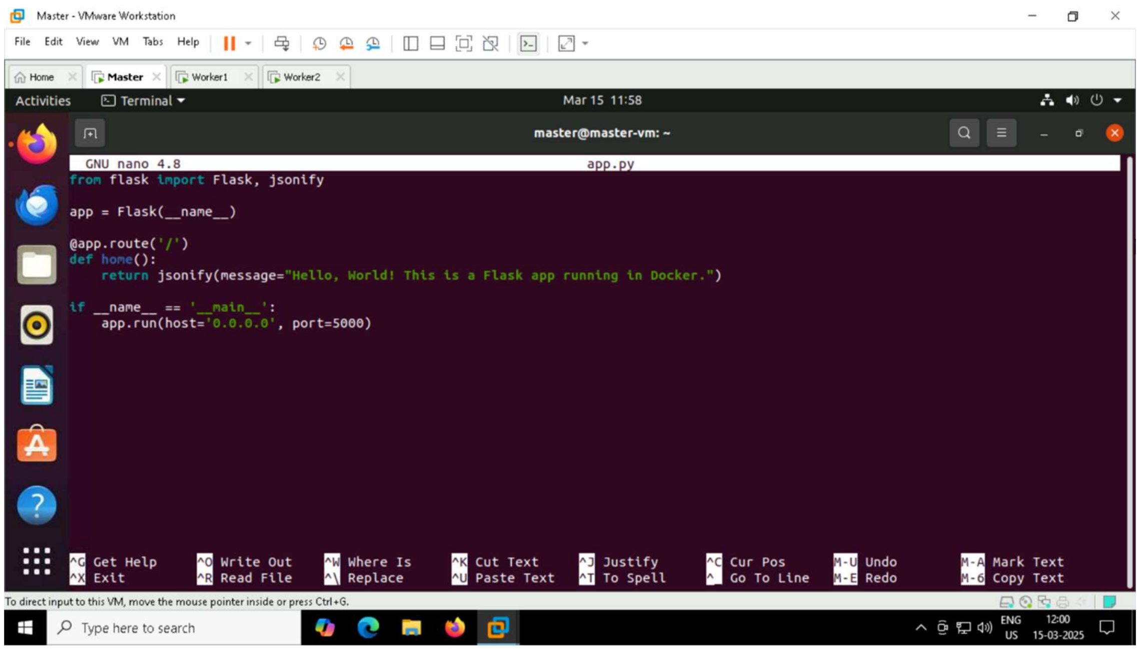
Kubernetes Project 1

Deploying a Flask Application on Kubernetes with Auto-Scaling

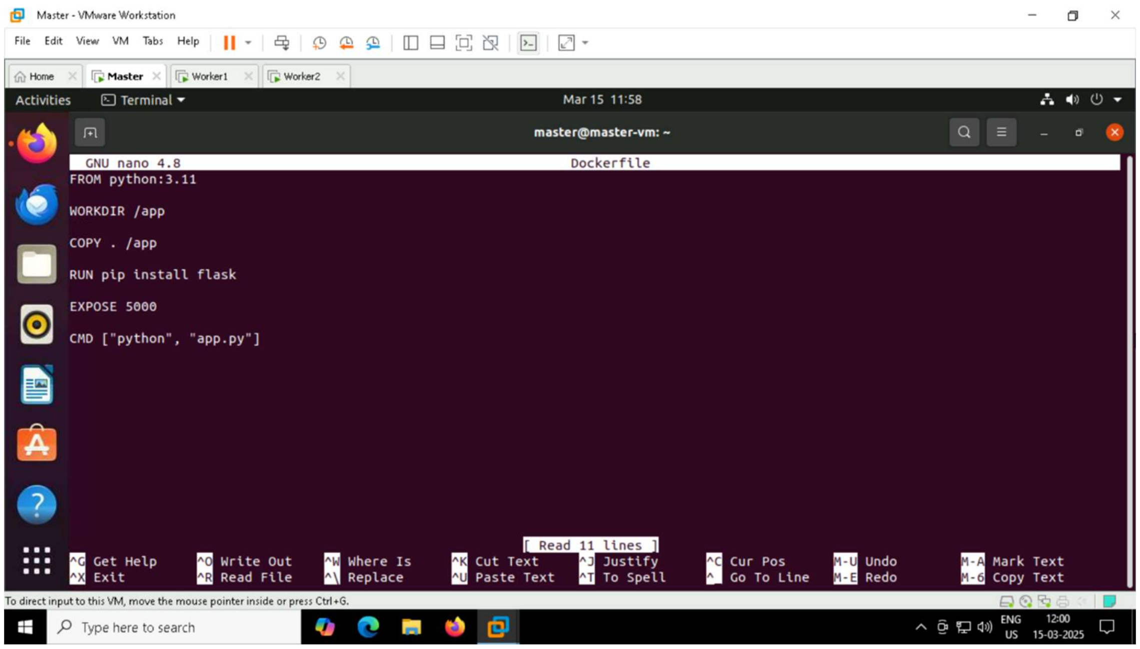
Step 1: Building and Containerizing the Flask Application

- Flask Application (app.py)



```
from flask import Flask, jsonify

app = Flask(__name__)

@app.route('/')
def home():
    return jsonify(message="Hello, World! This is a Flask app running in Docker.")

if __name__ == '__main__':
    app.run(host='0.0.0.0', port=5000)
```

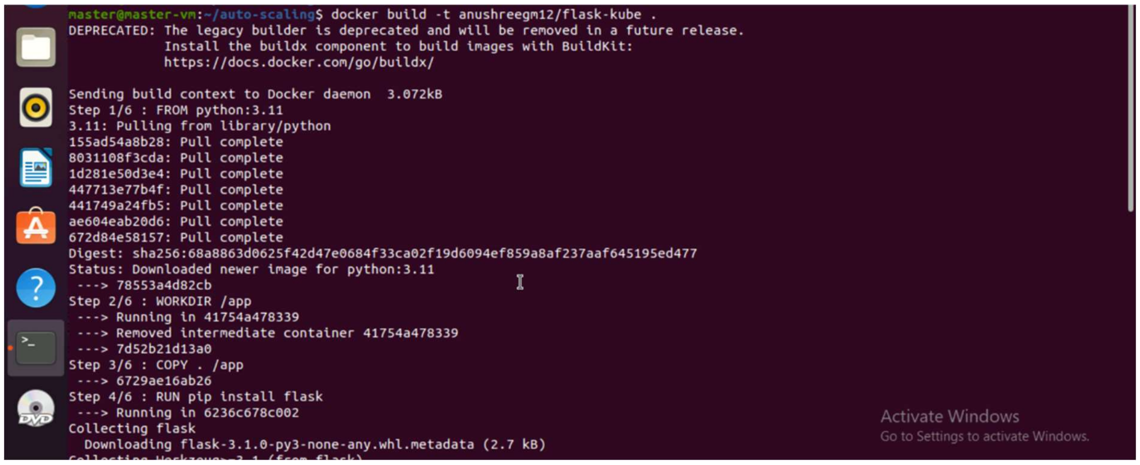
- Create a Dockerfile



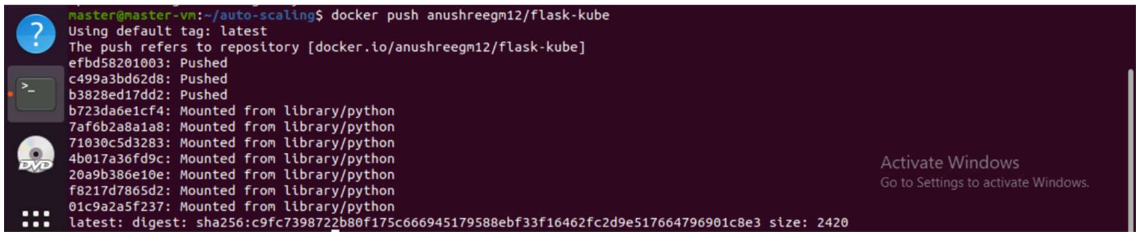
```
FROM python:3.11

WORKDIR /app

COPY . /app

RUN pip install flask

EXPOSE 5000

CMD ["python", "app.py"]
```

Step 2: Build and Push the Image

- docker build -t anushreegm12/flask-kube .
- docker push anushreegm12/flask-kube



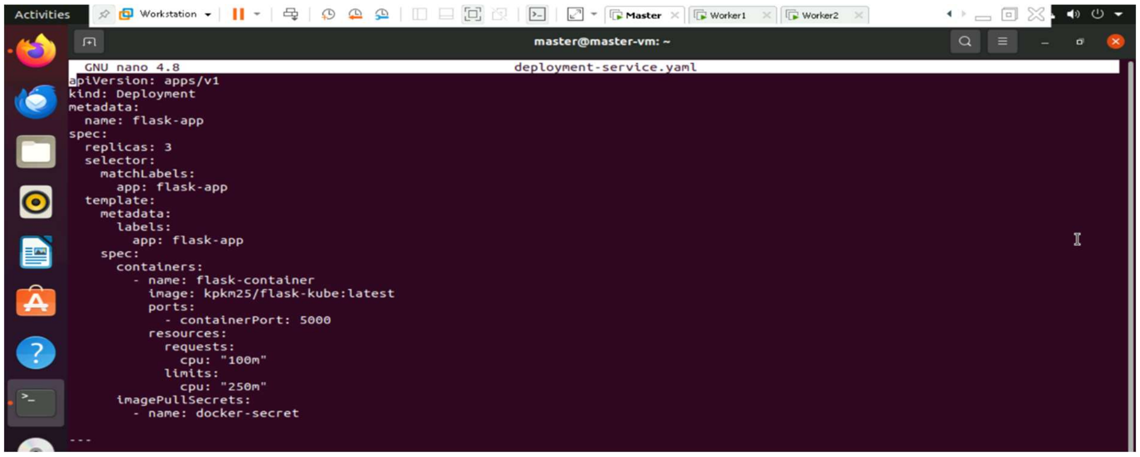
```
master@master-vm:~/auto-scaling$ docker build -t anushreegm12/flask-kube .
DEPRECATED: The legacy builder is deprecated and will be removed in a future release.
            Install the buildx component to build images with BuildKit:
            https://docs.docker.com/go/buildx/

Sending build context to Docker daemon  3.072kB
Step 1/6 : FROM python:3.11
3.11: Pulling from library/python
155ad54a8b28: Pull complete
8031108f3cda: Pull complete
1d281e50d3e4: Pull complete
447713e77b4f: Pull complete
441749a24fb5: Pull complete
ae604eab20d6: Pull complete
672d84e58157: Pull complete
Digest: sha256:68a8863d0625f42d47e0684f33ca02f19d6094ef859a8af237aaf645195ed477
Status: Downloaded newer image for python:3.11
 ---> 78553a4d82cb
Step 2/6 : WORKDIR /app
 ---> Running in 41754a478339
 ---> Removed intermediate container 41754a478339
 ---> 7d52b21d13a0
Step 3/6 : COPY . /app
 ---> 6729ae16ab26
Step 4/6 : RUN pip install flask
 ---> Running in 6236c678c002
Collecting flask
  Downloading flask-3.1.0-py3-none-any.whl.metadata (2.7 kB)
```



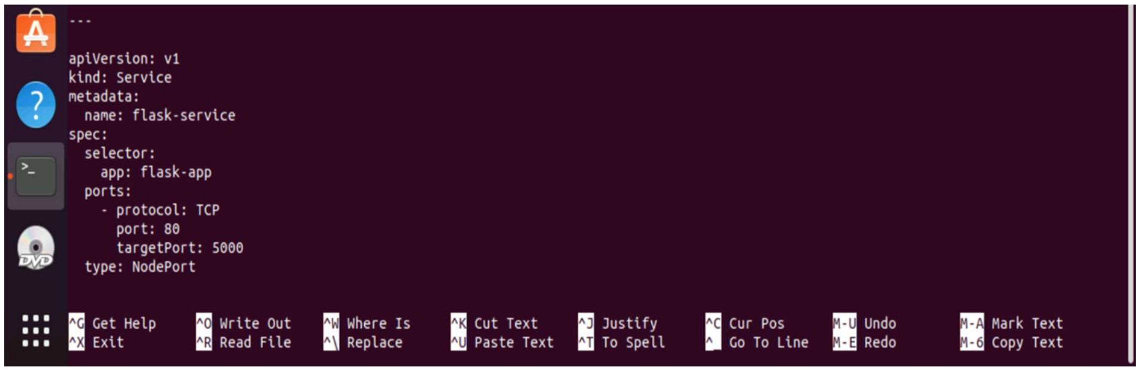
```
master@master-vm:~/auto-scaling$ docker push anushreegm12/flask-kube
Using default tag: latest
The push refers to repository [docker.io/anushreegm12/flask-kube]
efbd58201003: Pushed
c499a3bd62d8: Pushed
b3828ed17dd2: Pushed
b723da6e1cf4: Mounted from library/python
7af6b2a8a1a8: Mounted from library/python
71030c5d3283: Mounted from library/python
4b017a36fd9c: Mounted from library/python
20a9b386e10e: Mounted from library/python
f8217d7865d2: Mounted from library/python
01c9a2a5f237: Mounted from library/python
latest: digest: sha256:c9fc7398722b80f175c666945179588ebf33f16462fc2d9e517664796901c8e3 size: 2420
```

Step 3: Deploying Flask App on Kubernetes

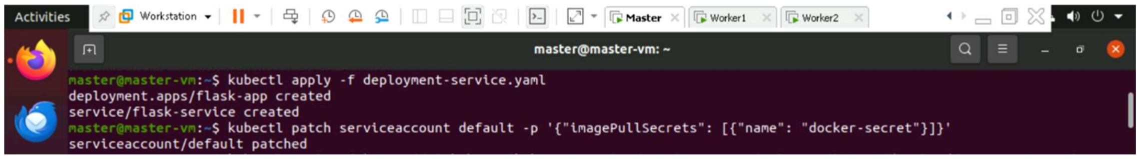
- Create Deployment & Service YAML (deployment-service.yaml)



```
  GNU nano 4.8                          deployment-service.yaml
apiVersion: apps/v1
kind: Deployment
metadata:
  name: flask-app
spec:
  replicas: 3
  selector:
    matchLabels:
      app: flask-app
  template:
    metadata:
      labels:
        app: flask-app
    spec:
      containers:
        - name: flask-container
          image: kpkm25/flask-kube:latest
          ports:
            - containerPort: 5000
          resources:
            requests:
              cpu: "100m"
            limits:
              cpu: "250m"
      imagePullSecrets:
        - name: docker-secret

---
```

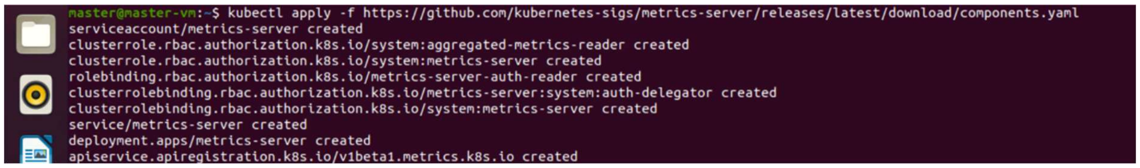

```
---

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

- Apply Deployment
- Patch Default Service Account



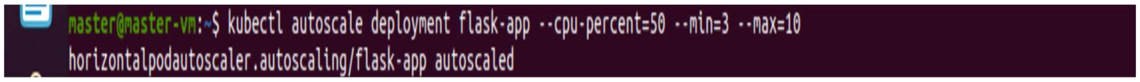
```
master@master-vm:~$ kubectl apply -f deployment-service.yaml
deployment.apps/flask-app created
service/flask-service created
master@master-vm:~$ kubectl patch serviceaccount default -p '{"imagePullSecrets": [{"name": "docker-secret"}]}'
serviceaccount/default patched
```

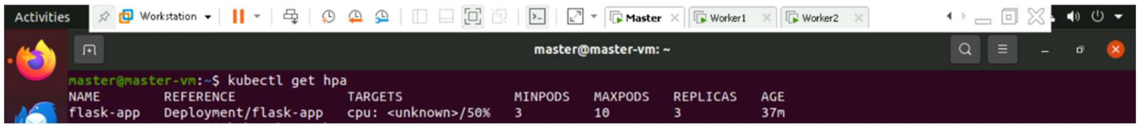
Step 4: Installing and Troubleshooting Metrics Server


```
master@master-vm:~$ kubectl apply -f https://github.com/kubernetes-sigs/metrics-server/releases/latest/download/components.yaml
serviceaccount/metrics-server created
clusterrole.rbac.authorization.k8s.io/system:aggregated-metrics-reader created
clusterrole.rbac.authorization.k8s.io/system:metrics-server created
rolebinding.rbac.authorization.k8s.io/metrics-server-auth-reader created
clusterrolebinding.rbac.authorization.k8s.io/metrics-server:system:auth-delegator created
clusterrolebinding.rbac.authorization.k8s.io/system:metrics-server created
service/metrics-server created
deployment.apps/metrics-server created
apiservice.apiregistration.k8s.io/v1beta1.metrics.k8s.io created
```

Step 5: Enabling HPA (Horizontal Pod Autoscaler)

- kubectl autoscale deployment flask-app --cpu-percent=50 --min=3 --max=10
- kubectl get hpa

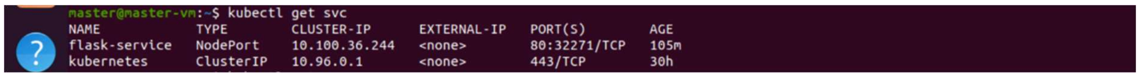

```
master@master-vm:~$ kubectl autoscale deployment flask-app --cpu-percent=50 --min=3 --max=10
horizontalpodautoscaler.autoscaling/flask-app autoscaled
```



```
master@master-vm:~$ kubectl get hpa
NAME        REFERENCE              TARGETS            MINPODS   MAXPODS   REPLICAS   AGE
flask-app   Deployment/flask-app   cpu: <unknown>/50%   3         10        3          37m
```

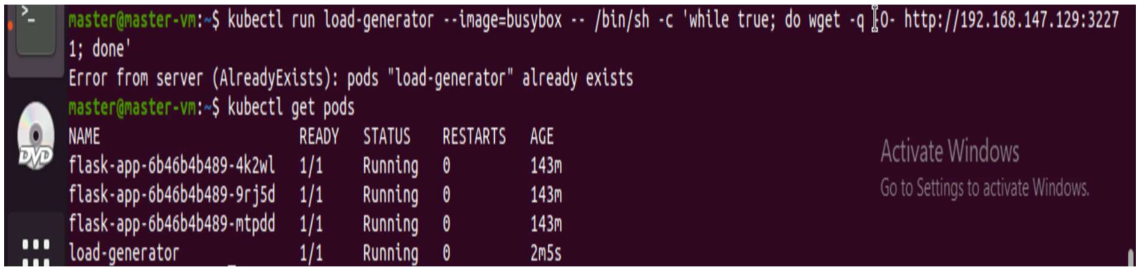
Step 6: Finding NodePort and Testing External Access

- kubectl get svc

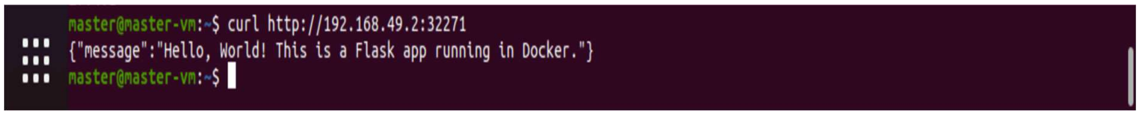

```
master@master-vm:~$ kubectl get svc
NAME            TYPE        CLUSTER-IP      EXTERNAL-IP   PORT(S)        AGE
flask-service   NodePort    10.100.36.244   <none>        80:32271/TCP   105m
kubernetes      ClusterIP   10.96.0.1       <none>        443/TCP        30h
```

Step 7: Simulating Load for HPA

- kubectl run -it --rm load-generator --image=busybox -- /bin/sh
- while true; do wget -q -O- http://192.168.147.129:32271; done
- kubectl get pods

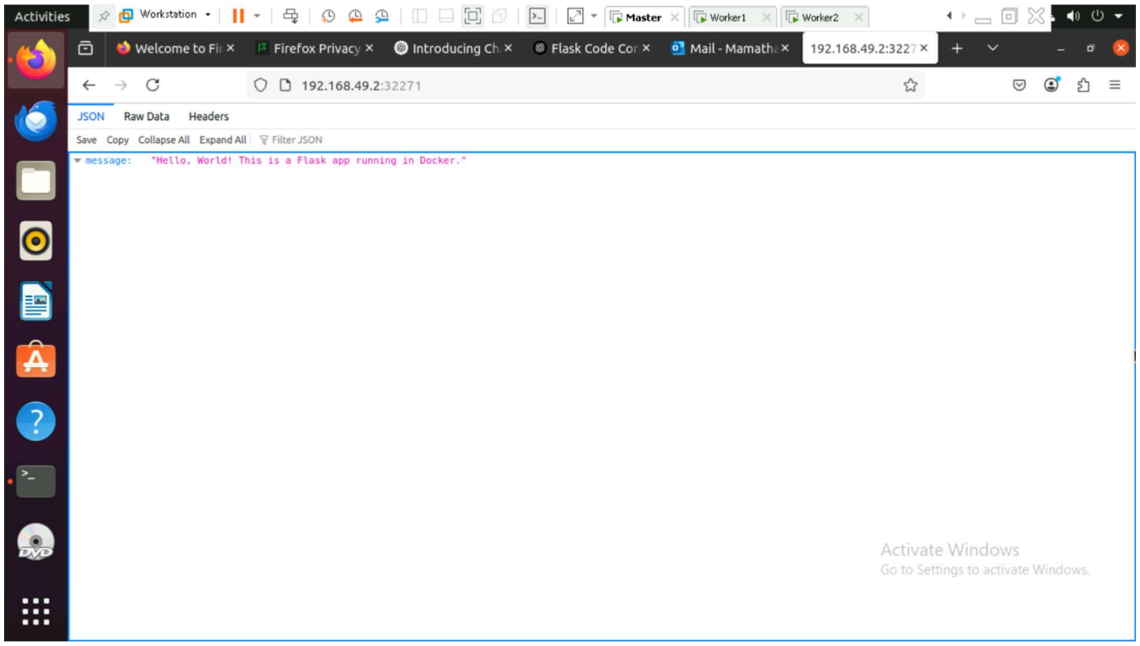


```
master@master-vm:~$ kubectl run load-generator --image=busybox -- /bin/sh -c 'while true; do wget -q -O- http://192.168.147.129:32271; done'
Error from server (AlreadyExists): pods "load-generator" already exists
master@master-vm:~$ kubectl get pods
NAME                          READY   STATUS    RESTARTS   AGE
flask-app-6b46b4b489-4k2wl    1/1     Running   0          143m
flask-app-6b46b4b489-9rj5d    1/1     Running   0          143m
flask-app-6b46b4b489-mtpdd    1/1     Running   0          143m
load-generator                1/1     Running   0          2m5s
```



```
master@master-vm:~$ curl http://192.168.49.2:32271
{"message":"Hello, World! This is a Flask app running in Docker."}
master@master-vm:~$
```

Step 8: View the json output in the browser by entering the IP address



```
message:   "Hello, World! This is a Flask app running in Docker."
```