record) and 'devopsbhargavi.xyz' (SOA record). The table includes columns for Record name, Type, Routing policy, Alias, Value/Route traffic to, TTL, and Health.

- Once the hosted zone is created, Route 53 will generate a set of Name Server (NS) records.
- These NS records are displayed in the Hosted Zone Details.

## 1.2 UPDATE NS RECORDS IN YOUR DOMAIN REGISTRAR (E.G., GODADDY)

- Log in to your domain provider's account (e.g., GoDaddy).

The screenshot shows the GoDaddy account dashboard. At the top, there are tabs for 'Deploy a Production Grade Site', 'login/logout (Channel) - DevC', 'EC2 App Deployment Setup', and 'Products'. The main content area is titled 'All Products and Services'. It shows sections for 'Domains' (listing 'devopsbhargavi.xyz' with a 'Manage' button), 'Websites + Marketing', and 'Additional Products'. A cookie consent banner at the bottom states: 'We serve cookies. We use tools, such as cookies, to enable essential services and functionality on our site and to collect data on how visitors interact with our site, products and services. By clicking Accept, you agree to our use of these tools for advertising, analytics and support. [Privacy Policy](#)'. Buttons for 'Accept', 'Decline', and 'Manage' are available. The system status bar at the bottom right shows 'Air Moderate Now', 'ENG IN', '09:02', and '29-01-2025'.

- Locate the DNS management section for your domain.

The screenshot shows the GoDaddy DNS Management interface for the domain `devopsbhargevixyz`. The 'Nameservers' tab is selected. The page displays four existing NS records:

- `ns-510.awsdns-63.com`
- `ns-1794.awsdns-32.co.uk`
- `ns-650.awsdns-17.net`
- `ns-1187.awsdns-20.org`

A 'Change Nameservers' button is located in the top right corner of the main content area.

- ♣ Replace the existing NS (Name Server) records with the Route 53 NS records.
- ♣ Delete the old NS records (if any).
- ♣ Add the four NS records provided by Route 53.
- ♣ Save the changes.

The screenshot shows the GoDaddy DNS Management interface for the domain `devopsbhargevixyz`. The 'Nameservers' tab is selected. The page displays four new NS records provided by Route 53:

- `ns-743.awsdns-23.net`
- `ns-1208.awsdns-23.org`
- `ns-1949.awsdns-79.co.uk`
- `ns-293.awsdns-56.com`

A 'Change Nameservers' button is located in the top right corner of the main content area.

## Wait for DNS Propagation

- DNS propagation can take up to 24-48 hours, but it often completes within 1-2 hours.
- During propagation, Route 53's DNS records may not yet be accessible globally.

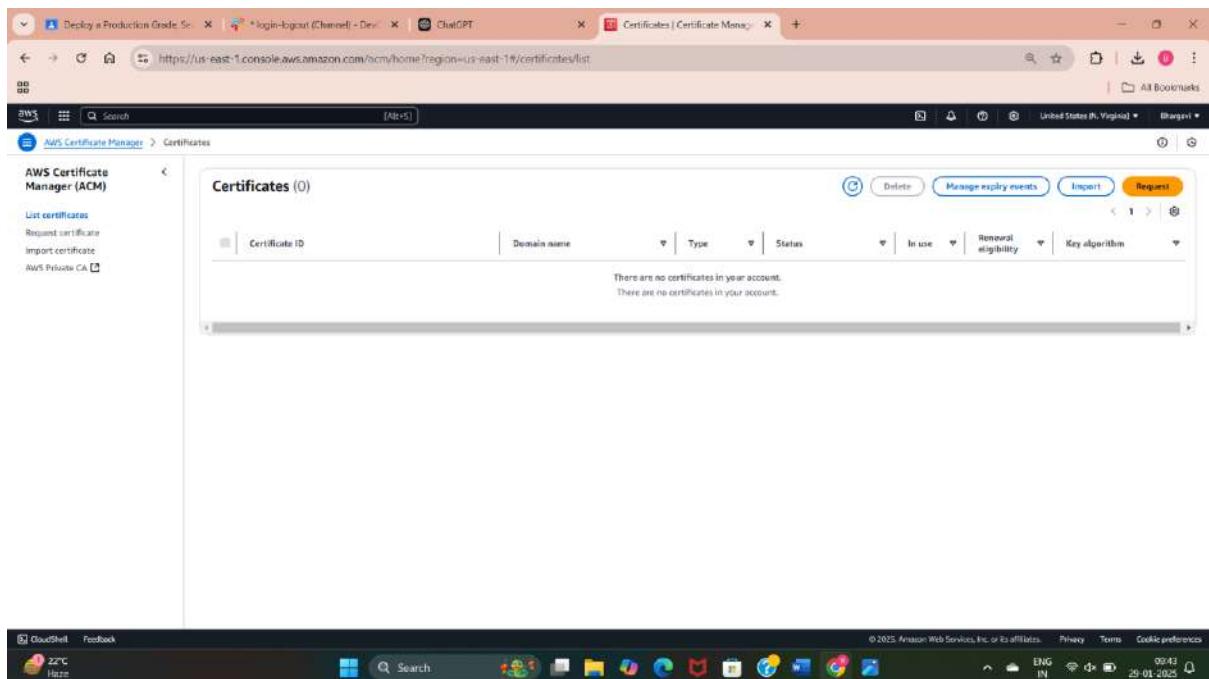
## AWS CERTIFICATE MANAGER

AWS Certificate Manager is a service provided by Amazon Web Services (AWS) that allows you to easily provision, manage, and deploy SSL/TLS certificates for securing your websites, applications, and communications.

To request a public SSL certificate using Amazon ACM (AWS Certificate Manager), follow these steps:

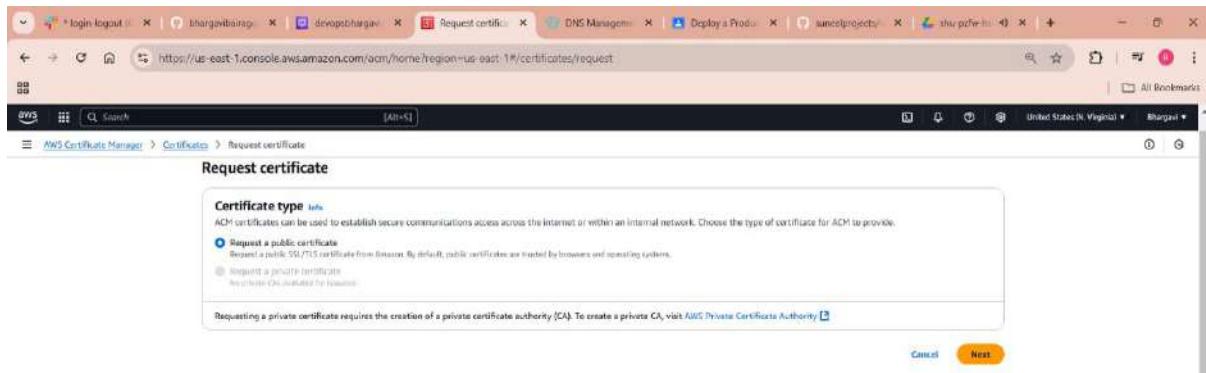
### STEP 2: REQUESTING A PUBLIC SSL CERTIFICATE USING AMAZON ACM

- Log in to your AWS Management Console.
- Navigate to Services and search for Certificate Manager under the "Security, Identity, & Compliance" section.

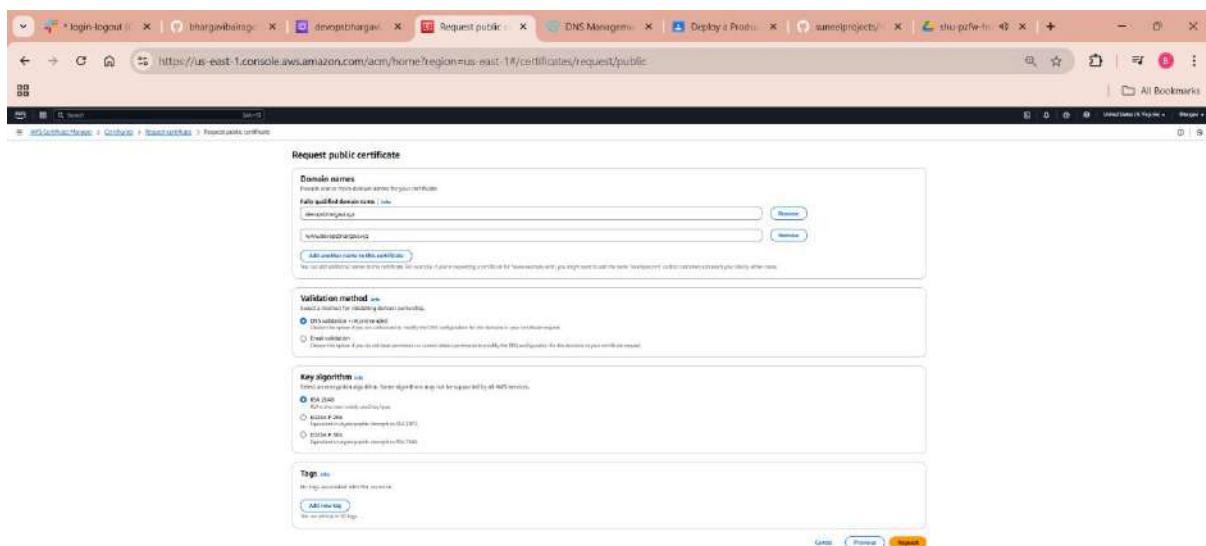


Request a Certificate:

- In the ACM console, click on Request a certificate.



- Choose Request a public certificate.
- Click Next.



Provide Domain Names:

- Enter the domain name for which you want the SSL certificate (e.g., devopsdost.xyz or www.devopsdost.xyz).
- Select the validation method DNS validation. We need to add a DNS record to prove ownership.
- Review the details of your request and click Confirm and Request.

### Create DNS Records:

- Once the certificate request is submitted, click on create records in Route 53 (if using Route 53) to automatically add the DNS validation record.

- After completing the validation process, the certificate will be issued and show as Issued in the ACM console.

The screenshot shows the AWS Route 53 DNS Management console. A green success message at the top states: "devopsbhargavi.xyz was successfully created. Now you can create records in the hosted zone to specify how you want Route 53 to route traffic for your domain." The main pane displays the "Hosted zone details" for "devopsbhargavi.xyz". Under the "Records (4)" tab, a table lists the following records:

Name	Type	Value	TTL
ns-2023.awsdns-00.co.uk.	NS	ns-115.awsdns-00.net.	172800
ns-115.awsdns-19.com.	NS	ns-1806.awsdns-47.org.	
ns-2023.awsdns-00.co.uk.	SOA	ns-2023.awsdns-00.co.uk...	300
devopsbhargavi.xyz	CNAME	_401b2Te0f65a5837b1eab0e51af102.devopsbhargavi.xyz	300
_594140221842f7a85d977...	CNAME	_594140221842f7a85d977...	300

- In hosted zones two new records are added from certificate manager.

## AMAZON VPC (VIRTUAL PRIVATE CLOUD)

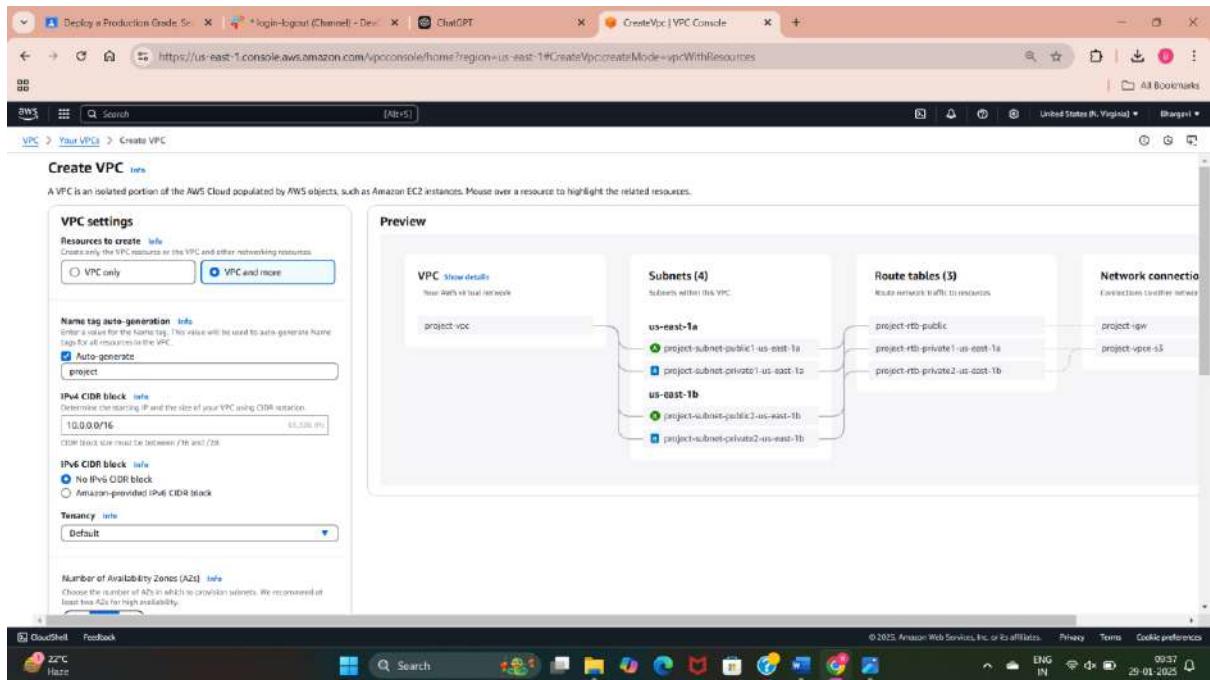
Amazon Virtual Private Cloud (VPC) is a service provided by Amazon Web Services (AWS) that enables you to create and control a logically isolated network in the AWS Cloud. With VPC, you can launch AWS resources (like EC2 instances) in a virtual network that you define, giving you full control over the network configuration.

### STEP 3: CREATING VPC & SUBNETS

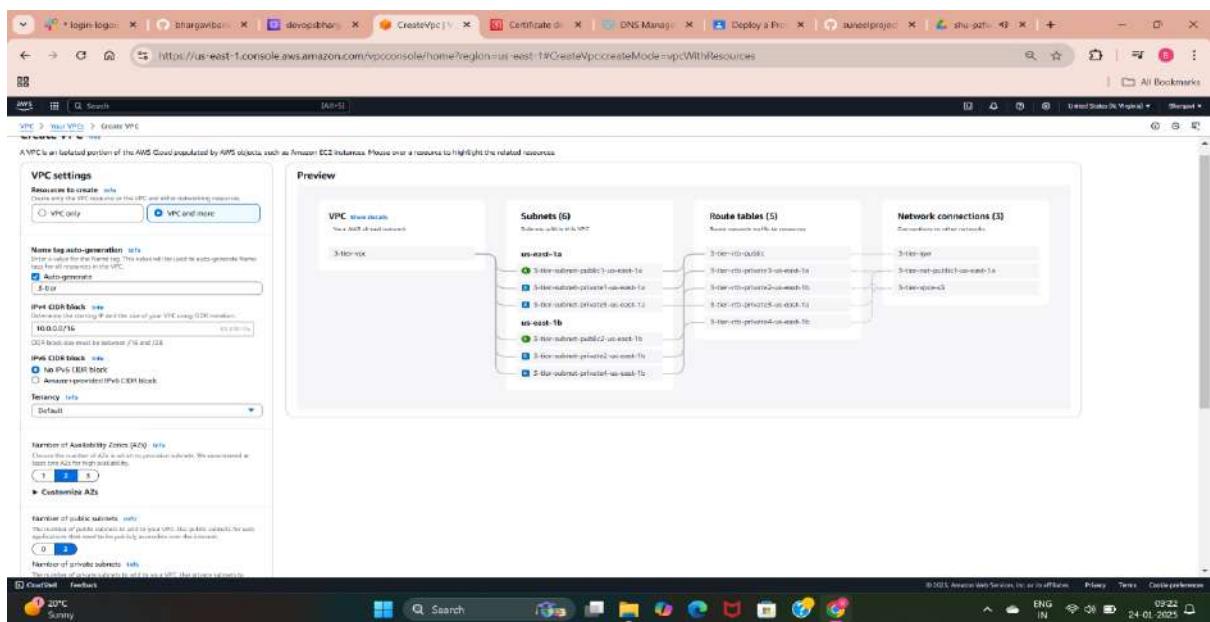
The screenshot shows the AWS VPC Console VPC dashboard. It lists one VPC entry:

Name	VPC ID	State	IPv4 CIDR	IPv6 CIDR	DHCP option set	Main route table	Main network ACL
vpc-01f5fe37a53d1d33	vpc-01f5fe37a53d1d33	Available	172.31.0.0/16	-	dopt-0fa14cc7d400ct9nq	rtb-0ba7ea176670a3be	ad-0c18ea4097a5077e7

- In the VPC Dashboard, click on Create VPC.



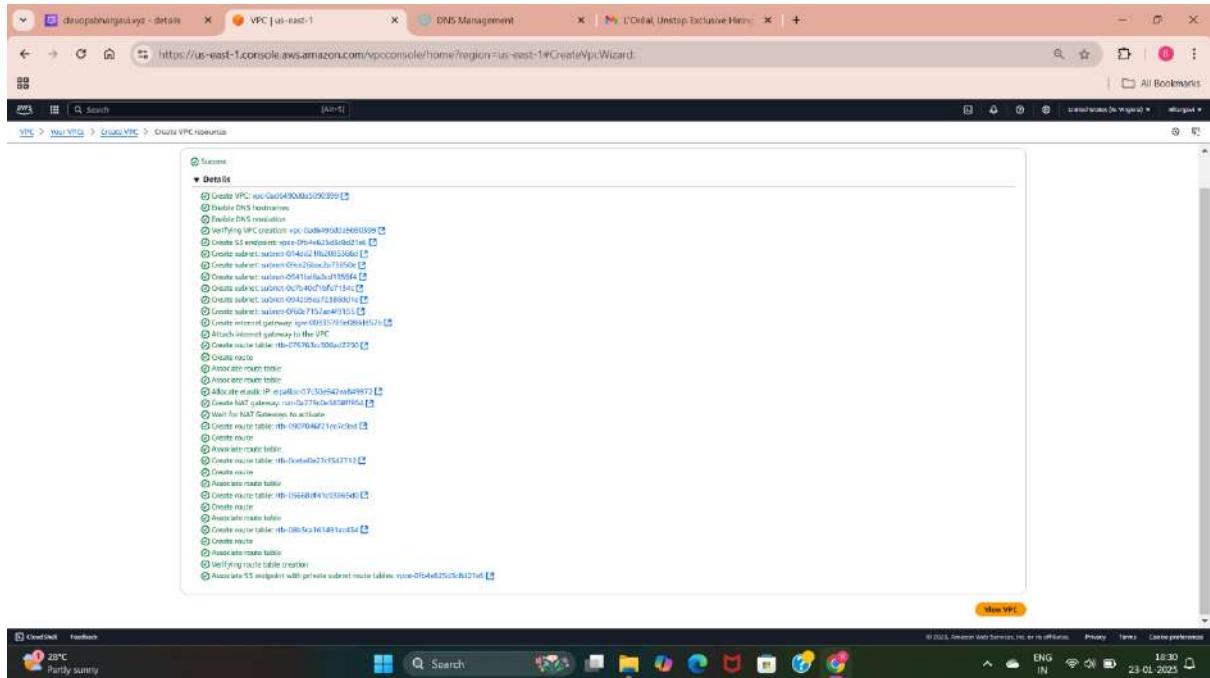
- Select VPC and More.



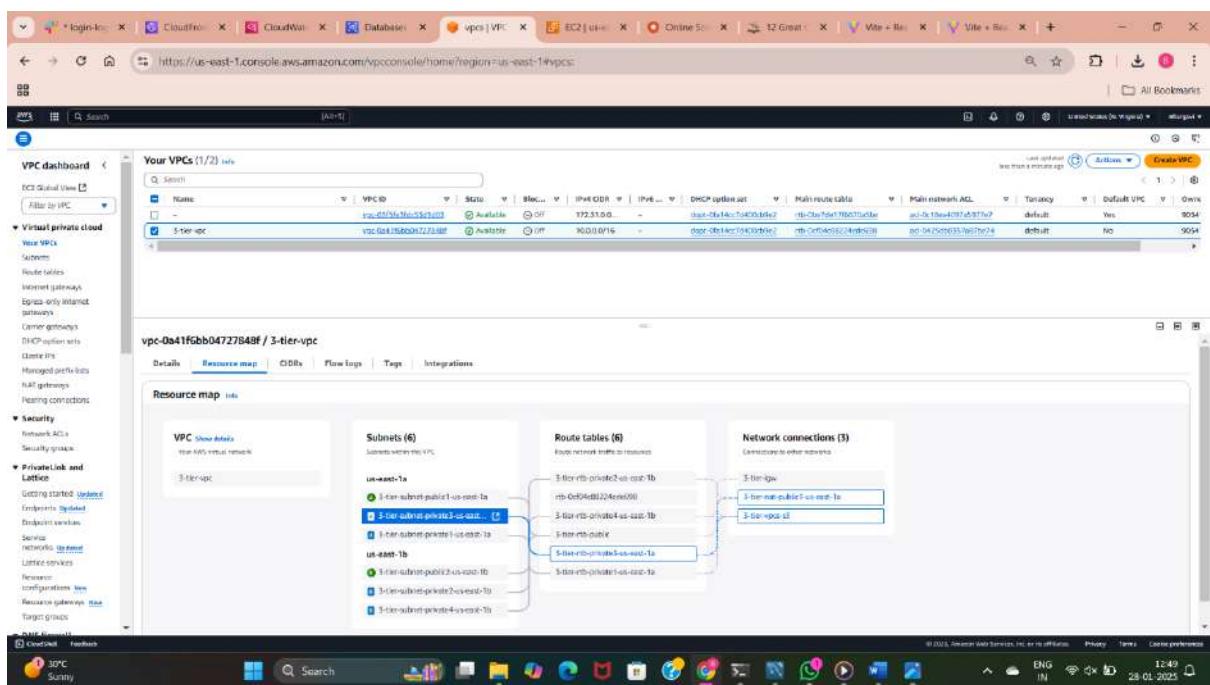
## Configure the VPC:

- Name: Enter 3-tier.
- IPv4 CIDR block: Choose an appropriate CIDR block (e.g., 10.0.0.0/16).
- Availability Zones: Choose 2 availability zones for the VPC (select the appropriate zones from the dropdown).
- Public Subnets: Set to 2 subnets (each in different availability zones).
- Private Subnets: Set to 4 subnets.
- NAT Gateway: Choose 1 AZ for the NAT Gateway to provide internet access to the private subnets.

- VPC Endpoints: Set to None for now.
- Once configured, click on Create.
- The creation process will take approximately 2-3 minutes.



- The creation process will take approximately 2-3 minutes.



- The 3-tier VPC is created with subnets and route table.
- In resource map we can check all the resources are properly connected.

## 1. SUBNET

A subnet is a segment of a VPC's IP address range where you can place resources such as EC2 instances. Subnets allow you to divide your VPC into smaller networks for better management and security.

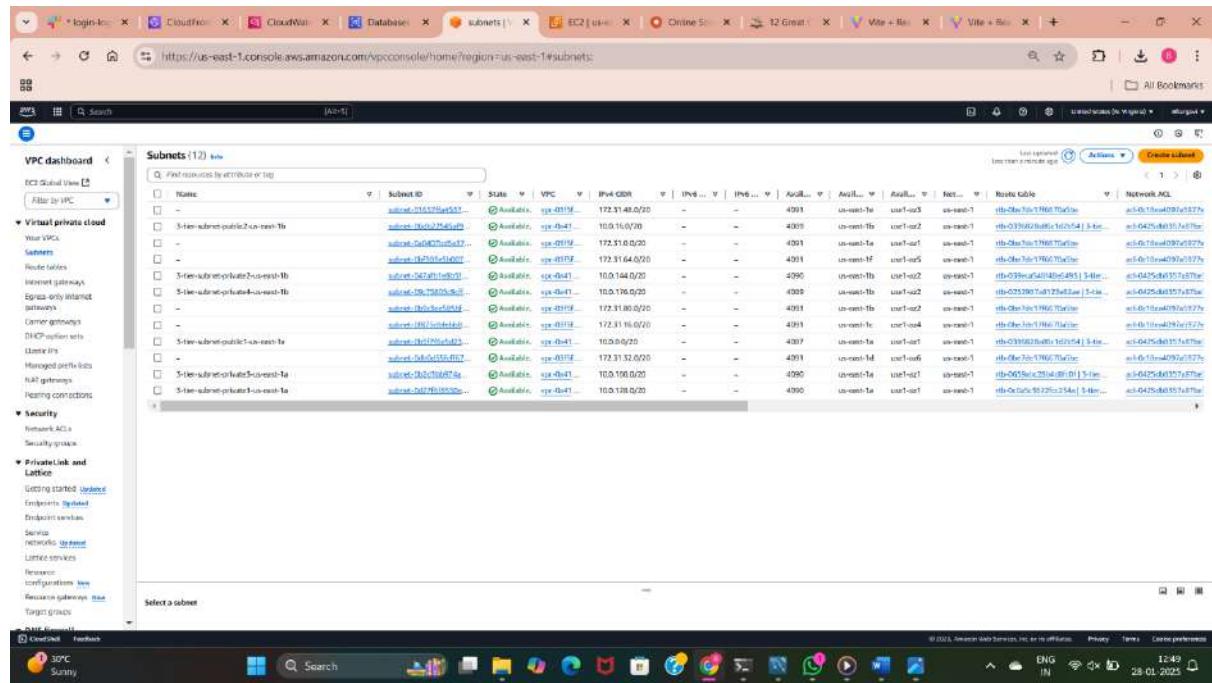
### TYPES OF SUBNETS:

#### Public Subnet:

- Accessible from the internet.
- Associated with a route table that has a route to an Internet Gateway.
- Typically used for web servers or public-facing resources.

#### Private Subnet:

- Not directly accessible from the internet.
- Can access the internet via a NAT Gateway if required.
- Used for databases, application servers, or other internal resources.



The screenshot shows the AWS VPC Subnets page with 12 subnets listed in a table. The columns include Name, Subnet ID, Status, VPC, IPv4 CIDR, IPv6 CIDR, Availability Zone, and Route Table. The subnets are categorized into three groups: 3-New-subnet-public1-on-east-1a, 3-New-subnet-private1-on-east-1a, and 3-New-subnet-private2-on-east-1a. The subnets are all in an available state and are associated with route tables rtb-01e8f7a1, rtb-01e8f7a2, and rtb-01e8f7a3 respectively.

Name	Subnet ID	Status	VPC	IPv4 CIDR	IPv6 CIDR	Availability Zone	Route Table
3-New-subnet-public1-on-east-1a	subnet-01a57f4a5f77	Available	vpc-021f34	172.31.48.0/20	-	us-east-1a us-east-1a	rtb-01e8f7a1
-	subnet-01b275d5a9	Available	vpc-021f34	10.0.16.0/20	-	4999 us-east-1b us-east-1b	rtb-01e8f7a2
-	subnet-01c07f15a57	Available	vpc-021f34	172.31.6.0/20	-	4991 us-east-1a us-east-1a	rtb-01e8f7a1
-	subnet-01d87f15a07	Available	vpc-021f34	172.31.64.0/20	-	4991 us-east-1f us-east-1f	rtb-01e8f7a1
3-New-subnet-private2-on-east-1a	subnet-01e47f15a59	Available	vpc-021f34	10.0.144.0/20	-	4990 us-east-1b us-east-1b	rtb-01e8f7a2
-	subnet-01f27f15a59	Available	vpc-021f34	10.0.136.0/20	-	4995 us-east-1b us-east-1b	rtb-01e8f7a2
-	subnet-01g07f15a59	Available	vpc-021f34	172.31.80.0/20	-	4991 us-east-1b us-east-1b	rtb-01e8f7a2
-	subnet-01h87f15a59	Available	vpc-021f34	10.0.0.0/20	-	4997 us-east-1a us-east-1a	rtb-01e8f7a1
3-New-subnet-private1-on-east-1a	subnet-01i67f15a59	Available	vpc-021f34	172.31.16.0/20	-	4991 us-east-1c us-east-1c	rtb-01e8f7a3
-	subnet-01j47f15a59	Available	vpc-021f34	10.0.100.0/20	-	4995 us-east-1a us-east-1a	rtb-01e8f7a1
-	subnet-01k27f15a59	Available	vpc-021f34	172.31.32.0/20	-	4991 us-east-1d us-east-1d	rtb-01e8f7a3
3-New-subnet-private3-on-east-1a	subnet-01l07f15a59	Available	vpc-021f34	10.0.100.0/20	-	4995 us-east-1a us-east-1a	rtb-01e8f7a1
-	subnet-01m87f15a59	Available	vpc-021f34	10.0.128.0/20	-	4990 us-east-1a us-east-1a	rtb-01e8f7a1

- We can check in VPC service two new public subnets and four new private subnets are created.

### 3.1 ENABLE PUBLIC IP FOR PUBLIC SUBNETS:

- Once the VPC is created, navigate to the Subnets section under the VPC Dashboard.
- Select the Public Subnets.

You have successfully changed subnet settings:  
Enable auto-assign public IPv4 address

Name	Subnet ID	Status	VPC	IPv4 CIDR	IPv6 CIDR	Available
3-tier-subnet-private2-us-east-1b	subnet-090d461e61b2...	Available	vpc-0994...	10.0.144.0/20	-	4091
-	subnet-01657f1fa453...	Available	vpc-0315...	172.31.48.0/20	-	4091
-	subnet-0107bd45a37...	Available	vpc-0315...	172.31.0.0/20	-	4091
-	subnet-0053a3b007...	Available	vpc-0315...	172.31.64.0/20	-	4091
-	subnet-037a0e1729...	Available	vpc-0994...	10.0.128.0/20	-	4091
-	subnet-009b1c0d88...	Available	vpc-0994...	10.0.0.0/20	-	4090
-	subnet-0932eef5bf...	Available	vpc-0315...	172.31.80.0/20	-	4091
-	subnet-0973e99bb...	Available	vpc-0315...	172.31.16.0/20	-	4091
-	subnet-0405516fb7...	Available	vpc-0315...	172.31.32.0/20	-	4091
<input checked="" type="checkbox"/> 3-tier-subnet-public2-us-east-1b	subnet-0e450453e73458ff4...	Available	vpc-0994...	10.0.16.0/20	-	4091
-	subnet-04057b7ba935...	Available	vpc-0994...	10.0.160.0/20	-	4091
-	subnet-0590ea751011...	Available	vpc-0994...	10.0.176.0/20	-	4091

- Click on Actions in the top-right corner, and then select Edit Subnet Settings.

Subnet  
Subnet ID: subnet-009b1c0d8877a065  
Name: 3-tier-subnet-public1-us-east-1a

Auto-assign IP settings

Enable AWS to automatically assign a public IPv4 or IPv6 address to a new primary network interface for an instance in this subnet.

Enable auto-assign public IPv4 address

Enable auto-assign customer-owned IPv4 address

Resource-based name (RBN) settings

Specify the hostname type for EC2 instances in this subnet and optional RBN DNS query settings.

Enable resource name DNS A record on launch

Enable resource name DNS AAAA record on launch

DNS64 settings

Enable DNS64 to allow IPv6-only services in Amazon VPC to communicate with IPv4-only services and networks.

Enable DNS64

- In the Edit Subnet Settings dialog, enable Public IP Automatically by toggling the option.
- Click on Save.

## 2. ROUTE TABLE

A Route Table contains rules (routes) that define how traffic is directed within the VPC and outside of it.

- Each subnet is associated with one route table.
- Route tables consist of
  - Destination: The IP range of the traffic (e.g., 0.0.0.0/0 for all traffic).
  - Target: Where to send the traffic (e.g., Internet Gateway, NAT Gateway, or another subnet).

### TYPES OF ROUTES:

Public Route Table:

- Contains a route to an Internet Gateway for internet traffic (0.0.0.0/0 → Internet Gateway).
- Associated with public subnets.

Private Route Table:

- Contains a route to a NAT Gateway for internet-bound traffic (0.0.0.0/0 → NAT Gateway).
- Associated with private subnets.

The screenshot shows the AWS VPC Route Tables page. On the left, there's a navigation sidebar with sections like 'VPC dashboard', 'Route tables', 'Virtual private cloud', 'Security', 'Networking and Lattice', and 'AWS Direct Connect'. The main content area has a table titled 'Route tables (7) info' with columns: Name, Route table ID, Explicit subnet associations, Edge associations, Main, VPC, and Owner ID. The table lists seven route tables, each associated with a specific VPC and owner ID. The table is paginated with '1 > 1 of 7' at the bottom.

Name	Route table ID	Explicit subnet associations	Edge associations	Main	VPC	Owner ID
S-1-eni-1-private2-us-east-1b	rtb-02f7aef2f102b6b	subnet-047efcfcfb00000 / 5-1-eni-1b...	-	No	vpc-0ae11ff6a04727548ff   5-1-eni-1...	9054119550109
S-1-eni-1-public	rtb-02f7aef2f102b6b	-	-	Yes	vpc-0ae11ff6a04727548ff   5-1-eni-1...	9054119550109
S-1-eni-1-private4-us-east-1b	rtb-02f7aef2f102b6b	subnet-07e75105b49-b6a11 / 5-1-eni-1b...	-	No	vpc-0ae11ff6a04727548ff   5-1-eni-1...	9054119550109
S-1-eni-1-private5-us-east-1a	rtb-02f7aef2f102b6b	subnet-02d2f116a794ab05e5 / 5-1-eni-1a...	-	No	vpc-0ae11ff6a04727548ff   5-1-eni-1...	9054119550109
S-1-eni-1-private6-us-east-1a	rtb-02f7aef2f102b6b	subnet-02d2f116a794ab05e5 / 5-1-eni-1a...	-	No	vpc-0ae11ff6a04727548ff   5-1-eni-1...	9054119550109
S-1-eni-1-private7-us-east-1a	rtb-02f7aef2f102b6b	subnet-02d2f116a794ab05e5 / 5-1-eni-1a...	-	No	vpc-0ae11ff6a04727548ff   5-1-eni-1...	9054119550109

- In route tables four private route tables are created and associated with four private subnets.
- Two public route tables are created and associated with two public subnets.

### 3. INTERNET GATEWAY (IGW)

An Internet Gateway is a VPC component that allows resources in a public subnet to send and receive traffic from the internet.

- It's attached to the VPC and supports bidirectional communication with the internet.
- Only instances in subnets with a route to the IGW (via the route table) can access the internet.
- Create and attach an Internet Gateway to your VPC.
- Add a route in the route table for public subnets: 0.0.0.0/0 → Internet Gateway.

The screenshot shows the AWS VPC console interface. On the left, there is a navigation sidebar with various VPC-related options like VPC Global View, Filter by VPC, Virtual private cloud, Security, Internet gateways, PrivateLink, and Latency. The 'Internet gateways' section is currently selected. In the main content area, there is a table titled 'Internet gateways (1/2)' with one item listed:

Name	Internet gateway ID	Status	VPC ID	Owner
3-tier-igw	igw-0173df3ced0641a28	Attached	vpc-01f90c0047278487 / 5-tier-vg	90541896099

Below the table, a detailed view for 'igw-0173df3ced0641a28 / 3-tier-igw' is shown. The 'Details' tab is selected, displaying the following information:

- Internet gateway ID: igw-0173df3ced0641a28
- State: Attached
- VPC ID: vpc-01f90c0047278487
- Owner: 90541896099

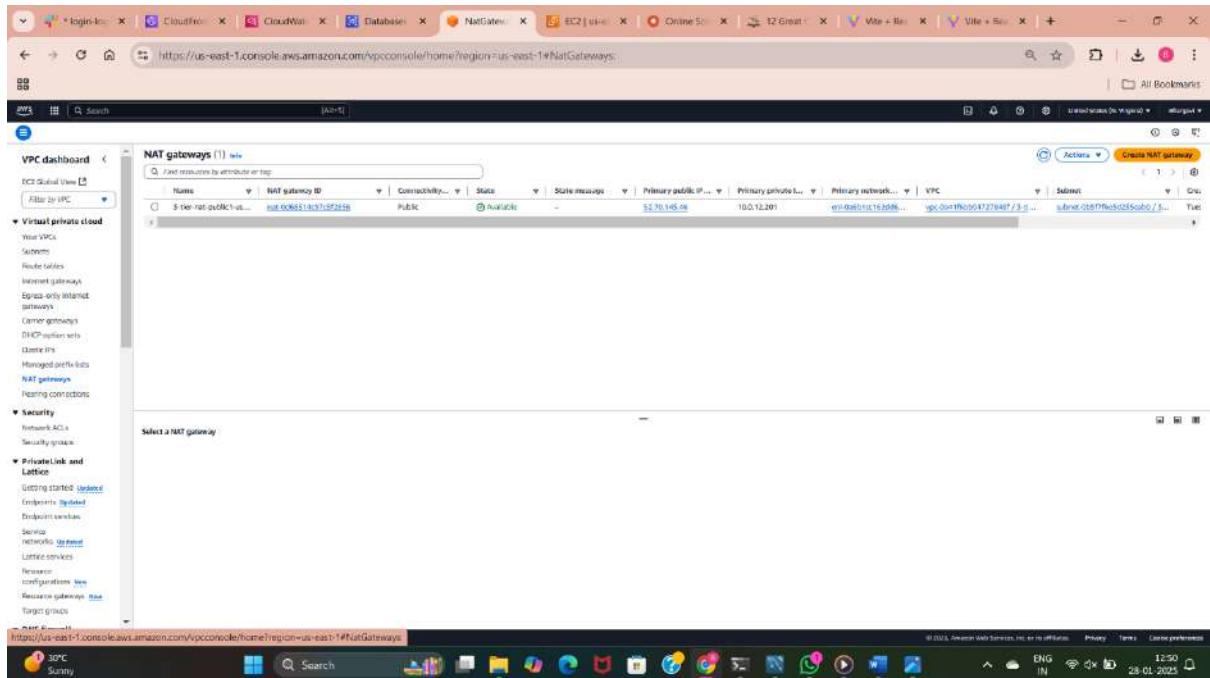
The bottom of the screen shows the Windows taskbar with various icons and the date/time: 28-01-2025, 12:49.

- The internet gateway is created and attached to vpc. This is used to provide internet for public subnets which are created using public subnet.

## 4. NAT GATEWAY

A NAT (Network Address Translation) Gateway allows instances in a private subnet to access the internet while preventing inbound traffic from the internet.

- Used for outbound internet traffic from private subnets.
- Provides security by keeping resources in private subnets inaccessible from the internet.
- A database server in a private subnet needs to download software updates or send logs to an external system. The NAT Gateway enables this without exposing the server to the internet.



The screenshot shows the AWS VPC console interface. On the left, there is a navigation sidebar with various VPC-related options like EC2 Global View, Virtual private cloud, Security, and Network ACLs. The main content area is titled "NAT gateways (1)" and displays a single row of data in a table:

Name	NAT gateway ID	State	Primary public IP...	Primary private IP...	VPC
3-tier-nat-public-us...	nat-006511937cf72558	Public	52.70.145.08	10.0.12.201	vpc-040f1c163696...

Below the table, there is a section titled "Select a NAT gateway" which is currently empty. The browser's address bar shows the URL: https://us-east-1.console.aws.amazon.com/vpc/home?region=us-east-1#NatGateways. The operating system taskbar at the bottom indicates it's running on Windows 10, with the date and time being 28-01-2025.

- NAT Gateway is created to provide internet for private subnets and private instances created using private subnets.

## 5.ELASTIC IP

An Elastic IP (EIP) in AWS is a static, public IPv4 address that you can allocate and associate with your AWS resources, such as EC2 instances, NAT Gateways, or Network Load Balancers. It is designed to provide consistent and reliable access to your resources, even if their private IP address or instance changes.

- Unlike dynamic public IPs assigned to EC2 instances, Elastic IPs remain constant even if you stop and restart an instance.

The screenshot shows the AWS VPC dashboard with the 'Elastic IP addresses' section selected. A table lists one elastic IP address:

Name	Allocated IPv4 address	Type	Allocation ID	Reverse DNS record	Associated instance ID	Private IP address	Association ID	Network interface
5-elastic-ip-us-east-1-1a	52.30.125.20	Public IP	eipalloc-02f048f760c8754a8	-	-	10.0.12.201	eipassoc-02cc04-09552d172f	9254159452

- One Elastic ip is created to attach to public instances.

## SECURITY GROUPS

A Security Group in AWS acts as a virtual firewall for your Amazon EC2 instances or other resources. It controls inbound and outbound traffic at the instance level, ensuring only authorized network traffic is allowed.

- If you allow inbound traffic, the corresponding outbound traffic is automatically allowed (and vice versa). For example, if you allow an inbound SSH connection, the outbound response is permitted without explicitly specifying it.

## STEP 4: CREATING SECURITY GROUPS

- ✓ In the EC2 Dashboard, on the left-hand side, scroll down and select Security Groups under the Network & Security section.

Name	Security group ID	Security group name	VPC ID	Description	Owner	Inbound rules count
sg_0000000000000000	ec2-rds-5	ec2-rds-5	vpc-0000000000000000	Security group...	905418555099	0 Permission entries
sg_0000000000000001	rtb-ec2-4	rtb-ec2-4	vpc-0000000000000001	Security group...	905418555099	1 Permission entry
sg_0000000000000002	ec2-rds-4	ec2-rds-4	vpc-0000000000000002	Security group...	905418555099	0 Permission entries
sg_0000000000000003	rtb-ec2-3	rtb-ec2-3	vpc-0000000000000003	Security group...	905418555099	1 Permission entry
sg_0000000000000004	default	default	vpc-0000000000000004	default VPC se...	905418365099	5 Permission entries
sg_0000000000000005	rtb-ec2-5	rtb-ec2-5	vpc-0000000000000005	Security group...	905418555099	1 Permission entry
sg_0000000000000006	ec2-rds-1	ec2-rds-1	vpc-0000000000000006	Security group...	905418555099	0 Permission entries
sg_0000000000000007	rtb-ec2-3	rtb-ec2-3	vpc-0000000000000007	Security group...	905418555099	1 Permission entry
sg_0000000000000008	ec2-rds-5	ec2-rds-5	vpc-0000000000000008	Security group...	905418555099	1 Permission entry
sg_0000000000000009	rtb-ec2-2	rtb-ec2-2	vpc-0000000000000009	Security group...	905418365099	1 Permission entry
sg_000000000000000a	ec2-rds-2	ec2-rds-2	vpc-000000000000000a	Security group...	905418555099	0 Permission entries

- ✓ Click on Create Security Group at the top of the page.

### 4.1: CREATING SECURITY GROUP FOR BASTION HOST

- ♣ Enter Bastion-Host as the name of the security group.
- ♣ Select the VPC you created earlier, which is 3-Tier-Architecture.
- ♣ Under the Inbound rules section, click on Add Rule.
- ♣ Select Type as SSH from the dropdown. This will automatically set the Port Range to 22.

- For Source, select Anywhere-IPv4 (0.0.0.0/0) to allow SSH access from any IPv4 address. This is generally used for Bastion Hosts to provide SSH access from anywhere. You can restrict access further by specifying a particular IP range if necessary.
- Click Create Security Group.

The screenshot shows the AWS EC2 Security Groups console. A green success message at the top says "Security group (sg-0b1399a02791647fb | Bastion-Host) was created successfully". The main card displays the security group's name, ID, owner, and basic details. Under the "Inbound rules" tab, there is one rule listed:

Name	Security group rule ID	IP version	Type	Protocol	Port range	Source
sg-fd85c38090be4816	IPv4	SSH	TCP	22	0.0.0.0/0	

- The security group for Bastion-Host is created.

## 4.2: CREATE A SECURITY GROUP FOR PRESENTATION TIER ALB

- Click on Create Security Group at the top of the page.

The screenshot shows the "Create security group" wizard. In the "Basic details" step, the security group name is set to "Presentation-ALB-SG" and the description is "PresentationALB-SG". The "VPC" dropdown is set to "vpc-0252aefaa74f754f (3-tier-vpc)".

**Inbound rules:**

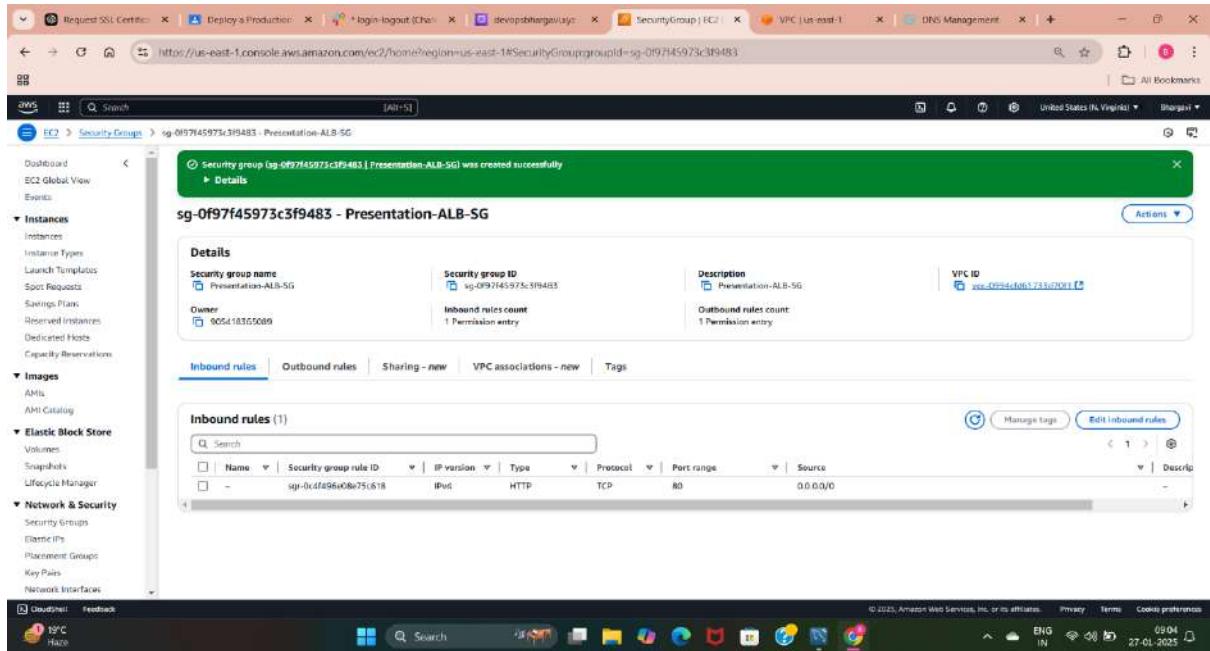
- Type: HTTP
- Protocol: TCP
- Port range: 80
- Source: Anywhere

**Outbound rules:**

- Type: All traffic
- Protocol: All
- Port range: All
- Destination: Anywhere

- Enter Presentation-ALB-SG as the name of the security group.
- Select the VPC you created earlier, which is 3-tier.

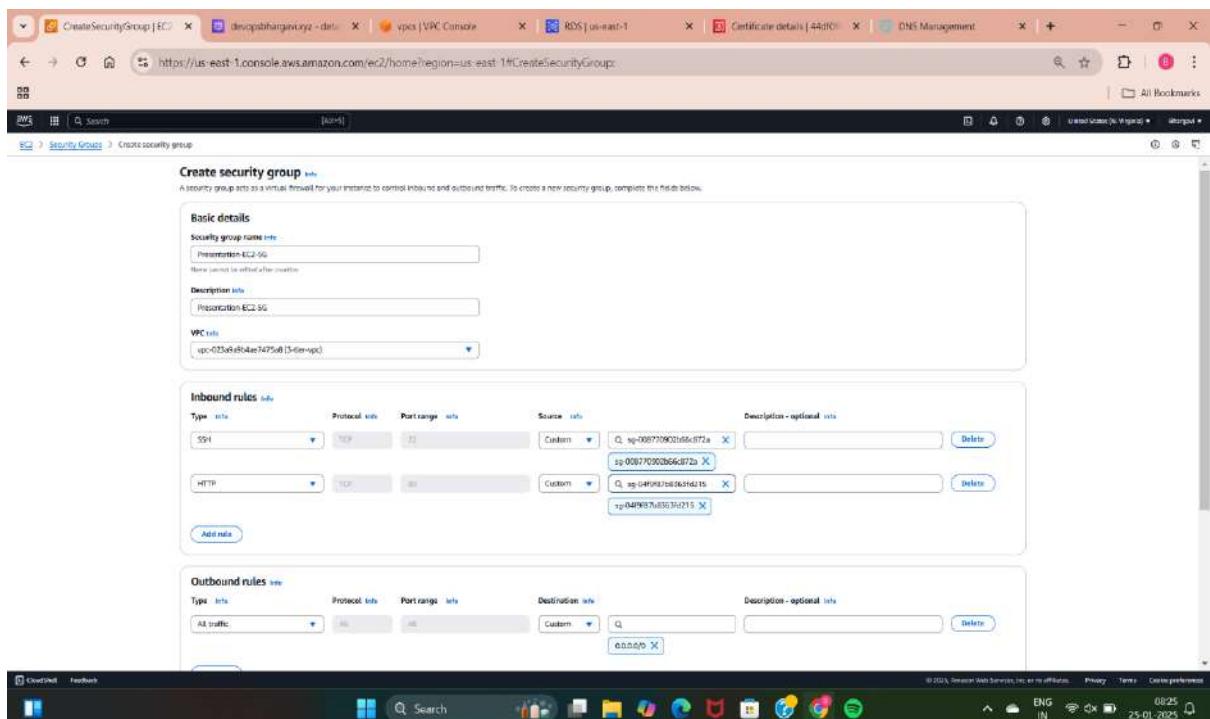
- Under the Inbound rules section, click on Add Rule, select HTTP from the dropdown. This will automatically set the Port Range to 80. Select Anywhere-IPv4 (0.0.0.0/0) to allow HTTP access from any IPv4 address. This is typical for an ALB that handles web traffic from the internet.
  - Click Create Security Group.



- ♣ The Presentation-ALB-SG security group is created.

#### 4.3: CREATING SECURITY GROUP FOR PRESENTATION TIER EC2

Click on Create Security Group at the top of the page.



- ♣ Enter Presentation-EC2-SG as the name of the security group.

- ♣ Select the VPC you created earlier, which is 3-Tier-Architecture.
- ♣ Under the Inbound rules section, click on Add Rule. Select SSH from the dropdown (this will automatically set the Port Range to 22). Select Custom and choose the Bastion-Host security group to restrict SSH access to only the Bastion Host.
- ♣ Click on Add Rule again.
- ♣ Select HTTP from the dropdown (this will automatically set the Port Range to 80). Select Custom and choose the Presentation-Tier-ALB security group to allow HTTP traffic from the ALB only.
- ♣ Once added both inbound rules, click Create Security Group.

The screenshot shows the AWS CloudFormation console with the following details:

**Security group sg-005765f4fadcb4124 - Presentation-EC2-SG**

**Details**

- Security group name:** Presentation-EC2-SG
- Security group ID:** sg-005765f4fadcb4124
- Description:** Presentation-EC2-SG
- VPC ID:** vpc-0924efdd123456789
- User:** 905418355089
- Inbound rules count:** 2 Permission entries
- Outbound rules count:** 1 Permission entry

**Inbound rules (2)**

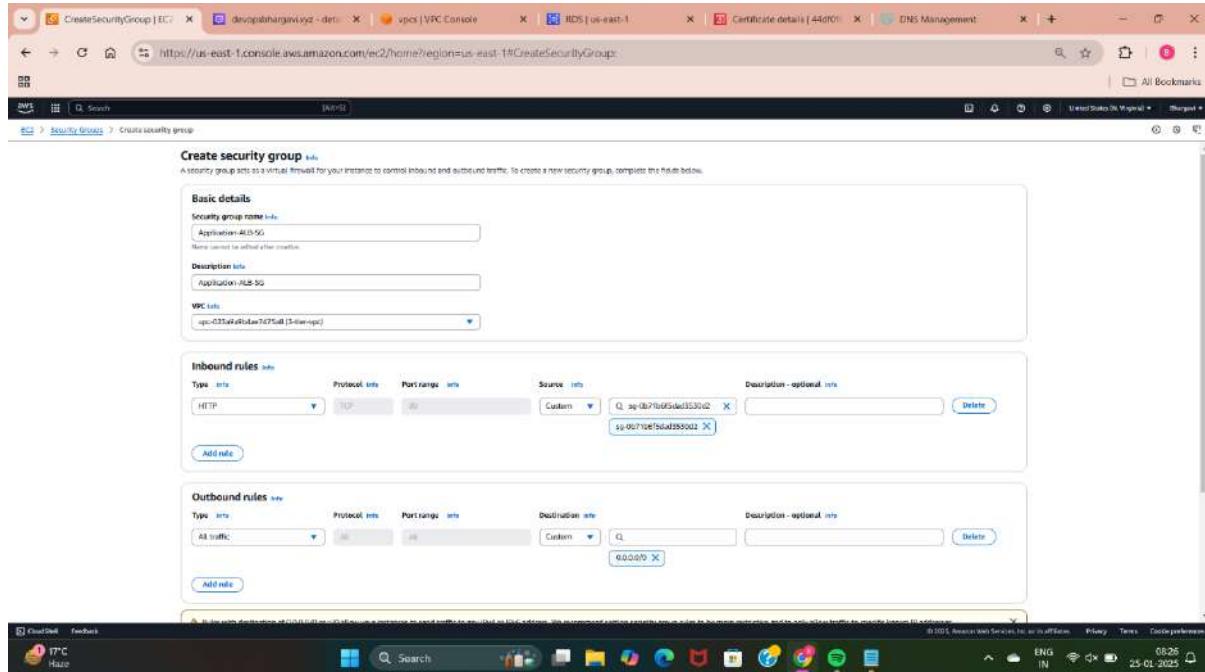
Name	Security group rule ID	IP version	Type	Protocol	Port range	Source
-	sg-0645cf5d837148e95	-	SSH	TCP	22	sg-0924efdd123456789 / Bastion-Host
-	sg-0ba5719c9af6f6834	-	HTTP	TCP	80	sg-0924efdd123456789 / Presentation-ALB-SG

This security group will allow:

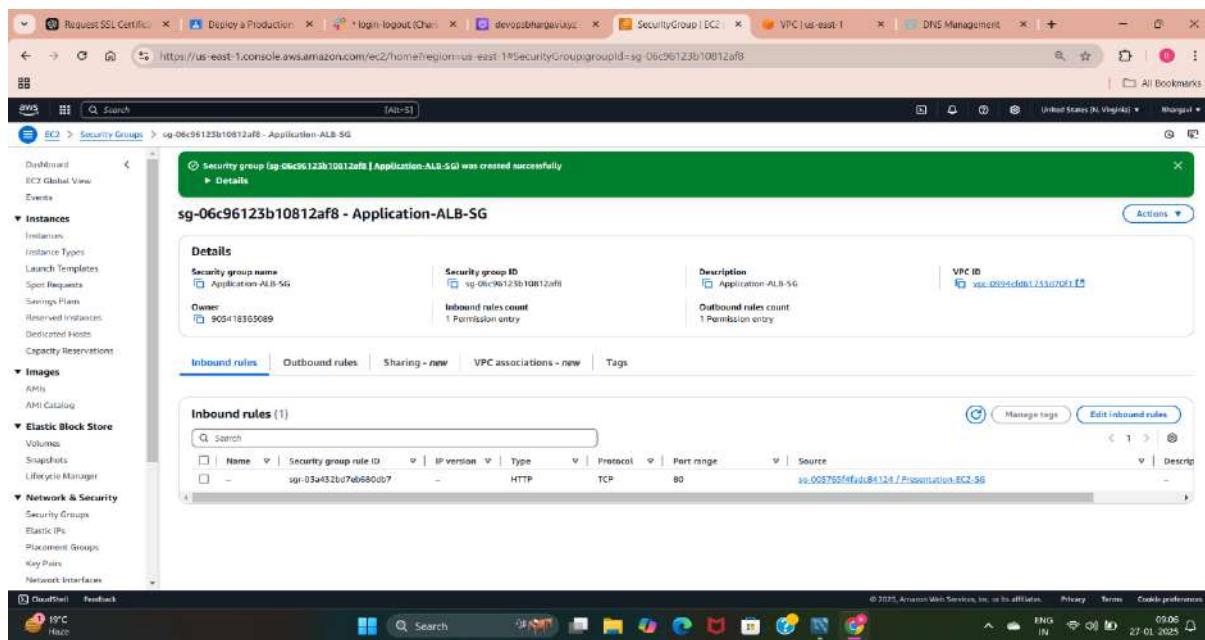
- ♣ SSH access from the Bastion Host (for management purposes).
- ♣ HTTP traffic from the Presentation-Tier-ALB (so the ALB can forward requests to the EC2 instances).

## 4.4: CREATING SECURITY GROUP FOR APPLICATION TIER ALB

Click on Create Security Group at the top of the page.

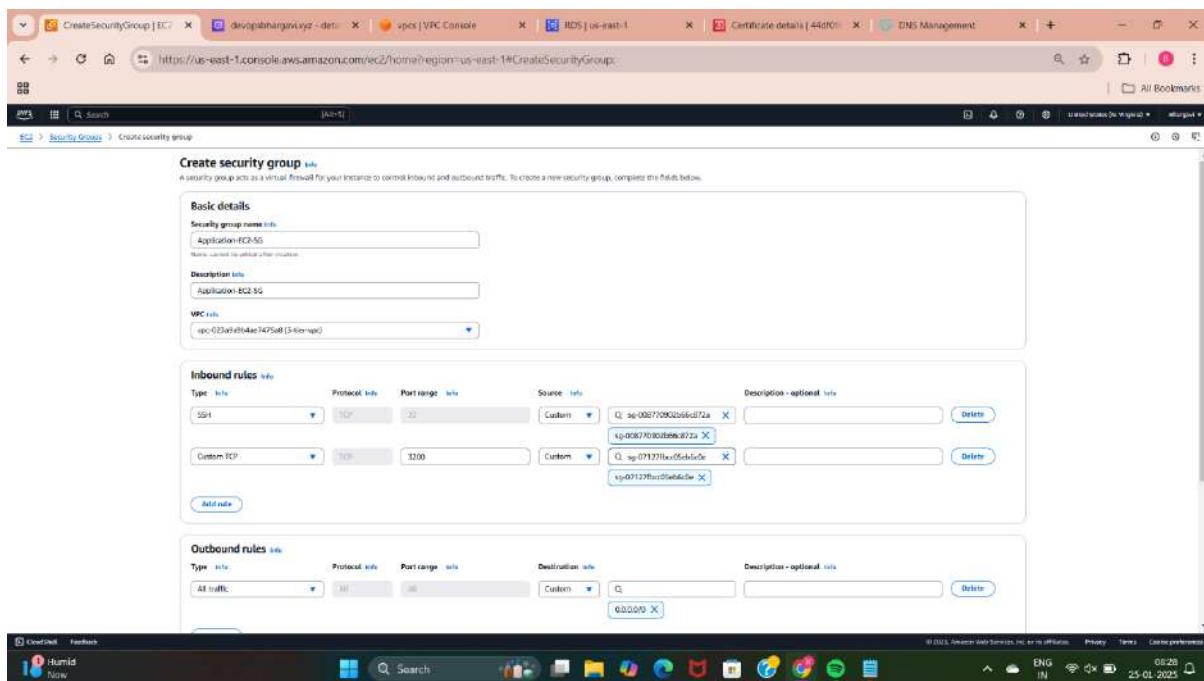


- Enter Application-ALB-SG as the name of the security group.
- Select the VPC you created earlier, which is 3-Tier-Architecture.
- Select HTTP from the dropdown (this will automatically set the Port Range to 80). Select Custom and choose the Presentation-Tier-EC2 security group to allow HTTP traffic only from the Presentation Tier EC2 instances.
- Click Create Security Group



- It is allowing HTTP traffic from the Presentation-Tier-EC2 security group (so the Application Tier ALB can communicate with the EC2 instances in the Application Tier).

## 4.5: CREATE SECURITY GROUP FOR APPLICATION TIER EC2



- ♣ Enter Application-EC2-SG as the name of the security group.
- ♣ Select the VPC you created earlier, which is 3-Tier-Architecture

### Rule 1: SSH from Bastion Host

- ♣ Under the Inbound rules section, click on Add Rule.
- ♣ Select SSH from the dropdown (this will automatically set the Port Range to 22).
- ♣ Source:Select Custom and choose the Bastion-Host security group to restrict SSH access to only the Bastion Host.

### Rule 2: Custom TCP for 3200 from App-Tier-ALB

- ♣ Click on Add Rule again.
- ♣ Type: Select Custom TCP from the dropdown.
- ♣ Port Range: Enter 3200 as the port number.
- ♣ Source: Select Custom and choose the Application-Tier-ALB security group to allow traffic on port 3200 from the ALB only.
- ♣ Click Create Security Group.

This security group will allow:

- ♣ SSH access from the Bastion Host (for management purposes).
- ♣ Custom TCP traffic on port 3200 from the Application-Tier-ALB (for communication between the ALB and EC2 instances in the Application Tier).

## 4.6: CREATE SECURITY GROUP FOR DATA TIER

- ♣ Enter Data-Tier as the name of the security group.
- ♣ Select the VPC you created earlier, which is 3-Tier-Architecture.

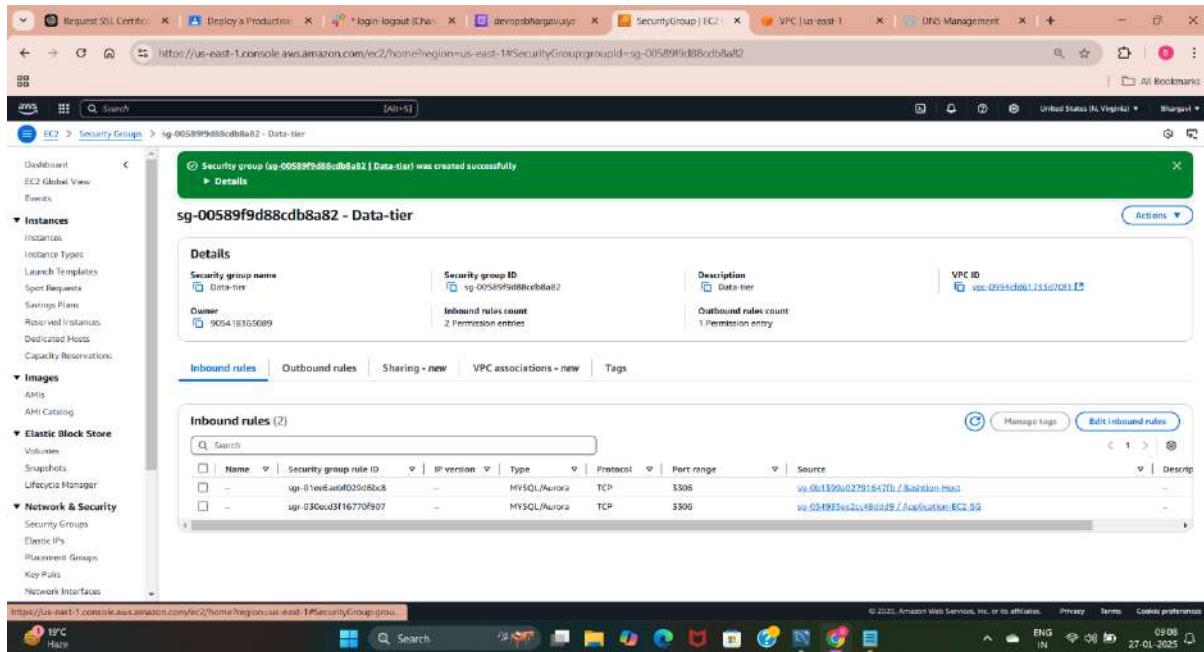
### Rule 1: MySQL/Aurora from Bastion Host

- ♣ Under the Inbound rules section, click on Add Rule.

- ♣ Type: Select MySQL/Aurora from the dropdown (this will automatically set the Port Range to 3306).
- ♣ Source: Select Custom and choose the Bastion-Host security group to allow MySQL traffic from the Bastion Host.

### Rule 2: MySQL/Aurora from Application-Tier-EC2

- ♣ Click on Add Rule again.
- ♣ Type: Select MySQL/Aurora from the dropdown (this will automatically set the Port Range to 3306).
- ♣ Source: Select Custom and choose the Application-Tier-EC2 security group to allow MySQL traffic from the EC2 instances in the Application Tier.
- ♣ Click Create Security Group.



This security group will allow:

- ♣ MySQL/Aurora traffic on port 3306 from the Bastion Host (for administrative access).
- ♣ MySQL/Aurora traffic on port 3306 from the Application-Tier-EC2 security group (for communication between the EC2 instances in the Application Tier and the Data Tier).

## BASTION HOST:

A Bastion Host is a special-purpose EC2 instance in a public subnet that provides secure access to instances in a private subnet via SSH or RDP. It acts as a jump server to prevent exposing private instances directly to the internet.

### Secure Access to Private Instances

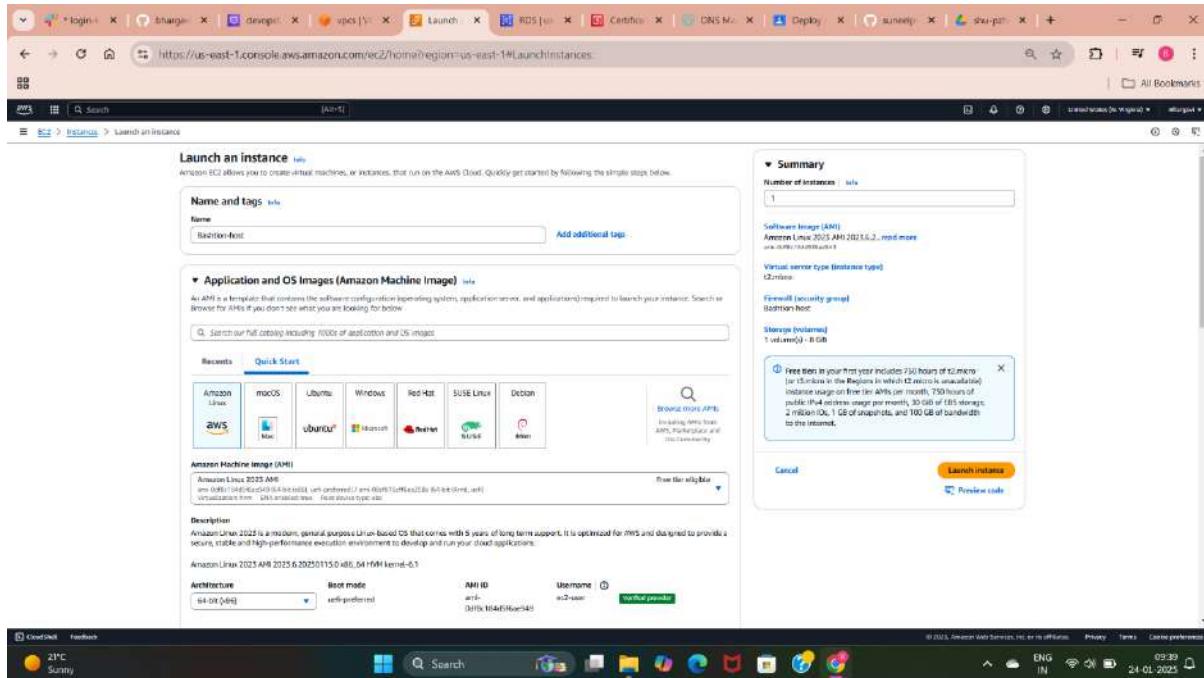
- Since private instances don't have public IPs, you can't directly SSH into them.
- The Bastion Host allows controlled access without exposing the entire network.

### Minimizes Attack Surface

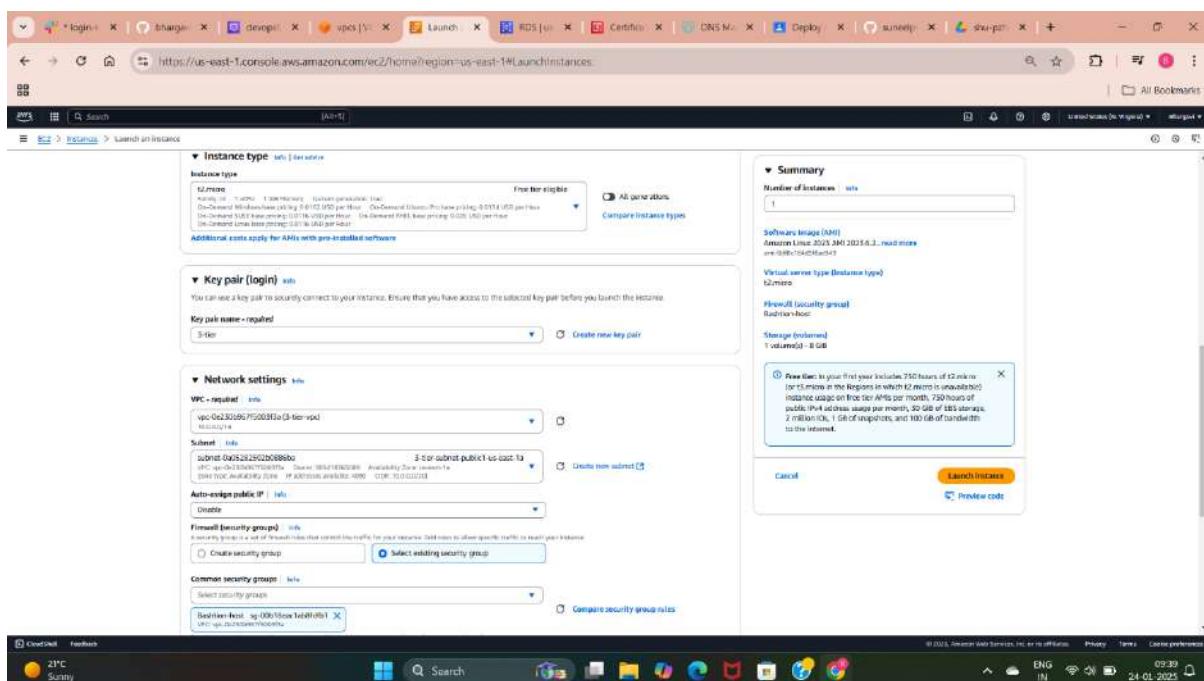
- Instead of exposing all instances to the internet, only one Bastion Host is publicly accessible.
- You can restrict access using security groups and IAM policies.

## STEP 5: LAUNCHING BASTION HOST

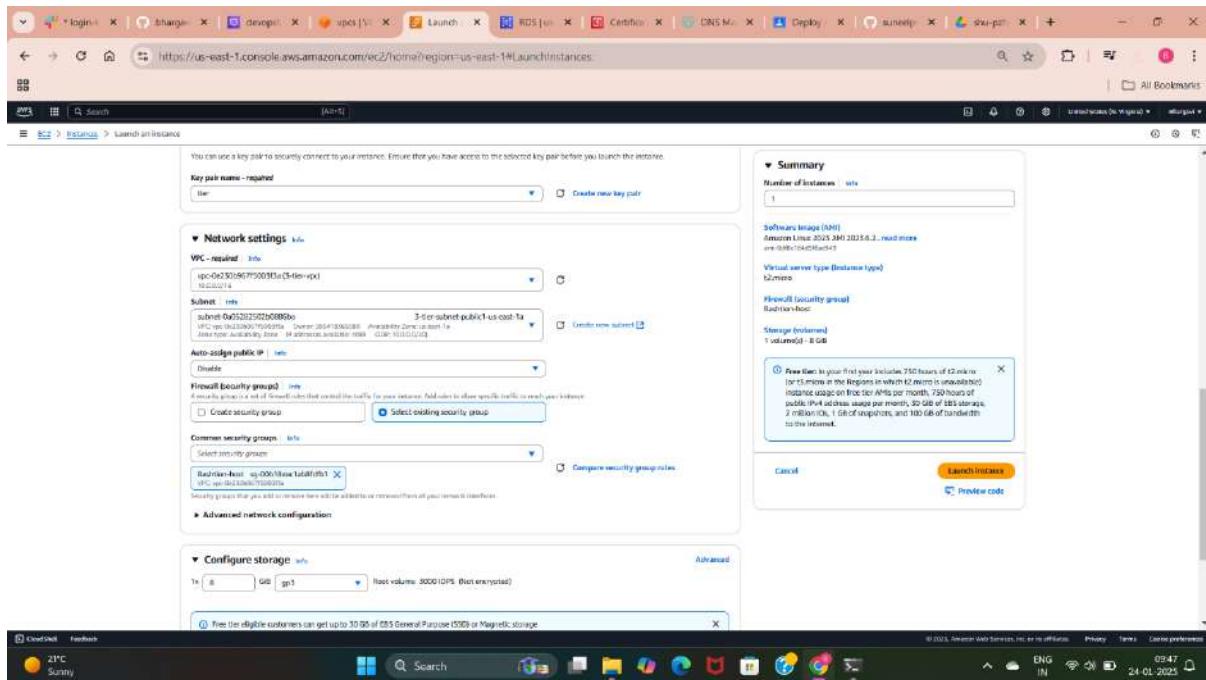
- Navigate to Services and search for EC2 under the "Compute" section.
- In the EC2 Dashboard, click on Launch Instance to create a new instance.



- Enter Bastion-Host as the name for your instance.
- AMI: Select Amazon Linux 2023 AMI (or another appropriate version for your needs).



- Instance Type: Select t2.micro (this is typically eligible for the free tier).



- Key Pair: Select an existing key pair or create a new one (tier.pem).
- Select the VPC 3-tier that you created earlier.
- Subnet: Select one of the Public Subnets you created (ensure this subnet has auto-assign Public IP enabled).
- Select the Bastion-Host security group that you created earlier. This ensures that the Bastion Host only allows SSH access from authorized sources (e.g., your IP or the VPC).
- Once everything looks good, click on Launch Instance.

## RELATIONAL DATABASE SERVICE (RDS):

Amazon Relational Database Service (RDS) is a managed database service that helps you easily set up, operate, and scale a relational database in the AWS Cloud. It automates time-consuming database tasks like provisioning, backups, patching, and scaling.

### Fully Managed Database

- AWS handles automatic backups, patching, scaling, and monitoring.
- Reduces manual effort compared to self-managed databases on EC2.

### High Availability & Reliability

- Multi-AZ Deployment: Creates a standby copy in another Availability Zone for failover.
- Read Replicas: Improves performance by distributing read traffic.

### Scalability

- Vertical Scaling: Change instance size (e.g., from db.t3.micro to db.m5.large).
- Horizontal Scaling: Add Read Replicas to distribute read queries.

### Security & Compliance

- Encryption (AWS KMS) for data at rest and in transit.
- IAM-based access control and VPC security groups to restrict access.

- Automated backups for disaster recovery.

#### Cost-Effective

- Pay-as-you-go pricing model (only pay for what you use).
- Reserved Instances for long-term savings.

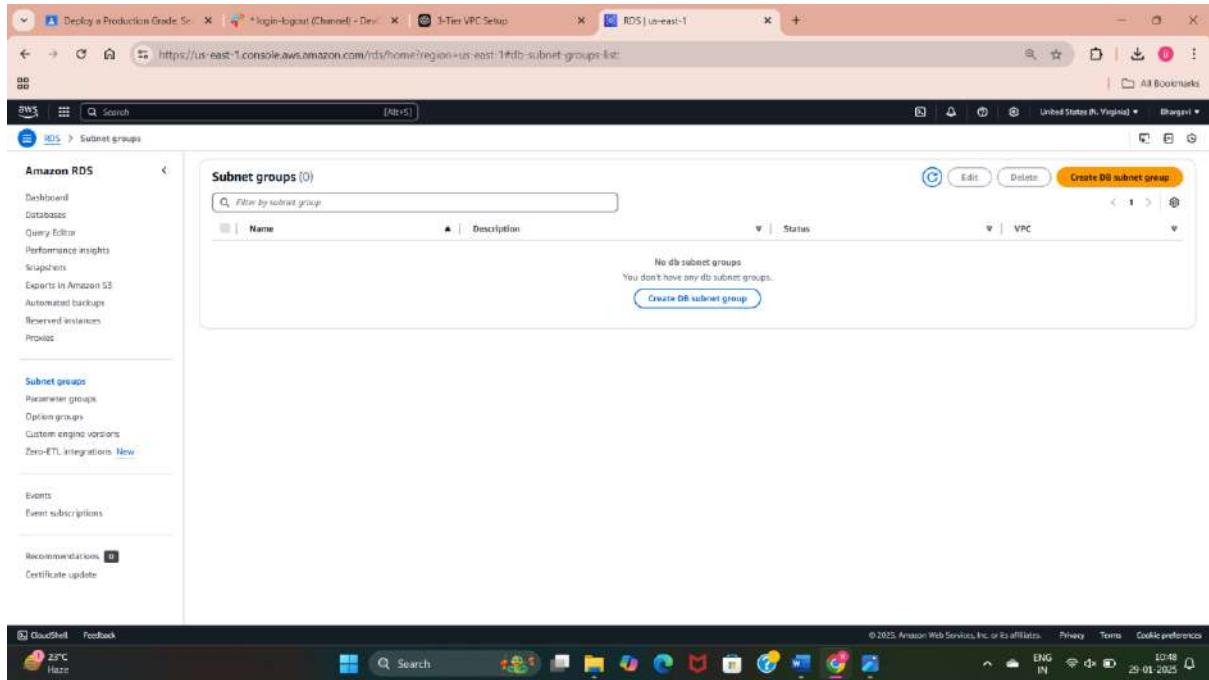
## MYSQL WORKBENCH

MySQL Workbench is a GUI (Graphical User Interface) tool provided by MySQL for designing, managing, and administering MySQL databases. It allows users to interact with MySQL databases visually instead of using command-line queries.

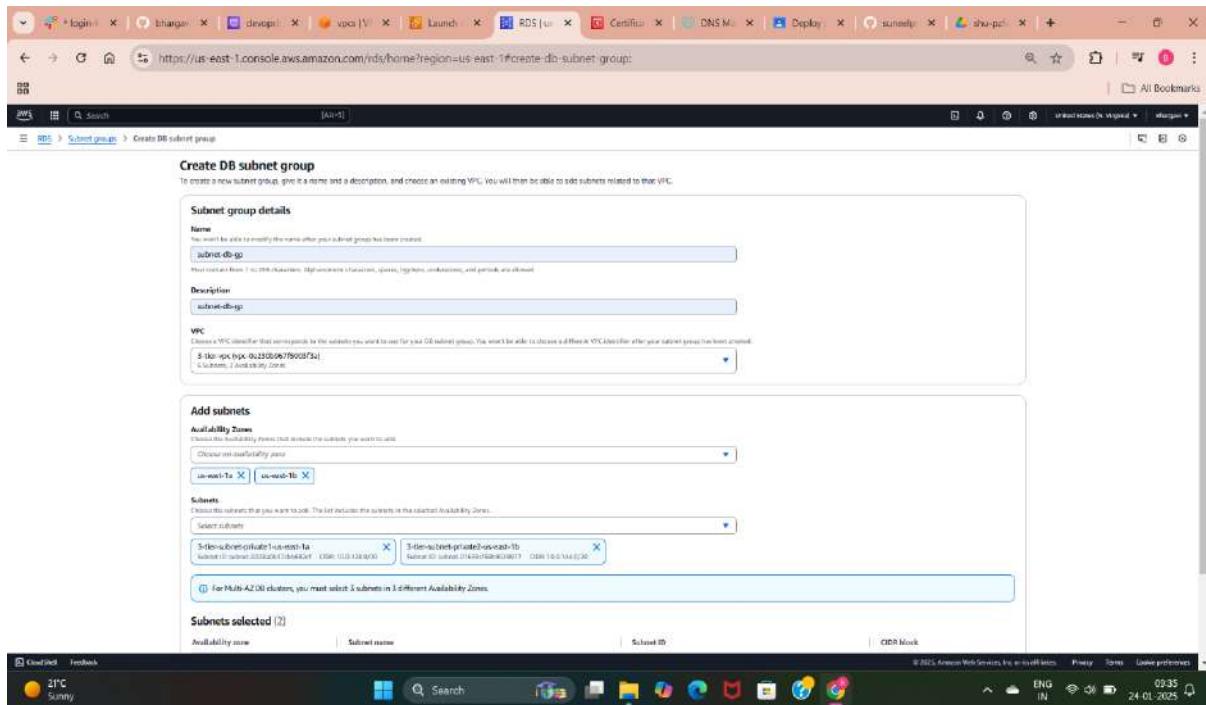
## STEP 6: SETUP DATA TIER WITH RDS

### 6.1 CREATE DB SUBNET GROUP

- ➲ Navigate to Services and search for RDS under the "Database" section.
- ➲ In the RDS Dashboard, on the left-hand side, click on Subnet Groups under Network & Security.

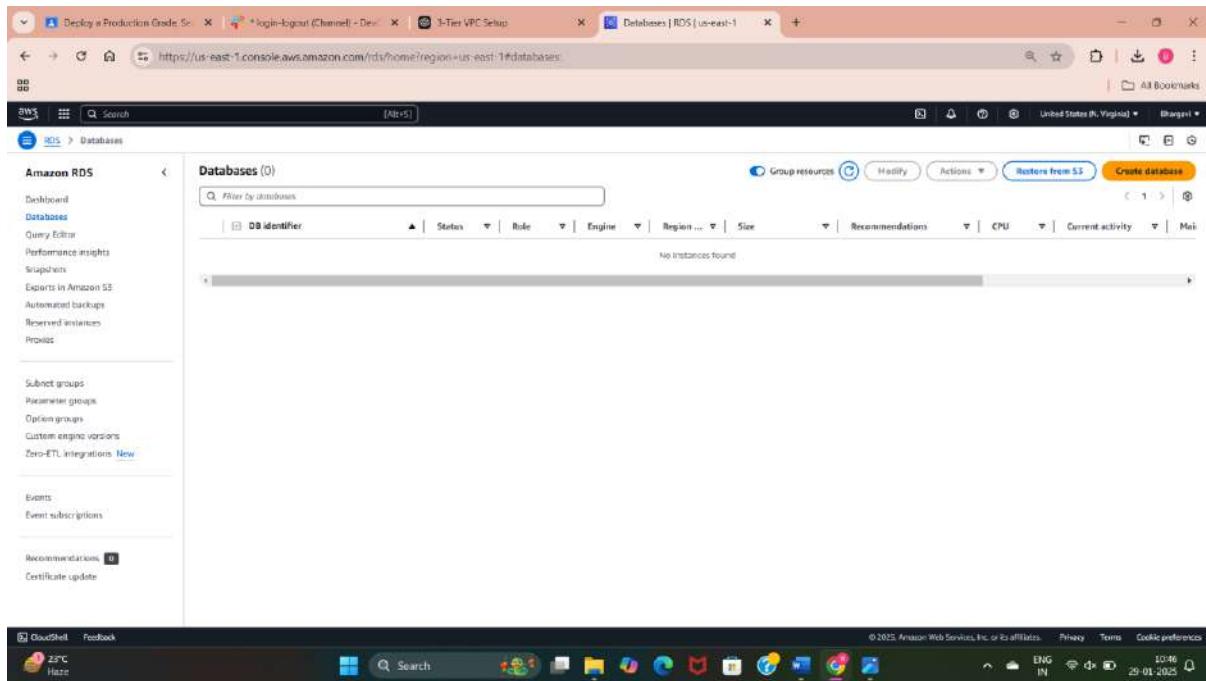


- ➲ Click on Create DB Subnet Group at the top of the page.

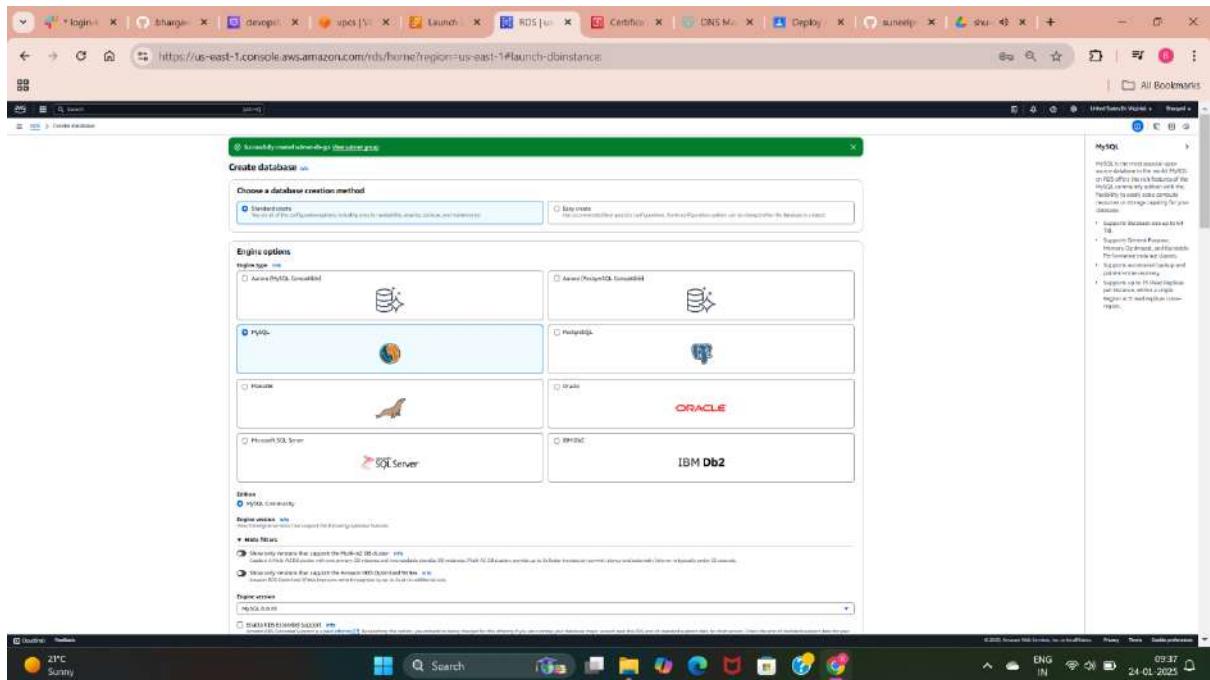


- ⇒ Enter subnet-db-gp as the name of your DB Subnet Group.
- ⇒ Select the VPC 3-tier you created earlier.
- ⇒ Select both Availability Zones that you created subnets in (for high availability).
- ⇒ Select 2 Private Subnets (to ensure your database instances are not exposed to the public internet).
- ⇒ Click on Create Subnet Group after completing these configurations.
- ⇒ After creating the subnet group, return to the RDS Dashboard and click on Databases.

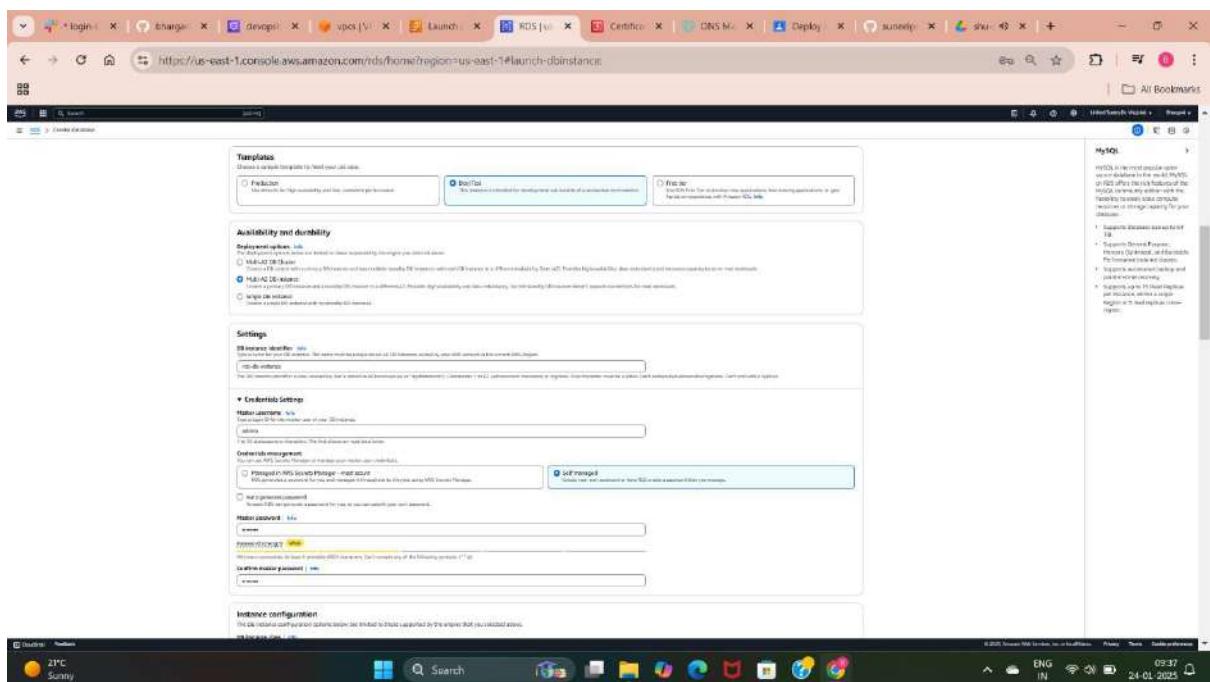
## 6.2 CREATE DATABASE



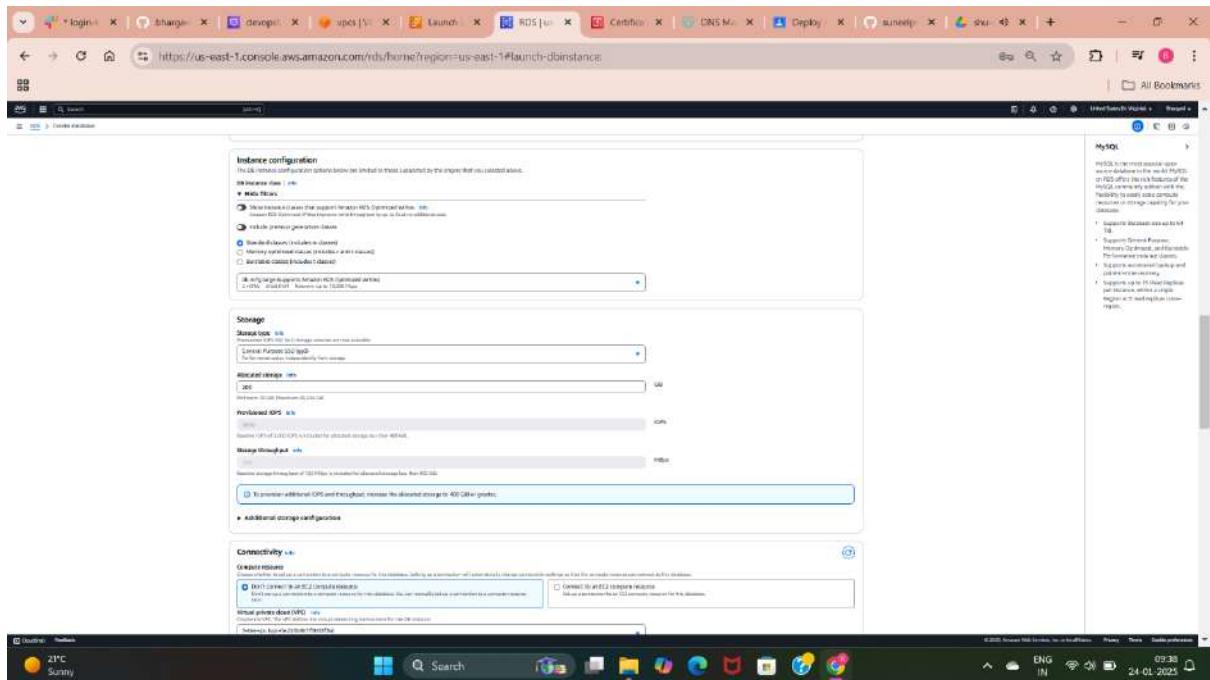
- ⇒ Click on Create Database to start the database creation process.



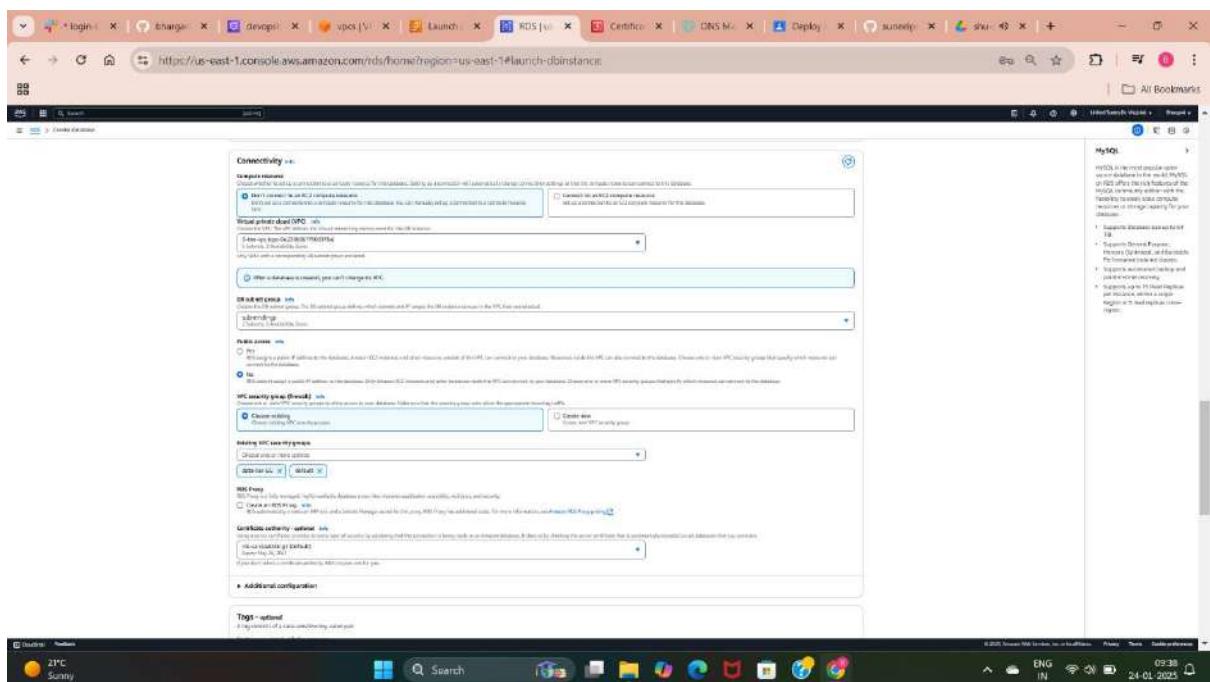
- ⦿ Select Standard and choose SQL (choose the specific SQL database engine like MySQL, PostgreSQL, or others depending on your needs).



- ⦿ Select the dev/test template (suitable for development or testing environments).
- ⦿ Select Multi-AZ deployment to enable high availability.
- ⦿ Configure other settings like DB instance identifier, username, password, storage, etc.
- ⦿ Enter dev-db-instance as the identifier for your database instance.
- ⦿ Select Self-managed and enter the password as admin123 (make sure to remember or store the password securely).



- Select the appropriate instance class for your requirements (e.g., db.m7g.large for testing purposes).



- Under the VPC section, select the 3-Tier VPC.
- For the DB Subnet Group, select the dev-db-subnet-group you created earlier.
- Configure backup retention, monitoring, and other settings according to your needs (you can leave the defaults for now).
- Review all settings and click on Create database.

The screenshot shows the AWS RDS console with a success message: "Successfully created database rds-db-instance". The instance details are as follows:

- DB Identifier:** rds-db-instance
- Status:** Available
- Engine:** MySQL Community
- Region & AZ:** us-east-1a
- Current activity:** Creating
- CPU Utilization:** 0.00%
- Memory Utilization:** 0.00%
- Storage Utilization:** 0.00%
- Connectivity & security:**
  - Endpoint:** rds-db-instance-clas.ssh.us-east-1.rds.amazonaws.com
  - Port:** 3306
  - Subnet group:** auto-subgroup
  - Subnets:** auto-subgroup-1 (auto-subgroup-1), auto-subgroup-2 (auto-subgroup-2)
  - Network type:** IPv4
- Networking:**
  - Availability Zone:** us-east-1a
  - VPC:** Vpc-1234567890 (vpc-1234567890)
  - Subnet group:** auto-subgroup
  - Subnets:** auto-subgroup-1 (auto-subgroup-1), auto-subgroup-2 (auto-subgroup-2)
- Security:**
  - VPC security groups:** Security group (sg-012345678901234567)
  - Publicly accessible:** No
  - Certificate authority:** None
  - Certificate authority date:** May 26, 2021, 09:04 UTC (09:04:50)
  - DB instance certificate expiration date:** January 24, 2026, 09:45 UTC (09:45:09)

- Once the database is created, we can view it in the RDS dashboard. The instance will be deployed with Multi-AZ for high availability.

## CONNECT TO YOUR RDS DATABASE

```

Microsoft Windows [Version 10.0.22631.4751]
(c) Microsoft Corporation. All rights reserved.

C:\Users\bhava>cd Downloads
C:\Users\bhava\Downloads>cd "AWS CLASS"
C:\Users\bhava\Downloads\AWS CLASS>ssh-add tier.pem
Identity added: tier.pem (tier.pem)

C:\Users\bhava\Downloads\AWS CLASS>

```

- Open Command Prompt for Windows/Terminal and locate the path of your Keypair
- To add key to SSH Agent use “ssh-add your\_key.pem(tier.pem)”.

```
Command Prompt - ssh -N -L
Microsoft Windows [Version 10.0.22631.4751]
(c) Microsoft Corporation. All rights reserved.

C:\Users\bhava>cd Downloads
C:\Users\bhava\Downloads>cd "AWS CLASS"
C:\Users\bhava\Downloads\AWS CLASS>ssh-add tier.pem
Identity added: tier.pem (tier.pem)

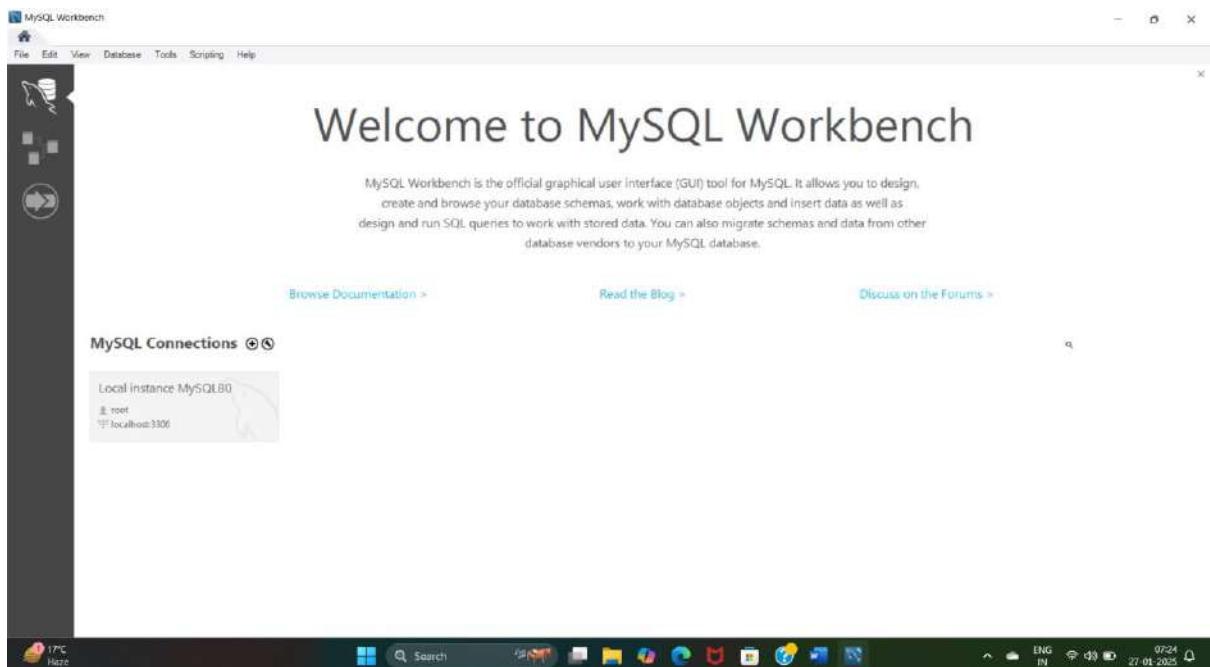
C:\Users\bhava\Downloads\AWS CLASS>ssh -N -L 3307:dev-rds-db-instance.c1au2u6sigra.us-east-1.rds.amazonaws.com:3306 ec2-user@ec2-44-199-210-102.compute-1.amazonaws.com
The authenticity of host 'ec2-44-199-210-102.compute-1.amazonaws.com (44.199.210.102)' can't be established.
ED25519 key fingerprint is SHA256:fibeACWTAtZAprWSWH54fsl1BXnXXd5/cYKfsPgag.
This key is not known by any other names.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added 'ec2-44-199-210-102.compute-1.amazonaws.com' (ED25519) to the list of known hosts.

|
```

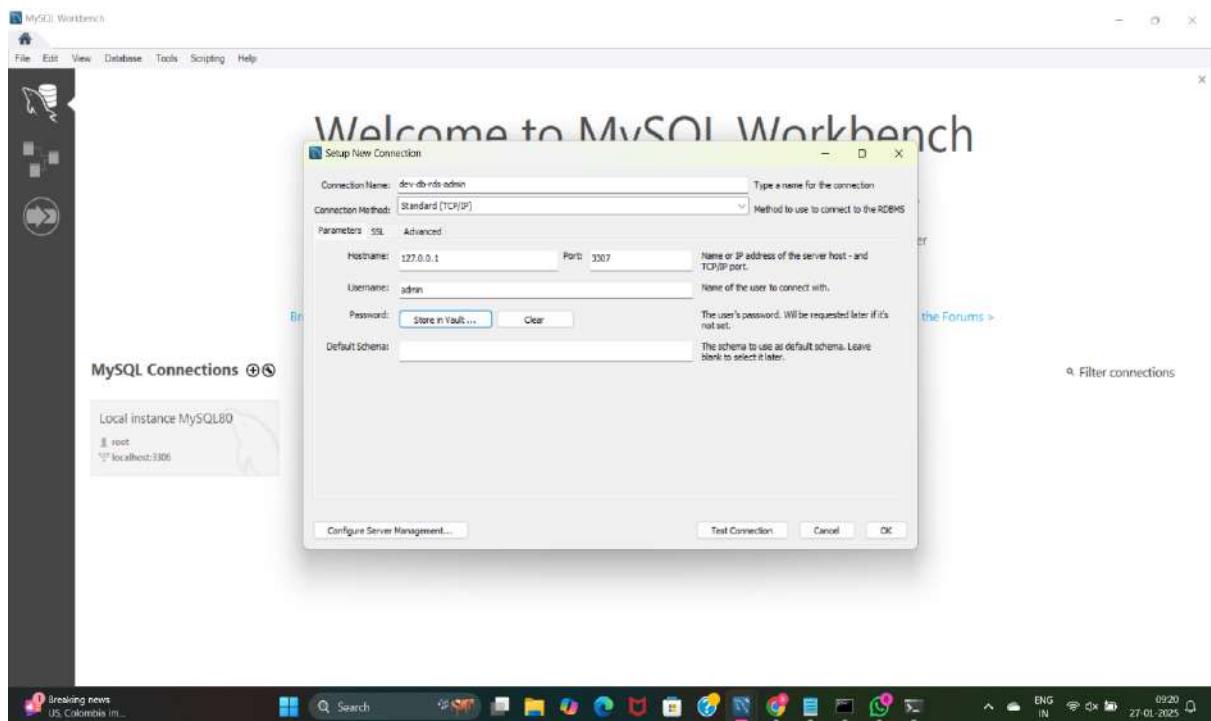
- ☛ Connect to Database using

“ssh -N -L 3307:<Database-endpoint>:3306 ec2-user@bastion\_host\_public\_ip”.

- ☛ Download MySQL Workbench.
- ☛ Open MySQL Workbench.

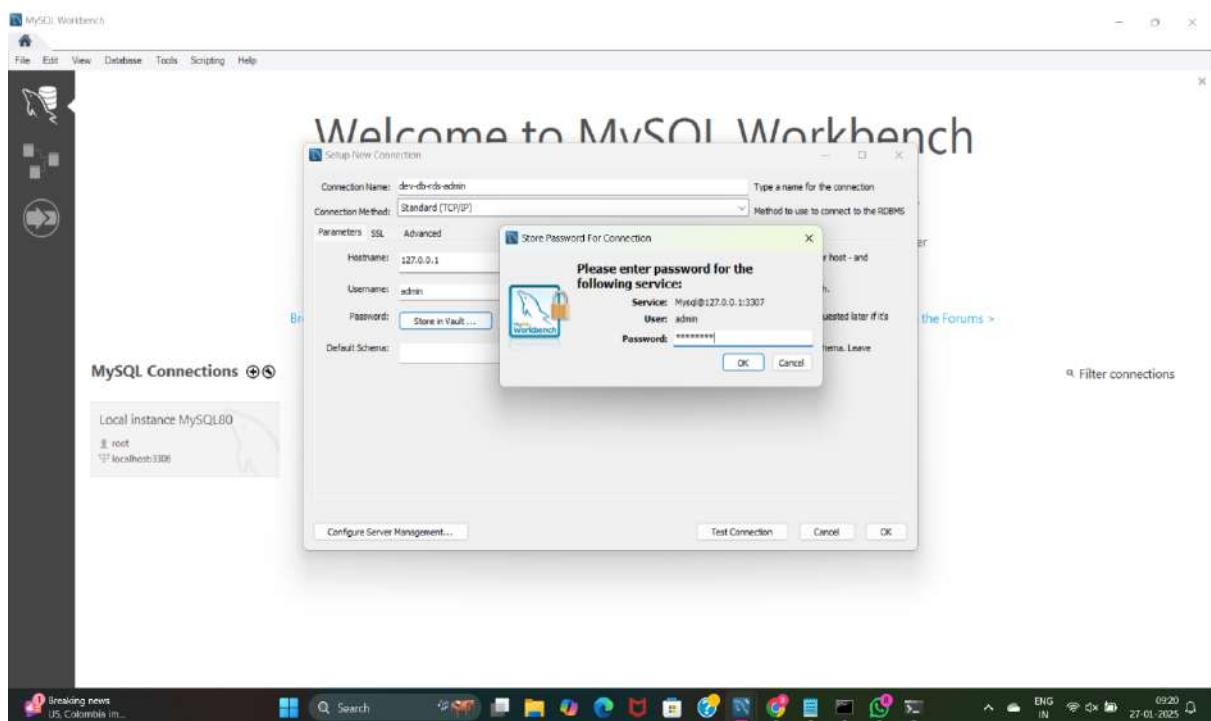


- ☛ Click the “+” symbol next to MySQL Connections to create a new connection.

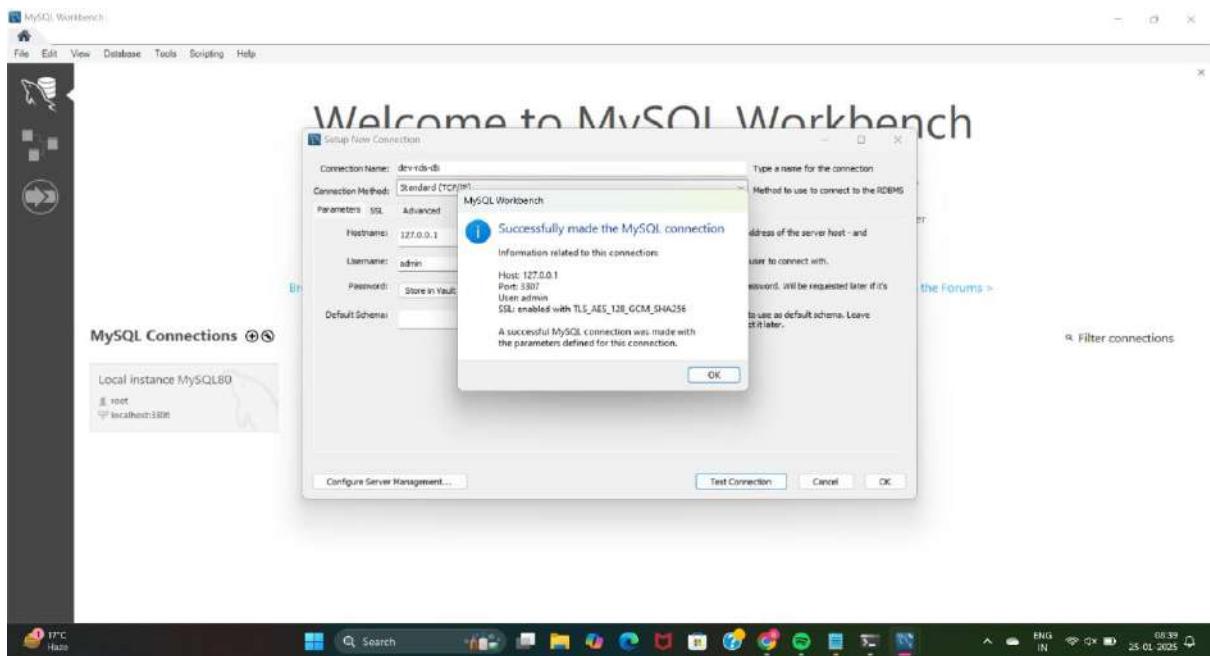


Fill in the following details:

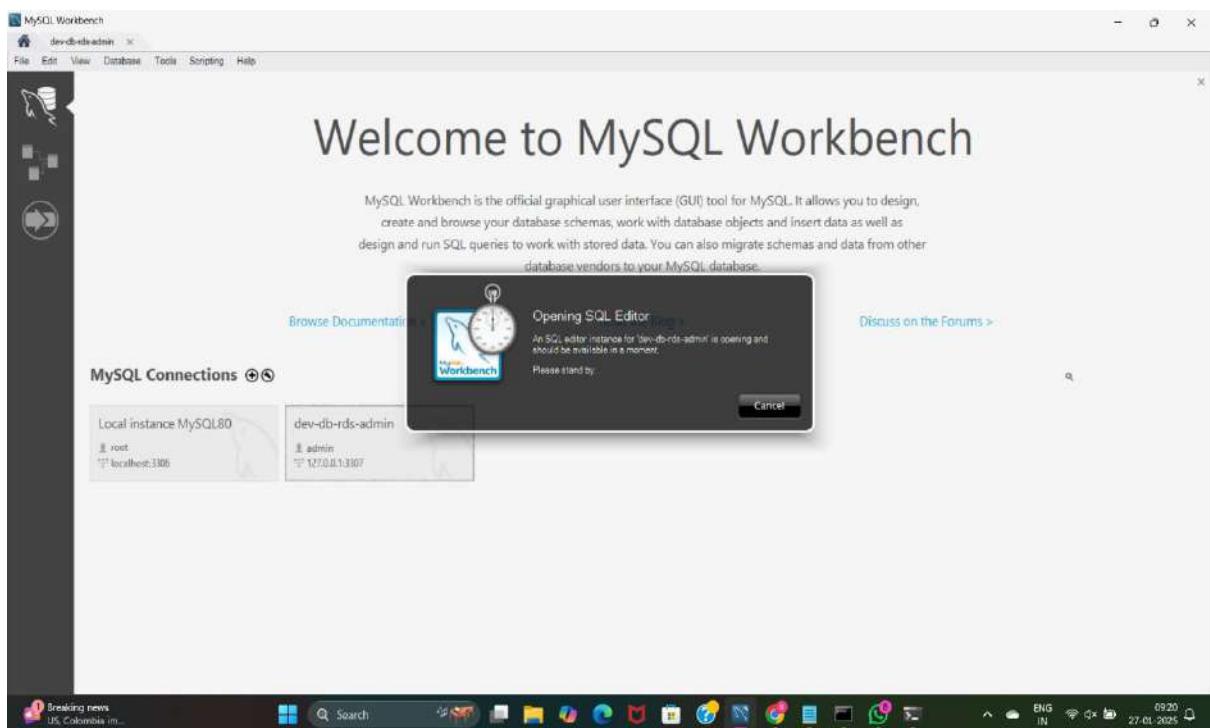
- ⌚ Connection Name: dev-rds-db
- ⌚ Port: 3307 (or the port you've configured; usually, MySQL uses port 3306, but change this if your setup uses 3307).
- ⌚ Username: admin (the master username you set during RDS creation).



- ⌚ Password: Click on Store in Vault or Store in Keychain, and enter the password admin123.



- ⦿ Click Test Connection. If successful, it will confirm the connection. Click OK to save.



- ⦿ Click on the newly created connection (dev-rds-db) from the MySQL Workbench homepage.
- ⦿ This will open the SQL Editor for the connected RDS instance.

The screenshot shows the MySQL Workbench interface. In the Query Editor (Query 1), the following SQL script is run:

```

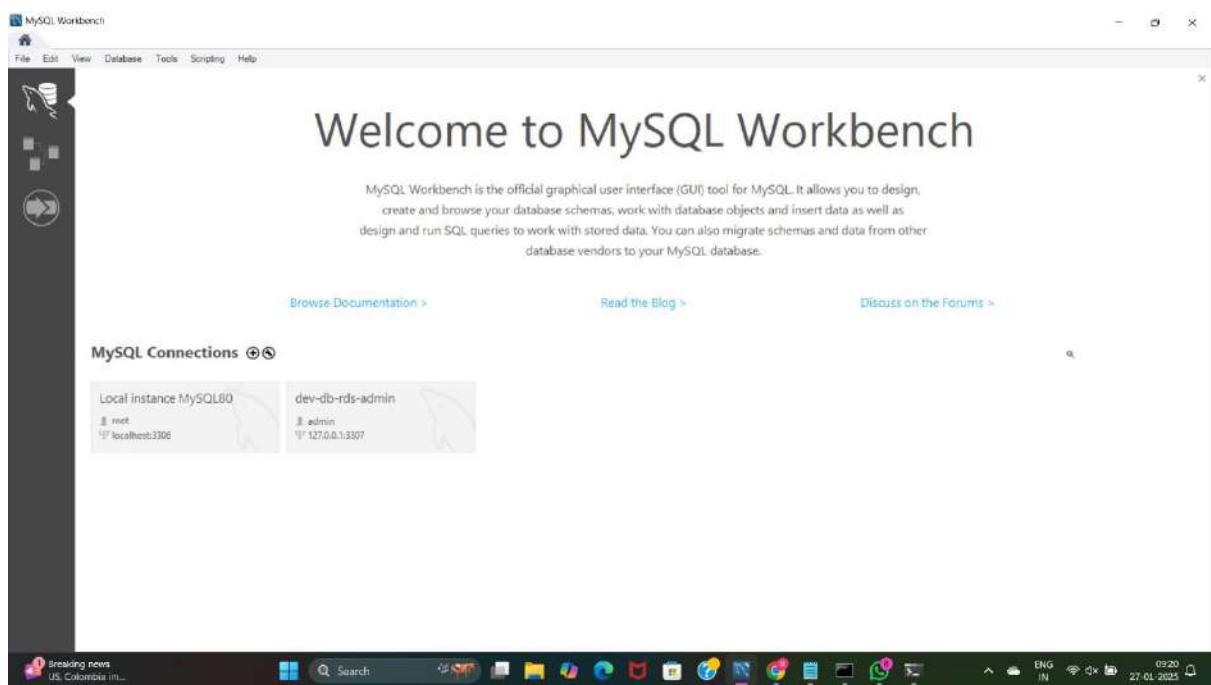
1 * CREATE DATABASE react_node_app;
2 * CREATE USER 'appuser'@'%' IDENTIFIED BY 'admin123';
3 * GRANT ALL PRIVILEGES ON react_node_app.* TO 'appuser'@'%';
4 * FLUSH PRIVILEGES;

```

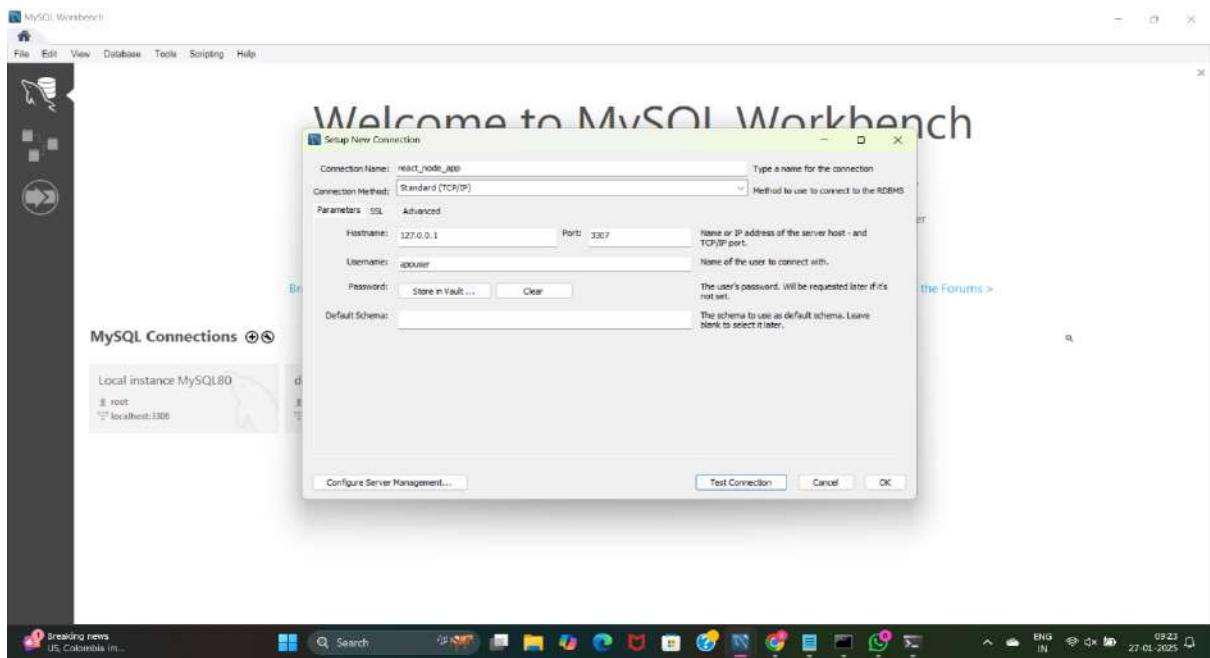
The SQL Editor panel displays the results of the execution:

Action	Time	Message	Duration / Fetch
CREATE DATABASE react_node_app	08:39:40	1 row(s) affected	0.219 sec
CREATE USER 'appuser'@'%' IDENTIFIED BY 'admin123'	08:39:40	0 row(s) affected	0.265 sec
GRANT ALL PRIVILEGES ON react_node_app.* TO 'appuser'@'%'	08:39:41	0 row(s) affected	0.313 sec
FLUSH PRIVILEGES	08:39:41	0 row(s) affected	0.312 sec

- >Create the new database with the name “react\_node\_app” with username and password using above script and run the script by selecting all lines.

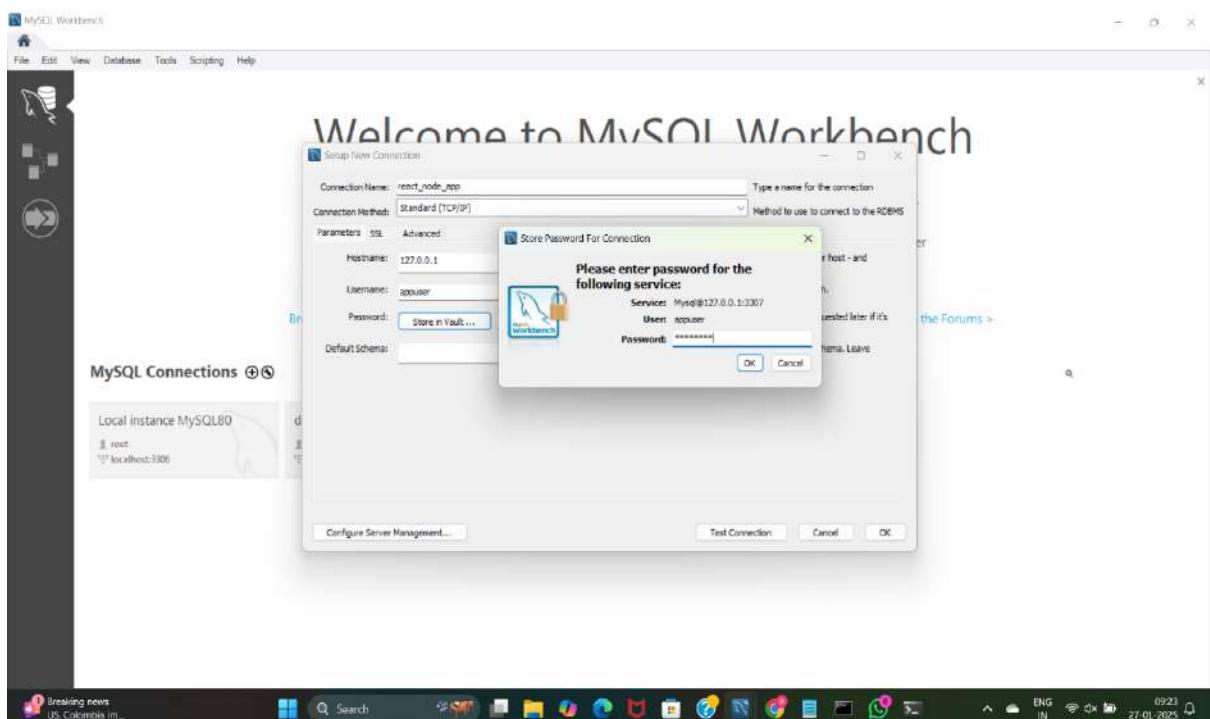


- Go back to the MySQL Workbench Home screen.
- Click “+” to create a new connection.

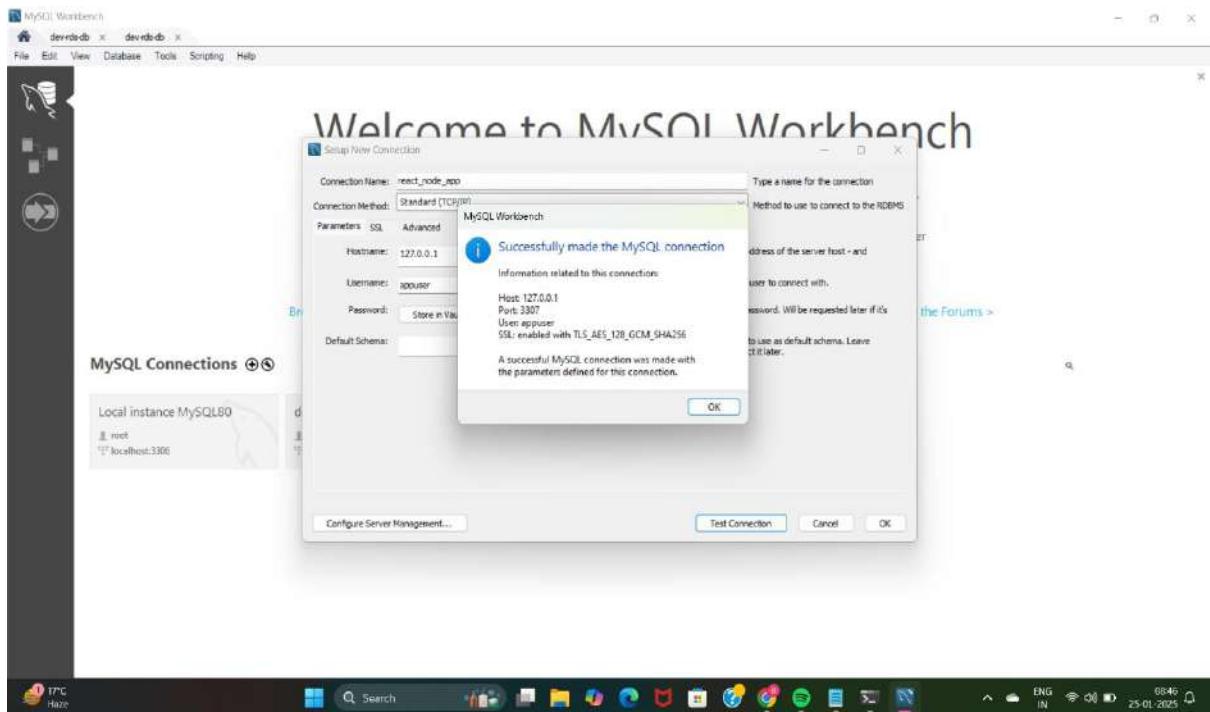


Fill the details :

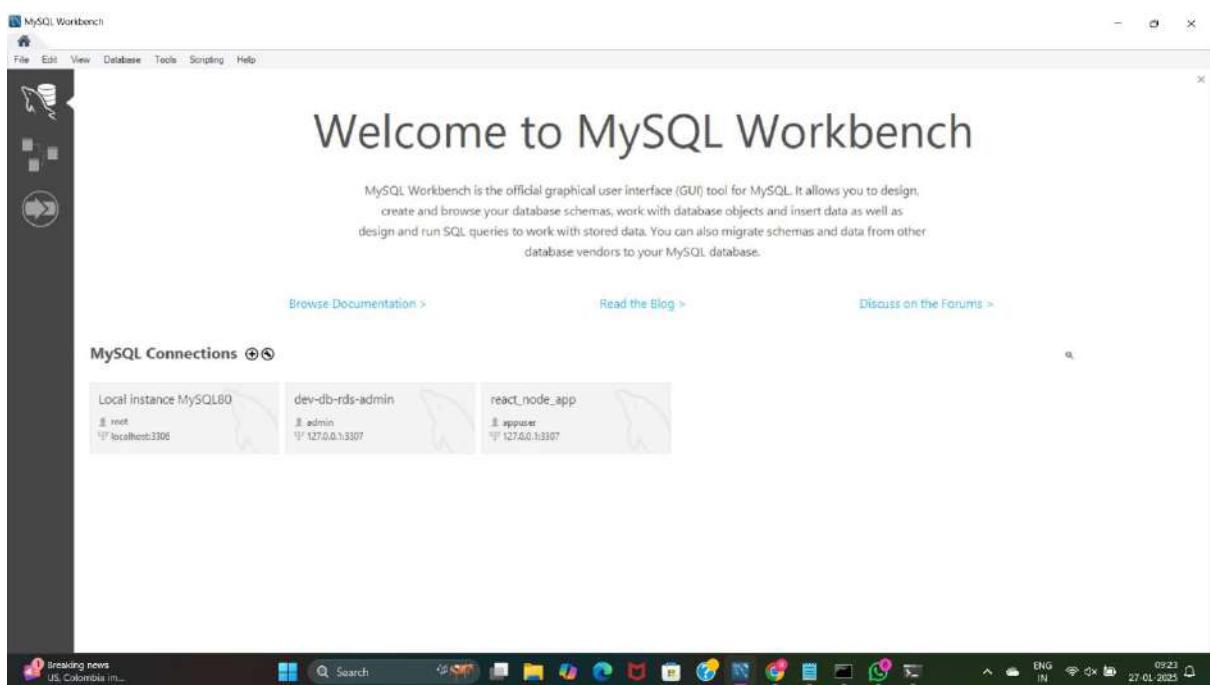
- ➲ Name: rds-dev-db-appuser
- ➲ Hostname: Your RDS endpoint
- ➲ Port: 3307
- ➲ Username: appuser



- ➲ Password: admin123 (store in vault/keychain)



⌚ Test the connection and click OK if successful.



⌚ Open newly created database and run some queries.

```

MySQL Workbench
File Edit View Query Database Server Tools Scripting Help
File Edit View Query Database Server Tools Scripting Help
Navigator
SCHEMAS
react_node_app
Tables Views Stored Procedures Functions
Query 1
CREATE TABLE `book` (
  `id` int NOT NULL AUTO_INCREMENT,
  `title` varchar(255) NOT NULL,
  `releasedate` date NOT NULL,
  `description` text NOT NULL,
  `pages` int NOT NULL,
  `createdAt` date NOT NULL,
  `updatedAt` date NOT NULL,
  `authorId` int DEFAULT NULL,
  PRIMARY KEY (`id`),
  KEY `FK_66aa0f0747943ab959c1secf90b2` (`authorId`),
  CONSTRAINT `FK_66aa0f0747943ab959c1secf90b2` FOREIGN KEY (`authorId`) REFERENCES `author` (`id`)
) ENGINE=InnoDB AUTO_INCREMENT=10 DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4_0900_ci_ci;
-- Restore Data
INSERT INTO `author` VALUES (1,'J.K. Rowling (Joanne Kathleen Rowling)', '1965-07-31', 'J.K. Rowling is a British author best known for her Harry Potter series.');
INSERT INTO `book` VALUES (1, 'Harry Potter and the Sorcerer\'s Stone', '1997-07-26', 'On his 11th birthday, Harry Potter discovers that he is the sole survivor of a mysterious massacre investigating a mysterious disappearance');

```

Action Output

Time	Action	Message	Duration / Fetch
1: 08:45:15	User react_node_app	0 rows affected	0.210 sec
2: 08:46:16	CREATE TABLE `author` ( `id` int NOT NULL AUTO_INCREMENT, `name` varchar(255) NOT NULL, `birth` date NOT NULL, `description` text NOT NULL ) ENGINE=InnoDB AUTO_INCREMENT=10 DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4_0900_ci_ci;	0 rows affected	0.296 sec
3: 08:46:16	CREATE TABLE `book` ( `id` int NOT NULL AUTO_INCREMENT, `title` varchar(255) NOT NULL, `releasedate` date NOT NULL, `description` text NOT NULL, `pages` int NOT NULL, `createdAt` date NOT NULL, `updatedAt` date NOT NULL, `authorId` int DEFAULT NULL, PRIMARY KEY (`id`), KEY `FK_66aa0f0747943ab959c1secf90b2` (`authorId`), CONSTRAINT `FK_66aa0f0747943ab959c1secf90b2` FOREIGN KEY (`authorId`) REFERENCES `author` (`id`)) ENGINE=InnoDB AUTO_INCREMENT=10 DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4_0900_ci_ci;	0 rows affected	0.257 sec
4: 08:46:17	INSERT INTO `author` VALUES (1,'J.K. Rowling (Joanne Kathleen Rowling)', '1965-07-31');	1 row(s) affected Records: 1 Duplicates: 0 Warnings: 0	0.328 sec
5: 08:46:17	INSERT INTO `book` VALUES (1, 'Harry Potter and the Sorcerer\'s Stone', '1997-07-26');	1 row(s) affected Records: 1 Duplicates: 0 Warnings: 0	0.235 sec

- Reconnect using rds-dev-db-appuser and open the SQL Editor. Now you can execute queries on the dev\_database schema.

```

MySQL Workbench
File Edit View Query Database Server Tools Scripting Help
File Edit View Query Database Server Tools Scripting Help
Navigator
SCHEMAS
react_node_app
Tables author book
Views
Stored Procedures Functions
Query 1
SELECT * FROM react_node_app.books;

```

Result Grid

ID	Title	Releasedate	Description	Pages	CreatedAt	UpdatedAt	AuthorID
1	Harry Potter and the Sorcerer's Stone	1997-07-26	On his 11th birthday, Harry Potter discovers that he is the sole survivor of a mysterious massacre investigating a mysterious disappearance	223	2024-05-29	2024-05-29	1
2	Harry Potter and the Chamber of Secrets	1998-07-16	An English novel by J.K. Rowling, the second book in the Harry Potter series. It follows Harry Potter and his friend Ron Weasley as they explore the mysterious Chamber of Secrets at Hogwarts School of Witchcraft and Wizardry.	223	2024-05-29	2024-05-29	1
3	Pride and Prejudice	1813-01-29	An English novel by Jane Austen, first published in 1813. It follows the life of Elizabeth Bennet, a young woman from a middle-class family, as she navigates social norms and expectations in Regency England.	224	2024-05-29	2024-05-29	3
4	Harry Potter and the Prisoner of Azkaban	1999-07-16	An English novel by J.K. Rowling, the third book in the Harry Potter series. It follows Harry Potter and his friends as they face the return of the dark wizard Lord Voldemort.	217	2024-05-29	2024-05-29	1
5	Harry Potter and the Goblet of Fire	2000-07-08	An English novel by J.K. Rowling, the fourth book in the Harry Potter series. It follows Harry Potter and his friends as they participate in the Triwizard Tournament.	202	2024-05-29	2024-05-29	1
6	The Hitchhiker's Guide to the Galaxy	1979-10-12	A comic science fiction comedy series created by Douglas Adams. It follows the adventures of Arthur Dent and Ford Prefect as they travel through space.	194	2024-05-29	2024-05-29	7
7	Hungerford or, The Modern Prometheus	1818-05-03	A Gothic novel by Mary Shelley that tells the story of Victor Frankenstein and his creation, the monster.	211	2024-05-29	2024-05-29	6
8	The Lord of the Rings: The Fellowship of the Ring	2001-07-20	The first book in J.R.R. Tolkien's epic fantasy trilogy, The Lord of the Rings.	839	2024-05-29	2024-05-29	5
9	The Hobbit	2009-09-09	The prequel to The Lord of the Rings, it follows the adventures of Bilbo Baggins and the dwarves Thorin Oakenshield as they seek the One Ring.	229	2024-05-29	2024-05-29	5

Action Output

Time	Action	Message	Duration / Fetch
1: 09:27:54	Time Author	0 rows returned	0.215 sec / 0.000 sec
2: 09:27:56	SELECT * FROM react_node_app.author LIMIT 0, 1000	6 rows(s) returned	0.219 sec / 0.000 sec
3: 09:28:12	SELECT * FROM react_node_app.book LIMIT 0, 1000	8 rows(s) returned	0.235 sec / 0.000 sec

```

MySQL Workbench
File Edit View Query Database Server Tools Scripting Help
File Edit View Query Database Server Tools Scripting Help
Navigator
SCHEMAS
react_node_app
Tables author book
Views
Stored Procedures Functions
Query 1
SELECT * FROM react_node_app.author;

```

Result Grid

ID	Name	Bio	CreatedAt	UpdatedAt	
1	J.K. Rowling (Joanne Kathleen Rowling)	1965-07-31	J.K. Rowling is a British author best known for her Harry Potter series.	2024-05-29	2024-05-29
2	Jane Austen	1775-12-16	Jane Austen was an English novelist, best known for her six major novels.	2024-05-29	2024-05-29
3	Harper Lee	1926-04-28	Harper Lee was an American novelist, best known for her novel To Kill a Mockingbird.	2024-05-29	2024-05-29
4	J.R.R. Tolkien	1903-09-29	J.R.R. Tolkien was a British philologist and writer, best known for his works The Hobbit and The Lord of the Rings.	2024-05-29	2024-05-29
5	Mary Shelley	1818-05-03	Mary Shelley was a British novelist, best known for her gothic novel Frankenstein.	2024-05-29	2024-05-29
6	Douglas Adams	1952-09-11	Douglas Adams was an English science fiction writer and comedian, best known for his radio series The Hitchhiker's Guide to the Galaxy.	2024-05-29	2024-05-29

Action Output

Time	Action	Message	Duration / Fetch
1: 09:27:54	SELECT * FROM react_node_app.author LIMIT 0, 1000	6 rows(s) returned	0.225 sec / 0.000 sec
2: 09:27:56	SELECT * FROM react_node_app.author LIMIT 0, 1000	6 rows(s) returned	0.219 sec / 0.000 sec

- We can also check the tables related to books and authors.

## PRESENTATION TIER

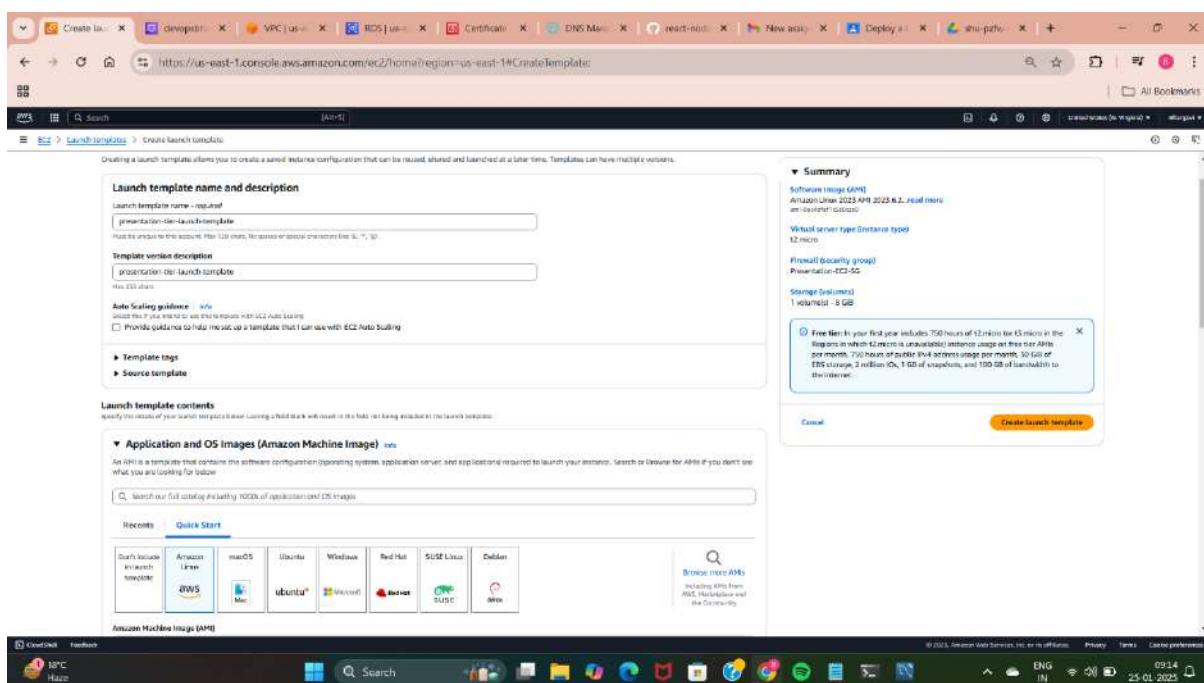
The Presentation Tier (also called the Frontend Tier) is the top layer in a 3-tier architecture. It is responsible for:

- Interacting with users(UI/UX).
- Displaying data fetched from the backend.
- Sending user input to the business logic tier.

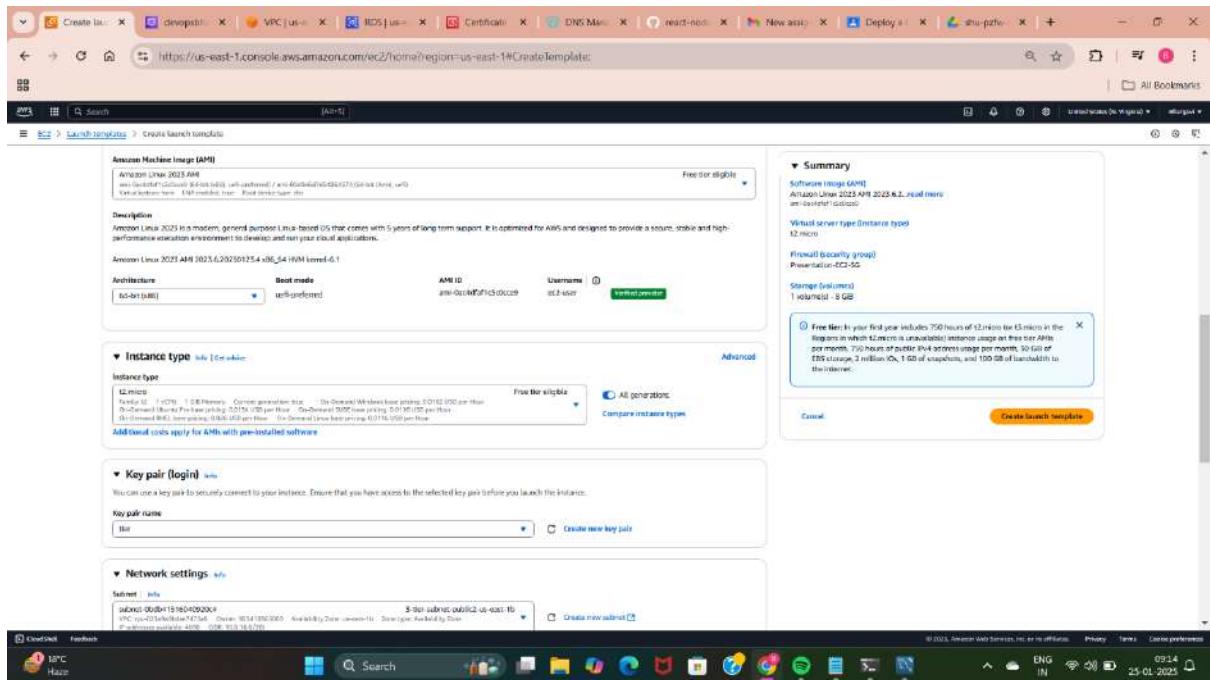
## STEP 7: SETTING UP THE PRESENTATION TIER

### 7.1: CREATE A LAUNCH TEMPLATE FOR PRESENTATION TIER

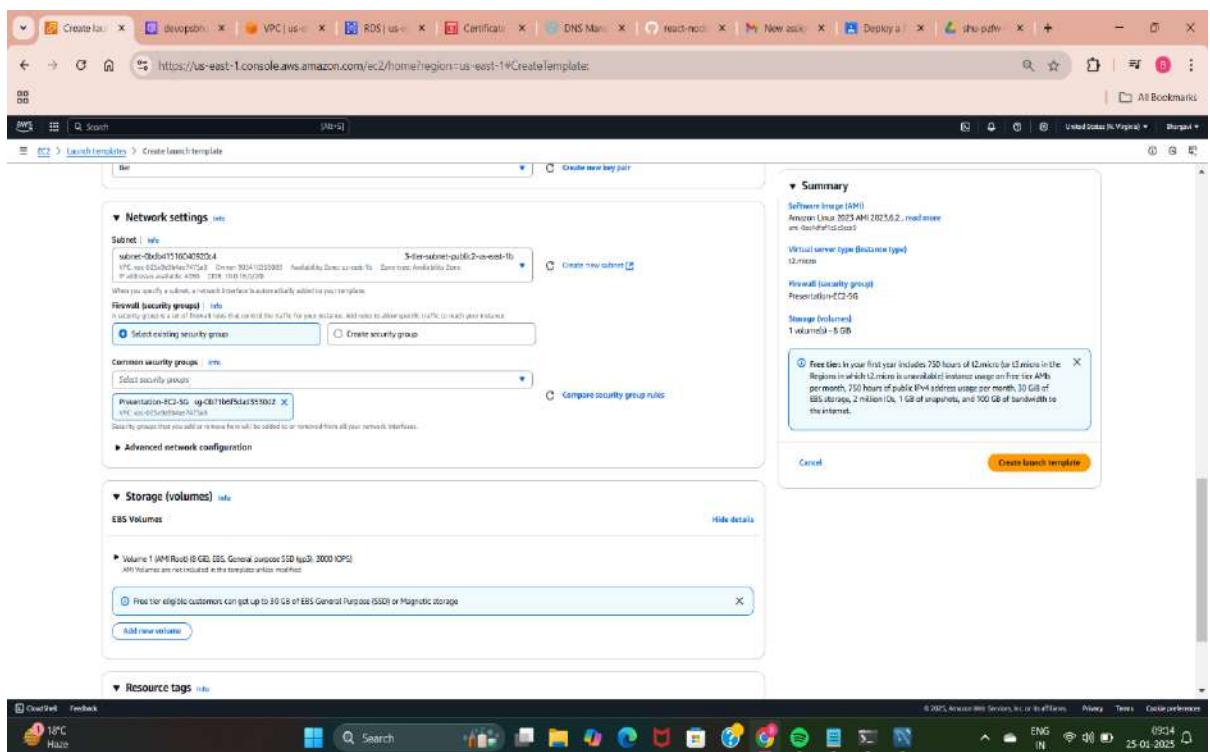
- Go to the EC2 Dashboard in the AWS Management Console.
- Click on "Launch Templates" under the Instances section.
- Click "Create Launch Template" and fill in the required details.



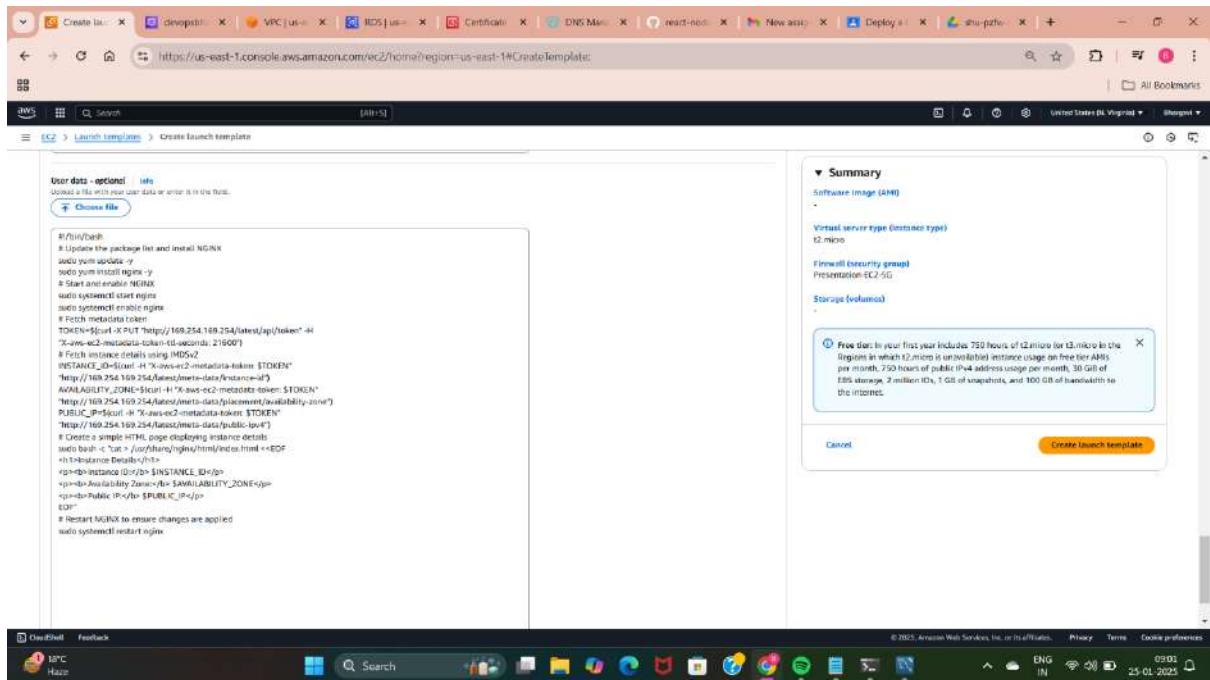
- Launch Template Name: Presentation-Tier-LaunchTemplate.
- Version Description: Presentation-Tier-LaunchTemplate.
- AMI: Use Amazon Linux 2023 or a specific AMI based on your application's requirements.



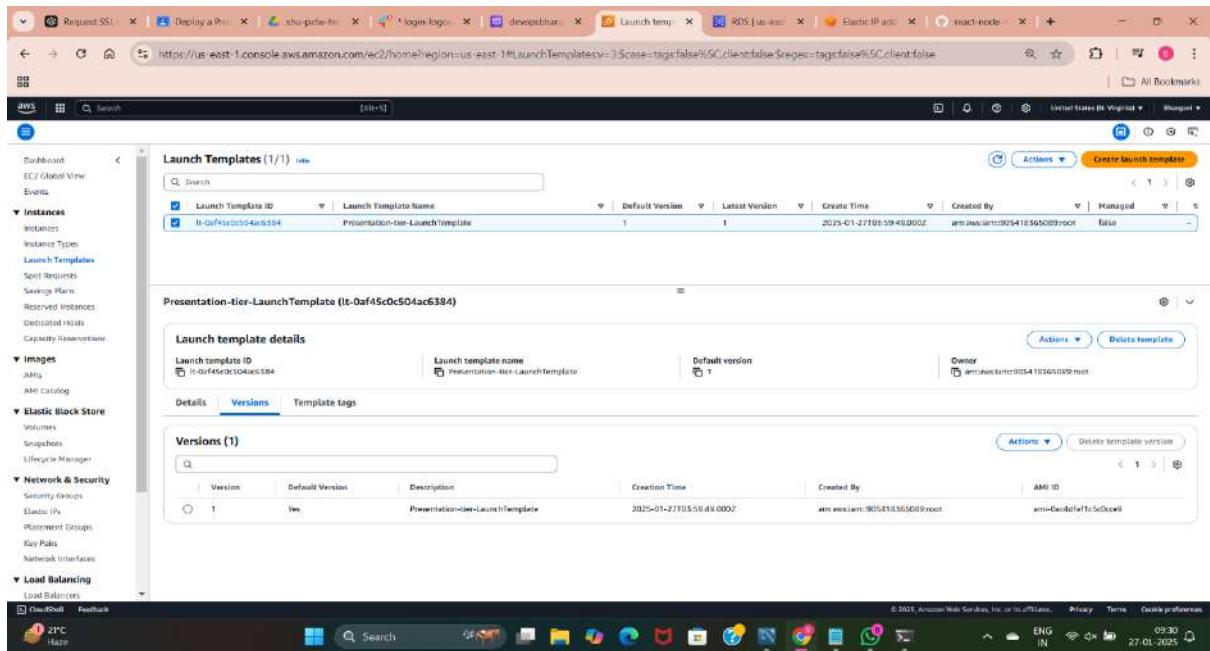
- Instance Type: t2.micro (or another type depending on your workload).
- Key Pair: Select an existing key pair or create a new one.



- Select the public subnet.
- Security Groups: Select the Presentation-Tier-EC2 security group created earlier.
- IAM Role: Attach a role with permissions for the instance to communicate with other AWS services if needed.



- Add the script to the Advanced Details > User Data section to set up the Presentation Tier EC2 instance.
- Click "Create Launch Template".



- Presentation launch template is created with default version as 1.

## TARGET GROUP

A Target Group in AWS is a collection of instances (EC2), IP addresses, or Lambda functions that serve as the backend for Elastic Load Balancers (ELB). It defines how AWS routes traffic to your application.

- It routes incoming traffic to the registered targets evenly across multiple EC2 instances.
- Supports different target types (EC2, IP, Lambda).
- Works with Application Load Balancer (ALB), Network Load Balancer (NLB), Gateway Load Balancer (GWLB).
- Allows health checks to monitor target availability.
- Used in Auto Scaling for distributing requests efficiently.

## TYPES OF TARGET GROUPS

### Instance Target Group

- Targets: EC2 instances
- Best for applications running on EC2 instances behind a Load Balancer.

### IP Target Group

- Targets: IP addresses (IPv4 only)
- Best for on-premises servers, hybrid cloud setups, or containerized applications.

### Lambda Target Group

Targets: AWS Lambda functions

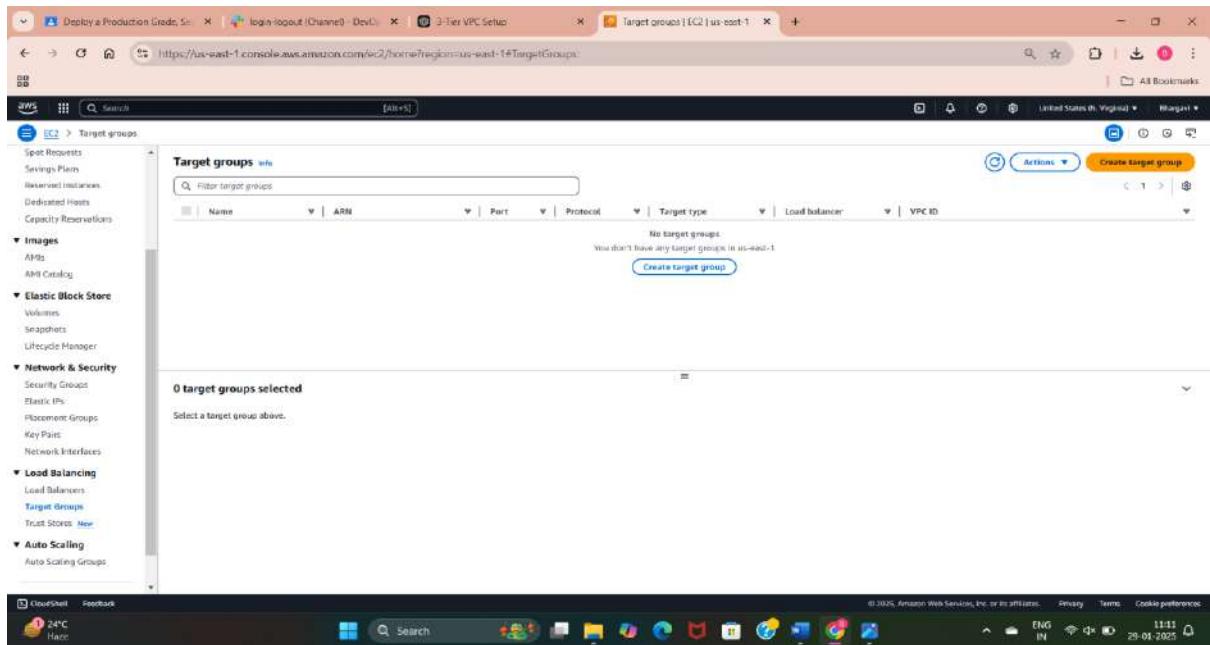
- Best for serverless applications where a Load Balancer triggers Lambda functions instead of EC2 instances.

### Application Load Balancer (ALB) Target Group

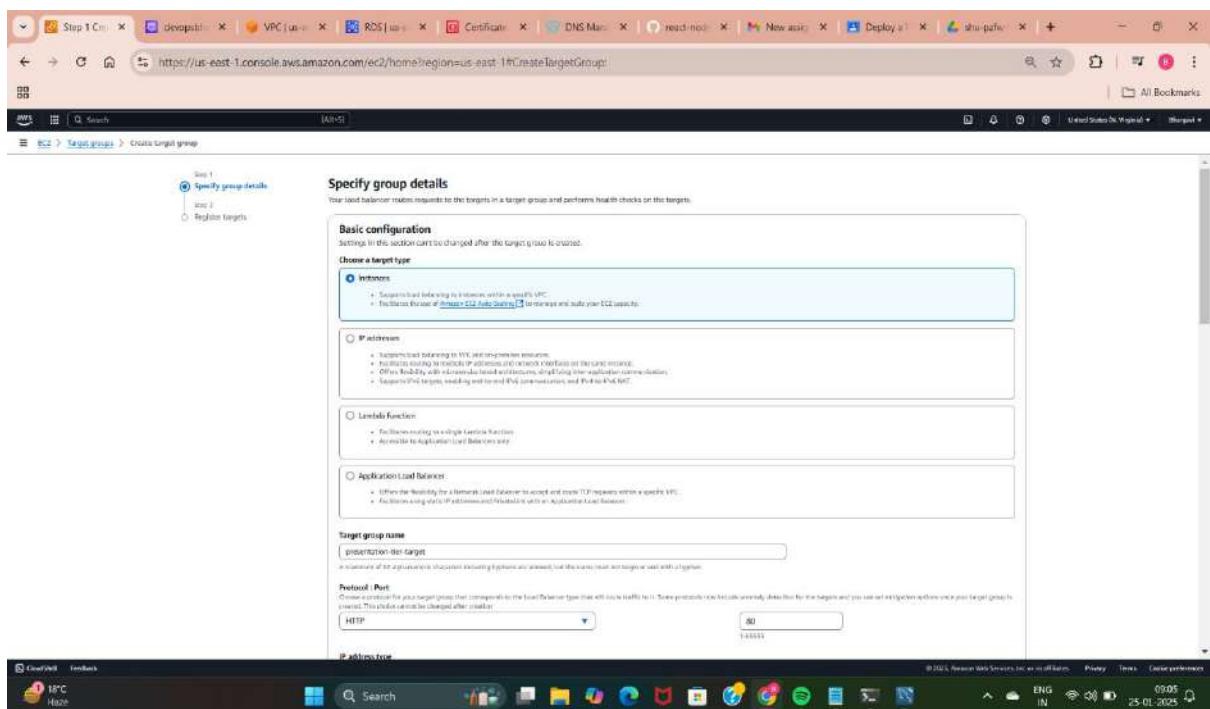
- Targets: Another ALB
- Best for layered architectures where one Load Balancer routes traffic to another ALB.

## 7.2 CREATING PRESENTATION TIER TARGET GROUP:

- Go to the EC2 Dashboard in the AWS Management Console.
- Under the Load Balancing section, click on Target Groups.

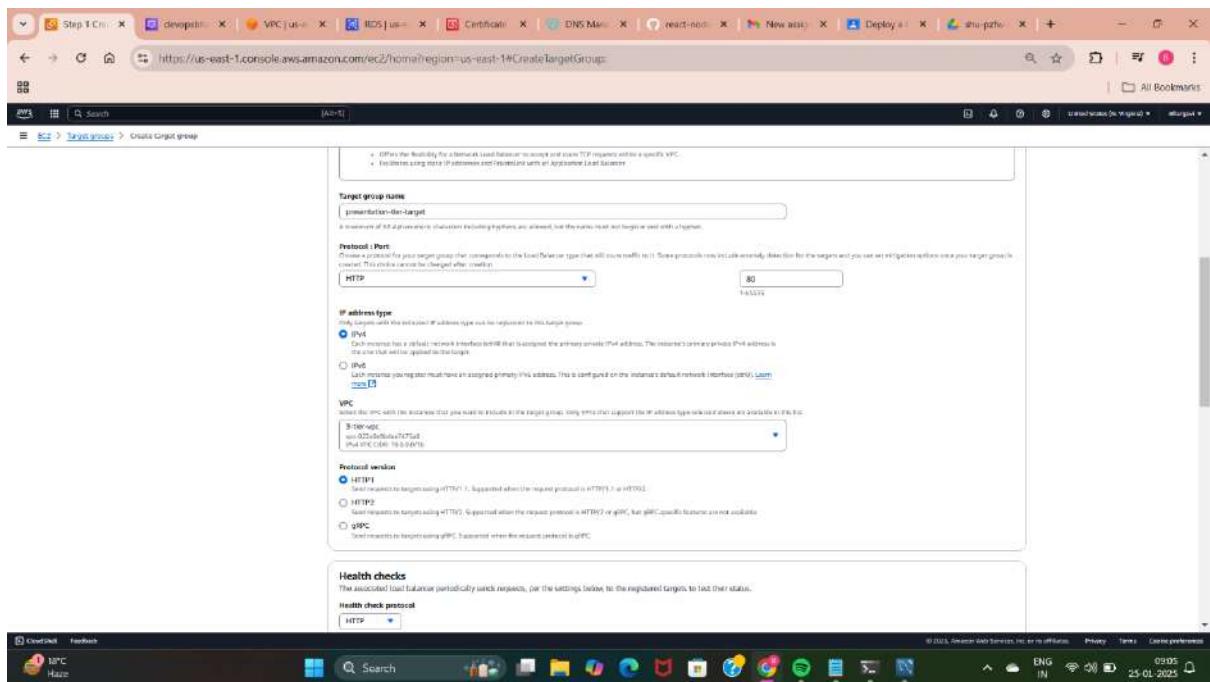


- Click on "Create target group".



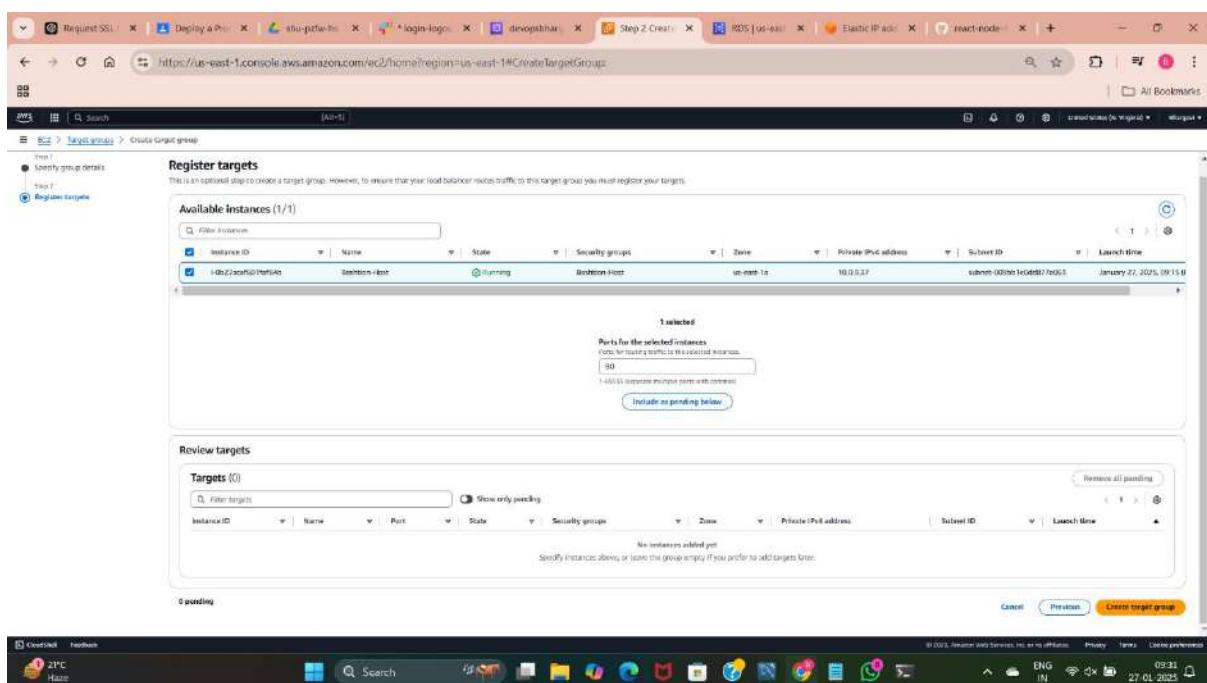
Choose a Target Type:

- Select Instances as the target type.

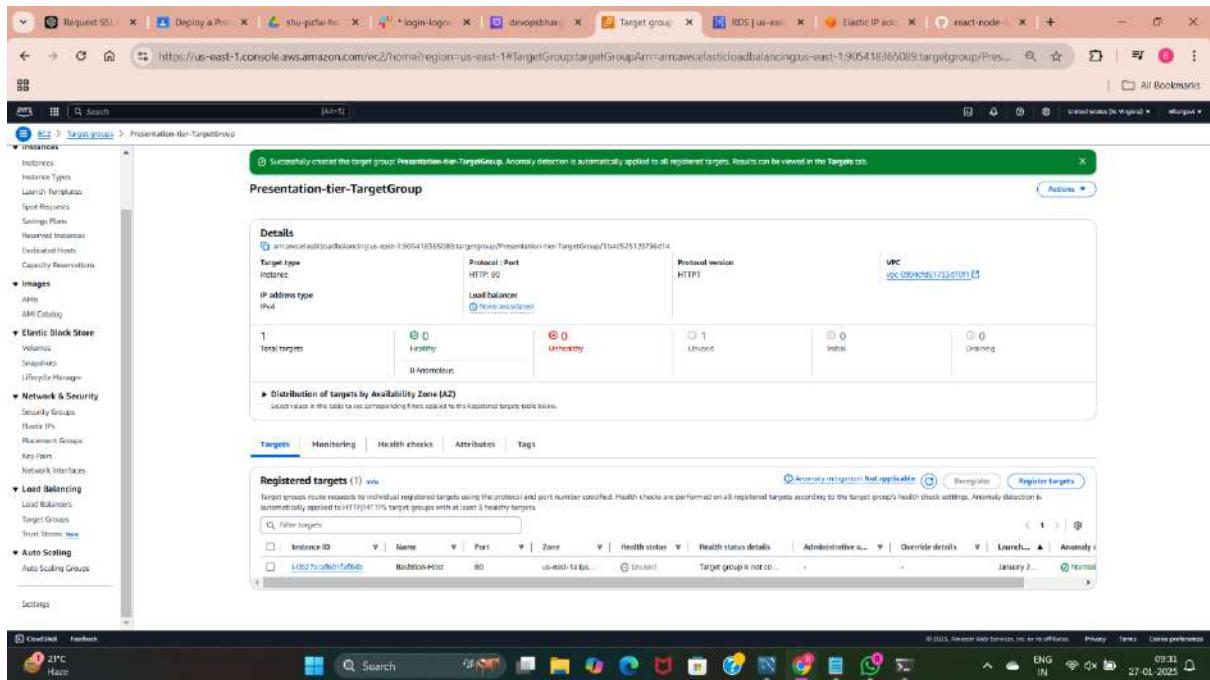


Provide the Target Group Details as mentioned below:

- Name: Presentation-Tier-target.
- Protocol: HTTP.
- Port: 80.
- VPC: Select the 3-tier VPC.



- In the Register Targets section, select the instances that will serve the Presentation Tier from the list of available instances (these are typically instances from the Presentation-Tier-EC2 Auto Scaling Group).
- Click Include as Pending.
- Click Create target group.



- ✓ Presentation tier target group is created.

## LOAD BALANCER

A Load Balancer is a network appliance or software tool that distributes incoming network traffic across multiple backend servers (also known as targets) to ensure high availability and reliability of applications. The goal of load balancing is to:

- ❖ Distribute traffic evenly across servers to avoid overloading any single server.
- ❖ Increase scalability by automatically adding or removing servers based on demand.
- ❖ Improve availability by rerouting traffic to healthy servers if one goes down.

Types of Load Balancers in AWS

AWS offers multiple types of Load Balancers:

- ❖ Application Load Balancer (ALB)
- ❖ Network Load Balancer (NLB)
- ❖ Classic Load Balancer (CLB)
- ❖ Gateway Load Balancer (GWLB)

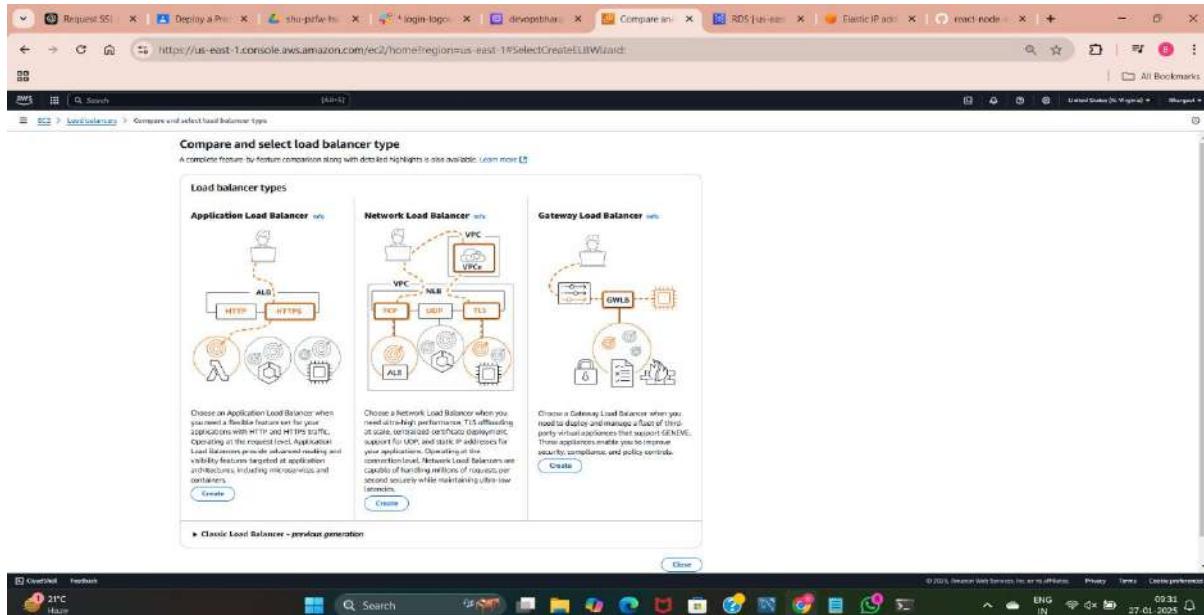
### APPLICATION LOADBALANCER:

The Application Load Balancer (ALB) is a Layer 7 (Application Layer) load balancer that routes HTTP/HTTPS traffic based on content and advanced routing logic. It operates at the application layer of the OSI model and supports routing based on:

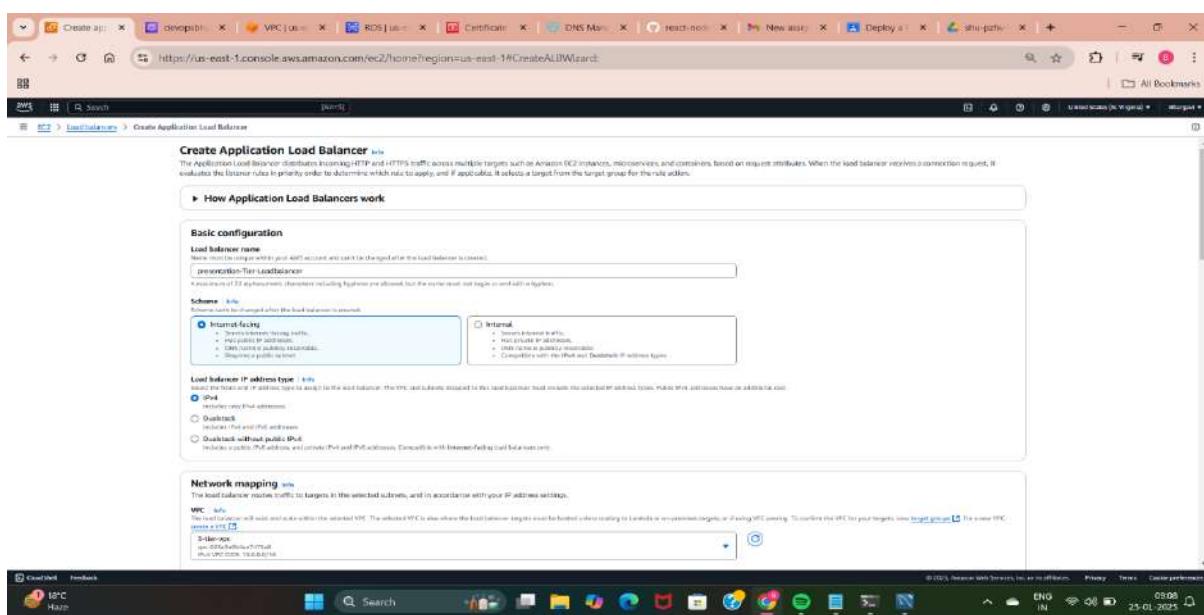
- URL path (e.g., /api/\* routes to an API server)
- Host headers (e.g., devopsbhargavi.xyz or api.example.com)
- Query strings or HTTP headers

## 7.3 CREATING PRESENTATION TIER LOAD BALANCER:

- ❖ Go to the EC2 Dashboard in the AWS Management Console.
- ❖ Under Load Balancing, click on Load Balancers.
- ❖ Click Create Load Balancer.



- ❖ Choose the loadbalancer type as Application Load Balancer (ALB).
- ❖ Click Create.



### Configure Load Balancer Basics

1. Name: Presentation-Tier-Loadbalancer.
2. Scheme: Select Internet-facing.
3. IP Address Type: IPv4.
4. Listeners:
  - Protocol: HTTP.
  - Port: 80.

**Network mapping**

The load balancer routes traffic to targets in the selected subnets, and in accordance with your IP address settings.

**VPC**

The load balancer will route traffic within the selected VPC. A private VPC allows the load balancer targets to be located in Lambda or step functions targets, or if using VPC peering. To confirm the VPC for your targets, click [target groups](#) to view a new VPC.

**Map to subnets**

Select at least two Availability Zones and one subnet per zone. The load balancer routes traffic to targets in these Availability Zones only. Available Zones that are not supported by the load balancer or the VPC are not available for selection.

**Availability Zones**

us-east-1a (us-east-1a)

**Subnet**

subnet-02e4d4a499c7cc  
Assigned by AWS

**IPV4 address**

us-east-1a (us-east-1a)

**Subnet**

subnet-0bb1519c40020208  
Assigned by AWS

**IPV6 address**

us-east-1b (us-east-1b)

**Subnet**

subnet-0bb1519c40020208  
Assigned by AWS

**Security groups**

A security group is a set of firewall rules that control the traffic to your load balancer. Select an existing security group, or you can create a new security group.

**Security groups**

Select up to 5 security groups

Presentation-ALB-SG

**Create load balancer**

- ❖ Select the 3-tier VPC.
- ❖ Select Public Subnets (ensure you select the same subnets configured earlier).
- ❖ Select the Presentation-Tier-ALB security group (created in Step 4.2).
- ❖ Under Default Routing, choose Existing Target Group.
- ❖ Select the Presentation-Tier-target group (created in Step 7.2).

**Review**

Please review the load balancer configurations and make changes if needed. After you finish reviewing the configurations, click [Create load balancer](#).

**Summary**

Review and edit your configurations. [Edit configuration](#)

**Basic configuration**

presentation-ALB-load-balancer

- Internet-facing
- IPv4

**Security groups**

Presentation-ALB-SG

**Network mapping**

VPC: [us-east-1a](#) (us-east-1a)  
2 subnets assigned

- us-east-1a
  - subnet-02e4d4a499c7cc
  - 1-to-1 default port (80 to 80)
- us-east-1b
  - subnet-0bb1519c40020208
  - 1-to-1 default port (80 to 80)

**Listeners and routing**

HTTP/HTTP to presentation-target-group

**Service integrations**

Amazon CloudWatch - AWS Lambda Application (ALB), AWS Lambda function, AWS CloudFront, AWS AppSync

**Attributes**

Certain default attributes will be applied to your load balancer. You can view and edit them after creating the load balancer.

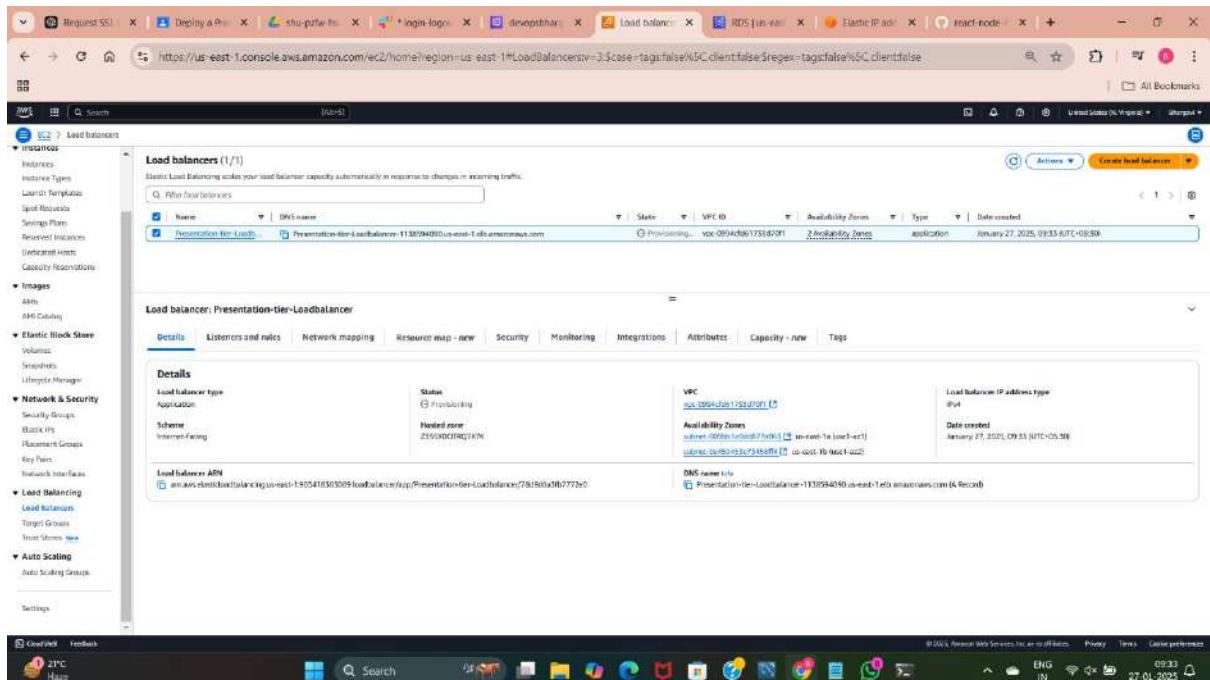
**Creation workflow and status**

**Server-side tasks and status**

After completing and submitting the above steps, all server-side tasks and their statuses become available for monitoring.

**Create load balancer**

- ❖ Review the configuration.
- ❖ Click Create Load Balancer.



- ❖ Presentation tier load balancer is created.

## AUTO SCALING GROUP (ASG)

An Auto Scaling Group (ASG) is a service in AWS that automatically adjusts the number of Amazon EC2 instances in your application's fleet based on demand. This helps to ensure that your application has the appropriate amount of compute resources to handle varying levels of traffic, while also controlling costs by scaling down when demand is low.

The Auto Scaling Group works in tandem with the Auto Scaling Policies to manage the lifecycle of EC2 instances, ensuring that you have the right number of instances running based on metrics like CPU utilization, memory usage, or network traffic.

### Automatic Scaling:

Adds new EC2 instances when demand increases (e.g., when traffic spikes). Removes EC2 instances when demand decreases (e.g., during periods of low traffic).

### Elasticity:

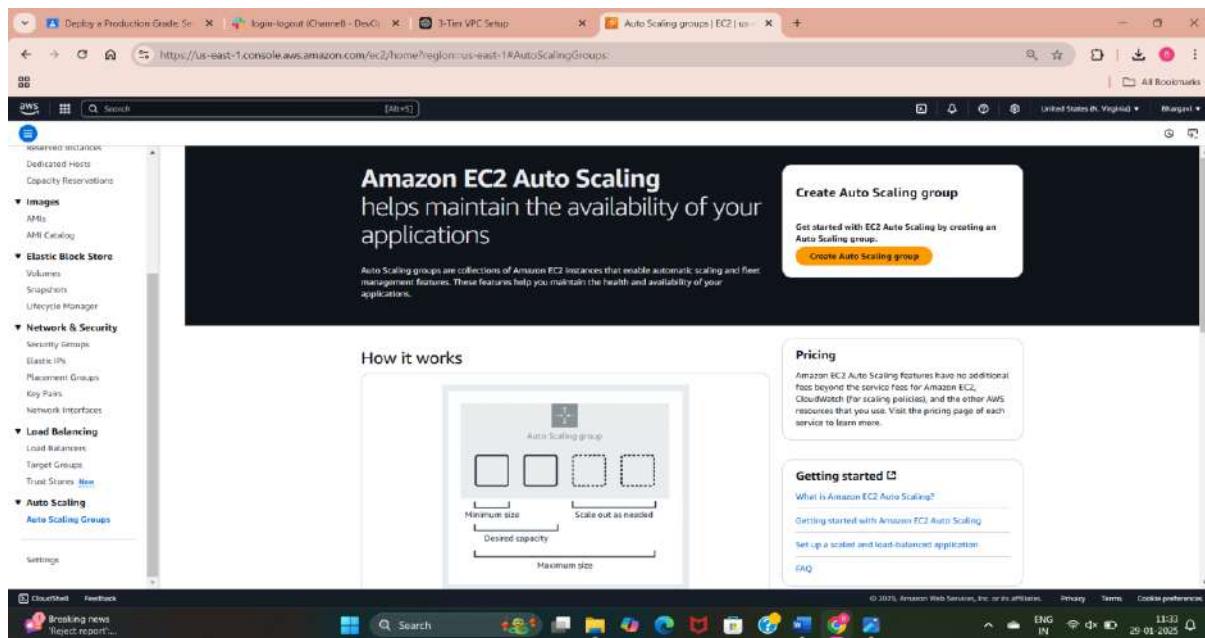
The number of instances in the group can increase or decrease automatically without manual intervention. You define the desired capacity (the ideal number of instances) and the minimum and maximum limits for scaling.

### Launch Configurations/Templates:

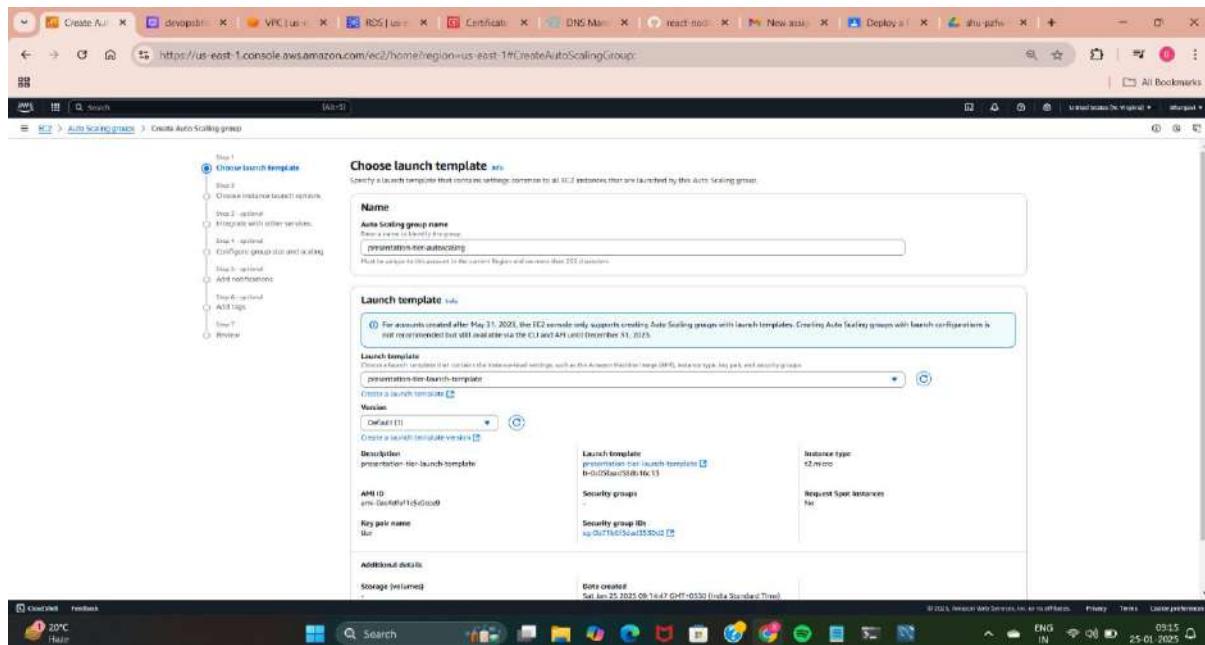
You define a Launch Configuration or Launch Template which specifies the EC2 instance type, AMI, key pair, security groups, and other settings to be used for launching new instances in the group.

## 7.4 CREATING PRESENTATION TIER AUTO SCALING GROUP WITH DESIRED CAPACITY=3, MIN=2, MAX=4

- ✓ Open the EC2 Dashboard.
- ✓ Scroll down to the Auto Scaling section.
- ✓ Click on Auto Scaling Groups.



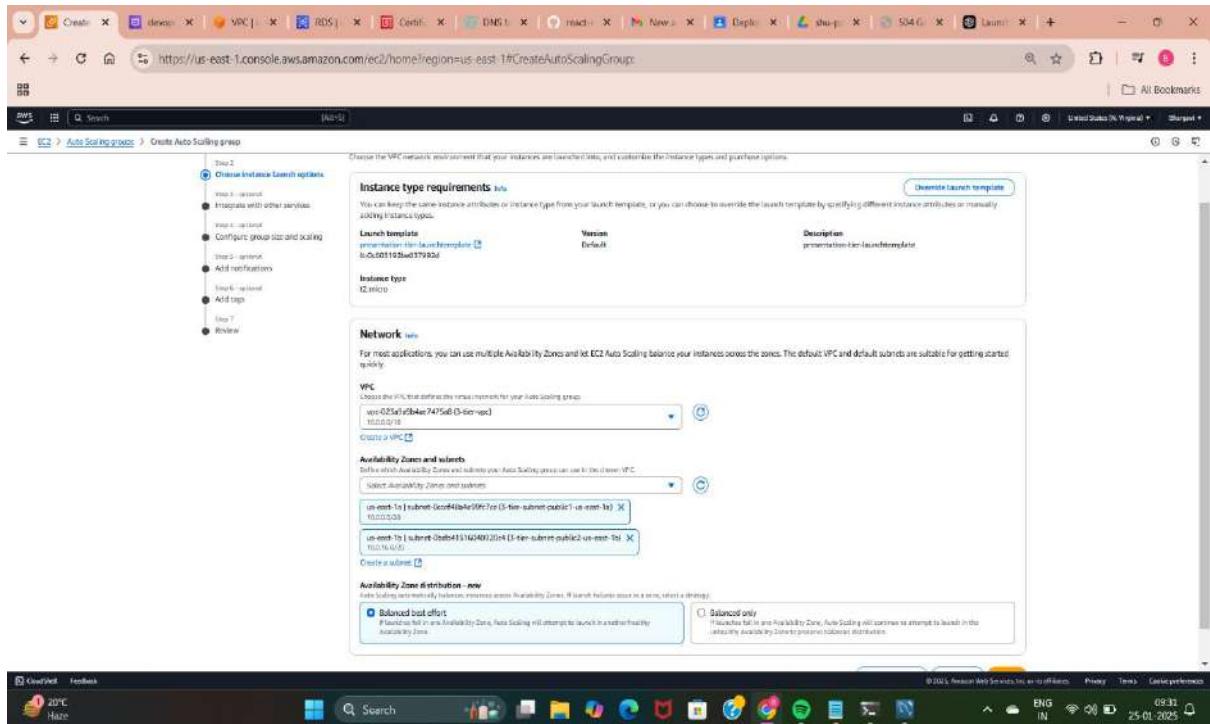
- ✓ Click Create Auto Scaling Group.



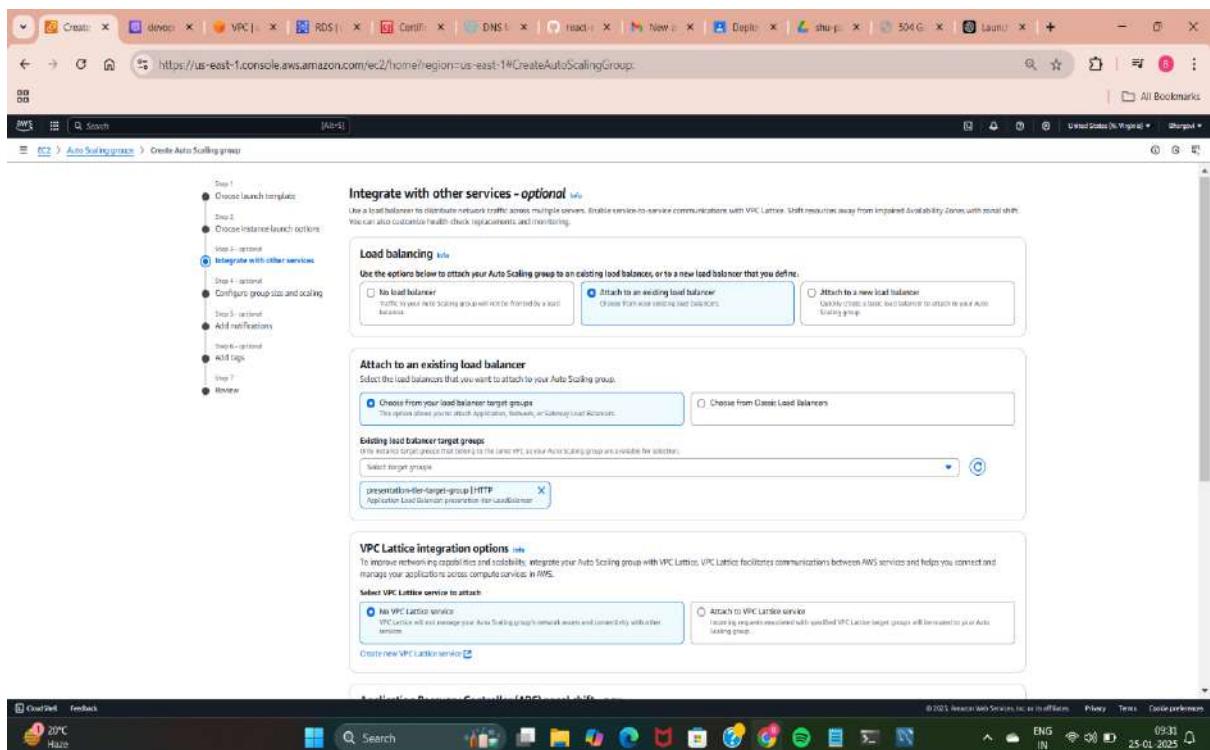
### Configure Basic Details

- ✓ Auto Scaling Group Name: Presentation-Tier-autoscaling.
- ✓ Launch Template: Select the Launch Template created earlier for the Presentation Tier (Step 7.1).

- ✓ Select the version of launch template.
- ✓ Click Next.



- ✓ Select the 3-Tier-Architecture VPC and select the Public Subnets from your VPC.



- ✓ In the Load Balancing section select Application Load Balancer.
- ✓ Choose the Presentation-Tier-TG Target Group created in Step 7.2.

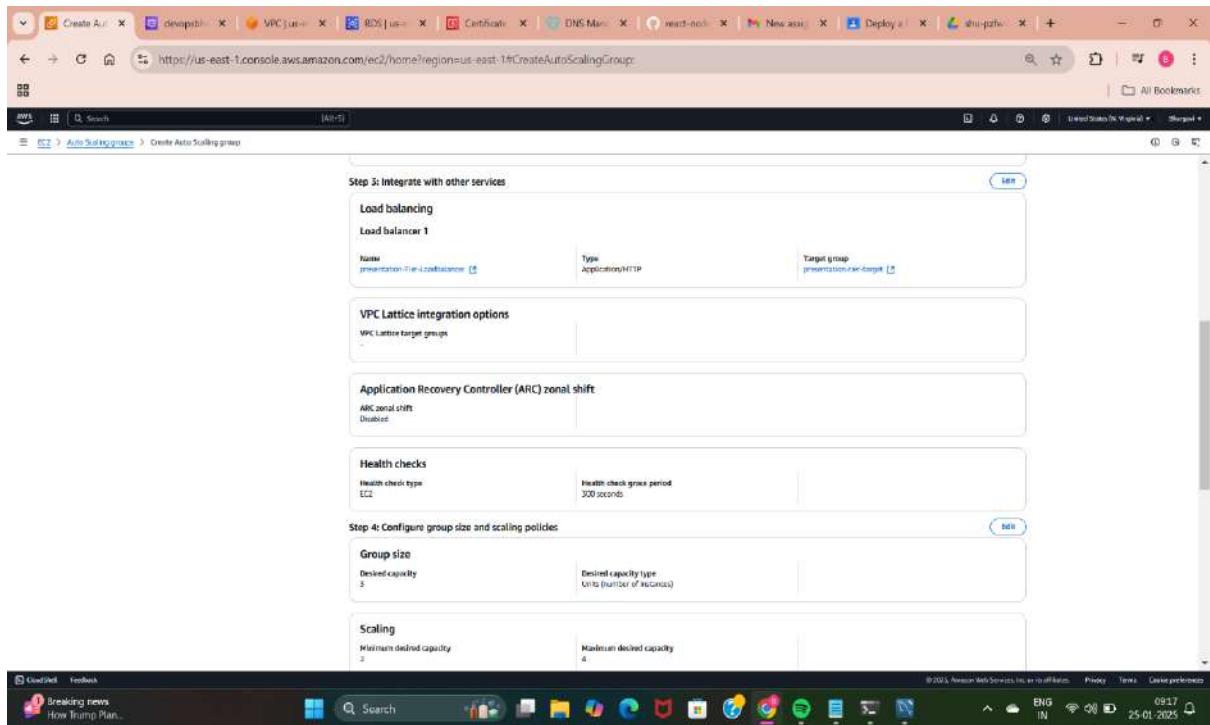
The screenshot shows the 'Configure group size and scaling - optional' step of the Auto Scaling Group creation wizard. The 'Group size' section is active, showing 'Min desired capacity' set to 2 and 'Max desired capacity' set to 4. Below it, the 'Scaling' section is shown with the note 'You can resize your Auto Scaling group manually or automatically to meet changes in demand.' The 'Automatic scaling - optional' section is also visible, showing 'No scaling policy' selected. The 'Instance maintenance policy' section is at the bottom.

## Configure Scaling Policies

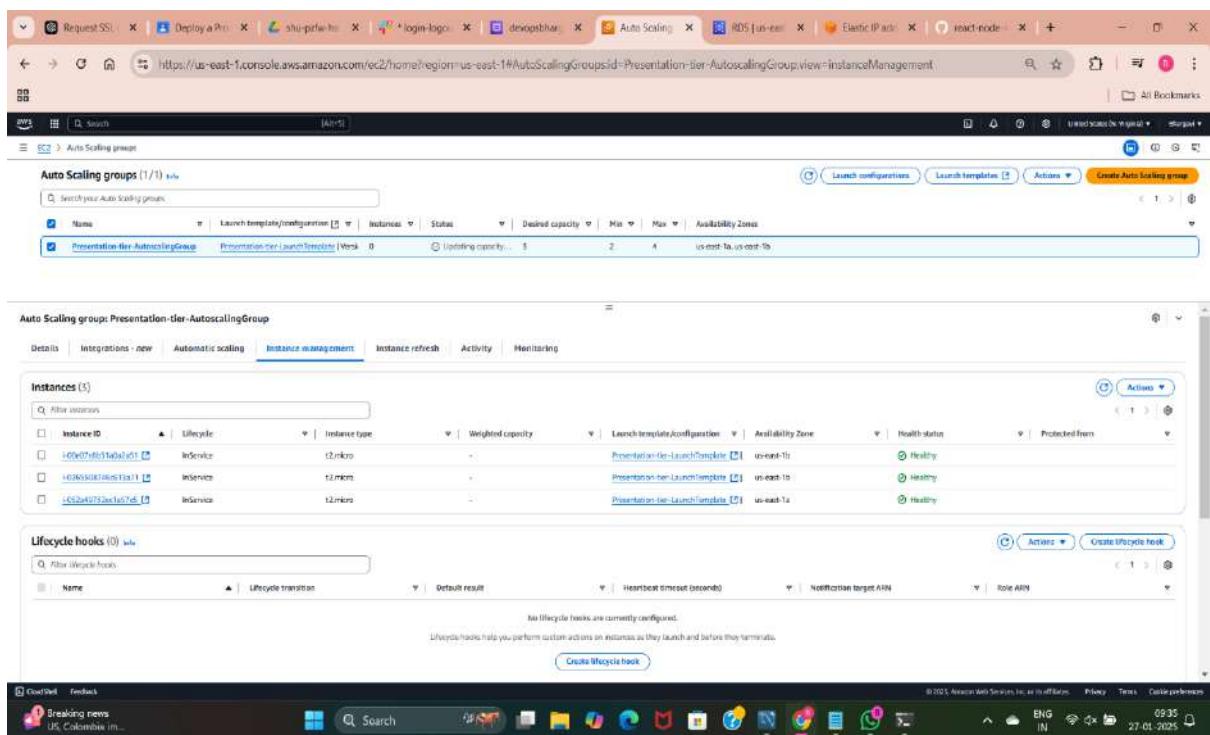
1. Desired Capacity: 3
2. Minimum Capacity: 2
3. Maximum Capacity: 4

The screenshot shows the 'Review' step of the Auto Scaling Group creation wizard. It summarizes the configuration: Step 1: Choose launch template (practitioner-lc-launch-template), Step 2: Choose instance launch options (VPC: us-east-1a, Availability Zones: us-east-1a, us-east-1b, Subnet: subnet-01ef47a69f87475e, CIDR range: 10.0.0.0/20, us-east-1b, CIDR range: 10.0.160.0/20), Step 3: Integrate with other services (Load balancing: None selected). The status bar at the bottom indicates the configuration is ready to proceed.

- ✓ Review the configuration.



- ✓ Click Create Auto Scaling Group.



- ✓ Autoscaling group is created for presentation tier.



### Instance Details

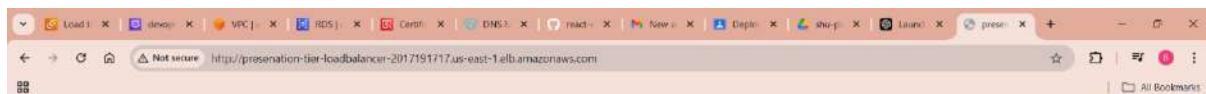
Instance ID: i-0caff92d5239263d6

Availability Zone: us-east-1a

Public IP: 44.222.146.232



- ✓ Access the DNS name of the load balancer in your browser to confirm it works as expected.



### Instance Details

Instance ID: i-00c6281d322f5600a

Availability Zone: us-east-1b

Public IP: 44.202.13.204



- ✓ If the Instance Metadata Details are visible when accessing the DNS name, everything is set up perfectly.

## APPLICATION TIER

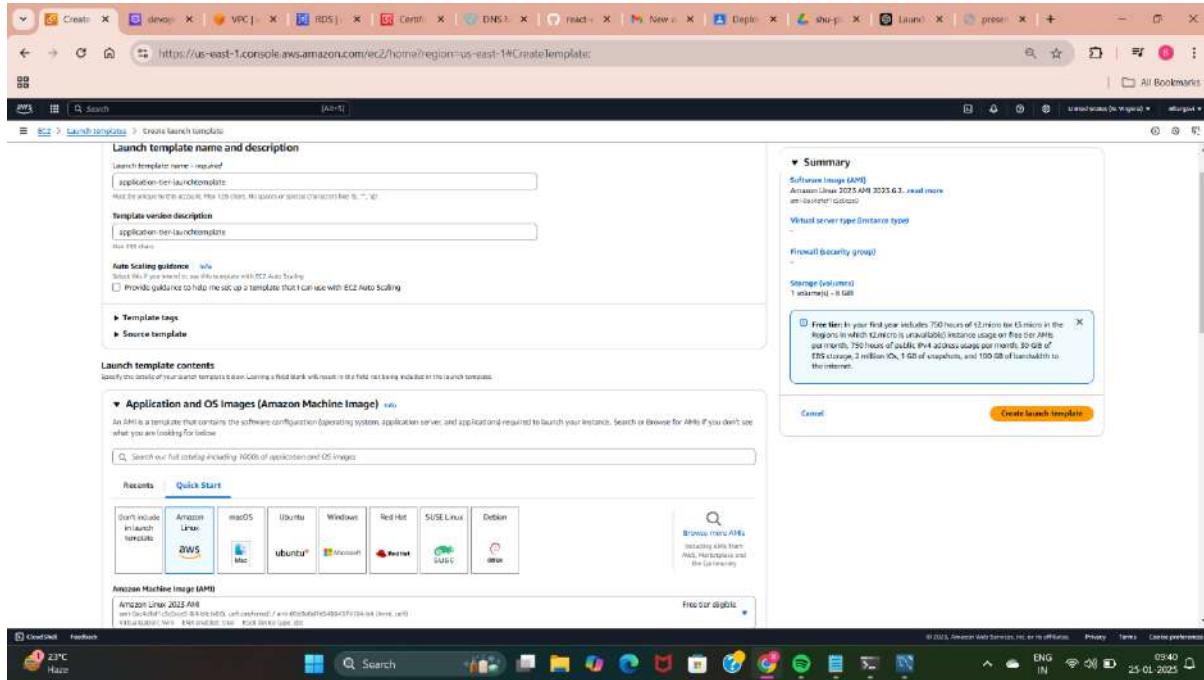
The Application Tier is one of the layers in a multi-tier application architecture, commonly used in the design of complex, scalable, and maintainable systems. Data Tier (Database)

The Application Tier is also known as the Middle Tier or Business Logic Layer. It contains the core functionality of the application and is responsible for processing the business logic, handling requests, and making decisions based on user input.

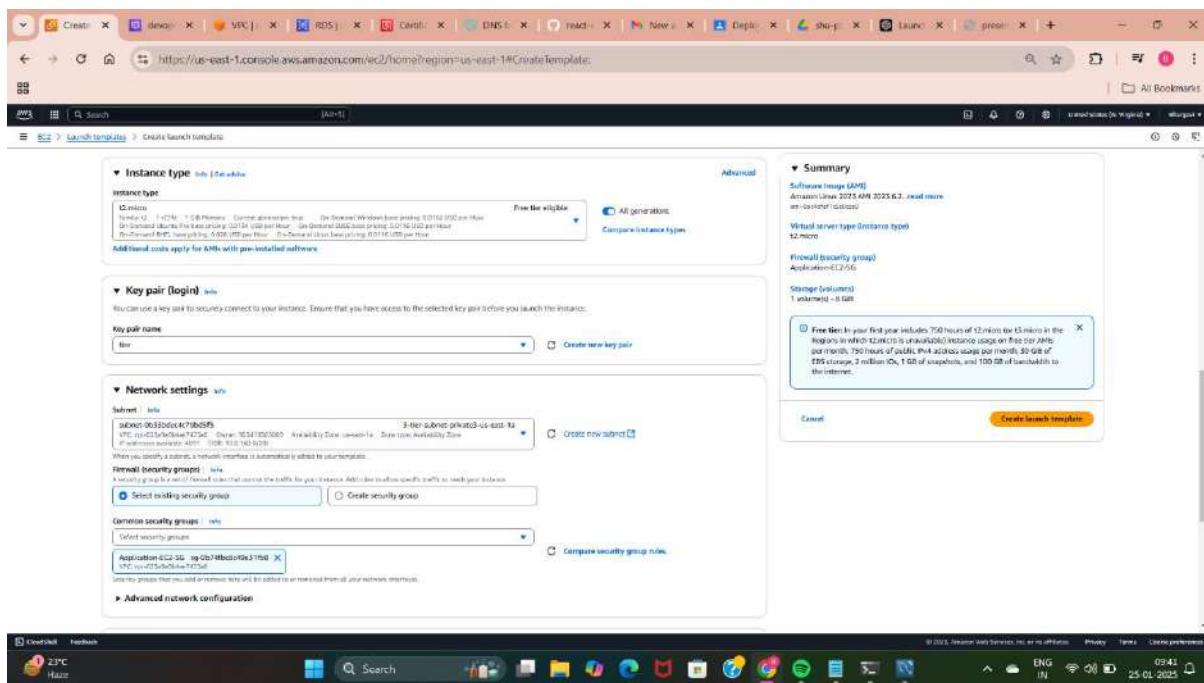
## STEP 8: SETUP APPLICATION TIER

### 8.1 CREATE LAUNCH TEMPLATE WITH THE USER DATA AS FOLLOWS

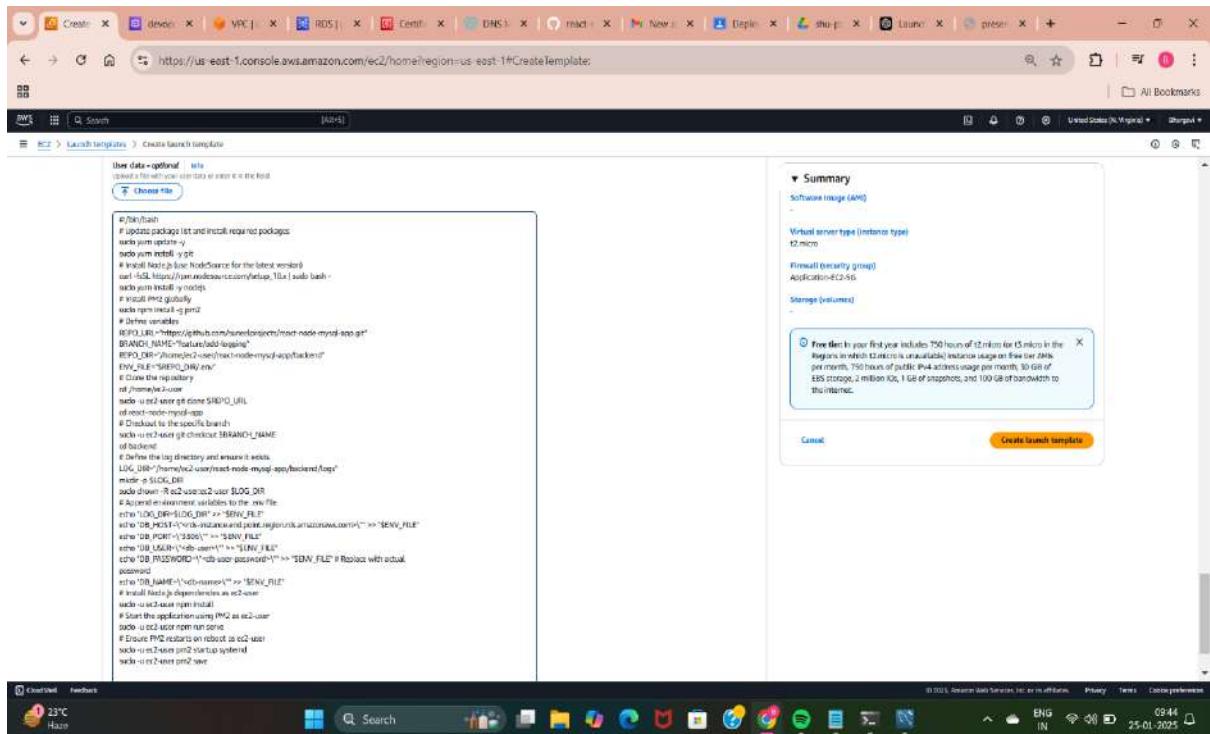
- Go to EC2 Dashboard → Launch Templates → Create Launch Template.



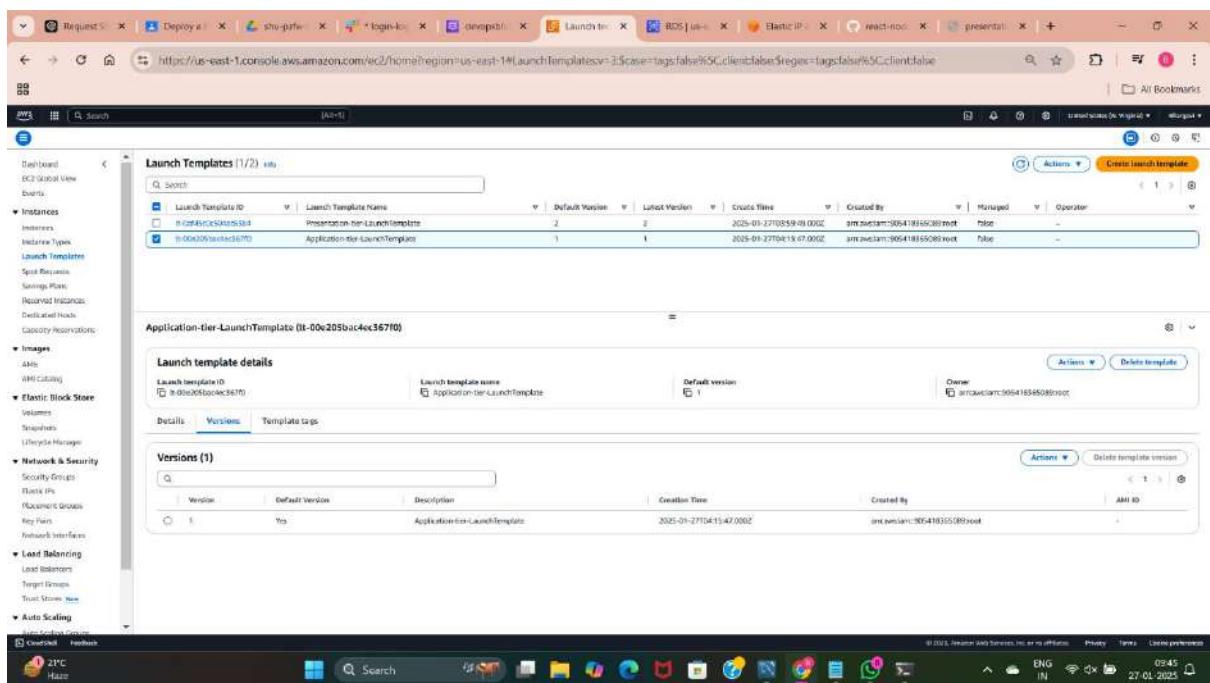
- Template Name: application-tier-launchtemplate.
- AMI: Select Amazon Linux 2023 AMI or the appropriate AMI for your application.



- Instance Type: Use t2.micro or an instance type suitable for your application.
- Key Pair: Select your key pair (tier.pem).
- Select the 3-Tier-Architecture VPC.
- Ensure instances will be launched in private subnets.
- Assign the Application-Tier-EC2 Security Group created in Step 4.5.



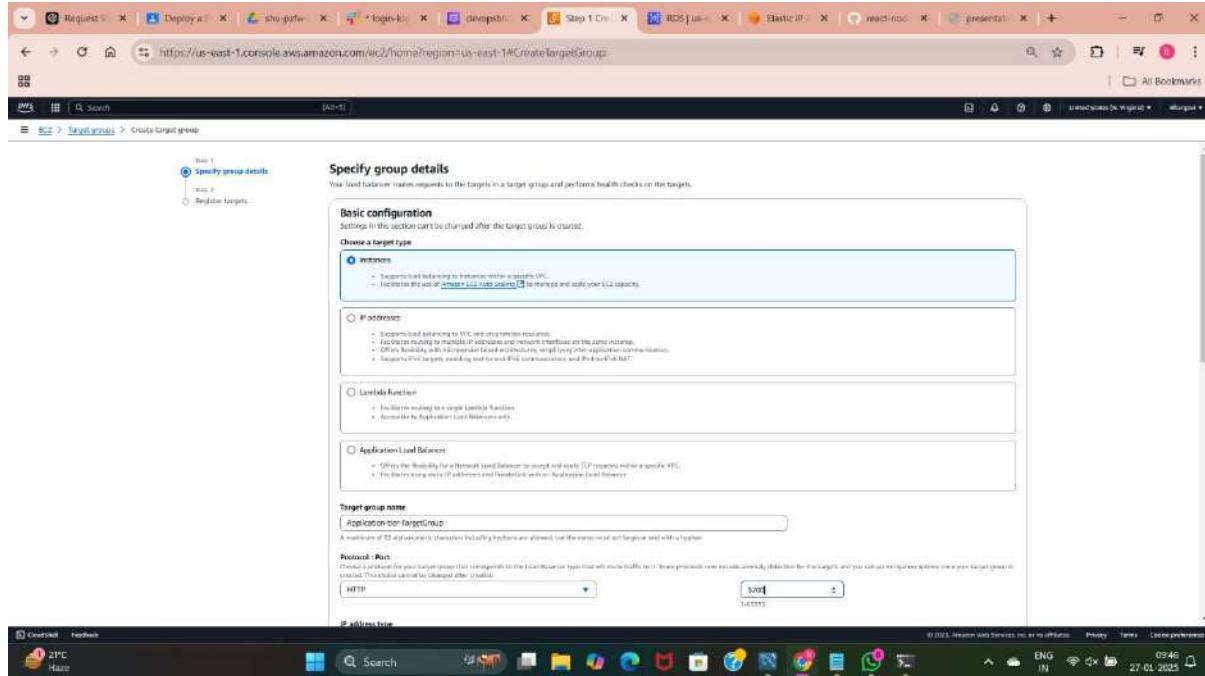
- Add user data to configure the application on launch (e.g., installing dependencies, deploying the app).



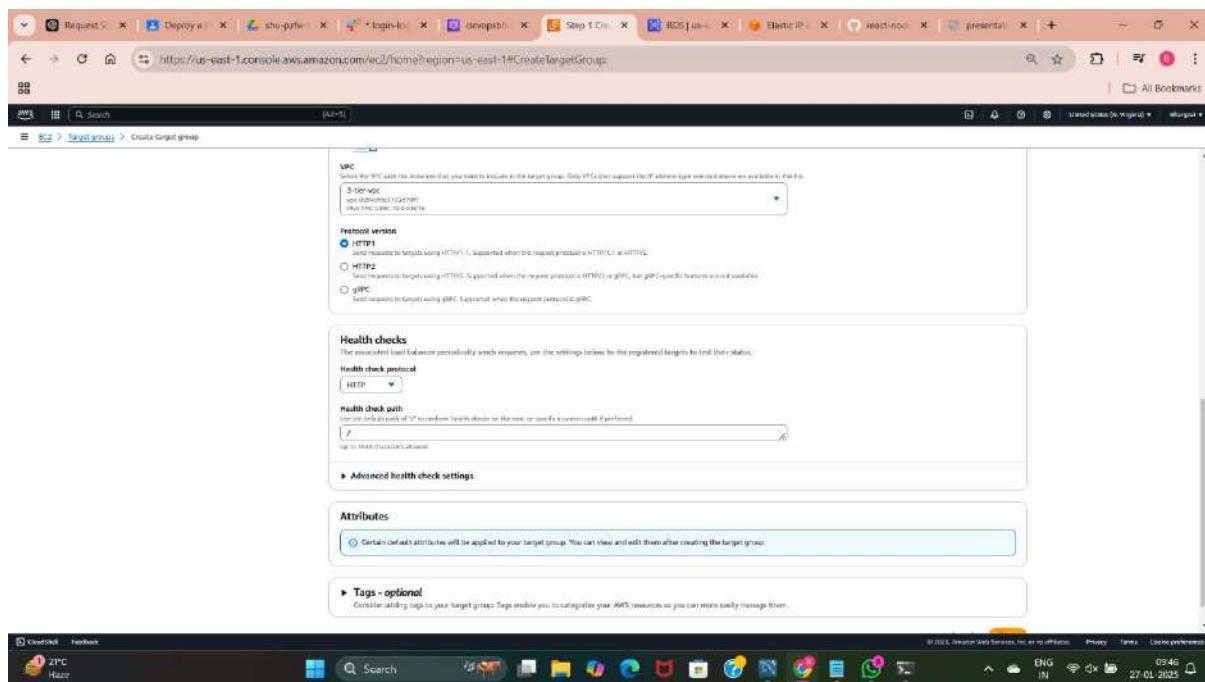
- Launch template for application tier is created.

## 8.2 CREATE TARGET GROUP

- In the AWS Management Console, navigate to the EC2 Dashboard.
- In the left sidebar, under Load Balancing, click on Target Groups.
- Click on Create target group.

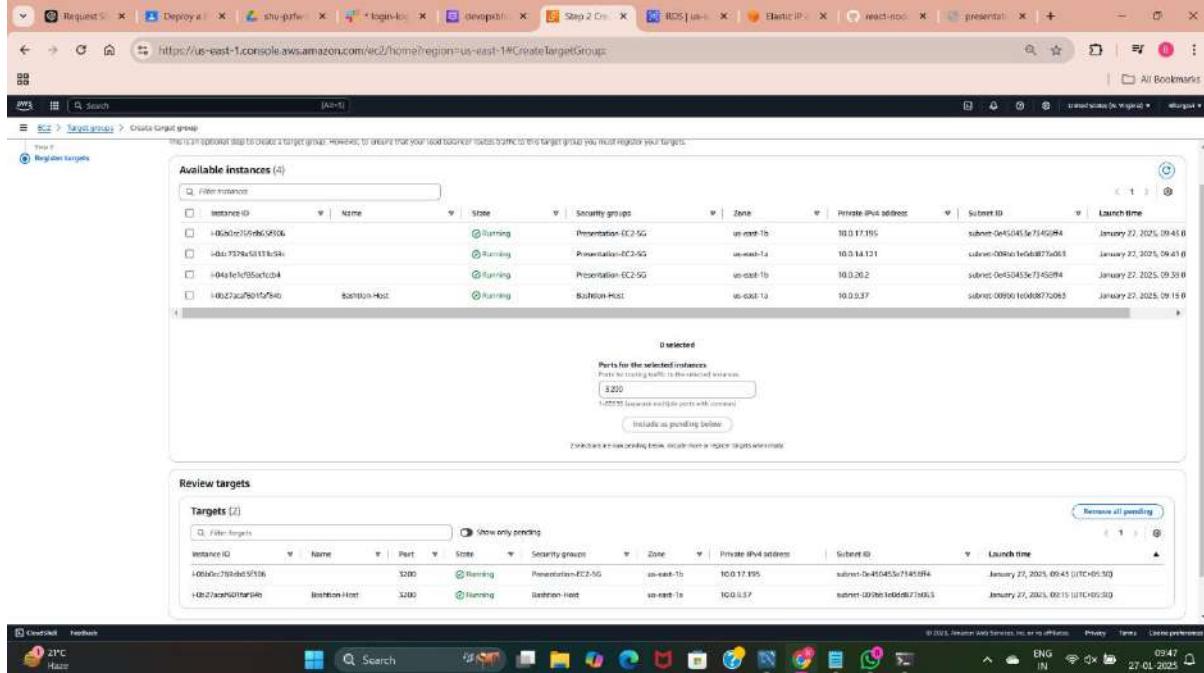


- Target Type: Choose Instances (since you'll be registering EC2 instances in this target group).

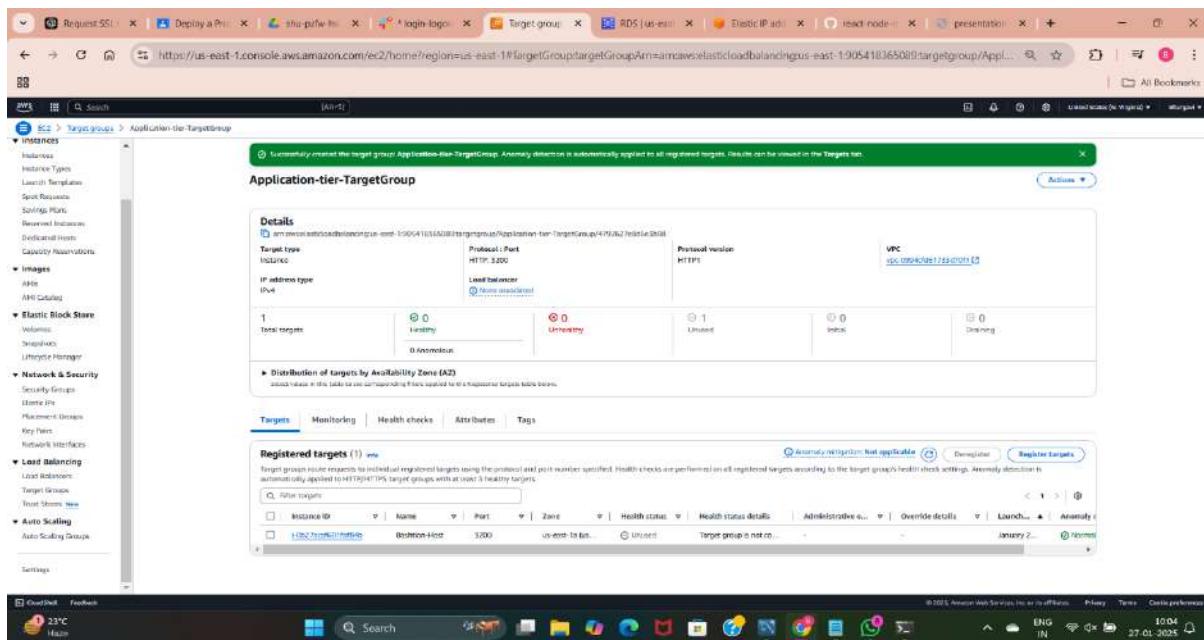


- Name: Enter a name, such as Application-Tier-TG\targetGroup.
- Protocol: Select HTTP.
- Set the port to 3200 (the port where the Application Tier will listen).
- Select 3-Tier-Architecture VPC.

- Health checks:  
Protocol: HTTP.  
Path: / or choose a specific health check endpoint if applicable.  
Port: Set it to traffic port.
- Click Next.



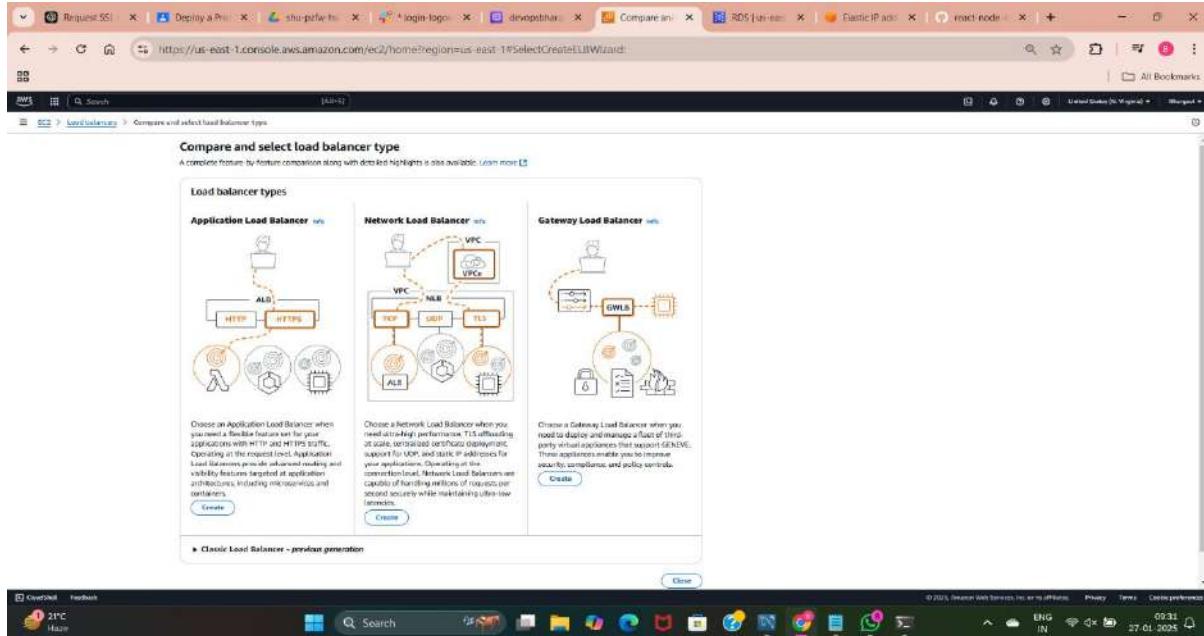
- After creating the target group, you can register your Application Tier EC2 instances.
- Select Add to registered targets.
- Click Create to finish the process.



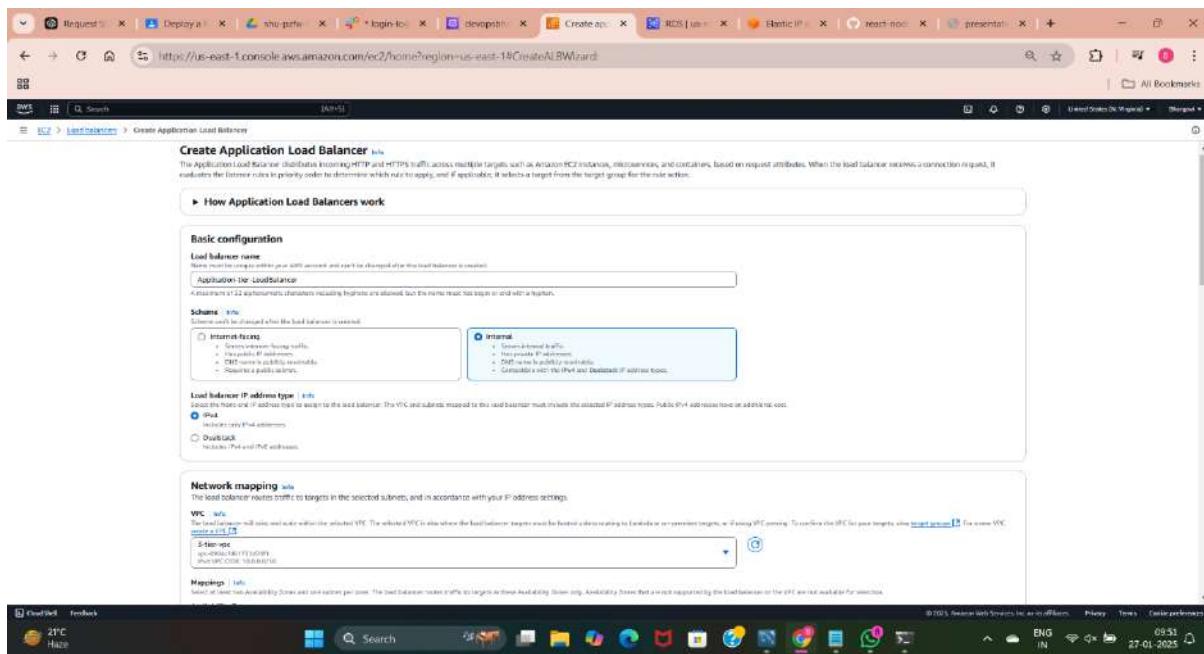
- Application tier target group is created. This will create the target group, and we can now attach it to our load balancer and configure scaling policies as needed.

## 8.3 CREATING APPLICATION TIER LOAD BALANCER

- In the AWS Management Console, navigate to the EC2 Dashboard.
- In the left sidebar, under Load Balancing, click on Load balancers.
- Click on Create Load Balancer.

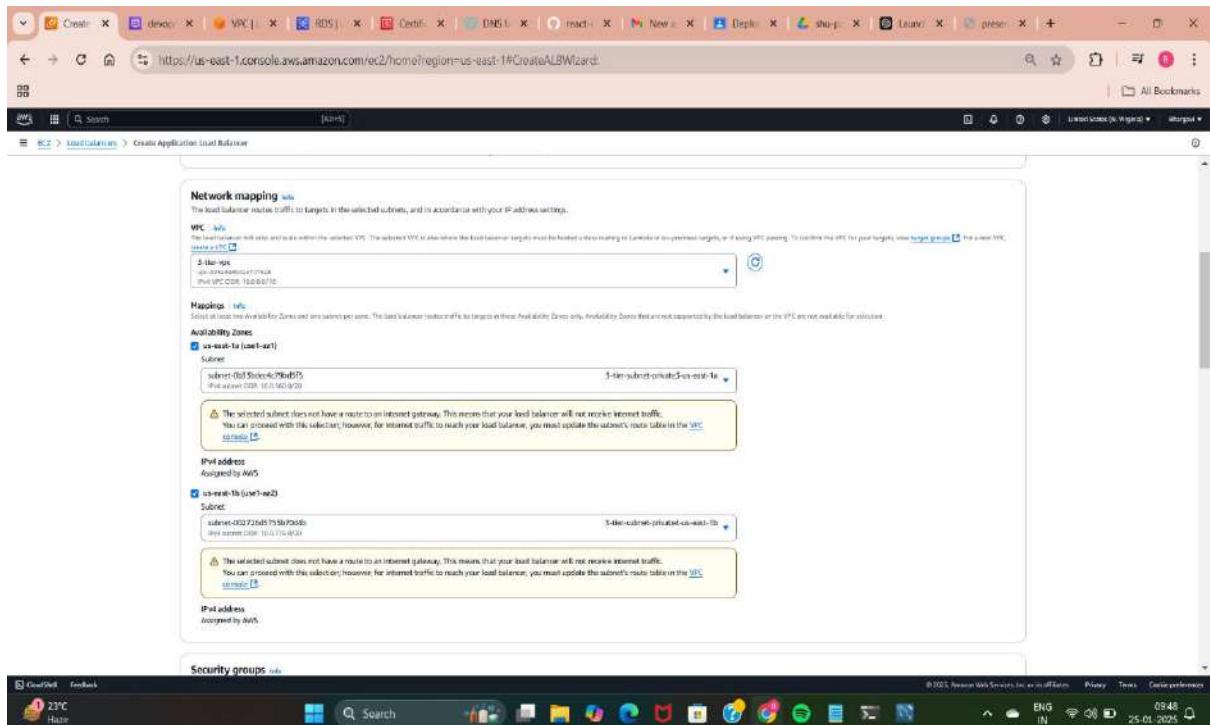


- Select Application Load Balancer (ALB).

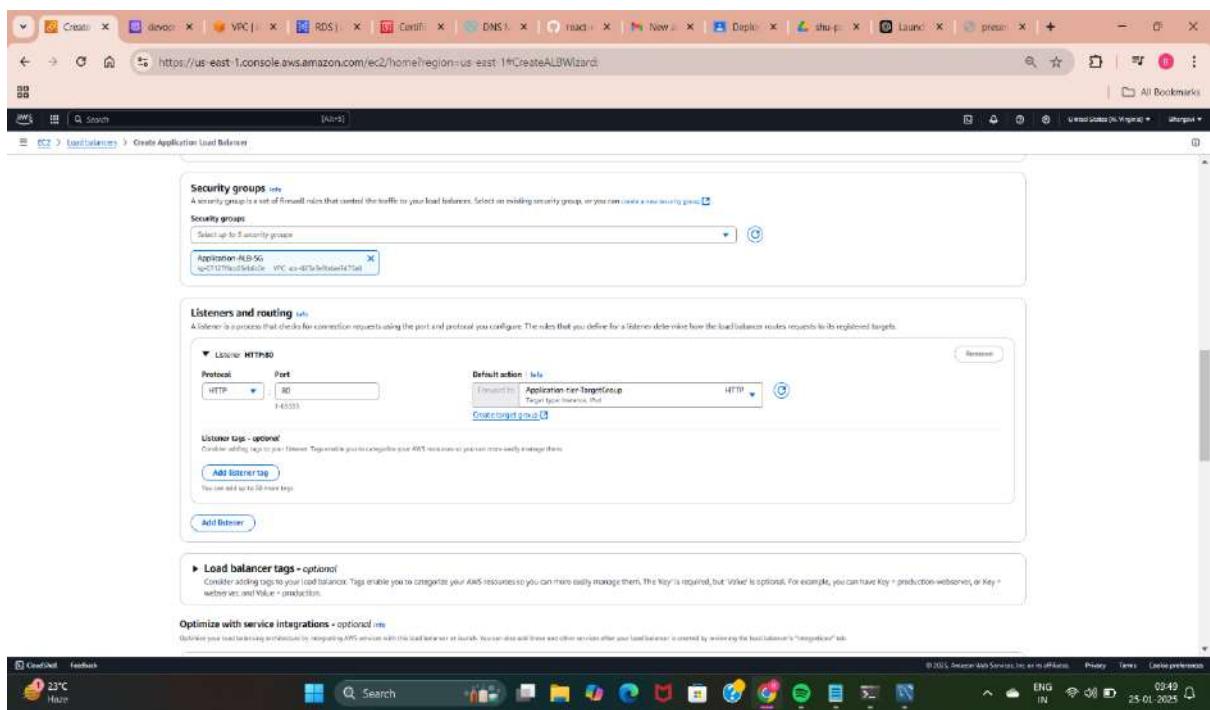


Configure Load Balancer Details:

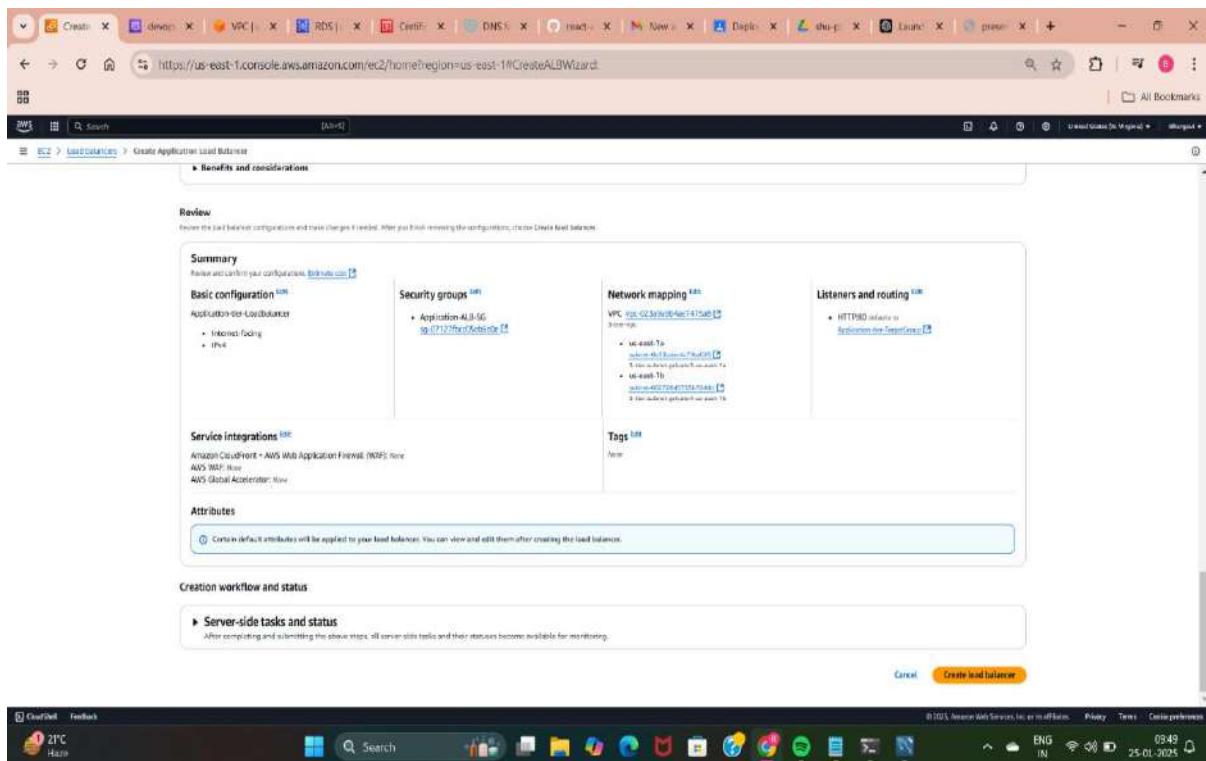
- Name: Enter a name, such as Application-Tier-LoadBalancer.
- Scheme: Choose internal based on your requirements.
- IP Address Type: Choose ipv4.



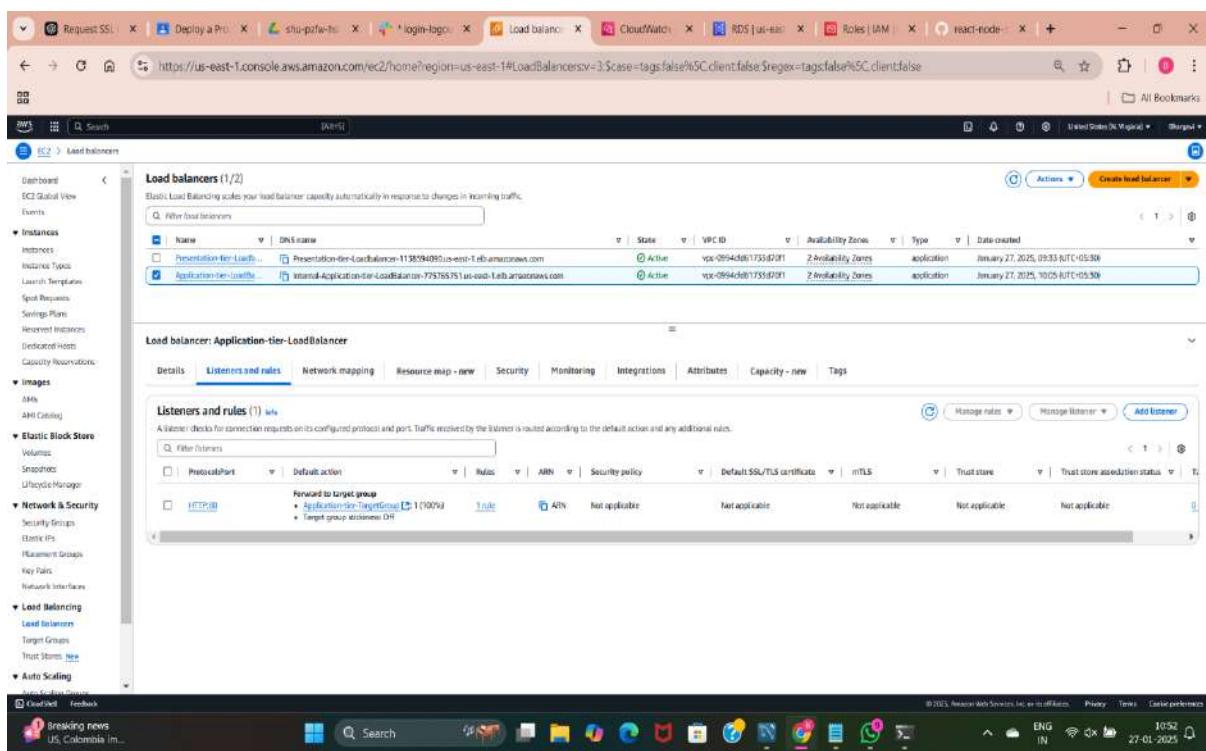
- Select 3-tier VPC.
- Select at least 2 availability zones from the region.
- Select two private subnets.



- Select the Application-Tier-ALB security group that you previously created.
- Listeners: By default, it should have an HTTP listener on port 80. You can leave this as it is or configure custom ports.



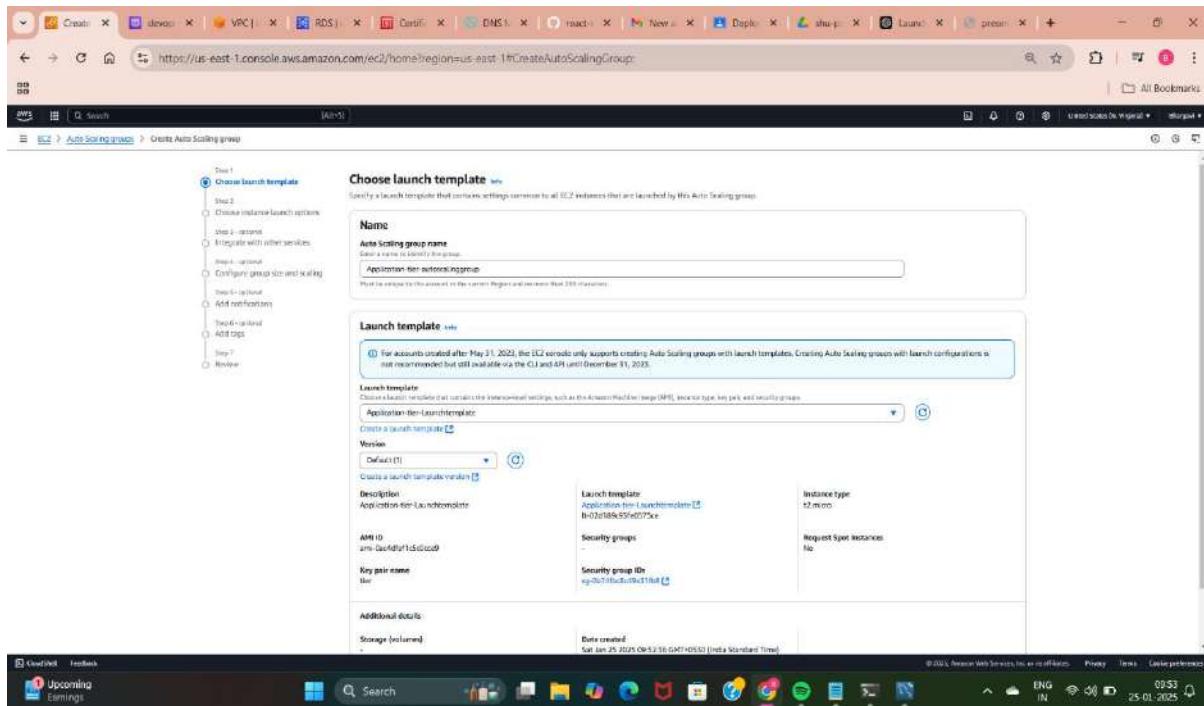
- Review all the configurations. Click Create to launch the Application Load Balancer.



- The Application Load Balancer is created for our Application Tier, and it will start routing traffic to the EC2 instances registered in the target group.

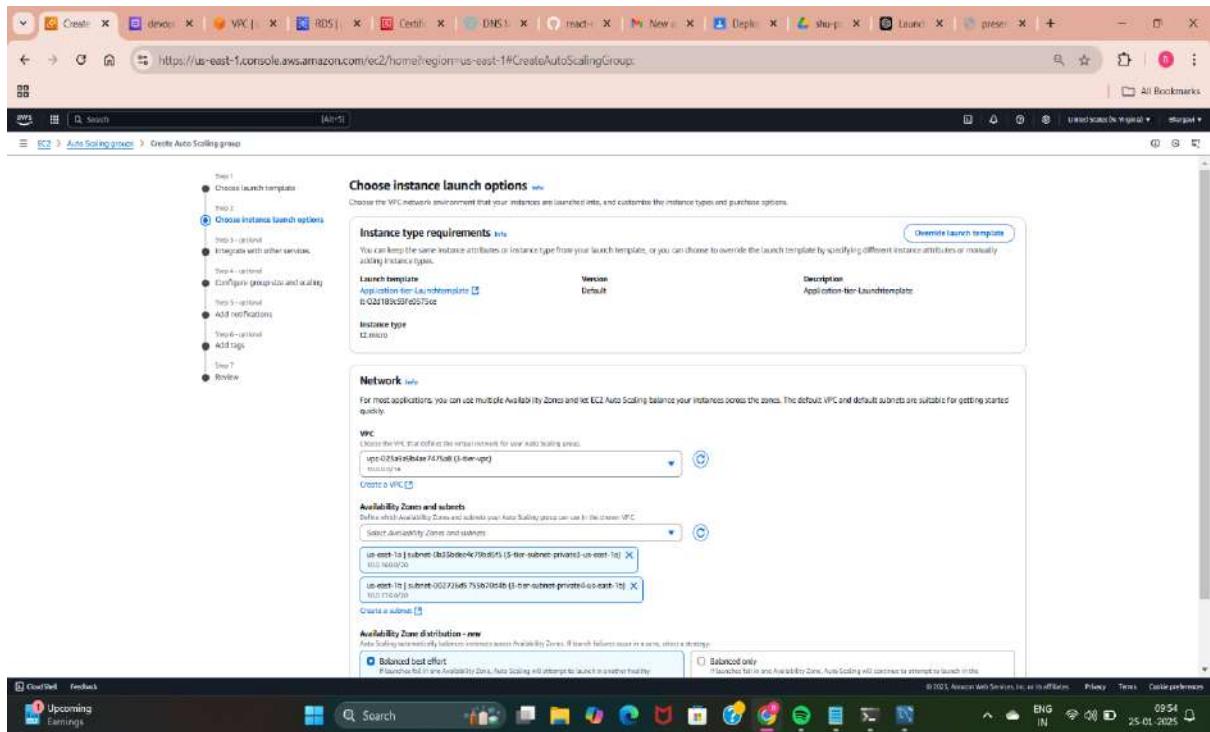
## 8.4 CREATING AUTO SCALING GROUP FOR APPLICATION TIER WITH DESIRED CAPACITY=3, MINIMUM=2, MAXIMUM=4

- In the AWS Management Console, navigate to EC2 Dashboard.
- In the left-hand sidebar, under Auto Scaling, click on Auto Scaling Groups.
- Click on the Create Auto Scaling group button.

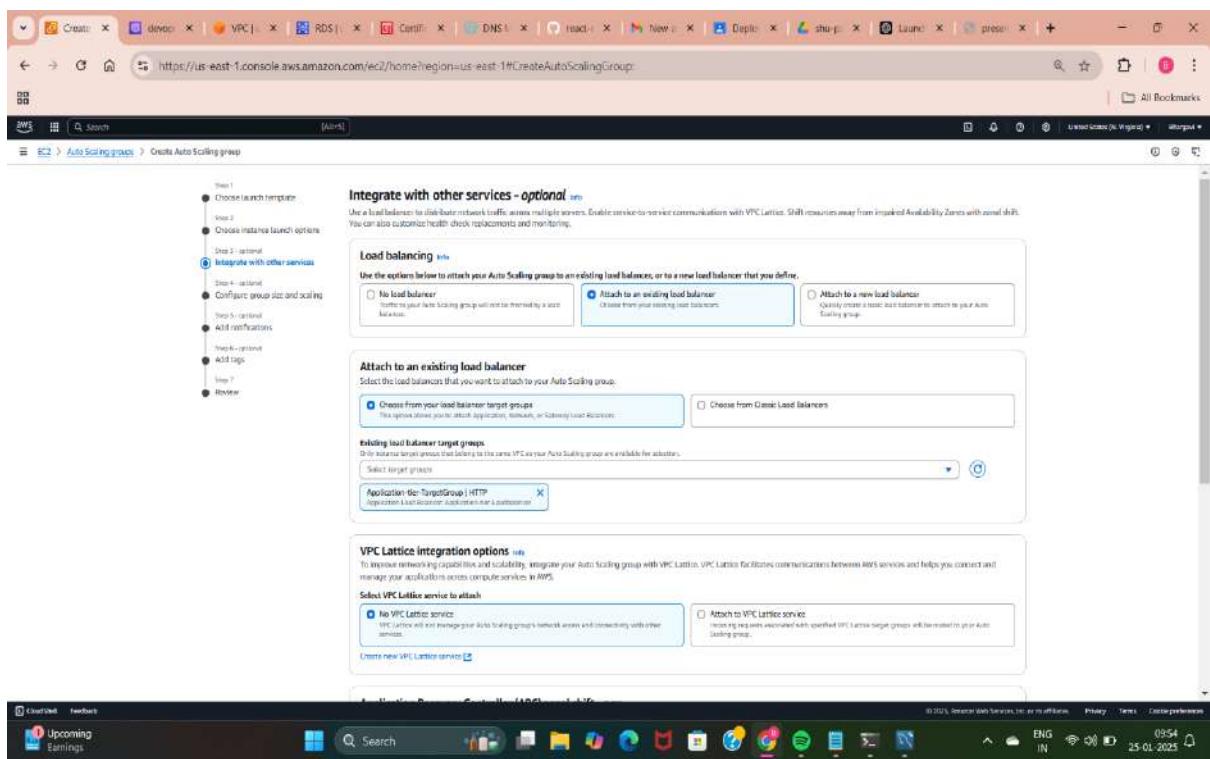


### Basic Configuration:

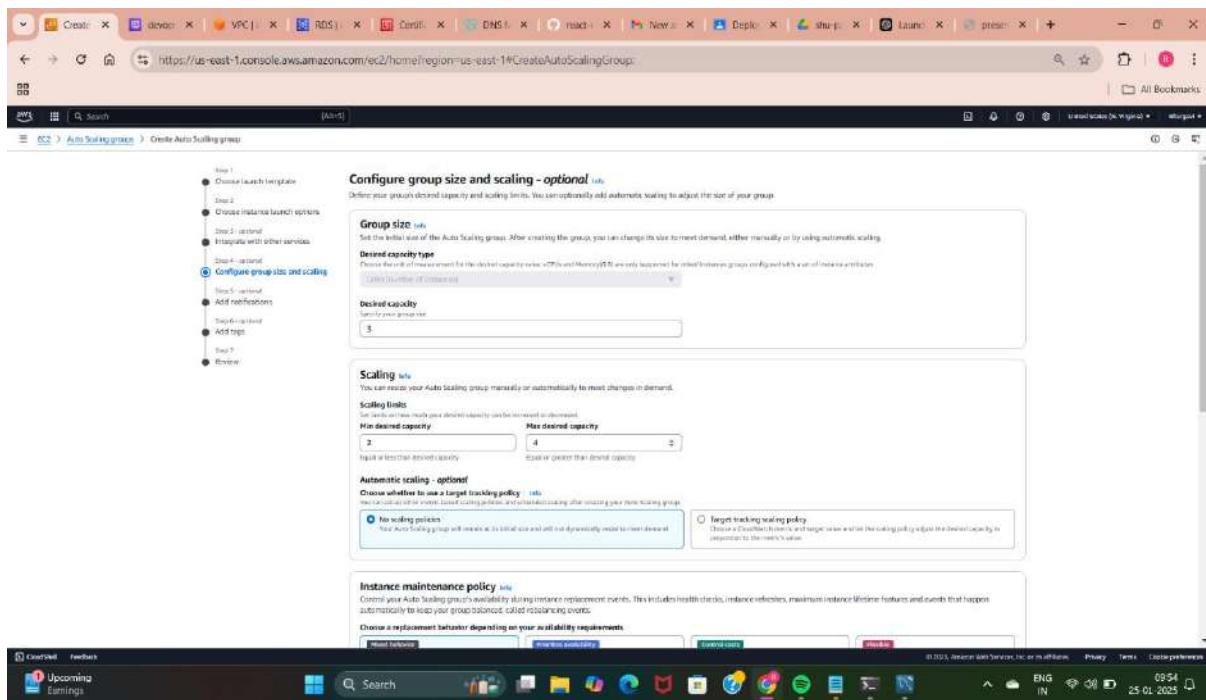
- Name: Enter a name, such as Application-tier-autoscalinggroup.
- Launch Template:
  - Select the Launch Template you created earlier for the Application Tier.
  - Ensure the correct version of the template is selected.



- Select 3-Tier VPC. Select the private subnets that correspond to the Application Tier.

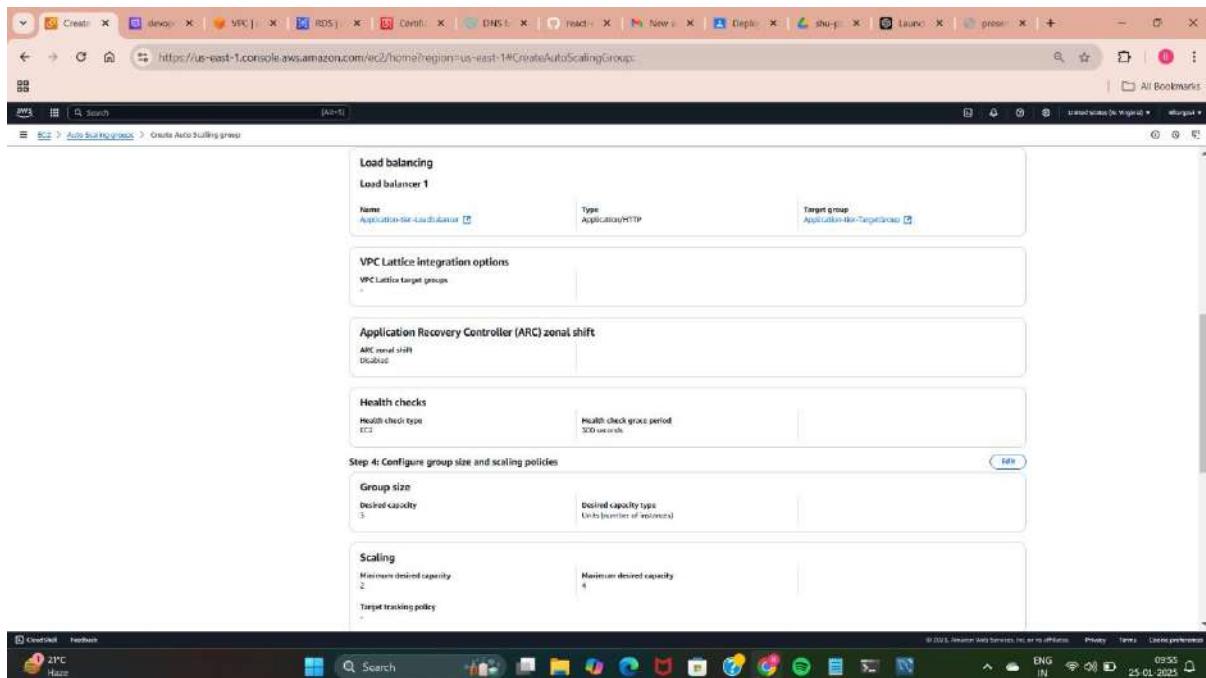


- Enable Application Load Balancer or Network Load Balancer.
- Select the Application-Tier-ALB Target Group you created earlier.



Configure Group Size as mentioned below:

- Desired Capacity: 3
- Minimum Capacity: 2
- Maximum Capacity: 4



- Review all your configurations. Click Create Auto Scaling Group.

The screenshot shows the AWS Auto Scaling Groups page. It displays two Auto Scaling groups: "Application-tier-AutoScalingGroup" and "Presentation-tier-AutoScalingGroup". The "Application-tier-AutoScalingGroup" is currently updating its capacity. The "Presentation-tier-AutoScalingGroup" has a desired capacity of 3. Both groups are in the us-east-1 region.

- If your configuration is correct, three instances will be created under EC2 Dashboard in the private subnets as part of the Application Tier Auto Scaling Group

The screenshot shows the AWS Target Groups page. It displays one target group named "Application-tier-TargetGroup". This target group uses an "Amazon VPC Load Balancer" and has two registered targets, both of which are healthy. The targets are EC2 instances with instance IDs starting with i-0956 and i-0028.

- The created application tier ec2 instances are added to application tier target group.

```

C:\Users\bhava\Downloads\AWS CLASS>ssh -A ec2-user@44.199.210.102
The authenticity of host '44.199.210.102 (44.199.210.102)' can't be established.
ED25519 key fingerprint is SHA256:fibEcACWTAzApnWSWGH54f+118XnXXDs/qVkfPGgag.
This host key is known by the following other names/addresses:
  C:\Users\bhava\.ssh\known_hosts:261: ec2-44-199-210-102.compute-1.amazonaws.com
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '44.199.210.102' (ED25519) to the list of known hosts.

  _\ #####
  ~\ #####
  ~\ #####
  ~\ /--> https://aws.amazon.com/linux/amazon-linux-2023

[ec2-user@ip-10-0-6-188 ~]$ ssh ec2-user@10.0.188.207
The authenticity of host '10.0.188.207 (10.0.188.207)' can't be established.
ED25519 key fingerprint is SHA256:E1+RdnrlUyEWokNTZ/09a17bkjuidxREFBYkUbDQXGEo.
This key is not known by any other names
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '10.0.188.207' (ED25519) to the list of known hosts.

  _\ #####
  ~\ #####
  ~\ #####
  ~\ /--> https://aws.amazon.com/linux/amazon-linux-2023

[ec2-user@ip-10-0-188-207 ~]$ pm2 logs
[TAILING] Tailing last 15 lines for [all] processes (change the value with --lines option)
/home/ec2-user/.pm2/pm2.log last 15 lines:
PM2 2025-01-26T03:48:35: PM2 log: PM2 version : 5.4.3
PM2 2025-01-26T03:48:35: PM2 log: Node.js version : 18.20.6
PM2 2025-01-26T03:48:35: PM2 log: Current arch : x64
PM2 2025-01-26T03:48:35: PM2 log: PM2 home : /home/ec2-user/.pm2

```

- SSH into the Bastion Host. Replace `bastion_host_public_ip` with the public IP of your Bastion Host.  
“`ssh -A ec2-user@bastion_host_public_ip`”
- Go to the EC2 Dashboard and check the private IP addresses of the instances created under the Application Tier.
- From the Bastion Host, connect to a private instance using its private IP address:  
“`ssh ec2-user@private-ip`”
- Run the following command to view logs from the backend application  
“`pm2 logs`”

```

[ec2-user@ip-10-0-6-188 ~]$ ssh ec2-user@10.0.188.207
The authenticity of host '10.0.188.207 (10.0.188.207)' can't be established.
ED25519 key fingerprint is SHA256:E1+RdnrlUyEWokNTZ/09a17bkjuidxREFBYkUbDQXGEo.
This key is not known by any other names
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '10.0.188.207' (ED25519) to the list of known hosts.

  _\ #####
  ~\ #####
  ~\ #####
  ~\ /--> https://aws.amazon.com/linux/amazon-linux-2023

[ec2-user@ip-10-0-188-207 ~]$ pm2 logs
[TAILING] Tailing last 15 lines for [all] processes (change the value with --lines option)
/home/ec2-user/.pm2/logs/pm2.log last 15 lines:
PM2 2025-01-26T03:48:35: PM2 log: PM2 version : 5.4.3
PM2 2025-01-26T03:48:35: PM2 log: Node.js version : 18.20.6
PM2 2025-01-26T03:48:35: PM2 log: Current arch : x64
PM2 2025-01-26T03:48:35: PM2 log: PM2 home : /home/ec2-user/.pm2
PM2 2025-01-26T03:48:35: PM2 log: PM2 PID file : /home/ec2-user/.pm2/pid
PM2 2025-01-26T03:48:35: PM2 log: RPC socket file : /home/ec2-user/.pm2/rpc.sock
PM2 2025-01-26T03:48:35: PM2 log: BUS socket file : /home/ec2-user/.pm2/pub.sock
PM2 2025-01-26T03:48:35: PM2 log: Application log path : /home/ec2-user/.pm2/logs
PM2 2025-01-26T03:48:35: PM2 log: Worker Interval : 30000
PM2 2025-01-26T03:48:35: PM2 log: Worker Dump File : /home/ec2-user/.pm2/dump.pm2
PM2 2025-01-26T03:48:35: PM2 log: Concurrency Actions : 1
PM2 2025-01-26T03:48:35: PM2 log: SIGTERM timeout : 1600
PM2 2025-01-26T03:48:35: PM2 log: =====
PM2 2025-01-26T03:48:35: PM2 log: App [server:0] starting in -fork mode-
PM2 2025-01-26T03:48:35: PM2 log: App [server:0] online

/home/ec2-user/.pm2/logs/server-error.log last 15 lines:
/home/ec2-user/.pm2/logs/server-out.log last 15 lines:
[Server] | Server is running on port http://localhost:3200
[Server] | 2025-01-26 03:48:36 [INFO]: Connected to MySQL Database

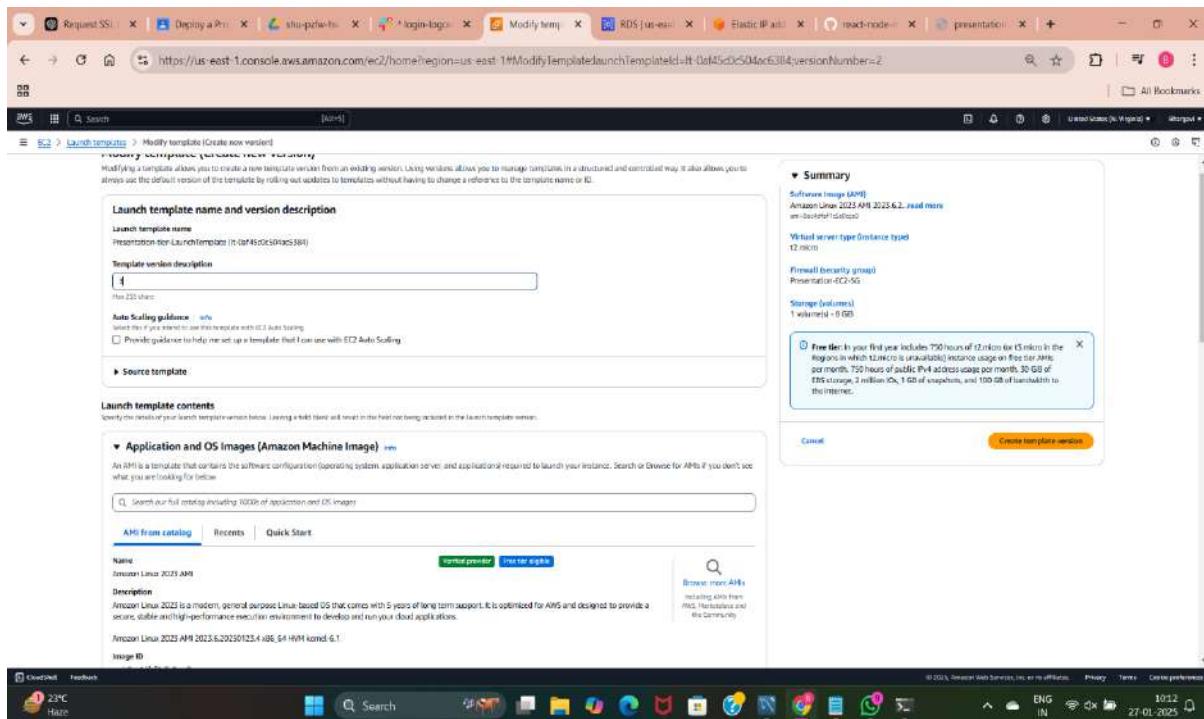
```

- The logs should display activity from our backend application running in the private instance. Look for entries like successful requests or database interactions.
- Your Application Tier Backend is now set up correctly, and the instances are processing requests as expected.

## STEP 9: MODIFYING PRESENTATION TIER LAUNCH TEMPLATE

### 9.1 MODIFYING LAUNCH TEMPLATE WITH VERSION 2 USING BELOW USER DATA

- To modify the existing Launch Template for the Presentation Tier and create a new version with updated User Data.
- Navigate to the EC2 Dashboard.
- On the left-hand menu, click Launch Templates.
- Select the Launch Template created for the Presentation Tier.



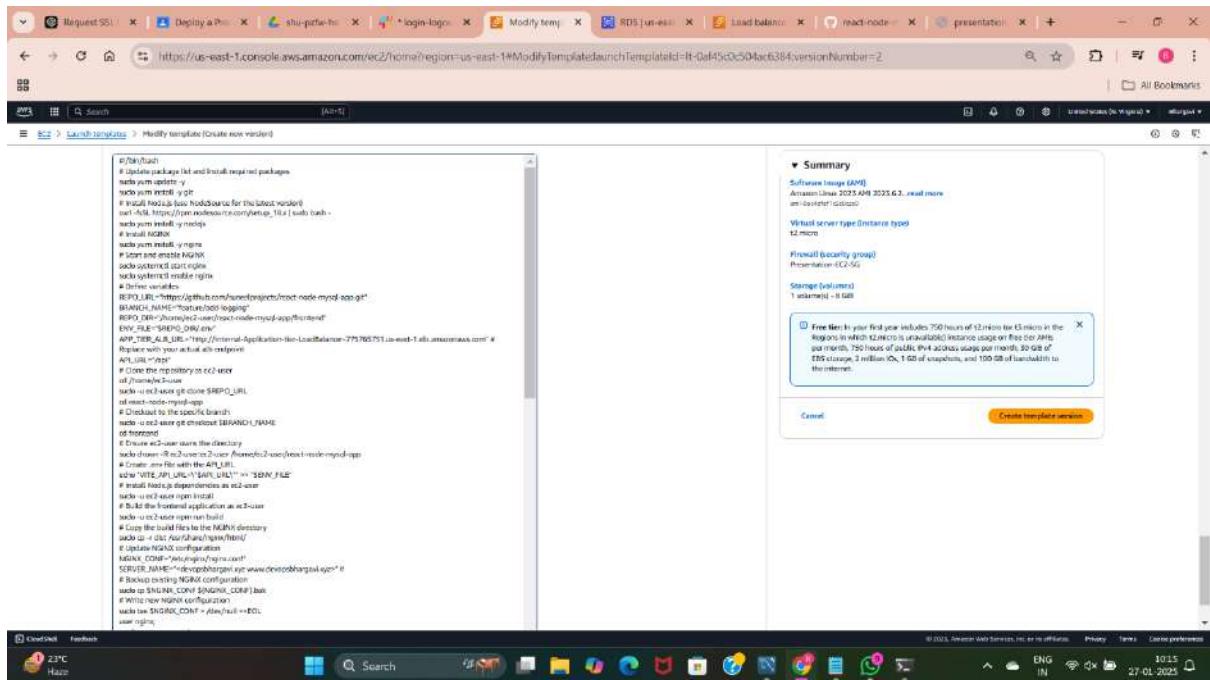
- Select Actions and click the dropdown menu and choose Create new version.

The screenshot shows the AWS CloudFormation 'Modify template [Create new version]' interface. In the 'Summary' section, the software image is listed as 'Amazon Linux 2023 AMI 2023.6.20230125.4.x86\_64-HVM kernel-6.1'. The instance type selected is 't2.micro'. The storage volume is '1 volume(s) - 8 GB'. A tooltip for the instance type indicates a free tier for the first year, including 750 hours of t2.micro usage per month, 750 hours of public IPv4 address usage per month, 30 GiB of EBS storage, 2 million I/Os, 1 GB of snapshots, and 100 GiB of bandwidth to the internet.

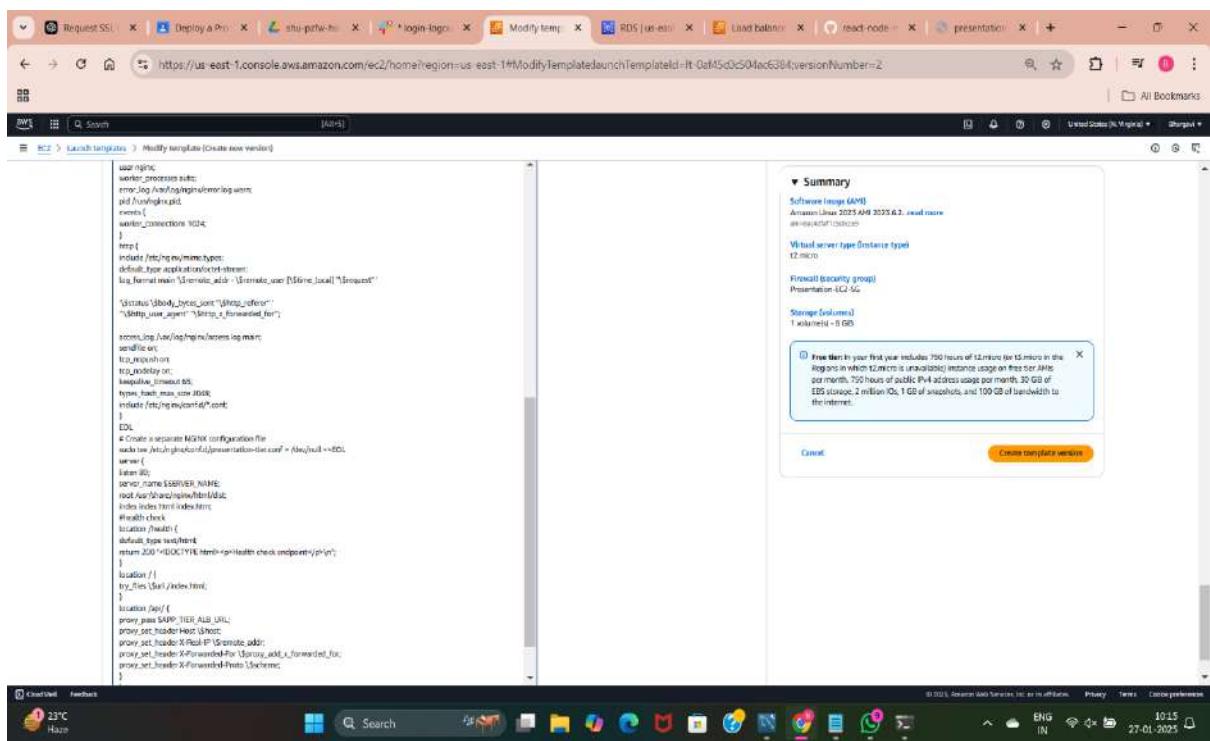
- Select key pair and check AMI details.

The screenshot shows the 'Network settings' section of the AWS CloudFormation interface. It includes fields for 'Subnet' (selected as 'subnet-048454575455f07'), 'Security group' (selected as 'Presentation-EC2-SG'), and 'Common security groups' (selected as 'Presentation-EC2-SG'). A tooltip for the subnet indicates it is a public subnet. The 'Storage (volumes)' section shows one EBS volume of 8 GB. The 'Resource tags' section notes that no resource tags are currently included in the template.

- Select the public subnet, security group for presentation tier launch template.



- Replace the existing User Data with the new script.



- Click Create Launch Template Version to finalize the new version.

- Once the new version is created, select Actions → Set Default Version.

## 9.2 MODIFYING AUTO SCALING GROUP OF PRESENTATION TIER BY SELECTING THE LAUNCH TEMPLATE VERSION 2, GIVE DESIRED CAPACITY, MIN & MAX AS 2

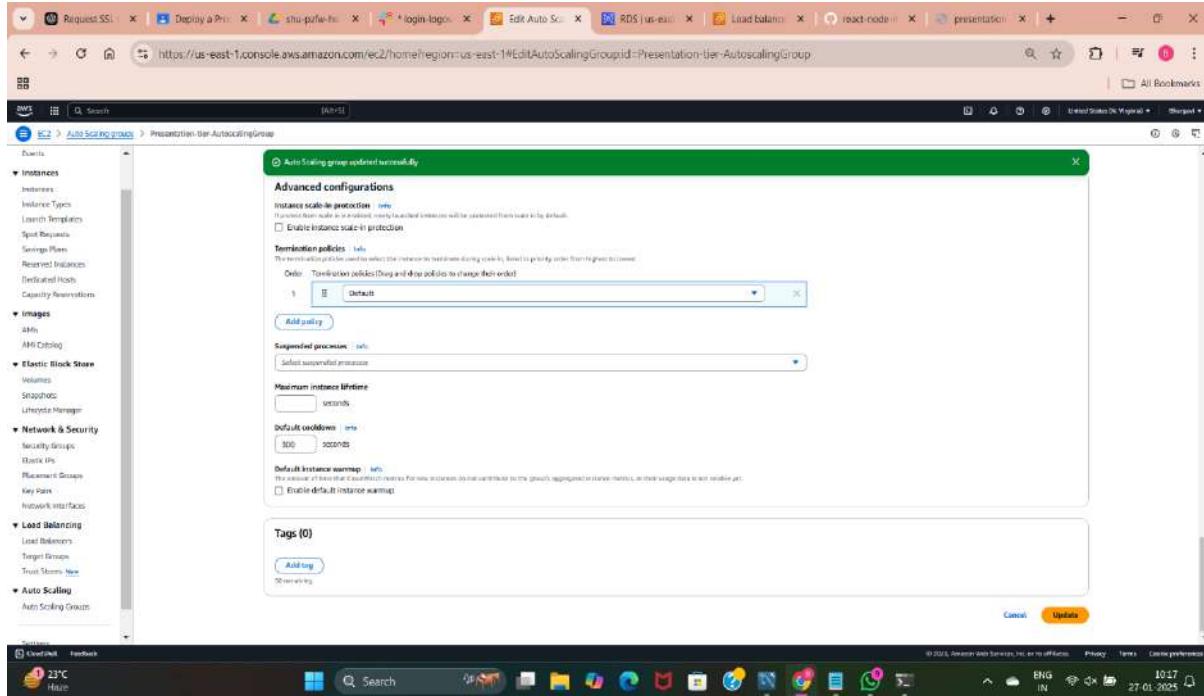
- To update the Presentation Tier Auto Scaling Group with the newly created Launch Template Version 2
- Go to the EC2 Dashboard in the AWS Console.
- On the left-hand menu, select Auto Scaling Groups.
- Find and select the Presentation Tier Auto Scaling Group.

- Click Edit in the details section of the selected Auto Scaling Group.

Adjust Capacity Settings:

- Update the Desired Capacity: Set it to 2.

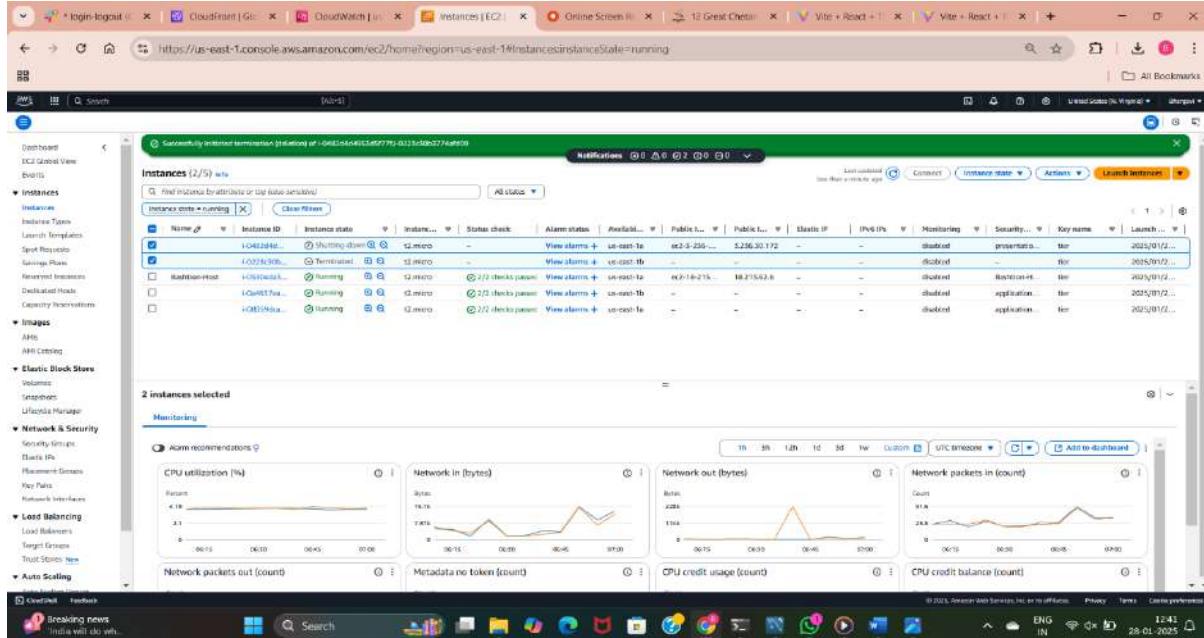
- Update the Minimum Capacity: Set it to 2.
- Update the Maximum Capacity: Set it to 2 (or adjust as needed for scaling flexibility).



- Click Update to apply the new settings.

Under Launch Template, ensure the following:

- Select the Launch Template Name for the Presentation Tier.
- Set the Launch Template Version to 3.
- New Autoscaling group is created



- Go to the EC2 Instances section in the AWS Console.

- Filter for instances associated with the Presentation Tier Auto Scaling Group.
- Terminate all running instances that are using the old configuration:
- Select the instances and click Instance State → Terminate.

The screenshot shows the AWS EC2 Instances page with a success message: "Successfully initiated termination (Idempotent) of i-062c1a0d556e779-0225305574af010". The table lists four instances, with the first three being terminated (status: "Terminated"). The fourth instance is still running. The left sidebar includes sections for Instances, Images, Elastic Block Store, Network & Security, Load Balancing, and Auto Scaling.

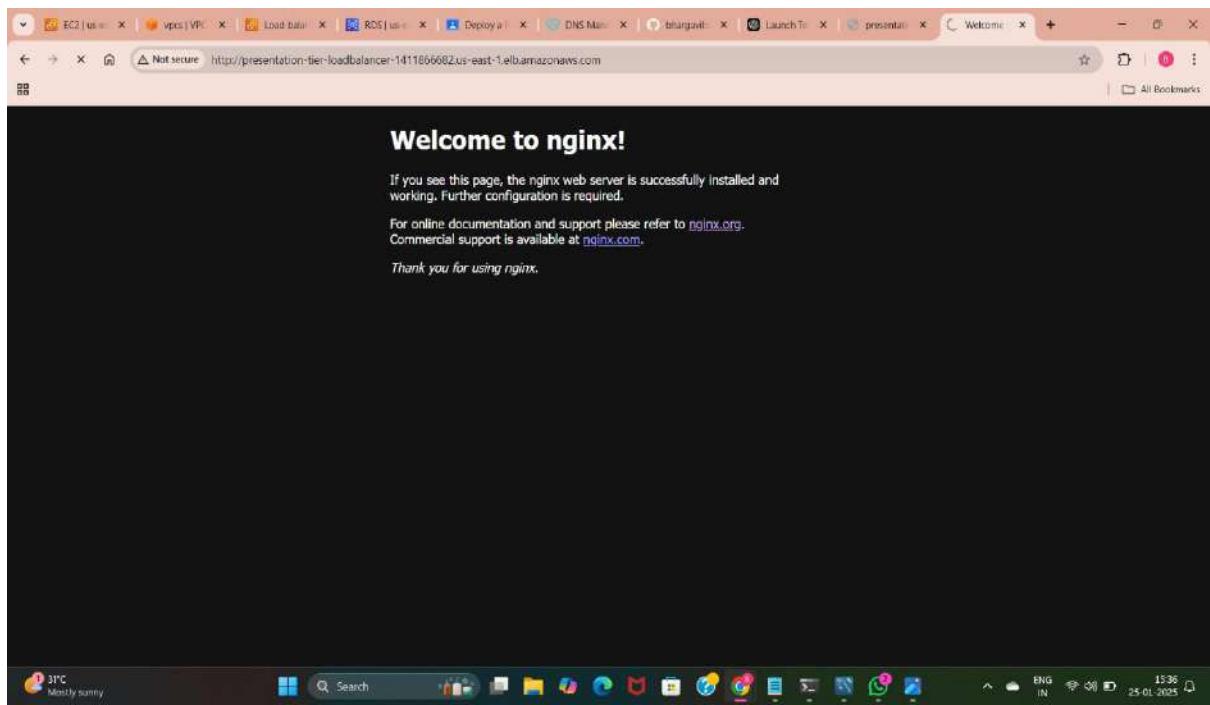
Name	Instance ID	Instance state	Public IP	Private IP	Monitoring	Security group	Key name	Launch time
Bashroot Host	i-07594645...	Terminated	-	-	disabled	None (VPC)	key	2025/01/2...
Qemu37...	i-07594645...	Terminated	-	-	disabled	application	key	2025/01/2...
Presentation-tier-...	i-07594645...	Running	ec2-18-215-18.215.62.6	-	disabled	presentation	key	2025/01/2...
I-08094645...	i-08094645...	Running	ec2-44-201-105-195	-	disabled	application	key	2025/01/2...

- The Auto Scaling Group will automatically launch new instances with the update configuration.

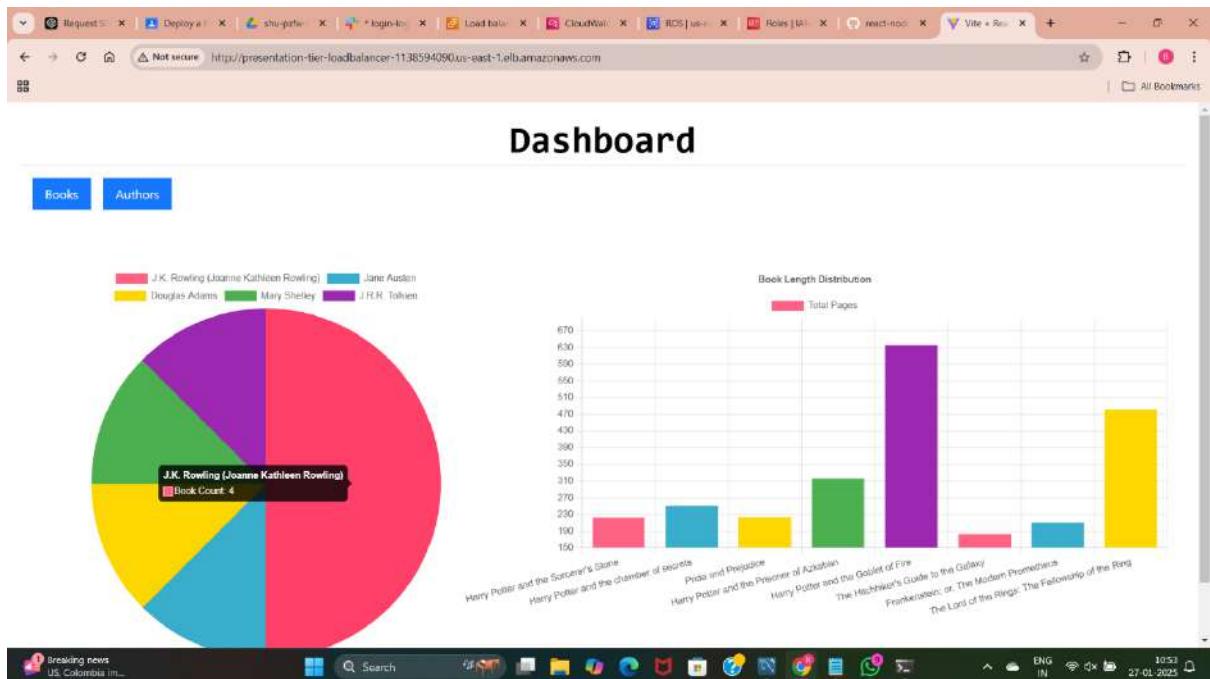
The screenshot shows the AWS EC2 Load Balancers page with two active load balancers: "Presentation-tier-Loadbalancer" and "Application-tier-Loadbalancer". The left sidebar includes sections for Instances, Images, Elastic Block Store, Network & Security, Load Balancing, and Auto Scaling.

Name	DNS name	State	VPC ID	Availability Zones	Type	Date created
Presentation-tier-Loadbalancer	Presentation-tier-Loadbalancer-1138594090.us-east-1.elb.amazonaws.com	Active	vpc-0994cf9617348f0f1	2 Availability Zones	application	January 27, 2025, 09:30
Application-tier-Loadbalancer	internal-application-tier-loadbalancer-775705751.us-east-1.elb.amazonaws.com	Active	vpc-0994cf961735d70f1	2 Availability Zones	application	January 27, 2025, 10:00

- Once the new instances are launched, go to the Load Balancer DNS Name for the Presentation Tier.
- The DNS Name is located in the Load Balancer section of the EC2 Dashboard under Description.



- Open the DNS Name in a browser.



- Verify that the updated configuration is reflected (e.g., custom web page message or application features).

## AMAZON CLOUDWATCH

Amazon CloudWatch is a monitoring and observability service provided by AWS that gives you insight into the performance and health of your AWS resources and applications. It allows you to collect, monitor, and analyze various metrics, logs, and events to help ensure that your applications are running smoothly and meet your performance and operational goals.

CloudWatch is used for a wide range of use cases, such as tracking the performance of EC2 instances, Lambda functions, databases, and other AWS services. It can also be used to create alarms, automate responses, and visualize data through dashboards.

## STEP 10: INTEGRATING APPLICATION LOGS WITH CLOUDWATCH

- To integrate the application logs from the backend of the Application Tier with Amazon CloudWatch, Follow these steps.
- From your terminal, SSH into the Application Tier EC2 instance through the Bastion Host:  
“ssh -A ec2-user@<bastion\_host\_public\_ip>”  
“ssh ec2-user@<application\_tier\_private\_ip>”

The screenshot shows a Windows Command Prompt window titled "Command Prompt - ssh - N - L". The title bar also includes "ec2-user@ip-10-0-128-37 ~" and "ec2-user@ip-10-0-128-37:~/". The window displays a terminal session where the user has navigated to the logs directory and listed files. The terminal output is as follows:

```
https://aws.amazon.com/linux/amazon-linux-2023

Last login: Sat Jan 25 09:01:26 2025 from 10.0.1.255
[ec2-user@ip-10-0-128-37 ~]$ cd /home/ec2-user/react-node-mysql-app/backend/logs
[ec2-user@ip-10-0-128-37 logs]$ vim combined.log
[ec2-user@ip-10-0-128-37 logs]$ cd
[ec2-user@ip-10-0-128-37 ~]$ ll
total 0
drwxr-xr-x. 5 ec2-user ec2-user 66 Jan 25 08:59 react-node-mysql-app
[ec2-user@ip-10-0-128-37 ~]$ cd react-node-mysql-app/
[ec2-user@ip-10-0-128-37 react-node-mysql-app]$ ll
total 44
-rw-r--r--. 1 ec2-user ec2-user 11346 Jan 25 08:59 README.md
drwxr-xr-x. 8 ec2-user ec2-user 16384 Jan 25 08:59 backend
drwxr-xr-x. 4 ec2-user ec2-user 16384 Jan 25 08:59 frontend
[ec2-user@ip-10-0-128-37 react-node-mysql-app]$ cd backend/
[ec2-user@ip-10-0-128-37 backend]$ ll
total 76
-rw-r--r--. 1 ec2-user ec2-user 709 Jan 25 08:59 app.js
drwxr-xr-x. 2 ec2-user ec2-user 19 Jan 25 08:59 config
drwxr-xr-x. 2 ec2-user ec2-user 66 Jan 25 08:59 controllers
-rw-r--r--. 1 ec2-user ec2-user 6485 Jan 25 08:59 db.sql
drwxr-xr-x. 2 ec2-user ec2-user 43 Jan 25 10:25 logs
drwxr-xr-x. 10 ec2-user ec2-user 16384 Jan 25 08:59 node_modules
-rw-r--r--. 1 ec2-user ec2-user 40143 Jan 25 08:59 package-lock.json
-rw-r--r--. 1 ec2-user ec2-user 491 Jan 25 08:59 package.json
drwxr-xr-x. 2 ec2-user ec2-user 22 Jan 25 08:59 routes
-rw-r--r--. 1 ec2-user ec2-user 167 Jan 25 08:59 server.js
drwxr-xr-x. 2 ec2-user ec2-user 23 Jan 25 08:59 utils
[ec2-user@ip-10-0-128-37 backend]$ cd logs/
[ec2-user@ip-10-0-128-37 logs]$ ll
total 4
-rw-r--r--. 1 ec2-user ec2-user 56 Jan 25 10:25 combined.log
-rw-r--r--. 1 ec2-user ec2-user 0 Jan 25 08:59 error.log
[ec2-user@ip-10-0-128-37 logs]$ |
```

The taskbar at the bottom of the screen shows icons for File Explorer, Task View, Start, Search, Taskbar settings, and several pinned application icons. The system tray indicates the date as 25.01.2025 and the time as 15:56.

- Once connected, navigate to the logs directory  
“cd /home/ec2-user/react-node-mysql-app/backend/logs”  
“ll”
- Open the log file to confirm it contains application logs  
“vim combined.log”

The screenshot shows a terminal window with three tabs open. The active tab displays the message: "2025-01-26 04:16:43 [INFO]: Connected to MySQL Database". Below the terminal, the desktop taskbar is visible, showing various application icons like FileZilla, Google Chrome, and Microsoft Edge. The system tray at the bottom right indicates the date as 26.01.2025.

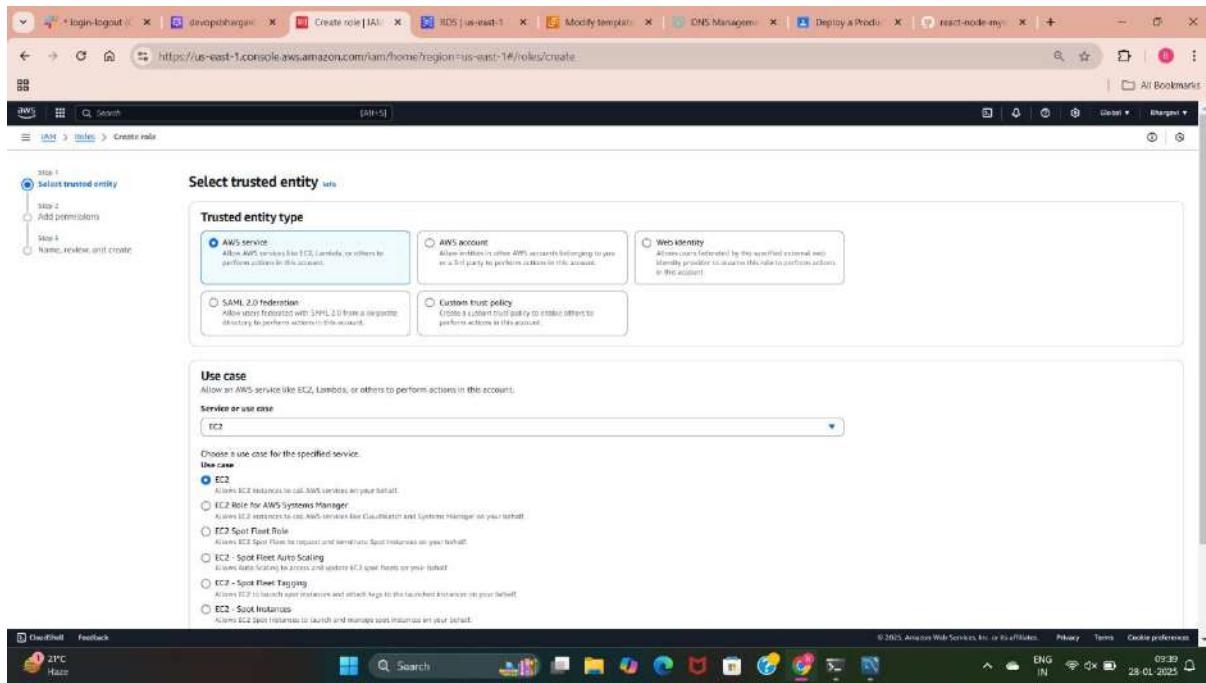
- As expected we can see the mysql database is connected.

## 10.1 CREATING IAM ROLE USING BELOW POLICIES

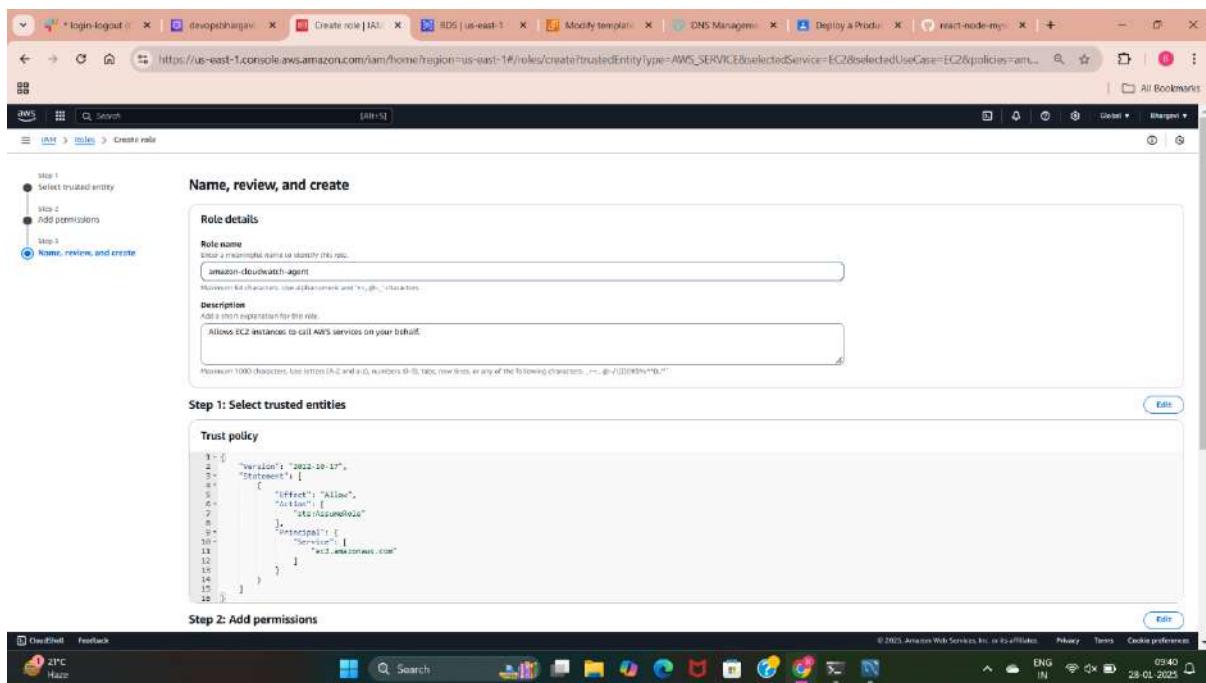
- To enable the CloudWatch Agent on your EC2 instances, you need to create an IAM Role with the necessary policies.
- Open the aws IAM console.
- In the left sidebar, click Roles.

The screenshot shows the AWS IAM Roles page. The left sidebar navigation includes 'Identity and Access Management (IAM)', 'Dashboard', 'Access management' (with 'User groups', 'Users', and 'Roles' selected), 'Policies', 'Identity providers', 'Account settings', and 'Root access management'. The main content area displays a table titled 'Roles (23)'. The table has columns for 'Role name', 'Trusted entities', and 'Last activity'. The roles listed include 'aws-mysql-cloudwatch-agent', 'aws-elasticbeanstalk-ec2-role', 'AWSServiceRoleForAmazonElasticFileSystem', 'AWSServiceRoleForAmazonSSM', 'AWSServiceRoleForAmazonDynamoDBTable', 'AWSServiceRoleForApplicationInsights', 'AWSServiceRoleForAutoscaling', 'AWSServiceRoleForCloudWatchLogs', 'AWSServiceRoleForCloudWatchEvents', 'AWSServiceRoleForAmazonCloudFront', 'AWSServiceRoleForGlobalAccelerator', 'AWSServiceRoleForImageBuilder', 'AWSServiceRoleForRDS', 'AWSServiceRoleForSupport', and 'AWSServiceRoleForTrustAdvisor'. The 'Create role' button is located in the top right corner of the table header.

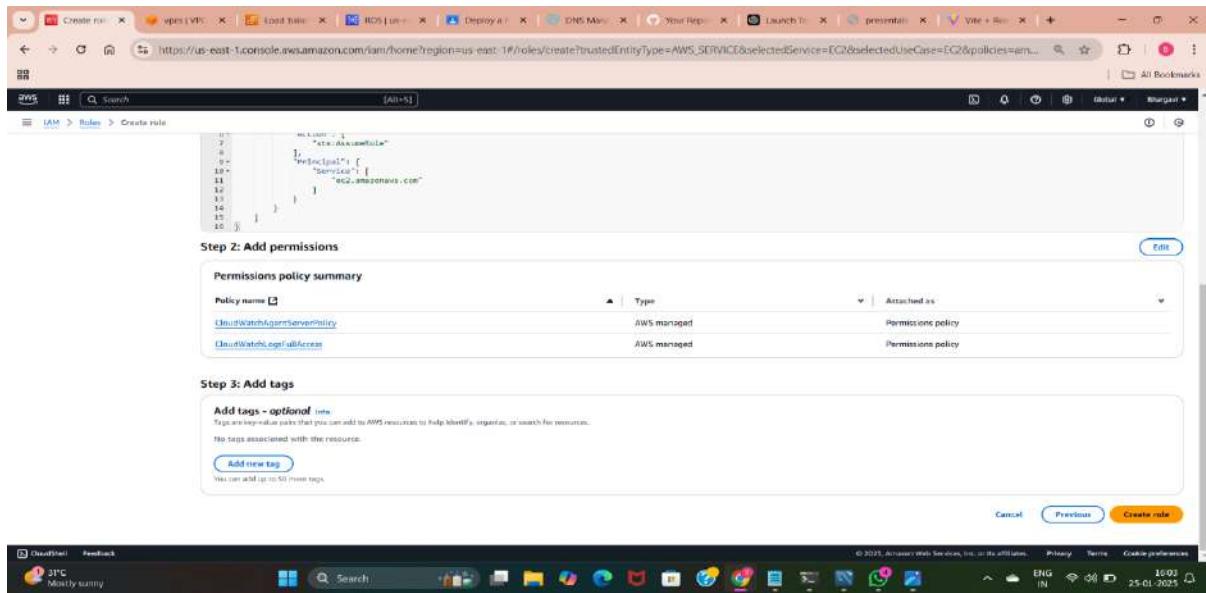
- Click the create role button



- Under Trusted entity type, select AWS Service.
- For Use case, choose EC2.
- Click Next.



- Give role name as amazon-cloudwatch-agent and select the roles.

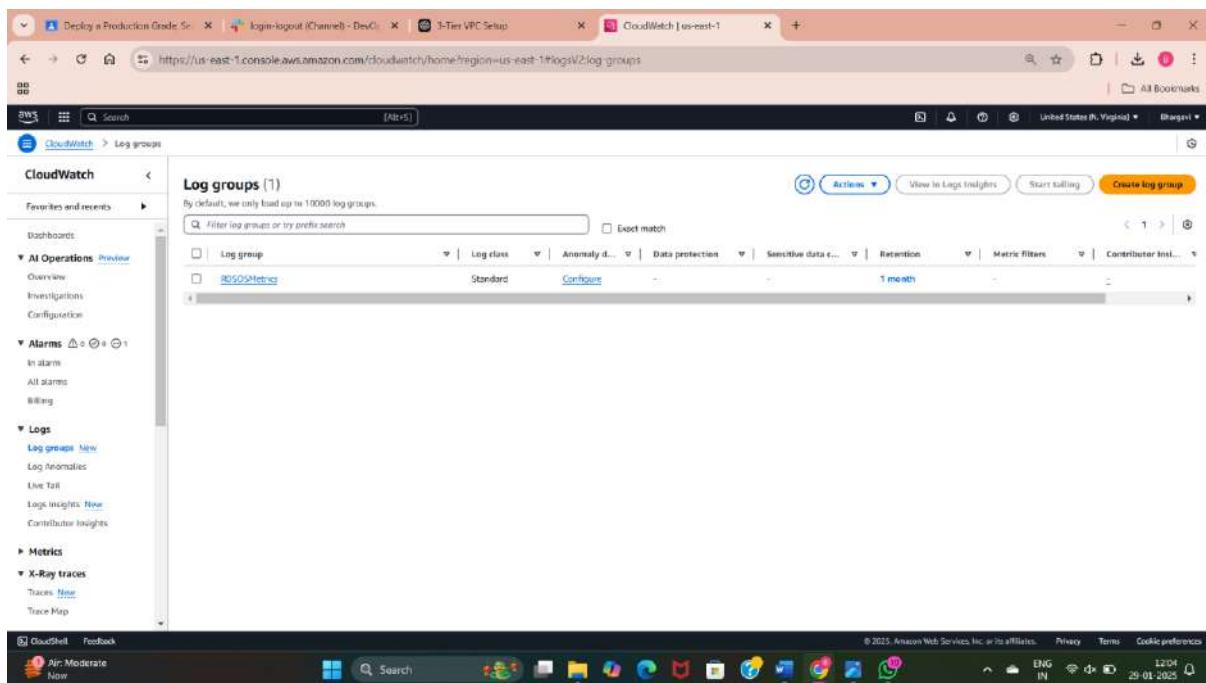


Search for and attach the following policies:

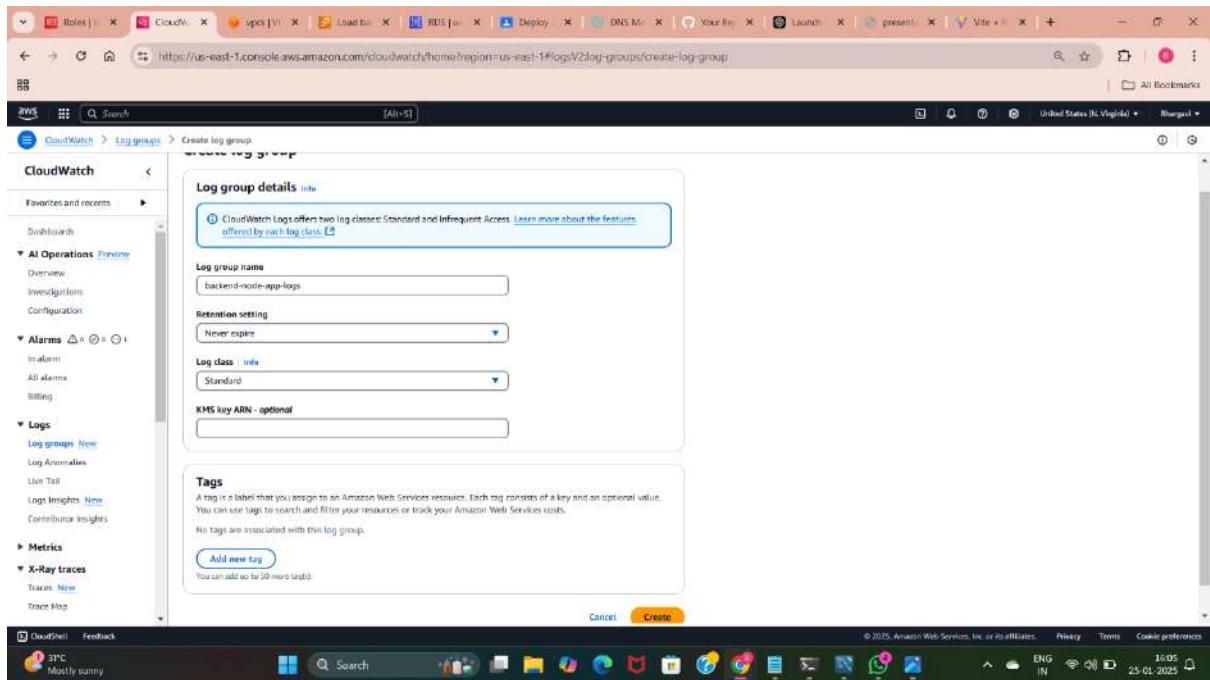
- CloudWatchLogsFullAccess: Allows full access to manage CloudWatch Logs.
- CloudWatchAgentServerPolicy: Provides permissions to the CloudWatch Agent to write metrics and logs to CloudWatch.
- Click on create role.

## 10.2 CREATING CLOUD WATCH LOG GROUP WITH NAME

- Open the AWS Management Console.
- Navigate to the CloudWatch service.
- In the CloudWatch dashboard, click on Logs from the left-hand menu.
- Select Log Groups.



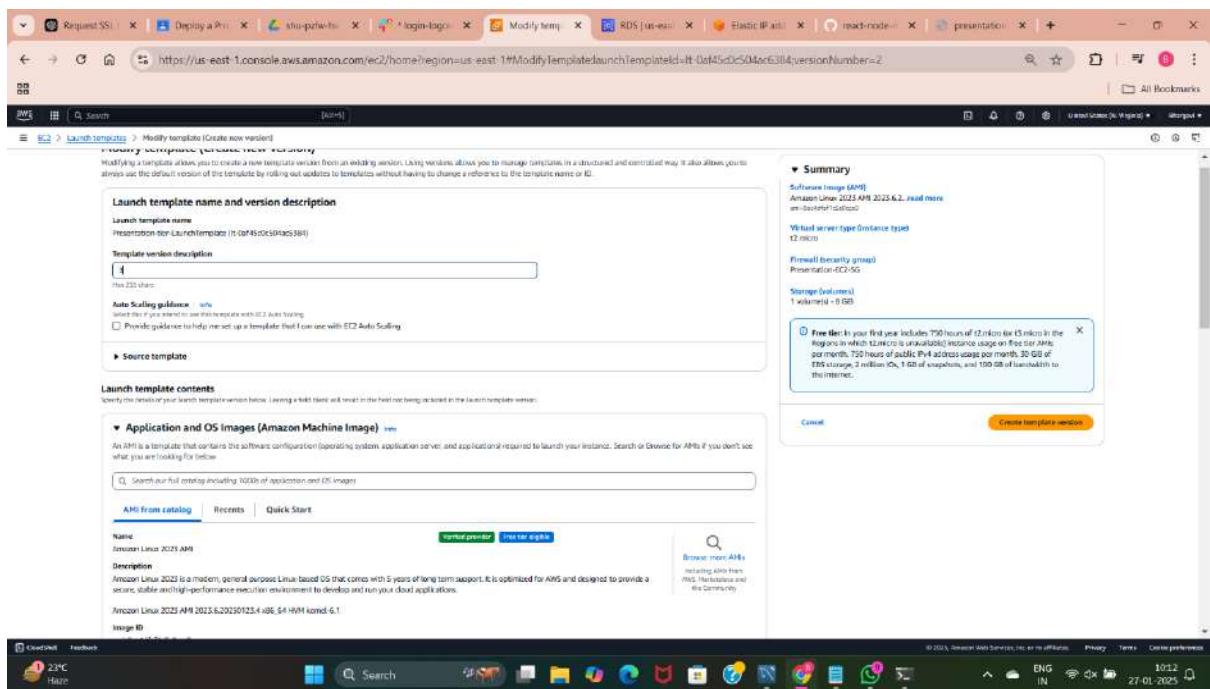
- Click on the Create log group button.



- Enter your desired log group name as backend-node-app-logs.
- Set a retention period for your logs (e.g., 7 days, 30 days, etc.).
- This ensures that logs are automatically deleted after the specified period.
- Click Create to finalize the log group.

## STEP 11: MODIFYING APPLICATION TIER LAUNCH TEMPLATE AS VERSION 2

- To modify the Application Tier Launch Template and create a new version (Version 3), follow the steps below to ensure all the changes are properly implemented:
- Go to the AWS Management Console.
- Navigate to EC2 Dashboard > Launch Templates.
- Select the launch template for the Application Tier.

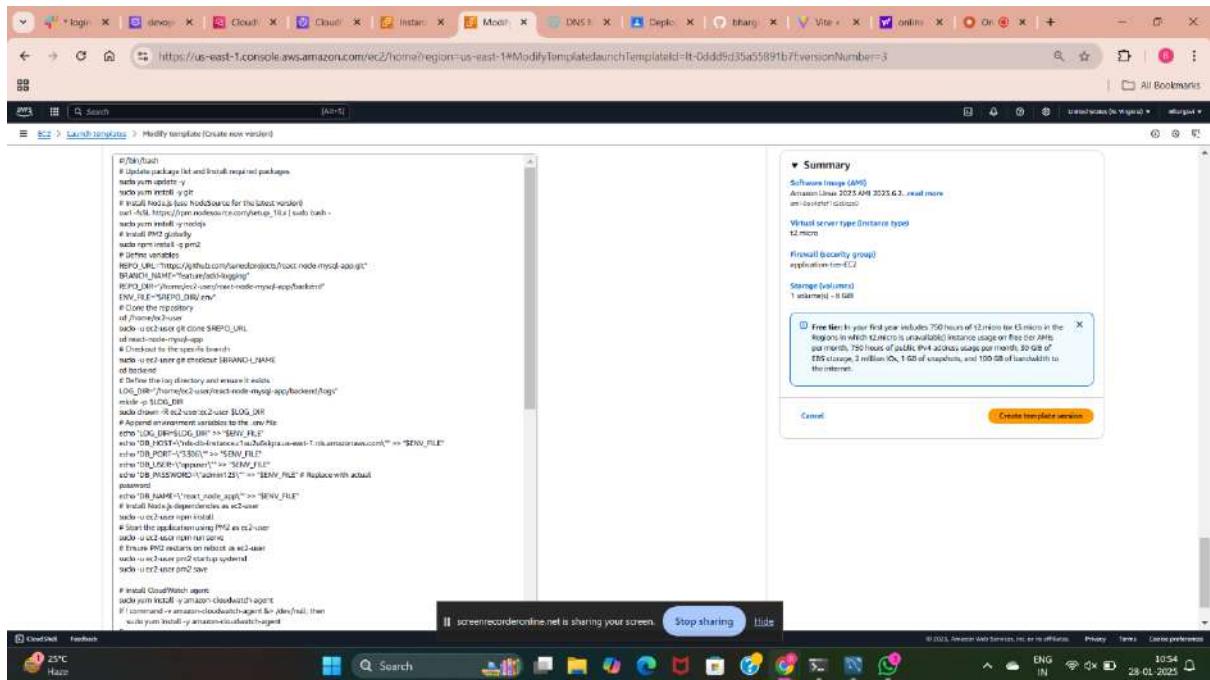


- Click on the Actions dropdown and select Modify Template (Create New Version).

Update the following fields as per the new requirements

- If necessary, change the instance type to handle increased workload. Here I have selected t2.micro with key pair.

- Ensure the appropriate security group for the Application Tier is selected (e.g., allows necessary ports like 3200, 3306, and others).



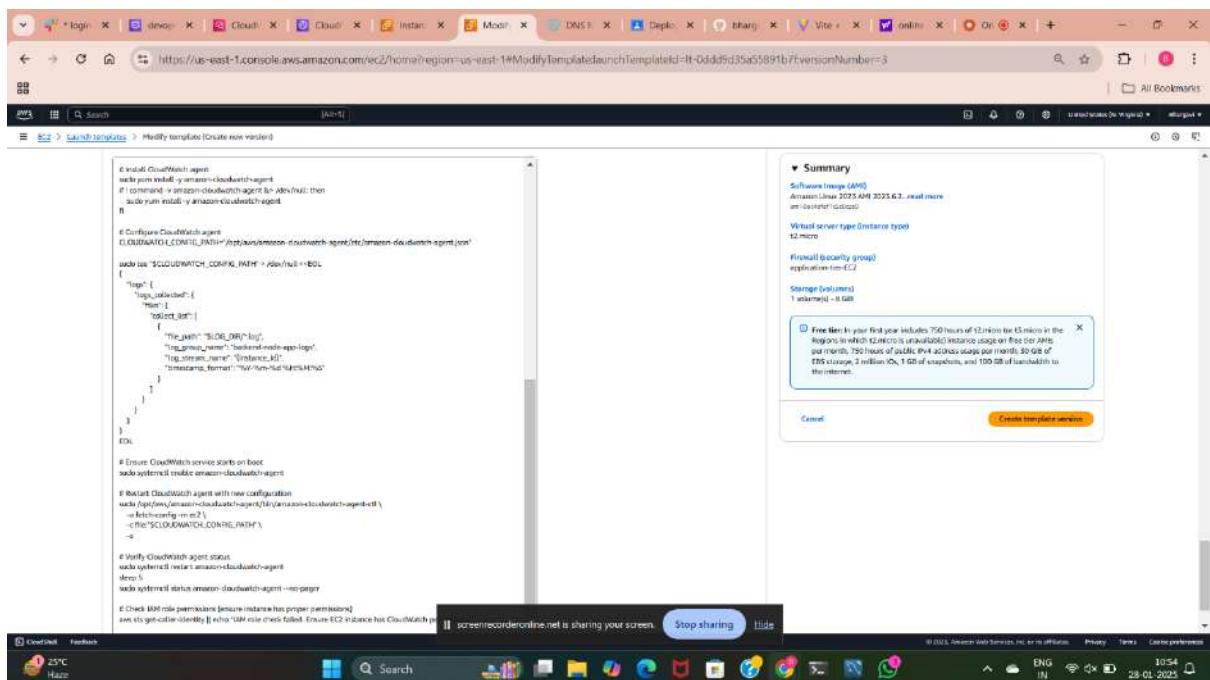
```

#!/bin/bash
# Update package list and install required packages
sudo apt-get update & sudo apt-get -y upgrade
# Install MySQL basic dependencies for the latest version
curl -fsSL https://raw.githubusercontent.com/awslabs/aws-lambda-mySQL/main/bin/install-debian.sh | sudo bash -
# Install MySQL client
sudo apt-get install -y mysql-client
# Set MySQL variables
sudo cp /etc/mysql/debian.cnf /etc/mysql/my.cnf
# Set MySQL root password
# curl -fsSL https://raw.githubusercontent.com/awslabs/aws-lambda-mySQL/main/bin/set-root-password.sh | sudo bash -
# Create MySQL directory
sudo -u ec2-user mkdir -p $MYPWD_URL
# Install nodejs-mySQL app
# curl -fsSL https://raw.githubusercontent.com/awslabs/aws-lambda-mySQL/main/bin/install-nodejs-mySQL.sh | sudo bash -
# Create the specific branch
sudo -u ec2-user git checkout dev-branch-LNAME
# Set branch
# Set Lambda function directory and ensure it exists
# curl -fsSL https://raw.githubusercontent.com/awslabs/aws-lambda-mySQL/main/bin/create-lambda-function.sh | sudo bash -
# Set Lambda function name
# curl -fsSL https://raw.githubusercontent.com/awslabs/aws-lambda-mySQL/main/bin/set-lambda-name.sh | sudo bash -
# Set Lambda function description
# curl -fsSL https://raw.githubusercontent.com/awslabs/aws-lambda-mySQL/main/bin/set-lambda-description.sh | sudo bash -
# Start the application using PM2 as ec2-user
sudo -u ec2-user npm start
# Ensure PM2 restarts on reboot as ec2-user
sudo -u ec2-user pm2 startup systemd
sudo -u ec2-user pm2 save
# Install CloudWatch agent
sudo -u ec2-user yum install -y amazon-cloudwatch-agent
# If command -v amazon-cloudwatch-agent >= 1.0.0; then
#   sudo yum install -y amazon-cloudwatch-agent
# fi
# Configure CloudWatch agent
# curl -fsSL https://raw.githubusercontent.com/awslabs/aws-lambda-mySQL/main/bin/configure-cloudwatch-agent.json | jq . > /etc/amazon/cloudwatch-agent/etc/amazon-cloudwatch-agent.json
sudo tee /etc/amazon/cloudwatch-agent/etc/amazon-cloudwatch-agent.json >> /etc/amazon/cloudwatch-agent/etc/amazon-cloudwatch-agent.json
[{"log_group": "logs", "log_stream": "logs", "region": "us-east-1", "log_file": "CloudWatchLogs.log"}, {"log_group": "awslogs", "log_stream": "awslogs", "region": "us-east-1", "log_file": "CloudWatchLogs.log"}, {"log_group": "awslogs", "log_stream": "awslogs", "region": "us-east-1", "log_file": "CloudWatchLogs.log"}, {"log_group": "awslogs", "log_stream": "awslogs", "region": "us-east-1", "log_file": "CloudWatchLogs.log"}]
# Ensure CloudWatch service starts on boot
sudo systemctl enable amazon-cloudwatch-agent
# Restart CloudWatch agent with new configuration
sudo systemctl restart amazon-cloudwatch-agent || (echo "Amazon CloudWatch Agent failed to start" & exit 1)
# Verify CloudWatch agent status
sudo systemctl status amazon-cloudwatch-agent
sleep 5
sudo systemctl status amazon-cloudwatch-agent --no-pager
# Check IAM role permissions (ensure instance has proper permissions)
aws iam get-role --role-name LambdaBasicExecutionRole | grep "Arn"

```

Update the script to include any new configurations.

- Ensure the DB\_HOST, DB\_USER, DB\_PASSWORD, and other relevant environment variables are correctly added or updated.
- Modify the DB\_USER to appuser and add the database name react\_node\_app.
- Ensure the RDS Endpoint matches the new database setup.



```

# Verify CloudWatch agent
sudo yum install -y amazon-cloudwatch-agent
# If command -v amazon-cloudwatch-agent >= 1.0.0; then
#   sudo yum install -y amazon-cloudwatch-agent
# fi
# Configure CloudWatch agent
# curl -fsSL https://raw.githubusercontent.com/awslabs/aws-lambda-mySQL/main/bin/configure-cloudwatch-agent.json | jq . > /etc/amazon/cloudwatch-agent/etc/amazon-cloudwatch-agent.json
sudo tee /etc/amazon/cloudwatch-agent/etc/amazon-cloudwatch-agent.json >> /etc/amazon/cloudwatch-agent/etc/amazon-cloudwatch-agent.json
[{"log_group": "logs", "log_stream": "logs", "region": "us-east-1", "log_file": "CloudWatchLogs.log"}, {"log_group": "awslogs", "log_stream": "awslogs", "region": "us-east-1", "log_file": "CloudWatchLogs.log"}, {"log_group": "awslogs", "log_stream": "awslogs", "region": "us-east-1", "log_file": "CloudWatchLogs.log"}, {"log_group": "awslogs", "log_stream": "awslogs", "region": "us-east-1", "log_file": "CloudWatchLogs.log"}]
# Ensure CloudWatch service starts on boot
sudo systemctl enable amazon-cloudwatch-agent
# Restart CloudWatch agent with new configuration
sudo systemctl restart amazon-cloudwatch-agent || (echo "Amazon CloudWatch Agent failed to start" & exit 1)
# Verify CloudWatch agent status
sudo systemctl status amazon-cloudwatch-agent
sleep 5
sudo systemctl status amazon-cloudwatch-agent --no-pager
# Check IAM role permissions (ensure instance has proper permissions)
aws iam get-role --role-name LambdaBasicExecutionRole | grep "Arn"

```

- Save the changes and click Create Template Version.

The screenshot shows the AWS EC2 Launch Templates page. On the left, there's a navigation sidebar with sections like Instances, Launch Templates, and Auto Scaling. The main area displays a table of launch templates, with one entry highlighted: 'Presentation-tier-LaunchTemplate (3-0ef45c015d4ac664)'. A modal window titled 'Set default version' is open over this entry, showing the current template details and a dropdown menu where 'Version 3' is selected as the default version.

- Am changing the newly created version as default version of launch template.

## 11.1 MODIFYING ASG WITH VERSION 2, AND INSTANCES AS 3

- Go to the Auto Scaling Groups section in the EC2 Dashboard.
- Select the Auto Scaling Group for the Application Tier.

The screenshot shows the AWS Auto Scaling Groups page. The left sidebar includes sections for Instances, Launch Templates, and Auto Scaling Groups. The main content area shows a table of auto scaling groups, with one group named 'Application-tier-AutoScalingGroup' highlighted. Below the table, a detailed view for 'Application-tier-AutoScalingGroup' is shown, specifically the 'Launch template' section. It indicates that the launch template is 'Presentation-tier-LaunchTemplate | Version 3', which corresponds to the newly created version 3 of the launch template.

- Click Edit and update the Launch Template to use Version 3

Update the version, Desired Capacity, Minimum, and Maximum Instances:

- Version: 3
- Desired Capacity: 2
- Minimum: 2
- Maximum: 4

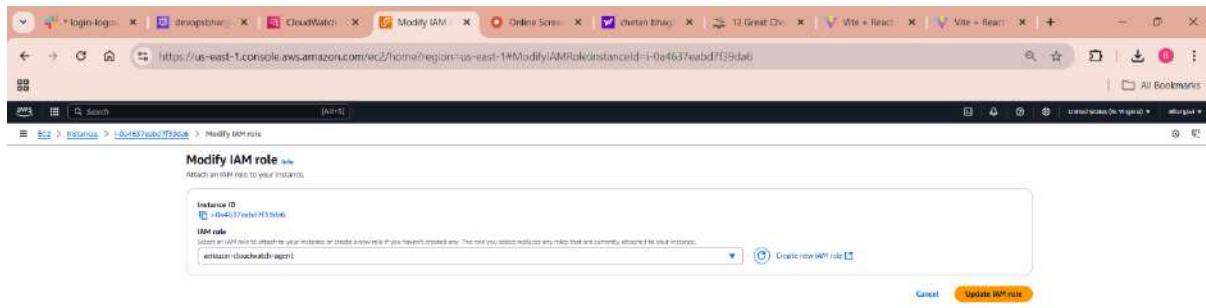
- Update the changes.

The screenshot shows the AWS EC2 Instances dashboard. On the left, there's a sidebar with navigation links for Dashboard, EC2 Global View, Events, Instances (selected), Instance Types, Launch Templates, Spot Requests, Savings Plans, Reserved Instances, Dedicated Hosts, Capacity Reservations, Images, AMI Catalog, and Auto Scaling. The main area displays a table of instances with columns for Name, Instance ID, Instance state, Status check, Alarm status, Availability zone, Public IP, Elastic IP, IPv6 IPs, Monitoring, Security group, and Key name. Five instances are listed, all currently running. Below the table, a section titled '3 instances selected' shows monitoring metrics for CPU utilization, Network in (bytes), Network out (bytes), Network packets out (count), Metadata no token (count), CPU credit usage (count), and CPU credit balance (count) over a 24-hour period.

- Go to the Instances section in the EC2 Dashboard.
- Locate the old instances launched using Launch Template Version 1.
- Manually terminate these instances.

The screenshot shows the AWS EC2 Instances dashboard. The sidebar is identical to the previous one. In the main area, three instances are listed: i-0302d12... (Running), i-0481641... (Running), and i-02212cc... (Running). The instance i-0a4637ea... is selected and highlighted in blue. An 'Actions' dropdown menu is open next to it, containing options: Connect, View details, Manage instance state, Instance settings, Networking, Security, Image and templates, and Modify IAM role. The 'Modify IAM role' option is likely the target of the user's next action.

- The ASG will automatically replace them with new instances using Launch Template Version 3. Now attach the created IAM role by selecting actions>security> modify IAM role.



- Provide the name of IAM role and update IAM role. Similarly update the IAM role for other application tier ec2 instance.

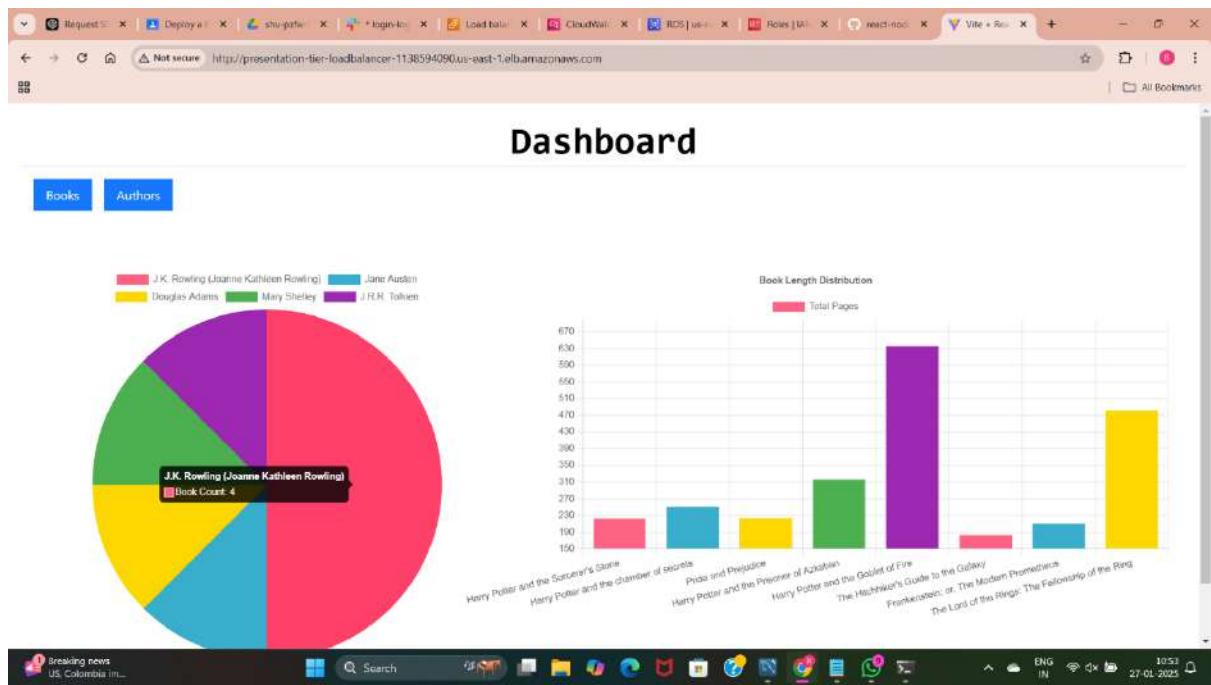
```

[ec2-user@ip-10-0-167-167 ~]$ pm2 logs
-bash: pm2: command not found
[ec2-user@ip-10-0-167-167 ~]$ pm2 logs
-bash: pm2: command not found
[ec2-user@ip-10-0-167-167 ~]$ pm2 logs
[TAILING] Tailing last 15 lines for [all] processes (change the value with --lines option)
/home/ec2-user/.pm2/pm2.log last 15 lines:
PM2 2025-01-27T05:08:33: PM2 log: PM2 version : 5.4.3
PM2 2025-01-27T05:08:33: PM2 log: Node.js version : 18.20.6
PM2 2025-01-27T05:08:33: PM2 log: Current arch : x64
PM2 2025-01-27T05:08:33: PM2 log: PM2 home : /home/ec2-user/.pm2
PM2 2025-01-27T05:08:33: PM2 log: RPC socket file : /home/ec2-user/.pm2/rpc.sock
PM2 2025-01-27T05:08:33: PM2 log: BUS socket file : /home/ec2-user/.pm2/pub.sock
PM2 2025-01-27T05:08:33: PM2 log: Application log path : /home/ec2-user/.pm2/logs
PM2 2025-01-27T05:08:33: PM2 log: Worker Interval : 30000
PM2 2025-01-27T05:08:33: PM2 log: Process dump file : /home/ec2-user/.pm2/dump.pm2
PM2 2025-01-27T05:08:33: PM2 log: Concurrent actions : 2
PM2 2025-01-27T05:08:33: PM2 log: SIGTERM timeout : 1600
PM2 2025-01-27T05:08:33: PM2 log: =====
PM2 2025-01-27T05:08:33: PM2 log: App [server:0] starting in -fork mode-
PM2 2025-01-27T05:08:33: PM2 log: App [server:0] online

/home/ec2-user/.pm2/logs/server-error.log last 15 lines:
/home/ec2-user/.pm2/logs/server-out.log last 15 lines:
0|server  | Server is running on port http://localhost:3200
0|server  | 2025-01-27 05:08:34 [INFO]: Connected to MySQL Database

^C
[ec2-user@ip-10-0-167-167 ~]$ cd react-node-mysql-app/backend/logs/
[ec2-user@ip-10-0-167-167 logs]$ ll
total 4
-rw-r--r--, 1 ec2-user ec2-user 56 Jan 27 05:08 combined.log
-rw-r--r--, 1 ec2-user ec2-user 0 Jan 27 05:08 error.log
[ec2-user@ip-10-0-167-167 logs]$ vi combined.log
[ec2-user@ip-10-0-167-167 logs]$ 
```

- Once the new instances are created, connect the application tier instance and check the database connection.



- Use the DNS Name of the Presentation Load Balancer (PLB) associated with the Application Tier.

The screenshot shows a "MANAGE AUTHORS" page with a table of existing authors and a modal for "Add Author".

ID	Author	Birthday	Description	Updated Date	Actions
1	J.K. Rowling (Joanne Kathleen Rowling)	1965-07-31T00:00:00.000Z	J.K. Rowling is a British作家, best known for her Harry Potter book series. She also wrote the novels Galbraith and The Casual Vacancy.	2024-05-29T00:00:00.000Z	
3	Jane Austen	1775-12-16T00:00:00.000Z	Jane Austen is a British novelist, best known for her works Sense and Sensibility, Pride and Prejudice, and Emma.	2024-05-29T00:00:00.000Z	
4	Harper Lee	1926-04-28T00:00:00.000Z	Harper Lee is an American novelist, best known for her novel To Kill a Mockingbird.	2024-05-29T00:00:00.000Z	
5	J.R.R. Tolkien	1892-01-03T00:00:00.000Z	J.R.R. Tolkien is a British novelist, poet, and academic, best known for his works The Hobbit and The Lord of the Rings.	2024-05-29T00:00:00.000Z	
6	Mary Shelley	1819-08-30T00:00:00.000Z	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	
7	Douglas Adams	1952-07-11T00:00:00.000Z	Douglas Adams was an English science-fiction writer, satirist, humorist, dramatist, screenwriter, and occasional actor.	2024-05-29T00:00:00.000Z	

The modal for "Add Author" contains the following fields:

- Name: Bhargavi
- Birthday: 10-05-2002
- Description: She is very good writer!

- Perform an operation like Add Authors to test the functionality of the backend application.

MySQL Workbench

File Edit View Query Database Server Tools Scripting Help

Navigator

SCHEMAS

Filter objects

react\_node\_app

Tables author book

Views Stored Procedures Functions

Query 1 author author book

1 • SELECT \* FROM react\_node\_app.author;

Result Grid Filter Rows | Edit Export/Import Wrap Cell Contents

	ID	Name	Birthday	Bio	CreatedAt
1	J.K. Rowling (Joanne Kathleen Rowling)	1965-07-31	J.K. Rowling is a British author best known for writing the Harry Potter fantasy series. The series has... 2024-05-29		
2	Jane Austen	1775-12-16	Jane Austen was an English novelist known for her wit, social commentary, and romantic stories. Her ... 2024-05-29		
3	Harper Lee	1926-07-11	Harper Lee was an American novelist best known for her Pulitzer Prize-winning novel To Kill a Mockingbird. 2024-05-29		
4	J.R.R. Tolkien	1892-01-03	J.R.R. Tolkien was a British philologist and writer best known for his fantasy novels The Hobbit and The Lord of the Rings. 2024-05-29		
5	Mary Shelley	1818-07-30	Mary Shelley was a British novelist, playwright, and short story writer, the daughter of Mary Wollstonecraft Godwin and ... 2024-05-29		
6	Douglas Adams	1979-10-32	Douglas Adams was an English science fiction writer, satirist, humorist, dramatist, screenwriter, and ... 2024-05-29		
7	Bharatav	2002-05-10	Bharatav is very good writer 2025-01-27		
8	Shagari	2022-05-05	Shagari is very good writer 2022-05-05		

Administration Schemas Information

No object selected

author\_1.x

Action Output

Time	Action	Message	Duration / Fetch
3:05:26.12	SELECT * FROM react_node_app.book LIMIT 0, 1000	0 rows returned	0.235 sec / 0.000 sec
4:10:56.03		Error Code: 2003 Unable to connect to localhost.	
5:10:57.58		Error Code: 2003 Unable to connect to localhost.	
6:10:58.01		Error Code: 2003 Unable to connect to localhost.	
7:10:58.41	SELECT * FROM react_node_app.author LIMIT 0, 1000	7 rows returned	0.234 sec / 0.000 sec
8:10:58.47	SELECT * FROM react_node_app.book LIMIT 0, 1000	Fetching...	0.266 sec / ?

Object Info Session

Query Completed

23°C Haze

Search

ENG IN 27.01.2025

- Now go to mysql workbench and check the author name whether newly added author is present or not.

Not secure http://presentation-tier-loadbalancer-1138594090.us-east-1.elb.amazonaws.com/books

MANAGE BOOKS

Add Book

Title: Book

Release Date: 21-12-2024

Description: This book is very interesting

Pages: 222

Author: Bharatav

Date Updated Date Actions

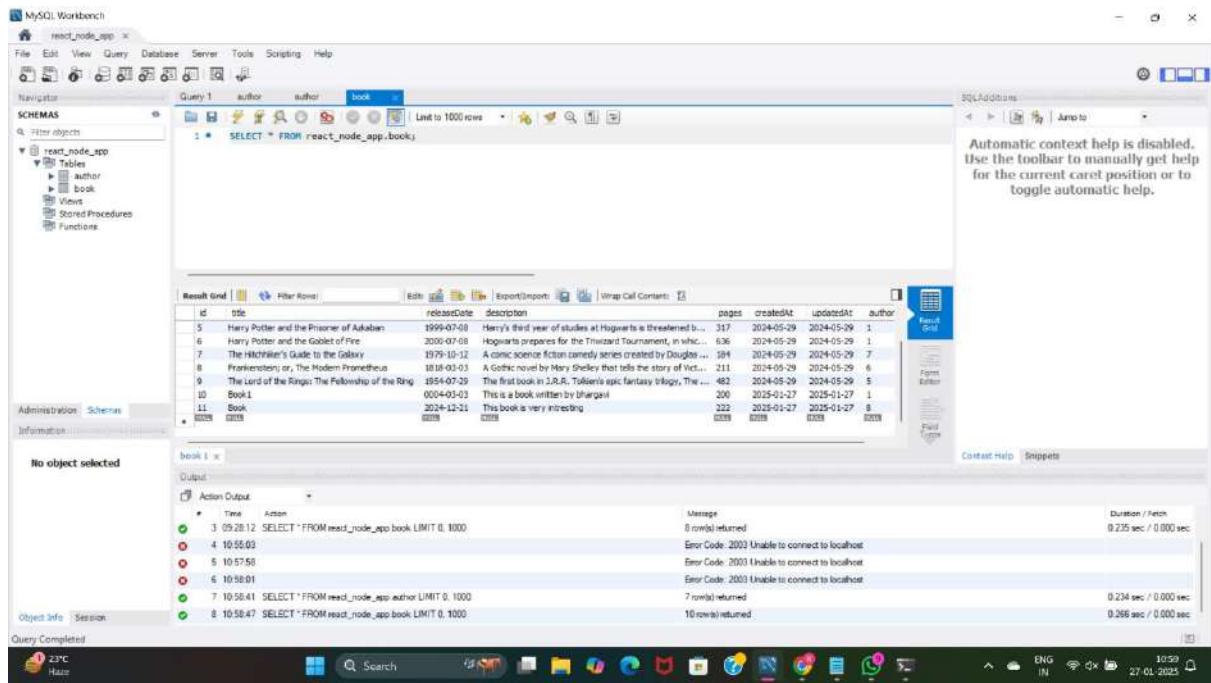
ID	Title	Description	Date	Updated Date	Actions
1	Harry Potter and the Sorcerer's Stone	On his birthday, Harry Potter has inherited magical powers that establish a friendship with Voldemort. During his first year at Hogwarts, Harry is in search of a p... 2024-05-29T00:00:00Z 2024-05-29T00:00:00Z			
2	Harry Potter and the Chamber of Secrets	Harry Potter and the mysterious creature that hides within the walls of Hogwarts. 2024-05-29T00:00:00Z 2024-05-29T00:00:00Z			
3	Pride and Prejudice	An English novel of manners and relationships among the Bennet family, centered around the wealthy Mr. Darcy. Austen uses her narrative voice. 2024-05-29T00:00:00Z 2024-05-29T00:00:00Z			
4	Harry Potter and the Prisoner of Azkaban	Harry's third year of studies at Hogwarts. Apparently, it is a dangerous year for Harry Potter. 2024-05-29T00:00:00Z 2024-05-29T00:00:00Z			

Bachupalli Road Construction

Search

ENG IN 27.01.2025

- Perform an operation like Add Book to test the functionality of the backend application.



- Now go to mysql workbench and check the book names whether newly added books is present or not.

```
2025-01-27 05:22:23 [INFO]: Connected to MySQL Database
2025-01-27 05:23:04 [INFO]: BooksController [GET]
2025-01-27 05:23:04 [INFO]: Books count: 8
2025-01-27 05:23:32 [INFO]: BooksController [GET]
2025-01-27 05:23:32 [INFO]: Books count: 8
2025-01-27 05:23:32 [INFO]: AuthorsController [GET]
2025-01-27 05:23:32 [INFO]: Authors count: 6
2025-01-27 05:26:09 [INFO]: BooksController [GET]
2025-01-27 05:26:09 [INFO]: Books count: 9
2025-01-27 05:26:15 [INFO]: BooksController [GET]
2025-01-27 05:26:15 [INFO]: Books count: 9
2025-01-27 05:26:40 [INFO]: BooksController [GET]
2025-01-27 05:26:40 [INFO]: Books count: 9
2025-01-27 05:26:50 [INFO]: BooksController [GET]
2025-01-27 05:26:50 [INFO]: Books count: 9

"react-node-mysql-app/backend/logs/combined.log" 15L, 711B
```

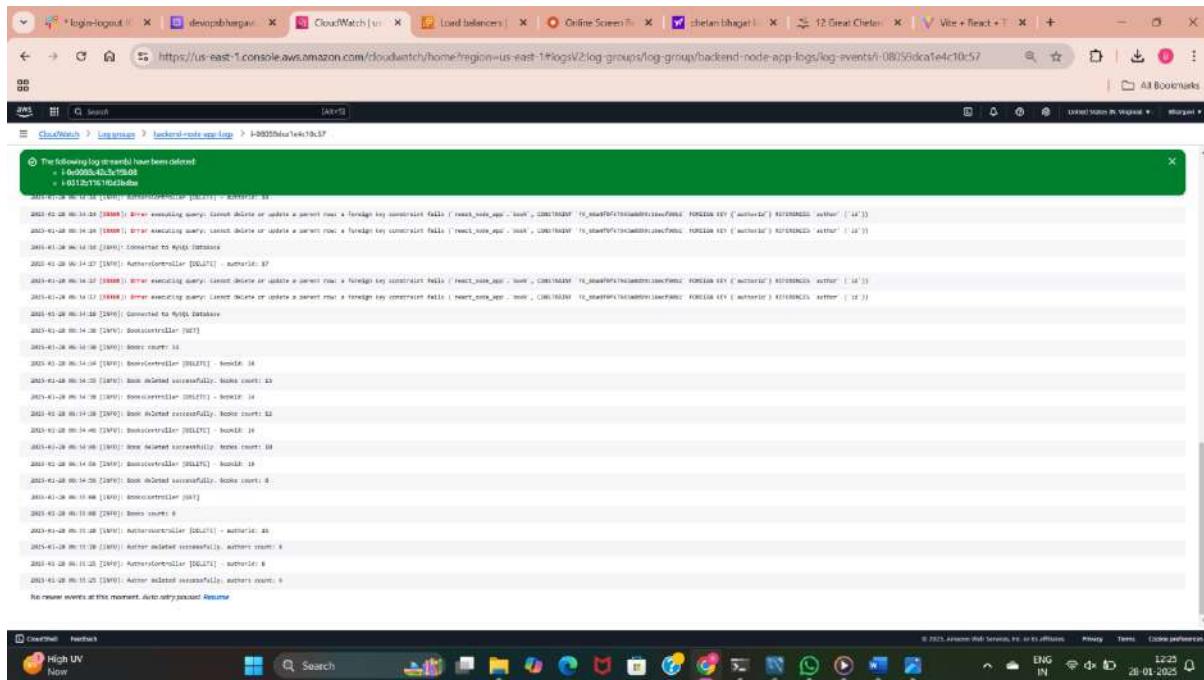
- Look for the log group you created for the backend application, e.g., backend-node-app-logs.
- Verify that logs are being recorded for operations performed on the application (e.g., adding a book).

The screenshot shows the AWS CloudWatch Log Groups page. The left sidebar includes sections for Alarms, Logs (Log group tree, Log Stream details, Log Insights, Metrics), X-ray traces, Events, Application Signals, and CloudWatch Metrics. The main area displays 'Log groups (2)'. A search bar at the top right says 'Search' and 'Exact match'. Below it, there are columns for Log group, Log stream, Anomaly detection, Data protection, Sensitive data count, Retention, Metric filters, and Contributor insights. Two log groups are listed: 'LOGSMESSAGES' and 'backend-node-app-logs'. The 'backend-node-app-logs' group is highlighted with a blue border. At the bottom right of the main area, there are buttons for Actions, View in Log Insights, Start tailing, and Delete log group.

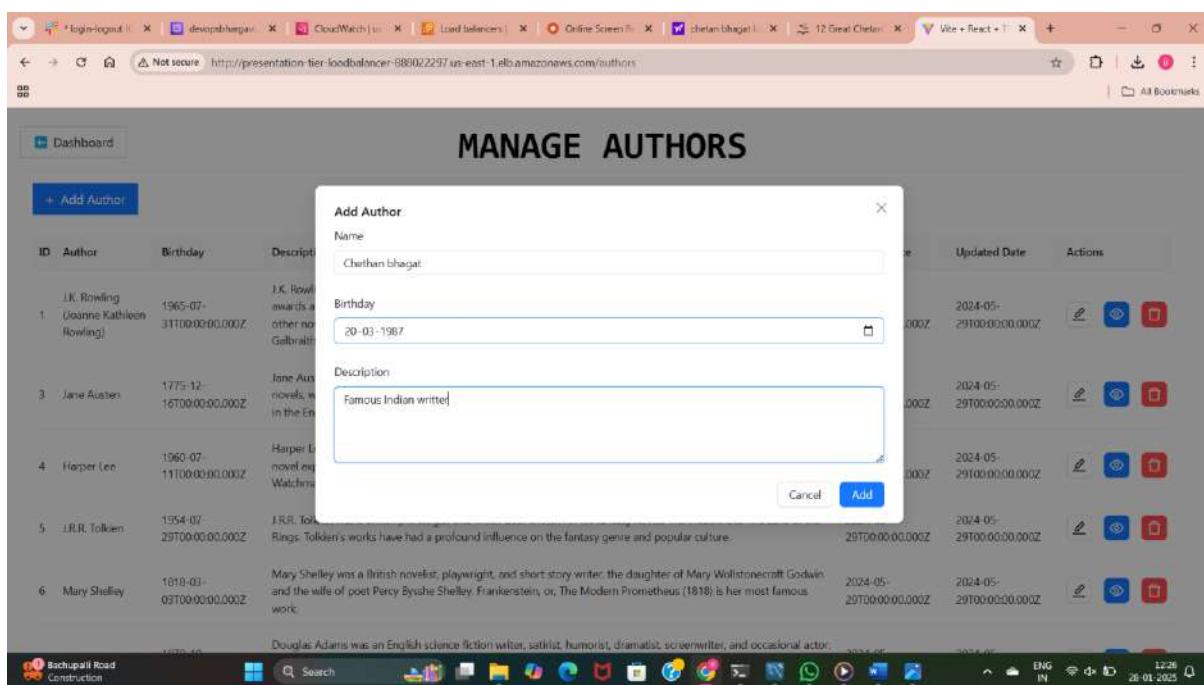
- To see the logs for the new instances. Go to CloudWatch in the AWS Management Console.
- Under Logs, navigate to the log group that you've configured for your application (e.g., backend-node-app-logs).

The screenshot shows the AWS CloudWatch Log Group details page for 'backend-node-app-logs'. The left sidebar shows 'Log group details' with fields for Log class (info), Standard, ARN (arn:aws:logs:us-east-1:19951102165902:log-group:backend-node-app-logs), Creation time (3 hours ago), Retention (Never expire), and Sensitive bytes. The main area has tabs for Log streams, Tags, Anomaly detection, Metric filters, Subscription filters, Contributor insights, Data protection, Field indexes - new, and Transformer - new. On the Log streams tab, it shows 'Log streams (2)' with two entries: 'l\_20250128\_041057' and 'l\_0401270107774d49'. A green banner at the top says 'The following log stream(s) have been deleted: l\_0401270107774d49'. At the bottom right, there are buttons for Actions, View in Log Insights, Start tailing, and Search log group.

- Look for the two new instances created by the Auto Scaling Group. These should be associated with the same ASG.
- We can see two instance IDs.



- ❖ Click on an instance to go to the instance details page. Under the Monitoring tab, look for CloudWatch Logs or any log streaming service configured on the instance.



- ❖ Similarly am adding other author for checking the application and database.

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	<a href="#">Edit</a> <a href="#">Delete</a> <a href="#">Copy</a>
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	<a href="#">Edit</a> <a href="#">Delete</a> <a href="#">Copy</a>
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	<a href="#">Edit</a> <a href="#">Delete</a> <a href="#">Copy</a>
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	<a href="#">Edit</a> <a href="#">Delete</a> <a href="#">Copy</a>
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	<a href="#">Edit</a> <a href="#">Delete</a> <a href="#">Copy</a>
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 books, stage shows, comic books, a 1981 TV series, a 2005 feature film, and a 2008 sequel film.	2024-05-29T00:00:00.000Z	2024-05-29T00:00:00.000Z	<a href="#">Edit</a> <a href="#">Delete</a> <a href="#">Copy</a>
18	Chethan bhagat	1987-03-20T00:00:00.000Z	Famous Indian writer	2025-01-28T00:00:00.000Z	2025-01-28T00:00:00.000Z	<a href="#">Edit</a> <a href="#">Delete</a> <a href="#">Copy</a>

❖ Here new author is added.

Time	Event
2024-05-28 08:14:28 [INFO]: AuthorController [80877]: - authorId: 8	
2024-05-28 08:14:28 [INFO]: Error: Alarming query: cannot define or update a column rule + foreign key constraint fails ('react_node_app'.book) : 'fk_bookAuthor' FOREIGN KEY ('authorId') REFERENCES 'author' ('id')	
2024-05-28 08:14:28 [INFO]: Connected to remote database	
2024-05-28 08:14:28 [INFO]: BookController [807]	
2024-05-28 08:14:28 [INFO]: Books count: 24	
2024-05-28 08:14:28 [INFO]: AuthorController [807]	
2024-05-28 08:14:28 [INFO]: Authors count: 18	
2024-05-28 08:14:28 [INFO]: BookController [807]: - bookId: 13	
2024-05-28 08:14:28 [INFO]: New Author successfully! book count: 13	
2024-05-28 08:14:28 [INFO]: BooksController [807]: - books: 17	
2024-05-28 08:14:40 [INFO]: Book deleted successfully! books count: 9	
2024-05-28 08:14:40 [INFO]: AuthorController [807]	
2024-05-28 08:14:40 [INFO]: Authors count: 18	
2024-05-28 08:15:34 [INFO]: AuthorController [80877]: - authorId: 37	
2024-05-28 08:15:34 [INFO]: Author deleted successfully! authors count: 9	
2024-05-28 08:15:42 [INFO]: AuthorController [80877]: - authorId: 38	
2024-05-28 08:15:42 [INFO]: Author deleted successfully! authors count: 8	
2024-05-28 08:15:42 [INFO]: BookController [807]: - books: 17	
2024-05-28 08:15:42 [INFO]: Books count: 8	
2024-05-28 08:15:42 [INFO]: BooksController [807]: - books: 17	
2024-05-28 08:15:42 [INFO]: AuthorController [80877]: - name: Chethan Bhagat, birthday: 1987-03-20, bio: Famous Indian writer	
2024-05-28 08:15:42 [INFO]: Author created successfully! authors count: 17	

❖ We can also check in cloud watch whether the updates are monitoring or not. Here cloud watch is monitoring everything related to database updates and deletions.

The screenshot shows a web application interface titled "MANAGE BOOKS". On the left, there is a table listing five books with columns for ID, Title, Description, Date, Updated Date, and Actions. The first book listed is "Harry Potter and the Sorcerer's Stone". A modal window titled "Add Book" is open in the center, prompting for new book details: Title ("One arranged murder"), Release Date ("20-02-2020"), Description ("it is a good book written by chehan"), Pages ("432"), and Author ("Chehan bhagat"). The "Add" button is visible at the bottom of the modal.

ID	Title	Description	Date	Updated Date	Actions
1	Harry Potter and the Sorcerer's Stone	On his birthday, Harry Potter has inherited magical powers and establishes a friendship with Ron Weasley and Hermione Granger. During his first year at Hogwarts School of Witchcraft and Wizardry, Harry learns that Voldemort is in search of a powerful dark artifact.	2024-05-29T00:00:00.000Z	2024-05-29T00:00:00.000Z	
3	Harry Potter and the chamber of secrets	Harry Potter and the chamber of secrets is the second book in the Harry Potter series. It follows Harry's second year at Hogwarts, where he discovers the secret of the Chamber of Secrets and the return of the Dark Lord Voldemort.	2024-05-29T00:00:00.000Z	2024-05-29T00:00:00.000Z	
4	Pride and Prejudice	An English novel of manners that explores the social class system and relationships among the Bennet family. It features Elizabeth Bennet's witty banter with Mr. Darcy and Austen's signature narrative voice.	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.	2024-05-29T00:00:00.000Z	2024-05-29T00:00:00.000Z	

❖ Add other book.

The screenshot shows the same "MANAGE BOOKS" application interface. The table now lists nine books. The ninth book, "The Lord of the Rings: The Fellowship of the Ring", has been updated. Its original entry (ID 9) is shown with a different date (1954-07-29T00:00:00.000Z). A new row below it shows the updated information: "The Lord of the Rings: The Fellowship of the Ring" with ID 19, published on 2020-02-20T00:00:00.000Z, written by J.R.R. Tolkien, and updated on 2025-01-26T00:00:00.000Z. The modal window from the previous screenshot is no longer visible.

ID	Title	Description	Date	Updated Date	Actions
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	2024-05-29T00:00:00.000Z	
6	Harry Potter and the Goblet of Fire	Hogwarts prepares for the Triwizard Tournament, in which three schools of wizardry will compete. To everyone's surprise, Harry Potter is chosen to participate in the competition, in which he must fight dragons, enter the water and face his greatest fears.	2000-07-08T00:00:00.000Z	2024-05-29T00:00:00.000Z	
7	The Hitchhiker's Guide to the Galaxy	A comic science-fiction comedy series created by Douglas Adams. The story follows the comedic misadventures of Arthur Dent, a hapless Englishman, following the destruction of the Earth by the Vogons, a race of unpleasant bureaucratic aliens. Arthur escapes with his friend Ford Prefect, who reveals himself to be an undercover researcher for the titular Hitchhiker's Guide to the Galaxy, a galactic encyclopedia containing information about anything and everything.	1979-10-12T00:00:00.000Z	2024-05-29T00:00:00.000Z	
8	Frankenstein; or, The Modern Prometheus	A Gothic novel by Mary Shelley that tells the story of Victor Frankenstein, a young scientist who creates a grotesque creature in an unorthodox scientific experiment. Frankenstein is horrified by his creation and abandons it, but the creature seeks revenge. The novel explores themes of scientific responsibility, creation versus destruction, and the nature of good and evil.	1818-03-08T00:00:00.000Z	2024-05-29T00:00:00.000Z	
9	The Lord of the Rings: The Fellowship of the Ring	The first book in J.R.R. Tolkien's epic fantasy trilogy, The Lord of the Rings. The Fellowship of the Ring follows hobbit Frodo Baggins as he inherits the One Ring, an evil artefact of power created by the Dark Lord Sauron. Frodo embarks on a quest to destroy the Ring in the fires of Mount Doom, accompanied by a fellowship of eight companions.	1954-07-29T00:00:00.000Z	2024-05-29T00:00:00.000Z	
19	One arranged murder	it is a good book written by chehan	2020-02-20T00:00:00.000Z	2025-01-26T00:00:00.000Z	

❖ Book is updated here.

The screenshot shows a browser window with multiple tabs open. The active tab is a CloudWatch Log Stream titled 'log-book'. The log entries are as follows:

```

The following log stream(s) have been defined:
+ $LogStreamId: 4235a78050
+ + 403.01.76.160:8080

2023-01-28 00:14:38 [INFO]: Book created: 14
2023-01-28 00:14:38 [INFO]: AuthorController [DELETE]
2023-01-28 00:14:38 [INFO]: Authors count: 14
2023-01-28 00:14:40 [INFO]: BookController [DELETE] - books: 15
2023-01-28 00:14:40 [INFO]: Book created successfully, books count: 15
2023-01-28 00:14:40 [INFO]: BookController [CREATE] - books: 15
2023-01-28 00:14:40 [INFO]: BookController [CREATE] - books: 17
2023-01-28 00:14:40 [INFO]: Book created successfully, books count: 17
2023-01-28 00:14:40 [INFO]: AuthorController [CREATE] - authors: 18
2023-01-28 00:14:40 [INFO]: AuthorController [CREATE] - authors: 19
2023-01-28 00:14:40 [INFO]: AuthorController [CREATE] - authors: 20
2023-01-28 00:14:40 [INFO]: AuthorController [CREATE] - authors: 21
2023-01-28 00:14:40 [INFO]: AuthorController [CREATE] - authors: 22
2023-01-28 00:14:40 [INFO]: AuthorController [CREATE] - authors: 23
2023-01-28 00:14:40 [INFO]: AuthorController [CREATE] - authors: 24
2023-01-28 00:14:40 [INFO]: AuthorController [CREATE] - authors: 25
2023-01-28 00:14:40 [INFO]: AuthorController [CREATE] - authors: 26
2023-01-28 00:14:40 [INFO]: AuthorController [CREATE] - authors: 27
2023-01-28 00:14:40 [INFO]: AuthorController [CREATE] - authors: 28
2023-01-28 00:14:40 [INFO]: Book created successfully, books count: 28
2023-01-28 00:14:40 [INFO]: AuthorController [DELETE]

```

No newer events at this moment. Auto-apply.possible: [Resync](#)

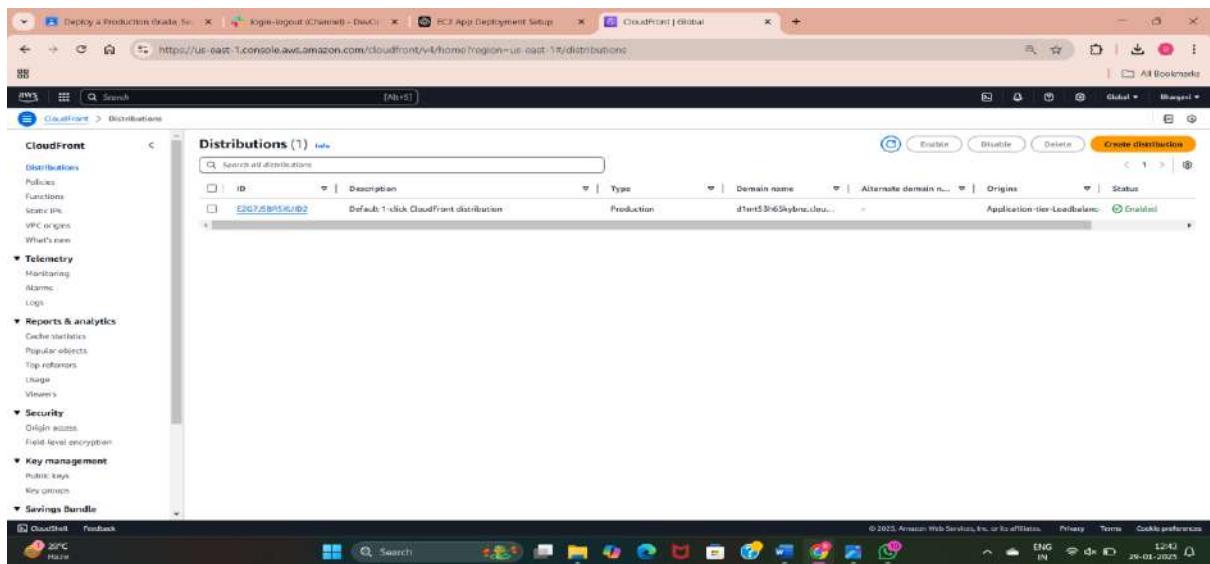
- ❖ Similarly in cloud watch we can check the updates of new book.

## CLOUDFRONT DISTRIBUTION

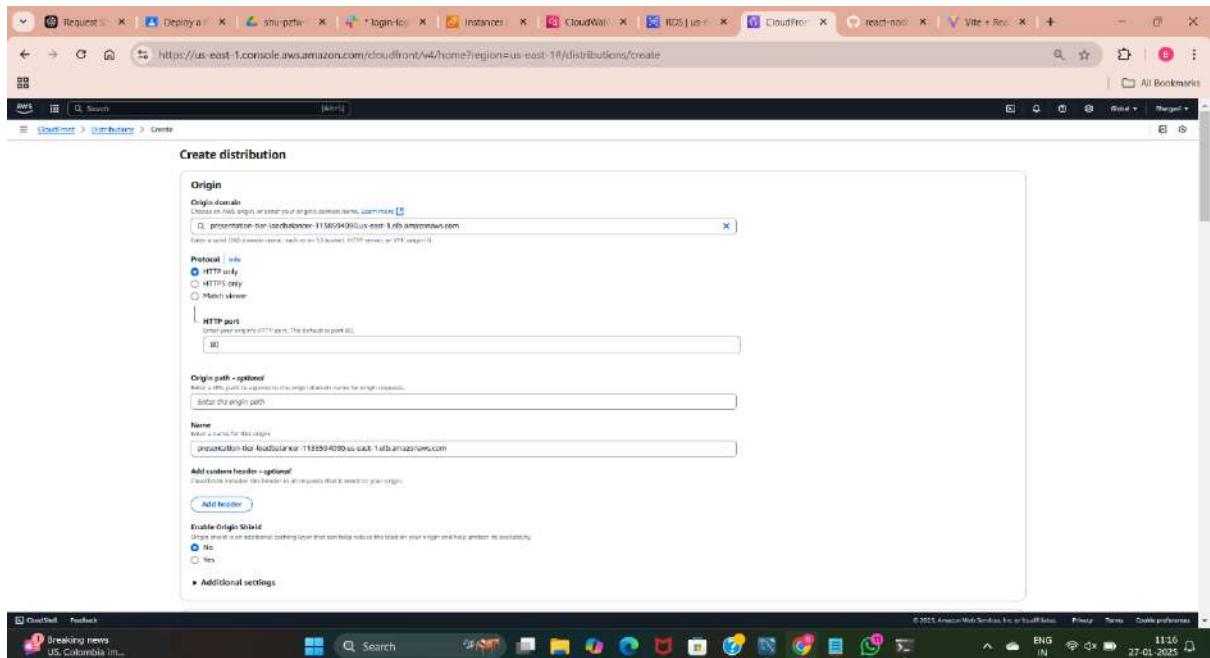
CloudFront Distribution is a feature of Amazon Web Services (AWS) that enables the delivery of content to users globally with low latency and high transfer speeds. It is part of the AWS Content Delivery Network (CDN) service. A CloudFront Distribution is essentially a configuration that tells CloudFront how to distribute your content, such as static files (images, JavaScript, CSS) or dynamic content (like API calls or HTML pages), to users via AWS's global network of edge locations.

## STEP 12: CREATING CLOUDFRONT DISTRIBUTION

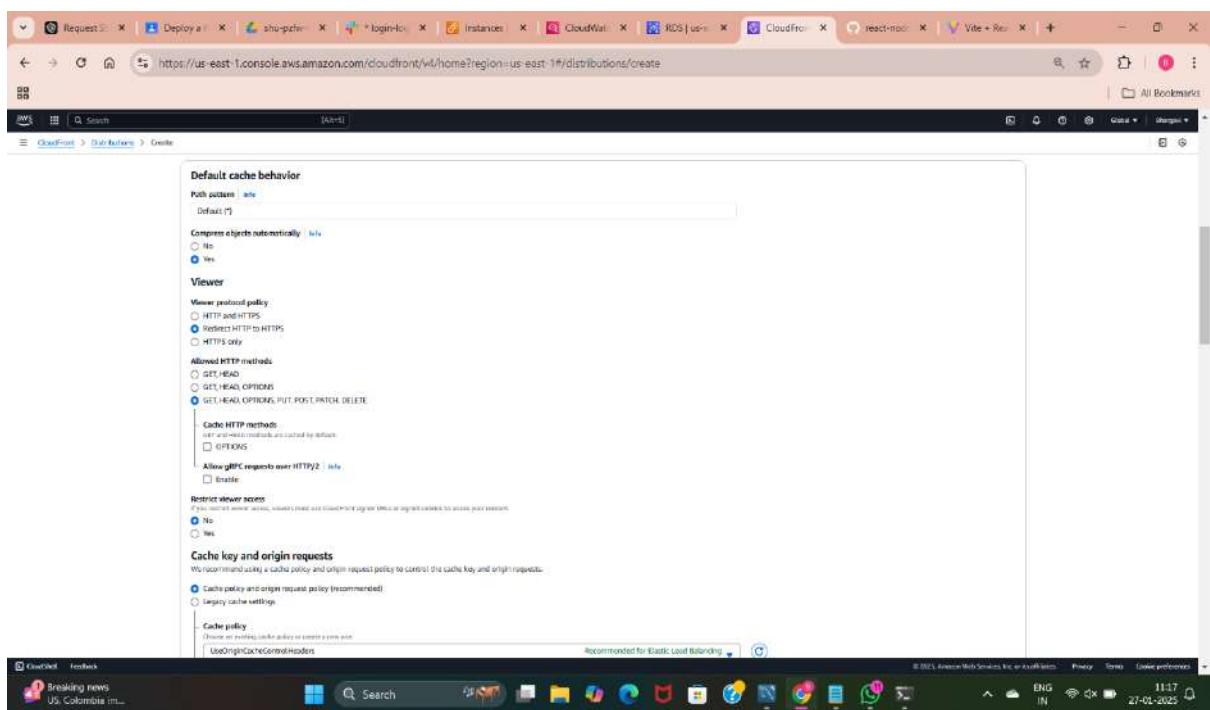
- Open the AWS Management Console.
- Go to CloudFront under the Networking and Content Delivery section.



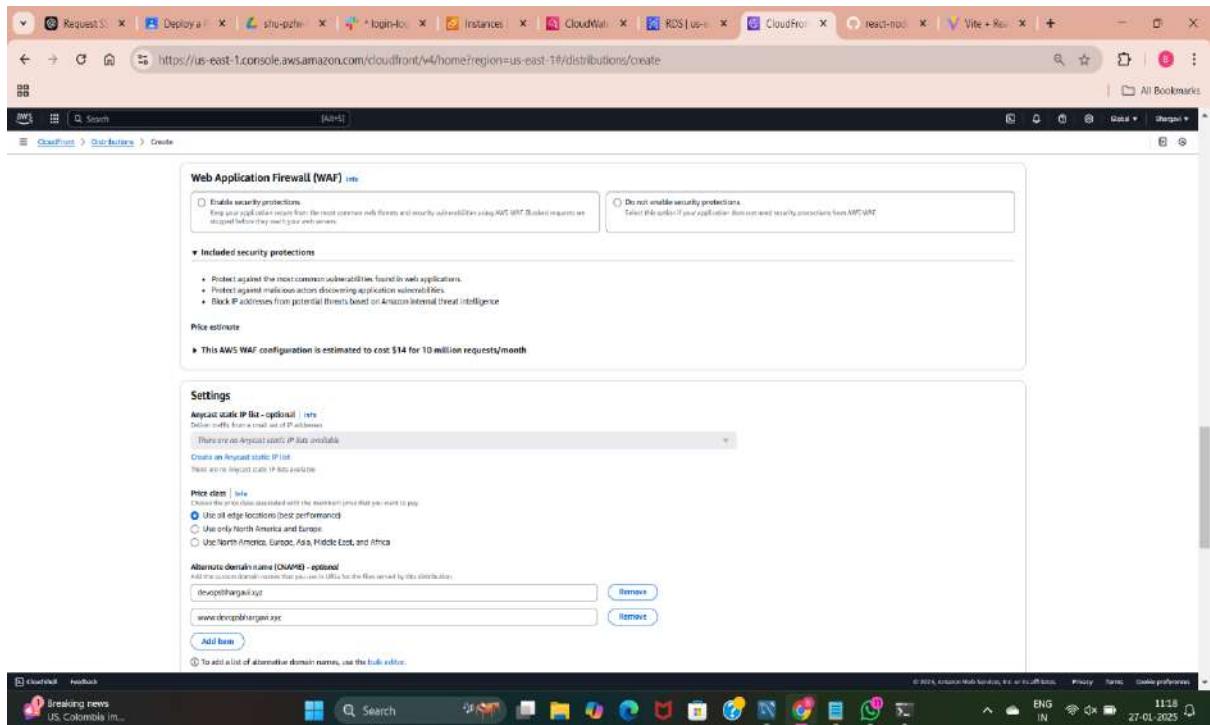
- Click on Create Distribution.



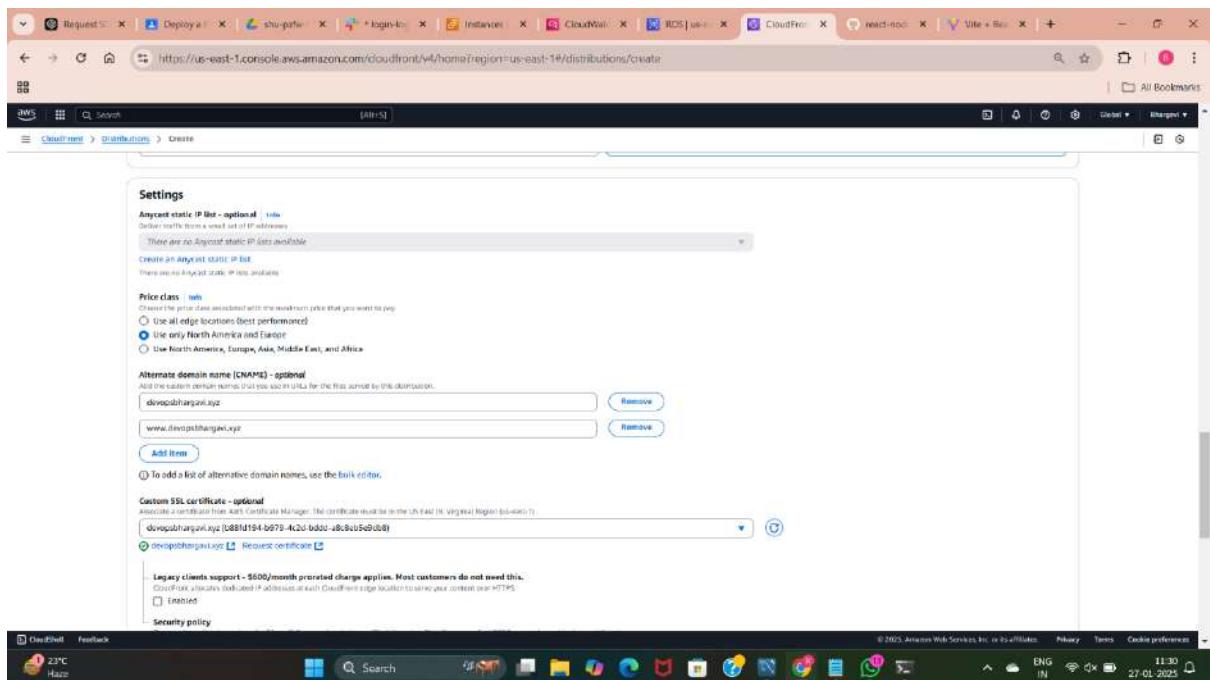
- Origin Domain:** Select the DNS Name of the Presentation-Tier ALB from the dropdown or enter it manually.
- Protocol:** HTTP



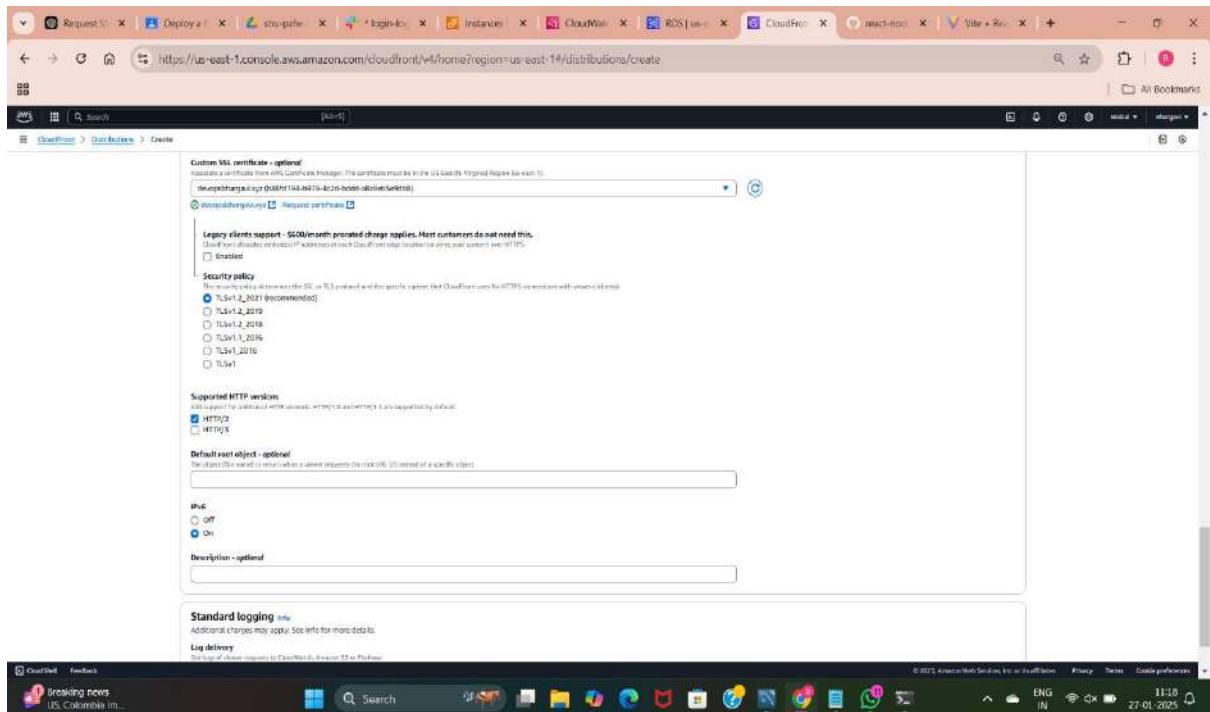
- Protocol Policy:** Select Redirect HTTP to HTTPS to ensure secure traffic only.



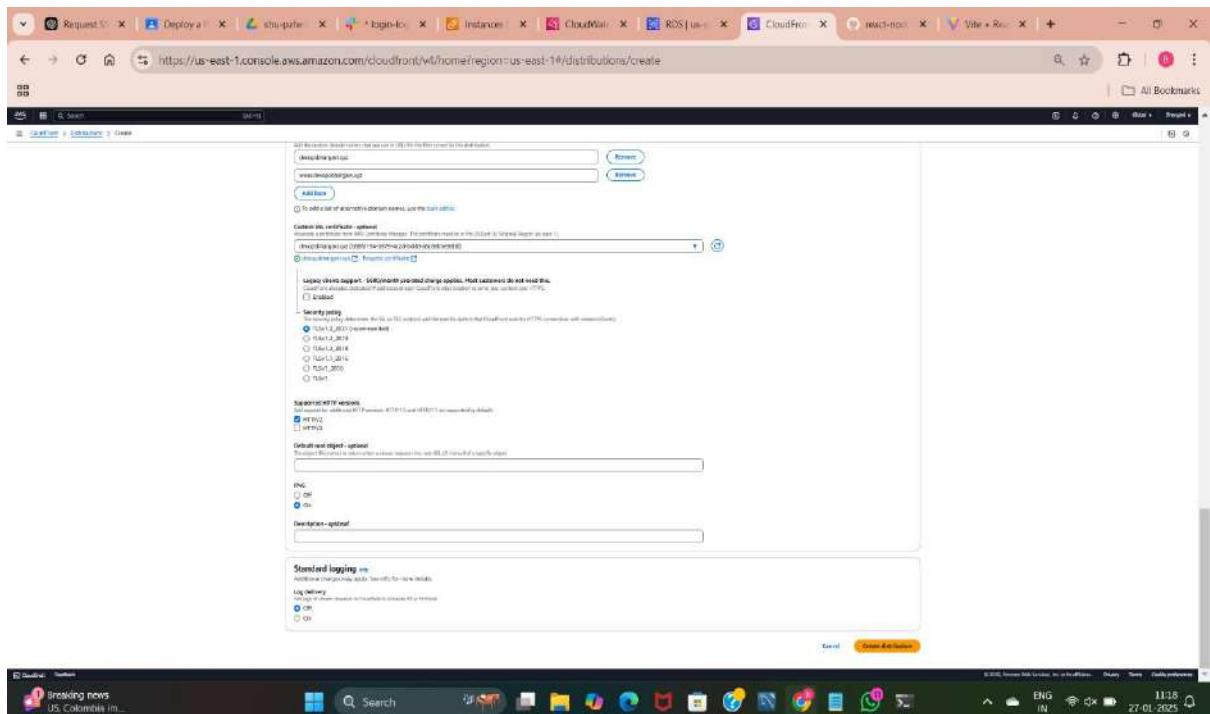
- Select Do Not Enable WAF unless you require specific security configurations.
- Choose the required AWS regions where your content will be distributed.



- Under the Settings section, provide alternate domain names(CNAME)
- Add devopsdost.xyz and www.devopsbhargavi.xyz.



- Choose a certificate from ACM (AWS Certificate Manager) that matches your domain names (devopsdost.xyz and www.devopsbhargavi).



- Click Create Distribution to finalize the setup.

The screenshot shows the AWS CloudFront console with a success message: "Successfully created new distribution." The distribution details include a distribution domain name (devopsdost.dev), an ARN, and a security policy (TSLv1\_2). The status is listed as "Deploying".

- Wait for the distribution status to change to Deployed (this may take several minutes).

## STEP 13: CREATE DNS RECORDS FOR CLOUDFRONT IN ROUTE53

- ♣ Open the AWS Management Console.
- ♣ Go to Route53 under the Networking and Content Delivery section.
- ♣ Open your Hosted Zone for the domain devopsdost.xyz.
- ♣ Click on Create Record

### ADD AN ALIAS RECORD FOR THE ROOT DOMAIN

The screenshot shows the AWS Route53 console with the "Create record" wizard. The "Record creation method" section offers "Quick create (recommended for expert users)" and "Wizard (recommended for new users)". The "Create record" section shows a "Record name" of "subdomain" and a "Record type" of "A - Routed traffic to an IPv4 address and some AWS resources". The "Alias" option is selected, and a CloudFront distribution is chosen as the target. The "Evaluate target health" checkbox is checked. The "Add another record" button is visible at the bottom right.

- ♣ Record Type: Select A - IPv4 Address.
- ♣ Alias: Select Yes.
- ♣ Choose route traffics to AWS to CloudFront distributions.
- ♣ Select your CloudFront distribution.
- ♣ Save the record.

## ADD AN ALIAS RECORD FOR THE WWW SUBDOMAIN

- Click on Add Record.

The screenshot shows the 'Create record' wizard for the hosted zone 'devopsbhargavi.xyz'. The 'Record name' is set to 'www' and the 'Record type' is selected as 'A - Routes traffic to an IPv4 address and some AWS resources'. The 'Alias' checkbox is checked, and the 'Route traffic to' dropdown is set to 'Alias to CloudFront distribution'. A CloudFront distribution ID is selected. The 'Evaluate target health' checkbox is unchecked. At the bottom right, there are 'Cancel' and 'Create record' buttons.



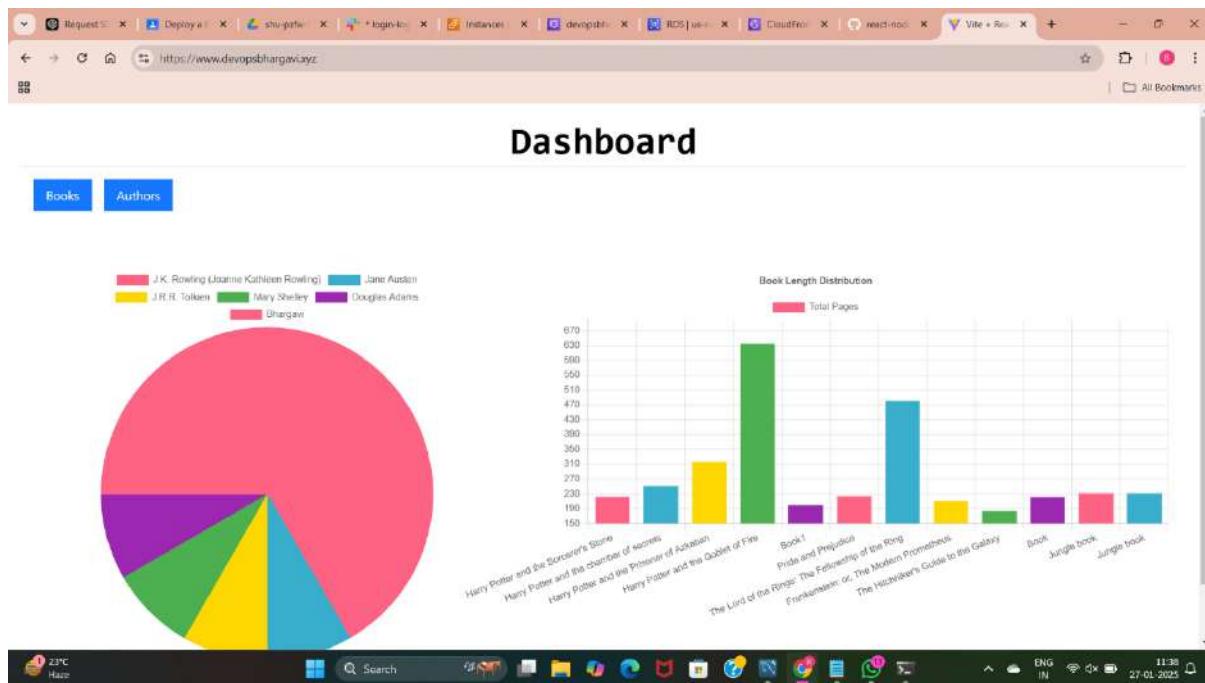
- Name: Enter www.
- Record Type: Select A - IPv4 Address.
- Alias: Select Yes.
- Choose route traffics to AWS to CloudFront distributions.
- Select your CloudFront distribution.
- Save the record.

The screenshot shows the 'Hosted zone details' page for the hosted zone 'devopsbhargavi.xyz'. It displays a table of records, including the newly created 'www' alias record. The table columns include Record name, Type, Routing policy, Alias, Value/Route traffic to, TTL, Health check, Evaluate target health, and Record ID. The 'Create record' button is visible at the top right of the table area.

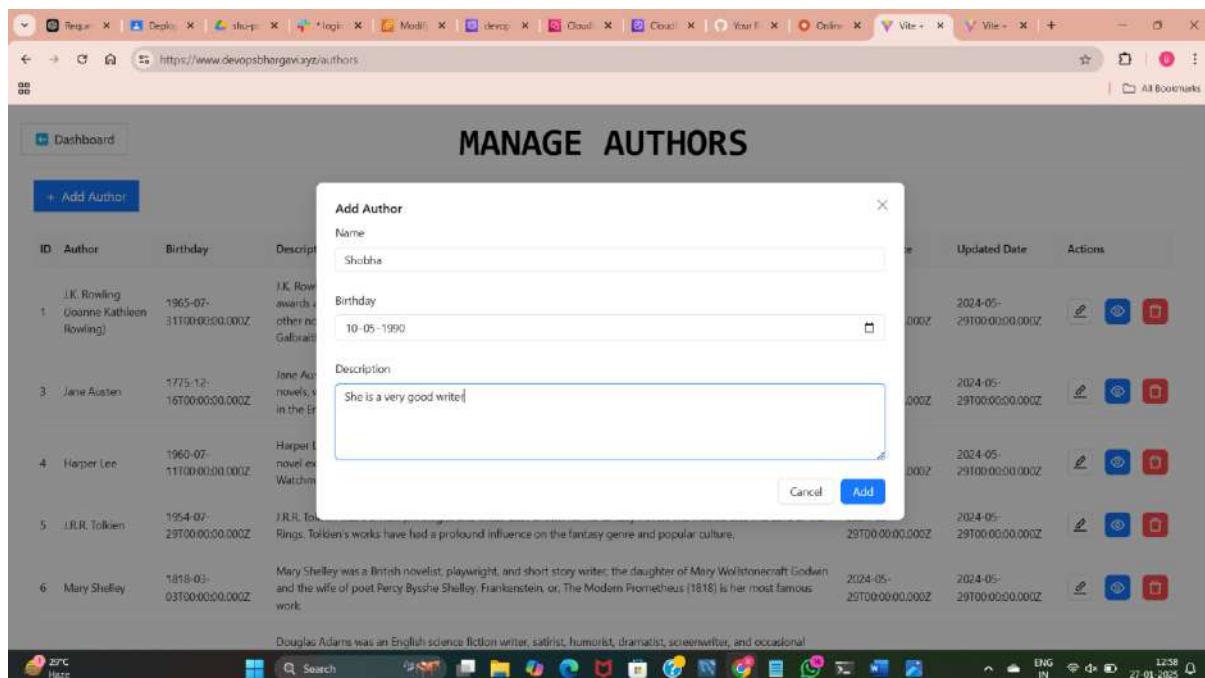
- Here we can see new records are added to our hosted zones.

## STEP 14: TEST THE APPLICATION

- ❖ Open a web browser.



- ❖ Navigate to your domain [www.devopsbhargavi.xyz](https://www.devopsbhargavi.xyz) and devopsbhargavi.xyz.
- ❖ Verify the homepage loads as expected.
- ❖ Ensure the site is loading over HTTPS with a secure padlock icon in the browser.



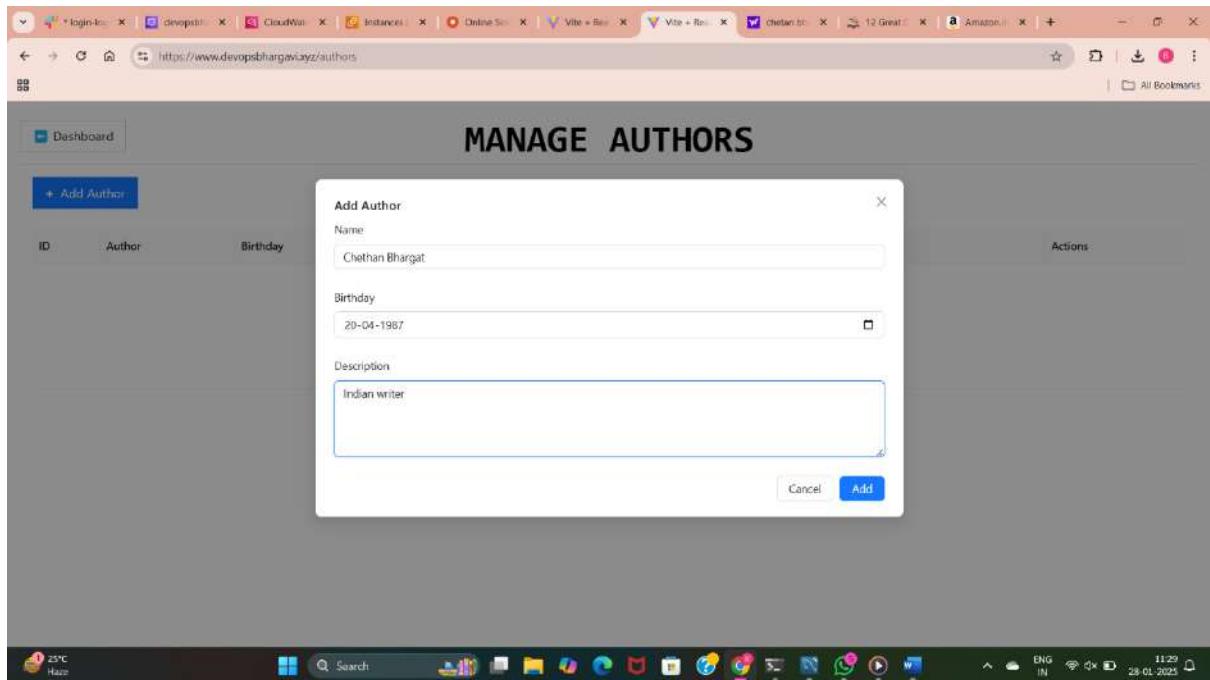
- ❖ Navigate through different pages of the application.
- ❖ Add a author (or any operation) in the application.

3	Jane Austen	16T00:00:00.000Z	novels, which explore themes of love, marriage, and money, have earned her a place as one of the greatest writers in the English language.	29T00:00:00.000Z	29T00:00:00.000Z	<a href="#">Edit</a> <a href="#">Delete</a> <a href="#">Copy</a>
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	<a href="#">Edit</a> <a href="#">Delete</a> <a href="#">Copy</a>
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	<a href="#">Edit</a> <a href="#">Delete</a> <a href="#">Copy</a>
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	<a href="#">Edit</a> <a href="#">Delete</a> <a href="#">Copy</a>
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 books, stage shows, comic books, a 1981 TV series, a 1984 video game, a 2005 feature film, and a 2008 sequel film.	2024-05-29T00:00:00.000Z	2024-05-29T00:00:00.000Z	<a href="#">Edit</a> <a href="#">Delete</a> <a href="#">Copy</a>
8	Bhargavi	2002-05-10T00:00:00.000Z	She is very good writer	2025-01-27T00:00:00.000Z	2025-01-27T00:00:00.000Z	<a href="#">Edit</a> <a href="#">Delete</a> <a href="#">Copy</a>
9	Venkanna	1987-04-10T00:00:00.000Z	He is very good writer	2025-01-27T00:00:00.000Z	2025-01-27T00:00:00.000Z	<a href="#">Edit</a> <a href="#">Delete</a> <a href="#">Copy</a>
10	Shobha	1990-05-10T00:00:00.000Z	She is a very good writer	2025-01-27T00:00:00.000Z	2025-01-27T00:00:00.000Z	<a href="#">Edit</a> <a href="#">Delete</a> <a href="#">Copy</a>

❖ Author is added successfully.

id	name	birthday	bio	createdAt
1	J.K. Rowling (Joanne Kathleen Rowling)	1965-07-31	J.K. Rowling is a British author best known for writing the Harry Potter fantasy series. The series has sold over 500 million copies worldwide.	2024-05-29T00:00:00.000Z
3	Jane Austen	1775-12-16	Jane Austen was an English novelist best known for her wit, social commentary, and romantic stories. Her most famous work is Pride and Prejudice.	2024-05-29T00:00:00.000Z
4	Harper Lee	1960-07-11	Harper Lee was an American novelist best known for her Pulitzer Prize-winning novel To Kill a Mockingbird.	2024-05-29T00:00:00.000Z
5	J.R.R. Tolkien	1954-07-29	J.R.R. Tolkien was a British philologist and writer best known for his fantasy novels The Hobbit and The Lord of the Rings.	2024-05-29T00:00:00.000Z
6	Mary Shelley	1818-03-03	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
7	Douglas Adams	1979-10-12	Douglas Adams was an English science fiction writer, satirist, humorist, dramatist, screenwriter, and comedian. He is best known for the Hitchhiker's Guide to the Galaxy comedy series.	2024-05-29T00:00:00.000Z
8	Bhargavi	2002-05-10	She is a very good writer	2025-01-27T00:00:00.000Z
9	Venkanna	1987-04-10	He is a very good writer	2025-01-27T00:00:00.000Z
10	Shobha	1990-05-10	She is a very good writer	2025-01-27T00:00:00.000Z

❖ Check in the mysql workbench by selecting the author.



- ❖ Add a book (or any operation) in the application.

ID	Author	Birthday	Description	Created Date	Updated Date	Actions
13	Bhargavi	4123-04-22T00:00:00.000Z	foxza	2025-01-28T00:00:00.000Z	2025-01-28T00:00:00.000Z	
14	Ravndiver	2000-12-12T00:00:00.000Z	he is very good writer	2025-01-28T00:00:00.000Z	2025-01-28T00:00:00.000Z	
15	Bhargavi	2002-05-10T00:00:00.000Z	Good	2025-01-28T00:00:00.000Z	2025-01-28T00:00:00.000Z	
16	Chehan Bhargat	1987-04-20T00:00:00.000Z	Indian writer	2025-01-28T00:00:00.000Z	2025-01-28T00:00:00.000Z	

- ❖ Here the new book is added.

The screenshot shows the MySQL Workbench interface. The left sidebar displays the 'react\_node\_app' schema with its tables ('author', 'book'). The main area shows the 'author' table with the following data:

ID	Name	Birthday	Bio
8	Bhargav	2000-05-10	Very intelligent
9	Venkatesh	2000-05-20	good
10	Gholam	1982-12-12	lightrf
11	Venkatesh	2222-02-21	specific
13	Bhargav	4123-04-22	fossi
14	Ramdevire	2000-12-12	he is very good writer
15	Bhargav	2002-05-10	Good
16	Cheetan Bhargat	1987-04-20	Indian writer

The SQL Editor pane shows a history of queries:

- 6 11:06:12 SELECT \* FROM react\_node\_app.author LIMIT 0, 1000
- 7 11:06:15 SELECT \* FROM react\_node\_app.book LIMIT 0, 1000
- 8 11:43:42
- 9 11:43:48
- 10 11:47:10 SELECT \* FROM react\_node\_app.author LIMIT 0, 1000
- 11 11:47:17 SELECT \* FROM react\_node\_app.book LIMIT 0, 1000

- ❖ The author name and his details are updated in mysql database.

The screenshot shows a web application for managing books. The main table lists the following books:

ID	Title	Description
1	Harry Potter and the Sorcerer's Stone	On his birthday, Harry Potter has inherited magical powers and establishes a friendship with Voldemort. During his first year at Hogwarts, Voldemort is in search of a s
3	Harry Potter and the chamber of secrets	Harry Potter and the sophomore menacing beast that hides w
4	Pride and Prejudice	An English novel of manners and relationships among the Bennet family. Wealthy Mr. Darcy, Austen's narrative voice.
5	Harry Potter and the Prisoner of Azkaban	Harry's third year of studies at Hogwarts. Apparently, it is a dangerous year as Voldemort takes revenge on Harry Potter.

A modal window titled 'Add Book' is open, showing the following form fields:

- Title: Three mistakes of my life
- Release Date: 10-02-2003
- Description: Very interesting book
- Pages: 432
- Author: Chethan Bhargat

- ❖ We can also check the new book data in workbench of react\_node\_app database.

ID	Title	Description	Release Date	Author	Created Date	Updated Date	Actions
15	400 pages	very interesting book	2023-02-02T00:00:00.000Z	Bhargavi	2025-01-28T00:00:00.000Z	2025-01-28T00:00:00.000Z	
16	One arranged murder	interesting book	2000-02-20T00:00:00.000Z	Ravndiver	2025-01-28T00:00:00.000Z	2025-01-28T00:00:00.000Z	
17	Three mistakes of my life	Very interesting book	2003-02-10T00:00:00.000Z	Chethan Bhargat	2025-01-28T00:00:00.000Z	2025-01-28T00:00:00.000Z	



❖ New book is added in the website.

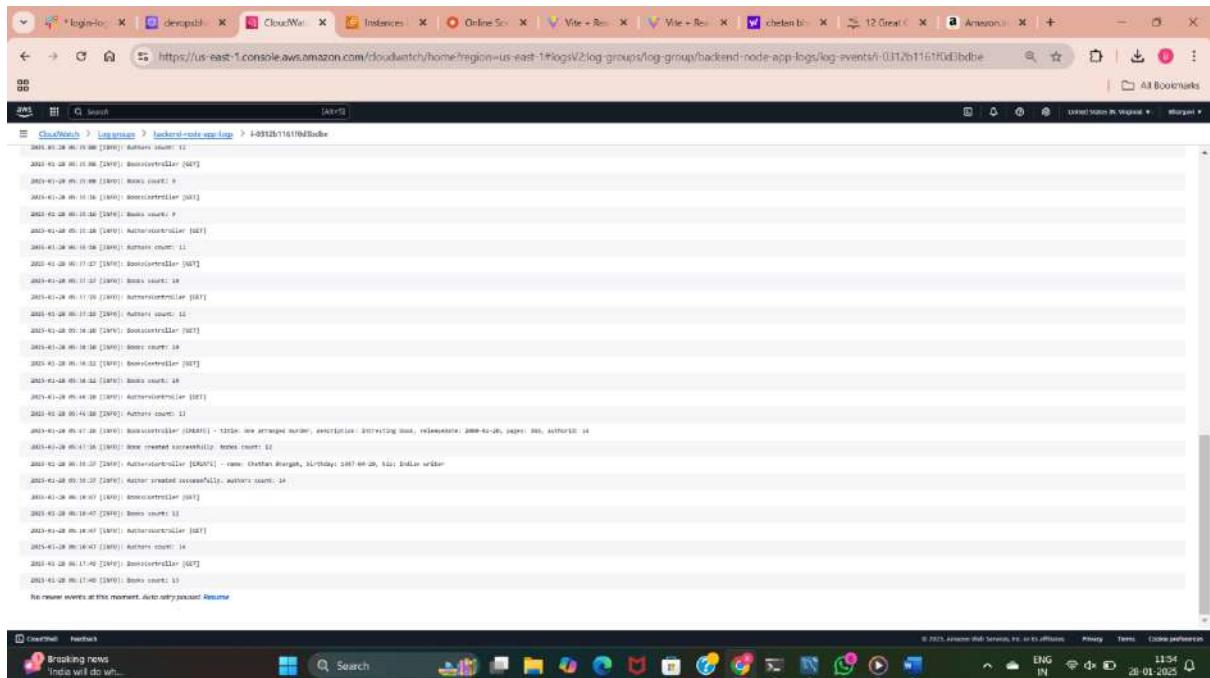
id	title	releaseDate	description	pages	createdAt	updatedAt	author
7	The Hitchhiker's Guide to the Galaxy	1979-10-12	A comic science fiction comedy series created by Douglas Adams	584	2024-05-29	2024-05-29	7
8	Frankenstein; or, The Modern Prometheus	1818-02-03	A Gothic novel by Mary Shelley that tells the story of Victor Frankenstein	211	2024-05-29	2024-05-29	5
9	The Lord of the Rings: The Fellowship of the Ring	1954-07-29	The first book in J.R.R. Tolkien's epic fantasy trilogy, The Lord of the Rings	482	2024-05-29	2024-05-29	5
10	His巧妙 Queen	2020-03-20	Very interesting book	266	2025-01-28	2025-01-28	8
11	I too have a love story	2020-12-10	This is a popular book, written by ravndiver	202	2025-01-28	2025-01-28	14
12	400 pages	2023-02-02	very interesting book	400	2025-01-28	2025-01-28	8
13	One arranged murder	2000-02-20	Interesting book	543	2025-01-28	2025-01-28	14
14	Three mistakes of my life	2003-02-10	Very interesting book	432	2025-01-28	2025-01-28	16

❖ New book details are updated in mysql database.

❖ Now go to cloudwatch logs and check for the updates. Here two instances are monitoring by cloudwatch.

- ❖ Select one instance and check the monitoring details.

- ❖ I am checking the database updating details here.
- ❖ Here the book creating details are monitored using cloudwatch.



- ❖ I have used other instance. Here the author details are monitored by cloudwatch.