CASE STUDY - INTRODUCTION TO KUBERNETES

You have just joined a startup Ventura Software as a Devops Lead Engineer. The company relies on a Monolithic Architecture for its product. Recently, the senior management was hired. The new CTO insists on having a Microservice Architecture. The Development Team, is working on breaking the Monolith. Meanwhile, you have been asked to host a Test Application on Kubernetes, to understand how it works.

Following things have to be implemented:

1. Deploy an Apache2 deployment of 2 replicas
2. Sample code has been checked-in at the following Git-Hub repo:

https://github.com/hshar/website.git.

You have to containerize this code, and push it to Docker Hub. Once done, deploy it on Kubernetes with 2 replicas

3. Deploy Ingress with the following rules:

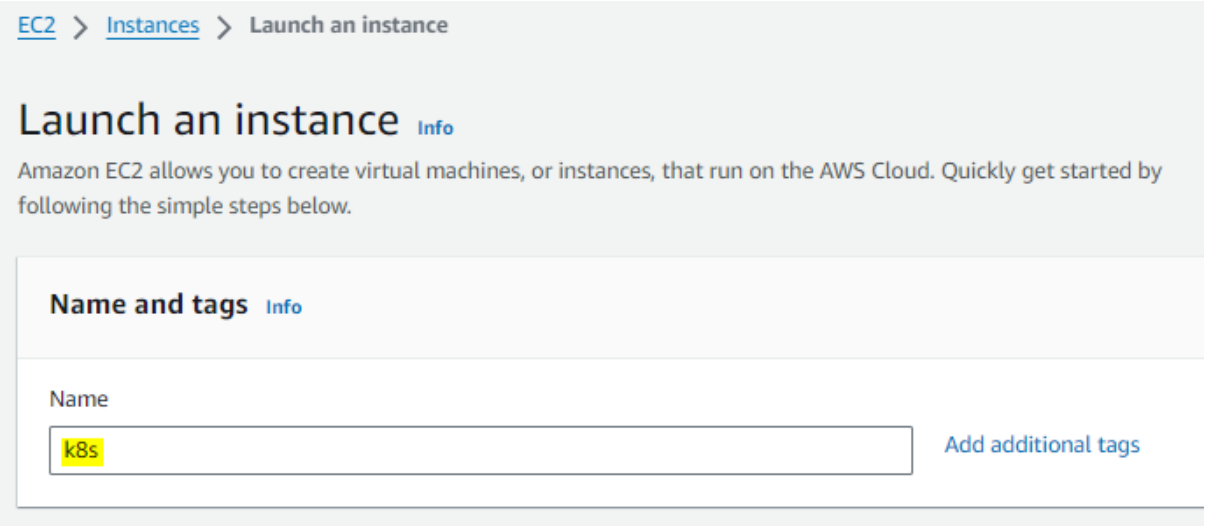
i) */apache* should point to the apache pods

ii) */custom* should point to the GitHub application

Solution:

Sample code has been checked-in at the following GitHub repo:
https://github.com/hshar/website.git
You have to containerize this code, and push it to Docker Hub. Once done, deploy it on Kubernetes with 2 replicas

Launch an instance for kubernetes



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Amazon Machine Image (AMI)

Ubuntu Server 24.04 LTS (HVM), SSD Volume Type — Free tier eligible

ami-01811d4912b4ccb26 (64-bit (x86)) / ami-0f0a689dea27d9dc8 (64-bit (Arm))

Virtualization: hvm ENA enabled: true Root device type: ebs

Description

Ubuntu Server 24.04 LTS (HVM),EBS General Purpose (SSD) Volume Type. Support available from Canonical (http://www.ubuntu.com/cloud/services).

Architecture AMI ID

Instance type

t2.medium

Family: t2 2 vCPU 4 GiB Memory Current generation: true

On-Demand RHEL base pricing: 0.0872 USD per Hour

On-Demand Windows base pricing: 0.0764 USD per Hour

On-Demand SUSE base pricing: 0.1584 USD per Hour

On-Demand Linux base pricing: 0.0584 USD per Hour

Additional costs apply for AMIs with pre-installed software

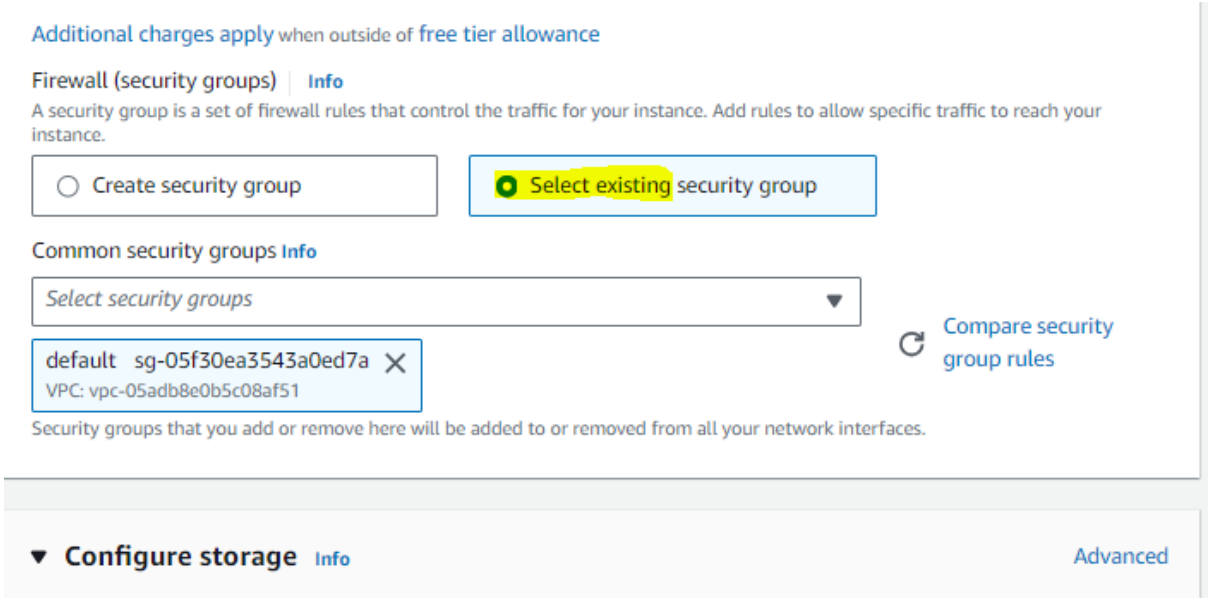
Key pair (login) Info

You can use a key pair to securely connect to your instance. Ensure that you have access to the selected key pair before you launch the instance.

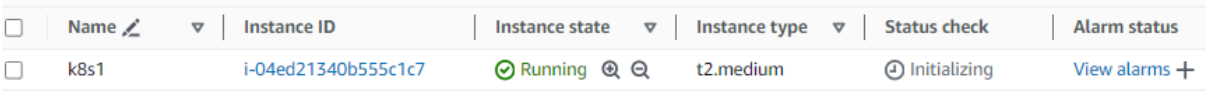
Key pair name - *required*

Ruchii-kp

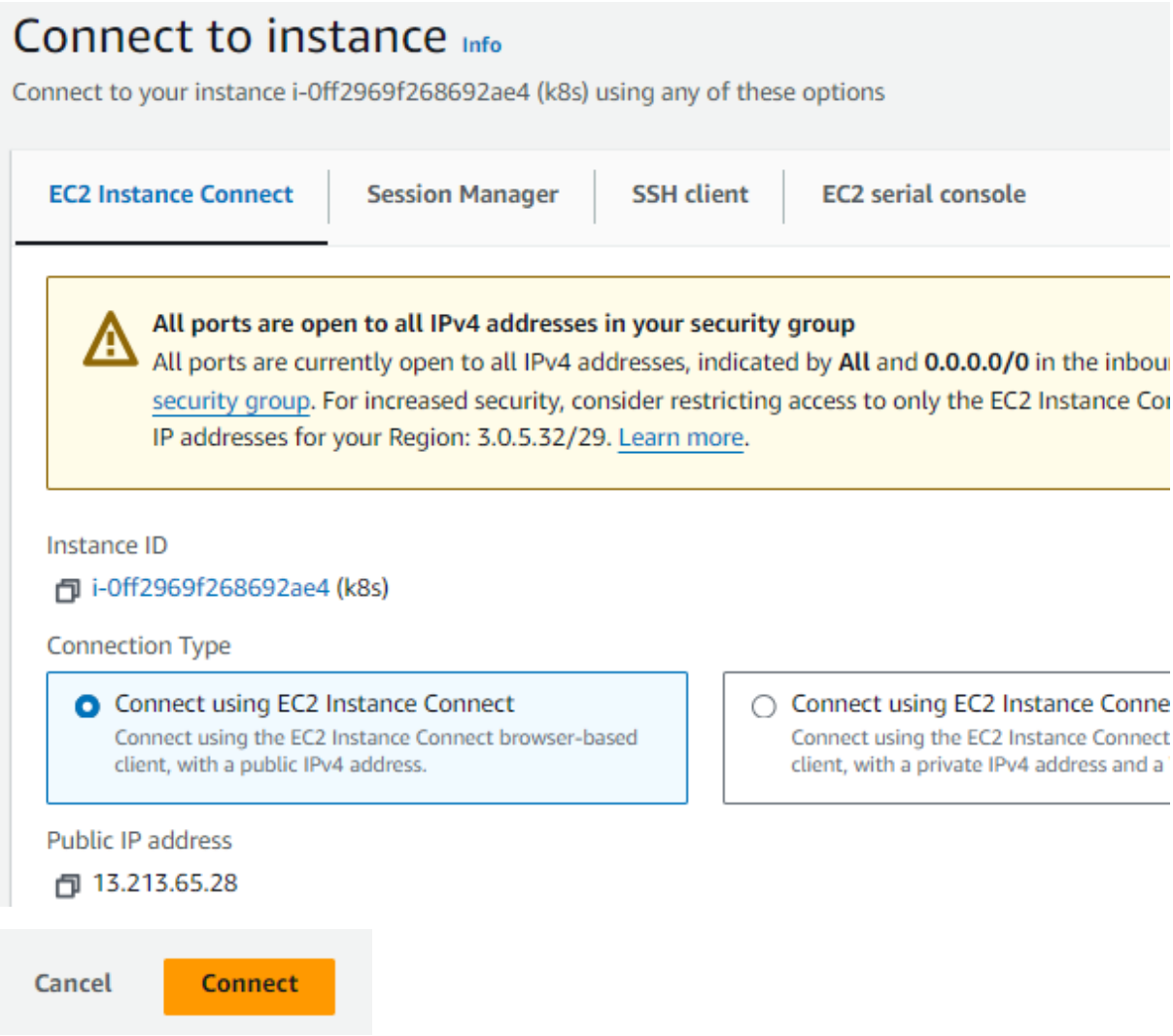
Create new key pair



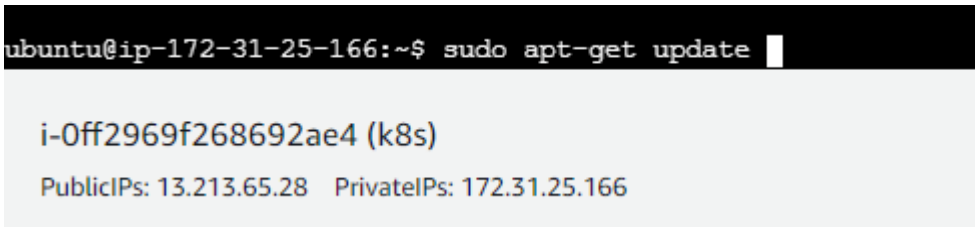
Successfully launched an instance



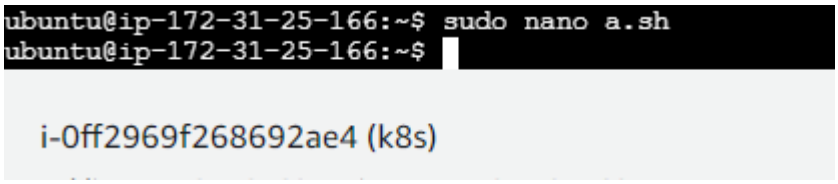
Name	Instance ID	Instance state	Instance type	Status check	Alarm status
k8s1	i-04ed21340b555c1c7	Running	t2.medium	Initializing	View alarms +



Update the machine



create a file a.sh



Install kubernetes, docker and minikube

```
sudo apt-get update
sudo apt-get install docker.io -y
sudo systemctl enable - now=docker
curl -LO https://storage.googleapis.com/minikube/releases/latest/minikube-linux-amd64
sudo install minikube-linux-amd64 /usr/local/bin/minikube && rm minikube-linux-amd64
sudo chmod 777 /var/run/docker.sock
minikube start - force - driver=docker
sudo snap install kubectl - classic
minikube status
minikube addons enable ingress
```

Execute the script

```
ubuntu@ip-172-31-25-166:~$ bash a.sh
```

i-0ff2969f268692ae4 (k8s)

You can see ingress is enabled

```
* ingress is an addon maintained by Kubernetes. For any concerns
You can view the list of minikube maintainers at: https://github
  - Using image registry.k8s.io/ingress-nginx/controller:v1.10.1
  - Using image registry.k8s.io/ingress-nginx/kube-webhook-certg
  - Using image registry.k8s.io/ingress-nginx/kube-webhook-certg
* Verifying ingress addon...
* The 'ingress' addon is enabled
ubuntu@ip-172-31-44-183:~$
```

i-04ed21340b555c1c7 (k8s1)

Check if kubernetes properly installed, if not re-enter the command

```
ubuntu@ip-172-31-44-183:~$ sudo snap install kubectl --classic
kubectl 1.30.4 from Canonical✓ installed
ubuntu@ip-172-31-44-183:~$
```

You can see node is installed

```
ubuntu@ip-172-31-44-183:~$ kubectl get nodes
NAME       STATUS   ROLES           AGE     VERSION
minikube   Ready    control-plane   5m31s   v1.30.0
ubuntu@ip-172-31-44-183:~$
```

Clone your repo

```
ubuntu@ip-172-31-44-183:~$ git clone https://github.com/hshar/website.git
Cloning into 'website'...
remote: Enumerating objects: 8, done.
remote: Total 8 (delta 0), reused 0 (delta 0), pack-reused 8 (from 1)
Receiving objects: 100% (8/8), 82.69 KiB | 20.67 MiB/s, done.
Resolving deltas: 100% (1/1), done.
ubuntu@ip-172-31-44-183:~$
```

Successfully cloned the project, go inside the website and create a Dockerfile

```
ubuntu@ip-172-31-44-183:~$ ls
a.sh  snap  website
ubuntu@ip-172-31-44-183:~$ cd website/
ubuntu@ip-172-31-44-183:~/website$ ls
images  index.html
ubuntu@ip-172-31-44-183:~/website$
```

Sudo nano Dockerfile

```
  GNU nano 7.2
FROM ubuntu
RUN apt-get update
RUN apt-get install apache2 -y
RUN apt-get install apache2-utils -y
RUN apt-get clean
ENTRYPOINT apachectl -D FOREGROUND
ADD . /var/www/html/
```

Run the below-given command to build an image from the Dockerfile:

```
ubuntu@ip-172-31-44-183:~/website$ sudo docker build -t img .
```

The image will be successfully created. Now run the below command to view the images in the website directory

```
ubuntu@ip-172-31-44-183:~/website$ docker images
REPOSITORY                    TAG       IMAGE ID       CREATED          SIZE
img                           latest    948795715c47   58 seconds ago   231MB
ubuntu                        latest    edbfe74c41f8   4 weeks ago      78.1MB
gcr.io/k8s-minikube/kicbase   v0.0.44   5a6e59a9bdc0   3 months ago     1.26GB
ubuntu@ip-172-31-44-183:~/website$
```

i-04ed21340b555c1c7 (k8s1)

this command will rename the image and create new out of it and run docker images to view the images

```
ubuntu@ip-172-31-44-183:~/website$ sudo docker tag img ruchithabtgowda/k8s-casestudy
ubuntu@ip-172-31-44-183:~/website$ docker images
REPOSITORY                      TAG       IMAGE ID       CREATED          SIZE
img                             latest    948795715c47   3 minutes ago    231MB
ruchithabtgowda/k8s-casestudy   latest    948795715c47   3 minutes ago    231MB
ubuntu                          latest    edbfe74c41f8   4 weeks ago      78.1MB
gcr.io/k8s-minikube/kicbase     v0.0.44   5a6e59a9bdc0   3 months ago     1.26GB
ubuntu@ip-172-31-44-183:~/website$
```

i-04ed21340b555c1c7 (k8s1)

To push the image to docker hub first login to docker using below command

```
ubuntu@ip-172-31-44-183:~/website$ docker login
Log in with your Docker ID or email address to push and pull images from Docker Hub. If you
 one.
You can log in with your password or a Personal Access Token (PAT). Using a limited-scope P
Learn more at https://docs.docker.com/go/access-tokens/

Username: ruchithabtgowda
Password:
WARNING! Your password will be stored unencrypted in /home/ubuntu/.docker/config.json.
Configure a credential helper to remove this warning. See
https://docs.docker.com/engine/reference/commandline/login/#credentials-store

Login Succeeded
ubuntu@ip-172-31-44-183:~/website$
```

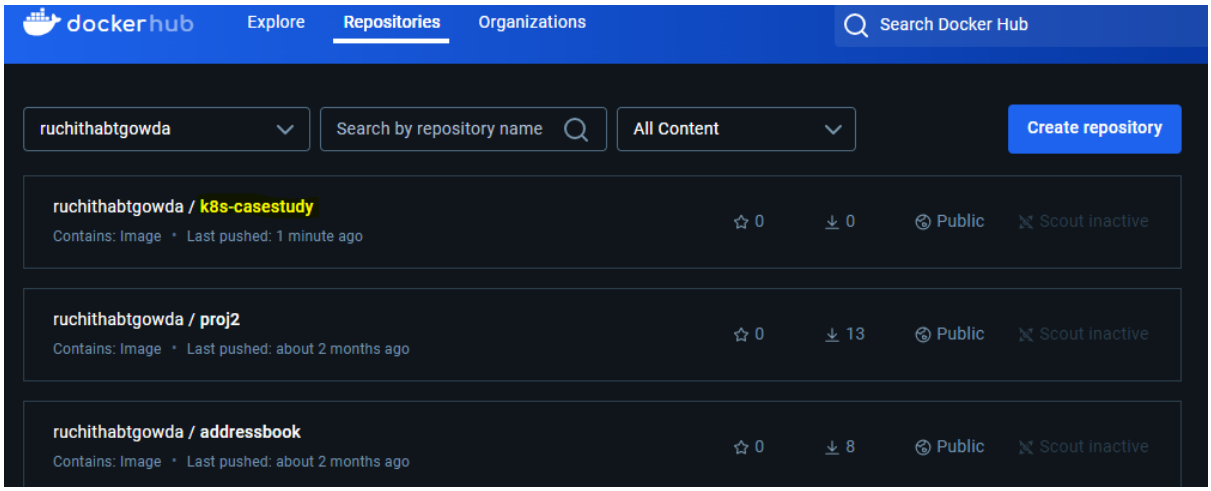
Use the below command to push the image to docker hub

```
ubuntu@ip-172-31-44-183:~/website$ docker push ruchithabtgowda/k8s-casestudy
Using default tag: latest
The push refers to repository [docker.io/ruchithabtgowda/k8s-casestudy]
2b9623bb7156: Pushed
22469224ce21: Pushed
3fd2364fdb57: Pushed
692b4a468249: Pushing [=========================>                          ]  56.96MB/113.3MB
4f9aac330f89: Pushing [=================================================>]  39.76MB
f36fd4bb7334: Waiting
```

Successfully pushed to docker hub

```
ubuntu@ip-172-31-44-183:~/website$ docker push ruchithabtgowda/k8s-casestudy
Using default tag: latest
The push refers to repository [docker.io/ruchithabtgowda/k8s-casestudy]
2b9623bb7156: Pushed
22469224ce21: Pushed
3fd2364fdb57: Pushed
692b4a468249: Pushed
4f9aac330f89: Pushed
f36fd4bb7334: Mounted from library/ubuntu
latest: digest: sha256:f6cc5d5da2ffa18e9435fe9f3e8bd170d6c17b1b46a26f280455862dfef3006c size: 1577
ubuntu@ip-172-31-44-183:~/website$
```

Go to your docker hub and you will find your image



Now we need to deploy the Custom Image with 2 Replicas:

First Run the below-given command to create the custom image with 2 replicas

```
kubectl create deployment custom --image=visaltyagi12/k8scasestudy --
replicas=2 --port=80
```

```
ubuntu@ip-172-31-44-183:~/website$ kubectl create deployment custom --image=ruchithabtgowda/k8s-casestudy --replicas=2 --port=80
deployment.apps/custom created
ubuntu@ip-172-31-44-183:~/website$
```

i-04ed21340b555c1c7 (k8s1)

A Custom Deployment will be created with Two Pods.
Run the below-given command to check how many deployments are present:

```
ubuntu@ip-172-31-44-183:~/website$ kubectl get deploy -o wide
NAME     READY   UP-TO-DATE   AVAILABLE   AGE   CONTAINERS      IMAGES                          SELECTOR
custom   2/2     2            2           65s   k8s-casestudy   ruchithabtgowda/k8s-casestudy   app=custom
ubuntu@ip-172-31-44-183:~/website$
```

Check the pods

```
ubuntu@ip-172-31-44-183:~/website$ kubectl get pods
NAME                      READY   STATUS    RESTARTS   AGE
custom-b5769bc85-7dhth    1/1     Running   0          93s
custom-b5769bc85-njgxn    1/1     Running   0          93s
ubuntu@ip-172-31-44-183:~/website$
```

Now we need to deploy the Apache2 with 2 Replicas
Run the below-given command to create the deployment with 2 replicas:

```
kubectl create deployment apache --image=ubuntu/apache2 --replicas=2 --
port=80
```

then check the pods available

```
ubuntu@ip-172-31-44-183:~/website$ kubectl create deployment apache --image=ubuntu/apache2 --replicas=2 --port=80
deployment.apps/apache created
ubuntu@ip-172-31-44-183:~/website$ kubectl get deploy -o wide
NAME     READY   UP-TO-DATE   AVAILABLE   AGE     CONTAINERS      IMAGES                          SELECTOR
apache   1/2     2            1           10s     apache2         ubuntu/apache2                  app=apache
custom   2/2     2            2           2m53s   k8s-casestudy   ruchithabtgowda/k8s-casestudy   app=custom
ubuntu@ip-172-31-44-183:~/website$ kubectl get pods
NAME                      READY   STATUS    RESTARTS   AGE
apache-5b9b5bff7c-js6pg   1/1     Running   0          19s
apache-5b9b5bff7c-vp42l   1/1     Running   0          19s
custom-b5769bc85-7dhth    1/1     Running   0          3m2s
custom-b5769bc85-njgxn    1/1     Running   0          3m2s
ubuntu@ip-172-31-44-183:~/website$
```

We need to deploy ingress with the following rules: -
a. */apache* should point to the Apache pods
b. */custom* should point to the GitHub application.

Expose Both the Replicas on NodePort for Creating a Service

```
ubuntu@ip-172-31-35-69:~/website$ kubectl expose deploy apache --type=NodePort
service/apache exposed
ubuntu@ip-172-31-35-69:~/website$ kubectl expose deploy custom --type=NodePort
service/custom exposed
ubuntu@ip-172-31-35-69:~/website$
```

i-021f0791e65df49fd (k8s)

PublicIPs: 47.128.223.5 PrivateIPs: 172.31.35.69

This command is used to find the services

```
ubuntu@ip-172-31-35-69:~/website$ kubectl get svc -o wide
NAME         TYPE        CLUSTER-IP      EXTERNAL-IP   PORT(S)        AGE   SELECTOR
apache       NodePort    10.96.95.7      <none>        80:32755/TCP   75s   app=apache
custom       NodePort    10.108.25.221   <none>        80:30443/TCP   37s   app=custom
kubernetes   ClusterIP   10.96.0.1       <none>        443/TCP        23m   <none>
ubuntu@ip-172-31-35-69:~/website$
```

i-021f0791e65df49fd (k8s)

PublicIPs: 47.128.223.5 PrivateIPs: 172.31.35.69

Create ingress.yml file

```
ubuntu@ip-172-31-35-69:~/website$ nano ingress.yml
ubuntu@ip-172-31-35-69:~/website$
```

i-021f0791e65df49fd (k8s)

PublicIPs: 47.128.223.5 PrivateIPs: 172.31.35.69

This is the command for Ingress file

```yaml
apiVersion: networking.k8s.io/v1
kind: Ingress
metadata:
  name: ingress
  annotations:
    nginx.ingress.kubernetes.io/rewrite-target: /
spec:
  ingressClassName: nginx
  rules:
  - http:
      paths:
      - path: /apache
        pathType: Prefix
        backend:
          service:
            name: apache
            port:
              number: 80
      - path: /custom
        pathType: Prefix
        backend:
          service:
            name: custom
            port:
              number: 80
```

```yaml
apiVersion: networking.k8s.io/v1
kind: Ingress
metadata:
  name: ingress
  annotations:
    nginx.ingress.kubernetes.io/rewrite-target: /
spec:
  ingressClassName: nginx
  rules:
  - http:
      paths:
      - path: /apache
        pathType: Prefix
        backend:
          service:
            name: apache
            port:
              number: 80
      - path: /custom
        pathType: Prefix
        backend:
          service:
            name: custom
```

Create an ingress.yml file

```
ubuntu@ip-172-31-44-183:~/website$ sudo nano ingress.yaml
ubuntu@ip-172-31-44-183:~/website$ kubectl create -f ingress.yaml
ingress.networking.k8s.io/ingress created
ubuntu@ip-172-31-44-183:~/website$
```

This command is used to view the Ingress

```
ubuntu@ip-172-31-44-183:~/website$ kubectl get ing
NAME      CLASS   HOSTS   ADDRESS         PORTS   AGE
ingress   nginx   *       192.168.49.2    80      31s
ubuntu@ip-172-31-44-183:~/website$
```

Run th following command

```
kubectl port-forward service/ingress-nginx-controller -n ingress-nginx --
address 0.0.0.0 :443
```

Ip address following with the port number