Bring Your Own Key for Oracle Cloud and Entrust Cryptographic Security Platform Key Management Vault

Integration Guide

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Chapter 1. Introduction

This document describes the integration of Oracle Cloud Infrastructure (OCI) Bring Your Own Key (BYOK), referred to as OCI BYOK in this guide, with the Entrust Cryptographic Security Platform Key Management Vault.

1.1. Documents to read first

- Entrust Cryptographic Security Platform Key Management Vault: nShield® HSM Integration Guide. This document is also available from the Entrust Document Library.
- Cryptographic Security Platform Vault for Cloud Keys.
- Configuring Vault Authentication for Cryptographic Security Platform Vault for Cloud Keys.
- Cryptographic Security Platform Vault BYOK Overview
- Configuring OCI for Cryptographic Security Platform Vault BYOK.
- Also refer to the documentation for OCI in the Oracle Cloud Infrastructure Documentation.

1.2. Product configurations

Entrust has successfully tested the integration of Cryptographic Security Platform Key Management Vault with OCI BYOK in the following configurations:

Vendor	Product	Version
Oracle	Oracle Cloud	N/A
Entrust	Cryptographic Security Platform	1.0
Entrust	Key Management Vault	10.4.5
VMware	vSphere	8.0

1.3. Features tested

Entrust has successfully tested the following features:

Feature	Tested
API Key Generation	✓

Feature	Tested
API Key Rotation	✓
OCI API Connection	✓
OCI Compartment Creation	✓
OCI Vault Creation	✓
OCI Vault Master Encryption Key Creation	✓
OCI Bucket Creation	✓
CloudKey Creation for OCI Vault Master Encryption Key.	✓
Disabling and Enabling cloud key	✓

1.4. Requirements

Entrust recommends that you allow only unprivileged connections unless you are performing administrative tasks.

Chapter 2. Procedures

2.1. Prerequisites

Before you perform the integration, complete the following tasks:

1. Deploy and configure Entrust Key Management Vault.
2. Ensure that you have access to Oracle Cloud Infrastructure (OCI).
3. If the OCI user is not in the administrators group, create a policy that allows the user to manage keys and vaults.
4. Ensure that the OCI user was created in the default identity domain for the tenancy, because users in non-default identity domains are not supported.
5. Ensure that the endpoints whitelisted for OCI BYOK work:

   If your organisation restricts outbound access to the public internet, the following endpoints will need to be whitelisted for OCI BYOK to work:

   - `https://cloud.oracle.com/`
   - `https://kms.<region>.oraclecloud.com`

     This endpoint must be individually whitelisted for each region you want to use.

   - `https://identity.<region>.oci.oraclecloud.com`

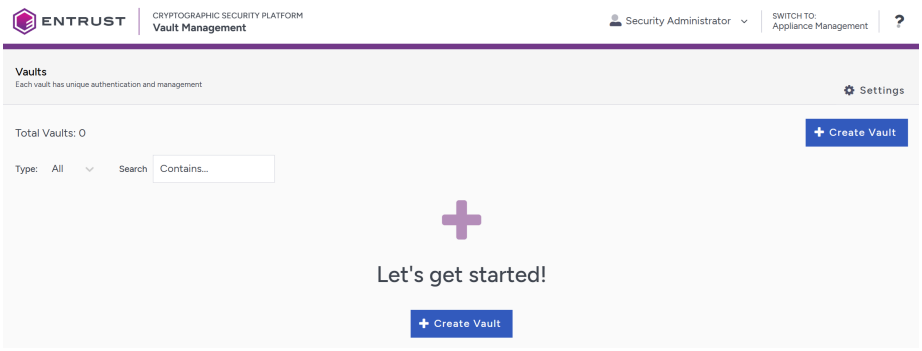
     This endpoint must be individually whitelisted for each region you want to use).

   - `https://<vaultid>-management.kms.<region>.oraclecloud.com`

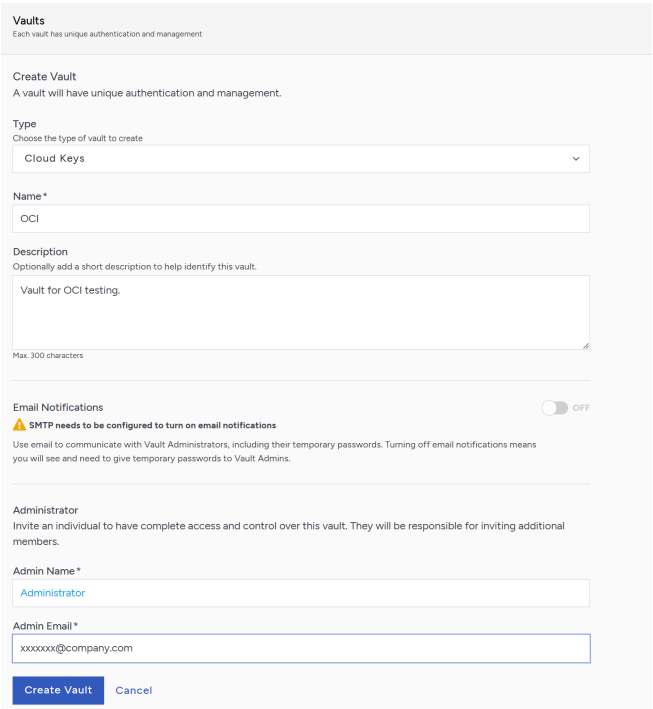
     This endpoint must be individually whitelisted for each vault you want to use. The URL can be found on the vault information tile in the OCI console.

2.2. Create a CloudKey Vault in the Key Management Vault server

1. Log in to the Key Management Vault server in your web browser using the **secroot** credentials.
2. If you are not in the Vault Management interface, select **SWITCH TO: Manage Vaults** in the menu header
3. Select **Create Vault**.

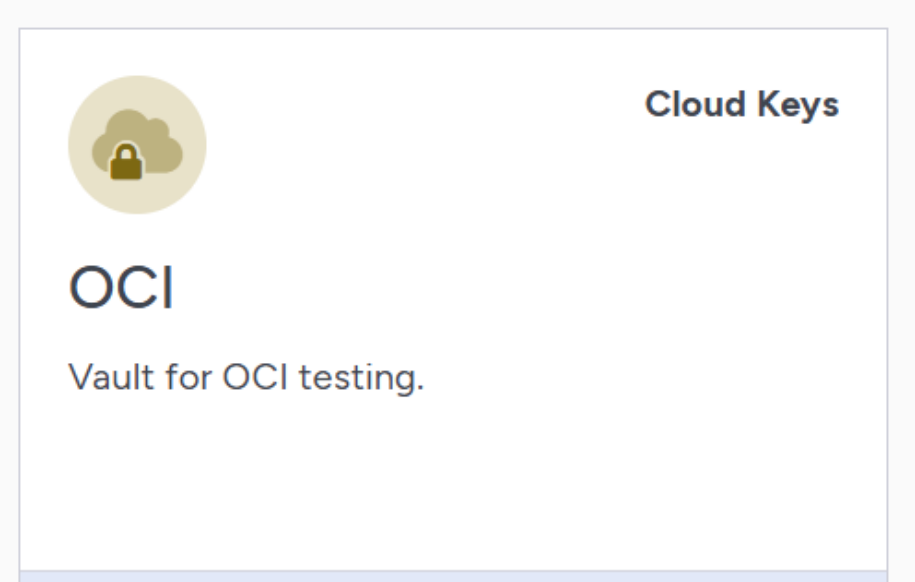


4. Create a **CloudKey** Vault:
    - For **Type**, select **Cloud Keys**.
    - For **Name**, enter a vault name.
    - For **Description**, enter a description for the vault.
    - For **Admin Name**, enter the name of the vault administrator.
    - For **Admin Email**, enter a valid email for the administrator.



A temporary password will be emailed to the administrator's email address when the vault is created. Use this password the first time that you sign in to the CloudKey Vaults space in Key Management Vault. In a closed gap environment where email is not available, the password for the user is displayed when you first create the vault. Copy this password and send it to the user.

5. Select **Create Vault**.
6. Select **Close** when the vault creation completes.
7. The newly created vault is added to the vault dashboard.



8. Go to the displayed URL and sign in with the credentials given.

   When you sign in for the first time, the system will prompt you to change the password.

2.3. OCI Setup

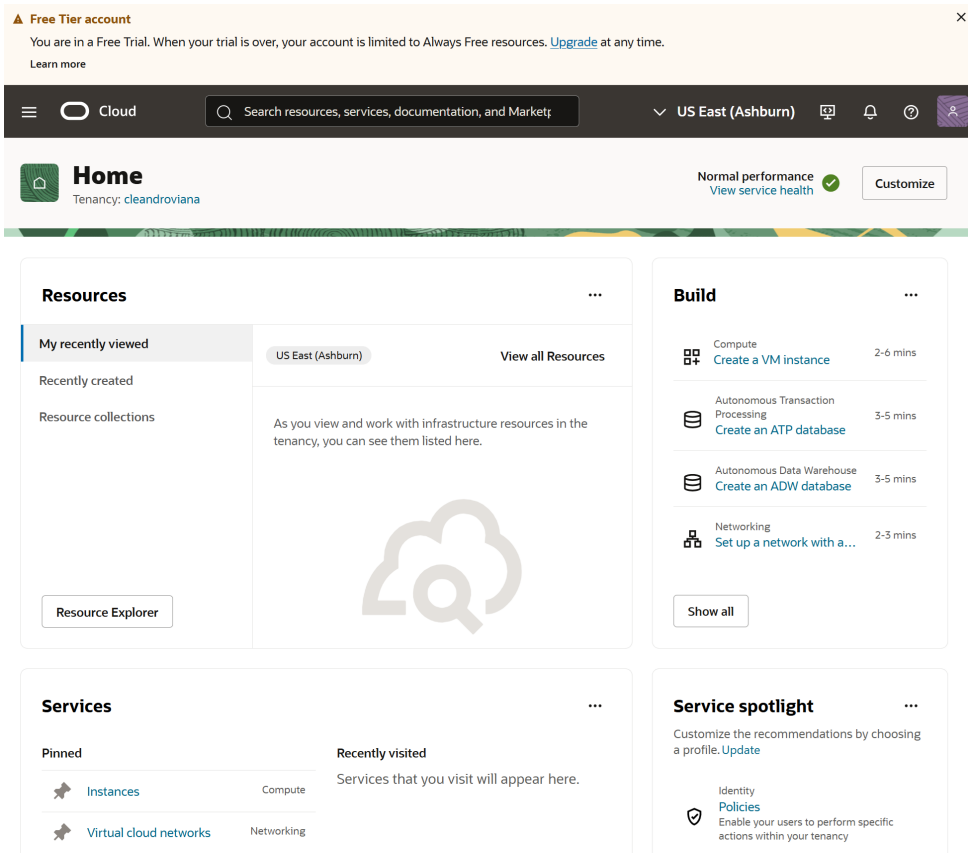
Setting up OCI from scratch is a multi-step process that involves creating an account, configuring networks, provisioning resources, and deploying your applications or services. Use the following steps as a general guide to get started:

2.3.1. Create an Oracle Cloud Account

Visit the Oracle Cloud website and create an account: https://cloud.oracle.com/

2.3.2. Log In to Oracle Cloud Console

Use your credentials to log in to the Oracle Cloud Console. This is your central location for configuring and managing OCI resources.



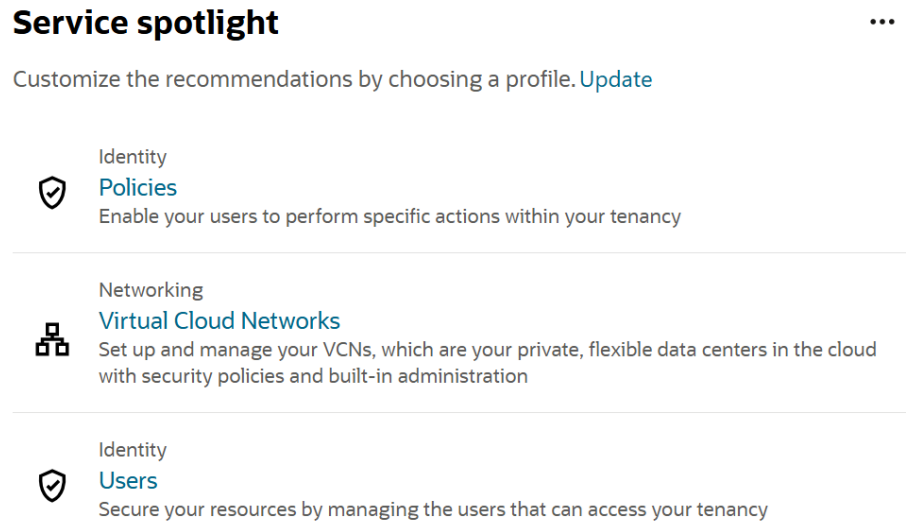
2.3.3. Add an API Key for the OCI User

The API key provides a configuration file snippet that contains the connection information that allows you to connect to the Entrust Cryptographic Security Platform Key Management Vault.

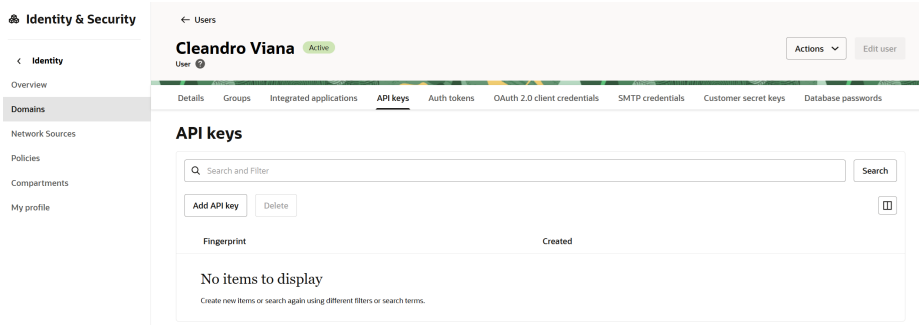
It might take up to 5 minutes for a new API key to become active on OCI. If you attempt to create your Cloud Service Provider account before the API key is active, it will fail with the following error: `Failed to validate Access Credentials OCI returned error: Client is unauthorized. null` Wait for a few minutes before you attempt to recreate your Cloud Service Provider account. For more information, see Adding a Cloud Service Provider Account for OCI.

1. In OCI, navigate to the user that got created for you when you signed up for OCI.

   You can find the **Users** link under the **Services spotlight** section in the console.



2. Select **Users** and then the user that got created for you.
3. On the user page, select the **API Keys** tab.



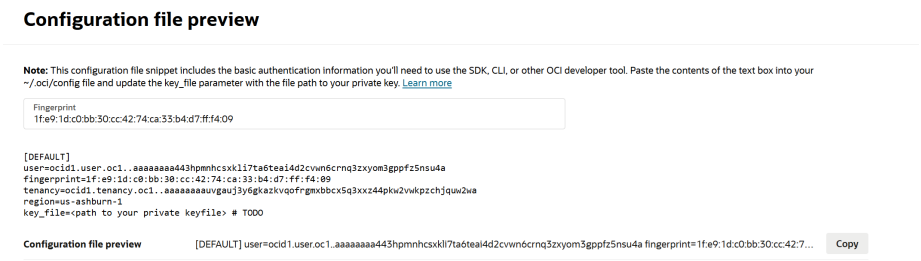
4. Under **API Keys**, select **Add API Key**.
5. Add the key using your preferred method. For this guide, **Generate API key pair** was used.

   The API key is an RSA key pair in PEM format. You can either generate the key pair here and download the private key, or, if you already have a key pair, you can choose to upload or paste your public key file instead.

   > Download the private and public keys because these files will be used later in the integration.

6. Click **Add**.

   The Configuration file preview window displays the information that you need to connect to Entrust Cryptographic Security Platform Key Management Vault.



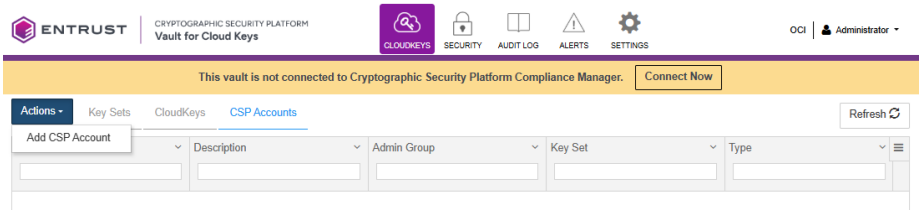
7. Click **Copy** to copy the file, and paste it somewhere you can access later on.

```
[DEFAULT]
user=ocid1.user.oc1..aaaaaaaa443hpmnhcsxkli7ta6teai4d2cvwn6crnq3zxyom3gppfz5nsu4a
fingerprint=1f:e9:1d:c0:bb:30:cc:42:74:ca:33:b4:d7:ff:f4:09
tenancy=ocid1.tenancy.oc1..aaaaaaaauvgauj3y6gkazkvqofrgmxbbcx5q3xxz44pkw2vwkpzchjquw2wa
region=us-ashburn-1
key_file=<path to your private keyfile> # TODO
```

2.3.4. Add a Cloud Service Provider Account for OCI

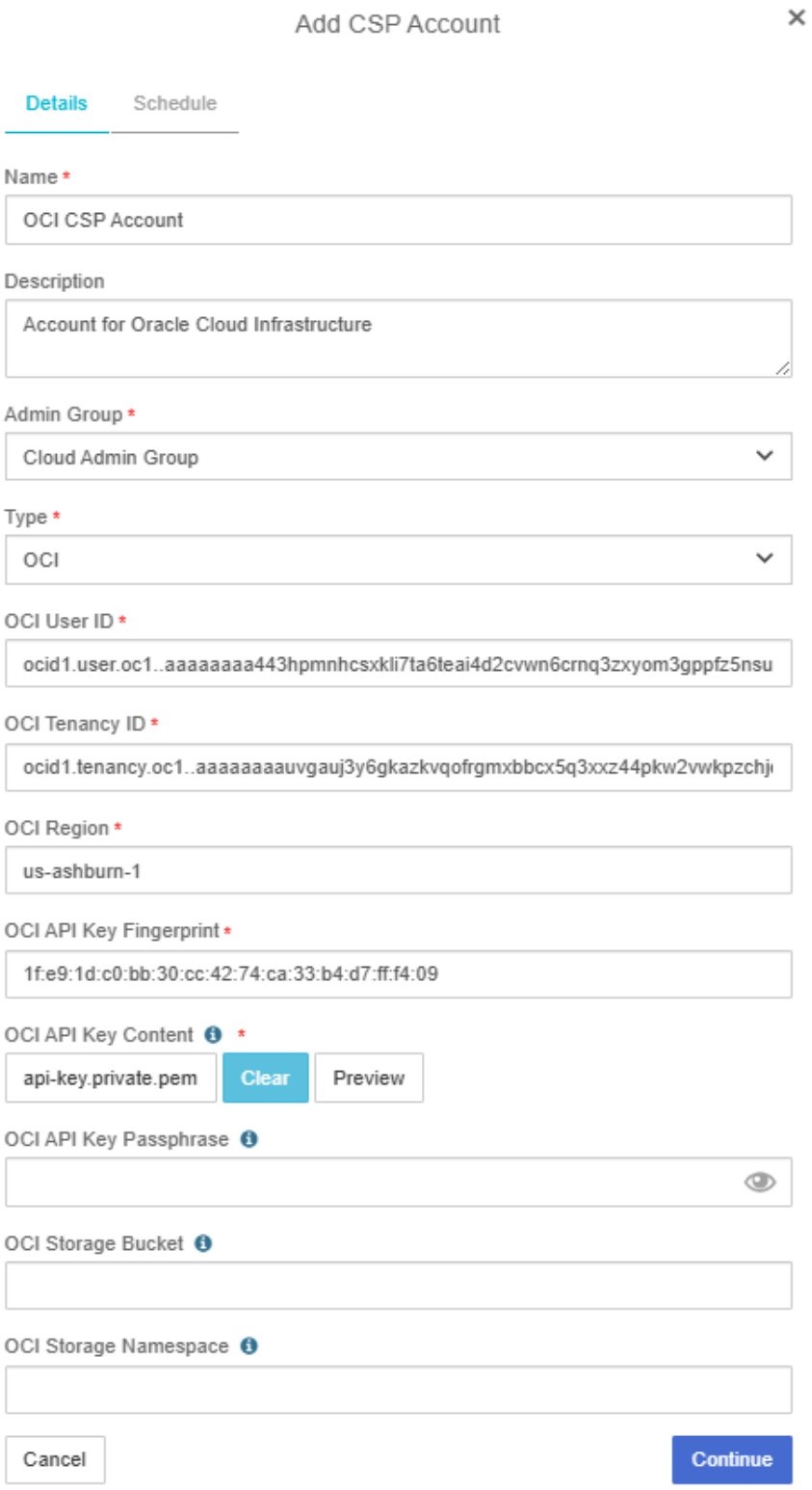
It may take up to 5 minutes for a new API key to become active on OCI. If you attempt to create your Cloud Service Provider account before the API key is active, it will fail with the following error: `Failed to validate Access Credentials OCI returned error: Client is unauthorized. null` Wait for a few minutes before you attempt to recreate your Cloud Service Provider account. For more information, see Adding a Cloud Service Provider Account for OCI.

1. Log in to the Entrust Cryptographic Security Platform Key Management Vault: Cloud Keys Vault webGUI using an account with Cloud Admin privileges.
2. In the top menu bar, select **CloudKeys**.
3. Select the **CSP Accounts** tab.
4. Select **Actions > Add Cloud Service Provider Account**.



5. On the **Details** tab of the **Add CSP Account** dialog box, enter the account details as follows:
   - For **Name**, enter the name you want to use for the Cloud Service Provider Account.

- For **Description**, enter an optional description of the Cloud Service Provider Account.
- For **Admin Group**, select the Admin Group that you want to use for the account, for example **Cloud Admin Group**.
- For **Type**, select **OCI**.
- For **OCI User ID**, copy the user information (everything after `user=`) from the configuration file preview.
- For **OCI Tenancy ID**, copy the tenancy information (everything after `tenancy=`) from the configuration file preview.
- For **OCI Region**, copy the region information (everything after `region=`) from the configuration file preview.
- For **OCI API Key Fingerprint**, copy the fingerprint information (everything after `fingerprint=`) from the configuration file preview.
- For **OCI API Key Content**, click **Load File** to upload the private keyfile that you generated.
- For **OCI API Key Passphrase**, if you generated an RSA Key Pair with a passphrase, enter the passphrase here.
- For **OCI Storage Bucket**, if you are using a virtual private vault, enter the bucket name. This is where backups of HSM-protected keys in a virtual private vault will be stored. If you have a virtual private vault, imported keys will not be stored in the Cryptographic Security Platform Vault for Cloud Keys.
- For **OCI Storage Namespace**, if you are using a virtual private vault, enter the namespace of the storage bucket.

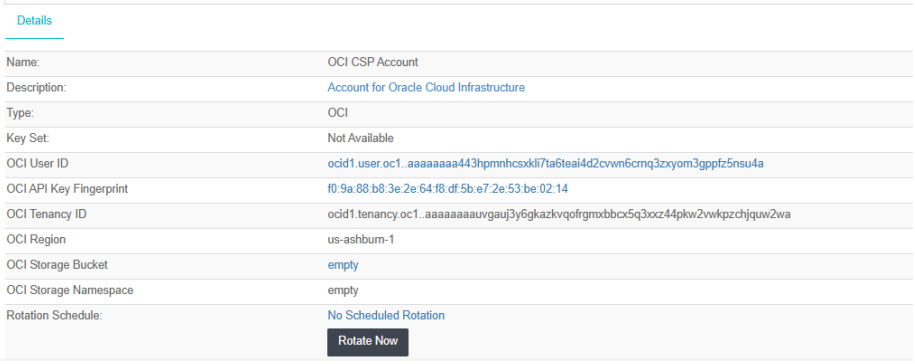


6. Click **Continue**.
7. On the **Schedule** tab, determine the rotation schedule. This can be one of the following:
    - Never: The api keys will never be rotated.

- Every *x* days: The API keys will be rotated after *x* days, where *x* is a value from 1 to 540.
- Every *x* weeks: The api keys will be rotated after *x* weeks, where *x* is a value from 1 to 72.
- Every *x* months: The api keys will be rotated after *x* months, where *x* is a value from 1 to 18.
- Every *x* years: The api keys will be rotated every year, where *x* must be "1".

8. Click **Add**.

   You should be able to see the newly created CSP Account. Select it to view the details:



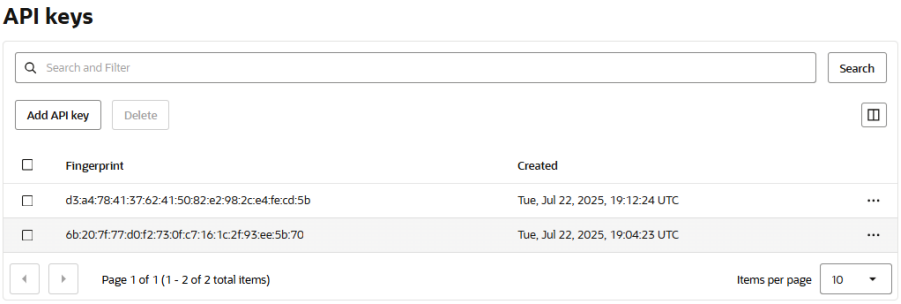
2.4. Testing the Integration

This section demonstrates one possible usage of Entrust Cryptographic Security Platform Key Management Vault in the integration. The following steps set up an OCI storage bucket where the contents are encrypted with an encryption key generated by Entrust Cryptographic Security Platform Key Management Vault and uploaded to an OCI vault.

2.4.1. Rotate the Access Credentials from Entrust Cryptographic Security Platform Key Management Vault

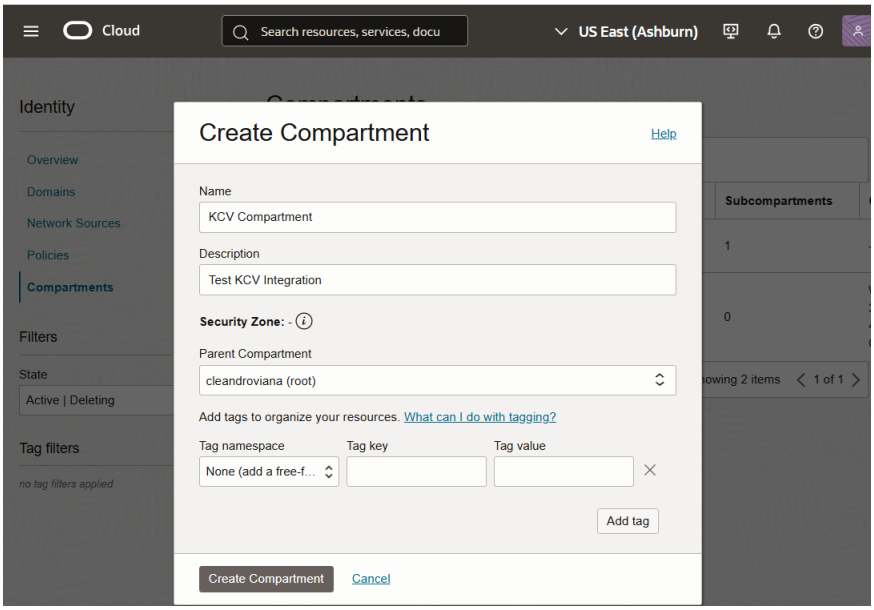
1. Log in to the Entrust Key Management Vault Cloud Keys Vault webGUI using an account with Cloud Admin privileges.
2. In the top menu bar, click **CloudKeys**.
3. Select the **CSP Accounts** tab.
4. Select the **CSP Account** created earlier.
5. In the **Details** tab, under the **Rotation Schedule**, select **Rotate Now**.

   This should rotate the API Keys. To check the rotation, you can check the **API Keys** tab in the User's page under OCI. You should see a new fingerprint for the key.



2.4.2. Create a Compartment in OCI that will be used for the testing.

1. In the OCI UI, search for **compartments**.
2. Under **Services**, select **compartments**.
3. Select **Create Compartment**.
4. In the **Create Compartment** dialog, enter the following details:
   - For **Name**, enter a name for the compartment.
   - For **Description**, enter a description for the compartment.
   - For **Parent Compartment**, use the default parent compartment.
   - For the other fields, leave the default values.



5. Select **Create Compartment**.
6. Refresh the page and you should see the compartment listed.

2.4.3. Create a Policy

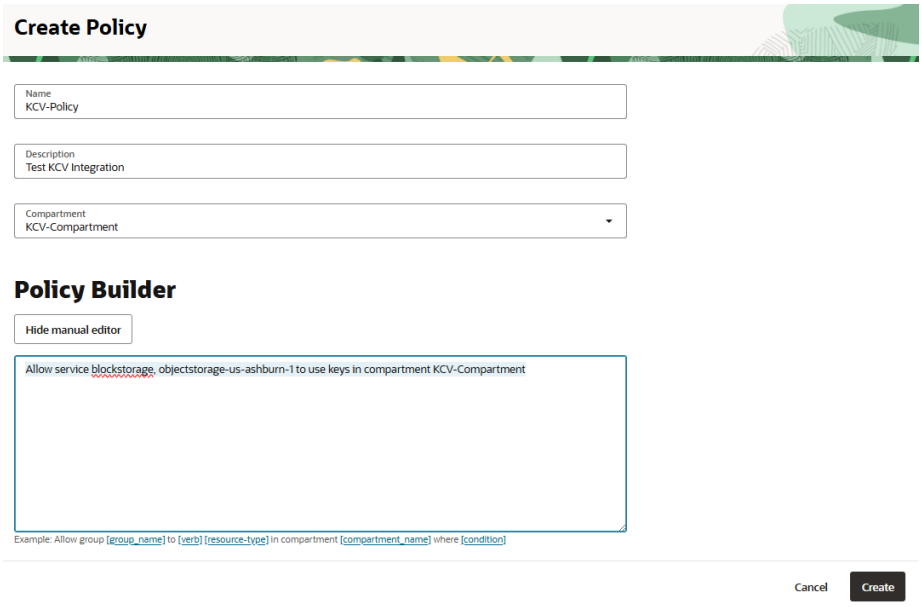
Create a policy that allows storage buckets to access the master encryption keys present in the test compartment.

1. In the OCI UI, search for **policies**.
2. Under **Services**, select **policies**.
3. Select **Create Policy**.
4. In the **Create Policy** dialog, enter the following details:
    - For **Name**, enter the name of the policy.
    - For **Description**, enter a description for the policy.
    - For **Compartment**, select the compartment created earlier.
    - Under **Policy Builder**, select **Show Manual Editor** and enter the following text:

```
Allow service blockstorage, objectstorage-us-ashburn-1 to use keys in compartment KCV-Compartment
```

us-ashburn-1 is the region and **KCV-comparment** is the compartment created earlier.

5. Select **Create**.

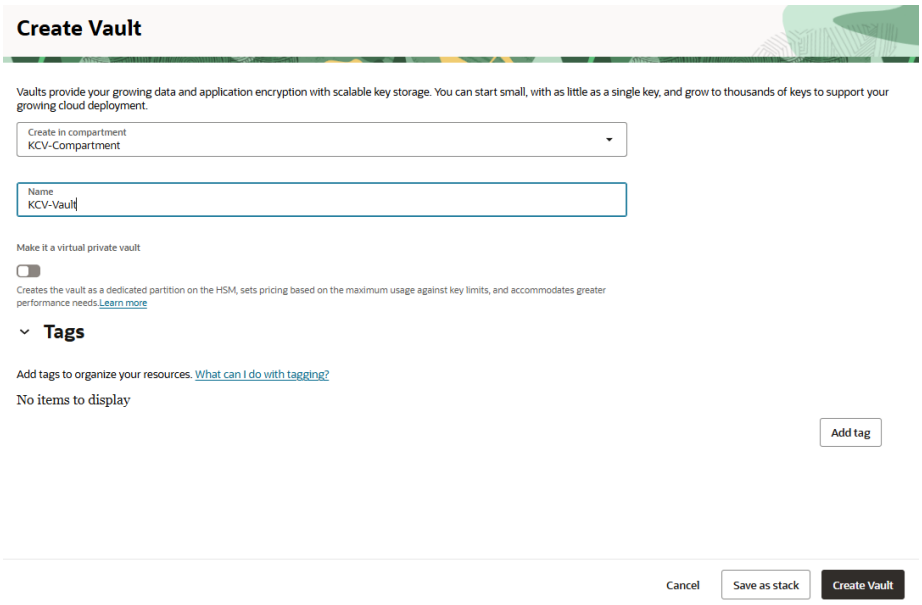


2.4.4. Create a Vault

Now create a vault in the compartment created earlier.

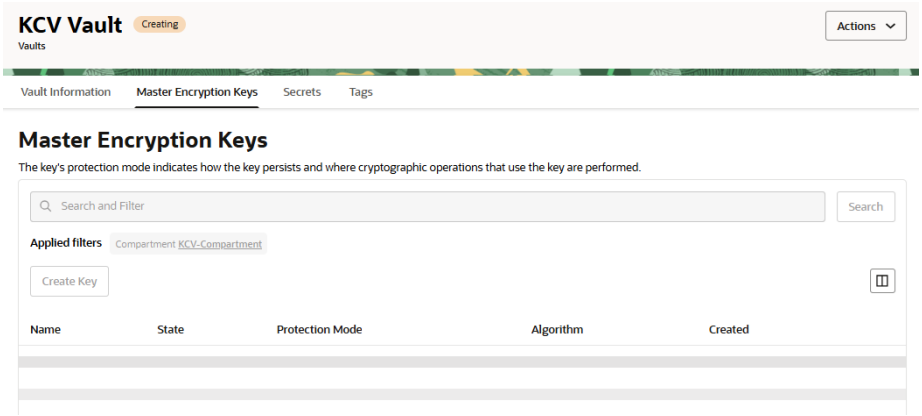
1. In the OCI UI, search for **vault**.

2. Under **Services**, select **vault**.
3. Select **Create Vault**.
4. In the **Create Vault** dialog, enter the following details:
    - For **Create in Compartment**, select the compartment created earlier.
    - For **Name**, enter a name.
    - For the other fields, leave the default values.
5. Select **Create Vault**.



6. Select the **Master Encryption Keys** tab in the vault that you just created.

    There are no encryption keys.

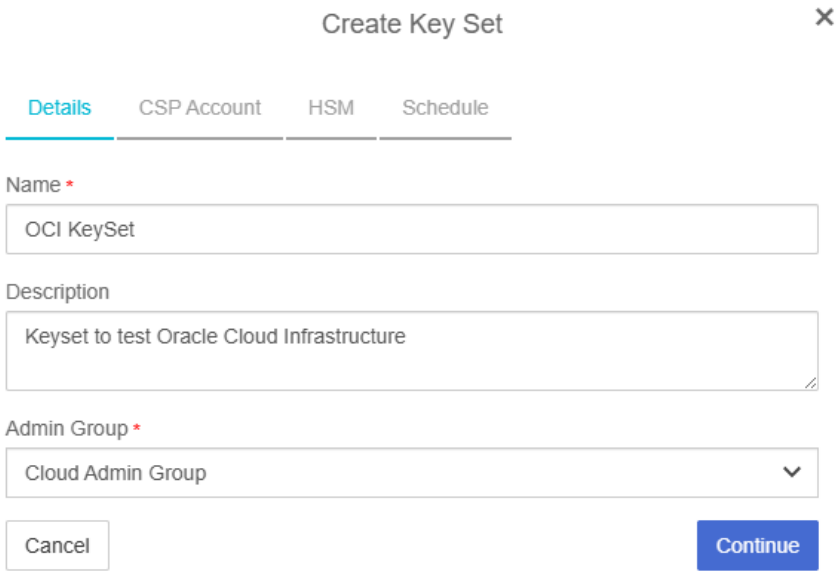


The next step is to use the Entrust Key Management Vault to create the encryption keys for the OCI vault, therefore bringing your own key to the vault.

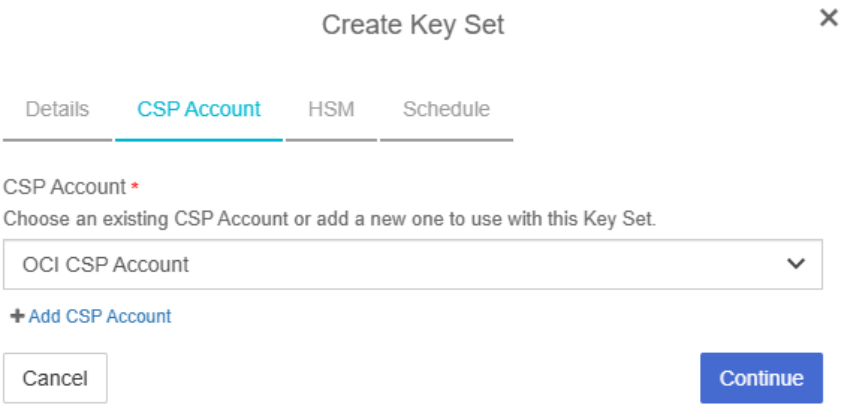
2.4.5. Create a New KeySet

Back in the Entrust Key Management Vault CloudKey Vault webGUI, create a KeySet.

1. In the top menu bar, select **CloudKeys**.
2. Select the **KeySets** tab.
3. Select **Create a Key Set Now**.
4. In the **Choose the Type of Keys in this key set** dialog, select **OCI Key**.
5. In the **Create Key Set** dialog, in the **Details** tab, enter the following details:
   - For **Name**, enter a name for the keyset.
   - For **Description**, enter a description for the keyset.
   - For **Admin Group**, select **Cloud Admin Group**.



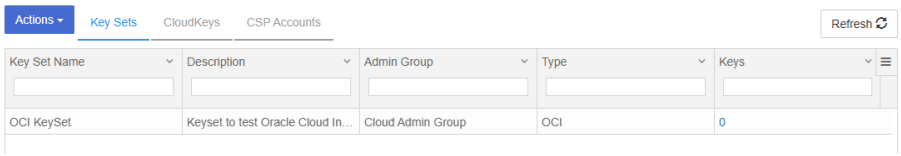
6. Select **Continue**.
7. In the **Create Key Set** dialog, in the **CSP Account** tab, enter the following details:
   - For **CSP Account**, select the CSP Account created earlier.



8. Select **Continue**.

9. In the **Create Key Set** dialog, in the **HSM** tab:
    - If Key Management Vault has been set with an HSM, select the HSM and then **Continue**.
    - If not, just select **Continue**.
10. In the **Create Key Set** dialog, in the **Schedule** tab, select the rotation schedule.
11. Select **Apply**.

    The KeySet gets created.

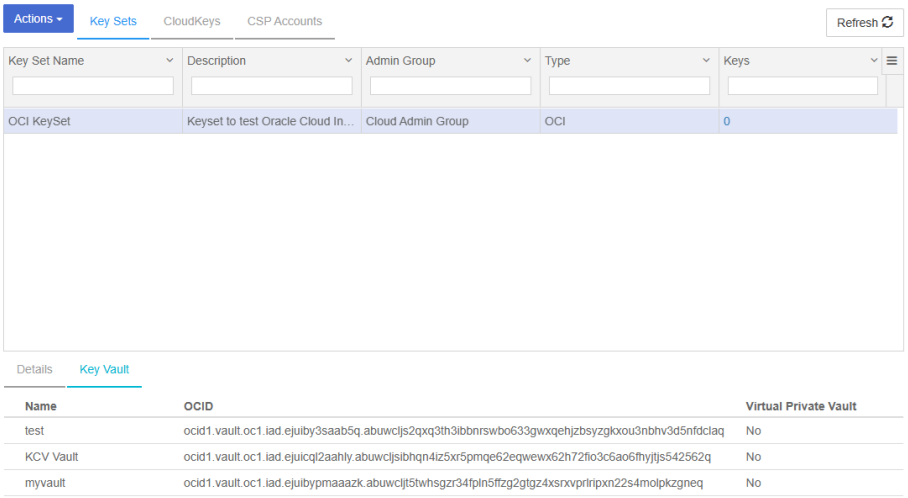


12. Check whether the KeySet has access to the Vaults in OCI that belong to the CSP Account created earlier.
13. Select the newly created KeySet.

    When you select the KeySet, the **Details** Tab for the KeySet gets displayed.

14. Select the **Key Vault** Tab to view the vaults.

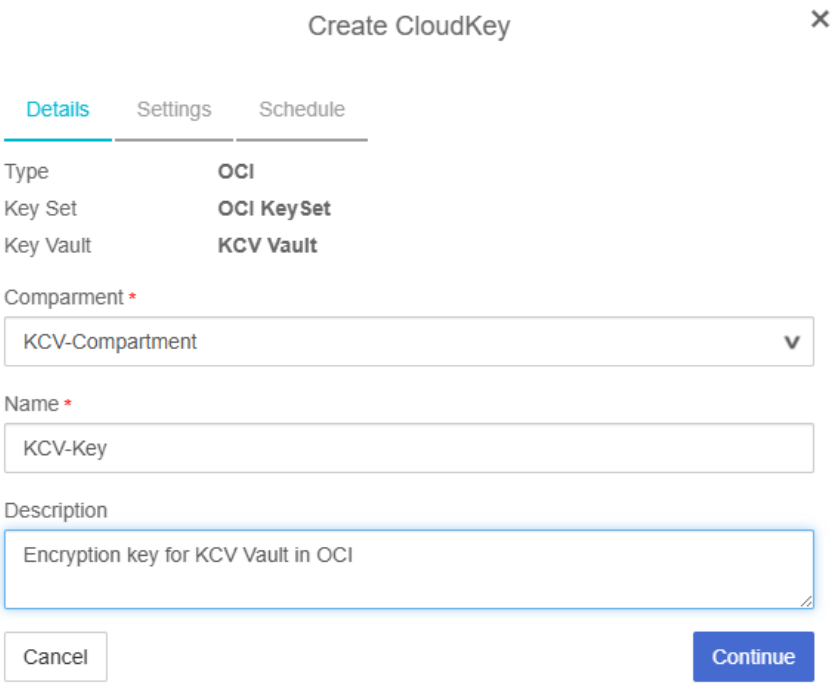
    You should see the OCI Vaults associated with the CSP account in the KeySet. The Vault created earlier should be listed.



2.4.6. Create a master encryption key in the OCI vault

Create a Cloud Key (BYOK) in the OCI vault created earlier. This will be the master encryption key for a storage bucket.

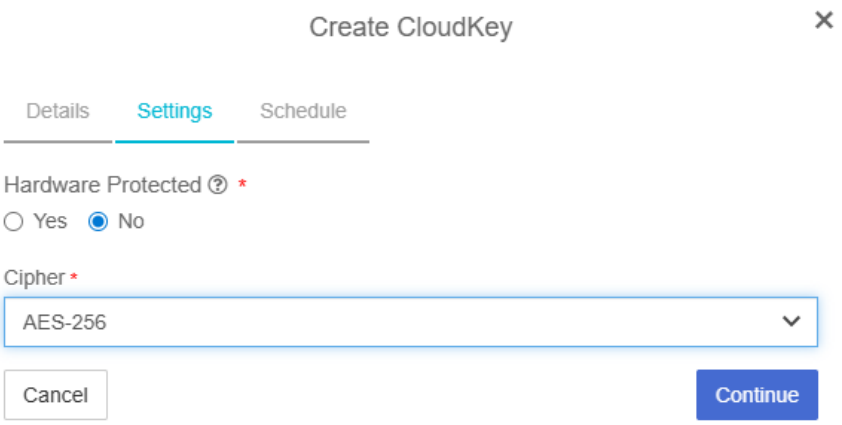
1. Log in to the Entrust Key Management Vault CloudKey Vault webGUI.
2. In the top menu bar, select **CloudKeys**.
3. Select the **CloudKeys** tab.
4. For **Key Set**, select the Key Set created earlier.
5. For **Key Vault**, select the Vault created earlier in OCI.
6. Under the **Actions** Menu, select **Create CloudKey**.
7. In the **Create CloudKey** ialog, in the **Details** tab, enter the following details:
    - The Type, Key Set and Key Vault values should be already set.
    - For **Compartment**, select the compartment created earlier in OCI.
    - For **Name**, enter a name for the Key.
    - For **Description**, enter a description for the key.



8. Select **Continue**.
9. In the **Create CloudKey** dialog, in the **Settings** tab:
    - Select a **Hardware Protected** option.

      Hardware Protected controls whether the key is protected by HSM in OCI and not whether the key is protected by the local HSM for the CloudKey vault.

    - Select the **Cipher**.
    - Select **Continue**.



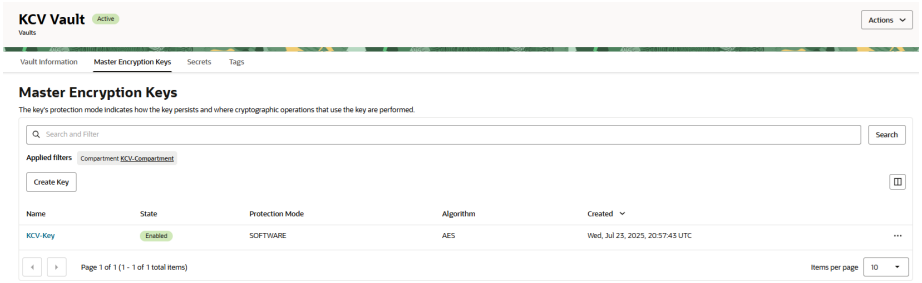
10. In the **Create CloudKey** dialog, in the **Schedule** tab, leave the default values.
11. Select **Apply**.

    The CloudKey gets created.

12. Select the newly created cloudkey to view its details.

    If you want to rotate the key, select **Rotate**.

13. Go back to OCI and check whether the master encryption key has been successfully created in the Vault created earlier.



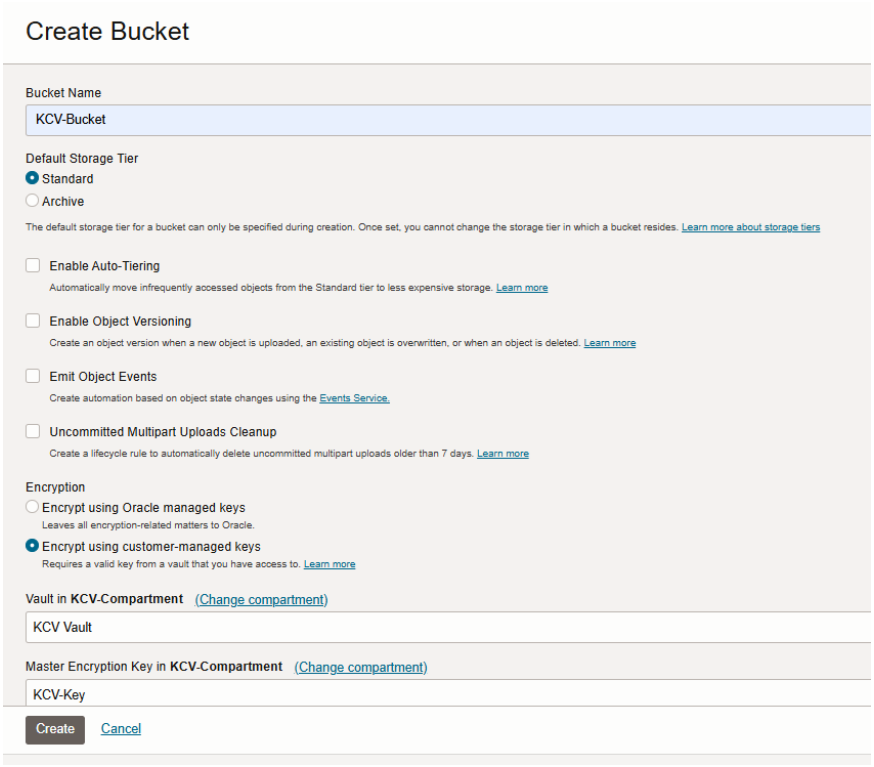
2.4.7. Test the Key Usage

Test the Key usage by creating a bucket in OCI inside the Vault that is protected by the encryption key created earlier. The contents in the bucket will be encrypted by that key. Disable the key in the Entrust Key Management Vault Cloud Key Vault which should prevent access to the bucket contents in OCI.

2.4.7.1. Create the OCI Bucket.

1. In the OCI UI, search for **buckets**.
2. Under **Service**, select **buckets**.

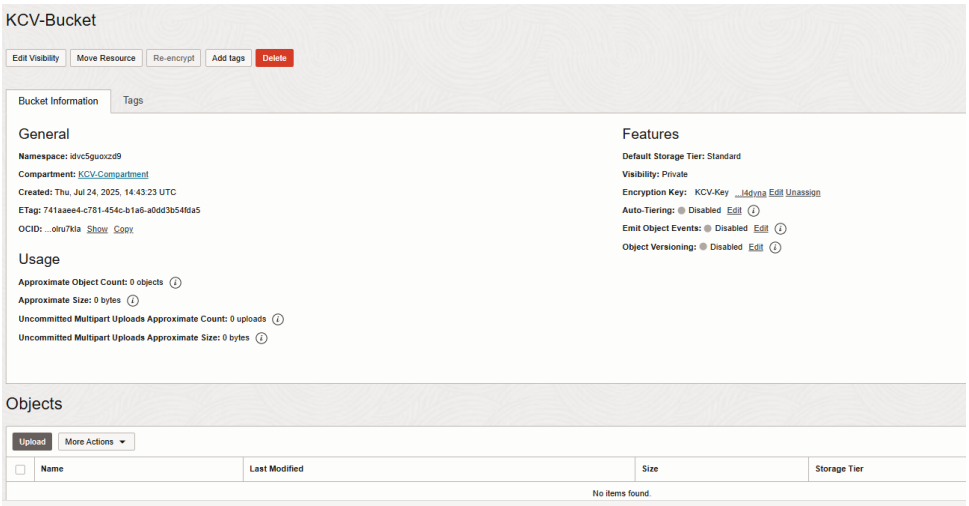
3. Select **Create Bucket**.
4. In the **Create Bucket** dialog, enter the following details:
    - For **Name**, enter a new name or leave the default name.
    - Under **Encryption**, select **Encrypt using customer-managed keys**. The dialog prompts for the Vault and Key.
    - Select the Vault and Key created earlier.
    - Leave the rest of the fields with the default values.



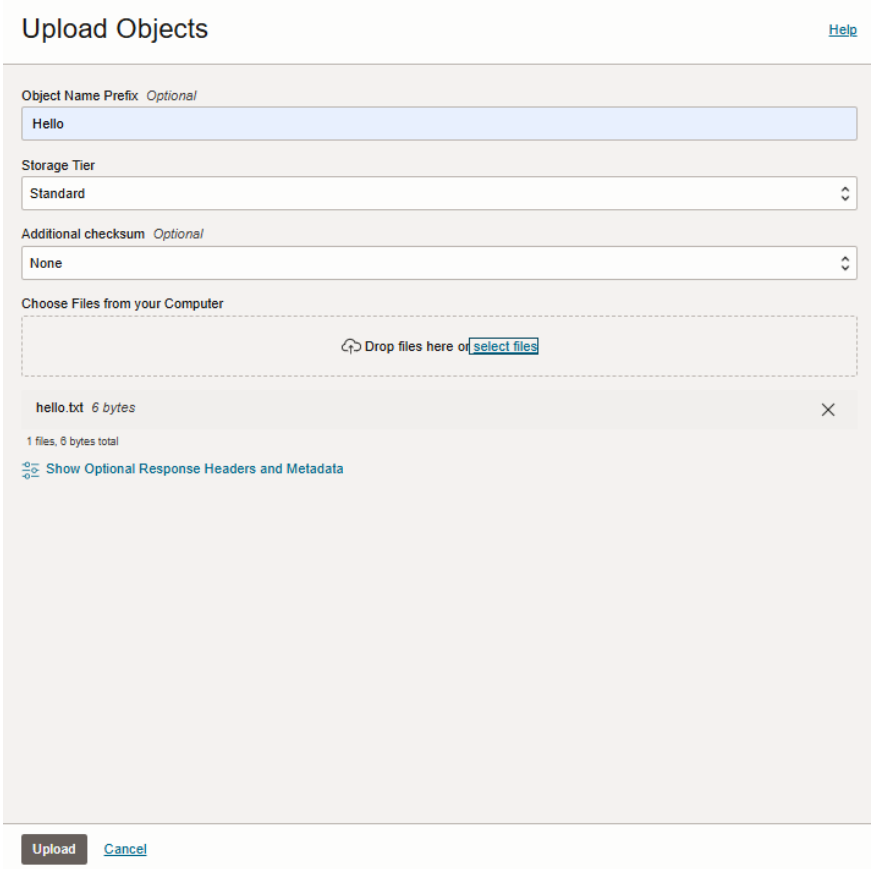
    - Select **Create**.

2.4.7.2. Upload a text file to the newly created bucket.

In the bucket, upload a text file to test the encryption.



1. Select the newly created bucket.
2. Under **Objects** in the bucket view, select **Upload**.
3. In the **Upload Object** dialog, upload the text file:
    - Leave the default values for all the fields.
    - In the **Choose Files from your computer** section, upload a text file.
    - Select **Upload**.
    - Select **Close**.



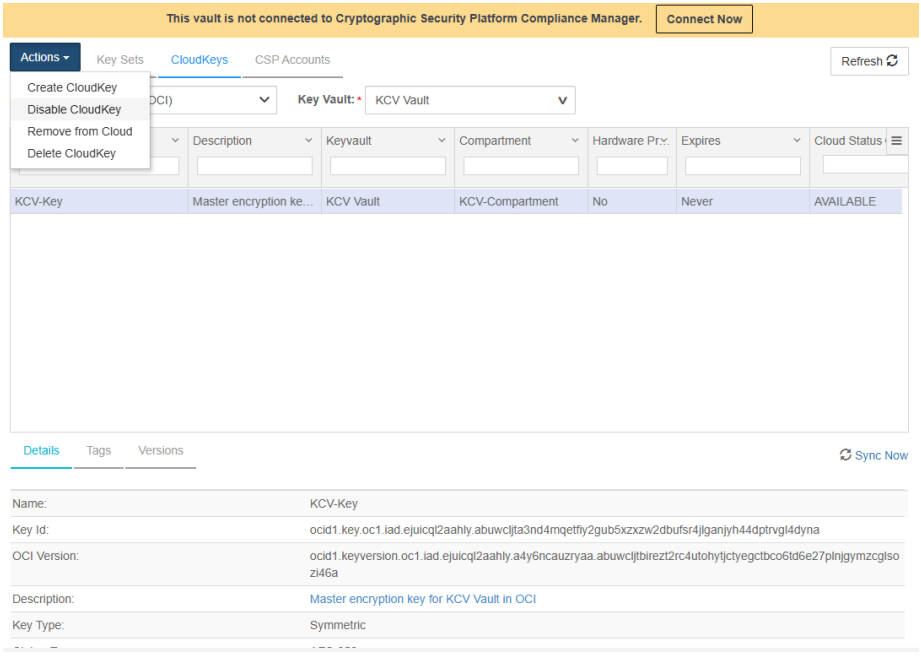
You should see the uploaded object in the list.

2.4.7.3. Disable the Key in the Entrust Key Management Vault

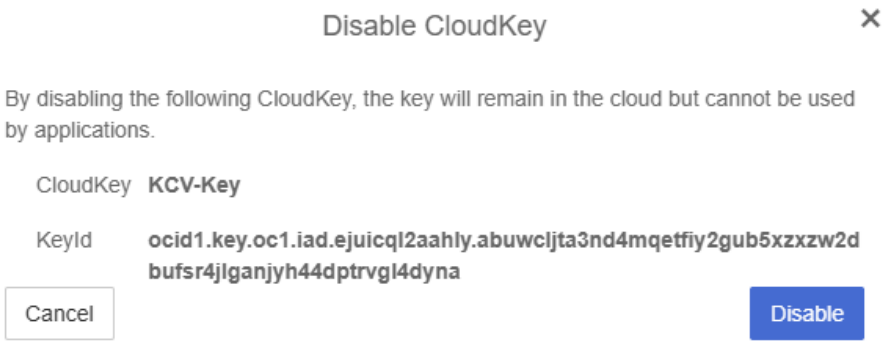
Now if you disable the key in the Entrust Key Management Vault, you can not access the objects in the OCI Vault.

In the Entrust Key Management Vault CloudKey Vault:

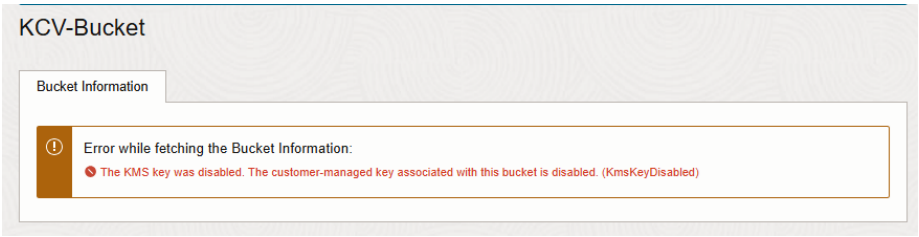
1. In the top menu bar, click **CloudKeys**.
2. Select the **CloudKeys** tab.
3. For **Key Set**, select the Key Set created earlier.
4. For **Key Vault**, select the Vault created earlier in OCI.
5. Select the key.
6. In the **Actions** menu, select **Disable CloudKey**.



7. In the **Disable CloudKey** dialog, select **Disable**.



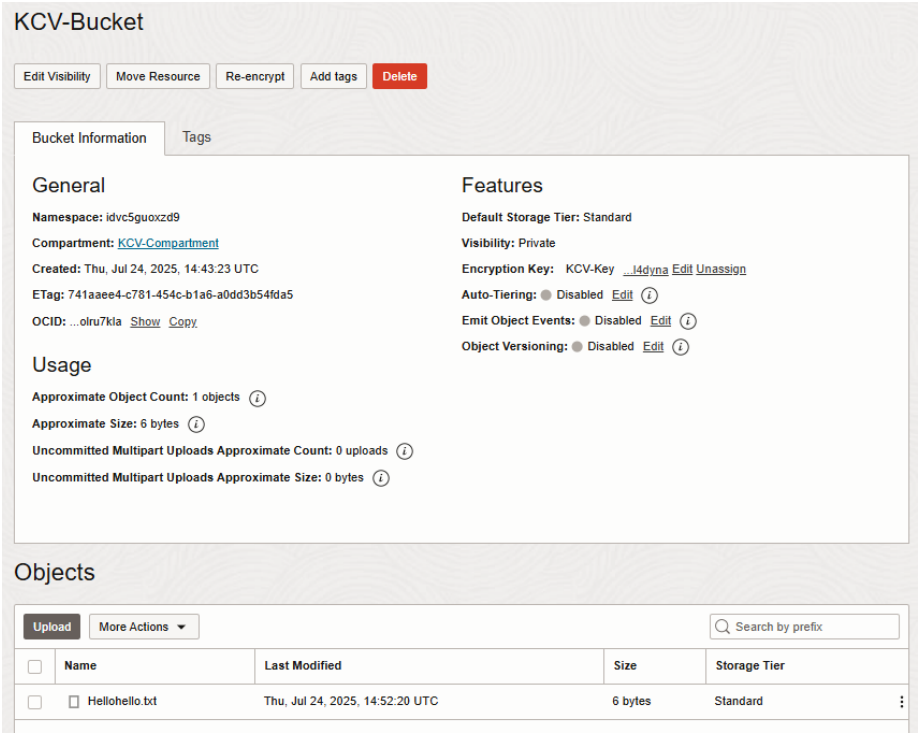
8. Test whether you can access the bucket. You should be denied access.



9. Enable the CloudKey again in the Key Management Vault CloudKey Vault.

   Select **Actions > Enable CloudKey**.

   Once enabled, the bucket can be viewed again in OCI.



Chapter 3. Additional resources and related products

3.1. nShield HSMs

3.2. nShield as a Service

3.3. Entrust CSP Key Manager

3.4. Entrust products

3.5. nShield product documentation