Container Orchestration and Infrastructure Management

For

Online Shopping Grocery App

Submitted By

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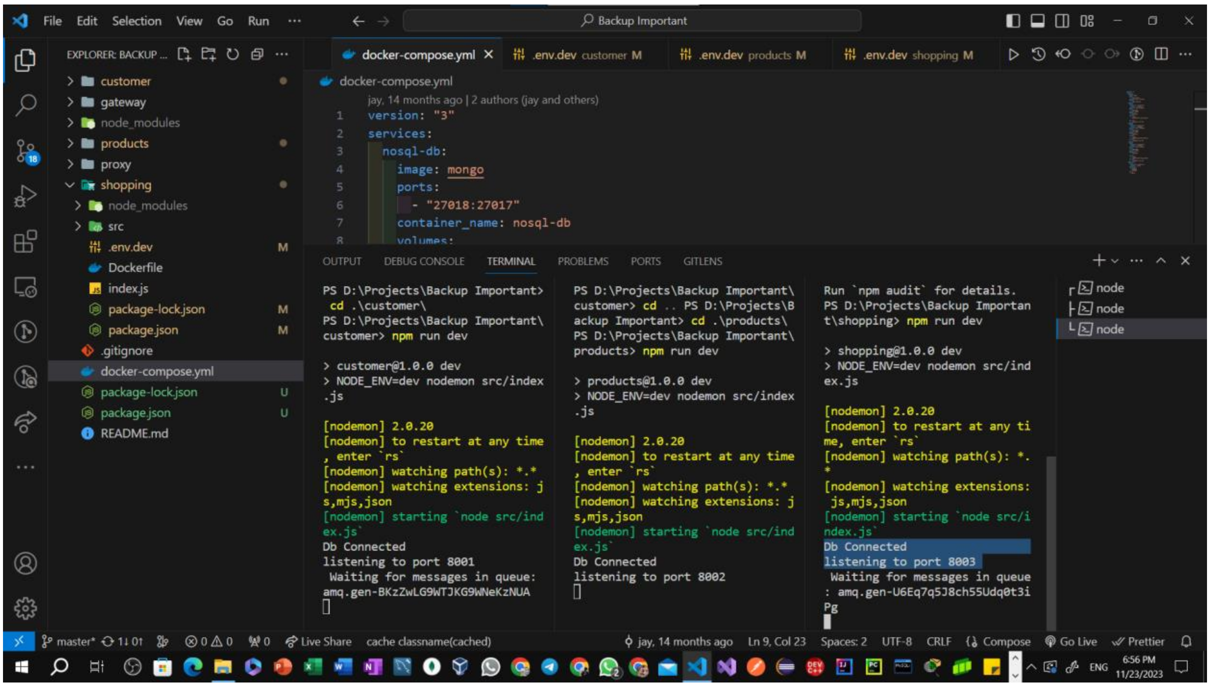
Container Orchestration and Infrastructure Automation

Assignment – 1 Recap

Microservices created for the project

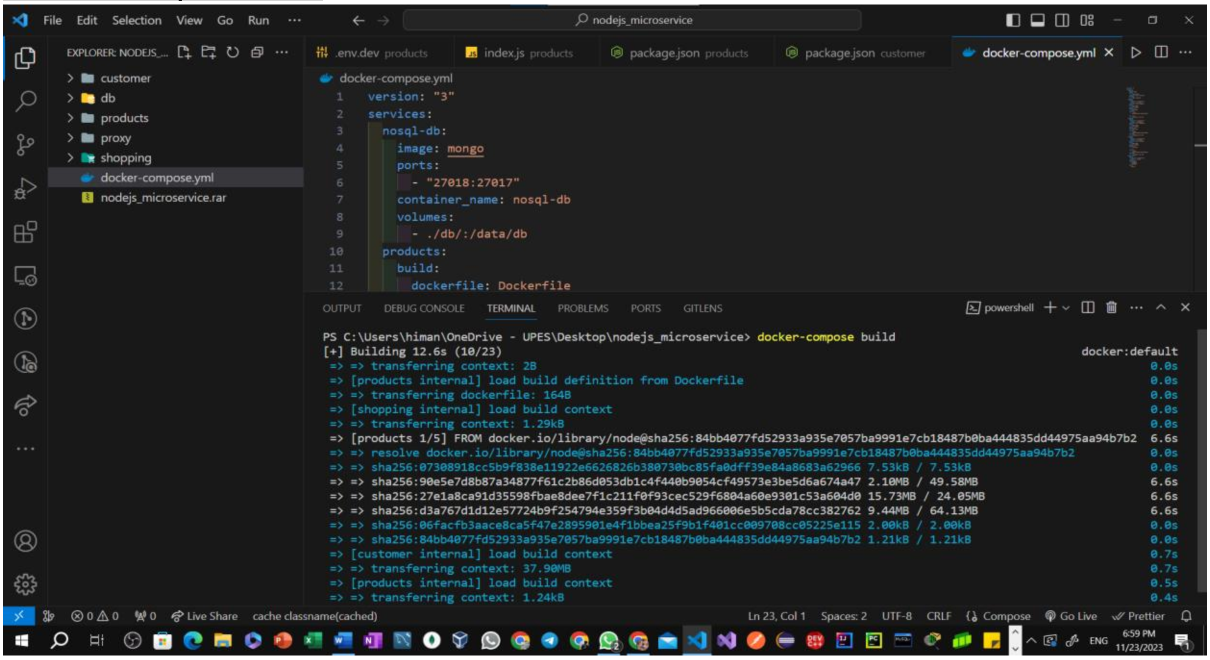
1) Customer: 8001
2) Products: 8002
3) Shopping: 8003
4) Proxy: 80 (Nginx Default Port No)

Each Microservices running individually at port 8001, 8002, 8003.



Executing the below command initiates the Docker Compose build process, ensuring that each microservice is built with its dependencies and configurations.

docker-compose build



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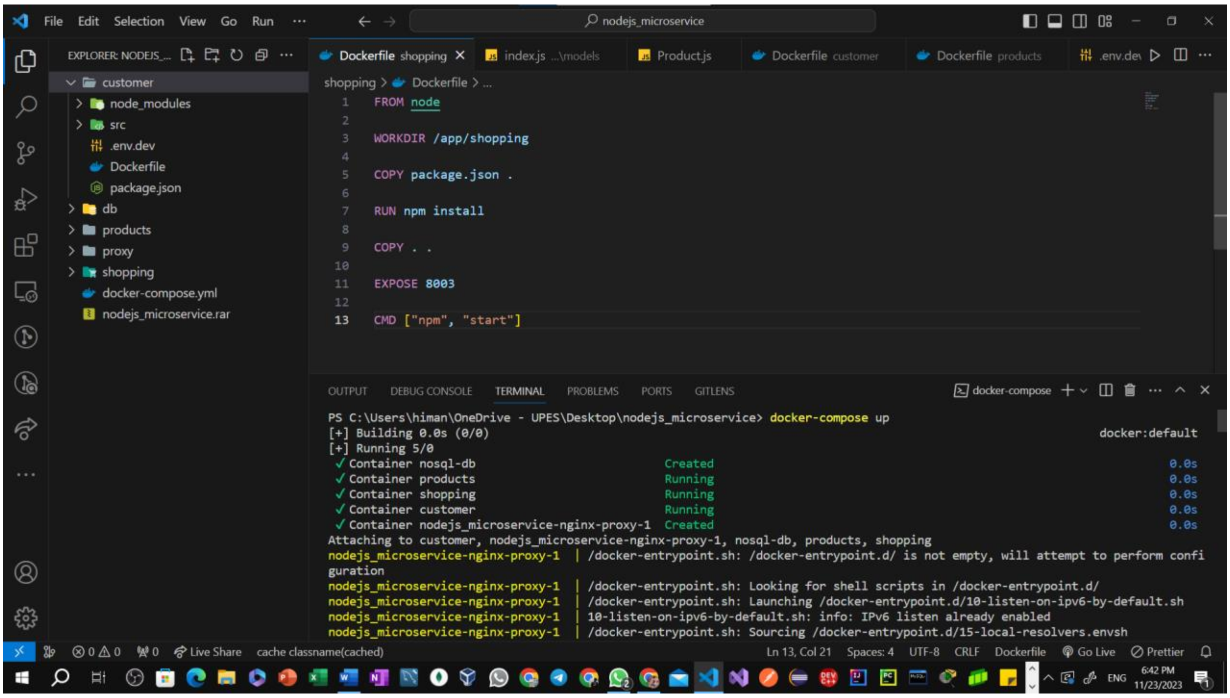
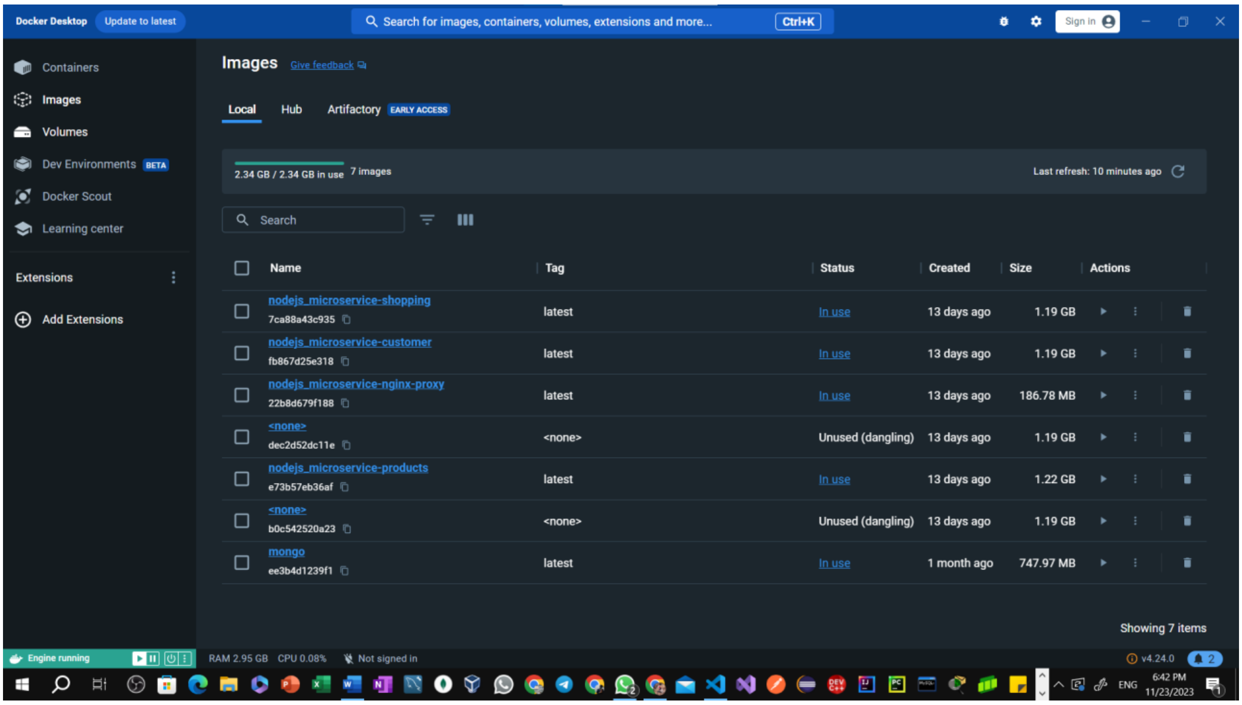
Running All Microservices using single command.

```
docker-compose up
```



Docker Images



Container Orchestration and Infrastructure Automation

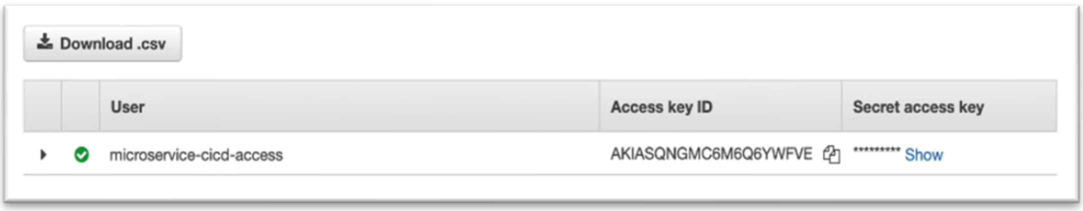
Assignment 2 - Part 2: Deployment and Scaling (50 marks)

Cloud Platform Selection

1. Justify the choice of a specific cloud platform (e.g., AWS, Azure, Google Cloud) based on its suitability for the project.

In the case of our "Grocery Online Shopping App," the justification of choosing of AWS (Amazon Web Services) based on its suitability for the project are as follows:

1. Microservices Architecture Support: AWS offers containerization services like Amazon ECS (Elastic Container Service) and Kubernetes-based Amazon EKS (Elastic Kubernetes Service), which are well-suited for deploying and managing microservices. These services provide the flexibility and scalability needed for a microservices-based architecture.
2. Security and Compliance: AWS places a strong emphasis on security, providing features like Identity and Access Management (IAM), encryption services, and compliance certifications. These features are crucial for handling sensitive customer data, especially in an online shopping app.



Creating user with help of IAM service in AWS

3. Scalability and Elasticity: AWS offers auto-scaling capabilities that allow our application to automatically adjust its capacity based on demand. This ensures that our online grocery shopping app can handle varying levels of user traffic efficiently, providing a seamless experience for customers.

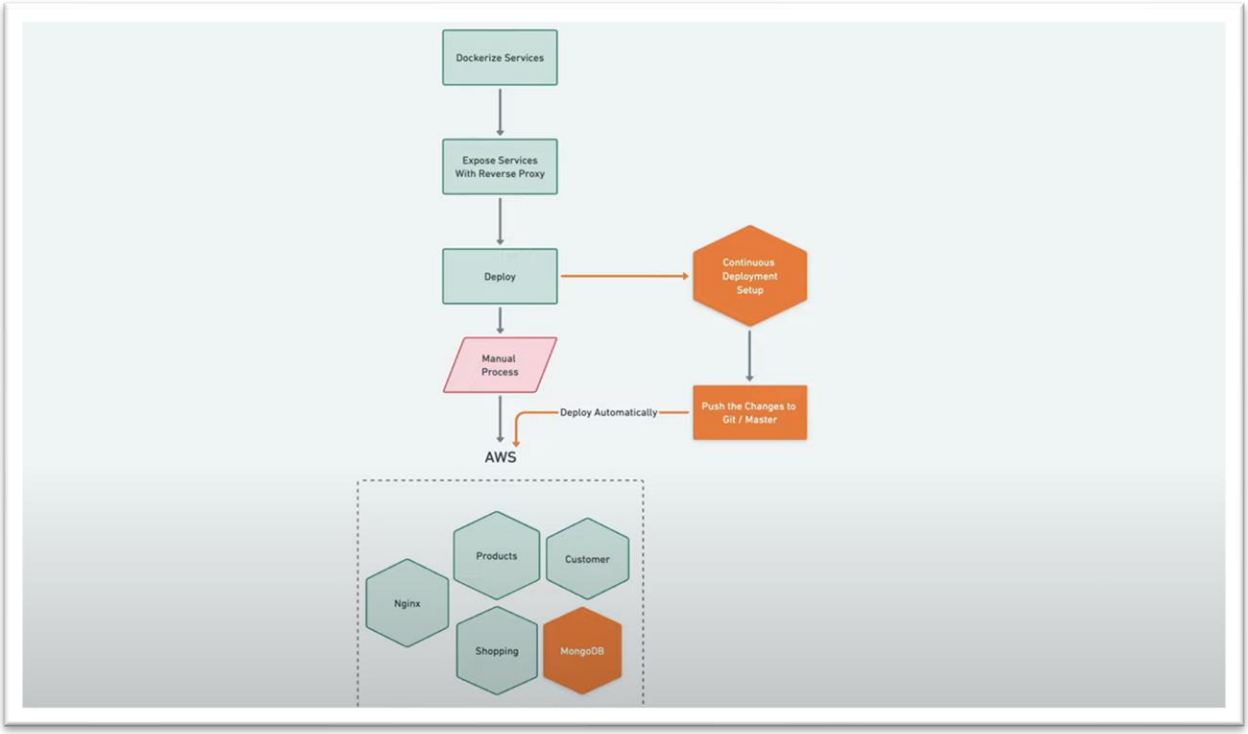
4. DevOps and CI/CD Support: AWS integrates well with DevOps practices, providing tools like AWS CodePipeline and AWS CodeDeploy for continuous integration and deployment. This facilitates automated testing, building, and deployment of our microservices, streamlining the development and release process.

The choice of AWS for our "Grocery Online Shopping App" is justified by its comprehensive service offerings, strong support for microservices architecture, security features, scalability options, global presence, and integration with DevOps practices. It provides a robust and flexible foundation for building, deploying, and managing the various components of our online grocery shopping application.

Container Orchestration and Infrastructure Automation

Container Orchestration

2. Utilize a container orchestration platform (e.g., Kubernetes) to manage and deploy the microservices.



Pre-requisites:
Kubernetes Cluster: Ensure we have access to a Kubernetes cluster, either locally using tools like Minikube.
Minikube, a local Kubernetes solution, simplifies Kubernetes learning and development by requiring only Docker or a compatible container, making Kubernetes just a single command away with 'minikube start'.

Deployment Steps

Step 1. Containerize Microservices
Ensure that each microservice (product, shopping, payments) is containerized using Docker. Each service should have its own Dockerfile. (already done)

Step 2. Create Kubernetes Deployment Files
For each microservice, create Kubernetes Deployment YAML files. These files describe how Kubernetes should create and manage instances of our containers. (Need to be done)

Container Orchestration and Infrastructure Automation

Manifest Creation:

Deployment Manifest: # customer-deployment.yaml

```yaml
apiVersion: apps/v1
kind: Deployment
metadata:
  name: customer-deployment
spec:
  replicas: 3
  selector:
    matchLabels:
      app: customer
  template:
    metadata:
      labels:
        app: customer
    spec:
      containers:
        - name: products
          image: demo/ customer -service:latest
          ports:
            - containerPort: 8001
          env:
            - name: DATABASE_URL
              value: mongodb://127.0.0.1:27017/msytt_customer
```

Deployment Manifest: # products-deployment.yaml

```yaml
apiVersion: apps/v1
kind: Deployment
metadata:
  name: products-deployment
spec:
  replicas: 3
  selector:
    matchLabels:
      app: products
  template:
    metadata:
      labels:
        app: products
    spec:
      containers:
        - name: products
          image: demo/products-service:latest
          ports:
            - containerPort: 8002
          env:
            - name: DATABASE_URL
              value: mongodb://127.0.0.1:27017/msytt_products
```

Deployment Manifest: # shopping-deployment.yaml

```yaml
apiVersion: apps/v1
kind: Deployment
metadata:
  name: shopping-deployment
spec:
  replicas: 3
  selector:
    matchLabels:
      app: shopping
  template:
    metadata:
      labels:
        app: shopping
    spec:
      containers:
        - name: shopping
          image: demo/shopping-service:latest
          ports:
            - containerPort: 8003
          env:
            - name: DATABASE_URL
              value: mongodb://127.0.0.1:27017/msytt_shopping
```

Step 3. Create Kubernetes Services

Create Kubernetes Service YAML files for each microservice. Services allow communication between different microservices.

Service YAML: Defines how other services or external clients can access our microservices. This includes details like ports, protocols, and selectors.

Service Manifest: # customer-service.yaml

```yaml
apiVersion: v1
kind: Service
metadata:
  name: customer-service
spec:
  selector:
    app: products
  ports:
    - protocol: TCP
      port: 80
      targetPort: 8001
```

Service Manifest: # products-service.yaml

```yaml
apiVersion: v1
kind: Service
metadata:
  name: products-service
spec:
  selector:
    app: products
  ports:
    - protocol: TCP
      port: 80
      targetPort: 8002
```

Service Manifest: # shopping-service.yaml

```yaml
apiVersion: v1
kind: Service
metadata:
  name: shopping-service
spec:
  selector:
    app: products
  ports:
    - protocol: TCP
      port: 80
      targetPort: 8003
```

Step 4. Apply Deployments and Services

Use kubectl to apply the Deployment and Service YAML files for each microservice:

```
kubectl apply -f <microservice-deployment.yaml>
kubectl apply -f <microservice-service.yaml>
```

Step 5. Verify Deployments and Check if our microservices are running:

```
kubectl get pods              # Check pods
kubectl get services          # Check services
kubectl describe pod <pod-name>   # Detailed info about a pod
```

3. Describe how container orchestration simplifies deployment, scaling, and management.

In the context of our "Grocery Online Shopping App" project, container orchestration plays a crucial role in simplifying deployment, scaling, and management of the microservices architecture. Here's how container orchestration addresses these aspects:

Container orchestration simplifies deployment, scaling, and management by automating the processes of deploying and managing containers at scale. It abstracts complexities, streamlines resource allocation, automates scaling based on demand, and provides centralized management, making it easier to maintain, update, and scale applications in a containerized environment.

Deployment Simplification: With the transition to a microservices architecture, our application is likely composed of multiple services running in separate containers. Container orchestration tools, such as Kubernetes or Docker Swarm, simplify the deployment process by automating the distribution of containerized microservices across a cluster of machines.

Scaling: If the load on our "Grocery Online Shopping App" increases, we can easily scale specific microservices or the entire application. Kubernetes, for example, supports horizontal scaling, where we can dynamically adjust the number of running instances of a microservice based on factors like CPU usage or incoming requests.

Management Efficiency: Container orchestration tools provide centralized management and monitoring capabilities, allowing we to oversee the health and performance of our microservices.

Resource Optimization: Container orchestration optimizes resource utilization by efficiently distributing microservices across the available infrastructure. Containers are isolated from each other, preventing interference and ensuring that each microservice runs in its own environment.

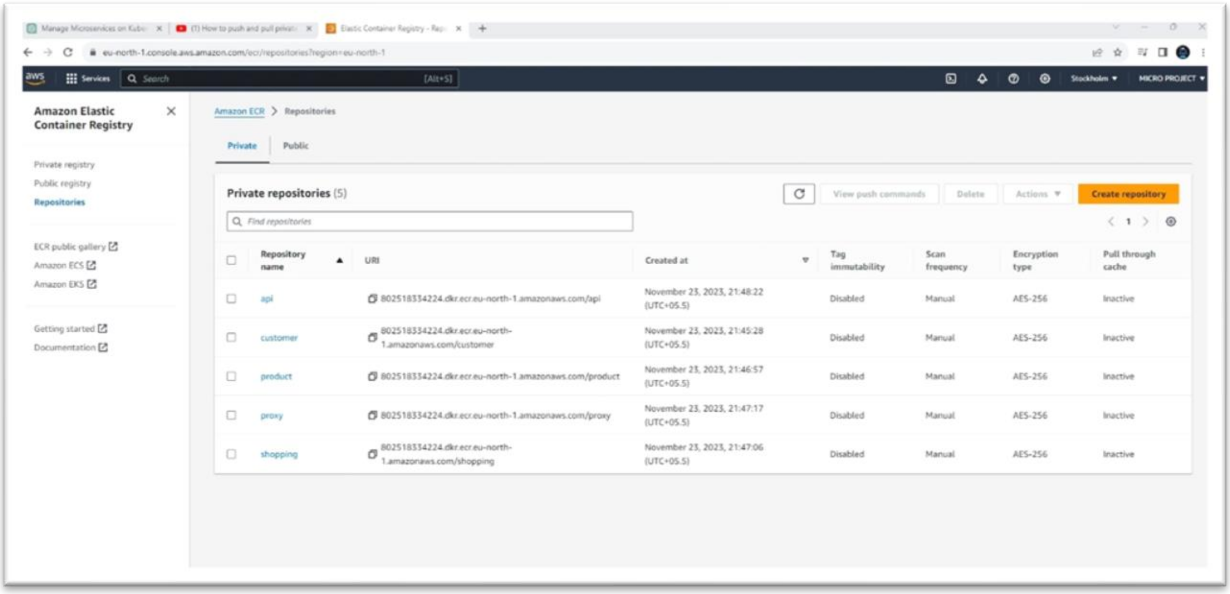
Load Balancing: Container orchestration tools often include built-in load balancing capabilities, distributing incoming traffic across multiple instances of a microservice. This ensures even distribution of requests, preventing any single microservice instance from becoming a bottleneck.

Deployment Process

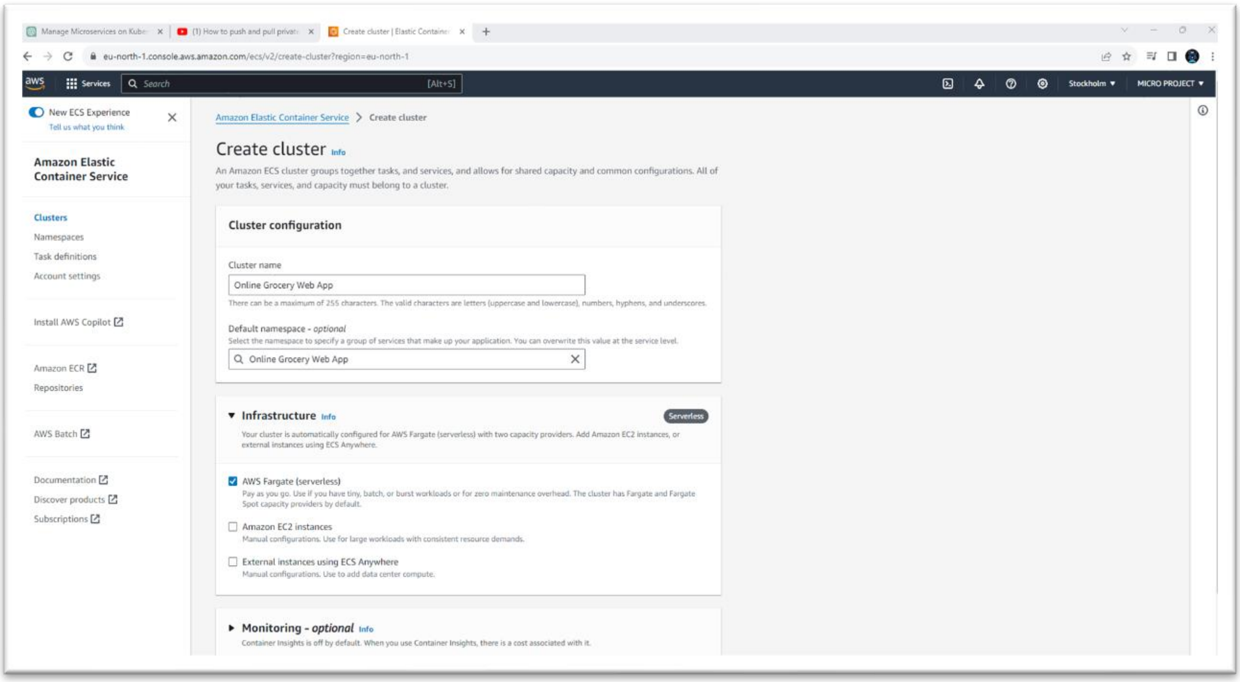
4. Provide scripts or configurations for deploying the microservices on the chosen cloud platform.

AWS ECS Deployment

Step 1: Push the images from your local machine to Amazon ECR (Elastic Container Registry):



Step 2: Create a cluster using Amazon ECS (Elastic Container Service): In this case, I opted for AWS Fargate over Amazon EC2 as it simplifies various complexities and decision-making, offering a faster and more straightforward approach. Additionally, I enabled monitoring during the cluster creation process, eliminating the need for a separate monitoring setup.



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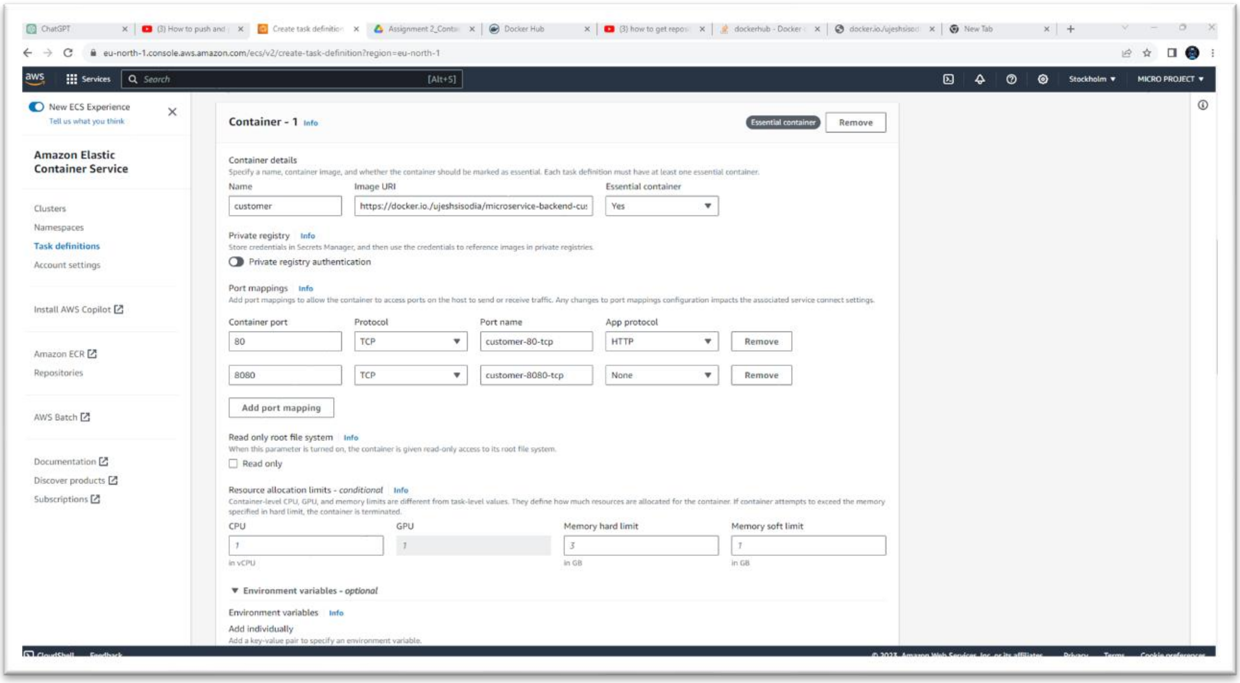
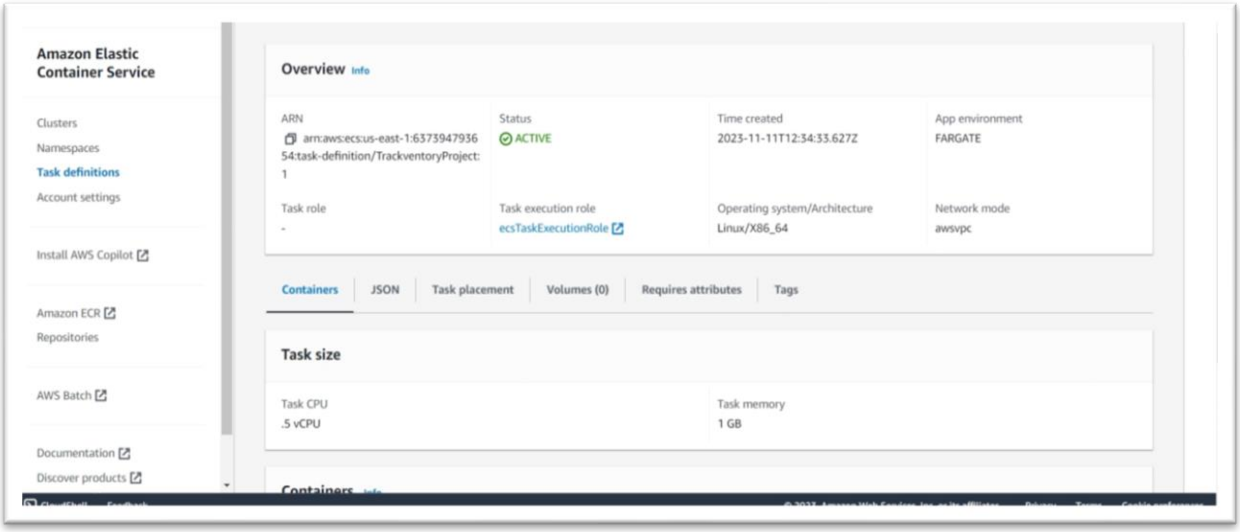
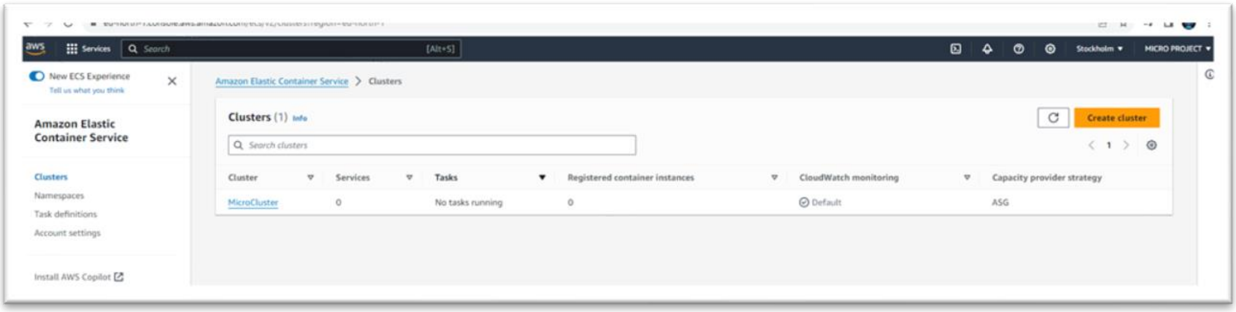
Step3: Task- A task is the instantiation of a task definition within a cluster. After you create a task definition for your application within Amazon ECS, you can specify the number of tasks to run on your cluster. An Amazon ECS service runs and maintains your desired number of tasks simultaneously in an Amazon ECS cluster. After creating a task, we had to wait a couple of minutes for its status to turn active.

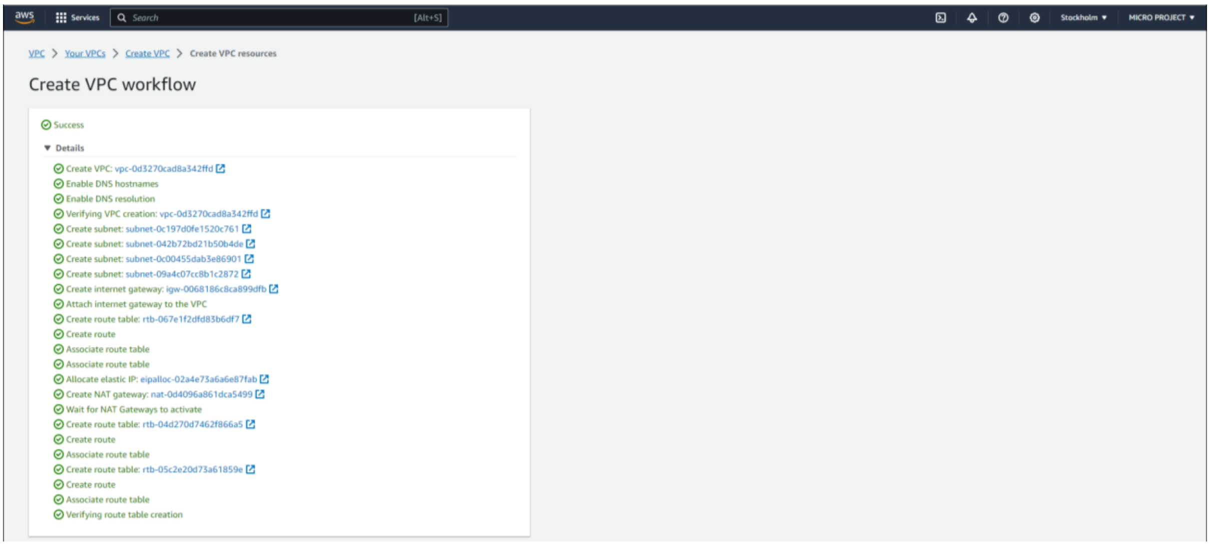


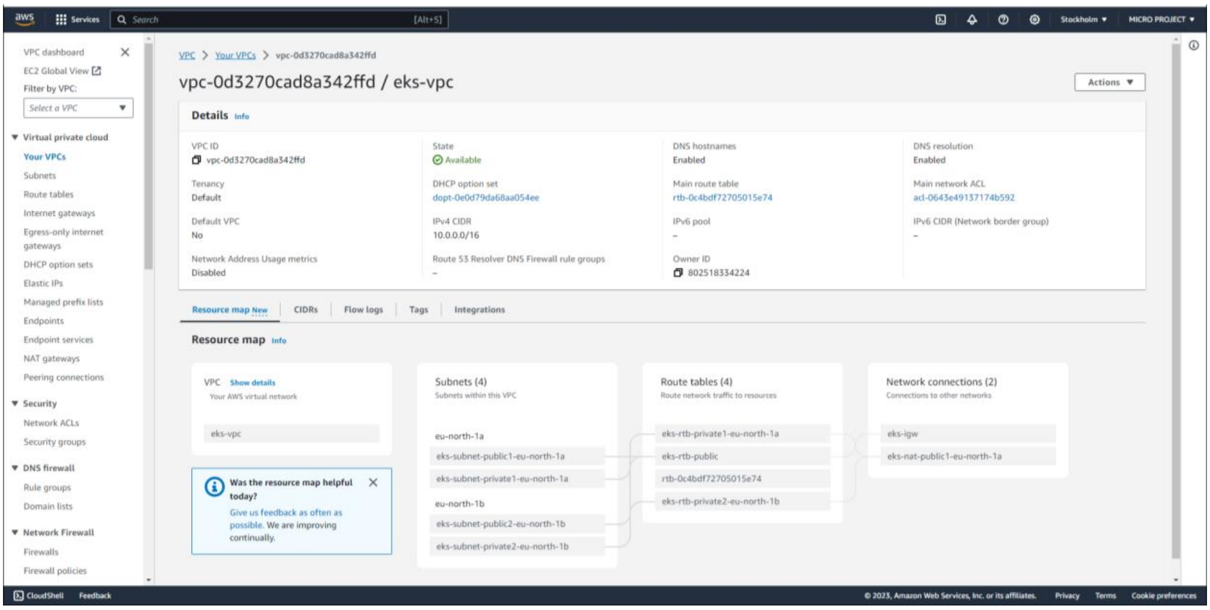


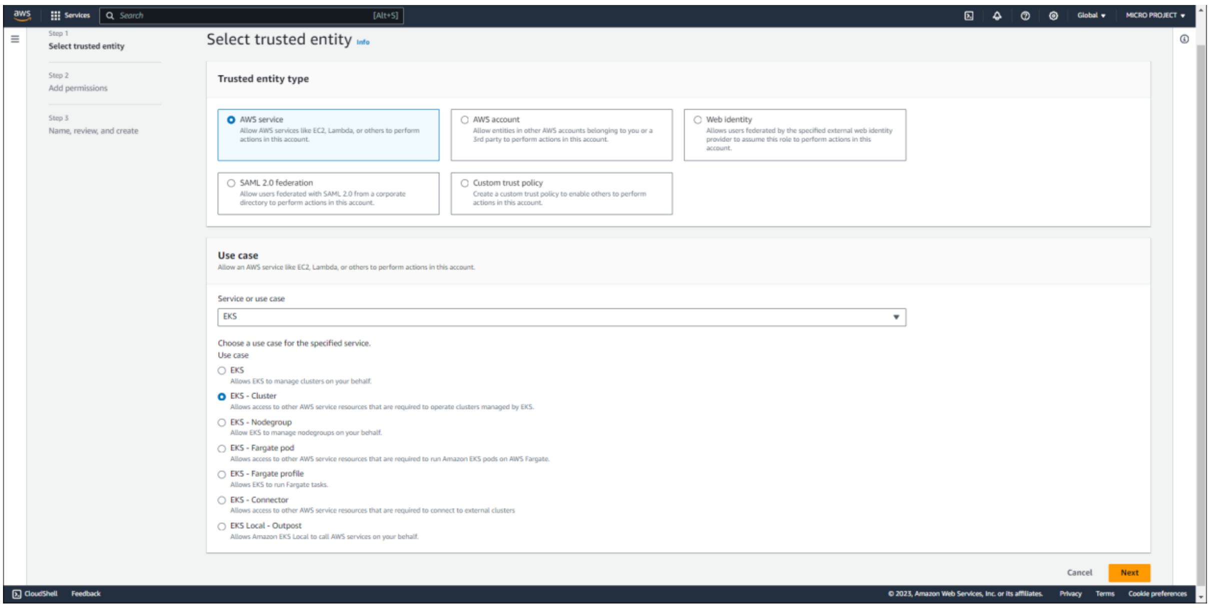
Step 4: To create the containers

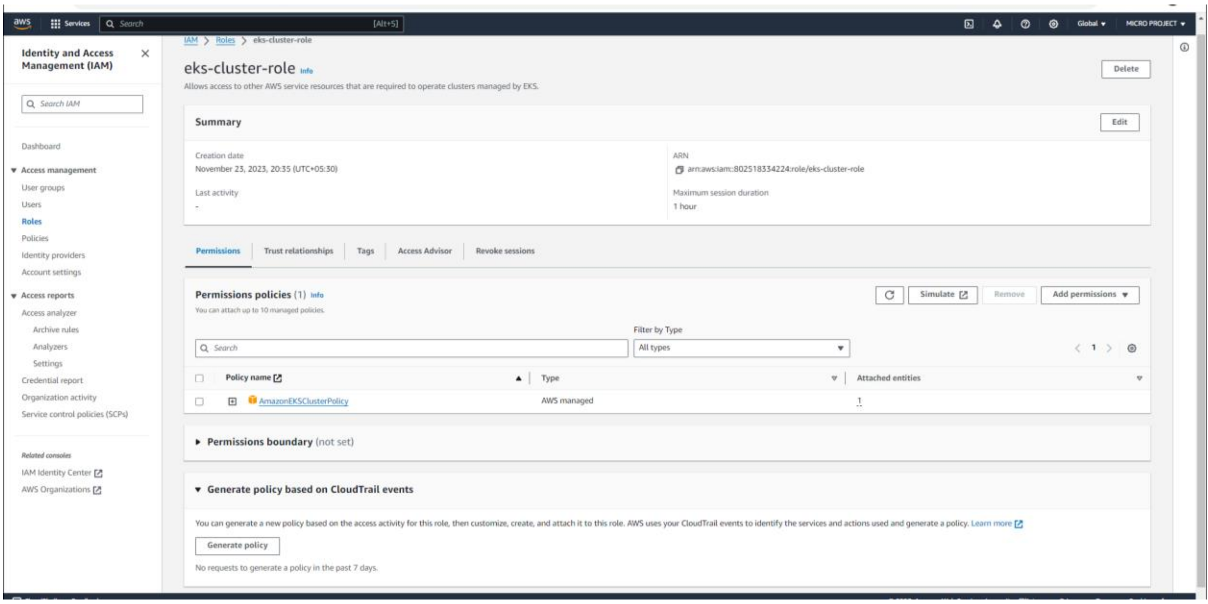


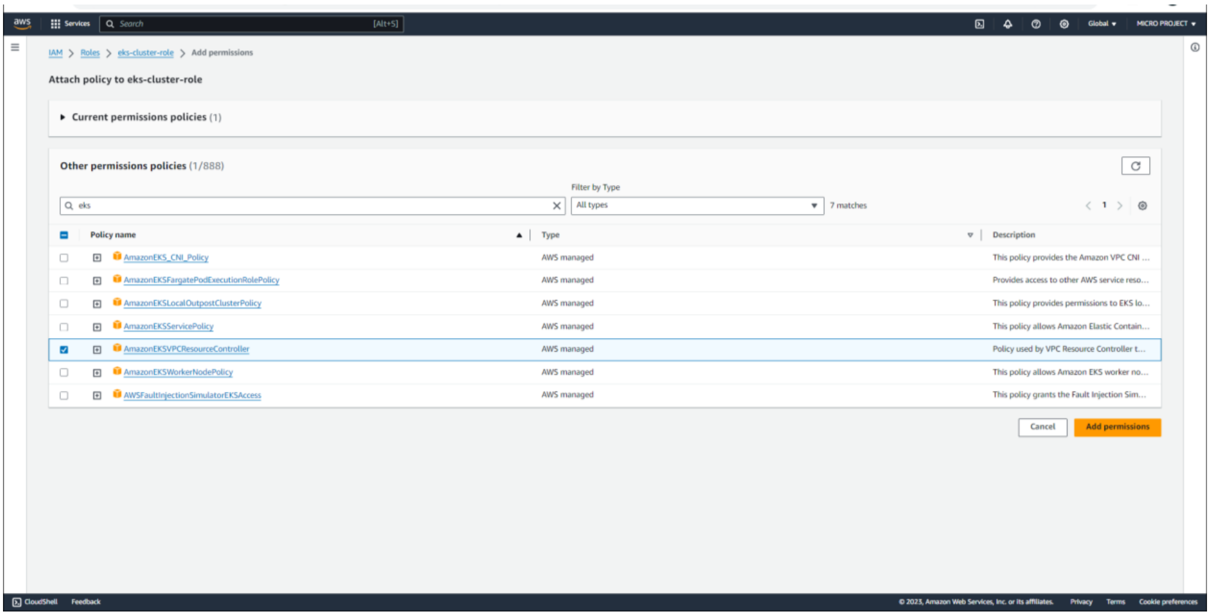
AWS EKS Deployment

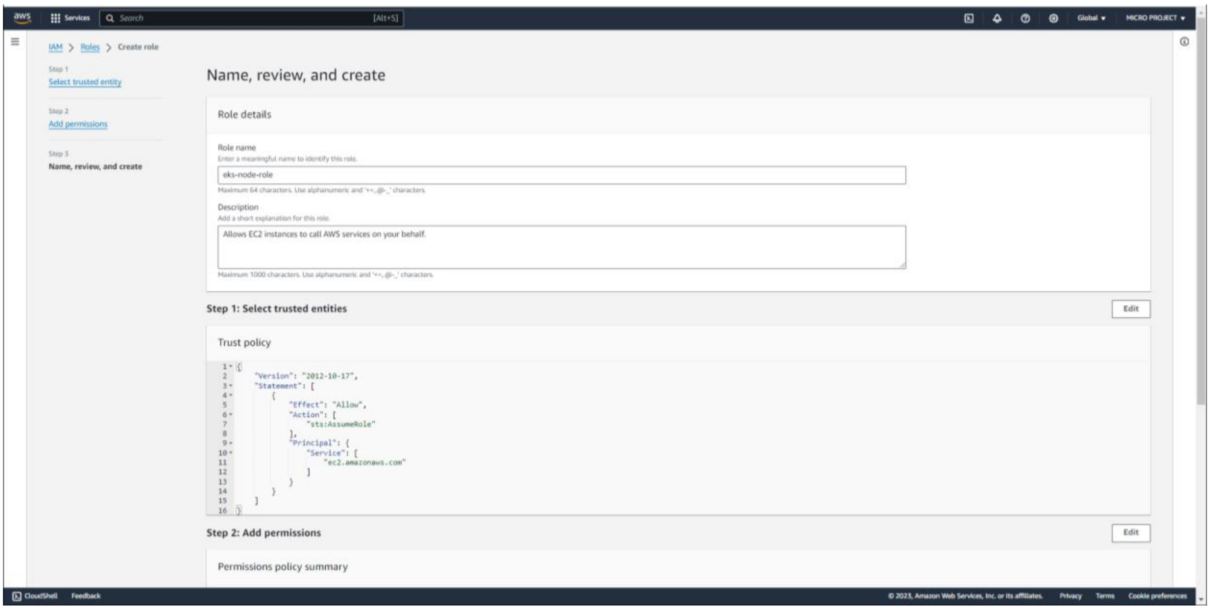


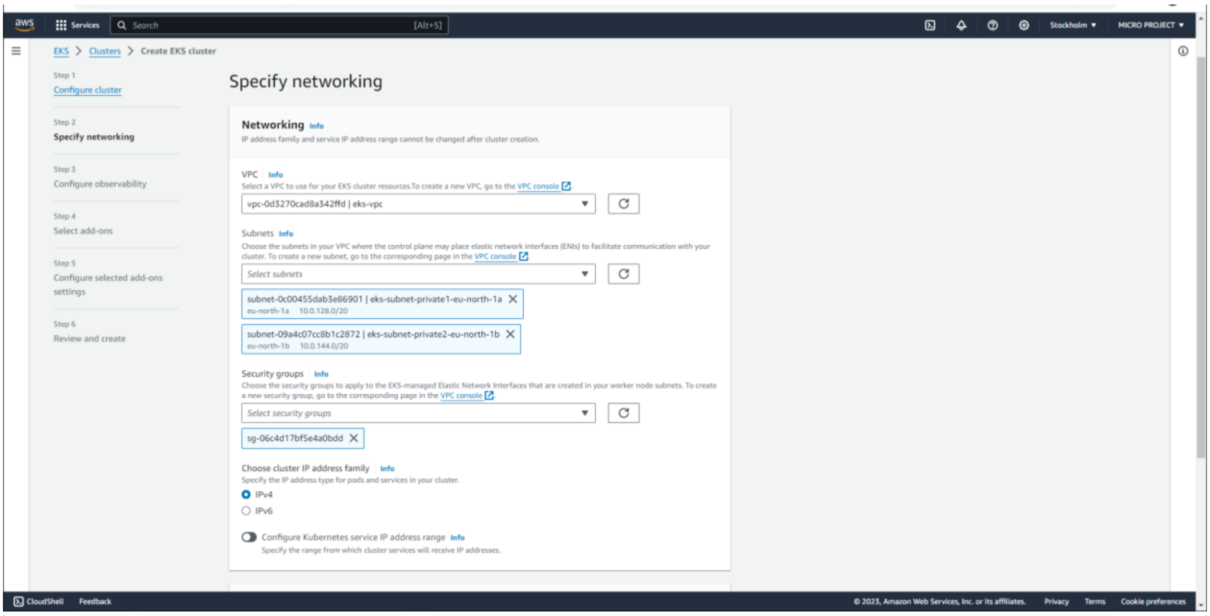


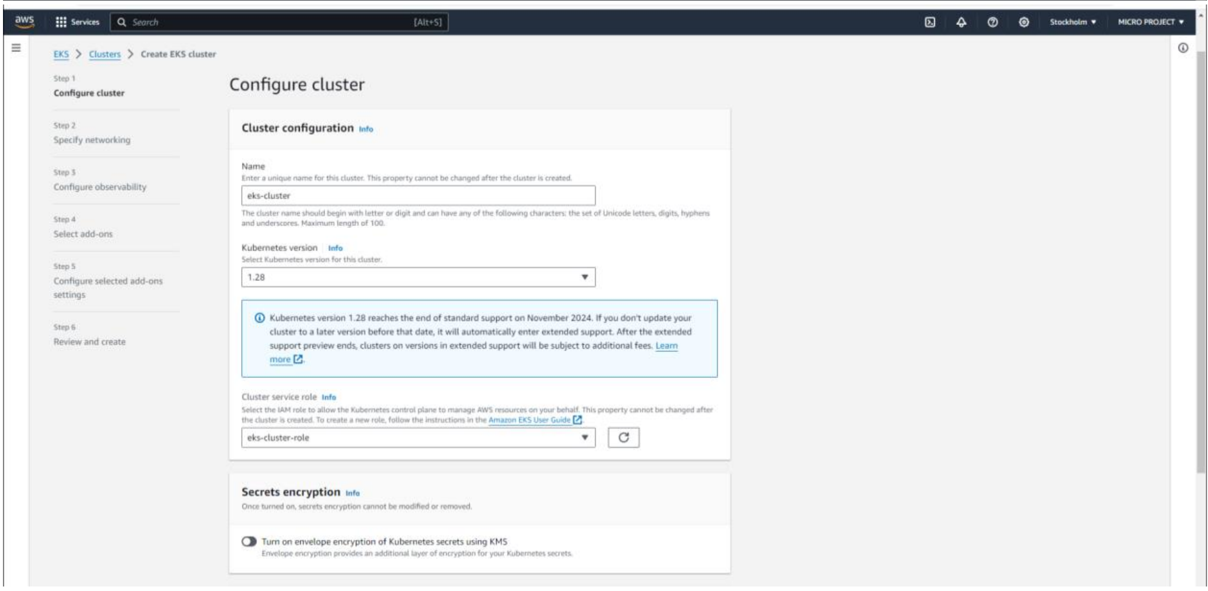


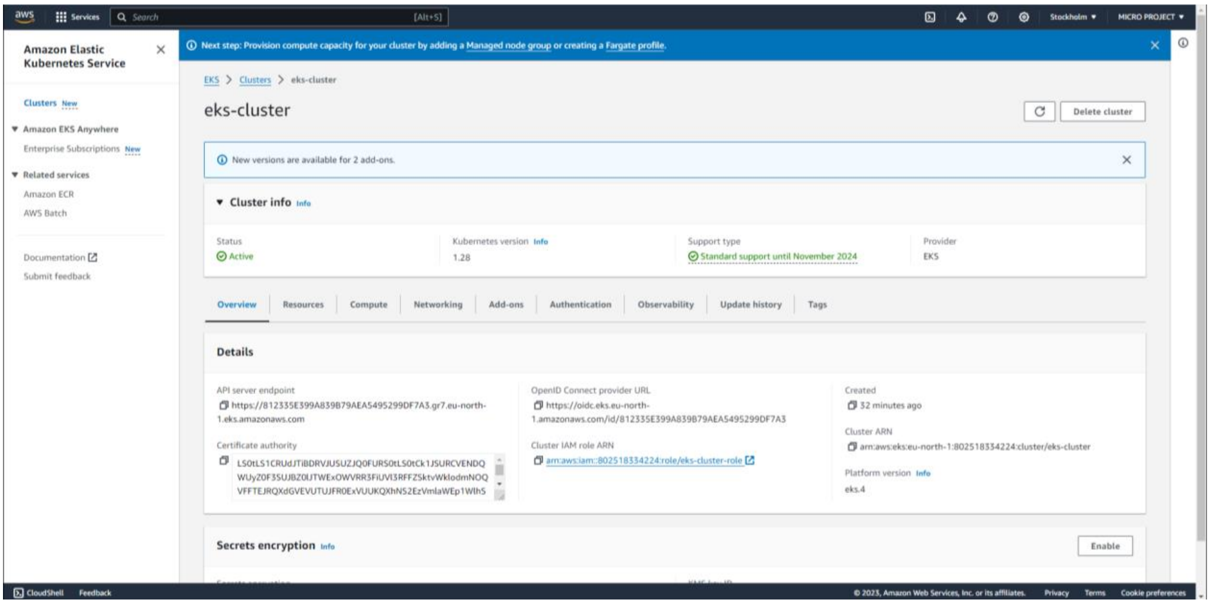

Identity and Access Management (IAM)
eks-cluster-role
Allows access to other AWS service resources that are required to operate clusters managed by EKS.
Summary
Creation date
November 23, 2023, 20:35 (UTC+05:30)
ARN
Maximum session duration
1 hour
Permissions
Trust relationships
Tags
Access Advisor
Revoke sessions
Permissions policies (1)
AmazonEKSClusterPolicy
AWS managed
Permissions boundary (not set)
Generate policy based on CloudTrail events
Generate policy
No requests to generate a policy in the past 7 days.


Attach policy to eks-cluster-role
Current permissions policies (1)
Other permissions policies (1/888)
AmazonEKS_CNI_Policy
AmazonEKSFargatePodExecutionRolePolicy
AmazonEKSLocalOutpostClusterPolicy
AmazonEKSServicePolicy
AmazonEKSVPCResourceController
AmazonEKSWorkerNodePolicy
AWSFaultInjectionSimulatorEKSAccess
Cancel
Add permissions

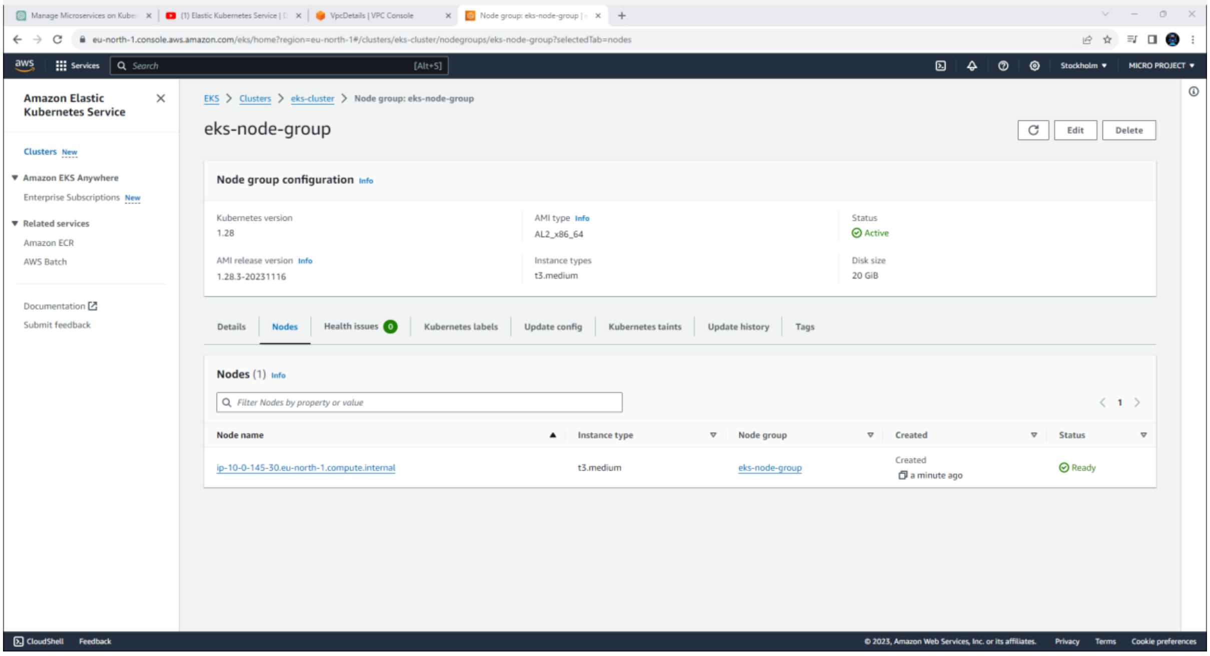

Name, review, and create
Role details
Role name
eks-node-role
Description
Allows EC2 instances to call AWS services on your behalf.
Step 1: Select trusted entities
Trust policy
Step 2: Add permissions
Permissions policy summary

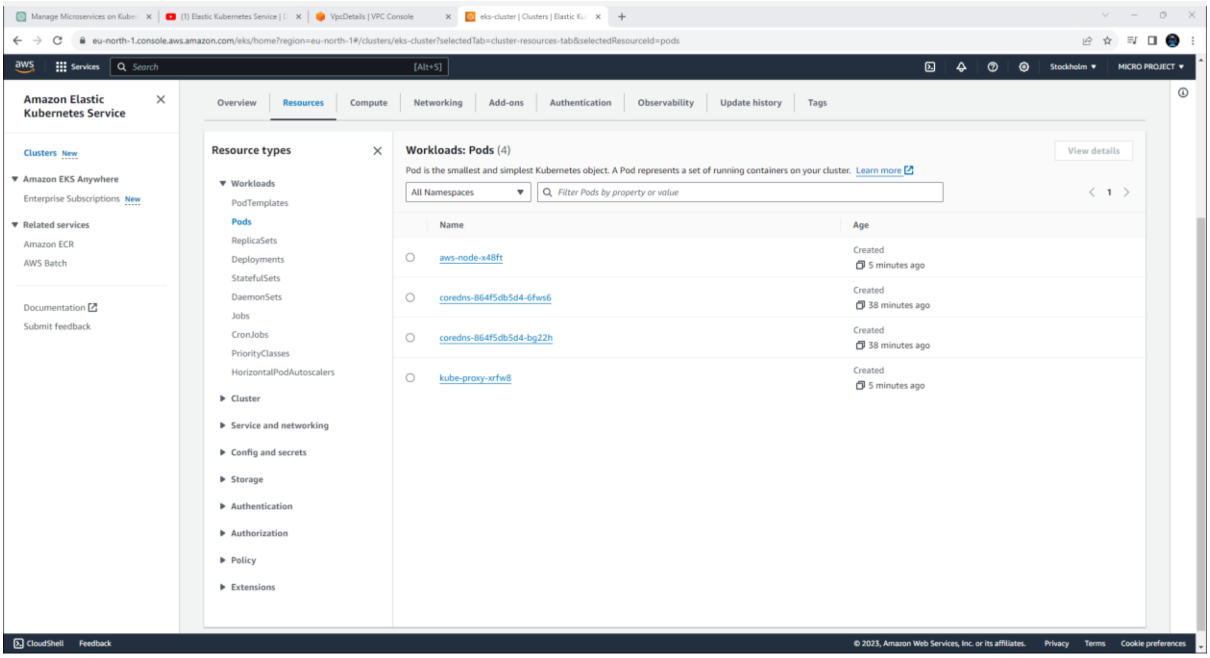

EKS > Clusters > Create EKS cluster
Step 1
Configure cluster
Step 2
Specify networking
Step 3
Configure observability
Step 4
Select add-ons
Step 5
Configure selected add-ons settings
Step 6
Review and create
Specify networking
Networking Info
IP address family and service IP address range cannot be changed after cluster creation.
VPC Info
Select a VPC to use for your EKS cluster resources.To create a new VPC, go to the VPC console
vpc-0d3270cad8a342ffd | eks-vpc
Subnets Info
Choose the subnets in your VPC where the control plane may place elastic network interfaces (ENIs) to facilitate communication with your cluster. To create a new subnet, go to the corresponding page in the VPC console
Select subnets
subnet-0c00455dab3e86901 | eks-subnet-private1-eu-north-1a
eu-north-1a 10.0.128.0/20
subnet-09a4c07cc8b1c2872 | eks-subnet-private2-eu-north-1b
eu-north-1b 10.0.144.0/20
Security groups Info
Choose the security groups to apply to the EKS-managed Elastic Network Interfaces that are created in your worker node subnets. To create a new security group, go to the corresponding page in the VPC console
Select security groups
sg-06c4d17bf5e4a0bdd
Choose cluster IP address family Info
Specify the IP address type for pods and services in your cluster.
IPv4
IPv6
Configure Kubernetes service IP address range Info
Specify the range from which cluster services will receive IP addresses.


EKS > Clusters > Create EKS cluster
Step 1
Configure cluster
Step 2
Specify networking
Step 3
Configure observability
Step 4
Select add-ons
Step 5
Configure selected add-ons settings
Step 6
Review and create
Configure cluster
Cluster configuration Info
Name
Enter a unique name for this cluster. This property cannot be changed after the cluster is created.
eks-cluster
The cluster name should begin with letter or digit and can have any of the following characters: the set of Unicode letters, digits, hyphens and underscores. Maximum length of 100.
Kubernetes version Info
Select Kubernetes version for this cluster.
1.28
Kubernetes version 1.28 reaches the end of standard support on November 2024. If you don't update your cluster to a later version before that date, it will automatically enter extended support. After the extended support preview ends, clusters on versions in extended support will be subject to additional fees. Learn more
Cluster service role Info
Select the IAM role to allow the Kubernetes control plane to manage AWS resources on your behalf. This property cannot be changed after the cluster is created. To create a new role, follow the instructions in the Amazon EKS User Guide
eks-cluster-role
Secrets encryption Info
Once turned on, secrets encryption cannot be modified or removed.
Turn on envelope encryption of Kubernetes secrets using KMS
Envelope encryption provides an additional layer of encryption for your Kubernetes secrets.

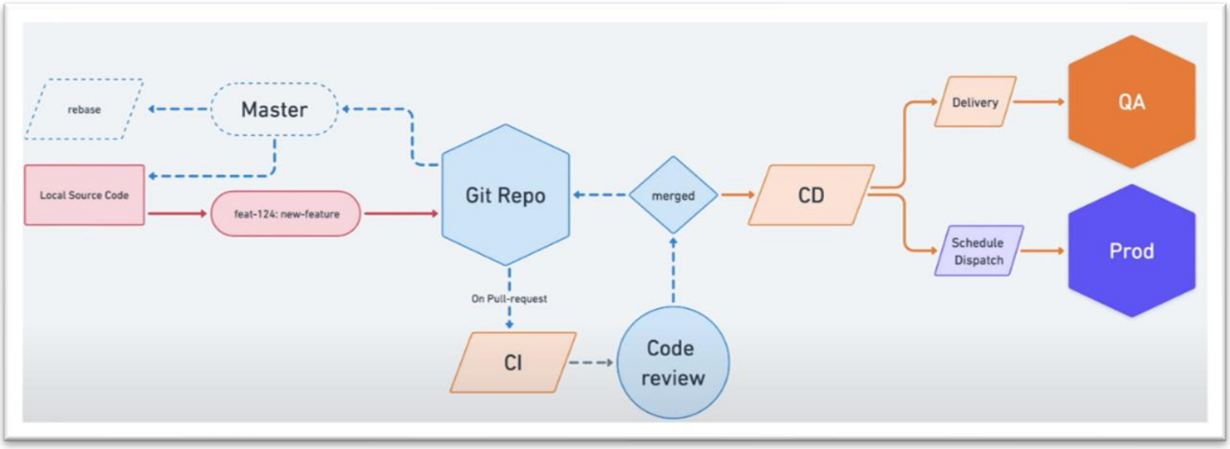

Amazon Elastic Kubernetes Service
Clusters New
Amazon EKS Anywhere
Enterprise Subscriptions New
Related services
Amazon ECR
AWS Batch
Documentation
Submit feedback
Next step: Provision compute capacity for your cluster by adding a Managed node group or creating a Fargate profile.
EKS > Clusters > eks-cluster
eks-cluster
Delete cluster
New versions are available for 2 add-ons.
Cluster info Info
Status
Active
Kubernetes version Info
1.28
Support type
Standard support until November 2024
Provider
EKS
Overview
Resources
Compute
Networking
Add-ons
Authentication
Observability
Update history
Tags
Details
API server endpoint
https://812335E399A839B79AEA5495299DF7A3.gr7.eu-north-1.eks.amazonaws.com
OpenID Connect provider URL
https://oidc.eks.eu-north-1.amazonaws.com/id/812335E399A839B79AEA5495299DF7A3
Created
32 minutes ago
Cluster ARN
arn:aws:eks:eu-north-1:802518334224:cluster/eks-cluster
Certificate authority
Cluster IAM role ARN
arn:aws:iam::802518334224:role/eks-cluster-role
Platform version Info
eks.4
Secrets encryption Info
Enable

Container Orchestration and Infrastructure Automation





5. Demonstrate the ability to deploy the application in a cloud environment consistently.



First of all, the Local Source code is pointed to Master. And when we working in the new feature then we check out to the new branch and that specific branch is going to work on whatever the changes we are going to do. Once it is done then we will push the source code to git repository. Afterwards once we have pushed the changes then we are going to pull the request.

And once we have pulled the request then there is a kind of settings that is Continuous Integration. This setting will take care all the test cases that what we are adding to new feature.

After passing all the test cases we can raise a kind of Code Review request. If the code review request is approved by other team member, then we can merge the source code to the repository. As soon as we have merged the source code it will run the Continuous Deployment pipeline.

It depends upon which pipeline that which pipeline is going to accommodate by default and depends on that it will automatically to the QA environment or maybe production environment.

Demonstration:

Container Orchestration and Infrastructure Automation

1. CI_Workflow.yml: this file contains all the configuration for the Continuous Improvement.

CD_Prod_Workflow.yml M   CD_QA_Workflow.yml M   CI_Workflow.yml ×

_Episodes > Part_6 > CI_Workflow.yml

```yaml
name: Continuous Integration

on:
  pull_request:
    branches: ["main"]

jobs:
  ci_verification:
    runs-on: ubuntu-latest

    strategy:
      matrix:
        node-version: [14.x]

    steps:
      - uses: actions/checkout@v3
      - name: Use Node.js ${{ matrix.node-version }}
        uses: actions/setup-node@v3
        with:
          node-version: ${{ matrix.node-version }}

      - name: Test Customer Service
        working-directory: ./customer
        run: |
          npm ci
          npm test

      - name: Test Products Service
        working-directory: ./products
        run: |
          npm ci
          npm test

      - name: Test Shopping Service
        working-directory: ./shopping
        run: |
          npm ci
          npm test
```

2. CD_QA_Workflow.yml: this file contains all the configuration for the Continuous Deployment.

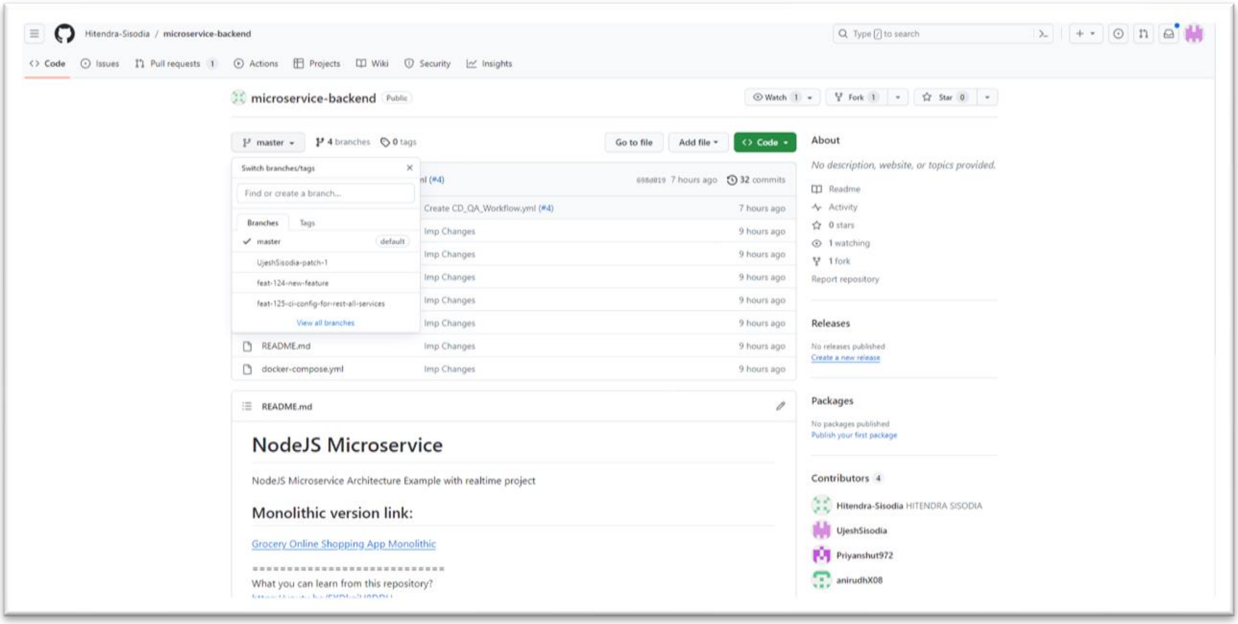
```
CD_Prod_Workflow.yml M    CD_QA_Workflow.yml M ×    CI_Workflow.yml
_Episodes > Part_6 > CD_QA_Workflow.yml
name: Deploy on QA
on:
  push:
    branches: [ "main" ]
  workflow_dispatch:
jobs:
  deploy_on_qa:
    runs-on: ubuntu-latest
    steps:
      - name: Checkout Source Code
        uses: actions/checkout@v2

      - name: Create customer Env file
        working-directory: ./customer
        run: |
          touch .env
          echo APP_SECRET=${{ secrets.QA_APP_SECRET }} >> .env
          echo MONGODB_URI=${{ secrets.QA_CUSTOMER_DB_URL }} >> .env
          echo MSG_QUEUE_URL=${{ secrets.QA_MSG_QUEUE_URL }} >> .env
          echo EXCHANGE_NAME=ONLINE_STORE >> .env
          echo PORT=8001 >> .env
          cat .env

      - name: Create Products Env file
        working-directory: ./products
        run: |
          touch .env
          echo APP_SECRET=${{ secrets.QA_APP_SECRET }} >> .env
          echo MONGODB_URI=${{ secrets.QA_PRODUCTS_DB_URL }} >> .env
          echo MSG_QUEUE_URL=${{ secrets.QA_MSG_QUEUE_URL }} >> .env
          echo EXCHANGE_NAME=ONLINE_STORE >> .env
          echo PORT=8002 >> .env
          cat .env
```

3 CD_Prod_Workflow.yml: this file contains all the configuration for the Continuous Deployment.

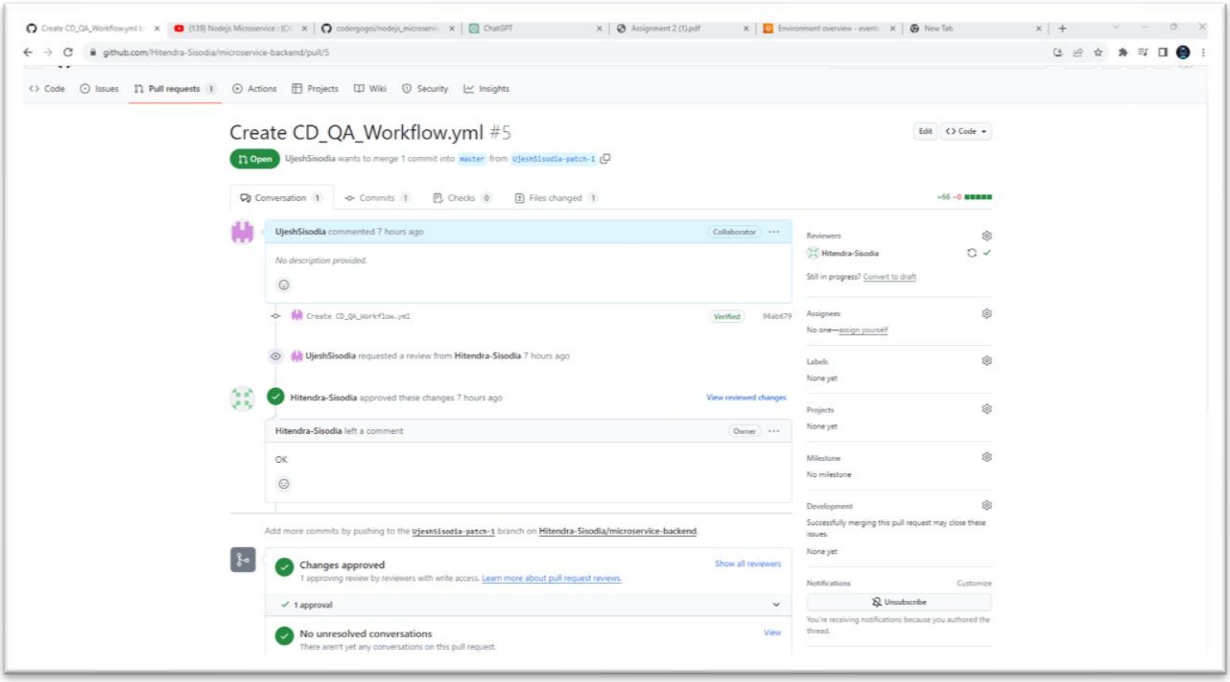
```
name: Deploy on Production
on:
  workflow_dispatch:
jobs:
  deploy_on_prod:

    runs-on: ubuntu-latest

    steps:
      - name: Checkout Source Code
        uses: actions/checkout@v2

      - name: Create customer Env file
        working-directory: ./customer
        run: |
          touch .env
          echo APP_SECRET=${{ secrets.PROD_APP_SECRET }} >> .env
          echo MONGODB_URI=${{ secrets.PROD_CUSTOMER_DB_URL }} >> .env
          echo MSG_QUEUE_URL=${{ secrets.PROD_MSG_QUEUE_URL }} >> .env
          echo EXCHANGE_NAME=ONLINE_STORE >> .env
          echo PORT=8001 >> .env
          cat .env
      - name: Create Products Env file
        working-directory: ./products
        run: |
          touch .env
          echo APP_SECRET=${{ secrets.PROD_APP_SECRET }} >> .env
          echo MONGODB_URI=${{ secrets.PROD_PRODUCTS_DB_URL }} >> .env
          echo MSG_QUEUE_URL=${{ secrets.PROD_MSG_QUEUE_URL }} >> .env
          echo EXCHANGE_NAME=ONLINE_STORE >> .env
          echo PORT=8002 >> .env
          cat .env
```

Container Orchestration and Infrastructure Automation

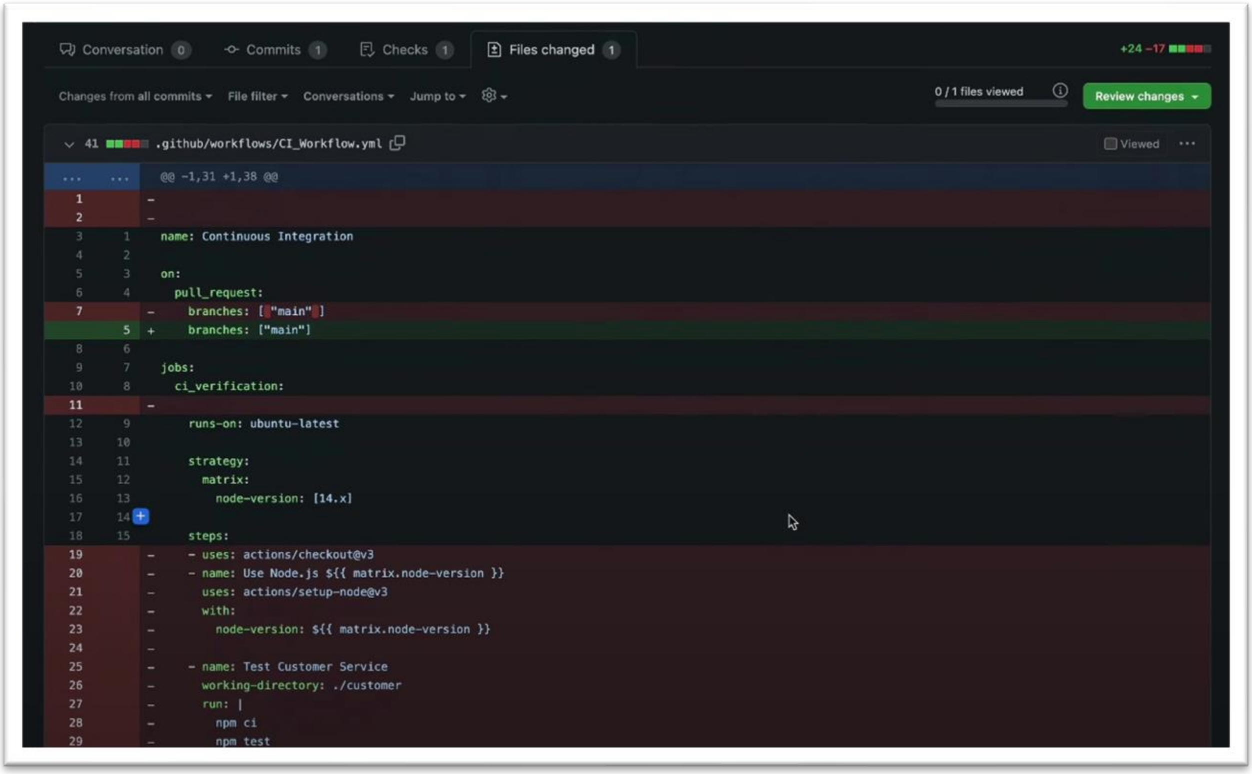
1. We have default branch i.e., master. We have created new branch feature i.e., feat-124-new-feature and feat-125-ci-config-for-all-services.



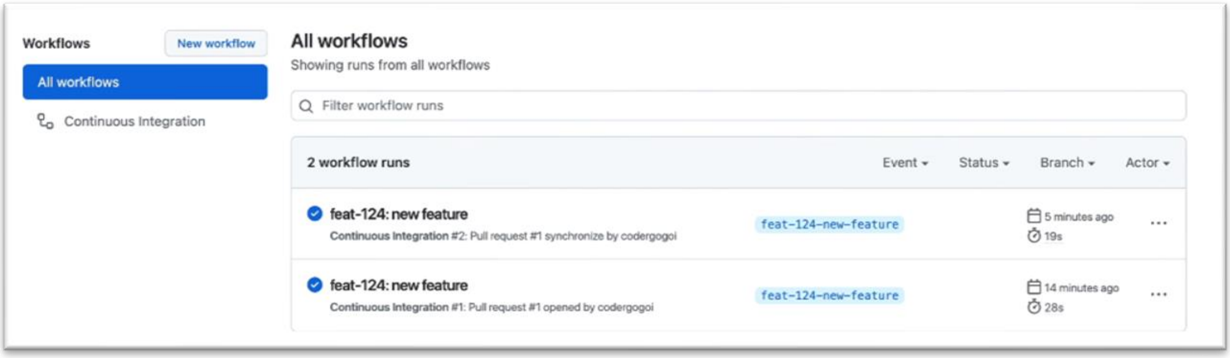
2. The changes which we have made are reviewed by our team member.



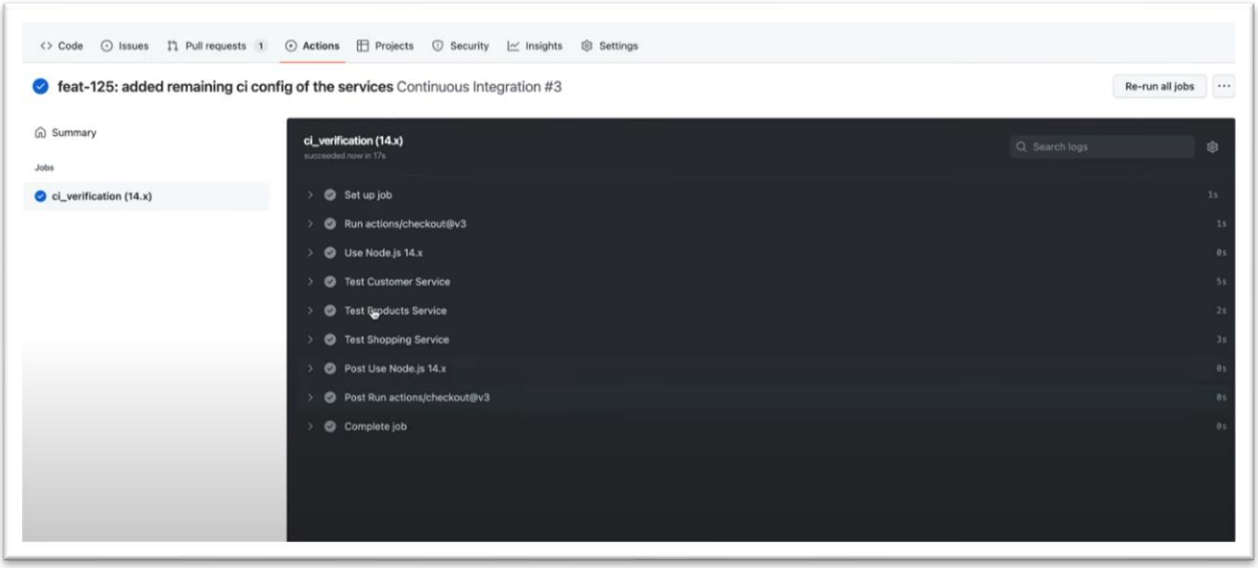
3. The changes which I made was adding configuration files for each microservice.



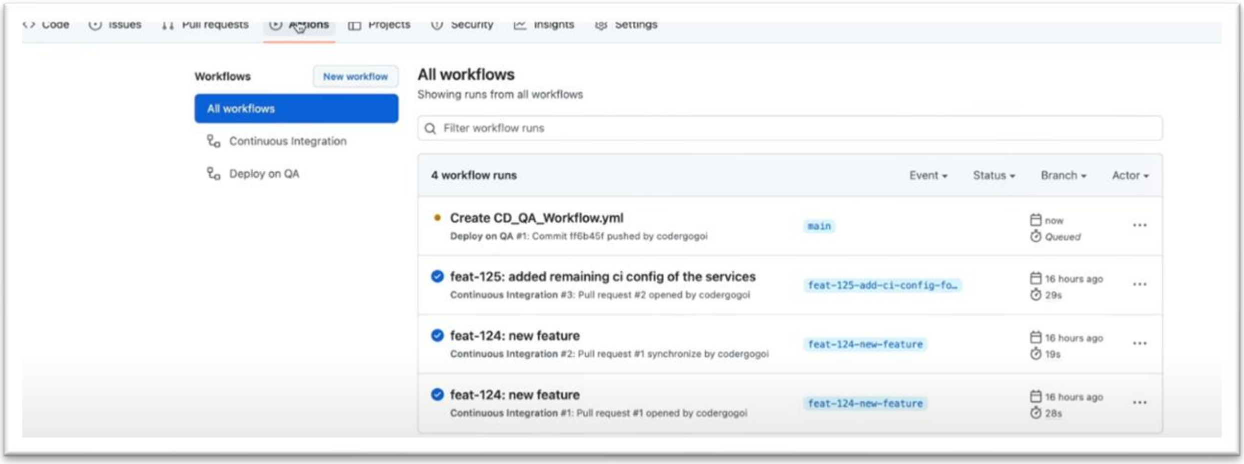
4. These are the Continuous integration changes which we have made in two new branch which we created.



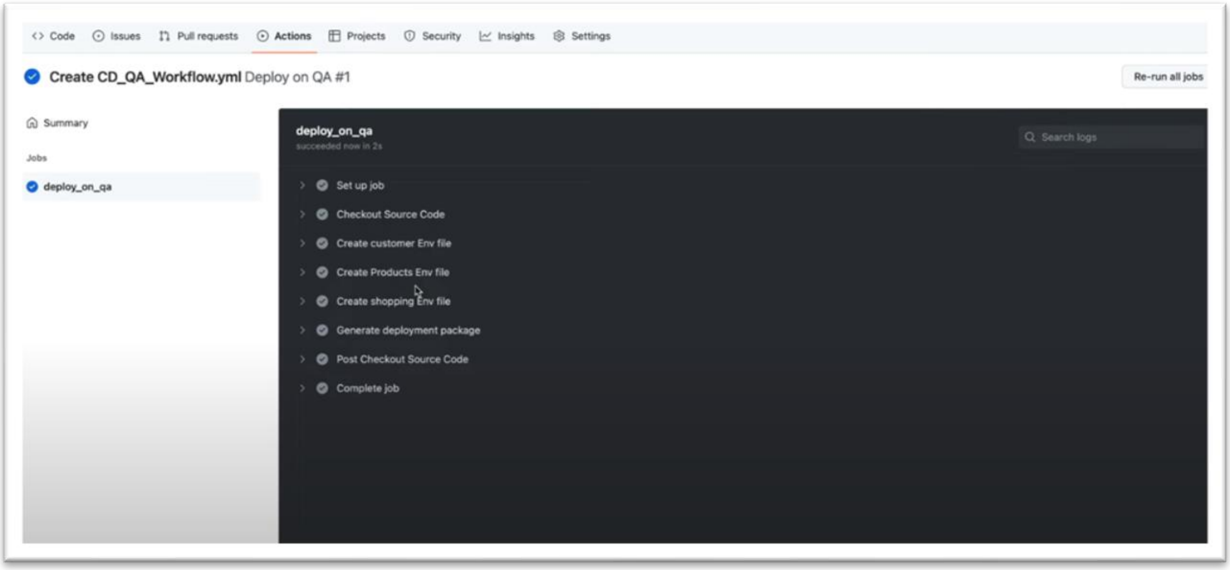
5. The verification are as follows.



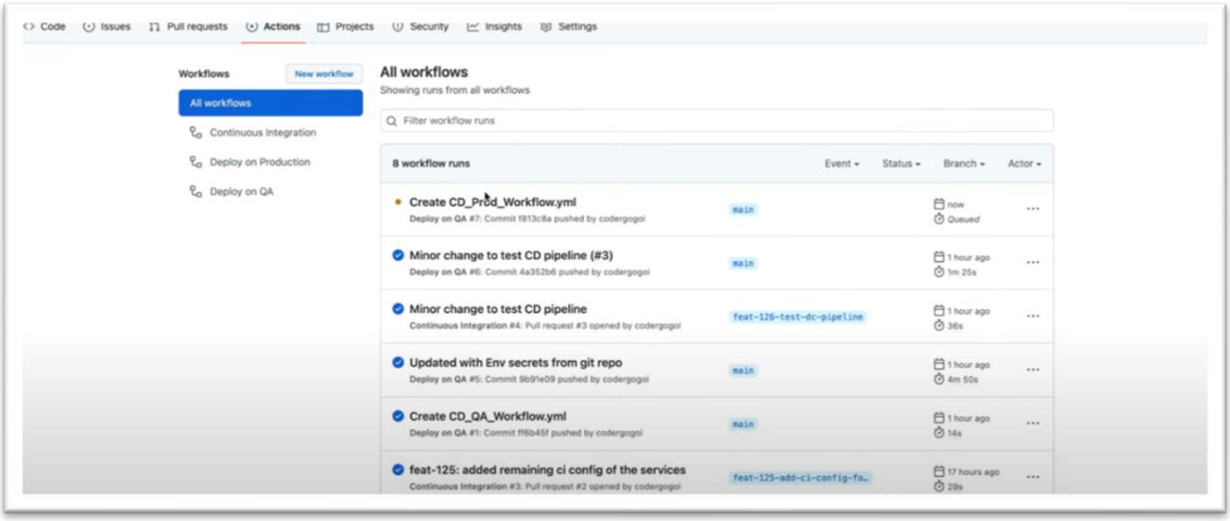
6. Creating Continuous Deployment Workflow.



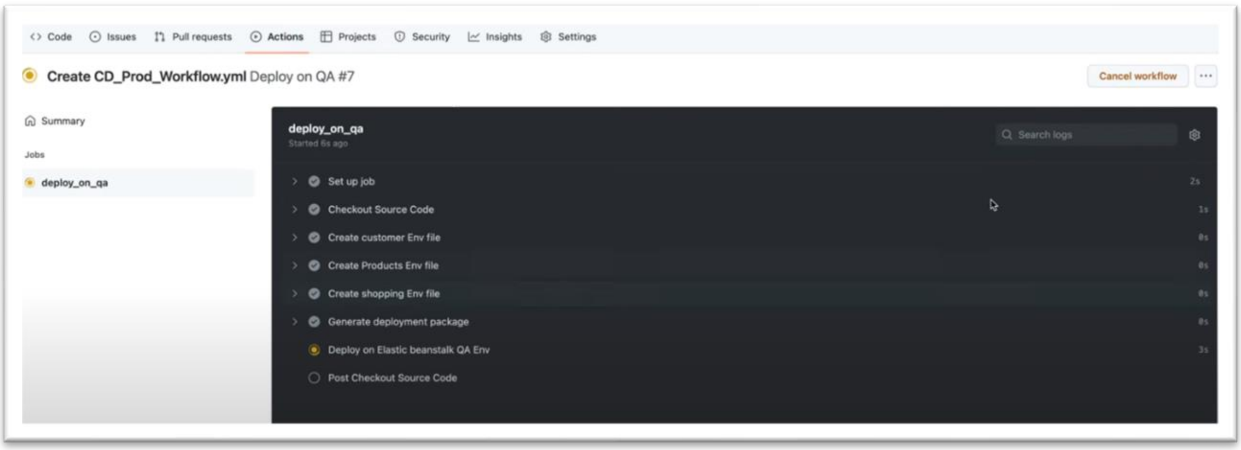
7. Now we will verify the Continuous Deployment



8. Updating the Continuous Deployment production environment in the workflow.



9. And verification are as follows



Scaling and Load Balancing

6. Implementing automatic scaling mechanisms for microservices based on resource usage is essential for ensuring optimal performance and resource utilization. Here's a general approach to implementing automatic scaling, assuming we're working with a container orchestration platform like Kubernetes:

Monitoring Resource Metrics: Set up monitoring for key resource metrics such as CPU utilization, memory usage, and network traffic. Tools like Prometheus and Grafana can be integrated into our Kubernetes cluster to collect and visualize these metrics.

Define Scaling Policies: Define scaling policies based on the monitored metrics. For example, we might decide to scale up the number of instances when CPU utilization exceeds a certain threshold or scale down when it falls below another threshold. Similar policies can be defined for memory usage and other relevant metrics.

Horizontal Pod Autoscaler (HPA): In Kubernetes, use the Horizontal Pod Autoscaler (HPA) to automatically adjust the number of replicas (instances) of a microservice based on observed metrics. Here's an example YAML configuration for an HPA that scales based on CPU utilization.

This HPA configuration specifies scaling behaviour based on CPU utilization, maintaining a minimum of 2 replicas and scaling up to a maximum of 10 replicas.

Customer HPA

```yaml
apiVersion: autoscaling/v2beta2
kind: HorizontalPodAutoscaler
metadata:
  name: customer-service-hpa
spec:
  scaleTargetRef:
    apiVersion: apps/v1
    kind: Deployment
    name: customer-service-deployment
  minReplicas: 2
  maxReplicas: 10
  metrics:
  - type: Resource
    resource:
      name: cpu
      targetAverageUtilization: 50
```

In this example, the HPA targets a deployment named my-microservice and scales the number of replicas to maintain an average CPU utilization of 50%.

Products HPA

```yaml
apiVersion: autoscaling/v2beta2
kind: HorizontalPodAutoscaler
metadata:
  name: products-service-hpa
spec:
  scaleTargetRef:
    apiVersion: apps/v1
    kind: Deployment
    name: products-service-deployment
  minReplicas: 2
  maxReplicas: 10
  metrics:
  - type: Resource
    resource:
      name: cpu
      targetAverageUtilization: 50
```

Shopping HPA

```yaml
apiVersion: autoscaling/v2beta2
kind: HorizontalPodAutoscaler
metadata:
  name: shopping-service-hpa
spec:
  scaleTargetRef:
    apiVersion: apps/v1
    kind: Deployment
    name: shopping-service-deployment
  minReplicas: 2
  maxReplicas: 10
  metrics:
  - type: Resource
    resource:
      name: cpu
      targetAverageUtilization: 50
```

Vertical Pod Autoscaler (VPA): Consider using the Vertical Pod Autoscaler (VPA) if our microservices have variable resource requirements. VPA adjusts the resource requests and limits for containers based on historical usage patterns.

Customer VPA

```yaml
apiVersion: autoscaling.k8s.io/v1
kind: VerticalPodAutoscaler
metadata:
  name: customer-service-vpa
spec:
  targetRef:
    apiVersion: "apps/v1"
    kind:       "Deployment"
    name:       "customer-service-deployment"
  updatePolicy:
    updateMode: "Auto"
```

Products VPA

```yaml
apiVersion: autoscaling.k8s.io/v1
kind: VerticalPodAutoscaler
metadata:
  name: products-service-vpa
spec:
  targetRef:
    apiVersion: "apps/v1"
    kind:       "Deployment"
    name:       "customer-service-deployment"
  updatePolicy:
    updateMode: "Auto"
```

Shopping VPA

```yaml
apiVersion: autoscaling.k8s.io/v1
kind: VerticalPodAutoscaler
metadata:
  name: shopping-service-vpa
spec:
  targetRef:
    apiVersion: "apps/v1"
    kind:       "Deployment"
    name:       "customer-service-deployment"
  updatePolicy:
    updateMode: "Auto"
```

Cluster Autoscaler: For automatic scaling of nodes in our Kubernetes cluster based on overall resource demand, use the Cluster Autoscaler. This ensures that there are enough nodes to accommodate the scaling of individual microservices.

Prometheus Alert Manager: Set up alerts based on resource metrics using Prometheus Alert Manager. Define alert rules that trigger notifications when resource usage surpasses defined thresholds. These alerts can be used for both manual intervention and triggering automatic scaling.

Integration with Cloud Provider Auto Scaling: If our microservices run on a cloud platform (e.g., AWS, Google Cloud, Azure), leverage the cloud provider's auto-scaling features. For example, AWS Auto Scaling Groups can automatically adjust the number of EC2 instances based on predefined policies.

Continuous Monitoring and Tuning: Regularly review and adjust our scaling policies based on the changing characteristics of our microservices. Continuous monitoring helps identify trends and patterns that might require adjustments to scaling thresholds.

Load Testing: Conduct load testing to simulate different levels of user traffic and observe how our scaling mechanisms respond. This helps ensure that our system can handle varying workloads effectively.

Logging and Auditing: Implement logging and auditing mechanisms to capture scaling events and changes in resource usage. This information is valuable for post-event analysis and troubleshooting.

7. Following are the ways for achieving load balancing:

1. Container Orchestration Platforms: Container orchestration platforms, such as Kubernetes and Docker Swarm, provide built-in support for load balancing. These platforms manage the deployment, scaling, and operation of containers, including distributing traffic among container instances.
2. Load balancing in a containerized environment is a fundamental aspect of maintaining application availability, scalability, and reliability, and container orchestration platforms provide the necessary tools and abstractions to simplify its implementation.
3. In ECS (Amazon Elastic Container Service), load balancing is achieved through the integration with Elastic Load Balancing (ELB). ECS allows you to define a 8 service that manages the deployment and scaling of containers. When using a load balancer, ECS distributes incoming traffic across the tasks within the service. ELB automatically registers and deregisters container instances as they are started or stopped, ensuring a balanced distribution of traffic. This dynamic scaling and registration process allows ECS to efficiently manage containerized workloads, ensuring optimal resource utilization and high availability
4. Service Discovery: Load balancing in a containerized environment starts with service discovery. Container orchestration platforms maintain a service registry that keeps track of the IP addresses and ports of running containers.
5. Load Balancer Configuration: Container orchestration platforms often include an internal load balancer or integrate with external load balancers.
6. Dynamic Scaling: Container orchestration platforms support dynamic scaling, allowing the automatic adjustment of the number of container instances based on demand.
7. External Load Balancers: In a cloud environment, external load balancers provided by cloud service providers (e.g., AWS Elastic Load Balancer, Google Cloud Load Balancer) can be used to distribute traffic to container instances.
8. Load Balancing for Microservices: In a microservices architecture, where services communicate with each other, load balancing is also applied

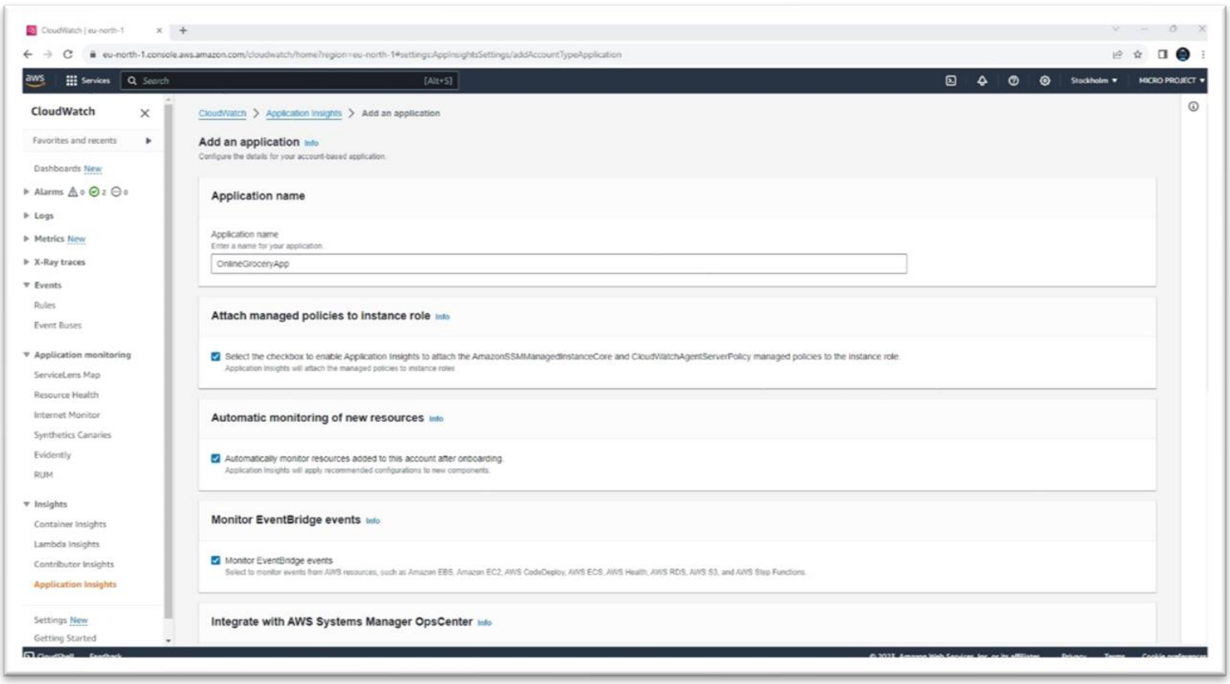
Monitoring and Logging

8. Monitoring and logging for the deployed microservices.

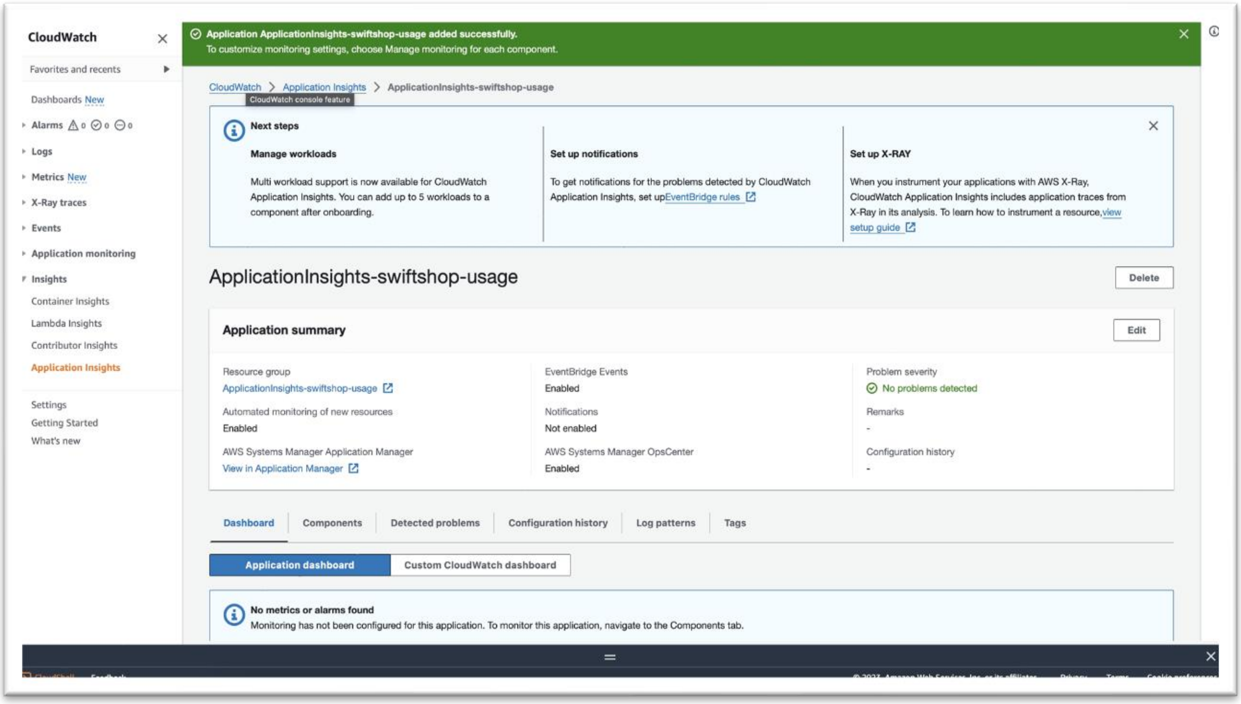
In the deployment of microservices, establishing robust monitoring and logging practices is paramount to ensuring the optimal performance and reliability of the application. For monitoring, services such as Amazon CloudWatch can be employed to capture real-time metrics, including CPU utilization, memory usage, and network activity. By setting up custom CloudWatch Alarms, teams can receive timely notifications or trigger automated actions when predefined thresholds are breached, enabling proactive responses to potential issues. In tandem with monitoring, logging mechanisms play a crucial role in troubleshooting and gaining insights into the microservices' behaviour. Leveraging CloudWatch Logs, developers can centralize log management and store logs generated by each microservice. Integrating CloudWatch Logs with additional tools like Amazon Elasticsearch and Kibana facilitates advanced log analysis, enabling efficient troubleshooting of issues and identification of performance bottlenecks.

The ability to monitor application performance and troubleshoot issues is not only about collecting data but also about utilizing these insights to iterate and optimize. Continuous refinement of monitoring and logging configurations ensures that the deployed microservices remain resilient, scalable, and responsive to evolving demands, ultimately contributing to the overall health and effectiveness of the application architecture.

Application insight creation



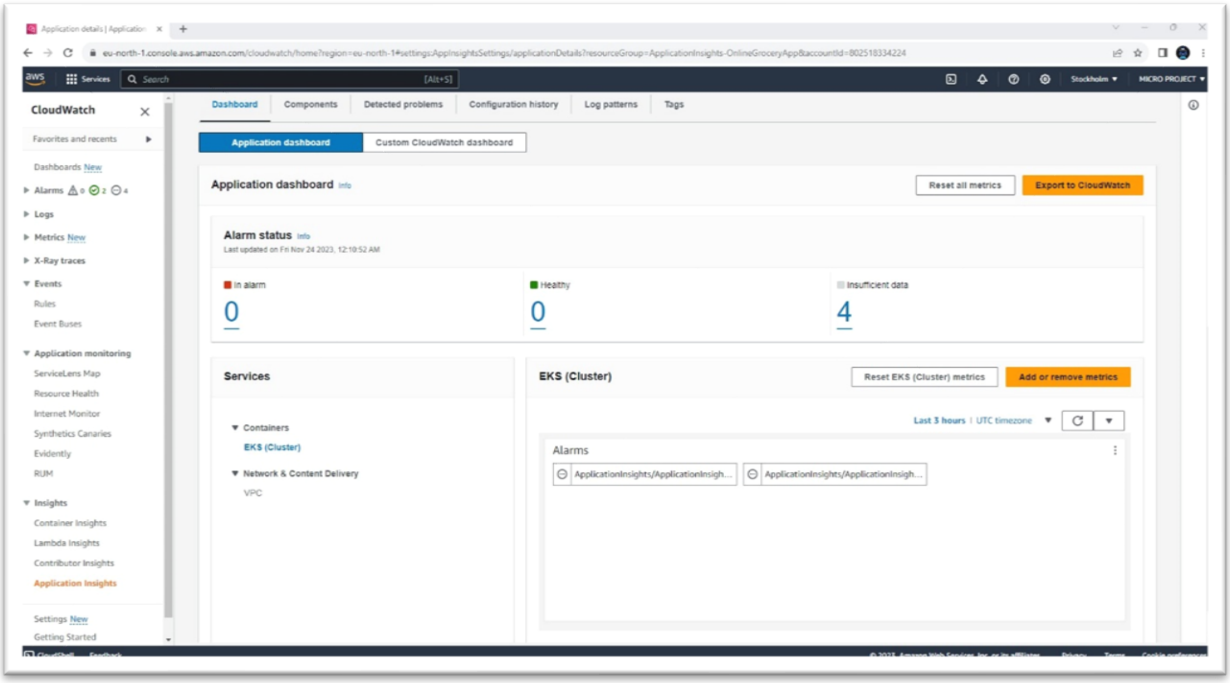
Instance creation:



9. Showcase the ability to monitor the application's performance and troubleshoot issues.

Troubleshooting:

- Using `kubectl logs` to inspecting container logs.
- Monitoring resource utilization with `kubectl top`.
- Implementing health probes for application reliability.



Container Orchestration and Infrastructure Automation

GitHub Link: https://github.com/Hitendra-Sisodia/microservice-backend

Overview