

Kubernetes Project-1 Deploying a Flask Application on Kubernetes with Auto-Scaling & Load Testing

STEP-1. Building & Containerizing the Flask Application

```
Activities Workstation Master Worker1 Worker2
master@master-vm: ~/Desktop/flask-kube

Reinitialized existing Git repository in /home/naster/Desktop/flask-kube/.git/
master@master-vm:~/Desktop/flask-kube$ ls
app.py deployment-service.yaml Dockerfile README.md requirements.txt
master@master-vm:~/Desktop/flask-kube$ git clone https://github.com/Bhargavakulla/flask-kube.git
Cloning into 'flask-kube'...
remote: Enumerating objects: 15, done.
remote: Counting objects: 100% (15/15), done.
remote: Compressing objects: 100% (12/12), done.
remote: Total 15 (delta 3), reused 0 (delta 0), pack-reused 0 (from 0)
Unpacking objects: 100% (15/15), 5.17 KiB | 529.00 KiB/s, done.
master@master-vm:~/Desktop/flask-kube$ docker build -t bhargavakulla/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 159.2kB
Step 1/7 : 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 2/7 : WORKDIR /app
--> Running in d55b712c6e05
--> Removed intermediate container d55b712c6e05
--> bfc2879be1f3
Step 3/7 : COPY . /app
--> cfb89a59692d
Step 4/7 : RUN pip install --no-cache-dir -r requirements.txt
--> Running in 72e28ef54e90
```

STEP-2. Deploying Flask App on Kubernetes

```
Using default tag: latest
The push refers to repository [docker.io/bhargavakulla/flask-kube]
ed2d2de7e13d: Pushed
a4e99a22ba81: Pushed
ff84030030d9: 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:c1654c6c11816344e2656ed12cde2f737465c81dc39ac3eb895a14bc0e52a8a8 size: 2422
master@master-vm:~/Desktop/flask-kube$ kubectl apply -f deployment-service.yaml
deployment.apps/flask-app created
service/flask-service created
```

STEP-3. Fixing Docker Hub Rate Limits (Authentication Issue)

```
master@master-vm:~/Desktop/flask-kube$ kubectl create secret docker-registry docker-secret \
> --docker-server=https://index.docker.io/v1/ \
> --docker-username=bhargavakulla \
> --docker-password=Bharu@12345 \
> --docker-email=bhargavaramcloud@gmail.com
secret/docker-secret created
```

STEP-4. Installing & Troubleshooting Metrics Server

```

master@master-vm:~/Desktop/flask-kube$ kubectl patch serviceaccount default -p '{"imagePullSecrets": [{"name": "docker-secret"}]}'
serviceaccount/default patched
master@master-vm:~/Desktop/flask-kube$ 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
master@master-vm:~/Desktop/flask-kube$

```

STEP-5. Enabling HPA (Horizontal Pod Autoscaler)

```

master@master-vm:~/Desktop/flask-kube$ kubectl autoscale deployment flask-app --cpu-percent=50 --min=3 --max=10
horizontalpodautoscaler.autoscaling/flask-app autoscaled
master@master-vm:~/Desktop/flask-kube$ kubectl get hpa
NAME          REFERENCE          TARGETS          MINPODS   MAXPODS   REPLICAS   AGE
flask-app     Deployment/flask-app  cpu: <unknown>/50%  3         10        0          3s
master@master-vm:~/Desktop/Flask-kube$ kubectl run -it --rm busybox --image=busybox -- /bin/sh
If you don't see a command prompt, try pressing enter.
/ #
/ # ls
bin    dev    etc    home  lib    lib64  proc   root   sys    tmp    usr    var
/ # pwd
/
/ # echo "hi bhargav"
hi bhargav
/ # exit
Session ended, resume using 'kubectl attach busybox -c busybox -l -t' command when the pod is running
pod "busybox" deleted
master@master-vm:~/Desktop/flask-kube$

```

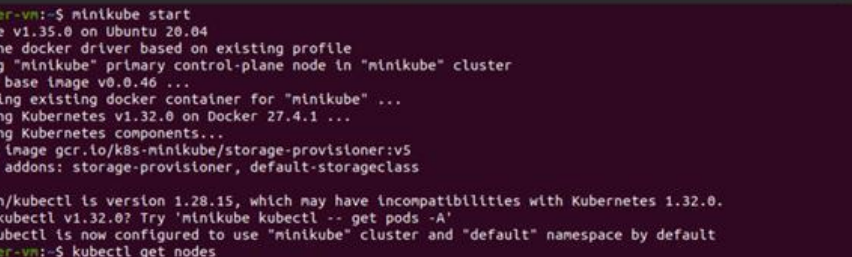
STEP-6. Load Testing & Debugging NodePort Issues

```

master@master-vm:~/Desktop/flask-kube$ wget -q -O- http://10.97.210.48:80
master@master-vm:~/Desktop/flask-kube$ kubectl get svc flask-service
NAME            TYPE        CLUSTER-IP      EXTERNAL-IP  PORT(S)          AGE
flask-service   NodePort    10.106.68.34    <none>       80:32665/TCP     25m

```

STEP-7. Simulating Load for HPA



```

master@master-vm:~$ minikube start
minikube v1.35.0 on Ubuntu 20.04
Using the docker driver based on existing profile
Starting "minikube" primary control-plane node in "minikube" cluster
Pulling base image v0.0.46 ...
Restarting existing docker container for "minikube" ...
Preparing Kubernetes v1.32.0 on Docker 27.4.1 ...
Verifying Kubernetes components...
  ■ Using image gcr.io/k8s-minikube/storage-provisioner:v5
  ★ Enabled addons: storage-provisioner, default-storageclass

! /usr/bin/kubectctl is version 1.28.15, which may have incompatibilities with Kubernetes 1.32.0.
  ■ Want kubectctl v1.32.0? Try 'minikube kubectctl -- get pods -A'
Done! kubectctl is now configured to use "minikube" cluster and "default" namespace by default

master@master-vm:~$ kubectctl get nodes
NAME      STATUS   ROLES    AGE   VERSION
minikube  Ready    control-plane  27h   v1.32.0

master@master-vm:~$ kubectctl get svc flask-service
NAME      TYPE      CLUSTER-IP   EXTERNAL-IP   PORT(S)    AGE
flask-service  NodePort  10.106.68.34  <none>        80:32665/TCP  77m

master@master-vm:~$ kubectctl get svc
NAME      TYPE      CLUSTER-IP   EXTERNAL-IP   PORT(S)    AGE
flask-service  NodePort  10.106.68.34  <none>        80:32665/TCP  77m
kubernetes   ClusterIP  10.96.0.1     <none>        443/TCP      27h

master@master-vm:~$ minikube ip
192.168.49.2

master@master-vm:~$ kubectctl run -it --rm load-generator --image=busybox -- /bin/sh
If you don't see a command prompt, try pressing enter.
/ # while true; do wget -q -O- http://192.168.49.2:32665; done
{"message":"Hello, World! This is a Flask app running in Docker."}
{"message":"Hello, World! This is a Flask app running in Docker."}
{"message":"Hello, World! This is a Flask app running in Docker."}
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```

Activate Windows
Go to Settings to activate Windows.

OUTPUT:

```
master@master-vm: ~/Desktop/flask-kube
flask-app-74b9cd7899-t55kx 1/1 Running 0 49m
load-generator 1/1 Running 0 33s
master@master-vm: ~/Desktop/flask-kube$ kubectl get hpa
NAME REFERENCE TARGETS MINPODS MAXPODS REPLICAS AGE
flask-app Deployment/flask-app 1%/50% 3 10 3 48m
master@master-vm: ~/Desktop/flask-kube$ kubectl get hpa
NAME REFERENCE TARGETS MINPODS MAXPODS REPLICAS AGE
flask-app Deployment/flask-app 1%/50% 3 10 3 56m
master@master-vm: ~/Desktop/flask-kube$ kubectl get hpa
NAME REFERENCE TARGETS MINPODS MAXPODS REPLICAS AGE
flask-app Deployment/flask-app 1%/50% 3 10 3 56m
master@master-vm: ~/Desktop/flask-kube$ kubectl get hpa
NAME REFERENCE TARGETS MINPODS MAXPODS REPLICAS AGE
flask-app Deployment/flask-app 1%/50% 3 10 3 56m
master@master-vm: ~/Desktop/flask-kube$ kubectl get hpa
NAME REFERENCE TARGETS MINPODS MAXPODS REPLICAS AGE
flask-app Deployment/flask-app 100%/50% 3 10 3 57m
master@master-vm: ~/Desktop/flask-kube$ kubectl get hpa
NAME REFERENCE TARGETS MINPODS MAXPODS REPLICAS AGE
flask-app Deployment/flask-app 100%/50% 3 10 3 57m
master@master-vm: ~/Desktop/flask-kube$ kubectl get hpa
NAME REFERENCE TARGETS MINPODS MAXPODS REPLICAS AGE
flask-app Deployment/flask-app 100%/50% 3 10 3 57m
master@master-vm: ~/Desktop/flask-kube$ kubectl get hpa
NAME REFERENCE TARGETS MINPODS MAXPODS REPLICAS AGE
flask-app Deployment/flask-app 50%/50% 3 10 6 57m
master@master-vm: ~/Desktop/flask-kube$ kubectl get hpa
NAME REFERENCE TARGETS MINPODS MAXPODS REPLICAS AGE
flask-app Deployment/flask-app 48%/50% 3 10 6 58m
master@master-vm: ~/Desktop/flask-kube$
master@master-vm: ~/Desktop/flask-kube$
master@master-vm: ~/Desktop/flask-kube$
master@master-vm: ~/Desktop/flask-kube$
```

```
192.168.49.2:32665/
message: "Hello, World! This is a Flask app running in Docker."
```