Kubernetes and KeyControl Secrets Vault Integration Guide

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Chapter 1. Introduction

This guide describes how to integrate a Kubernetes cluster with KeyControl Secrets Vault.

Kubernetes is an open-source system that automates the deployment, management, and scaling of containerized applications. It makes it easy for developers to quickly build, launch, and scale container-based web applications in a public cloud environment.

This integration allows pulling secrets from a secrets vault in KeyControl Vault and mount them as either environment variables or as volume mounts in containers. It focuses on the way one can pull secrets into Kubernetes pods or containers using a KeyControl Secrets Vault. For other details on the vault, please refer to the Entrust KeyControl Vault (KCV) documentation.

1.1. Integration architecture

Kubernetes cluster

In this integration, a Kubernetes K3s cluster is deployed on a Red Hat Linux VM. Container images are used from a third-party cloud registry.

Container images

Two container images are created for the purpose of this integration to demonstrate how secrets can be pulled into a container from KeyControl Vault.

Two more images are deployed to support the integration. These images come from the PASM Vault Kubernetes Agent v1.0. They are available at https://github.com/EntrustCorporation/PASM-Vault-Kubernetes-Agent/releases.

Docker Registry

An external Docker registry is required. This is where the container images from the PASM Kubernetes agents will be stored and referenced by the Kubernetes containers when they are created.

1.2. Product configurations

Entrust has successfully tested the integration KeyControl Secrets Vault with Kubernetes in the following configurations:

Product	Version
Base OS	Red Hat Enterprise Linux release 9.4 (Plow)
Kubernetes (K3s)	1.30.4
KeyControl Vault	10.3.1
PASM Vault Kubernetes Agent	1.0

1.3. Requirements

1.3.1. Before starting the integration process

Familiarize yourself with:

- The documentation for the Entrust KeyControl Vault.
- The documentation and setup process for a Kubernetes cluster.

Chapter 2. Procedures

2.1. Install docker

On the RedHat Linux Server, install docker.

1. Make sure system is up to date.

```
% sudo yum update
```

2. Remove Older Docker Versions.

   If you have any older versions of Docker installed, it's essential to remove them along with their associated dependencies. Use the following command to uninstall older Docker packages:

```
% sudo yum remove docker \
  docker-client \
  docker-client-latest \
  docker-common \
  docker-latest \
  docker-latest-logrotate \
  docker-logrotate \
  docker-engine
```

3. Install Required Dependencies.

   To prepare your system for Docker installation, install the necessary dependencies:

```
% sudo yum install -y yum-utils device-mapper-persistent-data lvm2
```

4. Add Docker Repository.

   Next, you need to add the official Docker repository to your system:

```
% sudo yum-config-manager --add-repo https://download.docker.com/linux/centos/docker-ce.repo
```

5. Install Docker.

   With the repository added, you're now ready to install Docker:

```
% sudo yum install docker-ce
```

6. Start and Enable Docker.

   After the installation is complete, start the Docker service and enable it to start on boot:

   ```
   % sudo systemctl start docker
   % sudo systemctl enable docker
   ```

7. Verify Docker Installation.

   Confirm that Docker is installed and running by checking its version:

   ```
   % sudo docker --version
   ```

8. Test Docker with a Hello World Container.

   Test your Docker installation by running a "Hello World" container:

   ```
   % sudo docker run hello-world
   ```

9. Managing Docker as a Non-root User.

   To avoid using the `sudo` command with every Docker command, you can add your user to the `docker` group:

   ```
   % sudo usermod -aG docker <your_userid>
   ```

10. Reboot the system for the changes to take effect.

2.2. Install k3s

We will use k3s environment to deploy our Kubernetes cluster to demonstrate this integration. It is up to the user to select and use the best Kubernetes environment of choice for a Kubernetes cluster. You can find information on how to deploy a k3s Kubernetes cluster here: https://k3s.io/.

On the RedHat Linux Server, install the Kubernetes Cluster.

1. Install the latest k3s release.

   To install the latest k3s stable release do the following:

   ```
   % curl -sfL https://get.k3s.io | sh -
   ```

```
[INFO]  Finding release for channel stable
[INFO]  Using v1.30.4+k3s1 as release
[INFO]  Downloading hash https://github.com/k3s-io/k3s/releases/download/v1.30.4+k3s1/sha256sum-amd64.txt
[INFO]  Downloading binary https://github.com/k3s-io/k3s/releases/download/v1.30.4+k3s1/k3s
[INFO]  Verifying binary download
[INFO]  Installing k3s to /usr/local/bin/k3s
[INFO]  Finding available k3s-selinux versions
Updating Subscription Management repositories.
Rancher K3s Common (stable)
3.3 kB/s | 1.3 kB     00:00
Dependencies resolved.
================================================================================================================================
================================================================================
 Package                                    Architecture                          Version
Repository                                              Size
================================================================================================================================
================================================================================
Installing:
 k3s-selinux                                noarch                                1.5-1.el9
rancher-k3s-common-stable                               22 k

Transaction Summary
================================================================================================================================
================================================================================
Install  1 Package

Total download size: 22 k
Installed size: 96 k
Downloading Packages:
k3s-selinux-1.5-1.el9.noarch.rpm
68 kB/s |  22 kB     00:00
--------------------------------------------------------------------------------------------------------------------------------
--------------------------------------------------------------------------------
Total
68 kB/s |  22 kB     00:00
Rancher K3s Common (stable)
35 kB/s | 2.4 kB     00:00
Importing GPG key 0xE257814A:
 Userid     : "Rancher (CI) <ci@rancher.com>"
 Fingerprint: C8CF F216 4551 26E9 B9C9 18BE 925E A29A E257 814A
 From       : https://rpm.rancher.io/public.key
Key imported successfully
Running transaction check
Transaction check succeeded.
Running transaction test
Transaction test succeeded.
Running transaction
  Preparing        :
1/1
  Running scriptlet: k3s-selinux-1.5-1.el9.noarch
1/1
  Installing       : k3s-selinux-1.5-1.el9.noarch
1/1
  Running scriptlet: k3s-selinux-1.5-1.el9.noarch
1/1

  Verifying        : k3s-selinux-1.5-1.el9.noarch
1/1
Installed products updated.

Installed:
  k3s-selinux-1.5-1.el9.noarch

Complete!
[INFO]  Creating /usr/local/bin/kubectl symlink to k3s
[INFO]  Creating /usr/local/bin/crictl symlink to k3s
[INFO]  Skipping /usr/local/bin/ctr symlink to k3s, command exists in PATH at /usr/bin/ctr
```

```
[INFO]  Creating killall script /usr/local/bin/k3s-killall.sh
[INFO]  Creating uninstall script /usr/local/bin/k3s-uninstall.sh
[INFO]  env: Creating environment file /etc/systemd/system/k3s.service.env
[INFO]  systemd: Creating service file /etc/systemd/system/k3s.service
[INFO]  systemd: Enabling k3s unit
Created symlink /etc/systemd/system/multi-user.target.wants/k3s.service → /etc/systemd/system/k3s.service.
[INFO]  systemd: Starting k3s
```

2. Set up `KUBECONFIG` for the user:

```
% export KUBECONFIG=~/.kube/config
% mkdir ~/.kube 2> /dev/null
% sudo /usr/local/bin/k3s kubectl config view --raw > "$KUBECONFIG"
% chmod 600 "$KUBECONFIG"
```

   You may want to put this in your profile so when you login into the server it gets set:

```
export KUBECONFIG=~/.kube/config
```

3. Check the cluster.

```
% kubectl get nodes

NAME                            STATUS   ROLES                  AGE     VERSION
redhat-9-kcv-secrets   Ready    control-plane,master   9m29s   v1.30.4+k3s1
```

4. Test the server connection.

   Run the following command and notice the **server** attribute:

```
% kubectl config view

apiVersion: v1
clusters:
- cluster:
    certificate-authority-data: DATA+OMITTED
    server: https://127.0.0.1:6443
  name: default
contexts:
- context:
    cluster: default
    user: default
  name: default
current-context: default
kind: Config
preferences: {}
users:
- name: default
  user:
    client-certificate-data: DATA+OMITTED
    client-key-data: DATA+OMITTED
```

   The **server*** attribute is set to:

```
    server: https://127.0.0.1:6443
```

The KeyControl node will need access to that URL. Since it is using the localhost IP address, you can just replace that with the server IP address. Now open a browser and attempt to connect to that url. In our case:

```
https://1X.19X.14X.XXX:6443
```

Attempt the connection from another server in the same subnet as the KeyControl nodes. If you can't connect, the port may be blocked by the firewall.

Open port 6443 on the firewall in the server:

```
% sudo firewall-cmd --zone=public --add-port=6443/tcp --permanent

success

% sudo firewall-cmd --reload

success
```

Test the connection again.

Some VPN blocks access to port 6443. Make sure you test the connect from a server that will not use a VPN.

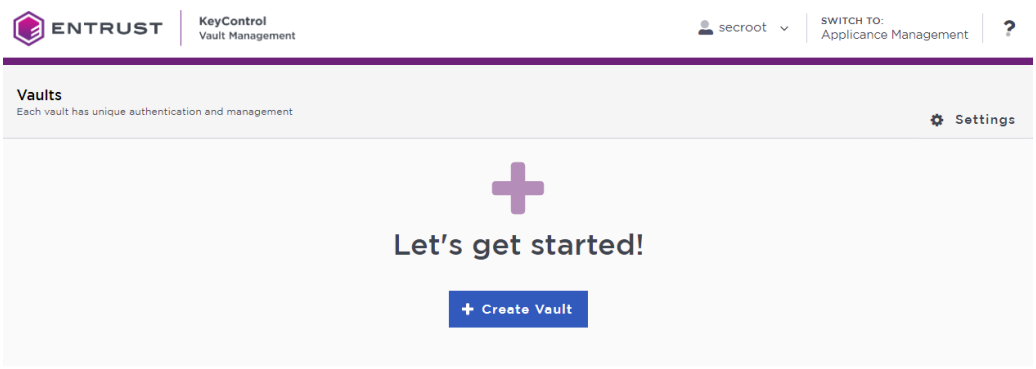
2.3. Deploy the KeyControl vault cluster

For this integration, KeyControl Vault is deployed as a two-node cluster.

Follow the installation and setup instructions in KeyControl Vault Installation and Upgrade Guide.

2.4. Create a secrets vault to be used with Kubernetes

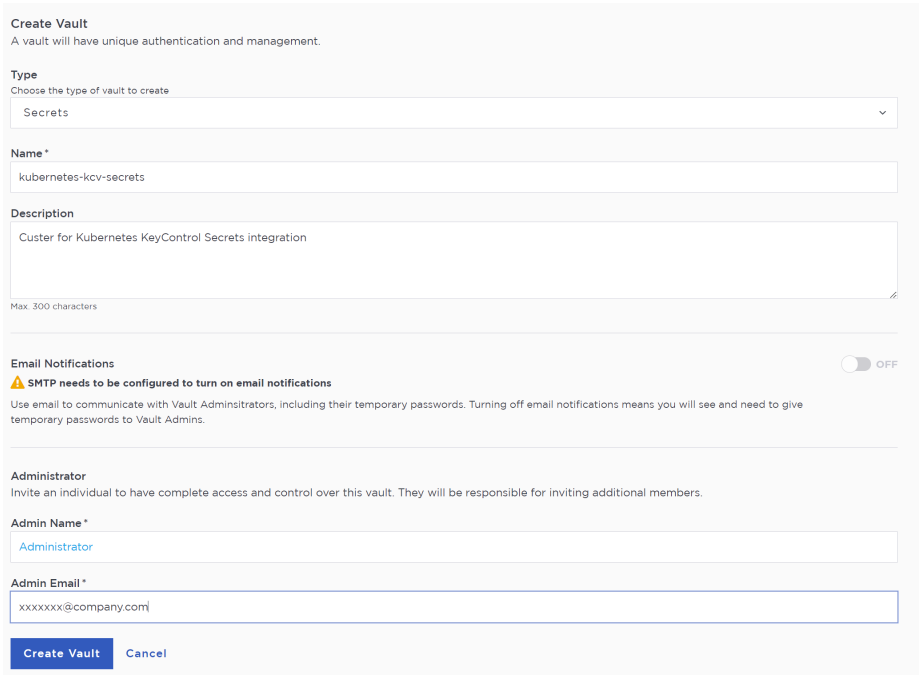
1. Sign in to the KeyControl Vault Manager.
2. In the home page, select **Create Vault**.



The **Create Vault** dialog appears.

3. In the **Type** drop-down box, select **Secrets**. Enter the required information.
4. Select **Create Vault**.

   For example:



5. When you receive an email with a URL and sign-in credentials to the KeyControl vault, bookmark the URL and save the credentials.

   You can also copy the sign-in credentials when the vault details are displayed.

6. Sign in to the URL provided.
7. Change the initial password when prompted.

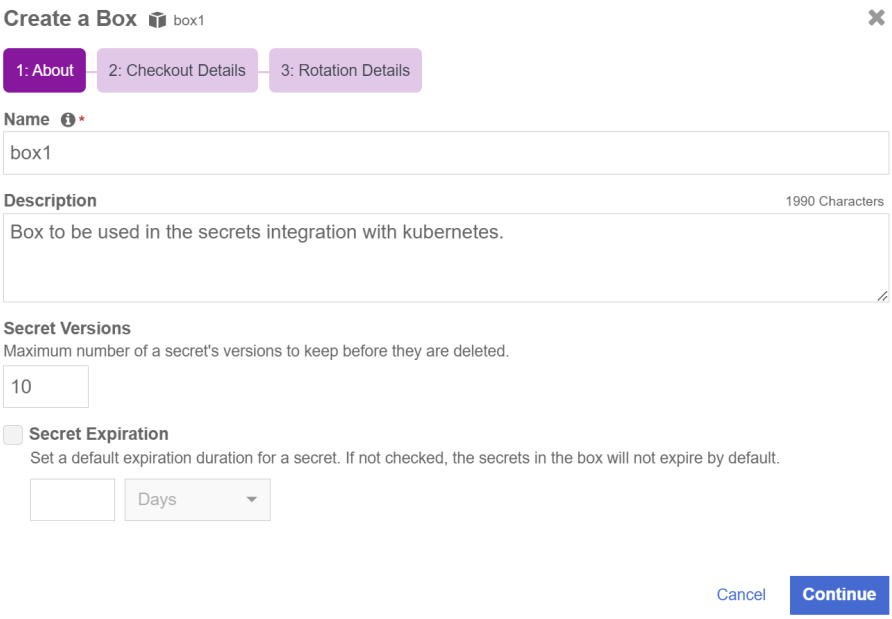
2.5. Create a secret in the secrets vault

After you sign in to the secrets vault, create a box that will contain the secret.

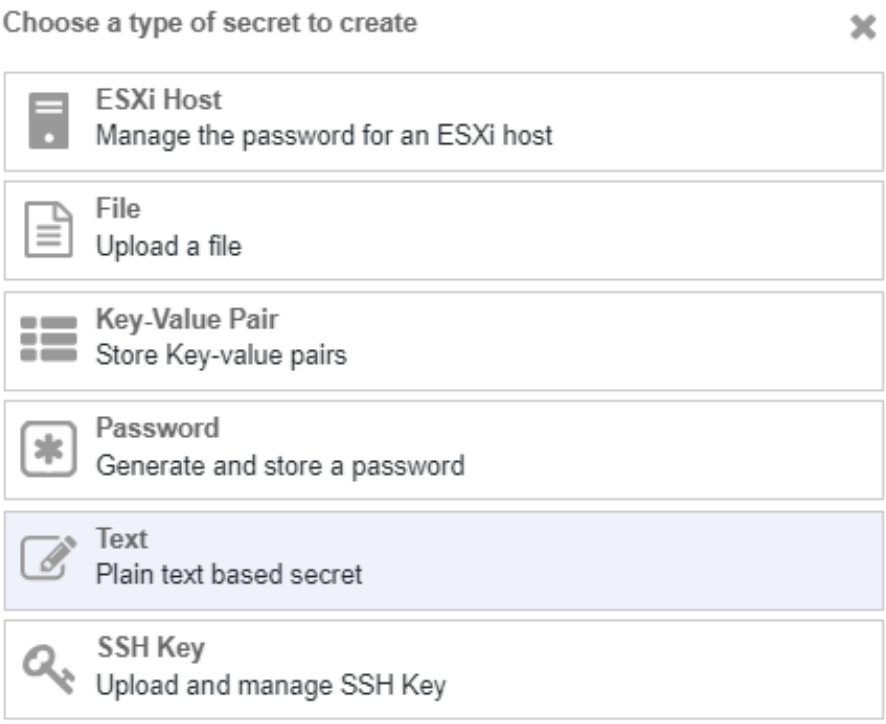
1. Select **Manage** in the Secrets Vault **Home** tab, then select **Manage Boxes**.
2. In the **Manage Boxes** Tab, select **Add a Box Now**.
3. In the **Create a Box** Window, enter the **Name** and **Description**.

   In this integration guide and the configuration file examples it contains, the box will be named **box1**.

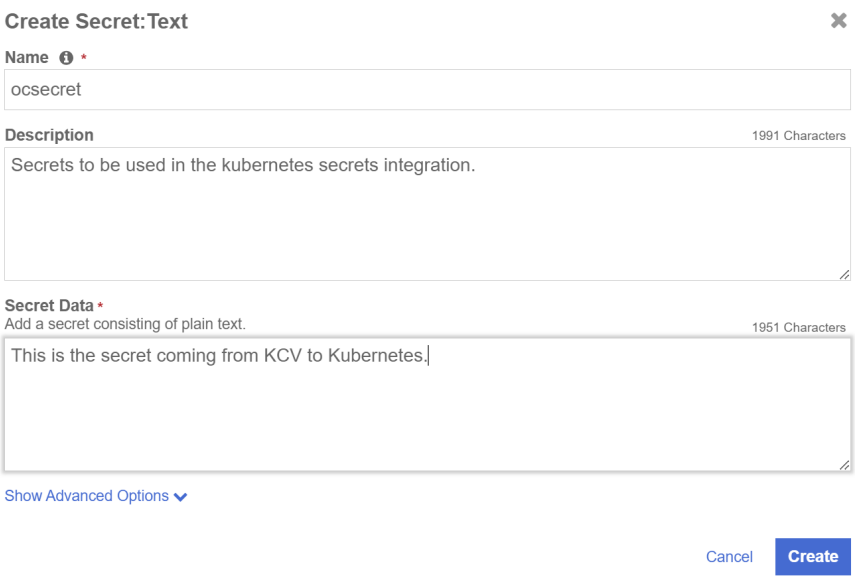
4. Select **Continue**.



5. In **Checkout Details**, select **Continue**.
6. In **Rotation Details**, select **Create**. The box gets created.
7. Select the new box.
8. In the **Secrets** Pane, select **Add a Secret Now**.
9. From the **Choose a type of secret to create** list, select **Text**.



10. In the **Create Secret: Text** window, enter the following:
    a. **Name**: Enter the name of the secret. This will be used later in configuration files in this integration.
    b. **Description**: Enter a brief description.
    c. **Secret Data**: Enter the value of the secret. This is the value the Kubernetes containers will try to retrieve during the integration.



11. Select **Create**.

2.6. Set up and configure the integration environment

From this point on, all setup and configuration will be done from the Linux server that you configured earlier.

2.6.1. Set up KUBECONFIG

This should give you access to the Kubernetes cluster.

```
% export KUBECONFIG=~/.kube/config
```

Check that you can see the Kubernetes cluster nodes:

```
% kubectl get nodes

NAME                  STATUS   ROLES                  AGE    VERSION
redhat-9-kcv-secrets  Ready    control-plane,master   2d2h   v1.30.4+k3s1
```

2.6.2. Set up namespaces

The integration will use two namespaces in Kubernetes.

1. Set up the mutating webhook namespace.
    a. Create a `yaml` file containing the following code:

    ```
    apiVersion: v1
    kind: Namespace
    metadata:
      name: mutatingwebhook
    ```

    b. Name the file `mutatingwebhooknamespace.yaml`
    c. Create the namespace:

    ```
    % kubectl create -f mutatingwebhooknamespace.yaml
    ```

2. Set up the test namespace.
    a. Create a yaml file containing the following code:

    ```
    apiVersion: v1
    kind: Namespace
    metadata:
      name: testnamespace
    ```

b. Name the file `testnamespace.yaml`.

c. Create the namespace:

```
% kubectl create -f testnamespace.yaml
```

2.6.3. Register Docker container images with the Docker registry

Register some of the Docker container images to a Docker registry so they can be used inside the Kubernetes cluster.

1. Set up `DOCKER_CONFIG`

   Export `DOCKER_CONFIG` to the directory where your docker configuration will be stored:

   ```
   % export DOCKER_CONFIG=~/.docker
   ```

2. Log in to the registry:

   ```
   % docker login -u YOURUSERID <registry-url>
   ```

3. Deploy the init container image.

   The `init` container image needs to be deployed to the Docker registry.

   Download the init container image:

   ```
   % wget https://github.com/EntrustCorporation/PASM-Vault-Kubernetes-Agent/releases/download/v1.0/init-container.tar
   ```

4. Load the provided image `init-container.tar` into the Docker registry:

   ```
   % docker load --input init-container.tar
   ```

5. Check the image:

   ```
   % docker images

   REPOSITORY                          TAG         IMAGE ID      CREATED        SIZE
   localhost/init-container            latest      1c476f57b72c  10 months ago  186 MB
   ```

6. Tag the image:

```
% docker tag localhost/init-container:latest <registry-url>/init-container
```

7. Push the image into the Docker registry that is used within Kubernetes:

```
% docker push <registry-url>/init-container:latest
```

8. Deploy the mutating webhook image.

   The webhook code is in the form of image and needs to be deployed as container. It needs to be deployed to the Docker registry.

   Download the webhook container image:

```
% wget https://github.com/EntrustCorporation/PASM-Vault-Kubernetes-Agent/releases/download/v1.0/mutating-webhook.tar
```

9. Load the provided image `mutating-webhook.tar` into the Docker registry:

```
% docker load --input mutating-webhook.tar
```

10. Check the image:

```
% docker images

REPOSITORY                 TAG         IMAGE ID      CREATED        SIZE
localhost/mutating-webhook  latest      805efa734095  10 months ago  222 MB
```

11. Tag the image:

```
% docker tag localhost/mutating-webhook:latest <registry-url>/mutating-webhook
```

12. Push the image into the Docker registry that is used within Kubernetes:

```
% docker push <registry-url>/mutating-webhook:latest
```

2.6.4. Get the secrets vault authentication token for the vault admin user

1. Sign in to the secrets vault as admin using the KeyControl Vault Rest API and get the vault authentication token.

```
https://<VAULT-IP>/vault/1.0/Login/<VAULT-UUID>
```

This URL is visible on vault management UI of the KeyControl. Also note the `VAULT-UUID` from the URL. This will be required in further steps.

Here is an example:

```
https://xx.xxx.xxx.xxx/vault/1.0/Login/d86e3c22-6563-45b4-bfb9-45ba6c911ec8
```

The request body should be in the form:

```
{
 "username":"admin",
 "password":"password"
}
```

The `username` should be one of the administrators of the vault. The examples uses `admin`, but this should be the actual admin user name.

2. Get the token using the following curl command:

```
% curl -k -X POST https://xx.xxx.xxx.xxx/vault/1.0/Login/d86e3c22-6563-45b4-bfb9-45ba6c911ec8/ -d '{
"username": "admin", "password":"xxxxxxx" }'
```

The response body for the command above should be similar to this:

```
{
  "is_user": false,
  "box_admin": false,
  "appliance_id": "bc1a085c-70c9-476c-b4f6-abff0c73cce4",
  "is_secondary_approver": false,
  "access_token":
"ZDg2ZTNjMjItNjU2My00NWI0LWJmYjktNDViYTZjOTExZWM4.eyJkYXRhIjoiU0ZSWFVBRUFKbktGNXNnWlBRSGJQNEQ3T2xTR2NXUHM2a
VdqdzVJN21jRythdXZ5NUhIQjZYQ0tPRG9iK0FGcjRsSjNDZm1oZGZZbVc4aUt5aEtENmgydnlRQUFBQ1FBQUFBYkxndE9LcE1mTDIyK1Jz
QXQ4ZVlYanRyQ3QrL2JBWFU0OFNYZGx4YVd1Qjl6N3RvYk8xRDhPOVZlbFFWdkZKenNIU3F6OXQ5VHd1TVhtMHNUMk11bjB0clRSakdDOUs
va1VQdXRMMUxDT2dXK00xd0ZSM1BUZjZTbGZoZ3BUc3IwVjJCcEVPL3FRME1LaHVucUNiRUNjVldJNkVIbDQrWER0WUNiYzVCYTl5NWpqR0
NVSHRFa2trcXdjQjBiTjl0SVBoSitCcnU5ZjVqV3I0ZUFvNW5ZQ1U4d3VKZmRqYkMvTWJ3R3RsNGpxSzRERnlwRVFzQUk5bGdRM3Nvcm0wK
zNlQjBKb0pWQ00wVTJZakZsWVRNM1pDMWlaVEF4TFRRd1pqVXRZV1l4TnkxaE5tTXpNek5rTlRVNU9UWT0iLCJzcGVjIjoxLCJpZCI6IjZi
MWVhMzdkLWJlMDEtNDBmNS1hZjE3LWE2YzMzM2Q1NTk5NiJ9",
  "expires_at": "2024-09-03T19:08:52.175191Z",
  "admin": true,
  "user": "admin"
}
```

3. Copy the token received in the response body in the field `access_token`.

This is required when executing APIs described in further steps and is referred to as **Vault Authentication Token**. The `access_token` field will be used in the `curl` headers from now on for the rest of the configuration calls. For example:

```
curl -H "X-Vault-Auth:
ZDg2ZTNjMjItNjU2My00NWI0LWJmYjktNDViYTZjOTExZWM4.eyJkYXRhIjoiU0ZSWFVBRUFKbktGNXNnWlBRSGJQNEQ3T2xTR2NXUHM2aV
dqdzVJN21jRythdXZ5NUhIQjZYQ0tPRG9iK0FGcjRsSjNDZm1oZGZZbVc4aUt5aEtENmgydnlRQUFBQ1FBQUFBYkxndE9LcE1mTDIyK1JzQ
```

```
XQ4ZVlYanRyQ3QrL2JBWFU0OFNYZGx4YVd1Qjl6N3RvYk8xRDhPOVZlbFFWdkZKenNIU3F6OXQ5VHd1TVhtMHNUMk11bjB0clRSakdDOUsv
a1VQdXRMMUxDT2dXK00xd0ZSM1BUZjZTbGZoZ3BUc3IwVjJCcEVPL3FRME1LaHVucUNiRUNjVldJNkVIbDQrWER0WUNiYzVCYTl5NWpqR0N
VSHRFa2trcXdjQjBiTjl0SVBoSitCcnU5ZjVqV3I0ZUFvNW5ZQ1U4d3VKZmRqYkMvTWJ3R3RsNGpxSzRERnlwRVFzQUk5bGdRM3Nvcm0wKz
NlQjBKb0pWQ00wVTJZakZsWVRNM1pDMWlaVEF4TFRRd1pqVXRZV1l4TnkxaE5tTXpNek5rTlRVNU9UWT0iLCJzcGVjIjoxLCJpZCI6IjZiM
WVhMzdkLWJlMDEtNDBmNS1hZjE3LWE2YzMzM2Q1NTk5NiJ9" ...
```

2.6.5. Configure the Kubernetes cluster with the KeyControl secrets vault

To configure a Kubernetes cluster in the KeyControl vault, the following API needs to be executed.

```
https://<VAULT-IP>/vault/1.0/SetK8sConfiguration
```

The headers must have the vault authentication token, `X-Vault-Auth*: <VAULT-AUTHENTICATION-TOKEN>`.

The request body should be in the form:

```
{
 // URL of the Kubernetes API server (or Loadbalancer if one is setup in front of
 // control plane) along with port. This URL must be accessible by PASM vault.
 // If Cluster is behind a service mesh, a proper ingress should be configured
 // so that API server is accessible.
 "k8s_url": "https://<KC-ACCESSIBLE-IP>/<FQDN of K8s API server>:6443",

 // Base64 encoded string of the certificate presented by API server during SSL handshake
 "k8s_ca_string": "<BASE64-ENCODED-CA-STRING>",

 // Indicates whether this configuration should be enabled or not. Valid values
 // are 'enabled' or 'disabled'. If the value is 'disabled', then "k8s_url" and
 // "k8s_ca_string" won't be validated and won't be saved in the configuration.
 "k8s_status": "enabled",
}
```

The certificate string can be obtained from the `kube config` file (~/.kube/config):

```
% cat ~/.kube/config

apiVersion: v1
clusters:
- cluster:
    certificate-authority-data:
LS0tLS1CRUdJTiBDRVJUSUZJQ0FURS0tLS0tCk1JSUJlRENDQVIyZ0F3SUJBZ0lCQURBS0JnZ3Foa2pPUFFRREFqQWpNU0V3SHdZRFZRUUREQmhyT
TNNdGMyVnkKZG1WeUxXTmhRREUzTWpVME5EZzJOekF3SGhjTk1qUXdPVEEwTVRFeE56VXdXaGNOTXpRd09UQXlNVEV4TnpVdwpXakFqTVNFd0h3WU
RWUVFEREJock0zTXRjMlZ5ZG1WeUxXTmhRREUzTWpVME5EZzJOekF3V1RBVEJnY3Foa2pPClBRSUJCZ2dxaGtqT1BRTUJCd05DQUFUQzFGNE1uQTM
zb3RpcERCT2V2M1ltV1BpRmc4QUtVV2U3MkhFRXNUdFUKbE5mSStLMmVOalh0MVZkREhrZ1ZUQUZ5Q0VIRDhIbmtYU2F5YUhWUnZONThvME13UURB
T0JnTlZIUThCQWY4RQpCQU1DQXFRd0R3WURWUjBUQVFIL0JBVXdBd0VCL3pBZEJnTlZIUTRFRmdRVTU2bERZK2ZiL2xvck5MdlBpWGZ2CjJIK1V4d
W93Q2dZSUtvWkl6ajBFQXdJRFNRQXdSZ0loQUxrU1Z4M2I1ell3YzFuRlBUNzVMcTJpMGZ2UEhMRWsKbm5qRk1VOFp3d2VoQWlFQXh1K2NjZlQ1VC
9pbmVMUW1KaERIcmlHVjRRTDBUbmVKVTRqcmVDaHpvcVU9Ci0tLS0tRU5EIENFUlRJRklDQVRFLS0tLS0K
    server: https://127.0.0.1:6443
  name: default
contexts:
- context:
    cluster: default
```

```
    user: default
  name: default
current-context: default
kind: Config
preferences: {}
users:
- name: default
  user:
    client-certificate-data:
LS0tLS1CRUdJTiBDRVJUSUZJQ0FURS0tLS0tCk1JSUJrRENDQVRlZ0F3SUJBZ0lJUUM5QWRSdlZ4dWN3Q2dZSUtvWkl6ajBFQXdJd0l6RWhNQjhHQ
TFVRUF3d1kKYXpOekxXTnNhV1Z1ZEMxallVQXhOekkxTkRRNE5qY3dNQjRYRFRJME1Ea3dOREV4TVRjMU1Gb1hEVEkxTURrdwpOREV4TVRjMU1Gb3
dNREVYTUJVR0ExVUVDaE1PYzNsemRHVnRPbTFoYzNSbGNuTXhGVEFUQmdOVkJBTVRESE41CmMzUmxiVHBoWkcxcGJqQlpNQk1HQnlxR1NNNDlBZ0V
HQ0NxR1NNNDlBd0VIQTBJQUJCdW54clR2cC9XNDdTVkEKWU1kdmEwckhaQ09kb0dLSUZHN0hKQU1KSzdIN1FSV28xeG0ycHVpN3pwSUNmQUc2N2I1
bUJ1NVJzZFRENTBFUgp4ZGxzaTRDalNEQkdNQTRHQTFVZER3RUIvd1FFQXdJRm9EQVRCZ05WSFNVRUREQUtCZ2dyQmdFRkJRY0RBakFmCkJnTlZIU
01FR0RBV2dCUVlvQVRyQ1BKYkRpejJacTJTay80MXFESjB1VEFLQmdncWhrak9QUVFEQWdOSEFEQkUKQWlCVUQyWHBMM3k0NW8rbVlGZXAvSzQ5cD
dVVW41RS85LyttRkRERVdQaXRFQUlnRDlPVDREdFFrMFdQMHkyMQpiMCtaajdIcmF3WDBaeDh1MTNPVjJKdUdhbUU9Ci0tLS0tRU5EIENFUlRJRkl
DQVRFLS0tLS0KLS0tLS1CRUdJTiBDRVJUSUZJQ0FURS0tLS0tCk1JSUJkakNDQVIyZ0F3SUJBZ0lCQURBS0JnZ3Foa2pPUFFRREFqQWpNU0V3SHdZ
RFZRUUREQmhyTTNNdFkyeHAKWlc1MExXTmhRREUzTWpVME5EZzJOekF3SGhjTk1qUXdPVEEwTVRFeE56VXdXaGNOTXpRd09UQXlNVEV4TnpVdwpXa
kFqTVNFd0h3WURWUVFEREJock0zTXRZMnhwWlc1MExXTmhRREUzTWpVME5EZzJOekF3V1RBVEJnY3Foa2pPClBRSUJCZ2dxaGtqT1BRTUJCd05DQU
FUVlFicGRhZ0hnU2REVDFjcWVSNy8zZTN5b21RL1ZJVXRwNnFiVmQxVG0KbFhneXB6NmluMXBEMjd0Rk1ZczhxOE0xZEx6YzdGMDNRVnN0Q0lGMzU
4aC9vMEl3UURBT0JnTlZIUThCQWY4RQpCQU1DQXFRd0R3WURWUjBUQVFIL0JBVXdBd0VCL3pBZEJnTlZIUTRFRmdRVUdLQUU2d2p5V3c0czltYXRr
cFArCk5hZ3lkTGt3Q2dZSUtvWkl6ajBFQXdJRFJ3QXdSQUlnWUlHQUI0TzRiQjhBR3lhRGxNQlpjdGNXSG9DZXJZemoKcWU1U09PQmtYVXdDSUNtV
DBPREF0RUVIeldmcTQ4aFdiT0FldmU5anppcGgwTXR3UmoyS2tmZmQKLS0tLS1FTkQgQ0VSVElGSUNBVEUtLS0tLQo=
    client-key-data:
LS0tLS1CRUdJTiBFQyBQUklWQVRFIEtFWS0tLS0tCk1IY0NBUUVFSUtWdHlza1UvSEx3Y3VHS2RpWVZMOW5uOC9NRVh6ZEJFVVRMNW1QbVpxT3lvQ
W9HQ0NxR1NNNDkQXdFSG9VUURRZ0FFRzZmR3RPK245Ymp0SlVCZ3gyOXJTc2RrSTUyZ1lvZ1Vic2NrQXdrcnNmdEJGYWpYR2JhbQo2THZPa2dKOE
FicnR2bVlHN2xHeDFNUG5RUkhGMld5TGdBPT0KLS0tLS1FTkQgRUMgUFJJVkFURSBLRVktLS0tLQo=
```

Look at the **certificate-authority-data** attribute. It contains the base64 encoded certificate string needed for the configuration.

Now look at the **server** attribute. This is the field that we are going to use to get to the needed **k8s_url**.

This attribute content is https://127.0.0.1:6443.

Replace the 127.0.0.1 in the URL with the IP address of the server. This URL needs to be accessible from the KeyControl server. Make sure port 6443 is not blocked by the firewall. If using a VPN, make sure you can access the URL from a server on the same subnet as the KeyControl node.

The URL in our case is https://1X.19X.14X.XXX:6443.

You should get the following response:

```
{
  "kind": "Status",
  "apiVersion": "v1",
  "metadata": {},
  "status": "Failure",
  "message": "Unauthorized",
  "reason": "Unauthorized",
  "code": 401
}
```

The final request body:

```
{
 "k8s_url": "https://1X.19X.14X.XXX:6443",
 "k8s_ca_string": "<certificate-string>",
 "k8s_status": "enabled"
}
```

Save the request body in a file named `SetK8sConfiguration.body` and execute the following command:

```
% curl -H "X-Vault-Auth:
ZDg2ZTNjMjItNjU2My00NWI0LWJmYjktNDViYTZjOTExZWM4.eyJkYXRhIjoiU0ZSWFVBRUFKbktGNXNnWlBRSGJQNEQ3T2xTR2NXUHM2aVdqdzVJ
N21jRythdXZ5NUhIQjZYQ0tPRG9iK0FGcjRsSjNDZm1oZGZZbVc4aUt5aEtENmgydnlRQUFBQ1FBQUFBYkxndE9LcE1mTDIyK1JzQXQ4ZVlYanRyQ
3QrL2JBWFU0OFNYZGx4YVd1Qjl6N3RvYk8xRDhPOVZlbFFWdkZKenNIU3F6OXQ5VHd1TVhtMHNUMk11bjB0clRSakdDOUsva1VQdXRMMUxDT2dXK0
0xd0ZSM1BUZjZTbGZoZ3BUc3IwVjJCcEVPL3FRME1LaHVucUNiRUNjVldJNkVIbDQrWER0WUNiYzVCYTl5NWpqR0NVSHRFa2trcXdjQjBiTjl0SVB
oSitCcnU5ZjVqV3I0ZUFvNW5ZQ1U4d3VKZmRqYkMvTWJ3R3RsNGpxSzRERnlwRVFzQUk5bGdRM3Nvcm0wKzNlQjBKb0pWQ00wVTJZakZsWVRNM1pD
MWlaVEF4TFRRd1pqVXRZV1l4TnkxaE5tTXpNek5rTlRVNU9UWT0iLCJzcGVjIjoxLCJpZCI6IjZiMWVhMzdkLWJlMDEtNDBmNS1hZjE3LWE2YzMzM
2Q1NTk5NiJ9" -k -X POST https://xx.xxx.xxx.xxx/vault/1.0/SetK8sConfiguration/ --data @./SetK8sConfiguration.body
```

The response should be:

```
{
  "Status": "Success",
  "Message": "Kubernetes configuration updated successfully"
}
```

2.6.6. Set the namespace

Before proceeding with the rest of the configuration, set the namespace in Kubernetes to the `mutatingwebhook` namespace created earlier.

```
% kubectl config set-context --current --namespace=mutatingwebhook
```

2.6.7. Create the registry secrets inside the namespace

The credentials for the external Docker registry access need to be created so they can be mentioned in the pod deployment specification.

1. Create the secret in the namespace:

   ```
   % kubectl create secret generic regcred --from-file=.dockerconfigjson=$HOME/.docker/config.json
   --type=kubernetes.io/dockerconfigjson
   ```

2. Confirm that the secret has been created:

   ```
   % kubectl get secret regcred
   ```

2.6.8. Deploy the webhook container

Use the following `yaml` specification to deploy the webhook container in Kubernetes:

```
apiVersion: apps/v1
kind: Deployment
metadata:
  name: mutatingwebhook
  namespace: mutatingwebhook
  labels:
    app: mutatingwebhook
spec:
  replicas: 1
  selector:
    matchLabels:
      app: mutatingwebhook
  template:
    metadata:
      labels:
        app: mutatingwebhook
    spec:
      containers:
      - name: mutatingwebhook
        image: 1.2.3.4:5000/mutating-webhook:latest
        ports:
        - containerPort: 5000
        env:
        # Specify these variables either as a mutatingwebhook container environment variables or
        # add appropriate annotations in the pod specification. Refer documentation further to get
        # the details about annotations. The annotations in pod specifications, if specified, take
        # precedance over these environment variables.
        - name: ENTRUST_VAULT_IPS
          value: <comma-separated-list-of-vault-ips>
        - name: ENTRUST_VAULT_UUID
          value: <uuid-of-vault-from-which-secrets-to-be-fetched>
        - name: ENTRUST_VAULT_INIT_CONTAINER_URL
          value: <complete-url-of-init-container-image-from-image-registry>
```

If image registry requires authentication, then make sure to add the credentials as secret in the yaml specification by adding the `imagePullSecrets` tag in the containers section.

Save the yaml in a file called `mutatingwebhook.yaml`.

Example mutatingwebhook file

```
apiVersion: apps/v1
kind: Deployment
metadata:
  name: mutatingwebhook
  namespace: mutatingwebhook
  labels:
    app: mutatingwebhook
spec:
  replicas: 1
  selector:
    matchLabels:
      app: mutatingwebhook
  template:
```

```
    metadata:
      labels:
        app: mutatingwebhook
    spec:
      imagePullSecrets:
        - name: regcred                         # external registry secret created earlier
      containers:
      - name: mutatingwebhook
        image: >-
          <registry-url>/mutating-webhook
        ports:
        - containerPort: 5000
        env:
        # Specify these variables either as a mutatingwebhook container environment variables or
        # add appropriate annotations in the pod specification. Refer documentation further to get
        # the details about annotations. The annotations in pod specifications, if specified, take
        # precedance over these environment variables.
        - name: ENTRUST_VAULT_IPS
          value: 1x.19x.14x.20x,1x.19x.14x.21x
        - name: ENTRUST_VAULT_UUID
          value: d86e3c22-6563-45b4-bfb9-45ba6c911ec8
        - name: ENTRUST_VAULT_INIT_CONTAINER_URL
          value: <registry-url>/init-container
```

Pay attention to these sections and adjust according to your environment.

```
      imagePullSecrets:
        - name: regcred                         # external registry secret created earlier

        image: >-
          <registry-url>/mutating-webhook

        - name: ENTRUST_VAULT_IPS
          value: 1x.19x.14x.20x,1x.19x.14x.21x
        - name: ENTRUST_VAULT_UUID
          value: d86e3c22-6563-45b4-bfb9-45ba6c911ec8
        - name: ENTRUST_VAULT_INIT_CONTAINER_URL
          value: <registry-url>/init-container
```

Deploy the file:

```
% kubectl create -f mutatingwebhook.yaml
```

Check that the mutating webhook deployment is running:

```
% kubectl get pods
NAME                              READY   STATUS    RESTARTS   AGE
mutatingwebhook-7666fc54d7-jxs2s   1/1     Running   0          19s

% kubectl describe pod mutatingwebhook-7666fc54d7-jxs2s

Name:             mutatingwebhook-7666fc54d7-jxs2s
Namespace:        mutatingwebhook
Priority:         0
Service Account:  default
Node:             redhat-9-kcv-secrets/1X.19X.14X.XXX
Start Time:       Wed, 04 Sep 2024 09:42:51 -0400
Labels:           app=mutatingwebhook
                  pod-template-hash=7666fc54d7
```

```
Annotations:      <none>
Status:           Running
IP:               10.42.0.7
IPs:
  IP:           10.42.0.7
Controlled By:  ReplicaSet/mutatingwebhook-7666fc54d7
Containers:
  mutatingwebhook:
    Container ID:   containerd://49b07ac85063041fe772194dece7bb416965d13ebec2c74418d67bbd3a474a1a
    Image:          <registry-ulr>/mutating-webhook
    Image ID:       <registry-url>/mutating-
webhook@sha256:d5379f9b116f725c1e34cda7f10cba2ef7ed369681a768fb985d098cd24f1b1d
    Port:           5000/TCP
    Host Port:      0/TCP
    State:          Running
      Started:      Wed, 04 Sep 2024 09:43:06 -0400
    Ready:          True
    Restart Count:  0
    Environment:
      ENTRUST_VAULT_IPS:                1X.19X.14X.XXX,1X.19X.14X.XXX
      ENTRUST_VAULT_UUID:               d86e3c22-6563-45b4-bfb9-45ba6c911ec8
      ENTRUST_VAULT_INIT_CONTAINER_URL:  <registry-url>/init-container
    Mounts:
      /var/run/secrets/kubernetes.io/serviceaccount from kube-api-access-trrn7 (ro)
Conditions:
  Type                        Status
  PodReadyToStartContainers   True
  Initialized                 True
  Ready                       True
  ContainersReady             True
  PodScheduled                True
Volumes:
  kube-api-access-trrn7:
    Type:                    Projected (a volume that contains injected data from multiple sources)
    TokenExpirationSeconds:  3607
    ConfigMapName:           kube-root-ca.crt
    ConfigMapOptional:       <nil>
    DownwardAPI:             true
QoS Class:                   BestEffort
Node-Selectors:              <none>
Tolerations:                 node.kubernetes.io/not-ready:NoExecute op=Exists for 300s
                             node.kubernetes.io/unreachable:NoExecute op=Exists for 300s
Events:
  Type    Reason     Age   From               Message
  ----    ------     ----  ----               -------
  Normal  Scheduled  67s   default-scheduler  Successfully assigned mutatingwebhook/mutatingwebhook-7666fc54d7-
jxs2s to redhat-9-kcv-secrets
  Normal  Pulling    67s   kubelet            Pulling image "<registry-url>/mutating-webhook"
  Normal  Pulled     52s   kubelet            Successfully pulled image "<registry-url>/mutating-webhook" in
14.716s (14.716s including waiting). Image size: 86935850 bytes.
  Normal  Created    52s   kubelet            Created container mutatingwebhook
  Normal  Started    52s   kubelet            Started container mutatingwebhook
```

2.6.9. Deploy the entrust-pasm service

1. Create a `yaml` file named `entrustpasmservice.yaml` that contains the following code:

```
apiVersion: v1
kind: Service
metadata:
  name: entrust-pasm        # DO NOT CHANGE THIS
```

```
  namespace: mutatingwebhook    # DO NOT CHANGE THIS
spec:
  selector:
    app: mutatingwebhook
  ports:
    - protocol: TCP
      port: 5000
      targetPort: 5000
```

2. Run the following command to create the service:

```
% kubectl create -f entustpasmservice.yaml
```

3. Check the service:

```
% kubectl get service

NAME           TYPE        CLUSTER-IP     EXTERNAL-IP   PORT(S)    AGE
entrust-pasm   ClusterIP   10.43.26.173   <none>        5000/TCP   9s
```

2.6.10. Obtain the webhook server certificate

After the container is deployed, obtain the webhook server certificate. This certificate will be needed to configure the webhook in Kubernetes. Use the following command:

```
% kubectl exec -it -n mutatingwebhook $(kubectl get pods --no-headers -o custom-columns=":metadata.name" -n
mutatingwebhook) -- wget -q -O- localhost:8080/ca.pem
```

The output should be something like this:

```
LS0tLS1CRUdJTiBDRVJUSUZJQ0FURS0tLS0tCk1JSUZTekNDQXpPZ0F3SUJBZ0lVRUFiWFlYazZHVUVJM2lrUGZQbnp4MVRMRjdVd0RRWUpLb1pJa
HZjTkFRRUwKQlFBd1FERXhNQzhHQTFVRUF3d29TSGxVY25WemRDQkxaWGxEYjI1MGNtOXNJRU5sY25ScFptbGpZWFJsSUVGMQpkR2h2Y21sMGVURU
xNQWtHQTFVRUJoTUNWVk13SGhjTk1qUXdPREkzTVRjeU1ERTNXaGNOTXpRd09ESTFNVGN5Ck1ERTNXakJBTVRFd0x3WURWUVFERENoSWVWUnlkWE4
wSUV0bGVVTnZiblJ5YjJ3Z1EyVnlkR2xtYVdOaGRHVWcKUVhWMGFHOXlhWFI1TVFzd0NRWURWUVFHRXdKVlV6Q0NBaUl3RFFZSktvWklodmNOQVFF
QkJRQURnZ0lQQURDQwpBZ29DZ2dJQkFMTlVMQk5KVVVzYU1nSHlrR3hHOWcvdFBtZXdFTi9DODVlSFJjMmREOHZyZndiNkZ5dFg3UG1BCnRhSVliM
mJ4OUdTaldXVFlNNXlPL0g5WkY5L3BjUmJuYkdaNFBMTzBGdG1vM2FicCszRVJjTENWREZCamszQlcKTW9hOWQ1VVBkU2kzYnFBdGFrT2xFZHdOQ2
ZvSWhlMDZNOGF2TDcrVWtZV1FQWGppMzBDODZCUTRRWE01dkFKQwpwaFg1NmhCY3N1RjJDc0w2cGZYUjlJbFVjVTgwZFBKN1BiT3ZubWdNbGpYakp
YUnpHREJOUG9VS25HNmJ5N0tpCjV2TkNBaXYxRmJPQUxXUlZCZWdRUHZEdmpJRmVoMzBZUDRkamlydk5Yc1pNZnRiamFzZFVPWGhIMGFYK1BYN3cK
YTNFRUpZL290TjR4VVlLaTFGRlhteDRRWTZaSTVheWdnTzNHSTZEWDJUcENQUzFqcnpXL2xETzhtd1QzNEhFSApKSno1T05abkRGME40YXJJWnFKa
2dUVTd2Q1RaL3ltaWFsc2lDNkJQM1lUTkl5NmlKY1loczFUYWRQUVpmaElnCmxqeFhPQ2dDTXdLV1poNjdPdEtWTkNmeC83ZzBsbHhyeW1YY0xoY2
5aRy81azRDbmlmZHVTQWl4a1hRRVpXaTcKenRJL0ZIZjJMVGNrVkNnSms5NDlJSlNpSTdVREQwQkFHTkVnTE5hVnFBQ0pRbTNlQmVTS24xZ0c0ODN
HMTRQawp5MkYyMEpEelBreG5ZVlBoVkVpK29scXZ3ZFVPVlFNWFV5UTUyQTZ5RTQwZFZsSjBIZGJoTjdzOUJZQWJSUjB4Ck9xalcvTW0yL2trUE1r
Z3IyRlNsK2JhcVlzS1hKUktsNFVIemZlQUxNRXNIeCs3L2lMK0hBZ01CQUFHalBUQTcKTUF3R0ExVWRFd0VCL3dRQ01BQXdLd1lEVlIwUkJDUXdJb
0lnWlc1MGNuVnpkQzF3WVhOdExtMTFkR0YwYVc1bgpkMlZpYUc5dmF5NXpkbU13RFFZSktvWklodmNOQVFFTEJRQURnZ0lCQU1aVFpPNmhSS29HVE
s0eHB3b1hqY3p1CnloSzZCbURsejg0akd2ek85Q083dkZJblFRSkVlK1Mrc3lBb1l6N3kwNlpnUDZJYi9lZEx5by9aTFB0UDAralAKSnloSUNoN3l
XVldhNkJyNEE3VExBT1BpSWEvQmtaZHBaR3NMdENrbE5uckF1MFBBbXY0QWpUZUZzZWF2aXREeApBTWlYSUlTYk1TZG55bEhFVTUrMWREdzRMRTBt
N01UR2JlU2E3TnZEelVZdWhCNkxDVlhxTWlUQTQ3MCtpdXF4Cm10dkZ3WVU5RVgvV3ZLdlNibWFZZjRKR24rL3pBMlNpU0d5V0R1NW03RCtjazZoT
XBKenRXWW91YlNROWxQQTUKWmZxcDhBYkdnc1J3a1IyTjF1VzZFK1BJNWEzb1llU2NKMUJJeG5GTTBxNjJuV3ppdHB3SlRQN2VsNTlkSWFEQwpYaE
c3UWVxbDFCSUpWUHR6M2Nra1dCTzhuNlJhOHNtVWxTMVNSNkdUWDZ5RGIrV1YzVzVranhmZ0lrNXJCRnlyClRXeEVPSHlJQkdQc1d2UnAvNFlyTHR
zOW10ekpPUVJqeVpLUVZlaUhmaGI1T1JTSE9MT1Y3MERESHd5K2hIc0wKemtKRkc3Mm9ocDJYeDkweHdoeUVFdlhWYU5mRFpTekdKVXpWSFhTSDRW
dG1WaXFBbkFYQkhLYXdHVlA1OXBRVwphOEtuZWNVZkk3VExlSk9ya09HelZLeU05YUFHaS83MW92WFUwZnZOWXZscTlENU9FajVKME5mQ1hzWXdlc
DE5CnVyYlFpRUJJRFNMbElpekIxK1lUYUsvOTJHQ1IwaU1JeG5ON2NWU3l1UEJ1emRZSkt4QjdNZEhhZXFsM1FERzQKcUpjSm5BNmRhUFZ1dzFqMi
```

```
9sZmgKLS0tLS1FTkQgQ0VSVElGSUNBVEUtLS0tLQo=
```

This is a base64 encoded certificate. With this value, configure webhook in Kubernetes.

2.6.11. Configure the webhook in Kubernetes

In sample YAML spec replace the `caBundle` value with the value obtained in the previous section and configure the webhook with the `kubectl apply` command.

1. Create a `webhook.yaml` with the following code:

```
apiVersion: admissionregistration.k8s.io/v1
kind: MutatingWebhookConfiguration
metadata:
  name: "entrust-pasm.mutatingwebhook.com"
webhooks:
  - name: "entrust-pasm.mutatingwebhook.com"
    objectSelector:
      matchLabels:
        entrust.vault.inject.secret: enabled
    rules:
    - apiGroups: ["*"]
      apiVersions: ["*"]
      operations: ["CREATE"]
      resources: ["deployments", "jobs", "pods", "statefulsets"]
    clientConfig:
      service:
        namespace: "mutatingwebhook"
        name: "entrust-pasm"
        path: "/mutate"
        port: 5000
        # Replace value below with the value obtained from command
      caBundle:
LS0tLS1CRUdJTiBDRVJUSUZJQ0FURS0tLS0tCk1JSUZTekNDQXpPZ0F3SUJBZ0lVRUFiWFlYazZHVUVJM2lrUGZQbnp4MVRMRjdVd0RRWUp
Lb1pJaHZjTkFRRUwKQlFBd1FERXhNQzhHQTFVRUF3d29TSGxVY25WemRDQkxaWGxEYjI1MGNtOXNJRU5sY25ScFptbGpZWFJsSUVGMQpkR2
h2Y21sMGVURUxNQWtHQTFVRUJoTUNWVk13SGhjTk1qUXdPREkzTVRjeU1ERTNXaGNOTXpRd09ESTFNVGN5Ck1ERTNXakJBTVRFd0x3WURWU
VFERENoSWVWUnlkWE4wSUV0bGVVTnZiblJ5YjJ3Z1EyVnlkR2xtYVdOaGRHVWcKUVhWMGFHOXlhWFI1TVFzd0NRWURWUVFHRXdKVlV6Q0NB
aUl3RFFZSktvWklodmNOQVFFQkJRQURnZ0lQQURDQwpBZ29DZ2dJQkFMTlVMQk5KVVVzYU1nSHlrR3hHOWcvdFBtZXdFTi9DODVlSFJjMmR
EOHZyZndiNkZ5dFg3UG1BCnRhSVliMmJ4OUdTaldXVFlNNXlPL0g5WkY5L3BjUmJuYkdaNFBMTzBGdG1vM2FicCszRVJjTENWREZCamszQl
cKTW9hOWQ1VVBkU2kzYnFBdGFrT2xFZHdOQ2ZvSWhlMDZNOGF2TDcrVWtZV1FQWGppMzBDODZCUTRRWE01dkFKQwpwaFg1NmhCY3N1RjJDc
0w2cGZYUjlJbFVjVTgwZFBKN1BiT3ZubWdNbGpYakpYUnpHREJOUG9VS25HNmJ5N0tpCjV2TkNBaXYxRmJPQUxXUlZCZWdRUHZEdmpJRmVo
MzBZUDRkamlydk5Yc1pNZnRiamFzZFVPWGhIMGFYK1BYN3cKYTNFRUpZL290TjR4VVlLaTFGRlhteDRRWTZaSTVheWdnTzNHSTZEWDJUcEN
QUzFqcnpXL2xETzhtd1QzNEhFSApKSno1T05abkRGME40YXJJWnFKa2dUVTd2Q1RaL3ltaWFsc2lDNkJQM1lUTkl5NmlKY1loczFUYWRQUV
pmaElnCmxqeFhPQ2dDTXdLV1poNjdPdEtWTkNmeC83ZzBsbHhyeW1YY0xoY25aRy81azRDbmlmZHVTQWl4a1hRRVpXaTcKenRJL0ZIZjJMV
GNrVkNnSms5NDlJSlNpSTdVREQwQkFHTkVnTE5hVnFBQ0pRbTNlQmVTS24xZ0c0ODNHMTRQawp5MkYyMEpEelBreG5ZVlBoVkVpK29scXZ3
ZFVPVlFNWFV5UTUyQTZ5RTQwZFZsSjBIZGJoTjdzOUJZQWJSUjB4Ck9xalcvTW0yL2trUE1rZ3IyRlNsK2JhcVlzS1hKUktsNFVIemZlQUx
NRXNIeCs3L2lMK0hBZ01CQUFHalBUQTcKTUF3R0ExVWRFd0VCL3dRQ01BQXdLd1lEVlIwUkJDUXdJb0lnWlc1MGNuVnpkQzF3WVhOdExtMT
FkR0YwYVc1bgpkMlZpYUc5dmF5NXpkbU13RFFZSktvWklodmNOQVFFTEJRQURnZ0lCQU1aVFpPNmhSS29HVEs0eHB3b1hqY3p1CnloSzZCb
URsejg0akd2ek85Q083dkZJblFRSkVlK1Mrc3lBb1l6N3kwNlpnUDZJYi9lZEx5by9aTFB0UDAralAKSnloSUNoN3lXVldhNkJyNEE3VExB
T1BpSWEvQmtaZHBaR3NMdENrbE5uckF1MFBBbXY0QWpUZUZzZWF2aXREeApBTWlYSUlTYk1TZG55bEhFVTUrMWREdzRMRTBtN01UR2JlU2E
3TnZEelVZdWhCNkxDVlhxTWlUQTQ3MCtpdXF4Cm10dkZ3WVU5RVgvV3ZLdlNibWFZZjRKR24rL3pBMlNpU0d5V0R1NW03RCtjazZoTXBKen
RXWW91YlNROWxQQTUKWmZxcDhBYkdnc1J3a1IyTjF1VzZFK1BJNWEzb1llU2NKMUJJeG5GTTBxNjJuV3ppdHB3SlRQN2VsNTlkSWFEQwpYa
Ec3UWVxbDFCSUpWUHR6M2Nra1dCTzhuNlJhOHNtVWxTMVNSNkdUWDZ5RGIrV1YzVzVranhmZ0lrNXJCRnlyClRXeEVPSHlJQkdQc1d2UnAv
NFlyTHRzOW10ekpPUVJqeVpLUVZlaUhmaGI1T1JTSE9MT1Y3MEREHd5K2hIc0wKemtKRkc3Mm9ocDJYeDkweHdoeUVFdlhWYU5mRFpTekd
KVXpWSFhTSDRWdG1WaXFBbkFYQkhLYXdHVlA1OXBRVwphOEtuZWNVZkk3VExlSk9ya09HelZLeU05YUFHaS83MW92WFUwZnZOWXZscTlENU
9FajVKME5mQ1hzWXdlcDE5CnVyYlFpRUJJRFNMbElpekIxK1lUYUsvOTJHQ1IwaU1JeG5ON2NWU3l1UEJ1emRZSkt4QjdNZEhhZXFsM1FER
zQKcUpjSm5BNmRhUFZ1dzFqMi9sZmgKLS0tLS1FTkQgQ0VSVElGSUNBVEUtLS0tLQo=
    admissionReviewVersions: ["v1", "v1beta1"]
```

```
    sideEffects: None
    timeoutSeconds: 5
```

2. Run the following command to apply the changes:

```
% kubectl apply -f webhook.yaml

mutatingwebhookconfiguration.admissionregistration.k8s.io/entrust-pasm.mutatingwebhook.com created
```

2.7. Test the integration

Now that the Kubernetes cluster and KeyControl Vault are properly configured and set up let's deploy a couple of pods that will attempt to use the `ocsecret` created earlier inside the pod containers.

Important points:

- The deployment of pod (in which the secrets need to be fetched) must happen by the service accounts mentioned in the policy created above.
- The service accounts added in policy must have **system:auth-delegator** ClusterRole at the Kubernetes side.

2.7.1. Set the namespace

We created two namespaces earlier. Currently the integration should be set to the mutatingwebhook namespace. Change the namespace so it points to the test namespace.

```
> kubectl config set-context --current --namespace=testnamespace
```

2.7.2. Create the registry secrets inside the namespace

The credentials for the external Docker registry access need to be created so they can be mentioned in the pod deployment specification.

1. Create the secret in the namespace:

```
% kubectl create secret generic regcred --from-file=.dockerconfigjson=$HOME/.docker/config.json
--type=kubernetes.io/dockerconfigjson
```

2. Confirm that the secret has been created:

```
% kubectl get secret regcred
```

2.7.3. Create a policy in Secrets Vault for Kubernetes service accounts

Create a policy in the Secrets Vault that will enable Kubernetes service accounts to read secrets from the vault. To create such policy, the following API needs to be executed.

URL: https://<VAULT-IP>/vault/1.0/CreatePolicy

The headers must have the vault authentication token.

X-Vault-Auth: <VAULT-AUTHENTICATION-TOKEN>

The request body should be in the form:

```
{
  "name": "vault_user_policy",         // Name of the policy to be created
  "role": "Vault User Role",               // Role of user. DO NOT CHANGE THIS
  "principals": [
     {
       "k8s_user": {
         "k8s_namespace": "default",       // Namespace in which the service account resides
         "k8s_service_account": "default"  // Name of the service account
       }
     }
  ],
  "resources": [
     {
       "box_id": "box1", // Name of the box in which the secret(s) that need access reside. Can be '*' to
indicate all boxes
       "secret_id": [    // List of secrets to which access needs to be granted. Can be '*' to indicate all
secrets.
         "secret1",
         "secret2
       ]
     }
  ]
}
```

You must match the namespace `k8s_namespace` to the same namespace the service account resides in and where you will be deploying the pods.

1. Save the request body for the environment to a file named `createpolicy.body`:

```
{
  "name": "kubernetes_vault_user_policy",
  "role": "Vault User Role",
  "principals": [
     {
       "k8s_user": {
         "k8s_namespace": "testnamespace",
```

```
        "k8s_service_account": "default"
      }
    }
  ],
  "resources": [
    {
      "box_id": "box1",
      "secret_id": [
        "*"
      ]
    }
  ]
}
```

In this example, the policy will allow the `default` user in the `testnamespace` to have access to any secret in `box1` in the KeyControl Secrets vault.

2. Check and adjust the following sections according to your environment:

```
      "k8s_user": {
        "k8s_namespace": "testnamespace",
        "k8s_service_account": "default"

      "box_id": "box1",
      "secret_id": [
        "*"
      ]
```

3. Create the policy:

```
curl -H "X-Vault-Auth: <VAULT-IDENTIFICATION-TOKEN>" -k -X POST
https://1X.19X.14X.XXX/vault/1.0/CreatePolicy/ --data @./createpolicy.body

{"policy_id": "kubernetes_vault_user_policy-82756a"}
```

2.7.4. Create the clusterrolebinding

Create the clusterrolebinding to allow the default user access to the secrets:

```
% kubectl create clusterrolebinding authdelegator --clusterrole=system:auth-delegator
--serviceaccount=testnamespace:default
```

Test the access by running the following command:

```
% kubectl auth can-i create tokenreviews --as=system:serviceaccount:testnamespace:default
```

The output should be `yes` if set up correctly.

2.7.5. Deploy the pod with secrets

Secrets can be added to the pod either as volume mounts or as environment variables.

2.7.5.1. Add secrets as volume mounts to the pod

The sample pod specification along with labels and annotations required for successfully pulling secrets as volumes mounts:

```
apiVersion: v1
kind: Pod
metadata:
  name: pod1
  namespace: testnamespace
  labels:
    app: test
    entrust.vault.inject.secret: enabled        # Must have this label
  annotations:
    entrust.vault.ips: <comma-separated-list-of-vault-ips>
    entrust.vault.uuid: <uuid-of-vault-from-which-secrets-to-be-fetched>
    entrust.vault.init.container.url: <complete-url-of-init-container-image-from-image-registry>
    entrust.vault.secret.file.k8s-box.ca-cert: output/cert.pem  # box and secret name from vault and value
denoting location of secret on the container. The location
spec:
  serviceAccountName: k8suser          # Service account name configured in PASM Vault Policy
  containers:
  - name: ubuntu
    image: 10.254.154.247:5000/ubuntu:latest
    command: ['cat','/output/ans.txt']
    imagePullPolicy: IfNotPresent
```

The pod specification must have the following annotations:

- `entrust.vault.inject.secret: enabled`: This label indicates that it needs secret.
- `entrust.vault.ips`: This value is a comma-separated list of IPs of vaults which are in the cluster.

  This annotation, if specified, will override the `ENTRUST_VAULT_IPS` environment variable from the mutating webhook configuration.

- `entrust.vault.uuid`: This value denotes the UUID of the vault from which we need to fetch the secrets.

  This annotation, if specified, will override the `ENTRUST_VAULT_UUID` environment variable from the mutating webhook configuration.

- `entrust.vault.init.container.url`: This value denotes the complete URL of the init container image pushed into image registry.

  This annotation, if specified, will override the `ENTRUST_VAULT_INIT_CONTAINER_URL` environment variable from the mutating webhook configuration.

- Annotations in the form of `entrust.vault.secret.file.{box-name}.{secret-name}`.

  The `box-name` and `secret-name` placeholders within the annotation should denote the name of the box and the secret name within that box that needs to be pulled.

  For example, if the secret was named `db-secret` and the box was `k8s-box`, then the name of the annotation would be `entrust.vault.secret.file.k8s-box.db-secret`. The value of the annotation should be the path to the file where the secret needs to be stored within the container. The path should be relative to the `/` directory, meaning that if the secret needs to be present in `/output/cert.pem`, then the value of the annotation should be `output/cert.pem`

- In the `spec` section, the `serviceAccountName` value should be the name of the service account that was added in the policy in the Secrets vault.

To add the secrets as volume mounts to the pod:

1. Create a file named `pod1.yaml` with the yaml for the environment. We are using the box and secret we created earlier in the Secrets vault. (`box1` and `ocsecret`). We also had to provide the credentials for the Docker registry.

```
apiVersion: v1
kind: Pod
metadata:
  name: pod1
  namespace: testnamespace
  labels:
    app: test
    entrust.vault.inject.secret: enabled               # Must have this label
  annotations:
    entrust.vault.ips: 1x.19x.14x.20x,1x.19x.14x.21x
    entrust.vault.uuid: d86e3c22-6563-45b4-bfb9-45ba6c911ec8
    entrust.vault.init.container.url: <registry-url>/init-container
    entrust.vault.secret.file.box1.ocsecret: output/ocsecret.txt
spec:
  imagePullSecrets:
    - name: regcred                    # external registry secret created earlier
  serviceAccountName: default          # Service account name configured in PASM Vault Policy
  containers:
  - name: ubuntu
    image: ubuntu
    command: ["sh", "-c"]
    args:
        - echo "Getting secret from KeyControl Secrets Vault";
          cat /output/ocsecret.txt;
          echo;
          echo "DONE" && sleep 3600
    imagePullPolicy: IfNotPresent
```

2. Check and adjust the following sections according to your environment:

```
  annotations:
```

```
    entrust.vault.ips: 1x.19x.14x.20x,1x.19x.14x.21x
    entrust.vault.uuid: d86e3c22-6563-45b4-bfb9-45ba6c911ec8
    entrust.vault.init.container.url: <registry-url>/init-container
    entrust.vault.secret.file.box1.ocsecret: output/ocsecret.txt

  imagePullSecrets:
    - name: regcred                    # external registry secret created earlier

    command: ["sh", "-c"]
    args:
        - echo "Getting secret from KeyControl Secrets Vault";
          cat /output/ocsecret.txt;
          echo;
          echo "DONE" && sleep 3600
```

3. Deploy the pod:

```
% kubectl create -f pod1.yaml
```

4. Check the pod to verify that it is capable of pulling the secret from a KeyControl Secrets Vault:

```
% kubectl logs pod/pod1

Defaulted container "ubuntu" out of: ubuntu, secret-v (init)
Getting secret from KeyControl Secrets Vault
This is the secret coming from KCV to Kubernetes.
DONE
```

2.7.5.2. Pull a secret as an environment variable into the pod

Kubernetes supports initiating environment variables for a container either directly or from Kubernetes secrets. For security purposes, the Secrets Vault takes the later approach. Also, if secrets are injected using environment variables, a sidecar container will be added which will delete the Kubernetes secrets after the successful injection of KeyControl Secret Vault secrets as environment variables in the main application container. Since we need to create and delete Kubernetes secrets for this, the service account must also have the required permissions to create and delete the Kubernetes secrets.

1. Grant the service account with required permissions: (replace the `namespace` and `serviceaccount` values appropriately)

```
% kubectl create rolebinding secretrole --namespace testnamespace --clusterrole=edit
--serviceaccount=testnamespace:default
```

2. To check if proper permissions are set up for the service account, use the following commands:

```
% kubectl auth can-i create secrets -n testnamespace --as=system:serviceaccount:testnamespace:default
% kubectl auth can-i delete secrets -n testnamespace --as=system:serviceaccount:testnamespace:default
```

The output of both the above commands should be **yes**.

3. Save the following sample pod specification yaml in a file called `pod2.yaml`. It shows how to deploy a pod with secrets as environment variables.

```
apiVersion: v1
kind: Pod
metadata:
  name: pod2
  namespace: testnamespace
  labels:
    app: test2
    entrust.vault.inject.secret: enabled        # Must have this label
  annotations:
    entrust.vault.ips: 10.19x.14x.20x.,10.19x.14x.21x
    entrust.vault.uuid: d86e3c22-6563-45b4-bfb9-45ba6c911ec8
    entrust.vault.init.container.url: <registry-url>/init-container
    entrust.vault.secret.env.box1.ocsecret: OCSECRET
spec:
  imagePullSecrets:
    - name: regcred                    # external registry secret created earlier
  serviceAccountName: default          # Service account name configured in PASM Vault Policy
  containers:
  - name: ubuntu
    image: ubuntu
    command: ["sh", "-c"]
    args:
        - echo "Getting secret from KeyControl Secrets Vault";
          printenv OCSECRET;
          echo "DONE" && sleep 3600
    imagePullPolicy: IfNotPresent
```

4. To pull the secret as an environment variable, add an annotation of the form `entrust.vault.secret.env.{box-name}.{secret-name}`. The value of the annotation should indicate the name of the environment variable in which the secret data is expected to be present.
5. Check and adjust the following sections according to your environment. These annotations are as documented in the previous section.

```
  annotations:
    entrust.vault.ips: 10.19x.14x.20x.,10.19x.14x.21x
    entrust.vault.uuid: d86e3c22-6563-45b4-bfb9-45ba6c911ec8
    entrust.vault.init.container.url: <registry-url>/init-container
    entrust.vault.secret.env.box1.ocsecret: OCSECRET

  imagePullSecrets:
    - name: regcred                    # external registry secret created earlier

    command: ["sh", "-c"]
    args:
        - echo "Getting secret from KeyControl Secrets Vault";
          printenv OCSECRET;
          echo "DONE" && sleep 3600
```

6. Create and test the pod:

```
% kubectl create -f pod2.yaml
```

7. Check the pod output to verify that it is capable of pulling the secret from the KeyControl Secrets vault:

```
% kubectl logs pod/pod2

Defaulted container "ubuntu" out of: ubuntu, pasm-sidecar, secret-v (init)
Getting secret from KeyControl Secrets Vault
This is the secret coming from KCV to Kubernetes.
DONE
```

Chapter 3. Troubleshooting

Use the following commands troubleshoot pods during deployment.

3.1. Look at the logs

You can use `kubectl logs`:

```
% kubectl logs pod/podname
```

For example:

```
% kubectl logs pod/pod1
```

You can also use `kubectl describe`:

```
% kubectl describe pod podname
```

For example:

```
% kubectl describe pod pod1
```

3.2. Look at the init container

In the guide, the `init` container is deployed at each pod that gets the secret.

To look at the logs for the `init` container:

```
% kubectl logs pods/pod1 -c secret-v --namespace=testnamespace
```

Chapter 4. Additional resources and related products

4.1. nShield Connect

4.2. nShield as a Service

4.3. KeyControl

4.4. KeyControl as a Service

4.5. nShield Container Option Pack

4.6. Entrust products

4.7. nShield product documentation