ADOPTING A MULTI-CLOUD STRATEGY WITH DOCKER AND KUBERNETES

PHASE 3 - SOLUTION ARCHITECTURE

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SOLUTION DEVELOPMENT

Setting up Multi-Cloud Environment and Configuring Necessary Tools

Step 1: Set Up Accounts on Multiple Cloud Providers

1. Create accounts on IBM Cloud, AWS, and Azure.
2. Ensure billing accounts are configured to access services across these platforms.

Step 2: Install Required Tools Locally

1. Install Minikube - Enable local Kubernetes testing.
2. Install kubectl - Set up Kubernetes CLI for cluster management.
3. Install Docker - Manage container images and deployments.

Step 3: Configure Multi-Cloud Container Registries

1. Set up registries on IBM Cloud, AWS, and Azure:

ibmcloud cr namespace-add <namespace_name>

aws ecr create-repository --repository-name <repository_name>

az acr create --name <registry_name> --resource-group <resource_group> --sku Basic

2. Enable security policies and vulnerability scanning for each registry.

IMPLEMENTATION DETAILS

Containerization Using Docker

Dockerfile (Backend Service):

```
FROM node:16-alpine
WORKDIR /app
COPY . .
RUN npm install
EXPOSE 5000
CMD ["node", "server.js"]
```

Building and Pushing Docker Images

```
docker build -t backend-app:latest .
docker tag backend-app:latest <REGISTRY_URL>/<namespace>/backend-app:latest
docker push <REGISTRY_URL>/<namespace>/backend-app:latest
```

Deploying to Kubernetes

Deployment YAML (backend-deployment.yml)

```
apiVersion: apps/v1
kind: Deployment
metadata:
  name: backend-deployment
spec:
  replicas: 3
  selector:
    matchLabels:
      app: backend
  template:
    metadata:
      labels:
        app: backend
    spec:
      containers:
      - name: backend
        image: <REGISTRY_URL>/<namespace>/backend-app:latest
```

```
    ports:
    - containerPort: 5000
```

Service YAML (backend-service.yml)

```
apiVersion: v1
kind: Service
metadata:
  name: backend-service
spec:
  selector:
    app: backend
  ports:
  - protocol: TCP
    port: 80
    targetPort: 5000
  type: LoadBalancer
```

TESTING THE SOLUTION

Step 1: Deploy Applications to Multi-Cloud Kubernetes Clusters

- **Use Minikube for local testing or IBM Kubernetes Service, AWS EKS, and Azure AKS for production.**
- **Start Minikube:**

```
minikube start
```

- **Deploy Kubernetes manifests:**

```
kubectl apply -f backend-deployment.yml
kubectl apply -f backend-service.yml
```

Step 2: Verify Deployments

```
kubectl get pods
kubectl get svc
```

- **Access the application via public IPs or NodePort configurations.**

Step 3: Automate Multi-Cloud CI/CD Pipelines

- **Use Jenkins, GitHub Actions, or IBM Continuous Delivery.**
- **Implement an Ansible-based Kubernetes deployment:**

```
- hosts: all
  become: true
```

tasks:

- name: create new deployment

command: kubectl apply -f /home/ubuntu/backend-deployment.yml

- name: create new service

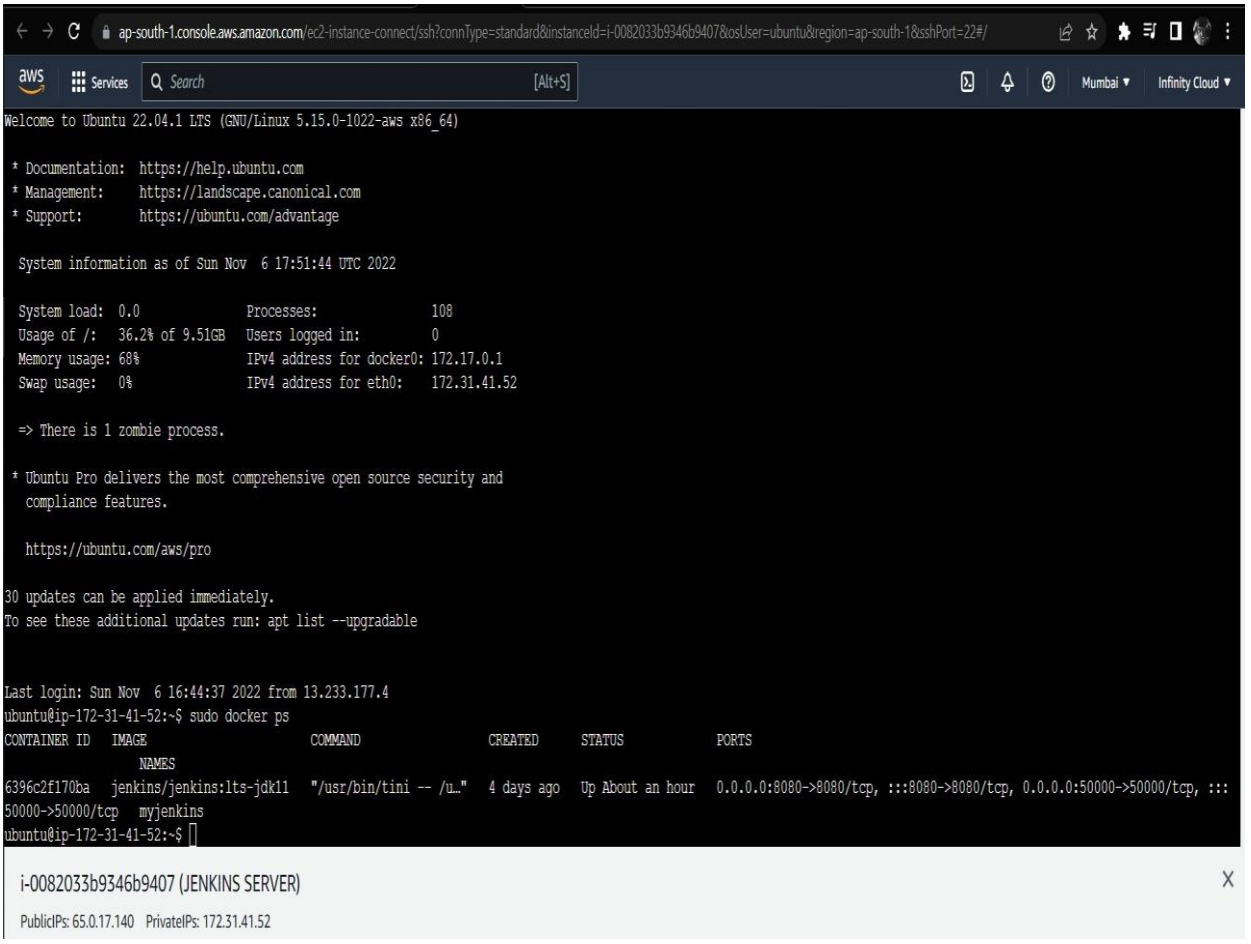
command: kubectl apply -f /home/ubuntu/backend-service.yml

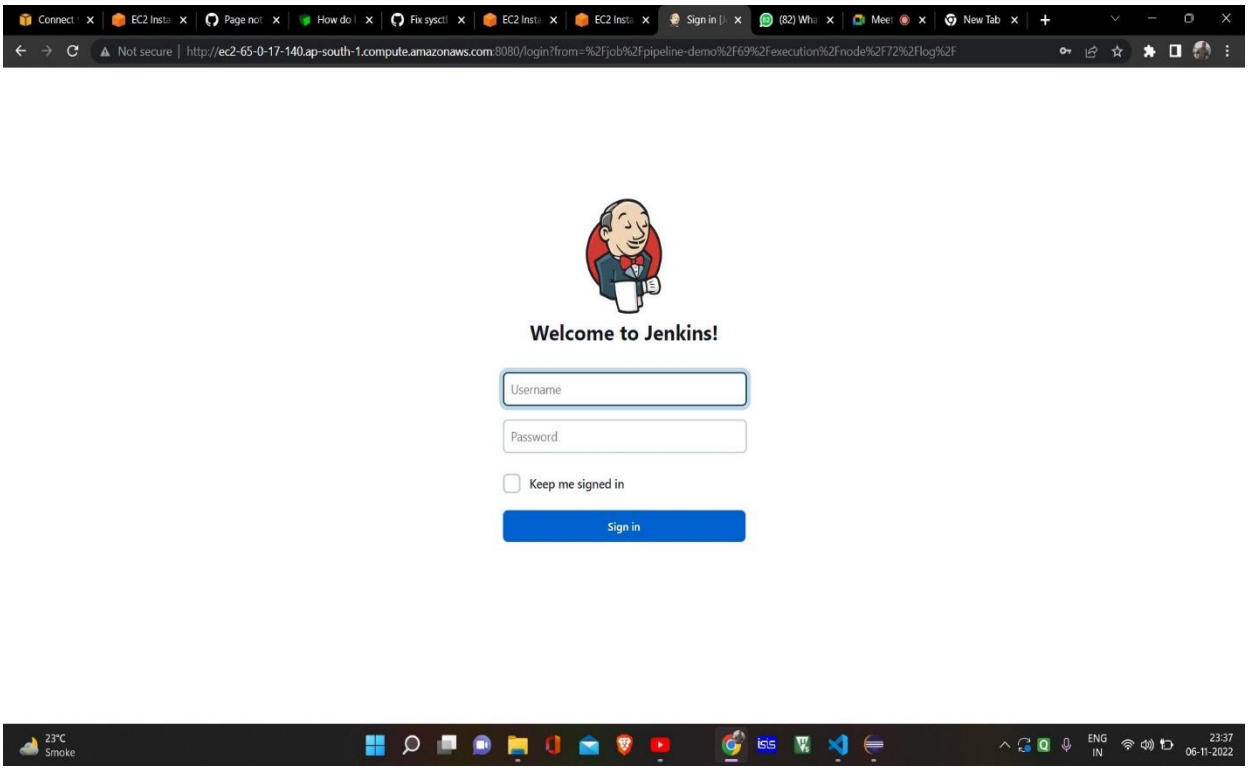
Step 4: Conduct Performance Testing

- **Use Apache JMeter or Postman for load testing.**
- **Monitor using Grafana or Azure Monitor.**

FUTURE IMPROVEMENTS

1. **Enable Auto-Scaling: Implement Kubernetes HPA.**
2. **Leverage Service Meshes: Deploy Istio for advanced networking.**
3. **Integrate Security Scanning: Automate real-time security analysis within CI/CD pipelines.**




Not secure | http://ec2-65-0-17-140.ap-south-1.compute.amazonaws.com:8080/login?from=%2Fjob%2Fpipeline-demo%2F69%2Fexecution%2Fnode%2F72%2Flog%2F
Welcome to Jenkins!
Username
Password
Keep me signed in
Sign in