Lesson 05 Demo 02

Configuring Pod Affinity and Anti-Affinity in Kubernetes

Objective: To configure pod affinity and anti-affinity rules in a Kubernetes cluster to ensure specific deployment patterns of pods across nodes

Tools required: kubeadm, kubectl, kubelet, and containerd

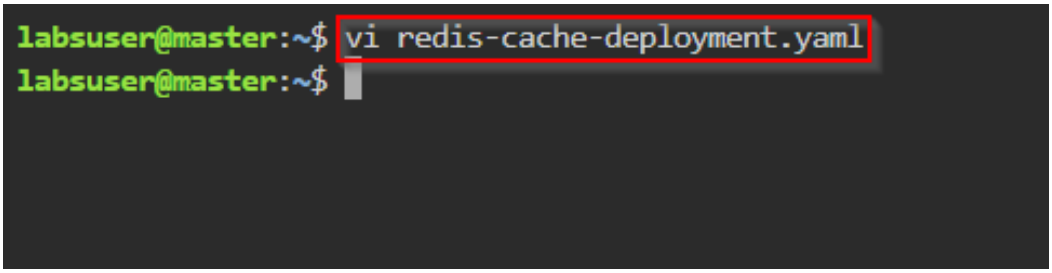
Prerequisites: A Kubernetes cluster should already be set up (refer to the steps in Lesson 02, Demo 01 for guidance).

Steps to be followed:

1. Deploy redis-cache with anti-affinity
2. Colocate web server with redis-cache using affinity

Step 1: Deploy redis-cache with anti-affinity

1.1 Create the redis-cache-deployment.yaml configuration file by entering the command:
vi redis-cache-deployment.yaml



1.2 Paste the following code to the **redis-cache-deployment.yaml** file:

```
apiVersion: apps/v1
kind: Deployment
metadata:
  name: redis-cache
spec:
  selector:
    matchLabels:
      app: store

  replicas: 3
  template:
    metadata:
      labels:
        app: store
    spec:
      affinity:
        podAntiAffinity:
          requiredDuringSchedulingIgnoredDuringExecution:
          - labelSelector:
              matchExpressions:
              - key: app
                operator: In
                values:
                - store
            topologyKey: "kubernetes.io/hostname"
      containers:
      - name: redis-server
        image: redis:3.2-alpine
```

```
apiVersion: apps/v1
kind: Deployment
metadata:
  name: redis-cache
spec:
  selector:
    matchLabels:
      app: store
  replicas: 3
  template:
    metadata:
      labels:
        app: store
    spec:
      affinity:
        podAntiAffinity:
          requiredDuringSchedulingIgnoredDuringExecution:
          - labelSelector:
              matchExpressions:
              - key: app
                operator: In
                values:
                - store
            topologyKey: "kubernetes.io/hostname"
      containers:
      - name: redis-server
        image: redis:3.2-alpine

:wq
```

1.3 Apply the **redis-cache-deployment.yaml** configuration file using the command:
kubectl apply -f redis-cache-deployment.yaml

```
labsuser@master:~$ kubectl apply -f redis-cache-deployment.yaml
deployment.apps/redis-cache created
labsuser@master:~$
```

1.4 Verify the deployment of **redis-cache** with the following commands:
kubectl get deploy redis-cache
kubectl get pod -l app=store -o wide

```
labsuser@master:~$ kubectl apply -f redis-cache-deployment.yaml
deployment.apps/redis-cache created
labsuser@master:~$ kubectl get deploy redis-cache
NAME          READY   UP-TO-DATE   AVAILABLE   AGE
redis-cache   1/3     3            1           6m43s
labsuser@master:~$ kubectl get pod -l app=store -o wide
NAME                           READY   STATUS    RESTARTS   AGE     IP              NODE                          NOMINATED NODE   READINESS GATES
redis-cache-8478cbdc86-74wnv   0/1     Pending   0          6m56s   <none>          <none>                        <none>           <none>
redis-cache-8478cbdc86-qw8jb   0/1     Pending   0          6m56s   <none>          <none>                        <none>           <none>
redis-cache-8478cbdc86-wldjq   1/1     Running   0          6m57s   172.16.232.202  worker-node-2.example.com     <none>           <none>
labsuser@master:~$
```

Step 2: Colocate web server with redis-cache using affinity

2.1 Create the **web-server-deployment.yaml** configuration file by using the command:
vi web-server-deployment.yaml

```
labsuser@master:~$ kubectl apply -f redis-cache-deployment.yaml
deployment.apps/redis-cache created
labsuser@master:~$ kubectl get deploy redis-cache
NAME          READY   UP-TO-DATE   AVAILABLE   AGE
redis-cache   1/3     3            1           6m43s
labsuser@master:~$ kubectl get pod -l app=store -o wide
NAME                           READY   STATUS    RESTARTS   AGE     IP              NODE                        NOMINATED NODE   READINESS GA
redis-cache-8478cbdc86-74wnv   0/1     Pending   0          6m56s   <none>          <none>                      <none>           <none>
redis-cache-8478cbdc86-qw8jb   0/1     Pending   0          6m56s   <none>          <none>                      <none>           <none>
redis-cache-8478cbdc86-wldjq   1/1     Running   0          6m57s   172.16.232.202  worker-node-2.example.com   <none>           <none>
labsuser@master:~$ kubectl get pod -l app=store -o wide
NAME                           READY   STATUS    RESTARTS   AGE   IP              NODE                        NOMINATED NODE   READINESS GATE
redis-cache-8478cbdc86-74wnv   0/1     Pending   0          17m   <none>          <none>                      <none>           <none>
redis-cache-8478cbdc86-qw8jb   0/1     Pending   0          17m   <none>          <none>                      <none>           <none>
redis-cache-8478cbdc86-wldjq   1/1     Running   0          17m   172.16.232.202  worker-node-2.example.com   <none>           <none>
labsuser@master:~$ vi web-server-deployment.yaml
labsuser@master:~$
```

2.2 Paste the following code to the **web-server-deployment.yaml** file:

```
apiVersion: apps/v1
kind: Deployment
metadata:
  name: web-server
spec:
  selector:
    matchLabels:
      app: web-store
  replicas: 3
  template:
    metadata:
      labels:
        app: web-store
    spec:
      affinity:
        podAntiAffinity:
          requiredDuringSchedulingIgnoredDuringExecution:
          - labelSelector:
              matchExpressions:
              - key: app
                operator: In
                values:
                - web-store
            topologyKey: "kubernetes.io/hostname"
        podAffinity:
          requiredDuringSchedulingIgnoredDuringExecution:
          - labelSelector:
              matchExpressions:
              - key: app
                operator: In
                values:
                - store
            topologyKey: "kubernetes.io/hostname"
      containers:
      - name: web-app
        image: nginx:1.16-alpine
```

```
  template:
    metadata:
      labels:
        app: web-store
    spec:
      affinity:
        podAntiAffinity:
          requiredDuringSchedulingIgnoredDuringExecution:
          - labelSelector:
              matchExpressions:
              - key: app
                operator: In
                values:
                - web-store
            topologyKey: "kubernetes.io/hostname"
        podAffinity:
          requiredDuringSchedulingIgnoredDuringExecution:
          - labelSelector:
              matchExpressions:
              - key: app
                operator: In
                values:
                - store
            topologyKey: "kubernetes.io/hostname"
      containers:
      - name: web-app
        image: nginx:1.16-alpine

:wq
```

2.3 Apply the **web-server-deployment.yaml** configuration using the command: **kubectl apply -f web-server-deployment.yaml**

```
redis-cache-8478cbdc86-qw8jb   0/1     Pending   0          17m   <none>
redis-cache-8478cbdc86-wldjq   1/1     Running   0          17m   172.16.232.202
labsuser@master:~$ vi web-server-deployment.yaml
labsuser@master:~$ kubectl apply -f web-server-deployment.yaml
deployment.apps/web-server created
labsuser@master:~$
```

2.4 Verify the deployment of the web server with the following commands:

kubectl get deploy web-server

kubectl get pod -l app=web-store -o wide

```
labsuser@master:~$ kubectl get deploy web-server
NAME         READY   UP-TO-DATE   AVAILABLE   AGE
web-server   1/3     3            1           95s
labsuser@master:~$ kubectl get pod -l app=web-store -o wide
NAME                          READY   STATUS    RESTARTS   AGE    IP              NODE                          NOMINATED NODE   READINESS GATES
web-server-55f57c89d4-8lnnb   0/1     Pending   0          103s   <none>          <none>                        <none>           <none>
web-server-55f57c89d4-kh5st   1/1     Running   0          103s   172.16.232.203  worker-node-2.example.com     <none>           <none>
web-server-55f57c89d4-rbxrf   0/1     Pending   0          103s   <none>          <none>                        <none>           <none>
labsuser@master:~$
```

2.5 Check the information of the pods using the following commands:

kubectl get pods -l app=store -o wide

kubectl get pods -l app=web-store -o wide

```
labsuser@master:~$ kubectl get deploy web-server
NAME         READY   UP-TO-DATE   AVAILABLE   AGE
web-server   1/3     3            1           95s
labsuser@master:~$ kubectl get pod -l app=web-store -o wide
NAME                          READY   STATUS    RESTARTS   AGE    IP              NODE                          NOMINATED NODE   READINESS GATES
web-server-55f57c89d4-8lnnb   0/1     Pending   0          103s   <none>          <none>                        <none>           <none>
web-server-55f57c89d4-kh5st   1/1     Running   0          103s   172.16.232.203  worker-node-2.example.com     <none>           <none>
web-server-55f57c89d4-rbxrf   0/1     Pending   0          103s   <none>          <none>                        <none>           <none>
labsuser@master:~$ kubectl get pods -l app=store -o wide
NAME                          READY   STATUS    RESTARTS   AGE    IP              NODE                          NOMINATED NODE   READINESS GATES
redis-cache-8478cbdc86-74wnv  0/1     Pending   0          27m    <none>          <none>                        <none>           <none>
redis-cache-8478cbdc86-qw8jb  0/1     Pending   0          27m    <none>          <none>                        <none>           <none>
redis-cache-8478cbdc86-wldjq  1/1     Running   0          27m    172.16.232.202  worker-node-2.example.com     <none>           <none>
labsuser@master:~$ kubectl get pods -l app=web-store -o wide
NAME                          READY   STATUS    RESTARTS   AGE    IP              NODE                          NOMINATED NODE   READINESS GATES
web-server-55f57c89d4-8lnnb   0/1     Pending   0          2m48s  <none>          <none>                        <none>           <none>
web-server-55f57c89d4-kh5st   1/1     Running   0          2m48s  172.16.232.203  worker-node-2.example.com     <none>           <none>
web-server-55f57c89d4-rbxrf   0/1     Pending   0          2m48s  <none>          <none>                        <none>           <none>
labsuser@master:~$
```

By following these steps, you have successfully configured pod affinity and anti-affinity in Kubernetes, ensuring that your **redis-cache** instances are spread across different hosts and your **web-server** instances are colocated with the **redis-cache** in the same nodes for optimal performance and resilience.