E-Commerce Capstone Project

This project is a cloud-based e-commerce application and deployed on Amazon EKS. It includes multi-region infrastructure setup using Terraform and CloudFormation, CI/CD automation using AWS CodePipeline, DNS failover using Route53, and monitoring with CloudWatch.

Project goals:

1. Deploy a containerized e-commerce application (Product, Order, Frontend services) on AWS EKS
2. Automate infrastructure setup using Terraform (Region B) and CloudFormation (Region A)
3. Implement CI/CD using AWS CodePipeline and CodeBuild
4. Setup multi-region failover using Route 53
5. Monitor infrastructure using CloudWatch

PHASES

1. **Application-layer:**
   Tools used: EKS + Docker
2. **CI/CD:**
   Tools used: AWS codePipeline, codeBuild
   This automates Docker image builds and EKS deployments
3. **Infra:**
   (region A) → us-east-1

   Tools used: AWS CloudFormation

   Sets up VPC, EKS, Subnets, Security groups

   (region B) → us-west-2

   Tools used: Terraform

   Replicates Infra setup in another region

4. **DNS Failover**

   Tools used: Route 53

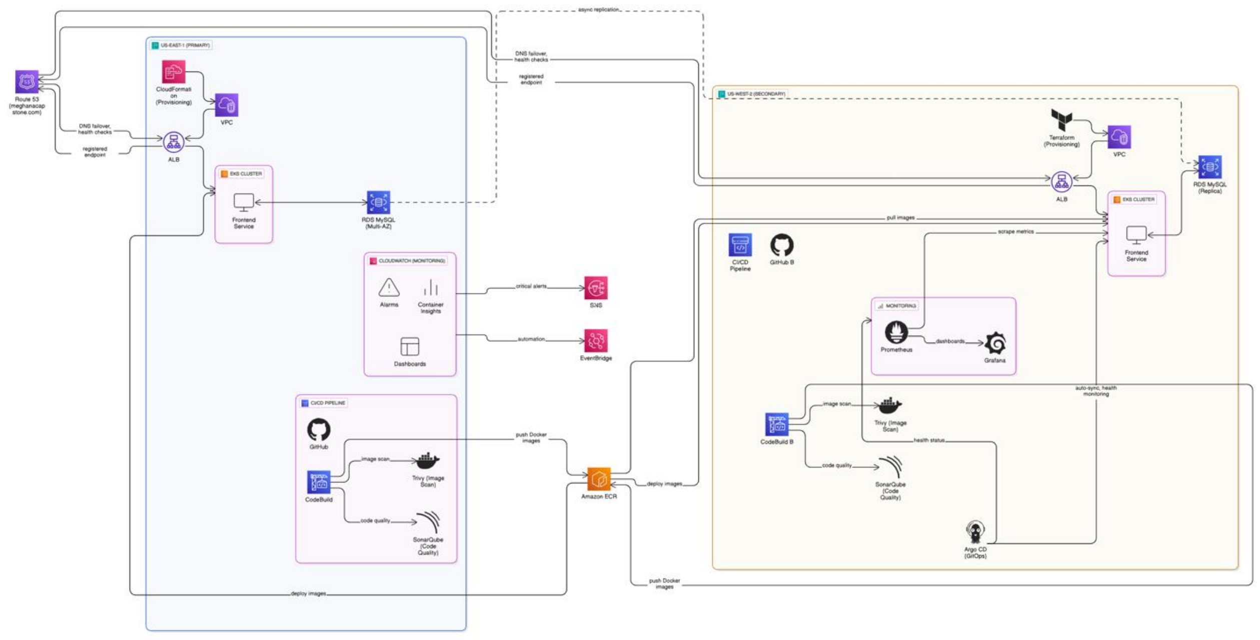
   Configures health checks and regional failover

5. **Monitoring**

   Tools used: CloudWatch, SNS

   Collects metrics/logs and sends alert notifications

Architecture:



Project Desc: Ecommerce Capstone project is a comprehensive tool designed to help businesses manage various aspects of their operations. It provides a user-friendly interface for tasks like managing customer data, inventory, orders, and more.

Features :

- **Customer Management**: Easily add, update, and delete customer information.
- **Inventory Management**: Keep track of your inventory items, including stock levels and pricing.
- **Order Management**: Manage customer orders such as order creation .
- **User Authentication**: Secure login and authentication for admin and staff members.
- **Role-Based Access Control**: Define roles and permissions for different user types.
- **Thymeleaf Templates**: Utilizes Thymeleaf for dynamic HTML templates.
- **Database Integration**: Integrated with MySQL for data storage.

Technologies Used :

Spring Boot: Backend framework for building Java-based web applications.

Thymeleaf: Server-side Java template engine for dynamic HTML generation.

MySQL: Relational database management system for data storage.

IDE/Tool : Spring Tool Suite 4 (Eclipse)

PHASE 1: DEPLOYMENT ON AMAZON EKS

Deploy a containerized e-commerce on Amazon Elastic Kubernetes Service (EKS) with Load Balancer access.

Step 1: Dockerize the Spring Boot App

Step 2: Push Docker Image to Amazon ECR

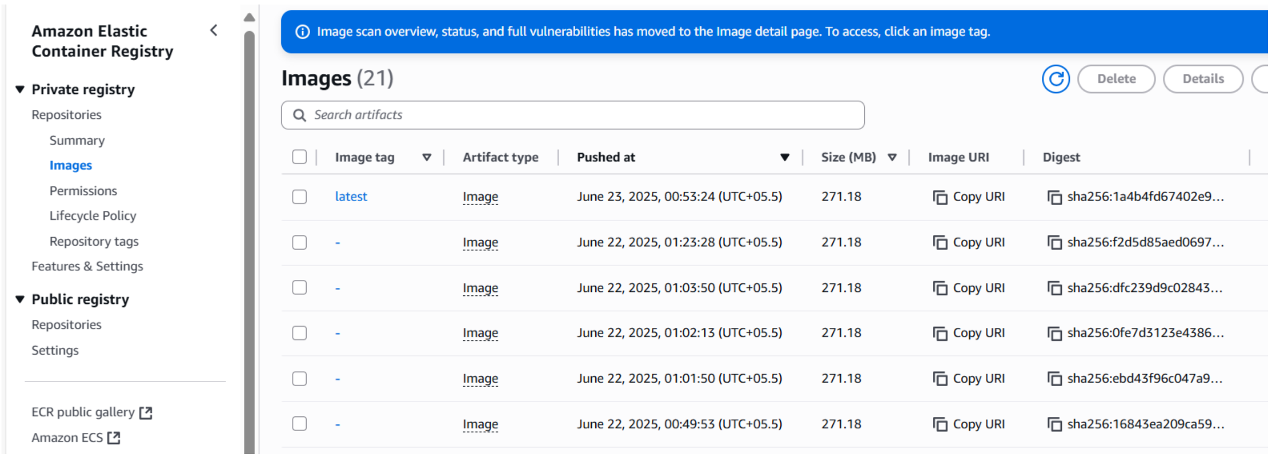


Image scan overview, status, and full vulnerabilities has moved to the Image detail page. To access, click an image tag.

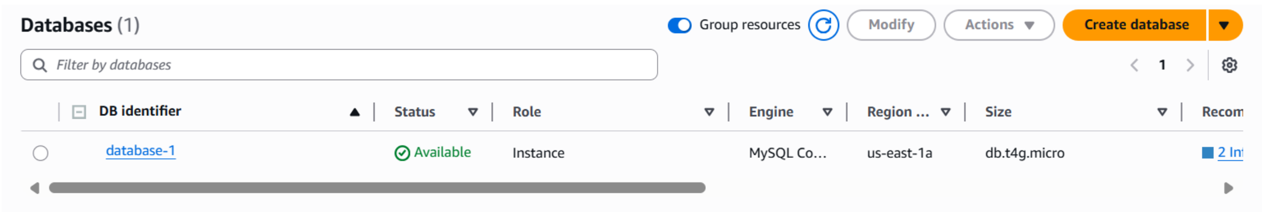
Images (21)

Image tag	Artifact type	Pushed at	Size (MB)	Image URI	Digest
latest	Image	June 23, 2025, 00:53:24 (UTC+05.5)	271.18	Copy URI	sha256:1a4b4fd67402e9...
-	Image	June 22, 2025, 01:23:28 (UTC+05.5)	271.18	Copy URI	sha256:f2d5d85aed0697...
-	Image	June 22, 2025, 01:03:50 (UTC+05.5)	271.18	Copy URI	sha256:dfc239d9c02843...
-	Image	June 22, 2025, 01:02:13 (UTC+05.5)	271.18	Copy URI	sha256:0fe7d3123e4386...
-	Image	June 22, 2025, 01:01:50 (UTC+05.5)	271.18	Copy URI	sha256:ebd43f96c047a9...
-	Image	June 22, 2025, 00:49:53 (UTC+05.5)	271.18	Copy URI	sha256:16843ea209ca59...

Step 3: Create an EKS Cluster (via eksctl)

Step 4: Provision and Connect to Amazon RDS MySQL Database

a. Create Amazon RDS MySQL DB



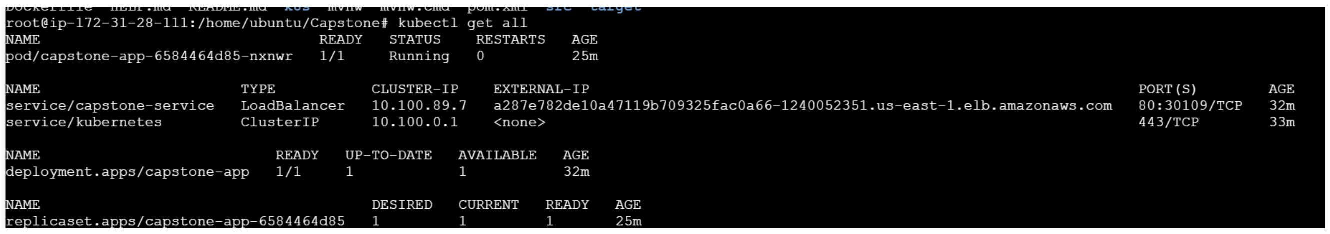
Databases (1)

DB identifier	Status	Role	Engine	Region ...	Size	Recom
database-1	Available	Instance	MySQL Co...	us-east-1a	db.t4g.micro	2 In

b. Update Spring Boot application.properties
c. Rebuild Docker Image
d. Update Kubernetes Deployment YAML
e. Apply Manifest and Verify

Step 5: Deploy Spring Boot App

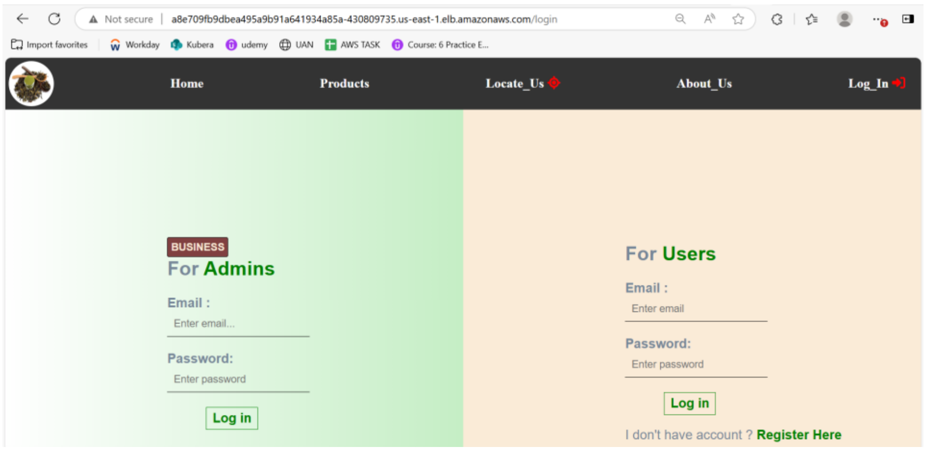
Step 6: Expose via LoadBalancer



```
Dockerfile  HELP.md  README.md  k8s  mvnw  mvnw.cmd  pom.xml  src  target
root@ip-172-31-28-111:/home/ubuntu/Capstone# kubectl get all
NAME                                READY   STATUS    RESTARTS   AGE
pod/capstone-app-6584464d85-nxnwr   1/1     Running   0          25m

NAME                          TYPE           CLUSTER-IP    EXTERNAL-IP                                                               PORT(S)        AGE
service/capstone-service      LoadBalancer   10.100.89.7   a287e782de10a47119b709325fac0a66-1240052351.us-east-1.elb.amazonaws.com   80:30109/TCP   32m
service/kubernetes            ClusterIP      10.100.0.1    <none>                                                                    443/TCP        33m

NAME                           READY   UP-TO-DATE   AVAILABLE   AGE
deployment.apps/capstone-app   1/1     1            1           32m

NAME                                      DESIRED   CURRENT   READY   AGE
replicaset.apps/capstone-app-6584464d85   1         1         1       25m
```

Step 7: Verify the App Functionality through load Balancers in different regions

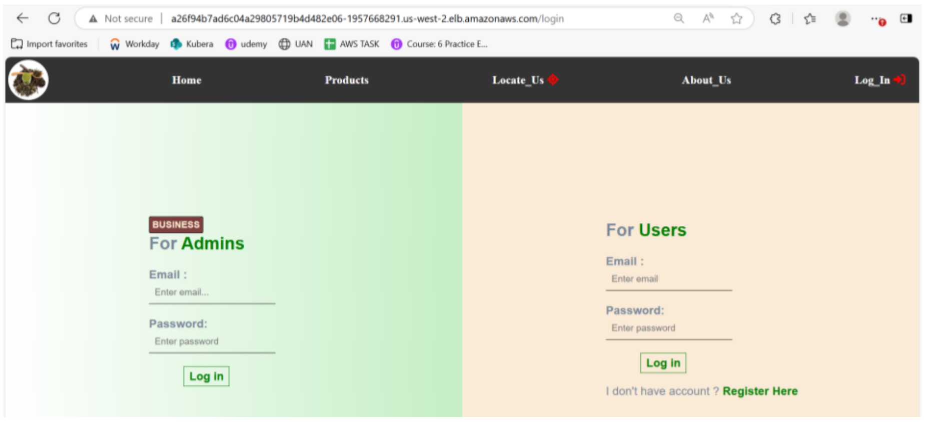
Us-east-1


Not secure | a8e709fb9dbea495a9b91a641934a85a-430809735.us-east-1.elb.amazonaws.com/login

BUSINESS
For Admins
Email :
Enter email...
Password:
Enter password
Log in

For Users
Email :
Enter email
Password:
Enter password
Log in
I don't have account ? Register Here

Us-west-2


Not secure | a26f94b7ad6c04a29805719b4d482e06-1957668291.us-west-2.elb.amazonaws.com/login

BUSINESS
For Admins
Email :
Enter email...
Password:
Enter password
Log in

For Users
Email :
Enter email
Password:
Enter password
Log in
I don't have account ? Register Here

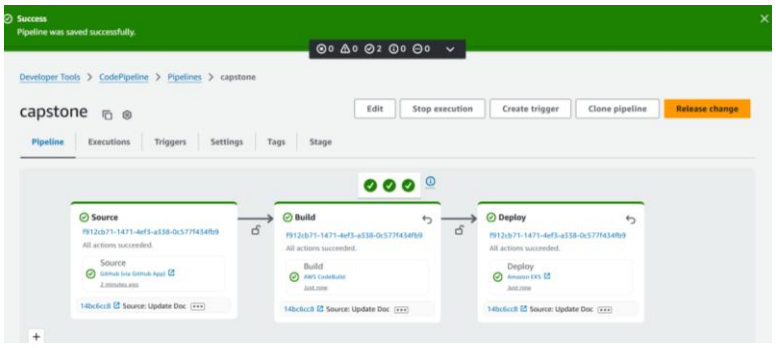
PHASE 2: AWS Core Pipeline Automation

Step 1: Create ECR Repository

Step 2: Define buildspec.yml in root of repo

Step 3: Create CodeBuild Project

Step 4: Create CodePipeline


Success
Pipeline was saved successfully.

Developer Tools > CodePipeline > Pipelines > capstone

capstone

Source
f912cb71-1471-4ef3-a338-0c577f434fb9
All actions succeeded.
Source
GitHub (via GitHub App)
2 minutes ago
14bc6cc8 Source: Update Doc

Build
f912cb71-1471-4ef3-a338-0c577f434fb9
All actions succeeded.
Build
AWS CodeBuild
Just now
14bc6cc8 Source: Update Doc

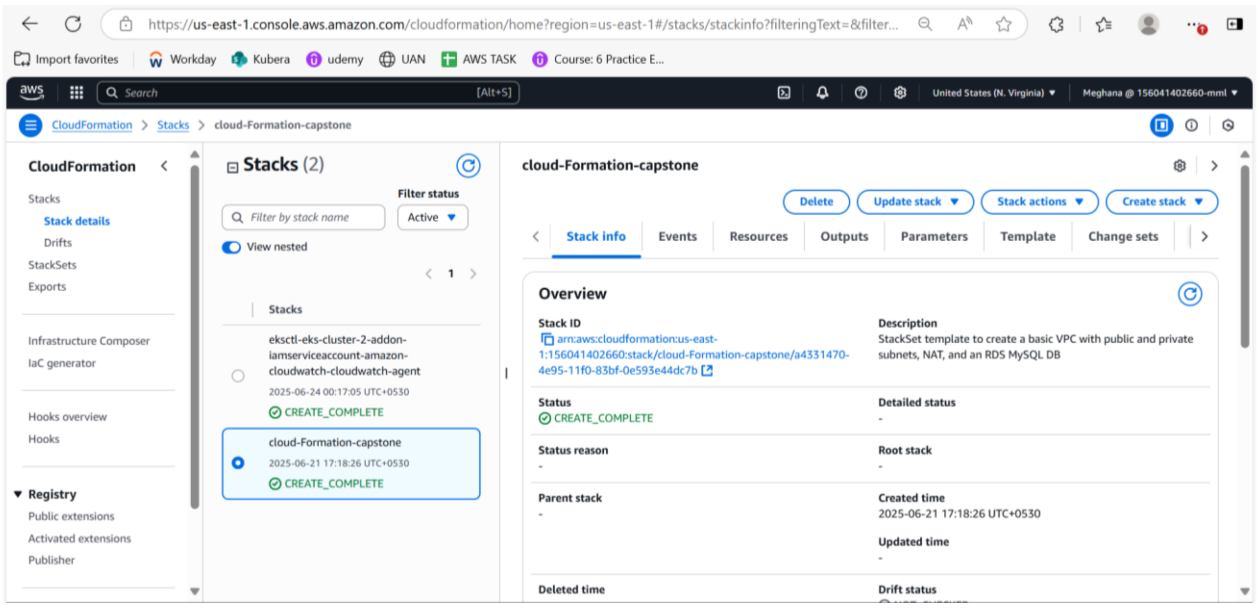
Deploy
f912cb71-1471-4ef3-a338-0c577f434fb9
All actions succeeded.
Deploy
Amazon EKS
Just now
14bc6cc8 Source: Update Doc

Step 5: Auto Deploy to EKS

PHASE 3: Multi-Region Infrastructure Deployment

1. CloudFormation in another (e.g., us-east-1)
2. Terraform in one region (e.g., us-west-2)

Step 1: CloudFormation Deployment in Region A



CloudFormation > Stacks > cloud-Formation-capstone

Stacks (2)

Stacks	
eksctl-eks-cluster-2-addon-iamserviceaccount-amazon-cloudwatch-cloudwatch-agent	2025-06-24 00:17:05 UTC+0530 CREATE_COMPLETE
cloud-Formation-capstone	2025-06-21 17:18:26 UTC+0530 CREATE_COMPLETE

cloud-Formation-capstone

Overview

Stack ID: arn:aws:cloudformation:us-east-1:156041402660:stack/cloud-Formation-capstone/a4331470-4e95-11f0-83bf-0e593e44dc7b	Description: StackSet template to create a basic VPC with public and private subnets, NAT, and an RDS MySQL DB
Status: CREATE_COMPLETE	Detailed status: -
Status reason: -	Root stack: -
Parent stack: -	Created time: 2025-06-21 17:18:26 UTC+0530
	Updated time: -
Deleted time	Drift status

Step 2: Terraform Deployment in Region B

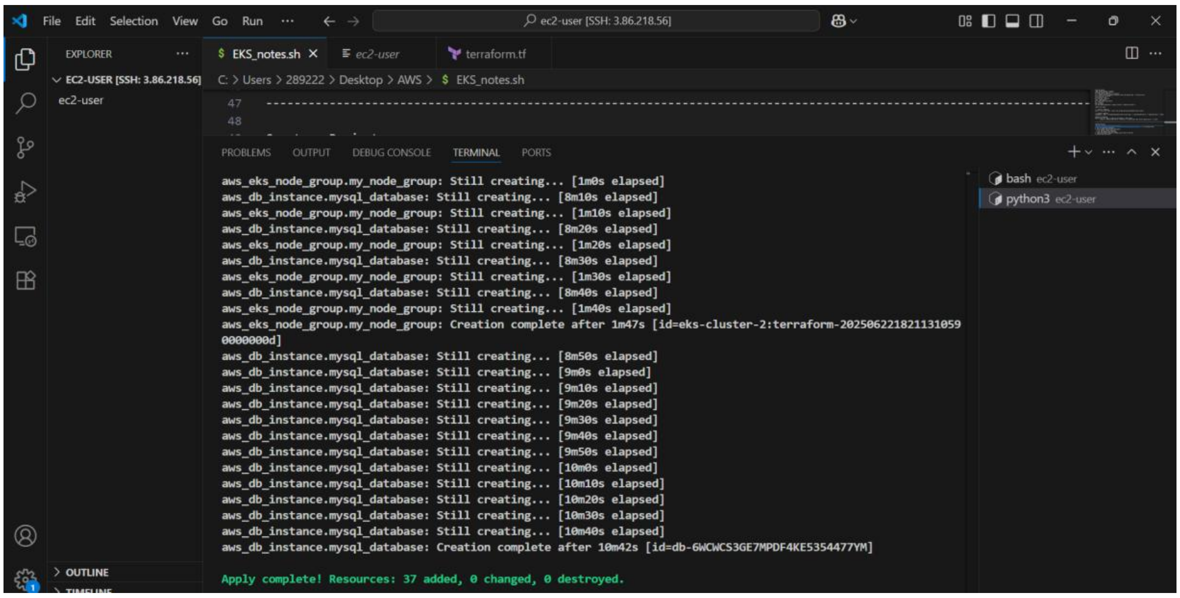
git clone https://github.com/meghanavalluri02/capstone-terraforn.git

cd capstone-terraforn

terraform init

terraform plan

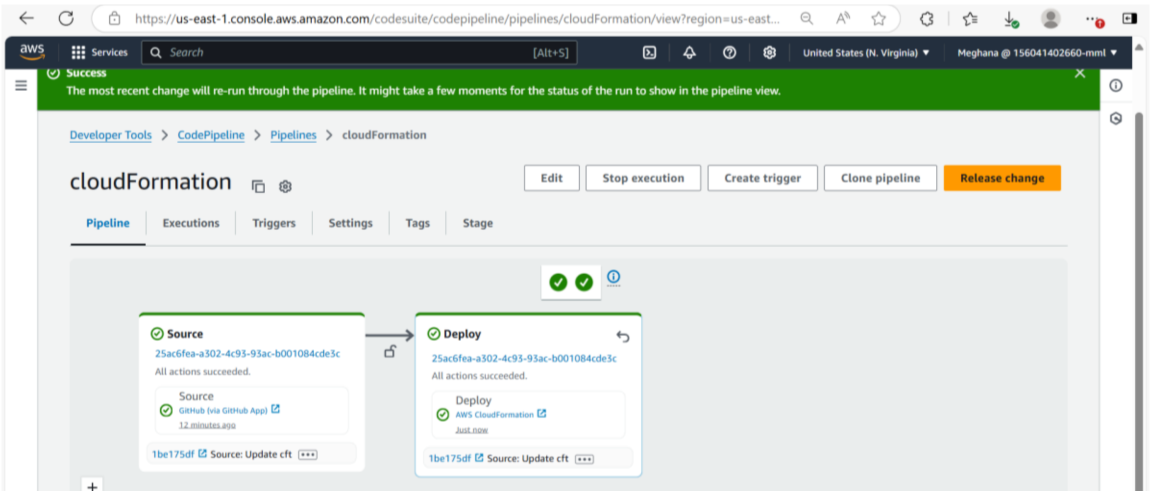
terraform apply



```
aws_eks_node_group.my_node_group: Still creating... [1m0s elapsed]
aws_db_instance.mysql_database: Still creating... [8m10s elapsed]
aws_eks_node_group.my_node_group: Still creating... [1m10s elapsed]
aws_db_instance.mysql_database: Still creating... [8m20s elapsed]
aws_eks_node_group.my_node_group: Still creating... [1m20s elapsed]
aws_db_instance.mysql_database: Still creating... [8m30s elapsed]
aws_eks_node_group.my_node_group: Still creating... [1m30s elapsed]
aws_db_instance.mysql_database: Still creating... [8m40s elapsed]
aws_eks_node_group.my_node_group: Still creating... [1m40s elapsed]
aws_eks_node_group.my_node_group: Creation complete after 1m47s [id=eks-cluster-2:terraform-202506221821131059
0000000d]
aws_db_instance.mysql_database: Still creating... [8m50s elapsed]
aws_db_instance.mysql_database: Still creating... [9m0s elapsed]
aws_db_instance.mysql_database: Still creating... [9m10s elapsed]
aws_db_instance.mysql_database: Still creating... [9m20s elapsed]
aws_db_instance.mysql_database: Still creating... [9m30s elapsed]
aws_db_instance.mysql_database: Still creating... [9m40s elapsed]
aws_db_instance.mysql_database: Still creating... [9m50s elapsed]
aws_db_instance.mysql_database: Still creating... [10m0s elapsed]
aws_db_instance.mysql_database: Still creating... [10m10s elapsed]
aws_db_instance.mysql_database: Still creating... [10m20s elapsed]
aws_db_instance.mysql_database: Still creating... [10m30s elapsed]
aws_db_instance.mysql_database: Still creating... [10m40s elapsed]
aws_db_instance.mysql_database: Creation complete after 10m42s [id=db-6WCWCS3GE7MPDF4KE5354477YM]

Apply complete! Resources: 37 added, 0 changed, 0 destroyed.
```

Step 3: CodePipeline

a. For cloudformation region


https://us-east-1.console.aws.amazon.com/codesuite/codepipeline/pipelines/cloudFormation/view?region=us-east...
aws
Services
Search
[Alt+S]
United States (N. Virginia)
Meghana @ 156041402660-mml
Edit
Stop execution
Create trigger
Clone pipeline
Release change
Pipeline
Executions
Triggers
Settings
Tags
Stage

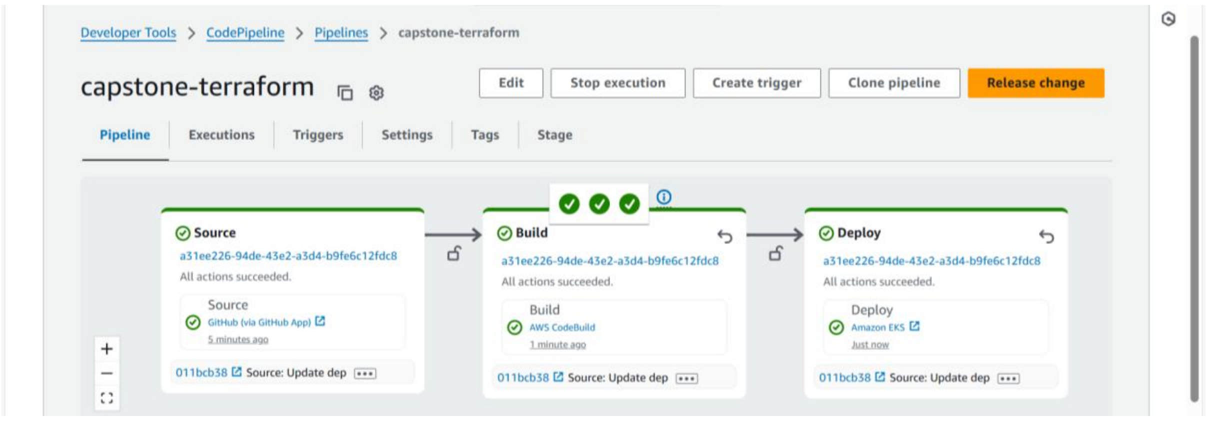
Success
The most recent change will re-run through the pipeline. It might take a few moments for the status of the run to show in the pipeline view.

Developer Tools > CodePipeline > Pipelines > cloudFormation

cloudFormation

Source	Deploy
25ac6fea-a302-4c93-93ac-b001084cde3c	25ac6fea-a302-4c93-93ac-b001084cde3c
All actions succeeded.	All actions succeeded.
Source – GitHub (via GitHub App) – 12 minutes ago	Deploy – AWS CloudFormation – Just now
1be175df Source: Update cft	1be175df Source: Update cft

b. For terraform region



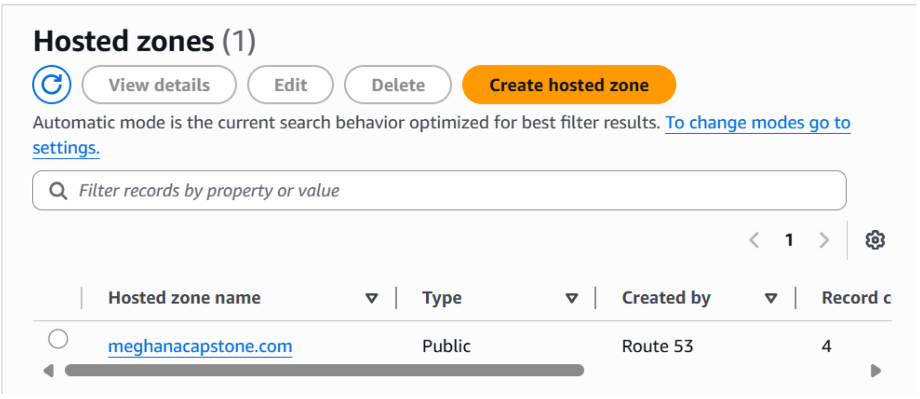
Developer Tools > CodePipeline > Pipelines > capstone-terraform

capstone-terraform

Source	Build	Deploy
a31ee226-94de-43e2-a3d4-b9fe6c12fdc8	a31ee226-94de-43e2-a3d4-b9fe6c12fdc8	a31ee226-94de-43e2-a3d4-b9fe6c12fdc8
All actions succeeded.	All actions succeeded.	All actions succeeded.
Source – GitHub (via GitHub App) – 5 minutes ago	Build – AWS CodeBuild – 1 minute ago	Deploy – Amazon EKS – Just now
011bcb38 Source: Update dep	011bcb38 Source: Update dep	011bcb38 Source: Update dep

PHASE 4: Setup Route 53 Failover

1. **Go to AWS Route 53 → Hosted Zones**

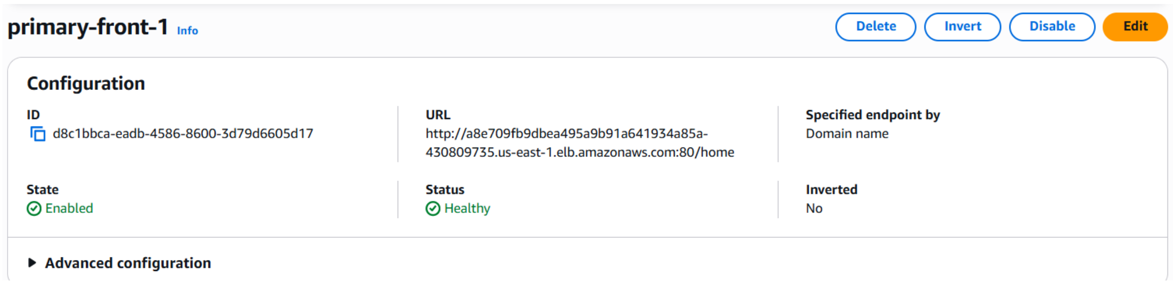


Hosted zones (1)

Automatic mode is the current search behavior optimized for best filter results. To change modes go to settings.

Hosted zone name	Type	Created by	Record c
meghanacapstone.com	Public	Route 53	4

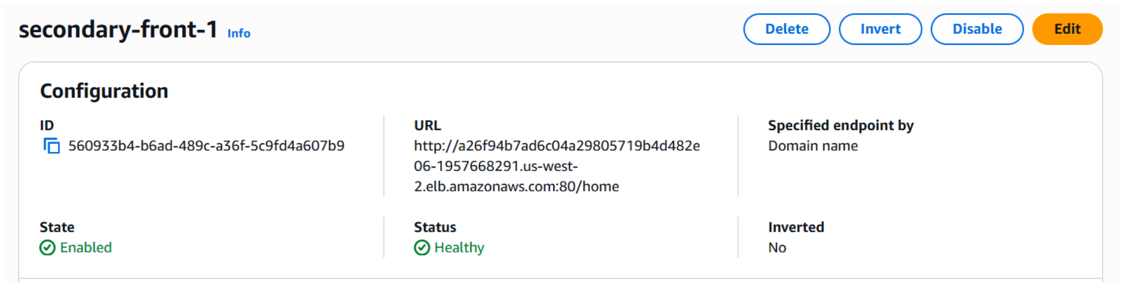
2. **Create 2 records**


primary-front-1 Info

Configuration

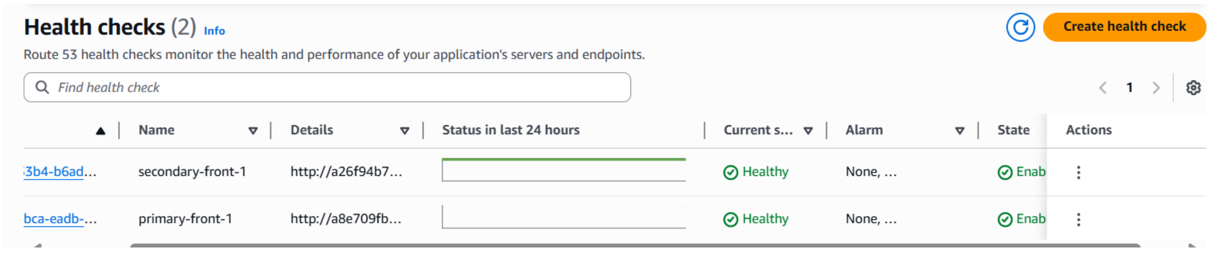
ID d8c1bbca-eadb-4586-8600-3d79d6605d17	URL http://a8e709fb9dbea495a9b91a641934a85a-430809735.us-east-1.elb.amazonaws.com:80/home	Specified endpoint by Domain name
State Enabled	Status Healthy	Inverted No

Advanced configuration


secondary-front-1 Info

Configuration

ID 560933b4-b6ad-489c-a36f-5c9fd4a607b9	URL http://a26f94b7ad6c04a29805719b4d482e06-1957668291.us-west-2.elb.amazonaws.com:80/home	Specified endpoint by Domain name
State Enabled	Status Healthy	Inverted No


Health checks (2) Info

Route 53 health checks monitor the health and performance of your application's servers and endpoints.

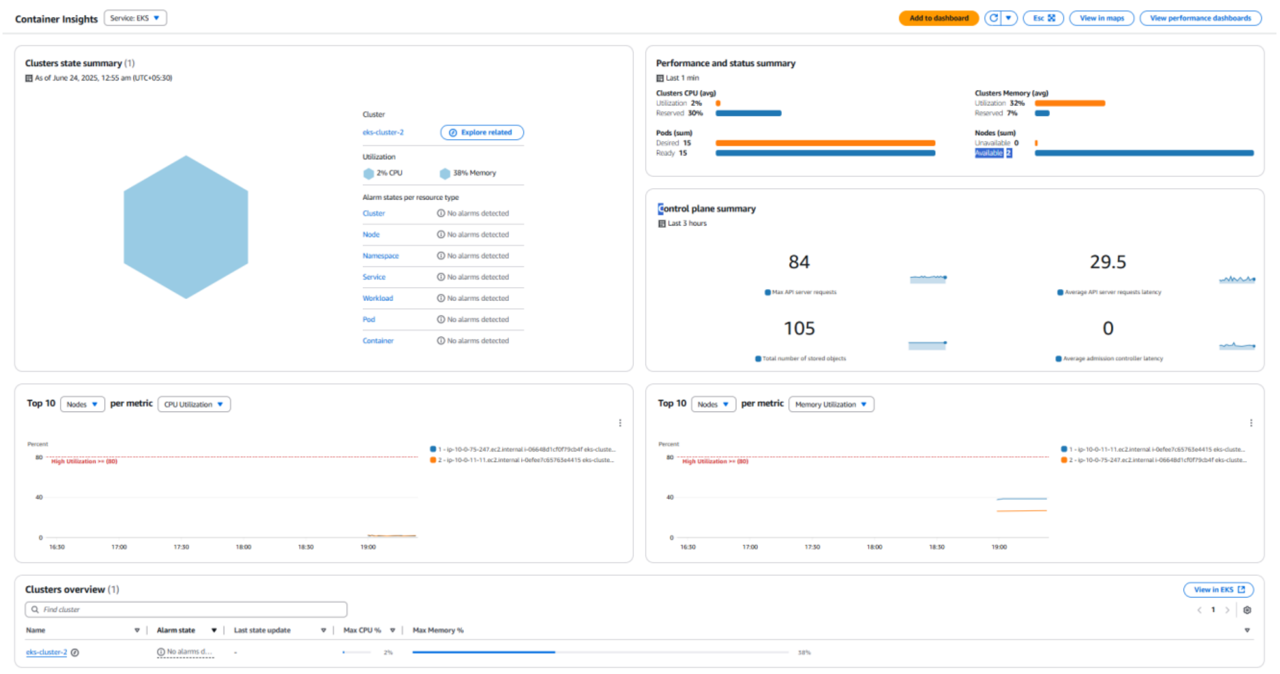
Find health check

▲	Name	Details	Status in last 24 hours	Current s...	Alarm	State	Actions
3b4-b6ad...	secondary-front-1	http://a26f94b7...		Healthy	None, ...	Enab	⋮
bca-eadb-...	primary-front-1	http://a8e709fb...		Healthy	None, ...	Enab	⋮

PHASE 5: CloudWatch Monitoring Setup

Step 1: Create a CloudWatch

Go to container insights


Container Insights Service: EKS

Clusters state summary (1)
As of June 24, 2025, 12:55 am (UTC+05:30)

Cluster
eks-cluster-2 Explore related

Utilization
2% CPU 38% Memory

Alarm states per resource type

Cluster	No alarms detected
Node	No alarms detected
Namespace	No alarms detected
Service	No alarms detected
Workload	No alarms detected
Pod	No alarms detected
Container	No alarms detected

Performance and status summary
Last 1 min

Clusters CPU (avg)
Utilization 2%
Reserved 30%

Clusters Memory (avg)
Utilization 32%
Reserved 7%

Pods (sum)
Desired 15
Ready 15

Nodes (sum)
Unavailable 0
Available 2

Control plane summary
Last 3 hours

84 Max API server requests
29.5 Average API server requests latency
105 Total number of stored objects
0 Average admission controller latency

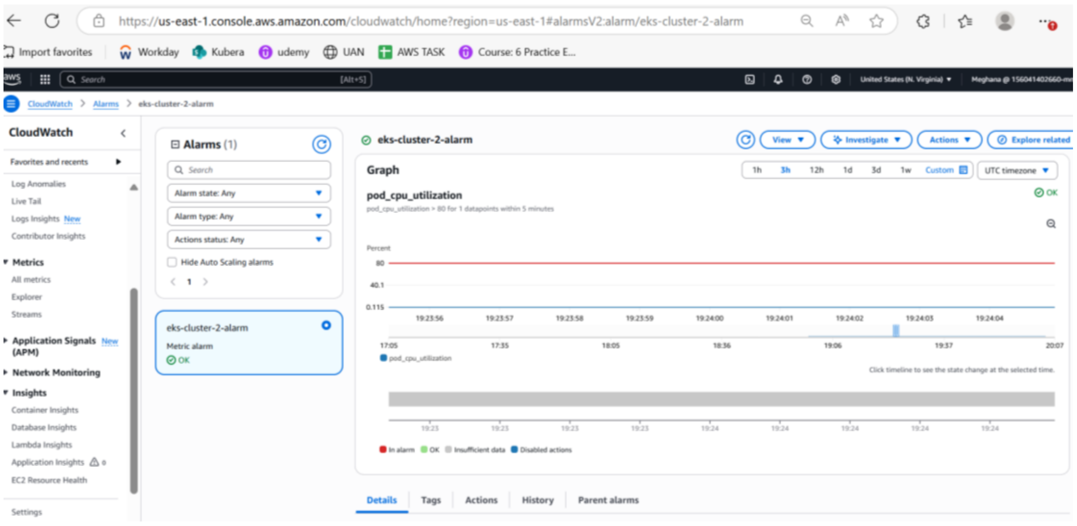
Top 10 Nodes per metric CPU Utilization
1 - ip-10-0-75-247.ec2.internal i-06648d1cf0f79cb4f eks-cluste...
2 - ip-10-0-11-11.ec2.internal i-0efee7c65763e4415 eks-cluste...

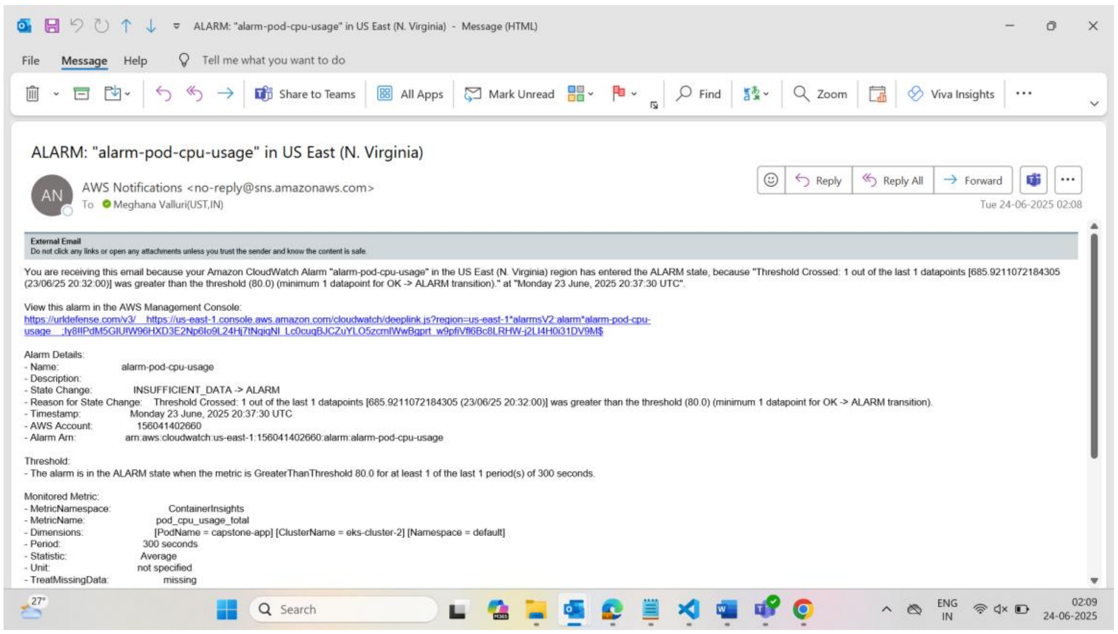
Top 10 Nodes per metric Memory Utilization
1 - ip-10-0-11-11.ec2.internal i-0efee7c65763e4415 eks-cluste...
2 - ip-10-0-75-247.ec2.internal i-06648d1cf0f79cb4f eks-cluste...

Clusters overview (1)
Find cluster

Name	Alarm state	Last state update	Max CPU %	Max Memory %
eks-cluster-2	No alarms d...	-	2%	38%

Step 2: Alarms




ALARM: "alarm-pod-cpu-usage" in US East (N. Virginia)

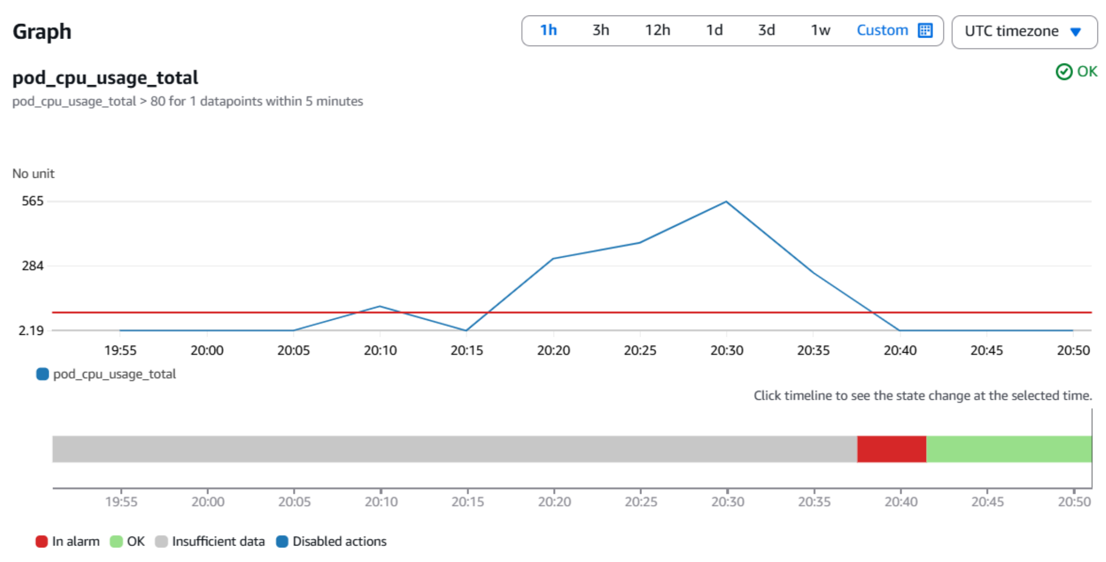
AWS Notifications <no-reply@sns.amazonaws.com>
To Meghana Valluri(UST,IN)
Tue 24-06-2025 02:08

External Email
Do not click any links or open any attachments unless you trust the sender and know the content is safe.

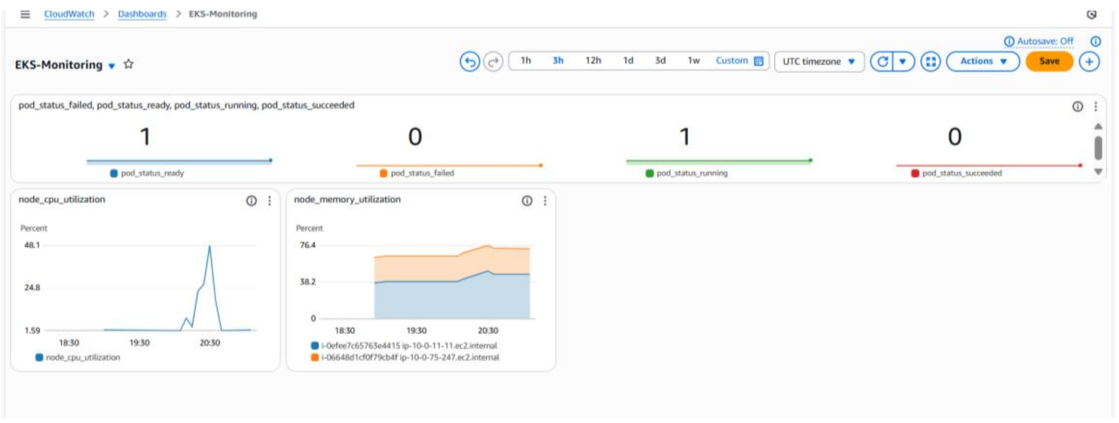
You are receiving this email because your Amazon CloudWatch Alarm "alarm-pod-cpu-usage" in the US East (N. Virginia) region has entered the ALARM state, because "Threshold Crossed: 1 out of the last 1 datapoints [685.9211072184305 (23/06/25 20:32:00)] was greater than the threshold (80.0) (minimum 1 datapoint for OK -> ALARM transition)." at "Monday 23 June, 2025 20:37:30 UTC".

View this alarm in the AWS Management Console:
https://urldefense.com/v3/__https://us-east-1.console.aws.amazon.com/cloudwatch/deeplink.js?region=us-east-1*alarmsV2:alarm*alarm-pod-cpu-usage__;Iy8!!PdM5GIUIW96HXD3E2Np6lo9L24Hj7tNqiqNI_Lc0cuqBJCZuYLO5zcmIWwBgprt_w9pfiVfl6Bc8LRHW-j2LI4H0i31DV9M$

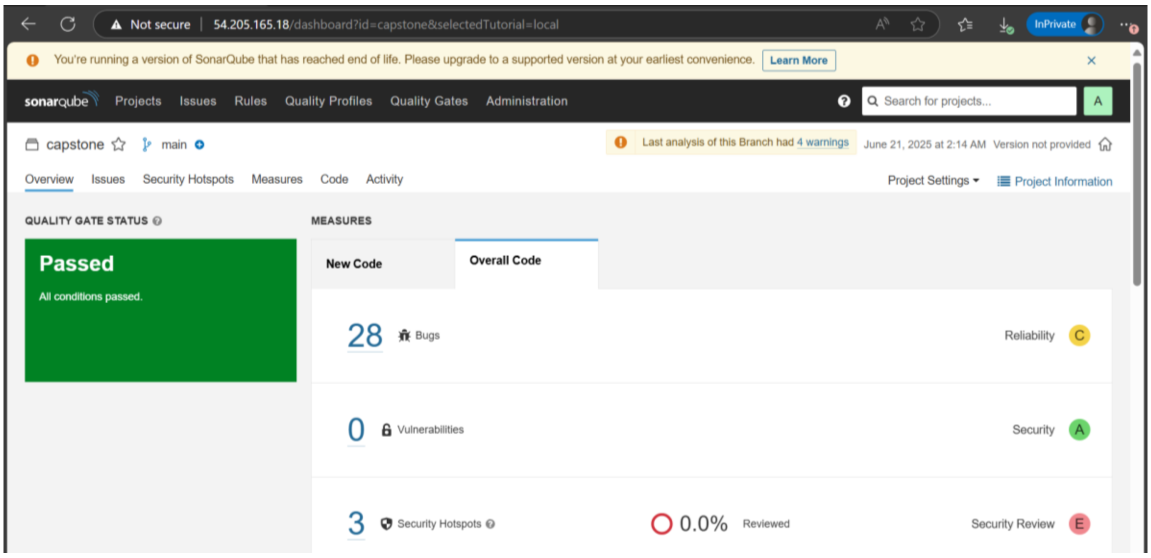
```
Alarm Details:
- Name:                     alarm-pod-cpu-usage
- Description:
- State Change:             INSUFFICIENT_DATA -> ALARM
- Reason for State Change:  Threshold Crossed: 1 out of the last 1 datapoints [685.9211072184305 (23/06/25 20:32:00)] was greater than the threshold (80.0) (minimum 1 datapoint for OK -> ALARM transition).
- Timestamp:                Monday 23 June, 2025 20:37:30 UTC
- AWS Account:              156041402660
- Alarm Arn:                arn:aws:cloudwatch:us-east-1:156041402660:alarm:alarm-pod-cpu-usage

Threshold:
- The alarm is in the ALARM state when the metric is GreaterThanThreshold 80.0 for at least 1 of the last 1 period(s) of 300 seconds.

Monitored Metric:
- MetricNamespace:          ContainerInsights
- MetricName:               pod_cpu_usage_total
- Dimensions:               [PodName = capstone-app] [ClusterName = eks-cluster-2] [Namespace = default]
- Period:                   300 seconds
- Statistic:                Average
- Unit:                     not specified
- TreatMissingData:         missing
```



CloudWatch dashboards:



PHASE 6: Code Quality Analysis with SonarQube


Not secure | 54.205.165.18/dashboard?id=capstone&selectedTutorial=local
InPrivate
Learn More
sonarqube Projects Issues Rules Quality Profiles Quality Gates Administration
Search for projects...
capstone
main
Overview Issues Security Hotspots Measures Code Activity
Project Settings
Project Information
New Code
Overall Code

You're running a version of SonarQube that has reached end of life. Please upgrade to a supported version at your earliest convenience.

Last analysis of this Branch had 4 warnings June 21, 2025 at 2:14 AM Version not provided

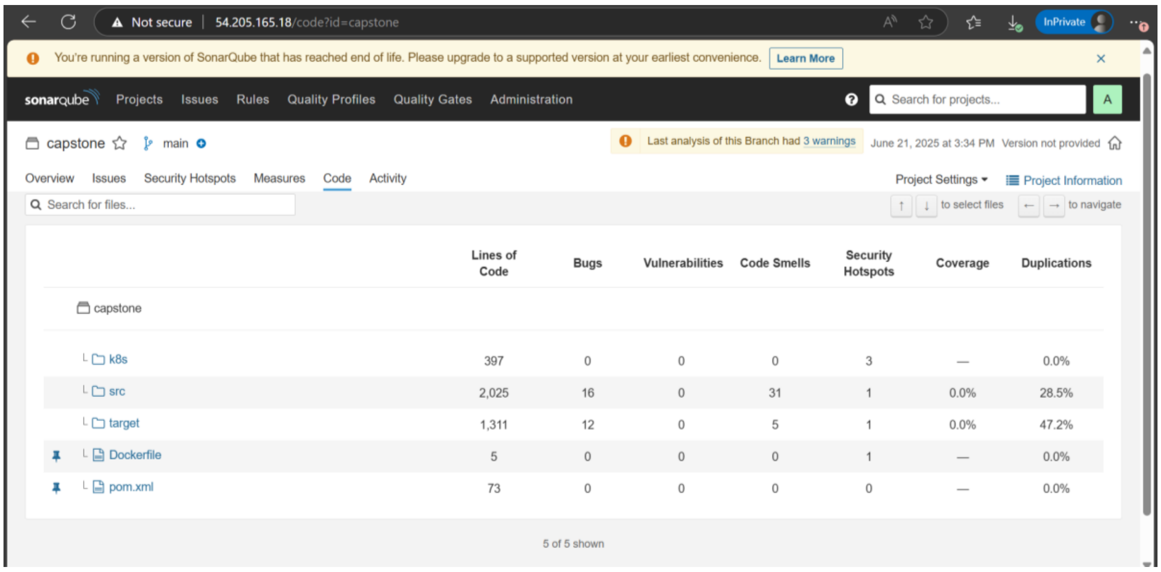
QUALITY GATE STATUS

Passed

All conditions passed.

MEASURES

28	Bugs	Reliability	C
0	Vulnerabilities	Security	A
3	Security Hotspots	0.0% Reviewed	Security Review E


Not secure | 54.205.165.18/code?id=capstone
InPrivate
Learn More
sonarqube Projects Issues Rules Quality Profiles Quality Gates Administration
Search for projects...
capstone
main
Overview Issues Security Hotspots Measures Code Activity
Project Settings
Project Information
Search for files...
to select files
to navigate

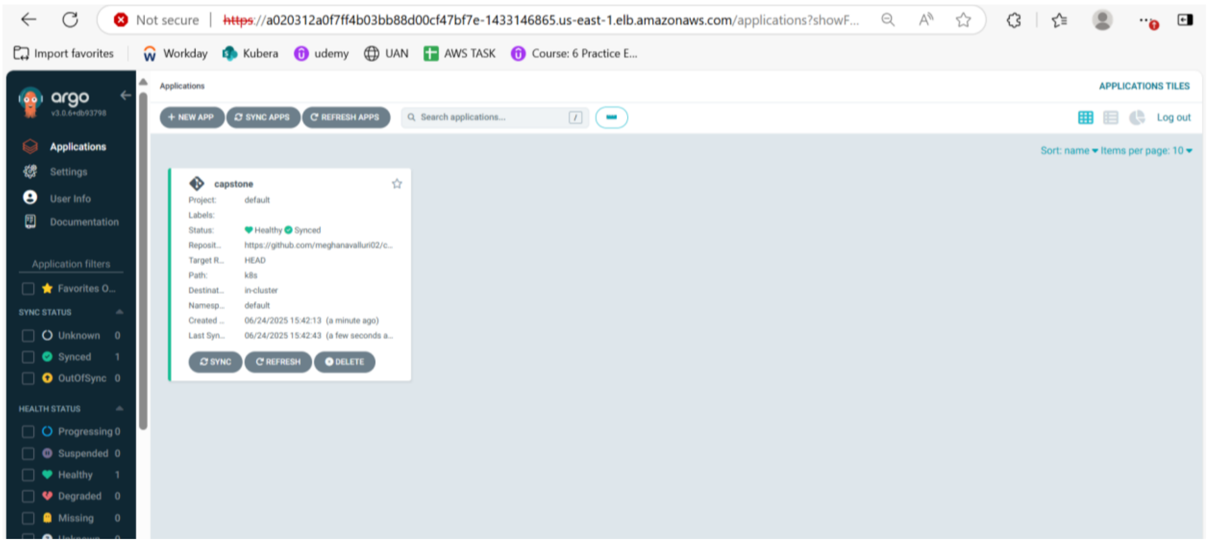
You're running a version of SonarQube that has reached end of life. Please upgrade to a supported version at your earliest convenience.

Last analysis of this Branch had 3 warnings June 21, 2025 at 3:34 PM Version not provided

	Lines of Code	Bugs	Vulnerabilities	Code Smells	Security Hotspots	Coverage	Duplications
capstone							
k8s	397	0	0	0	3	—	0.0%
src	2,025	16	0	31	1	0.0%	28.5%
target	1,311	12	0	5	1	0.0%	47.2%
Dockerfile	5	0	0	0	1	—	0.0%
pom.xml	73	0	0	0	0	—	0.0%

5 of 5 shown

PHASE 7: Continuous Deployment with Argo CD



Not secure | https://a020312a0f7ff4b03bb88d00cf47bf7e-1433146865.us-east-1.elb.amazonaws.com/applications?showF...

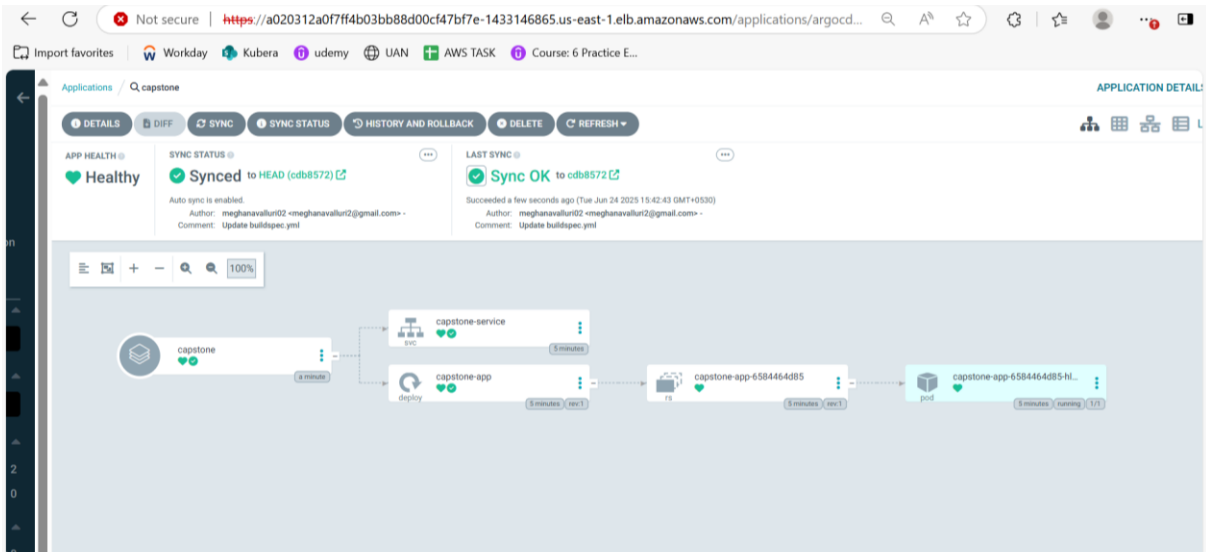
Applications

+ NEW APP | SYNC APPS | REFRESH APPS

capstone
Project: default
Labels:
Status: Healthy Synced
Reposit... https://github.com/meghanavalluri02/c...
Target R... HEAD
Path: k8s
Destinat... in-cluster
Namesp... default
Created ... 06/24/2025 15:42:13 (a minute ago)
Last Syn... 06/24/2025 15:42:43 (a few seconds a...

SYNC STATUS: Unknown 0, Synced 1, OutOfSync 0

HEALTH STATUS: Progressing 0, Suspended 0, Healthy 1, Degraded 0, Missing 0



Not secure | https://a020312a0f7ff4b03bb88d00cf47bf7e-1433146865.us-east-1.elb.amazonaws.com/applications/argocd...

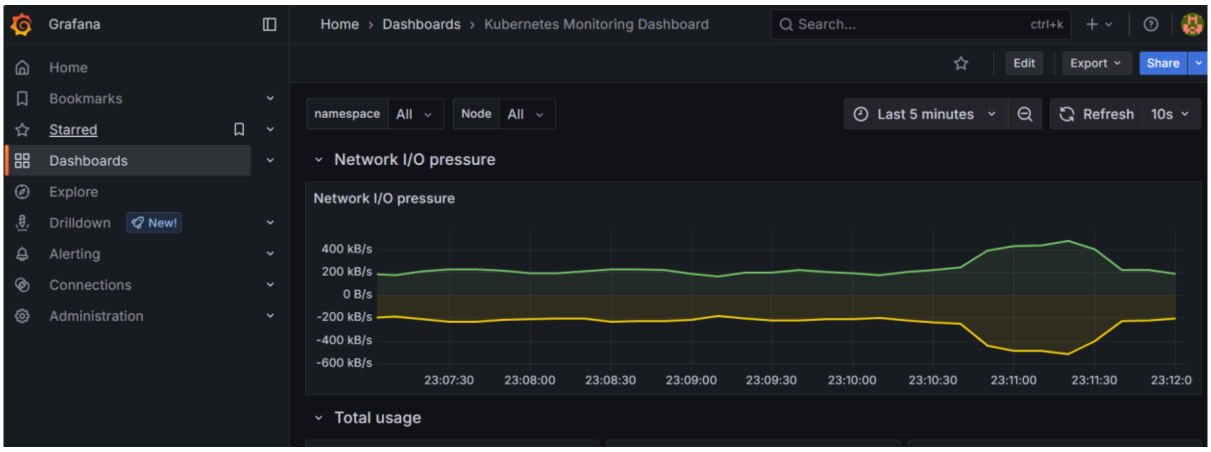
Applications / capstone

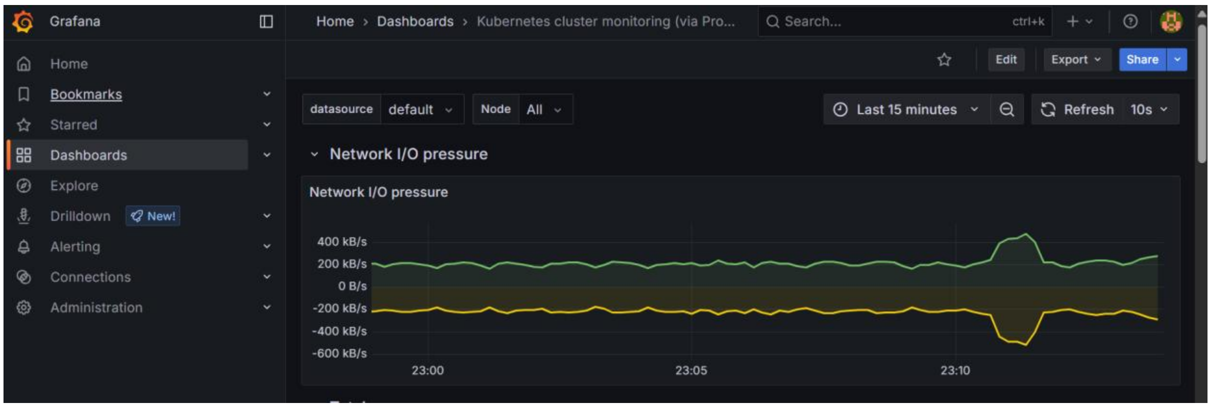
APP HEALTH: Healthy

SYNC STATUS: Synced to HEAD (cdb8572)
Auto sync is enabled.
Author: meghanavalluri02 <meghanavalluri2@gmail.com> -
Comment: Update buildspec.yml

LAST SYNC: Sync OK to cdb8572
Succeeded a few seconds ago (Tue Jun 24 2025 15:42:43 GMT+0530)
Author: meghanavalluri02 <meghanavalluri2@gmail.com> -
Comment: Update buildspec.yml

PHASE 8: Kubernetes Metrics with Prometheus and Grafana




Grafana
Home
Bookmarks
Starred
Dashboards
Explore
Drilldown
New!
Alerting
Connections
Administration
Home › Dashboards › Kubernetes cluster monitoring (via Pro...
Search...
ctrl+k
Edit
Export
Share
datasource
default
Node
All
Last 15 minutes
Refresh
10s
Network I/O pressure
Network I/O pressure
400 kB/s
200 kB/s
0 B/s
-200 kB/s
-400 kB/s
-600 kB/s
23:00
23:05
23:10