

## Testing Scenarios

To ensure the Kubernetes deployment is working as expected, perform the following test cases:

### 1. Application Availability Tests

✅ **Test:** Check if the application is accessible via the Kubernetes service.

◆ **Command:**

```
kubectl get services
curl http://<EXTERNAL-IP>:<PORT>
```

```
garvit@Garvit:~/software_engineering_da/software_da$ kubectl get services
NAME                                TYPE          CLUSTER-IP    EXTERNAL-IP    PORT(S)          AGE
flask-hello-world-service          NodePort      10.110.179.131 <none>         5000:30007/TCP   33h
kubernetes                         ClusterIP     10.96.0.1     <none>         443/TCP          33h
garvit@Garvit:~/software_engineering_da/software_da$ minikube ip
192.168.67.2
garvit@Garvit:~/software_engineering_da/software_da$ curl http://192.168.67.2:30007
garvit@Garvit:~/software_engineering_da/software_da$ |
```

### 2. Scaling Tests

✅ **Test:** Trigger high CPU usage to see if the **Horizontal Pod Autoscaler (HPA)** scales up pods.

```
garvit@Garvit:~/software_engineering_da/software_da$ kubectl get pods -w
NAME                                READY   STATUS             RESTARTS   AGE
flask-hello-world-74b7775fbd-22vp8  0/1     ContainerCreating  0          2s
flask-hello-world-74b7775fbd-8jc78  1/1     Running            0          77m
flask-hello-world-74b7775fbd-b2n9h  1/1     Running            0          77m
flask-hello-world-74b7775fbd-cmj8d  0/1     ContainerCreating  0          2s
stress-test                          1/1     Running            0          67s
stress-test-2                       1/1     Running            0          28s
flask-hello-world-74b7775fbd-cmj8d  1/1     Running            0          3s
flask-hello-world-74b7775fbd-22vp8  1/1     Running            0          3s
|
```

```
garvit@Garvit:~/software_engineering_da/software_da$ kubectl get pods -w
```

NAME	READY	STATUS	RESTARTS	AGE
flask-hello-world-74b7775fbd-22vp8	0/1	ContainerCreating	0	2s
flask-hello-world-74b7775fbd-8jc78	1/1	Running	0	77m
flask-hello-world-74b7775fbd-b2n9h	1/1	Running	0	77m
flask-hello-world-74b7775fbd-cmj8d	0/1	ContainerCreating	0	2s
stress-test	1/1	Running	0	67s
stress-test-2	1/1	Running	0	28s
flask-hello-world-74b7775fbd-cmj8d	1/1	Running	0	3s
flask-hello-world-74b7775fbd-22vp8	1/1	Running	0	3s
flask-hello-world-74b7775fbd-94n2t	0/1	Pending	0	0s
flask-hello-world-74b7775fbd-94n2t	0/1	Pending	0	0s
flask-hello-world-74b7775fbd-94n2t	0/1	ContainerCreating	0	0s
flask-hello-world-74b7775fbd-94n2t	1/1	Running	0	3s
stress-test	1/1	Terminating	0	116s
stress-test	0/1	Terminating	0	116s
stress-test	0/1	Terminating	0	117s
stress-test	0/1	Terminating	0	117s
stress-test	0/1	Terminating	0	117s
stress-test	0/1	Pending	0	0s
stress-test	0/1	Pending	0	0s
stress-test	0/1	ContainerCreating	0	0s
stress-test	1/1	Running	0	4s

### 3. Rolling Update & Rollback Test

✅ **Test:** Perform a rolling update and verify zero downtime.

◆ **Command:**

```
kubectl set image deployment/<DEPLOYMENT_NAME> <CONTAINER_NAME>=new- image:v2
```

◆ **Expected Output:** New version is deployed while keeping the app running.

```

garvit@Garvit:~/software_engineering_da/software_da$ kubectl get pods
NAME                                READY   STATUS    RESTARTS   AGE
flask-hello-world-574dff6756-khvv7 1/1     Running   0           11s
flask-hello-world-574dff6756-lpr76 1/1     Running   0           13s
flask-hello-world-574dff6756-p9qk8 1/1     Running   0           38s
flask-hello-world-74b5459b47-5dw5q 1/1     Terminating 0           18m
flask-hello-world-74b5459b47-k87b6 1/1     Terminating 0           38s
flask-hello-world-74b5459b47-s8rg6 1/1     Terminating 0           18m
garvit@Garvit:~/software_engineering_da/software_da$ kubectl describe pod flask-hello-world-574dff6756-khvv7
Name:                               flask-hello-world-574dff6756-khvv7
Namespace:                         default
Priority:                           0
Service Account:                   default
Node:                               minikube/192.168.67.2
Start Time:                        Sat, 29 Mar 2025 10:57:14 +0530
Labels:                            app=flask-hello-world
                                   pod-template-hash=574dff6756
Annotations:                        <none>
Status:                             Running
IP:                                 10.244.0.119
IPs:                                <none>
Controlled By:                      ReplicaSet/flask-hello-world-574dff6756
Containers:
  flask-container:
    Container ID:   docker://887089fca78349e82f488220da175ecdd7bbaf939c7fd49c0163844c700d43ac
    Image:          garvitpathak27/hello-world-flask:v2
    Image ID:       docker-pullable://garvitpathak27/hello-world-flask@sha256:f4a0bbdabfac868d7754aea984eb4a74fc03fda66af1126b9a450083508ff2e
    Port:          5000/TCP
    Host Port:     0/TCP
    State:         Running
      Started:     Sat, 29 Mar 2025 10:57:15 +0530
    Ready:         True
    Restart Count:  0
    Limits:
      cpu: 250m
    Requests:
      cpu: 100m
    Environment:
      APP_ENV:      <set to the key 'APP_ENV' of config map 'flask-config'> Optional: false
      FLASK_DEBUG:  <set to the key 'FLASK_DEBUG' of config map 'flask-config'> Optional: false
    Mounts:
      /var/run/secrets/kubernetes.io/serviceaccount from kube-api-access-ndkpx (ro)
Conditions:
  Type                               Status
  PodReadyToStartContainers          True
  Initialized                        True
  Ready                             True
  ContainersReady                   True
  PodScheduled                      True
Volumes:
  kube-api-access-ndkpx:
    Type:              Projected (a volume that contains injected data from multiple sources)
    TokenExpirationSeconds: 3607
    ConfigMapName:      kube-root-ca.crt
    ConfigMapOptional:  <nil>
    DownwardAPI:        true
  QoS Class:           Burstable
  Node-Selectors:      <none>
  Tolerations:         node.kubernetes.io/not-ready:NoExecute op=Exists for 300s
                       node.kubernetes.io/unreachable:NoExecute op=Exists for 300s
Events:
  Type    Reason      Age   From          Message
  ----    ------      --   -
  Normal  Scheduled   39s   default-scheduler Successfully assigned default/flask-hello-world-574dff6756-khvv7 to minikube
  Normal  Pulled      39s   kubelet       Container image "garvitpathak27/hello-world-flask:v2" already present on machine
  Normal  Created     39s   kubelet       Created container flask-container
  Normal  Started     39s   kubelet       Started container flask-container
garvit@Garvit:~/software_engineering_da/software_da$ kubectl get pods
NAME                                READY   STATUS    RESTARTS   AGE
flask-hello-world-574dff6756-khvv7 1/1     Running   0           90s
flask-hello-world-574dff6756-lpr76 1/1     Running   0           92s
flask-hello-world-574dff6756-p9qk8 1/1     Running   0          117s
garvit@Garvit:~/software_engineering_da/software_da$ kubectl rollout undo deployment flask-hello-world
deployment.apps/flask-hello-world rolled back
garvit@Garvit:~/software_engineering_da/software_da$ kubectl rollout status deployment flask-hello-world
deployment "flask-hello-world" successfully rolled out
garvit@Garvit:~/software_engineering_da/software_da$ kubectl get pods
NAME                                READY   STATUS    RESTARTS   AGE
flask-hello-world-574dff6756-khvv7 1/1     Terminating 0           2m26s
flask-hello-world-574dff6756-lpr76 1/1     Terminating 0           2m28s
flask-hello-world-574dff6756-p9qk8 1/1     Terminating 0           2m53s
flask-hello-world-74b5459b47-4u1l5 1/1     Running      0           23s
flask-hello-world-74b5459b47-mhv44 1/1     Running      0           21s
flask-hello-world-74b5459b47-r77zj 1/1     Running      0           25s

```

```

garvit@Garvit:~/software_engineering_da/software_da$ kubectl describe deployment flask-hello-world
Name: flask-hello-world
Namespace: default
CreationTimestamp: Fri, 28 Mar 2025 13:34:38 +0530
Labels: <none>
Annotations: deployment.kubernetes.io/revision: 6
Selector: app=flask-hello-world
Replicas: 3 desired | 3 updated | 3 total | 3 available | 0 unavailable
StrategyType: RollingUpdate
MinReadySeconds: 0
RollingUpdateStrategy: 25% max unavailable, 25% max surge
Pod Template:
  Labels: app=flask-hello-world
  Containers:
    flask-container:
      Image: garvitpathak27/hello-world-flask:latest
      Port: 5000/TCP
      Host Port: 0/TCP
      Limits:
        cpu: 250m
      Requests:
        cpu: 100m
      Environment:
        APP_ENV: <set to the key 'APP_ENV' of config map 'flask-config'> Optional: false
        FLASK_DEBUG: <set to the key 'FLASK_DEBUG' of config map 'flask-config'> Optional: false
      Mounts: <none>
      Volumes: <none>
      Node-Selectors: <none>
      Tolerations: <none>
  Conditions:
    Type             Status Reason
    ---             -
    Available         True  MinimumReplicasAvailable
    Progressing       True  NewReplicaSetAvailable
  OldReplicaSets: flask-hello-world-69df9579c4 (0/0 replicas created), flask-hello-world-5787fdd686 (0/0 replicas created), flask-hello-world-7f49d474c (0/0 replicas created), flask-hello-world-574dff6756 (0/0 replicas created)
  NewReplicaSet: flask-hello-world-74b5459b47 (3/3 replicas created)
  Events:
    Type Reason Age From Message
    ---
    Normal ScalingReplicaSet 20m deployment-controller Scaled up replica set flask-hello-world-74b5459b47 to 1
    Normal ScalingReplicaSet 20m deployment-controller Scaled down replica set flask-hello-world-7f49d474c to 2 from 3
    Normal ScalingReplicaSet 20m deployment-controller Scaled down replica set flask-hello-world-7f49d474c to 1 from 2
    Normal ScalingReplicaSet 20m deployment-controller Scaled up replica set flask-hello-world-74b5459b47 to 3 from 2
    Normal ScalingReplicaSet 20m deployment-controller Scaled down replica set flask-hello-world-74b5459b47 to 1
    Normal ScalingReplicaSet 20m deployment-controller Scaled down replica set flask-hello-world-7f49d474c to 2 from 3
    Normal ScalingReplicaSet 20m deployment-controller Scaled down replica set flask-hello-world-7f49d474c to 1 from 2
    Normal ScalingReplicaSet 20m deployment-controller Scaled up replica set flask-hello-world-74b5459b47 to 3 from 2
    Normal ScalingReplicaSet 20m deployment-controller Scaled down replica set flask-hello-world-74b5459b47 to 0 from 1
    Normal ScalingReplicaSet 18m deployment-controller Scaled up replica set flask-hello-world-74b5459b47 to 5 from 3
    Normal ScalingReplicaSet 16m deployment-controller Scaled up replica set flask-hello-world-74b5459b47 to 10 from 5
    Normal ScalingReplicaSet 13m deployment-controller Scaled down replica set flask-hello-world-74b5459b47 to 5 from 10
    Normal ScalingReplicaSet 32s (x2 over 20m) deployment-controller Scaled up replica set flask-hello-world-74b5459b47 to 2 from 1
    Normal ScalingReplicaSet 28s (x14 over 8m19s) deployment-controller (combined from similar events): Scaled down replica set flask-hello-world-574dff6756 to 0 from 1

```

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## 4. Pod Failure and Self-Healing Test

✅ **Test:** Manually delete a pod and check if Kubernetes automatically recreates it.

◆ **Command:**

```
garvit@Garvit:~/software_engineering_da/software_da$ kubectl get pods
NAME                                READY   STATUS    RESTARTS   AGE
flask-hello-world-85b94cdc99-kf6rx  1/1     Running   0           63s
flask-hello-world-85b94cdc99-zwgdb  1/1     Running   0           40s
garvit@Garvit:~/software_engineering_da/software_da$ kubectl delete pod flask-hello-world-85b94cdc99-zwgdb
pod "flask-hello-world-85b94cdc99-zwgdb" deleted
garvit@Garvit:~/software_engineering_da/software_da$ kubectl get pods
NAME                                READY   STATUS    RESTARTS   AGE
flask-hello-world-85b94cdc99-kf6rx  1/1     Running   0           2m
flask-hello-world-85b94cdc99-qwt4n  1/1     Running   0           34s
garvit@Garvit:~/software_engineering_da/software_da$ |
```

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## 5. Logging Test

✅ **Test:** Check if application logs are available.

◆ **Command:**

```
garvit@Garvit:~/software_engineering_da/software_da$ kubectl logs flask-hello-world-85b94cdc99-qwt4n
* Serving Flask app 'app'
* Debug mode: off
WARNING: This is a development server. Do not use it in a production deployment. Use a production WSGI
server instead.
* Running on all addresses (0.0.0.0)
* Running on http://127.0.0.1:5000
* Running on http://10.244.0.197:5000
Press CTRL+C to quit
garvit@Garvit:~/software_engineering_da/software_da$
```