

ADVANCE DEVOPS CASE STUDY

Kubernetes Application Deployment on AWS using Cloud9 IDE

1. Introduction

The purpose of this case study is to set up a Kubernetes cluster on AWS using the Cloud9 IDE, deploy a sample application (like Nginx) using kubectl, and ensure that the application runs successfully. Additionally, we will verify the deployment by accessing the application through a NodePort or LoadBalancer service.

Technologies and Tools

- **AWS Cloud9 IDE:** A cloud-based IDE providing an environment to work directly on the cloud infrastructure.
- **Kubernetes:** An open-source platform for automating deployment, scaling, and management of containerized applications.
- **Kubectl:** The command-line tool to manage Kubernetes clusters.
- **AWS EKS:** Elastic Kubernetes Service, a managed Kubernetes service on AWS.
- **Nginx:** A web server that will be deployed as a sample application.

2. Setup and Configuration

2.1 Installing and Configuring Kubectl on Cloud9 IDE

1. **Create an AWS Cloud9 environment:**
 - Open the AWS Management Console and navigate to Cloud9.
 - Create a new environment by configuring the necessary parameters (EC2 instance size, networking, etc.).
2. **Install kubectl:**

On the Cloud9 terminal, install kubectl using the following commands:

```
curl -o kubect1
https://amazon-eks.s3.us-west-2.amazonaws.com/1.22.2/2021-10-04/bin/linux/amd64/kubect1
chmod +x ./kubect1
sudo mv ./kubect1 /usr/local/bin
kubect1 version --short --client
```

```
[cloudshell-user@ip-10-136-62-40 ~]$ kubect1 version
Client Version: v1.30.2-eks-1552ad0
Kustomize Version: v5.0.4-0.20230601165947-6ce0bf390ce3
Unable to connect to the server: dial tcp: lookup 79950C43F2E91F99E723ACEC7F6F6C5F.gr7.us-east-1.eks.amazonaws.com on 10.0.0.2:53: no such host
[cloudshell-user@ip-10-136-62-40 ~]$
```

- This installs kubect1, the Kubernetes command-line tool.

Install AWS CLI: Ensure the AWS CLI is installed to interact with AWS services.

```
sudo apt install awscli -y
aws --version
```

```
[cloudshell-user@ip-10-136-62-40 ~]$ aws --version
aws-cli/2.18.9 Python/3.12.6 Linux/6.1.109-118.189.amzn2023.x86_64 exec-env/CloudShell exe/x86_64.amzn.2023
[cloudshell-user@ip-10-136-62-40 ~]$
```

3.

Configure AWS credentials:

```
aws configure
```

```
[cloudshell-user@ip-10-136-62-40 ~]$ aws configure
AWS Access Key ID [*****RXZU]:
AWS Secret Access Key [*****jYmp]:
Default region name [us-east-1]:
Default output format [json]:
[cloudshell-user@ip-10-136-62-40 ~]$
```

4. Provide the required AWS access keys to authenticate with AWS services.

Install eksctl: eksctl is the official CLI for managing EKS clusters.

```
curl -sL https://eksctl.io/install | sh
```

eksctl version

```
[cloudshell-user@ip-10-136-62-40 ~]$ curl -sL https://eksctl.io/install | sh
sh: line 1: syntax error near unexpected token `<'
sh: line 1: `<!doctype html><html lang=en class=no-js> <head><meta charset=utf-8><meta name=viewport content="width=device-width,initial-scale=1"><meta name=description
content="The official CLI for Amazon EKS"><meta name=author content="eksctl authors"><link rel=icon href=/img/favicon.png><meta name=generator content="mkdocs-1.5.3, mkd
ocs-material-9.5.17"><title>eksctl</title><link rel=stylesheet href=/assets/stylesheets/main.bcfd587.min.css><link rel=stylesheet href=/assets/stylesheets/palette.06af6
0db.min.css><link rel=preconnect href=https://fonts.gstatic.com crossorigin><link rel=stylesheet href="https://fonts.googleapis.com/css?family=Segoe+UI:300,300i,400,400i
,700,700i%7CRoboto+Mono:400,400i,700,700i&display=fallback"><style>:root{--md-text-font:"Segoe UI";--md-code-font:"Roboto Mono"}</style><link rel=stylesheet href=/styles
heets/extra.css><link rel=stylesheet href=/stylesheets/schema.css><script>  _md_scope=new URL("/","location"),_md_hash=e=>[...e].reduce((e,_)=>(e<<5)-e+_charCodeAt(0,0),
_md_get(e,_.localStorage,t=_md_scope)>>JSON.parse(_.getItem(t.pathname+"."+e)),_md_set=(e,_,t=localStorage,a=_md_scope)=>{try{t.setItem(a.pathname+"."+e,JSON.string
ify(_))}catch(e){}}</script><script id=_analytics>function _md_analytics(){function n(t){dataLayer.push(arguments)}window.dataLayer=window.dataLayer||[],n("js",new Date
),n("config","G-EQYVC0Y5Q2"),document.addEventListener("DOMContentLoaded",function(){document.forms.search&&document.forms.search.query.addEventListener("blur",function(
){this.value&&n("event","search",{search_term:this.value}))}),document.subscribe(function(){var a=document.forms.feedback;if(void 0!==a)for(var e of a.querySelectorAll("
#thumbs-up"))e.addEventListener("click",function(e){a.reset();if(!e.target.closest("#data-md-hash"))e.target.setAttribute("event","feedback")})})})
```

5.

2.2 Create the Kubernetes Cluster on AWS EKS

Create an EKS Cluster: Use eksctl to create a Kubernetes cluster on AWS:

```
eksctl create cluster --name my-cluster --region us-east-1
--nodegroup-name standard-workers --node-type t2.medium
--nodes 2
```

```
2024-10-21 12:49:02 [i] waiting for CloudFormation stack "eksctl-kubernetes-cluster"
2024-10-21 12:50:02 [i] waiting for CloudFormation stack "eksctl-kubernetes-cluster"
2024-10-21 12:50:03 [i] recommended policies were found for "vpc-cni" addon, but since OIDC is disabled on the cluster, eksctl cannot configure the requested permissions; the recommended
way to provide IAM permissions for "vpc-cni" addon is via pod Identity associations; after addon creation is completed, add all recommended policies to the config file, under "addon.PodI
dentityAssociations", and run "eksctl update addon"
2024-10-21 12:50:03 [i] creating addon
2024-10-21 12:50:03 [i] successfully created addon
2024-10-21 12:50:03 [i] creating addon
2024-10-21 12:50:04 [i] successfully created addon
2024-10-21 12:50:04 [i] creating addon
2024-10-21 12:50:04 [i] successfully created addon
2024-10-21 12:52:04 [i] building managed nodegroup stack "eksctl-kubernetes-nodegroup-pranav"
2024-10-21 12:52:05 [i] deploying stack "eksctl-kubernetes-nodegroup-pranav"
2024-10-21 12:52:05 [i] waiting for CloudFormation stack "eksctl-kubernetes-nodegroup-pranav"
2024-10-21 12:52:35 [i] waiting for CloudFormation stack "eksctl-kubernetes-nodegroup-pranav"
2024-10-21 12:53:32 [i] waiting for CloudFormation stack "eksctl-kubernetes-nodegroup-pranav"
2024-10-21 12:54:05 [i] waiting for CloudFormation stack "eksctl-kubernetes-nodegroup-pranav"
2024-10-21 12:54:53 [i] waiting for CloudFormation stack "eksctl-kubernetes-nodegroup-pranav"
2024-10-21 12:54:53 [i] waiting for the control plane to become ready
2024-10-21 12:54:54 [✓] saved kubeconfig as "/home/cloudshell-user/.kube/config"
2024-10-21 12:54:54 [i] no tasks
2024-10-21 12:54:54 [✓] all EKS cluster resources for "kubernetes" have been created
2024-10-21 12:54:54 [✓] created 0 nodegroup(s) in cluster "kubernetes"
2024-10-21 12:54:54 [i] nodegroup "pranav" has 2 node(s)
2024-10-21 12:54:54 [i] node "ip-192-168-13-215.ec2.internal" is ready
2024-10-21 12:54:54 [i] node "ip-192-168-33-39.ec2.internal" is ready
2024-10-21 12:54:54 [i] waiting for at least 2 node(s) to become ready in "pranav"
2024-10-21 12:54:54 [i] nodegroup "pranav" has 2 node(s)
2024-10-21 12:54:54 [i] node "ip-192-168-13-215.ec2.internal" is ready
2024-10-21 12:54:54 [i] node "ip-192-168-33-39.ec2.internal" is ready
2024-10-21 12:54:54 [✓] created 1 managed nodegroup(s) in cluster "kubernetes"
2024-10-21 12:54:54 [i] kubect command should work with "/home/cloudshell-user/.kube/config", try "kubectl get nodes"
2024-10-21 12:54:54 [✓] EKS cluster "kubernetes" in "us-east-1" region is ready
```

1. This command creates an EKS cluster with 2 worker nodes.

Configure kubectl to use the EKS Cluster: After the cluster is created, configure kubectl to interact with it:

```
aws eks --region <your-region> update-kubeconfig --name
my-cluster
```

```
[cloudshell-user@ip-10-136-62-40 ~]$ aws eks --region us-east-1 update-kubeconfig --name kubernetes1
Added new context arn:aws:eks:us-east-1:008971674169:cluster/kubernetes1 to /home/cloudshell-user/.kube/config
[cloudshell-user@ip-10-136-62-40 ~]$
```

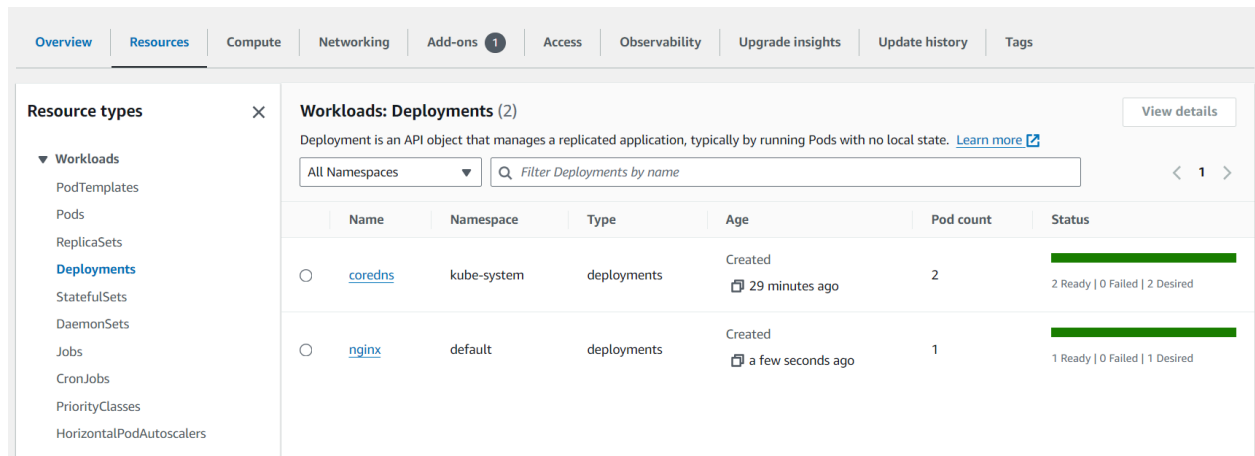
2.

2.3 Deploy a Sample Application (Nginx)

Deploy Nginx as a sample application: Create an Nginx deployment using kubectl:

```
kubectl create deployment nginx --image=nginx:latest
```

```
[cloudshell-user@ip-10-140-108-236 ~]$ kubectl create deployment nginx --image=nginx:latest
deployment.apps/nginx created
```



Name	Namespace	Type	Age	Pod count	Status
coredns	kube-system	deployments	Created 29 minutes ago	2	2 Ready 0 Failed 2 Desired
nginx	default	deployments	Created a few seconds ago	1	1 Ready 0 Failed 1 Desired

1. This command deploys an Nginx web server.

Expose the Nginx deployment: To access the Nginx server, expose it using a NodePort or LoadBalancer service:

```
kubectl expose deployment nginx --type=NodePort --port=80
```

or, for a LoadBalancer (on AWS):

```
kubectl expose deployment nginx --type=LoadBalancer --port=80
```

```
[cloudshell-user@ip-10-140-108-236 ~]$ kubectl expose deployment nginx --type=LoadBalancer --port=80
service/nginx exposed
```

2.

Verify the deployment: To check if the deployment is running:

```
kubectl get pods
```

```
kubectl get svc
```

```
[cloudshell-user@ip-10-140-108-236 ~]$ kubectl get svc
NAME         TYPE        CLUSTER-IP   EXTERNAL-IP   PORT(S)          AGE
kubernetes   ClusterIP   10.100.0.1    <none>         443/TCP          58m
nginx        LoadBalancer 10.100.229.5  a2a71631b805b4781ab5758b6cef05c6-125741757.us-east-1.elb.amazonaws.com 80:31218/TCP    48m
[cloudshell-user@ip-10-140-108-236 ~]$
```

Pods (1) Info			
< 1 >			
Name	Status	Created	IP
nginx-7584b6f84c-gklm8	Running	2 minutes ago	192.168.13.40

Conditions (2)		
Name	Status	Message
Available	True	Deployment has minimum availability.
Progressing	True	ReplicaSet "nginx-7584b6f84c" has successfully progressed.

- The output should show the nginx pod running and the Service exposing it.

3. Accessing the Application

NodePort: If you used a NodePort, you can access the application using the external IP of any node and the assigned port:

```
kubectl get nodes -o wide
```

```
Kubectl get deployments
```

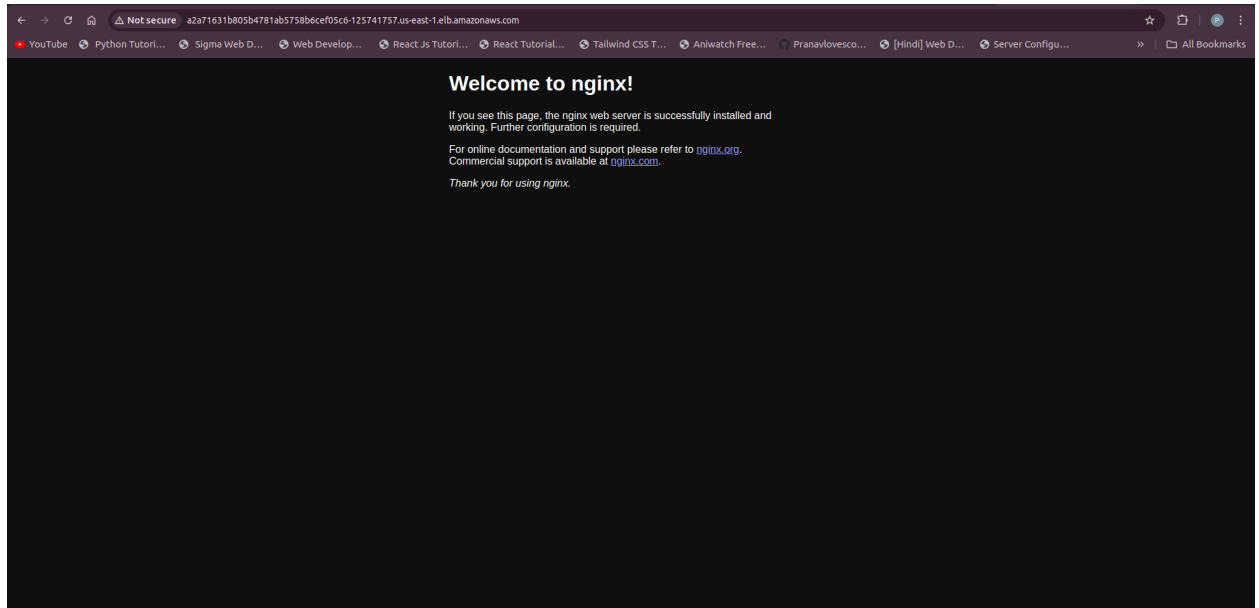
```
[cloudshell-user@ip-10-140-108-236 ~]$ kubectl get deployments
NAME      READY   UP-TO-DATE   AVAILABLE   AGE
nginx     1/1     1             1           50m
[cloudshell-user@ip-10-140-108-236 ~]$
```

- Open a web browser and paste the external ip shown as an output of the previous command.

LoadBalancer: If you used a LoadBalancer, check the external IP of the service:

```
kubectl get svc
```

- Open a web browser and paste the external ip shown as an output of the previous command.



4. Conclusion

This case study successfully demonstrates the setup of a Kubernetes cluster on AWS using Cloud9 IDE. We installed and configured kubectl, created an EKS cluster, deployed an Nginx application, and verified its accessibility using both NodePort and LoadBalancer services. Kubernetes simplifies application management and deployment, especially in cloud environments like AWS EKS.