

Create Roles, Role Bindings, and Service Accounts for RBAC in Kubernetes

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Introduction

Kubernetes provides a powerful Role-Based Access Control (RBAC) mechanism to manage permissions and access to resources within your cluster. By defining roles and bindings, you can enforce fine-grained control over who can do what in your cluster. This guide will walk you through the process of creating roles, role bindings, and service accounts in a Kubernetes environment using Minikube.

Problem Statement

Managing access permissions is critical for maintaining security in a Kubernetes cluster. Without proper RBAC configuration, unauthorized users may gain access to sensitive resources or perform actions that could compromise the stability and security of the cluster. This lab will demonstrate how to implement RBAC by creating roles, role bindings, and service accounts in your Minikube environment.

Prerequisites

Completion of all previous lab guides (up to Lab Guide-08) is required before proceeding with Lab Guide-09.

- A running **Minikube** cluster on Windows.
- **kubectl** installed and configured to interact with your cluster.
- Basic understanding of Kubernetes objects (Namespaces, Roles, RoleBindings, ServiceAccounts, etc.).

Software Requirements

- **Minikube**: v1.19 or later

- **kubectl**: Latest version compatible with your Kubernetes setup

Hardware Requirements

- Minimum 2 CPU cores
- 2GB RAM for Minikube cluster

Lab Guide: Create Roles, Role Bindings, and Service Accounts for RBAC

Step 1: Create a Namespace

1. Create a New Namespace

First, we will create a separate namespace for our RBAC tests:

```
kubectl create namespace rbac-example
```

Note:

A **namespace** is a way to divide cluster resources between multiple users or teams. It helps to organize resources and manage them more effectively.

```
C:\Users\Administrator>kubectl create namespace rbac-example
namespace/rbac-example created
```

2. Verify the Namespace

Check if the namespace has been created successfully:

```
kubectl get namespaces
```

```
C:\Users\Administrator>kubectl get namespaces
NAME                STATUS    AGE
default             Active   20h
ingress-nginx       Active   95m
kube-node-lease     Active   20h
kube-public         Active   20h
kube-system         Active   20h
monitoring          Active   18m
rbac-example        Active   3m2s
```

Step 2: Create a Service Account

1. Create a Service Account

Run the following command to create a service account named **rbac-user** in the **rbac-example** namespace:

```
kubectl create serviceaccount rbac-user --namespace rbac-example
```

Note:

A **Service Account** is an account for processes in a Pod. When a Pod runs, it can access the Kubernetes API using the Service Account credentials.

```
C:\Users\Administrator>kubectl create serviceaccount rbac-user --namespace rbac-example
serviceaccount/rbac-user created
```

2. Verify the Service Account

Check if the service account has been created:

```
kubectl get serviceaccounts -n rbac-example
```

```
C:\Users\Administrator>kubectl get serviceaccounts -n rbac-example
NAME          SECRETS  AGE
default       0        3m35s
rbac-user     0        16s
```

Step 3: Create a Role

1. Define a Role

Create a YAML file named `rbac-role.yaml` with the following content:

```
apiVersion: rbac.authorization.k8s.io/v1
kind: Role
metadata:
  namespace: rbac-example
  name: pod-reader
rules:
  - apiGroups: [""]
    resources: ["pods"]
    verbs: ["get", "list", "watch"]
```

Note:

A **Role** defines permissions for resources within a specific namespace. In this example, the `pod-reader` role allows reading Pods in the `rbac-example` namespace.

2. Apply the Role

Run the following command to create the role:

```
kubectl apply -f rbac-role.yaml
```

```
PS C:\Users\Administrator> kubectl apply -f rbac-role.yaml
role.rbac.authorization.k8s.io/pod-reader created
```

3. Verify the Role

Check if the role has been created:

```
kubectl get roles -n rbac-example
```

```
PS C:\Users\Administrator> kubectl get roles -n rbac-example
NAME          CREATED AT
pod-reader    2024-11-21T08:33:48Z
```

Step 4: Create a RoleBinding

1. Define a RoleBinding

Create a YAML file named `rbac-rolebinding.yaml` with the following content:

```
apiVersion: rbac.authorization.k8s.io/v1
kind: RoleBinding
metadata:
  name: read-pods
  namespace: rbac-example
subjects:
  - kind: ServiceAccount
    name: rbac-user
    namespace: rbac-example
roleRef:
  kind: Role
  name: pod-reader
  apiGroup: rbac.authorization.k8s.io
```

Note:

A **RoleBinding** grants the permissions defined in a Role to a specific subject (like a Service Account) within a namespace.

2. Apply the RoleBinding

Run the following command to create the role binding:

```
kubectl apply -f rbac-rolebinding.yaml
```

```
PS C:\Users\Administrator> kubectl apply -f rbac-rolebinding.yaml
rolebinding.rbac.authorization.k8s.io/read-pods created
```

3. Verify the RoleBinding

Check if the role binding has been created:

```
kubectl get rolebindings -n rbac-example
```

```
PS C:\Users\Administrator> kubectl get rolebindings -n rbac-example
NAME          ROLE          AGE
read-pods     Role/pod-reader 16s
```

Step 5: Deploy a Simple Application

1. Deploy an Nginx Pod

To test the RBAC configuration, we will deploy a simple Nginx application in the `rbac-example` namespace:

```
kubectl run nginx --image=nginx --restart=Never --namespace=rbac-example
```

Note:

This command creates a Pod named `nginx` using the Nginx image, which will be used to verify that the `rbac-user` service account can access the resources.

```
PS C:\Users\Administrator> kubectl run nginx --image=nginx --restart=Never --namespace=rbac-example
pod/nginx created
```

2. Verify the Nginx Pod

Check if the Nginx Pod is running:

```
kubectl get pods -n rbac-example
```

```
PS C:\Users\Administrator> kubectl get pods -n rbac-example
NAME    READY   STATUS    RESTARTS   AGE
nginx   1/1     Running   0           3m57s
```

Step 6: Verify RBAC Configuration

1. Test the Permissions of the Service Account

First, you need to get the token for the service account using PowerShell:

```
$SECRET_NAME = (kubectl get sa rbac-user -n rbac-example -o
jsonpath='{.secrets[0].name}')
$TOKEN = (kubectl get secret $SECRET_NAME -n rbac-example -o
jsonpath='{.data.token}' | % {
[System.Text.Encoding]::UTF8.GetString([System.Convert]::FromBase64String($_
)) })
```

2. Use the Service Account Token

Now, you can test the permissions using `kubectl` with the service account token:

```
kubectl get pods --namespace rbac-example --token=$TOKEN
```

```
PS C:\Users\Administrator> $SECRET_NAME = (kubectl get sa rbac-user -n rbac-example -o jsonpath='{.secrets[0].name}')
>> $TOKEN = (kubectl get secret $SECRET_NAME -n rbac-example -o jsonpath='{.data.token}' | % { [System.Text.Encoding]::UTF8.GetString([System.Convert
]::FromBase64String($_)) })
PS C:\Users\Administrator> kubectl get pods --namespace rbac-example --token=$TOKEN
NAME      READY   STATUS    RESTARTS   AGE
nginx     1/1     Running   0           4m24s
```

If the RBAC configuration is correct, you should see the Nginx pod listed. If no pods are present in the `rbac-example` namespace, you will receive a message saying "No resources found in rbac-example namespace." This is expected if you have not deployed any resources yet.

References

- [Kubernetes RBAC Documentation](#)
 - [Kubernetes Service Accounts Documentation](#)
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