

# Lab Exercise 10- Creating and Managing a ReplicaSet in Kubernetes

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## 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:

```
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
```

```
File Edit View

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
```

## 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.
  - **name:** The unique name for the ReplicaSet.
- **spec:** Provides the specification for the ReplicaSet.
  - **replicas:** Defines the desired number of Pod replicas.
  - **selector:** Criteria for selecting Pods managed by this ReplicaSet.
    - **matchLabels:** Labels that Pods must have to be managed by this ReplicaSet.
  - **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.
  - **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
```

```
PS C:\Users\ASUS\Desktop> notepad nginx-replicaset.yaml
PS C:\Users\ASUS\Desktop> kubectl apply -f nginx-replicaset.yaml
replicaset.apps/nginx-replicaset created
PS C:\Users\ASUS\Desktop> |
```

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

```
kubectl get replicaset
```

```
PS C:\Users\ASUS\Desktop> kubectl get replicaset
NAME                DESIRED    CURRENT    READY    AGE
nginx-replicaset    3          3          3        26s
PS C:\Users\ASUS\Desktop> |
```

This command lists all ReplicaSets in the current namespace.

**To check the Pods created by the ReplicaSet:**

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

```
PS C:\Users\ASUS\Desktop> kubectl get pods -l app=my-app
NAME                                READY   STATUS    RESTARTS   AGE
nginx-replicaset-hlzh8             1/1     Running   0          69s
nginx-replicaset-ts7j7             1/1     Running   0          69s
nginx-replicaset-xvbx4             1/1     Running   0          69s
PS C:\Users\ASUS\Desktop> |
```

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
```

```
PS C:\Users\ASUS\Desktop> 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=nginx
```

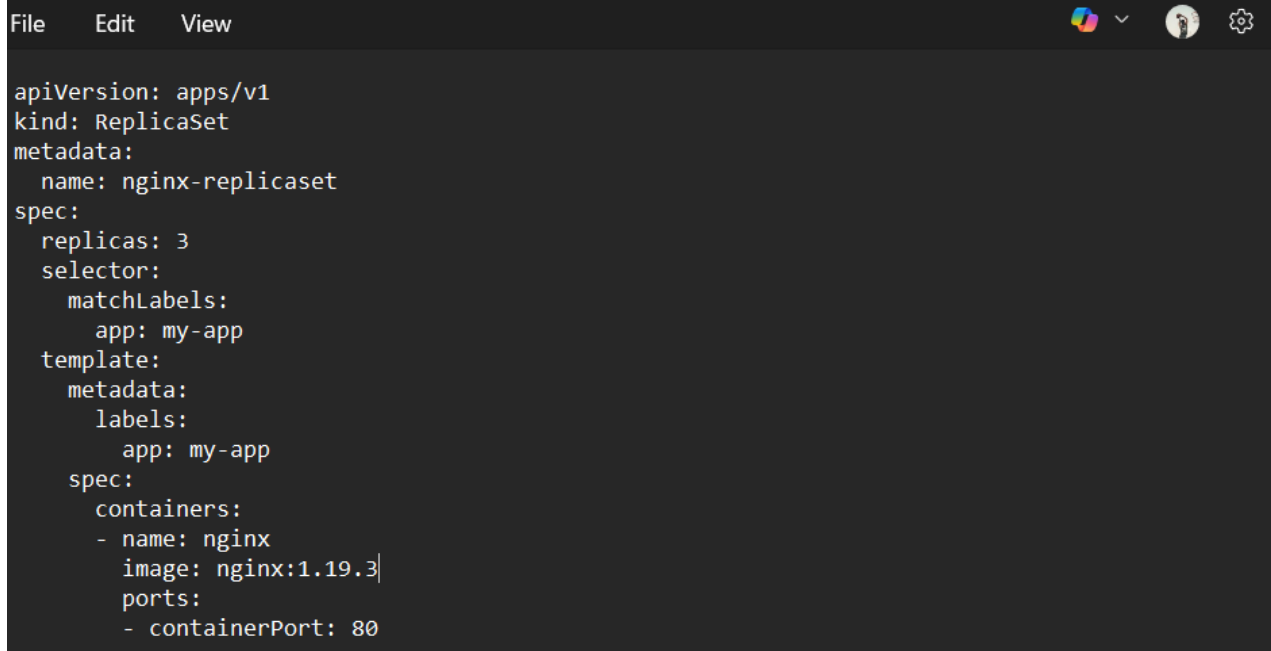
```
PS C:\Users\ASUS\Desktop> kubectl get pods -l app=my-app
NAME                                READY   STATUS    RESTARTS   AGE
nginx-replicaset-9cm5j             1/1     Running   0          10s
nginx-replicaset-hlzh8             1/1     Running   0          97s
nginx-replicaset-prv9r             1/1     Running   0          10s
nginx-replicaset-ts7j7             1/1     Running   0          97s
nginx-replicaset-xvbx4             1/1     Running   0          97s
PS C:\Users\ASUS\Desktop> |
```

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
```



```
File Edit View
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:1.19.3
        ports:
        - containerPort: 80
```

**Apply the changes:**

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

```
PS C:\Users\ASUS\Desktop> kubectl apply -f nginx-replicaset.yaml
replicaset.apps/nginx-replicaset unchanged
```

**Check the status to ensure the Pods are updated:**

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

```
PS C:\Users\ASUS\Desktop> kubectl get pods -l app=my-app
NAME                                READY   STATUS    RESTARTS   AGE
nginx-replicaset-g9f5k             1/1     Running   0           25m
nginx-replicaset-hsfk9             1/1     Running   0           25m
nginx-replicaset-zpv22             1/1     Running   0           25m
PS C:\Users\ASUS\Desktop> kubectl delete pod nginx-replicaset-g9f5k
pod "nginx-replicaset-g9f5k" deleted from default namespace
PS C:\Users\ASUS\Desktop> kubectl get pods -l app=my-app
NAME                                READY   STATUS    RESTARTS   AGE
nginx-replicaset-h8hwj             1/1     Running   0           13s
nginx-replicaset-hsfk9             1/1     Running   0           25m
nginx-replicaset-zpv22             1/1     Running   0           25m
```

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
```

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

```
PS C:\Users\ASUS\Desktop> kubectl delete -f nginx-replicaset.yaml
replicaset.apps "nginx-replicaset" deleted from default namespace
PS C:\Users\ASUS\Desktop> |
PS C:\Users\ASUS\Desktop> kubectl get pods
No resources found in default namespace.
PS C:\Users\ASUS\Desktop> |
```