Deploy a web application in a cloud-based Kubernetes solution, ensuring proper logging and monitoring are in place.

Application Functionality

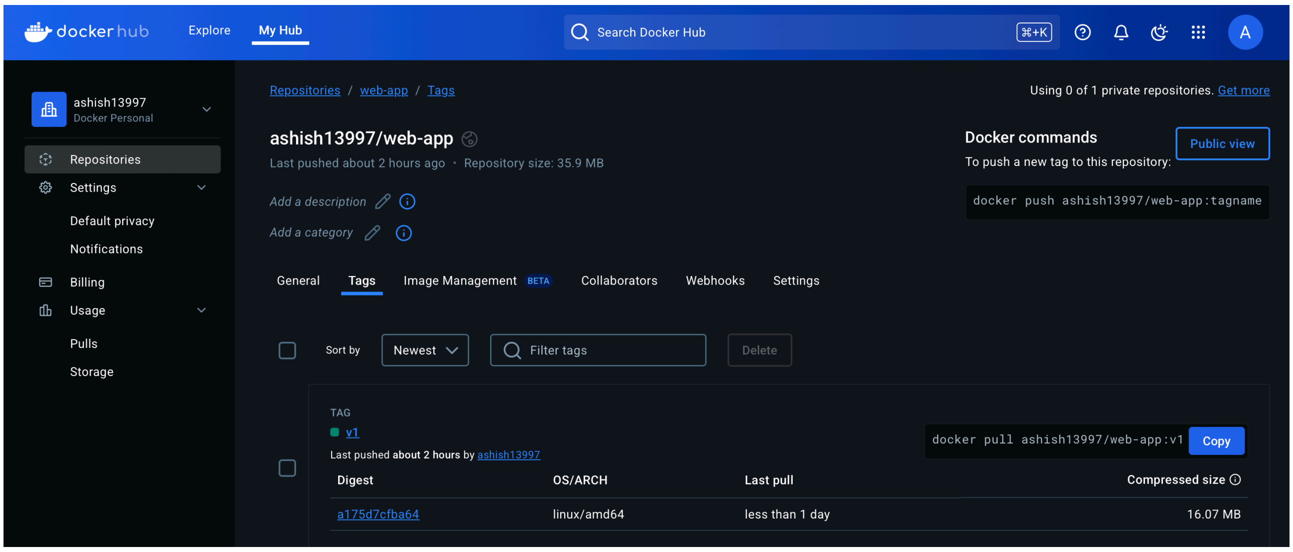
The web application shall have a simple static page of content.

Through Terraform we will deploy - VPC, EKS Cluster, Node Group, IAM Role associated with eks and nodegroup.
Create a folder and inside the folder create .tf file for -

- provider.tf - We need to specify terraform the resources it need to interact and manage, here i have provided aws provider as we are deploying resources in AWS Environment.
- vpc.tf - Need to create a vpc, where we can deploy our eks cluster and worker nodes. I have created 2 public and 2 private subnets.
- eks-cluster.tf - Inside the file we need to specify terraform about the creation of resources - EKS cluster, nodegroups, IAM policy, IAM role and attachment with resources created for permissions.
- variables.tf - The variables used within the above templates, here we can provide values to them.

We can also create terraform workspace for multi-environment configuration, helping in maintaining particular state file. We can use .tfvars file to provide the value to the variables used.

To create webserver, we are using nginx which we will specify in Dockerfile. Make sure to create the image as per the architecture of worker nodes otherwise it will create an error at the time of deployment of pods. For content to show in webpage, create an index.html file and provide valid content. Now create an image through docker build image command and push the image to docker hub. I have provided the image publicly available. Use the image inside the spec of container in deployment. It will build the pods with that container image.



Repositories / web-app / Tags

Using 0 of 1 private repositories. Get more

ashish13997/web-app

Last pushed about 2 hours ago · Repository size: 35.9 MB

Add a description

Add a category

Docker commands

To push a new tag to this repository:

```
docker push ashish13997/web-app:tagname
```

TAG

v1

Last pushed about 2 hours by ashish13997

```
docker pull ashish13997/web-app:v1
```

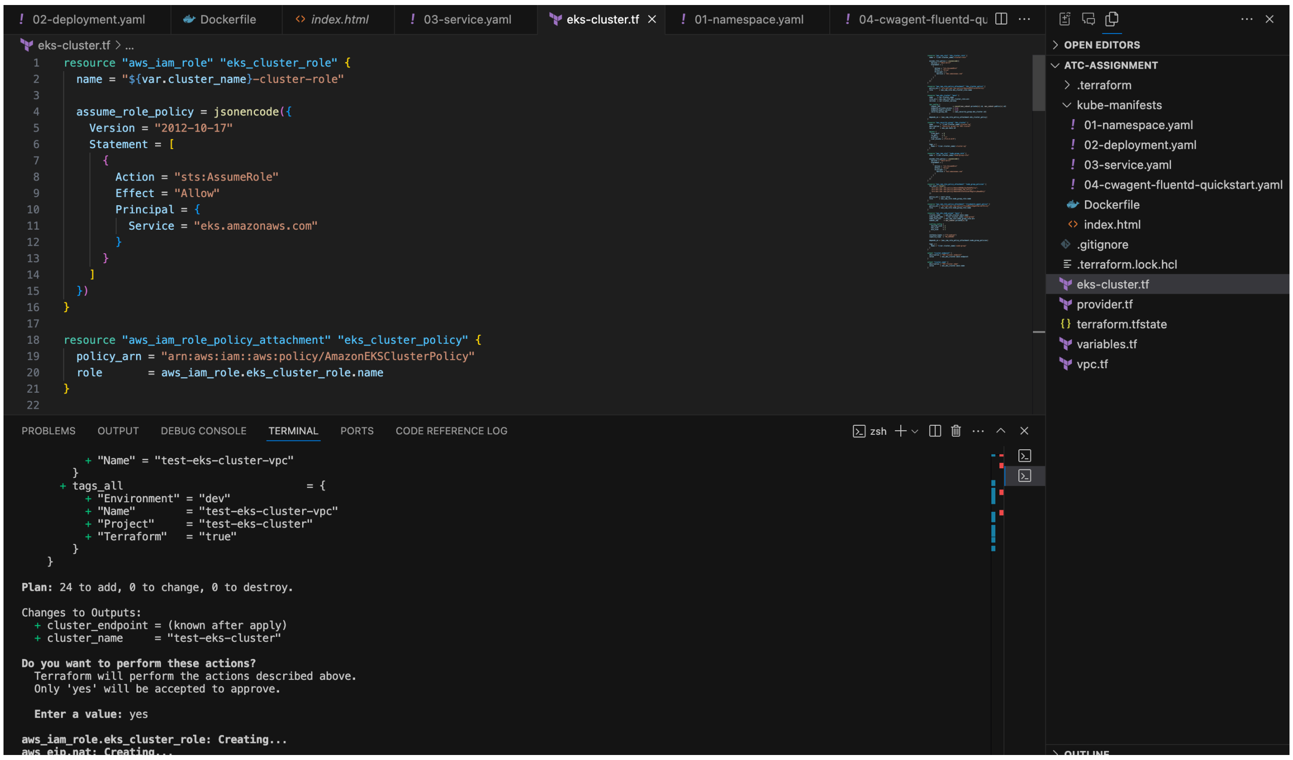
Digest	OS/ARCH	Last pull	Compressed size
a175d7cfba64	linux/amd64	less than 1 day	16.07 MB

In Kubernetes manifest, we will create yaml file for -

- namespace.yaml - To isolate and organise the resources with others. Basically it act as environment where we can create multi namespaces to differentiate prod, dev and provide limits with resource quota.
- deployment.yaml - This file help us with managing and deploying our application. Here i have specified replicas = 2, so we will have two pods created with specified image within spec of container's template. In labels we have to specify namespace, as per the value it will deploy the template under that namespace.
- service.yaml - This file help us in exposing our application to network traffic. Here i have taken Load Balancer, it is best practise to deploy worker nodes in private subnets. Therefore, to access our webserver, load balancer is used to provide internet access. By default, in service if we opt for load balancer it will take classic load balancer.
- cloudwatch-fluentd.yaml - To monitor our eks cluster and nodes cpu utilisation, memory etc. we are using AWS CloudWatch Container-insights, through the template we are creating namespace for cloudwatch, security account, cluster role, cluster role binding, daemon set for cloudwatch agent and fluentd to collect metrics and send them to AWS container insights, config-map for both the daemon sets.

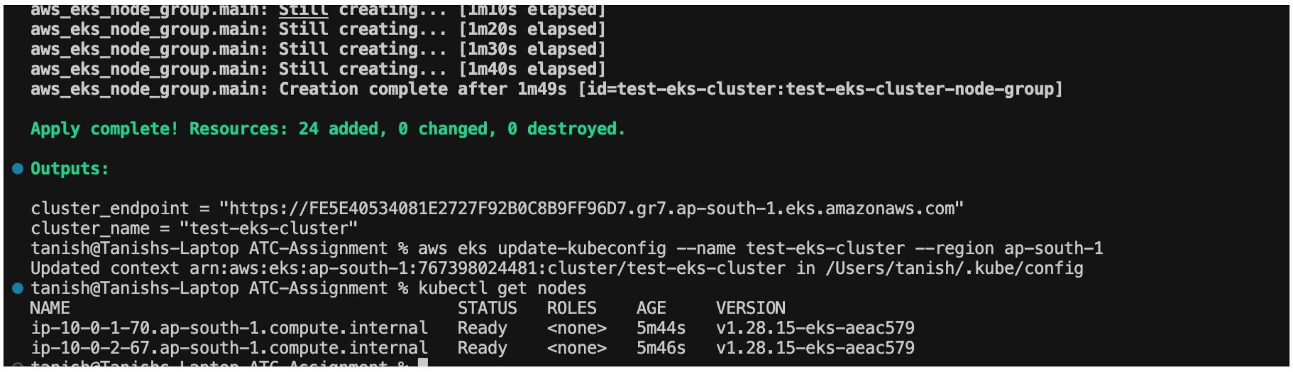
Steps -

- After the creation of above templates, give command - terraform init
- To initialise the mandate plugins as specified under provider.tf file.
- To check the output of our terraform file, give command: terraform plan, it will give us an output regarding resource creation.
- After checking give command: terraform plan and yes or —auto-approve
- After the creation of VPC, EKS Cluster, nodegroups and IAM Role.
- Verify Namespace - kubectl get ns
- Verify EKS Cluster - aws eks list-clusters
- To describe the cluster - aws eks describe-cluster --name test-eks-cluster
- Verify worker nodes are up and running - kubectl get nodes

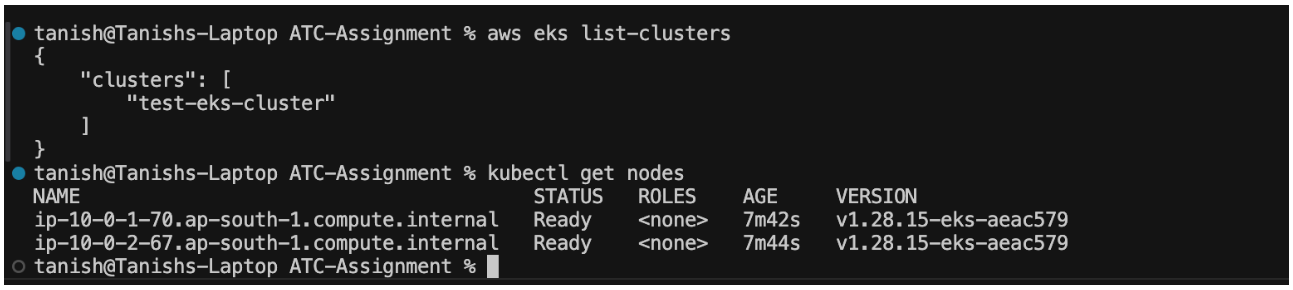


```
resource "aws_iam_role" "eks_cluster_role" {
  name = "${var.cluster_name}-cluster-role"

  assume_role_policy = jsonencode({
    Version = "2012-10-17"
    Statement = [
      {
        Action = "sts:AssumeRole"
        Effect = "Allow"
        Principal = {
          Service = "eks.amazonaws.com"
        }
      }
    ]
  })
}

resource "aws_iam_role_policy_attachment" "eks_cluster_policy" {
  policy_arn = "arn:aws:iam::aws:policy/AmazonEKSClusterPolicy"
  role       = aws_iam_role.eks_cluster_role.name
}
```

```
          + "Name" = "test-eks-cluster-vpc"
        }
      + tags_all                             = {
          + "Environment" = "dev"
          + "Name"        = "test-eks-cluster-vpc"
          + "Project"     = "test-eks-cluster"
          + "Terraform"   = "true"
        }
    }

Plan: 24 to add, 0 to change, 0 to destroy.

Changes to Outputs:
  + cluster_endpoint = (known after apply)
  + cluster_name     = "test-eks-cluster"

Do you want to perform these actions?
  Terraform will perform the actions described above.
  Only 'yes' will be accepted to approve.

  Enter a value: yes

aws_iam_role.eks_cluster_role: Creating...
aws_eip.nat: Creating...
```



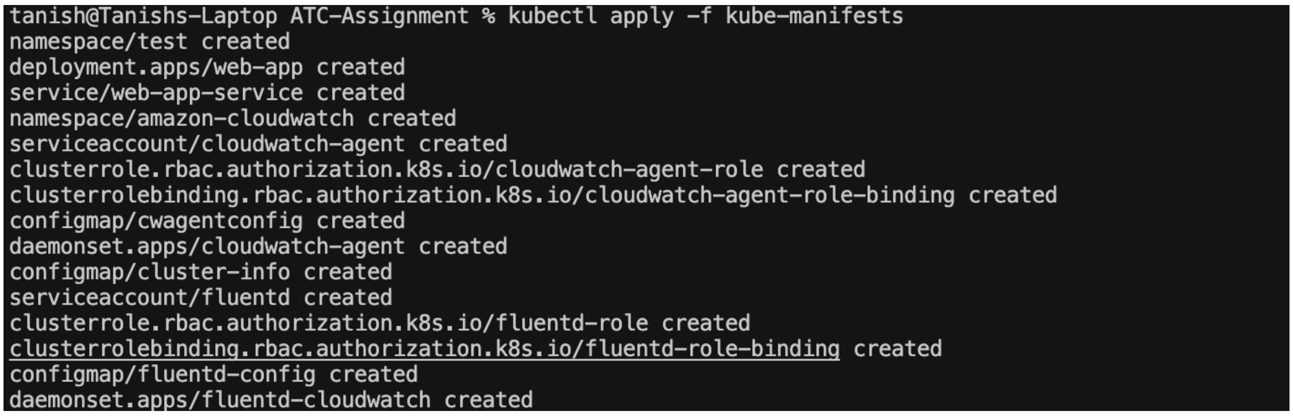
```
  aws_eks_node_group.main: Still creating... [1m10s elapsed]
  aws_eks_node_group.main: Still creating... [1m20s elapsed]
  aws_eks_node_group.main: Still creating... [1m30s elapsed]
  aws_eks_node_group.main: Still creating... [1m40s elapsed]
  aws_eks_node_group.main: Creation complete after 1m49s [id=test-eks-cluster:test-eks-cluster-node-group]

  Apply complete! Resources: 24 added, 0 changed, 0 destroyed.

● Outputs:

  cluster_endpoint = "https://FE5E40534081E2727F92B0C8B9FF96D7.gr7.ap-south-1.eks.amazonaws.com"
  cluster_name = "test-eks-cluster"
  tanish@Tanishs-Laptop ATC-Assignment % aws eks update-kubeconfig --name test-eks-cluster --region ap-south-1
  Updated context arn:aws:eks:ap-south-1:767398024481:cluster/test-eks-cluster in /Users/tanish/.kube/config
● tanish@Tanishs-Laptop ATC-Assignment % kubectl get nodes
  NAME                                       STATUS   ROLES    AGE     VERSION
  ip-10-0-1-70.ap-south-1.compute.internal   Ready    <none>   5m44s   v1.28.15-eks-aeac579
  ip-10-0-2-67.ap-south-1.compute.internal   Ready    <none>   5m46s   v1.28.15-eks-aeac579
○ tanish@Tanishs-Laptop ATC-Assignment %
```



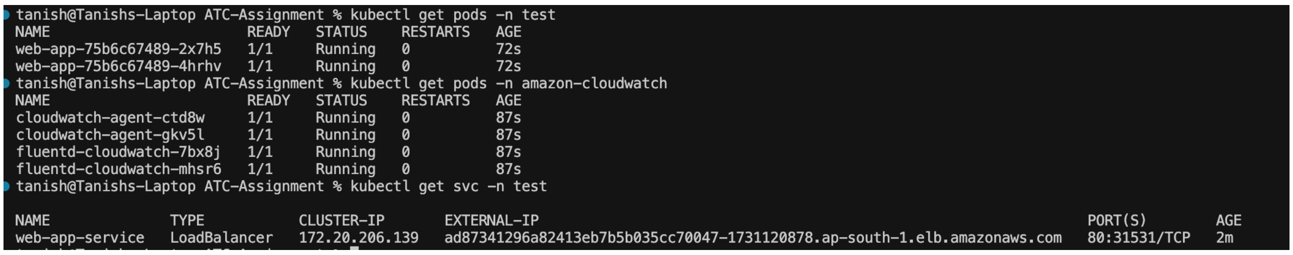
```
● tanish@Tanishs-Laptop ATC-Assignment % aws eks list-clusters
  {
      "clusters": [
          "test-eks-cluster"
      ]
  }
● tanish@Tanishs-Laptop ATC-Assignment % kubectl get nodes
  NAME                                       STATUS   ROLES    AGE     VERSION
  ip-10-0-1-70.ap-south-1.compute.internal   Ready    <none>   7m42s   v1.28.15-eks-aeac579
  ip-10-0-2-67.ap-south-1.compute.internal   Ready    <none>   7m44s   v1.28.15-eks-aeac579
○ tanish@Tanishs-Laptop ATC-Assignment %
```

- Go the path where our kubernetes manifest folder is present, inside manifest folder add the namespace, deloyment, service and cloud-watch yaml files.
- Give command - cd ..
- Now give command - kubectl apply -f <kube-manifest-folder-name>/

It will automatically create all the yaml files and configuration inside given.

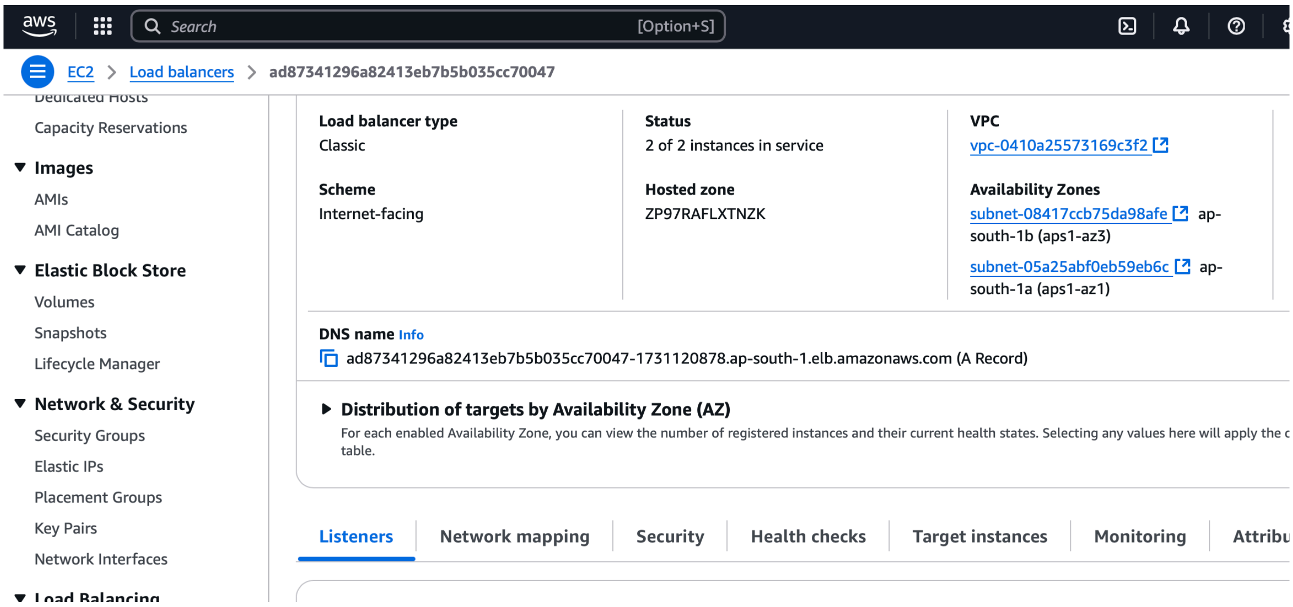


```
tanish@Tanishs-Laptop ATC-Assignment % kubectl apply -f kube-manifests
namespace/test created
deployment.apps/web-app created
service/web-app-service created
namespace/amazon-cloudwatch created
serviceaccount/cloudwatch-agent created
clusterrole.rbac.authorization.k8s.io/cloudwatch-agent-role created
clusterrolebinding.rbac.authorization.k8s.io/cloudwatch-agent-role-binding created
configmap/cwagentconfig created
daemonset.apps/cloudwatch-agent created
configmap/cluster-info created
serviceaccount/fluentd created
clusterrole.rbac.authorization.k8s.io/fluentd-role created
clusterrolebinding.rbac.authorization.k8s.io/fluentd-role-binding created
configmap/fluentd-config created
daemonset.apps/fluentd-cloudwatch created
```



```
tanish@Tanishs-Laptop ATC-Assignment % kubectl get pods -n test
NAME                      READY   STATUS    RESTARTS   AGE
web-app-75b6c67489-2x7h5  1/1     Running   0          72s
web-app-75b6c67489-4hrhv  1/1     Running   0          72s
tanish@Tanishs-Laptop ATC-Assignment % kubectl get pods -n amazon-cloudwatch
NAME                      READY   STATUS    RESTARTS   AGE
cloudwatch-agent-ctd8w    1/1     Running   0          87s
cloudwatch-agent-gkv5l    1/1     Running   0          87s
fluentd-cloudwatch-7bx8j  1/1     Running   0          87s
fluentd-cloudwatch-mhsr6  1/1     Running   0          87s
tanish@Tanishs-Laptop ATC-Assignment % kubectl get svc -n test

NAME              TYPE           CLUSTER-IP      EXTERNAL-IP                                                                  PORT(S)        AGE
web-app-service   LoadBalancer   172.20.206.139  ad87341296a82413eb7b5b035cc70047-1731120878.ap-south-1.elb.amazonaws.com   80:31531/TCP   2m
```

- To check pods are running for app server and cloudwatch -
- kubectl get pods -n amazon-cloudwatch
- kubectl get pods -n test
- To access our webpage - kubectl get svc -n test
- Copy the DNS name or from AWS console > EC2 > LoadBalancer > Click on LoadBalancer created and copy the DNS Name.



Load balancer type
Classic

Status
2 of 2 instances in service

VPC
vpc-0410a25573169c3f2

Scheme
Internet-facing

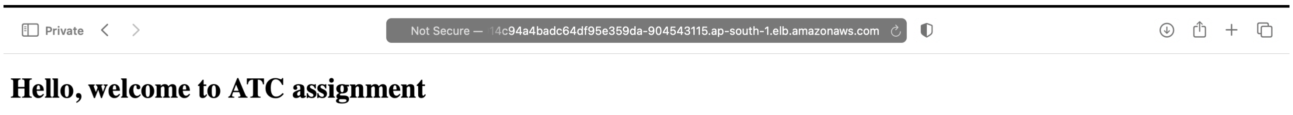
Hosted zone
ZP97RAFLXTNZK

Availability Zones
subnet-08417ccb75da98afe ap-south-1b (aps1-az3)
subnet-05a25abf0eb59eb6c ap-south-1a (aps1-az1)

DNS name Info
ad87341296a82413eb7b5b035cc70047-1731120878.ap-south-1.elb.amazonaws.com (A Record)

Distribution of targets by Availability Zone (AZ)
For each enabled Availability Zone, you can view the number of registered instances and their current health states. Selecting any values here will apply the c table.

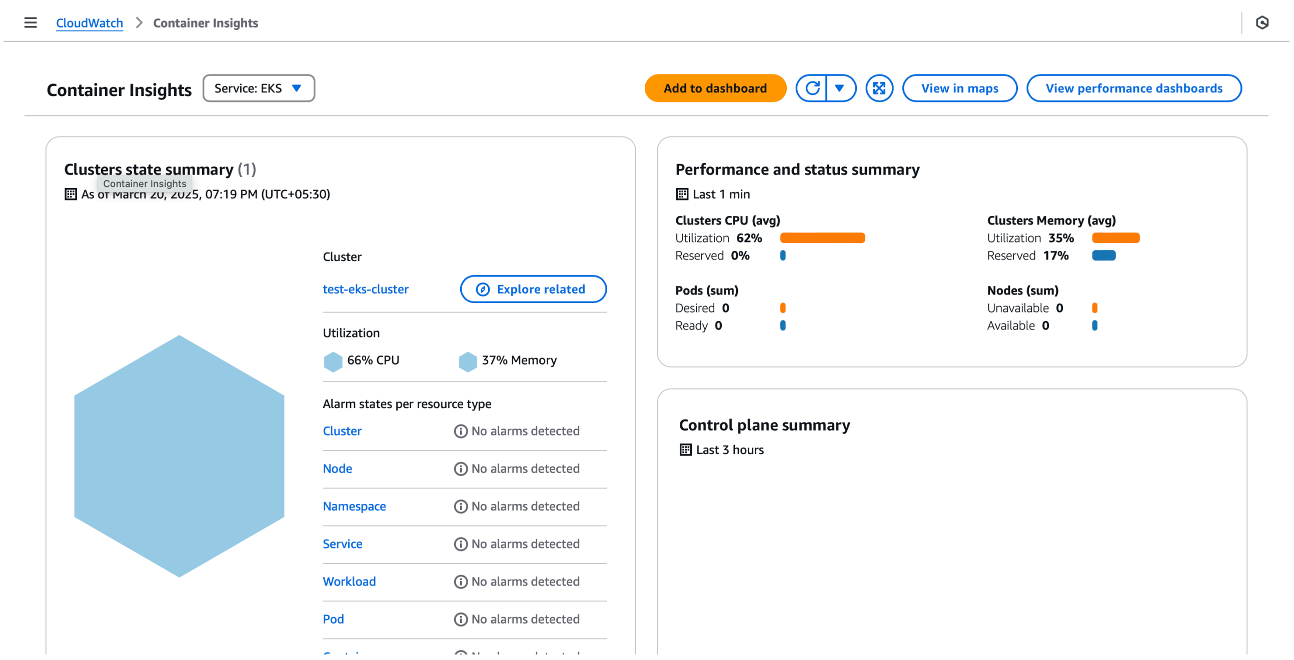
- Paste the URL over the browser, here we can access the webpage.



Not Secure — 14c94a4badc64df95e359da-904543115.ap-south-1.elb.amazonaws.com

Hello, welcome to ATC assignment

- To check the monitoring and utilisation of our cluster and nodes, go to AWS Console > CloudWatch > Container Insights
- Here we can see metrics related to our EKS Cluster.


CloudWatch > Container Insights

Container Insights | Service: EKS | Add to dashboard | View in maps | View performance dashboards

Clusters state summary (1)
As of March 20, 2025, 07:19 PM (UTC+05:30)

Cluster
test-eks-cluster | Explore related

Utilization
66% CPU | 37% Memory

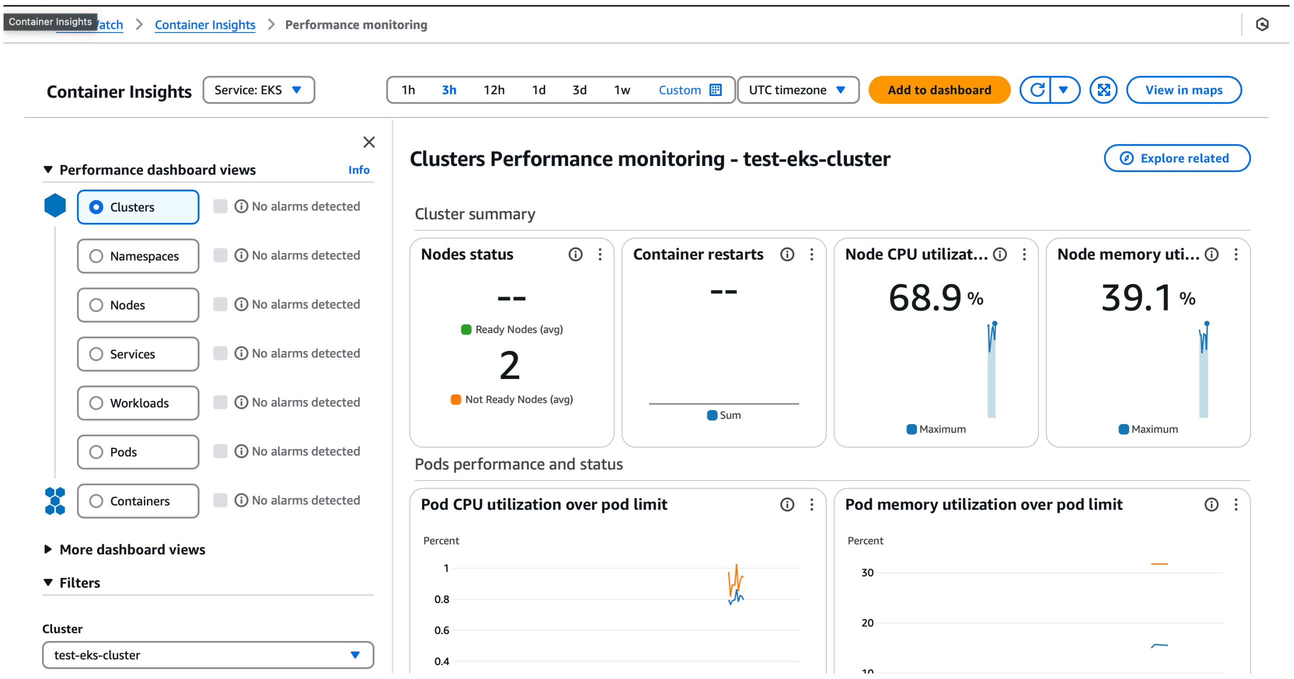
Alarm states per resource type

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

Performance and status summary
Last 1 min

Clusters CPU (avg)	**Clusters Memory (avg)**
Utilization **62%**	Utilization **35%**
Reserved **0%**	Reserved **17%**
Pods (sum)	**Nodes (sum)**
Desired **0**	Unavailable **0**
Ready **0**	Available **0**

Control plane summary
Last 3 hours


CloudWatch > Container Insights > Performance monitoring

Container Insights | Service: EKS | 1h 3h 12h 1d 3d 1w Custom | UTC timezone | Add to dashboard | View in maps

Performance dashboard views — Info

[✓ Clusters]	No alarms detected
Namespaces	No alarms detected
Nodes	No alarms detected
Services	No alarms detected
Workloads	No alarms detected
Pods	No alarms detected
Containers	No alarms detected

More dashboard views
Filters
Cluster: test-eks-cluster

Clusters Performance monitoring - test-eks-cluster | Explore related

Cluster summary

Nodes status	Container restarts	Node CPU utilizat...	Node memory uti...
-- Ready Nodes (avg)	--	68.9 %	39.1 %
2 Not Ready Nodes (avg)	Sum	Maximum	Maximum

Pods performance and status

Pod CPU utilization over pod limit — Percent
Pod memory utilization over pod limit — Percent

Based upon our load we can also use Vertical Pod Autoscaler (By default present within EKS) and Horizontal Pod Autoscaler.