Assignment 1 :: Write a step by step process to create kubernetes kind cluster. Also write process to containerize any sample application. Steps to deploy that application on kind cluster.

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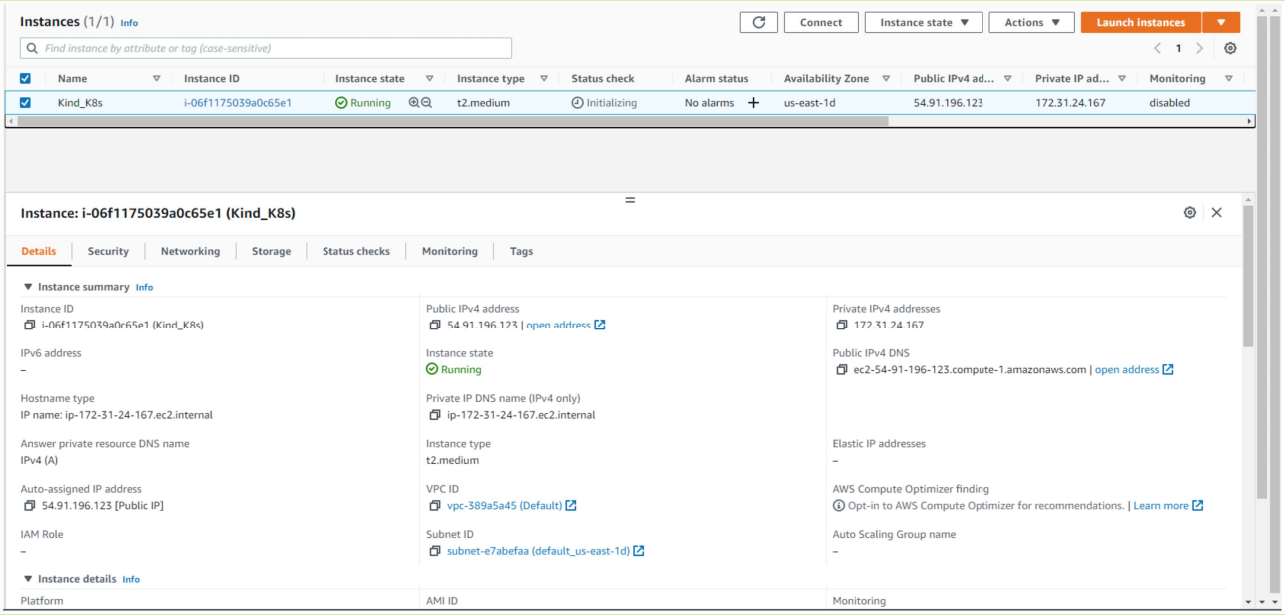
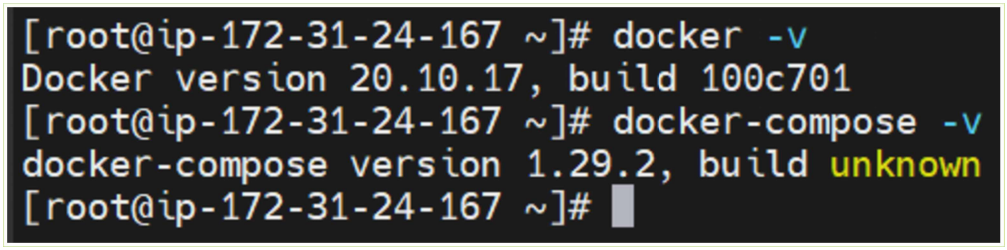
Step 1 :: Create an instance with t2.medium and storage 60 GB



Step 2 :: Install Docker and Docker-Compose

yum update
yum install -y docker
yum install -y python3-pip
pip3 install docker-compose
systemctl enable docker.service
systemctl start docker.service
systemctl status docker.service
docker -v
docker-compose -v



Step 3 :: Install Kubectl

curl -o kubectl https://s3.us-west-2.amazonaws.com/amazon-eks/1.23.7/2022-06-29/bin/linux/amd64/kubectl
curl -o kubectl.sha256 https://s3.us-west-2.amazonaws.com/amazon-eks/1.23.7/2022-06-29/bin/linux/amd64/kubectl.sha256

openssl sha1 -sha256 kubectl
chmod +x ./kubectl
mkdir -p $HOME/bin && cp ./kubectl $HOME/bin/kubectl && export PATH=$PATH:$HOME/bin
echo 'export PATH=$PATH:$HOME/bin' >> ~/.bashrc
kubectl version --short --client

```
[root@ip-172-31-24-167 ~]# kubectl version --short --client
Client Version: v1.23.7-eks-4721010
[root@ip-172-31-24-167 ~]#
```

Step 4 :: Install Kind

curl -Lo ./kind https://kind.sigs.k8s.io/dl/v0.15.0/kind-linux-amd64
chmod +x ./kind
mv ./kind /usr/local/bin/kind
kind version

```
[root@ip-172-31-24-167 ~]# kind version
kind v0.15.0 go1.19 linux/amd64
[root@ip-172-31-24-167 ~]#
```

Step 5 :: Create a cluster using Kind

vi kind-config.yaml

kind: Cluster
apiVersion: kind.x-k8s.io/v1alpha4
nodes:
- role: control-plane
- role: worker
- role: worker
- role: worker

kind create cluster --config kind-config.yaml --name=assignment-1a

```
[root@ip-172-31-24-167 ~]# kind create cluster --config kind-config.yaml --name=assignment-1a
Creating cluster "assignment-1a" ...
 ✓ Ensuring node image (kindest/node:v1.25.0)
 ✓ Preparing nodes
 ✓ Writing configuration
 ✓ Starting control-plane
 ✓ Installing CNI
 ✓ Installing StorageClass
 ✓ Joining worker nodes
Set kubectl context to "kind-assignment-1a"
You can now use your cluster with:

kubectl cluster-info --context kind-assignment-1a

Have a question, bug, or feature request? Let us know! https://kind.sigs.k8s.io/#community
[root@ip-172-31-24-167 ~]#
```

kubectl get all
kubectl get node -o wide

```
[root@ip-172-31-24-167 ~]# kubectl get all
NAME                 TYPE        CLUSTER-IP   EXTERNAL-IP   PORT(S)   AGE
service/kubernetes   ClusterIP   10.96.0.1    <none>        443/TCP   62s
[root@ip-172-31-24-167 ~]# kubectl get node -o wide
NAME                          STATUS   ROLES           AGE   VERSION   INTERNAL-IP    EXTERNAL-IP   OS-IMAGE             KERNEL-VERSION                  CONTAINER-RUNTIME
assignment-1a-control-plane   Ready    control-plane   68s   v1.25.0   172.18.0.2     <none>        Ubuntu 22.04.1 LTS   5.10.135-122.509.amzn2.x86_64   containerd://1.6.7
assignment-1a-worker          Ready    <none>          34s   v1.25.0   172.18.0.3     <none>        Ubuntu 22.04.1 LTS   5.10.135-122.509.amzn2.x86_64   containerd://1.6.7
assignment-1a-worker2         Ready    <none>          34s   v1.25.0   172.18.0.5     <none>        Ubuntu 22.04.1 LTS   5.10.135-122.509.amzn2.x86_64   containerd://1.6.7
assignment-1a-worker3         Ready    <none>          34s   v1.25.0   172.18.0.4     <none>        Ubuntu 22.04.1 LTS   5.10.135-122.509.amzn2.x86_64   containerd://1.6.7
[root@ip-172-31-24-167 ~]#
```

docker ps -a

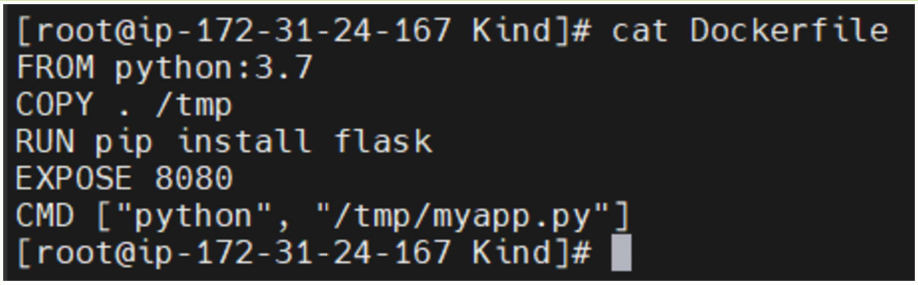
```
[root@ip-172-31-24-167 ~]# docker ps -a
CONTAINER ID   IMAGE                  COMMAND                  CREATED         STATUS         PORTS                       NAMES
9b7b65cf1889   kindest/node:v1.25.0   "/usr/local/bin/entr…"   2 minutes ago   Up 2 minutes                               assignment-1a-worker
e8588eae5cd4   kindest/node:v1.25.0   "/usr/local/bin/entr…"   2 minutes ago   Up 2 minutes                               assignment-1a-worker2
0167e5e43811   kindest/node:v1.25.0   "/usr/local/bin/entr…"   2 minutes ago   Up 2 minutes                               assignment-1a-worker3
7177e46c486d   kindest/node:v1.25.0   "/usr/local/bin/entr…"   2 minutes ago   Up 2 minutes   127.0.0.1:37743->6443/tcp   assignment-1a-control-plane
[root@ip-172-31-24-167 ~]#
```

Step 6 :: Creating a sample application using dockerfile

Step 6.1 :: Create a docker file

vi Dockerfile

```
FROM python:3.7
COPY . /tmp
RUN pip install flask
EXPOSE 8080
CMD ["python", "/tmp/myapp.py"]
```



Step 6.2 :: Placing the necessary scripts

Create myapp.py where the Dockerfile is available

vi myapp.py

```
from flask import Flask
import os
app = Flask(__name__)
@app.route('/')
def hello():
    return('Hello from container..\n')
if __name__ == '__main__':
    app.run(host='0.0.0.0', port=8080, debug=True)
```

Step 6.3 :: Creation and pushing an image to docker hub

docker build -t webapp .

```
[root@ip-172-31-24-167 ~]# docker build -t webapp .
Sending build context to Docker daemon  102.5MB
Step 1/5 : FROM python:3.7
3.7: Pulling from library/python
23858da423a6: Pull complete
326f452ade5c: Pull complete
a42821cd14fb: Pull complete
8471b75885ef: Pull complete
8ffa7aaef404: Pull complete
15132af73342: Pull complete
a81a13cb42bc: Pull complete
39baa166dda6: Pull complete
28d172f530ba: Pull complete
Digest: sha256:2341ac5eedd71f1e6481afe854af572f5ec1b78fa3aea2293dba65942108e663
Status: Downloaded newer image for python:3.7
 ---> 7d2ecbd72983
Step 2/5 : COPY . /tmp
 ---> 08fe6245fe29
Step 3/5 : RUN pip install flask
 ---> Running in 162d6d2cbc65
Collecting flask
  Downloading Flask-2.2.2-py3-none-any.whl (101 kB)
     ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 101.5/101.5 KB 11.0 MB/s eta 0:00:00
Collecting Jinja2>=3.0
  Downloading Jinja2-3.1.2-py3-none-any.whl (133 kB)
     ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 133.1/133.1 KB 24.9 MB/s eta 0:00:00
Collecting click>=8.0
  Downloading click-8.1.3-py3-none-any.whl (96 kB)
     ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 96.6/96.6 KB 20.7 MB/s eta 0:00:00
Collecting Werkzeug>=2.2.2
  Downloading Werkzeug-2.2.2-py3-none-any.whl (232 kB)
     ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 232.7/232.7 KB 36.1 MB/s eta 0:00:00
Collecting itsdangerous>=2.0
  Downloading itsdangerous-2.1.2-py3-none-any.whl (15 kB)
Collecting importlib-metadata>=3.6.0
  Downloading importlib_metadata-5.0.0-py3-none-any.whl (21 kB)
Collecting typing-extensions>=3.6.4
  Downloading typing_extensions-4.3.0-py3-none-any.whl (25 kB)
Collecting zipp>=0.5
  Downloading zipp-3.8.1-py3-none-any.whl (5.6 kB)
Collecting MarkupSafe>=2.0
  Downloading MarkupSafe-2.1.1-cp37-cp37m-manylinux_2_17_x86_64.manylinux2014_x86_64.whl (25 kB)
Installing collected packages: zipp, typing-extensions, MarkupSafe, itsdangerous, Werkzeug, Jinja2, importlib-metadata, click, flask
Successfully installed Jinja2-3.1.2 MarkupSafe-2.1.1 Werkzeug-2.2.2 click-8.1.3 flask-2.2.2 importlib-metadata-5.0.0 itsdangerous-2.1.2 typing-extensi
ons-4.3.0 zipp-3.8.1
WARNING: Running pip as the 'root' user can result in broken permissions and conflicting behaviour with the system package manager. It is recommended
to use a virtual environment instead: https://pip.pypa.io/warnings/venv
WARNING: You are using pip version 22.0.4; however, version 22.2.2 is available.
You should consider upgrading via the '/usr/local/bin/python -m pip install --upgrade pip' command.
Removing intermediate container 162d6d2cbc65
 ---> 49ee7b2c06dd
Step 4/5 : EXPOSE 8080
 ---> Running in bffa573844f0
Removing intermediate container bffa573844f0
 ---> 7e3cc1674ffc
Step 5/5 : CMD ["python", "/tmp/myapp.py"]
 ---> Running in edf2a017dbca
Removing intermediate container edf2a017dbca
 ---> 2a494d267023
Successfully built 2a494d267023
Successfully tagged webapp:latest
[root@ip-172-31-24-167 ~]#
```

docker images

```
[root@ip-172-31-24-167 Kind]# docker images
REPOSITORY     TAG       IMAGE ID       CREATED          SIZE
webapp         latest    c7a91035a38e   6 seconds ago    918MB
python         3.7       7d2ecbd72983   2 weeks ago      907MB
kindest/node   <none>    d3da246e125a   4 weeks ago      870MB
[root@ip-172-31-24-167 Kind]#
```

Push the image to docker hub

docker login

Enter username and password of docker hub

docker tag <image-id> hariharan410/webapp:latest

docker push hariharan410/webapp:latest

Step 7 :: Deploy the application in Kind Cluster

kubectl run mywebapp --image=hariharan410/webapp --restart=Never --dry-run=client -o yaml > web-app.yaml

cat web-app.yaml

```
[root@ip-172-31-24-167 Kind]# cat web-app.yaml
apiVersion: v1
kind: Pod
metadata:
  creationTimestamp: null
  labels:
    run: mywebapp
  name: mywebapp
spec:
  containers:
  - image: hariharan410/webapp
    name: mywebapp
    resources: {}
  dnsPolicy: ClusterFirst
  restartPolicy: Never
status: {}
```

kubectl apply -f web-app.yaml

```
[root@ip-172-31-24-167 Kind]# kubectl run mywebapp --image=hariharan410/webapp --restart=Never --dry-run=client -o yaml > web-app.yaml
[root@ip-172-31-24-167 Kind]# cat web-app.yaml
apiVersion: v1
kind: Pod
metadata:
  creationTimestamp: null
  labels:
    run: mywebapp
  name: mywebapp
spec:
  containers:
  - image: hariharan410/webapp
    name: mywebapp
    resources: {}
  dnsPolicy: ClusterFirst
  restartPolicy: Never
status: {}
[root@ip-172-31-24-167 Kind]# kubectl apply -f web-app.yaml
pod/mywebapp created
[root@ip-172-31-24-167 Kind]# kubectl get pod -o wide
NAME       READY   STATUS              RESTARTS   AGE   IP       NODE                  NOMINATED NODE   READINESS GATES
mywebapp   0/1     ContainerCreating   0          10s   <none>   assignment-1a-worker   <none>           <none>
[root@ip-172-31-24-167 Kind]#
```

kubectl get pod -o wide

```
[root@ip-172-31-24-167 Kind]# kubectl get pod -o wide
NAME       READY   STATUS    RESTARTS   AGE    IP           NODE                  NOMINATED NODE   READINESS GATES
mywebapp   1/1     Running   0          117s   10.244.3.3   assignment-1a-worker   <none>           <none>
[root@ip-172-31-24-167 Kind]#
```

kubectl expose pod mywebapp --type=NodePort --port=8080 --name webservice

```
[root@ip-172-31-24-167 Kind]# kubectl expose pod mywebapp --type=NodePort --port=8080 --name webservice
service/webservice exposed
```

kubectl get all -o wide

```
[root@ip-172-31-24-167 Kind]# kubectl get all -o wide
NAME           READY   STATUS    RESTARTS   AGE     IP           NODE                   NOMINATED NODE   READINESS GATES
pod/mywebapp   1/1     Running   0          4m48s   10.244.3.3   assignment-1a-worker   <none>           <none>

NAME                 TYPE        CLUSTER-IP     EXTERNAL-IP   PORT(S)          AGE   SELECTOR
service/kubernetes   ClusterIP   10.96.0.1      <none>        443/TCP          73m   <none>
service/webservice   NodePort    10.96.61.93    <none>        8080:30672/TCP   96s   run=mywebapp
[root@ip-172-31-24-167 Kind]#
```

Step 8 :: Result

kubectl get all -o wide
kubectl get node -o wide
curl 172.18.0.3:30672

```
[root@ip-172-31-24-167 Kind]# kubectl get all -o wide
NAME           READY   STATUS    RESTARTS   AGE     IP           NODE                   NOMINATED NODE   READINESS GATES
pod/mywebapp   1/1     Running   0          6m38s   10.244.3.3   assignment-1a-worker   <none>           <none>

NAME                 TYPE        CLUSTER-IP     EXTERNAL-IP   PORT(S)          AGE     SELECTOR
service/kubernetes   ClusterIP   10.96.0.1      <none>        443/TCP          75m     <none>
service/webservice   NodePort    10.96.61.93    <none>        8080:30672/TCP   3m26s   run=mywebapp
[root@ip-172-31-24-167 Kind]#
[root@ip-172-31-24-167 Kind]# kubectl get node -o wide
NAME                                STATUS   ROLES           AGE   VERSION   INTERNAL-IP   EXTERNAL-IP   OS-IMAGE             KERNEL-VERSION                  CONTAINER-RUNTIME
assignment-1a-control-plane         Ready    control-plane   75m   v1.25.0   172.18.0.2    <none>        Ubuntu 22.04.1 LTS   5.10.135-122.509.amzn2.x86_64   containerd://1.6.7
assignment-1a-worker                Ready    <none>          75m   v1.25.0   172.18.0.3    <none>        Ubuntu 22.04.1 LTS   5.10.135-122.509.amzn2.x86_64   containerd://1.6.7
assignment-1a-worker2               Ready    <none>          75m   v1.25.0   172.18.0.5    <none>        Ubuntu 22.04.1 LTS   5.10.135-122.509.amzn2.x86_64   containerd://1.6.7
assignment-1a-worker3               Ready    <none>          75m   v1.25.0   172.18.0.4    <none>        Ubuntu 22.04.1 LTS   5.10.135-122.509.amzn2.x86_64   containerd://1.6.7
[root@ip-172-31-24-167 Kind]#
[root@ip-172-31-24-167 Kind]# curl 172.18.0.3:30672
Hello from container..
[root@ip-172-31-24-167 Kind]#
```