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

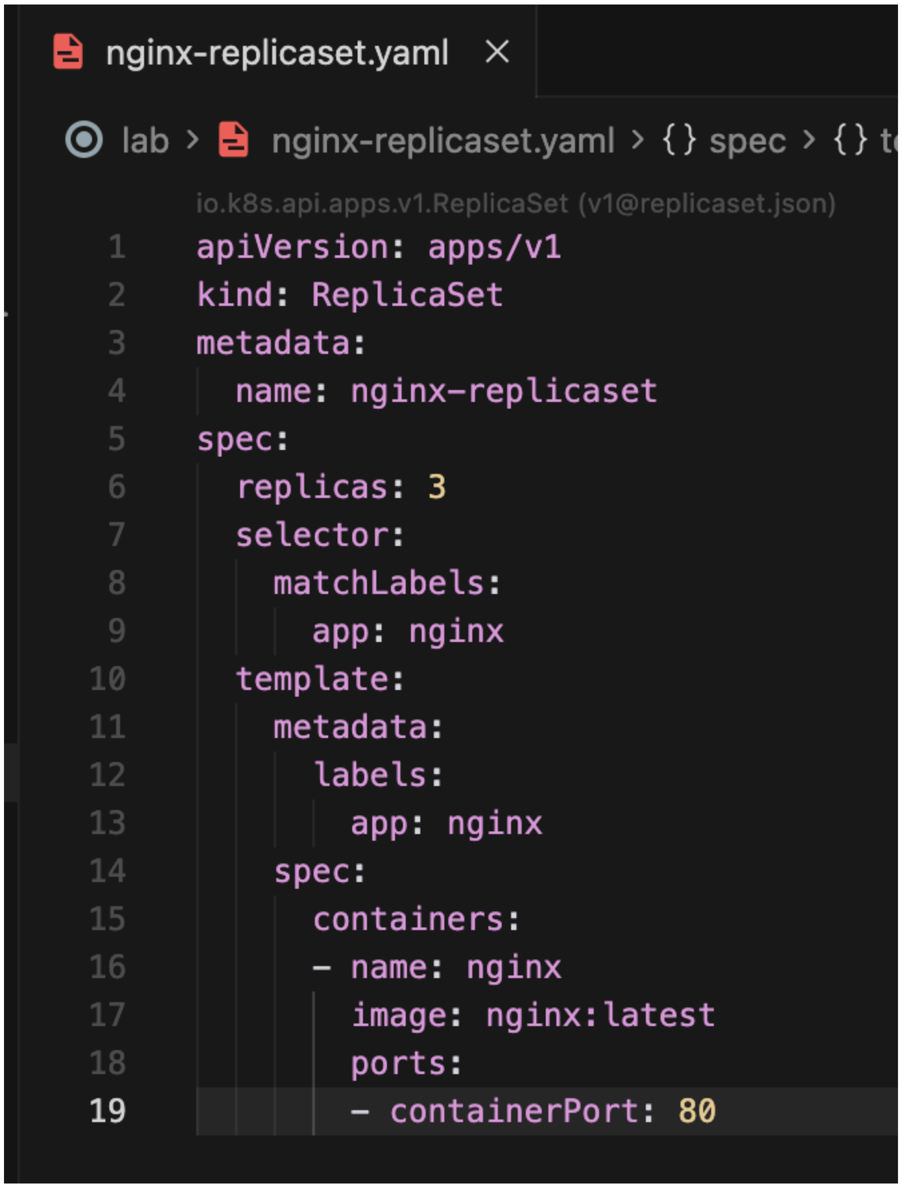
Step 1: Understanding ReplicaSet

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:

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


nginx-replicaset.yaml
lab > nginx-replicaset.yaml > {} spec > {} t
io.k8s.api.apps.v1.ReplicaSet (v1@replicaset.json)

```yaml
apiVersion: apps/v1
kind: ReplicaSet
metadata:
  name: nginx-replicaset
spec:
  replicas: 3
  selector:
    matchLabels:
      app: nginx
  template:
    metadata:
      labels:
        app: nginx
    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
```

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

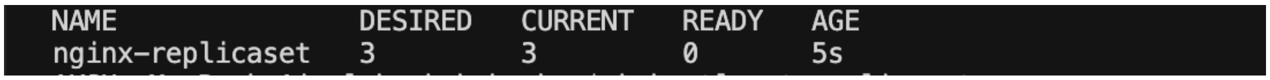
```
kubectl get replicaset
```

This command lists all ReplicaSets in the current namespace.

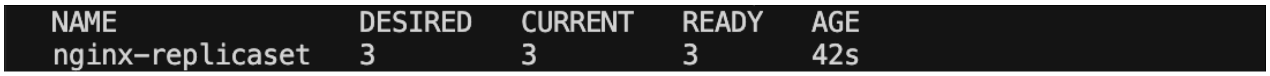
To check the Pods created by the ReplicaSet:

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

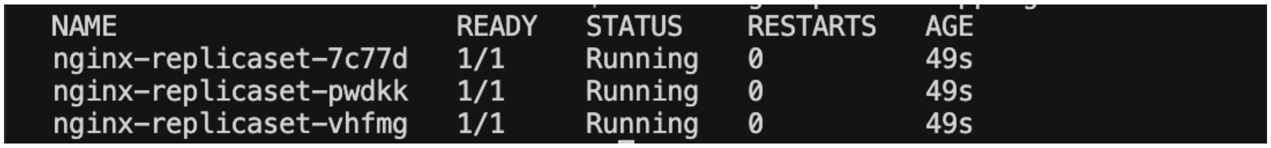
This command lists all Pods with the label app=nginx.



```
NAME               DESIRED   CURRENT   READY   AGE
nginx-replicaset   3         3         0       5s
```



```
NAME               DESIRED   CURRENT   READY   AGE
nginx-replicaset   3         3         3       42s
```


```
NAME                       READY   STATUS    RESTARTS   AGE
nginx-replicaset-7c77d     1/1     Running   0          49s
nginx-replicaset-pwdkk     1/1     Running   0          49s
nginx-replicaset-vhfmg     1/1     Running   0          49s
```

Step 4: Managing the ReplicaSet

1. Scaling the ReplicaSet

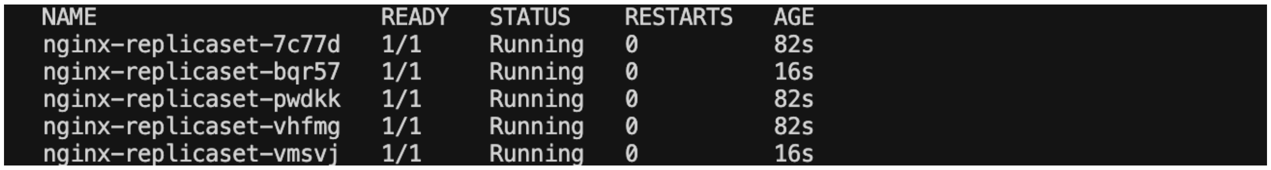
You can scale the number of replicas managed by the ReplicaSet using the kubectl scale command.

```
kubectl scale --replicas=5 replicaset/nginx-replicaset
```

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

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

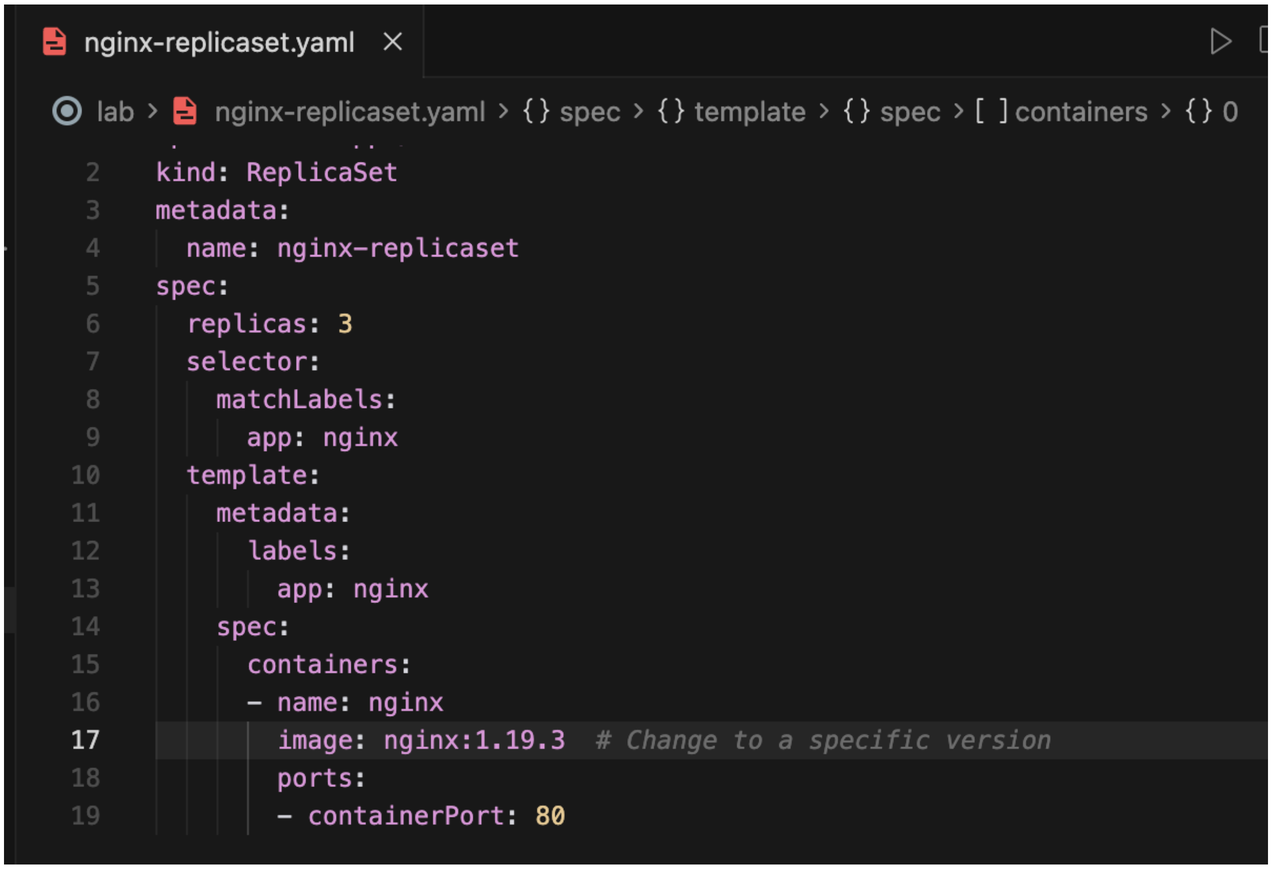
You should see that the number of Pods has increased to 5.


```
NAME                       READY   STATUS    RESTARTS   AGE
nginx-replicaset-7c77d     1/1     Running   0          82s
nginx-replicaset-bqr57     1/1     Running   0          16s
nginx-replicaset-pwdkk     1/1     Running   0          82s
nginx-replicaset-vhfmg     1/1     Running   0          82s
nginx-replicaset-vmsvj     1/1     Running   0          16s
```

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
```


nginx-replicaset.yaml
lab > nginx-replicaset.yaml > {} spec > {} template > {} spec > [ ] containers > {} 0

```yaml
kind: ReplicaSet
metadata:
  name: nginx-replicaset
spec:
  replicas: 3
  selector:
    matchLabels:
      app: nginx
  template:
    metadata:
      labels:
        app: nginx
    spec:
      containers:
      - name: nginx
        image: nginx:1.19.3  # Change to a specific version
        ports:
        - containerPort: 80
```

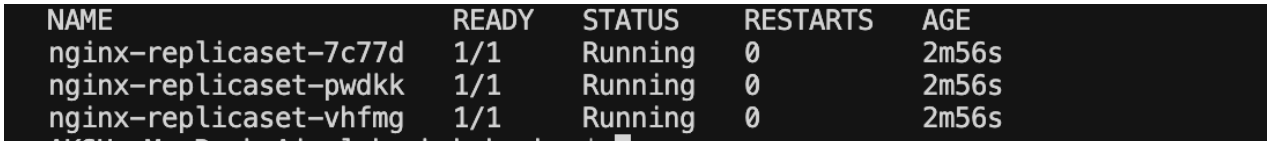
Apply the changes:

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

Check the status to ensure the Pods are updated:

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

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.



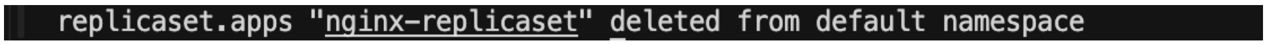
```
NAME                     READY   STATUS    RESTARTS   AGE
nginx-replicaset-7c77d   1/1     Running   0          2m56s
nginx-replicaset-pwdkk   1/1     Running   0          2m56s
nginx-replicaset-vhfmg   1/1     Running   0          2m56s
```

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.



```
replicaset.apps "nginx-replicaset" deleted from default namespace
```