Lab Exercise 10- Creating and Managing a ReplicaSet in Kubernetes

Objective:

A ReplicaSet in Kubernetes ensures a specified number of Pod replicas are running at any given time. This exercise will guide you through creating a ReplicaSet to maintain the desired state of your application.

- Understand the syntax and structure of a Kubernetes ReplicaSet definition file (YAML).
- Learn how to create and manage a ReplicaSet to ensure application availability.
- Understand how a ReplicaSet helps in scaling applications and maintaining desired states.

Prerequisites

- Kubernetes Cluster: Have a running Kubernetes cluster (locally using Minikube or kind, or a cloud-based service).
- kubectl: Install and configure kubectl to interact with your Kubernetes cluster.
- Basic Knowledge of YAML: Familiarity with YAML format will be helpful for understanding Kubernetes resource definitions.

Step-by-Step Guide

Step 1: Understanding ReplicaSet

A ReplicaSet ensures a specified number of Pod replicas are running at any given time. If a Pod crashes or is deleted, the ReplicaSet creates a new one to meet the defined number of replicas. This helps maintain application availability and ensures that your application can handle increased load by distributing traffic among multiple Pods.
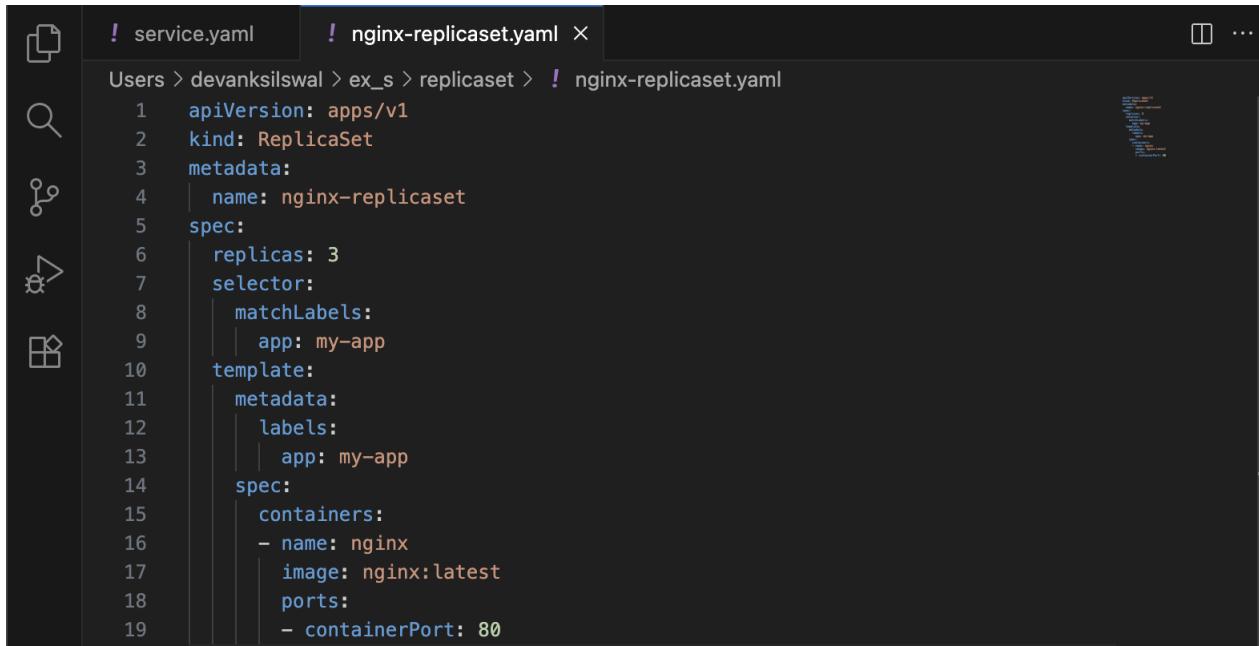
Step 2: Create a ReplicaSet

We'll define a ReplicaSet to maintain three replicas of a simple Nginx web server Pod.

Create a YAML file named nginx-replicaset.yaml with the following content:

```
devanksilswal@devanks-MacBook-Air ex_s % mkdir replicaset
cd replicaset

devanksilswal@devanks-MacBook-Air replicaset % touch nginx-replicaset.yaml
```

```
apiVersion: apps/v1
kind: ReplicaSet
metadata:
  name: nginx-replicaset
spec:
  replicas: 3
  selector:
    matchLabels:
      app: my-app
  template:
    metadata:
      labels:
        app: my-app
    spec:
      containers:
      - name: nginx
        image: nginx:latest
        ports:
        - containerPort: 80
```

```yaml
! service.yaml        ! nginx-replicaset.yaml ×

Users > devanksilswal > ex_s > replicaset > ! nginx-replicaset.yaml
1    apiVersion: apps/v1
2    kind: ReplicaSet
3    metadata:
4      name: nginx-replicaset
5    spec:
6      replicas: 3
7      selector:
8        matchLabels:
9          app: my-app
10     template:
11       metadata:
12         labels:
13           app: my-app
14       spec:
15         containers:
16         - name: nginx
17           image: nginx:latest
18           ports:
19           - containerPort: 80
```

Explanation:

- apiVersion: Defines the API version (apps/v1) used for the ReplicaSet resource.

- kind: Specifies that this resource is a ReplicaSet.

- metadata: Contains metadata about the ReplicaSet, including name.

   o   name: The unique name for the ReplicaSet.

- spec: Provides the specification for the ReplicaSet.

   o   replicas: Defines the desired number of Pod replicas.

   o   selector: Criteria for selecting Pods managed by this ReplicaSet.

      ▪   matchLabels: Labels that Pods must have to be managed by this ReplicaSet.

   o   template: Defines the Pod template used for creating new Pods.

      ▪   metadata: Contains metadata for the Pods, including labels.

         •   labels: Labels applied to Pods created by this ReplicaSet.

   o   spec: Specification for the Pods.

      ▪   containers: Lists the containers that will run in the Pod.

         •   name: The unique name of the container within the Pod.

         •   image: The Docker image used for the container.

         •   ports: Ports exposed by the container.

Step 3: Apply the YAML to Create the ReplicaSet

Use the kubectl apply command to create the ReplicaSet based on the YAML file.

kubectl apply -f nginx-replicaset.yaml

```
devanksilswal@devanks-MacBook-Air replicaset % kubectl apply -f nginx-replicaset.yaml
replicaset.apps/nginx-replicaset created
```

Verify the ReplicaSet is running and maintaining the desired number of replicas:

kubectl get replicaset

```
devanksilswal@devanks-MacBook-Air replicaset % kubectl get replicaset

NAME               DESIRED   CURRENT   READY   AGE
nginx-replicaset   3         3         2       12s
```

This command lists all ReplicaSets in the current namespace.

To check the Pods created by the ReplicaSet:

kubectl get pods -l app=my-app

```
devanksilswal@devanks-MacBook-Air replicaset % kubectl get pods -l app=my-app

NAME                     READY   STATUS    RESTARTS   AGE
nginx-replicaset-2pj2c   1/1     Running   0          26s
nginx-replicaset-r4kt5   1/1     Running   0          26s
nginx-replicaset-rqxmd   1/1     Running   0          26s
```

This command lists all Pods with the label app=nginx.

Step 4: Managing the ReplicaSet

1. Scaling the ReplicaSet

You can scale the number of replicas managed by the ReplicaSet using the kubectl scale command.

```
kubectl scale --replicas=5 replicaset/nginx-replicaset
```
```
devanksilswal@devanks-MacBook-Air replicaset % kubectl scale --replicas=5 replicaset/nginx-replicaset
replicaset.apps/nginx-replicaset scaled
```

This command scales the ReplicaSet to maintain 5 replicas. Verify the scaling operation:

```
kubectl get pods -l app=my-app
```
```
devanksilswal@devanks-MacBook-Air replicaset % kubectl get pods -l app=my-app

NAME                      READY   STATUS    RESTARTS   AGE
nginx-replicaset-2pj2c    1/1     Running   0          68s
nginx-replicaset-hz96q    1/1     Running   0          33s
nginx-replicaset-r4kt5    1/1     Running   0          68s
nginx-replicaset-rqxmd    1/1     Running   0          68s
nginx-replicaset-w2n9t    1/1     Running   0          33s
```
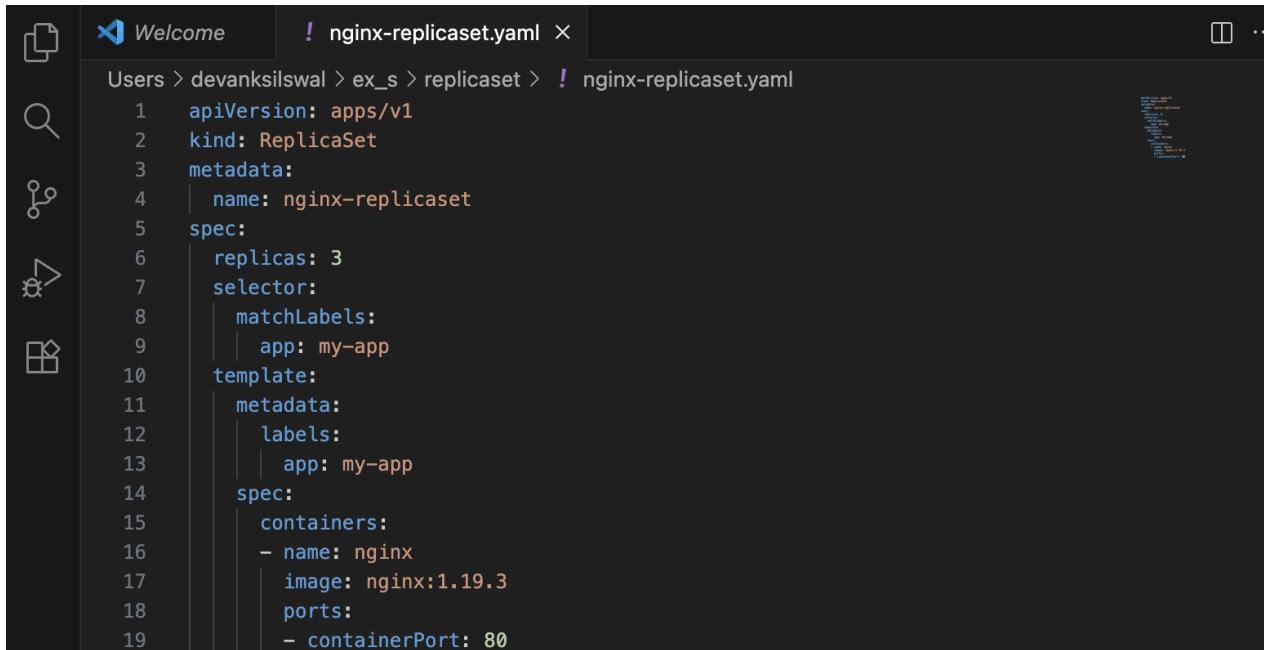
You should see that the number of Pods has increased to 5.

2. Updating the ReplicaSet

If you need to update the Pod template (e.g., to use a different Docker image version), modify the YAML file and apply it again. For instance, change the image to a specific version of Nginx:

```
spec:
 template:
  spec:
   containers:
   - name: nginx
     image: nginx:1.19.3  # Change to a specific version
```

```
     Welcome        ! nginx-replicaset.yaml  ×

Users > devanksilswal > ex_s > replicaset > ! nginx-replicaset.yaml
    1    apiVersion: apps/v1
    2    kind: ReplicaSet
    3    metadata:
    4      name: nginx-replicaset
    5    spec:
    6      replicas: 3
    7      selector:
    8        matchLabels:
    9          app: my-app
   10      template:
   11        metadata:
   12          labels:
   13            app: my-app
   14        spec:
   15          containers:
   16          - name: nginx
   17            image: nginx:1.19.3
   18            ports:
   19            - containerPort: 80
```

Apply the changes:

```
kubectl apply -f nginx-replicaset.yaml
```

```
devanksilswal@devanks-MacBook-Air replicaset % kubectl apply -f nginx-replicaset.yaml

replicaset.apps/nginx-replicaset configured
```

Check the status to ensure the Pods are updated:

```
kubectl get pods -l app=my-app
```

```
devanksilswal@devanks-MacBook-Air replicaset % kubectl get pods -l app=my-app

NAME                       READY   STATUS    RESTARTS   AGE
nginx-replicaset-hz96q     1/1     Running   0          3m55s
nginx-replicaset-r4kt5     1/1     Running   0          4m30s
nginx-replicaset-w2n9t     1/1     Running   0          3m55s
```

Note: Updating a ReplicaSet doesn't automatically replace existing Pods with new ones. In practice, you often create a new ReplicaSet or Deployment for updates.

3. Deleting the ReplicaSet

To clean up the ReplicaSet and its Pods, use the kubectl delete command:

```
kubectl delete -f nginx-replicaset.yaml
```

```
[devanksilswal@devanks-MacBook-Air replicaset % kubectl delete -f nginx-replicaset.yaml
 replicaset.apps "nginx-replicaset" deleted from default namespace
```

This command deletes the ReplicaSet and all the Pods managed by it.