



VMware vSphere and Entrust KeyControl KMIP Vault

Integration Guide

17 Aug 2023

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1. Introduction

This guide describes the integration of the Entrust KeyControl KMIP Vault Key Management Solution (KMS) with VMware encryption solutions, vSAN, and VM encryption. Entrust KeyControl KMIP Vault can serve as a KMS in vCenter using the Key Management Interoperability Protocol (KMIP) open standard.

1.1. Documents to read first

This guide describes how to configure the Entrust KeyControl KMIP Vault as a KMS in vCenter.

To install and configure the Entrust KeyControl KMIP Vault as a KMIP server, see the following documents:

- *Entrust KeyControl Vault nShield HSM Integration Guide* in the Entrust Document Library.
- [KeyControl Vault with VSAN and VMware vSphere VM Encryption](#).

Also refer to the following documents in the [VMware online documentation](#):

- Using Encryption in a vSAN Cluster.
- Virtual Machine Encryption.

1.2. Product configuration

Product	Version
VMware vSphere	7.0, 8.0
KeyControl Vault	10.1.1

1.3. Requirements

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

2. Procedures

2.1. Prerequisites

Before you integrate the Entrust KeyControl KMIP Vault KMS with VMware encryption solutions, complete the following tasks:

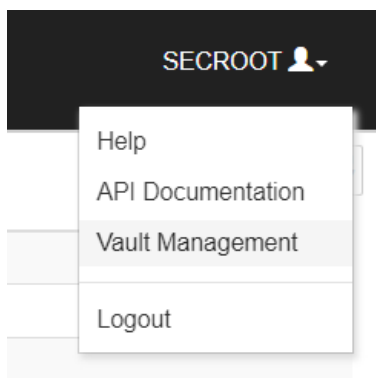
- Entrust KeyControl KMIP Vault is deployed and configured.
- VMware vSphere is deployed and configured using vCenter.
- You have administrator rights to manage the KMS configuration in vCenter.

2.2. Create a KMIP Vault in the KeyControl Vault Server

The KeyControl Vault appliance supports different type of vaults that can be used by all type of applications. This section describes how to create a KMIP Vault in the KeyControl Vault Server.

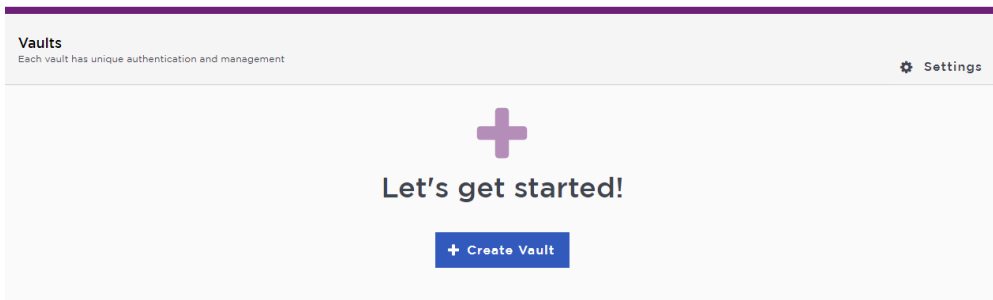
Refer to the [Creating a Vault](#) section of the admin guide for more details about it.

1. Log into the KeyControl Vault Server web user interface:
 - a. Use your browser to access the IP address of the server.
 - b. Sign in using the **secroot** credentials.
2. Select the user's drop down menu and select **Vault Management**.



This action will take you to the KeyControl Vault Management interface.

3. In the KeyControl Vault Management interface, select **Create Vault**.



KeyControl Vault supports the following types of vaults:

- **Cloud Key Management** - Vault for cloud keys such as BYOK and HYOK.
- **KMIP** - Vault for KMIP Objects.
- **PASM** - Vault for objects such as passwords, files, SSH keys, and so on.
- **Database** - Vault for database keys.
- **Tokenization** - Vault for tokenization policies.
- **VM Encryption** - Vault for encrypting VMs.

4. In the **Create Vault** page, create a **KMIP** Vault:

- a. For **Type**, select **KMIP**.
- b. For **Name**, enter the name of the Vault.
- c. For **Description**, enter the description of the Vault.
- d. For **Admin Name**, enter the name of the administrator of the Vault.
- e. For **Admin Email**, enter a valid email for the administrator.

Create Vault
A vault will have unique authentication and management.

Type
Choose the type of vault to create

Name*

Description

Max. 300 characters

Administration
Invite an individual to have complete access and control over this vault. They will be responsible for inviting additional members.

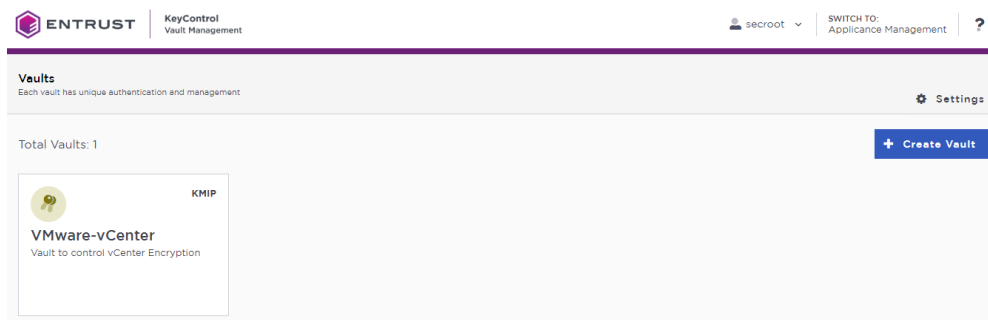
Admin Name*

Admin Email*



A temporary password will be emailed to the administrator's email address. This is the password that will be used to sign in for the first time to the KMIP Vaults space in KeyControl. In a closed gap environment where email is not available, the password for the user is displayed when you first create the vault. That can be copied and sent 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. After the Vault has been created, the KMIP server settings on the appliance are **enabled**.

2.2.1. KMIP server settings

The KMIP server settings are set at the KeyControl appliance level and apply to all the KMIP Vaults in the appliance. After a KMIP Vault is created, they are automatically set to **ENABLED**.

To use external key management and configure the KeyControl Vault KMIP settings, refer to the [KMIP Client and Server Configuration](#) section of the admin guide.



When using external key management, as is the case in this solution, the KeyControl server is the KMIP server and the VMware vCenter server is the KMIP client.

1. Select the **Settings** icon on the top right to view/change the KMIP settings.
 - a. The defaults settings are appropriate for most applications.
 - b. Make any changes necessary.

Vault Details



VMware-vCenter

Vault to control vCenter Encryption

Type

KMIP

Created

Apr 13, 2023 02:15:02 PM

Vault URL

[Redacted URL]

Copy

API URL

[Redacted URL]

Copy

Administrator

Administrator

Close

2.2.3. Edit a vault

To edit the details of the Vault, select **Edit** when you hover over the Vault.

Vaults

Each vault has unique authentication and management

Edit Vault

Type
KMIP

Name
VMware-vCenter

Description

Vault to control vCenter Encryption

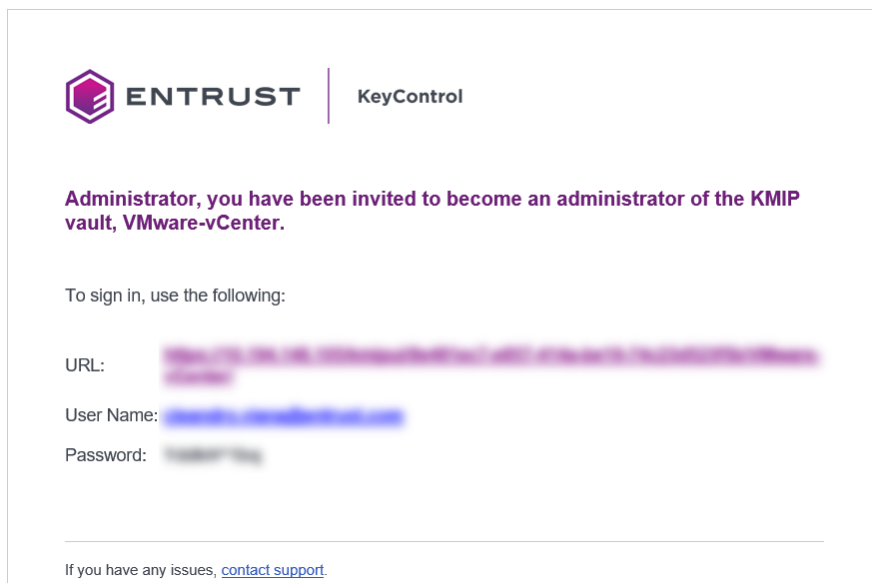
Max. 300 characters

Administrator
Administrator

2.2.4. Managing the Vault

After the Vault has been created, look for the email that was sent with the Vault's URL

and the login information for the Vault. For example:



Go to the URL and sign in with the credentials given. When you sign in for the first time, the system will ask the user to change the password.



In a closed gap environment where email is not available, the password for the user is displayed when you first create the vault. That can be copied and sent to the user.

2.2.5. Setup other Administrators

It is important to have other administrators set up on the Vault for recovery purposes. Add one or more admins to the Vault.

1. Select **Security > Users**.



2. In the **Manage Users** dashboard:
 - a. Select the **+** icon to add one or more users.
 - b. Add the user by providing the information requested in the **Add User** dialog.

Add User ✕

Status ENABLED

User Name ? *

Full Name *

Email *

Password ? *

Password Expiration *

[Cancel](#) [Add](#)

c. Select **Add**.

After the user is added, a window appears which requests selection of the policy to be used by this user.

3. Select **Add to Existing Policy**.

✓ **New User Successfully Added** ✕

A new user has been successfully added.

Before the user can login, you will need to add the user to either a new or existing access policy. This will determine whether the user is an Admin or User.

[Not Now](#) [Add to Existing Policy](#) [Create New Policy](#)

4. On the **Add User to Access Policy** dialog, select the **KMIP Admin Policy** and select **Apply**. The new user is added as an administrator to the Vault.

Add User to Access Policy ✕

User

Assign this user to one of the following access policies.

Filter

Name	Description	Role
<input checked="" type="checkbox"/> Kmp Admin Policy	Default Kmp Admin Policy	Kmp Admin Role

Showing 1 to 1 of 1 records (1 Selected)

[Cancel](#) [Apply](#)

2.3. Establishing trust between the KeyControl KMIP Vault and the VMware vCenter

Certificates are required to facilitate the KMIP communications from the KeyControl KMIP Vault and the vCenter application and conversely. The built-in capabilities in the KeyControl KMIP Vault are used to create and publish the certificates.

For more information on how to create a certificate bundle, refer to [Establishing a Trusted Connection with a KeyControl Vault-Generated CSR](#).

The process below will show how to integrate VMware vSphere encryption or VSAN encryption with KeyControl KMIP Vault.

1. Sign in to the KMIP Vault created earlier. Use the login URL and credentials provided to the administrator of the Vault.
2. Select **Security**, then **Client Certificates**.



3. In the **Manage Client Certificate** page, select the **+** icon on the right to create a new certificate.
 - a. There is the option of creating two types of certificates that can be used by vCenter:
 - A certificate with no authentication.
 - A certificate with authentication.
 - b. Create the certificate that best fits your environment needs.
4. In the **Create Client Certificate** dialog box:
 - a. Enter a name in the **Certificate Name** field.
 - b. Set the date on which you want the certificate to expire in the **Certificate Expiration** field.
 - c. If creating a certificate with authentication:
 - i. Select **Add Authentication for Certificate**.
 - ii. Enter the User Name
 - iii. Enter the Password
 - iv. These settings will be used later when the certificates are used in vCenter if authentication is used.
 - d. Select **Create**.

The new certificates are added to the **Manage Client Certificate** pane.

5. Select the certificate and select the **Download** icon to download the certificate.

The webGUI downloads `certname_datetimestamp.zip`, which contains a user certification/key file called `certname.pem` and a server certification file called `cacert.pem`.

6. Unzip the file so that you have the `certname.pem` file available to upload.

7. The download zip file contains the following:

- A `certname.pem` file that includes both the client certificate and private key. In this example, this file is called `vCenterKMS.pem`.

The client certificate section of the `certname.pem` file includes the lines “-----BEGIN CERTIFICATE-----” and “-----END CERTIFICATE-----” and all text between them.

The private key section of the `certname.pem` file includes the lines “-----BEGIN PRIVATE KEY-----” and “-----END PRIVATE KEY-----” and all text in between them.

- A `cacert.pem` file which is the root certificate for the KMS cluster. It is always named `cacert.pem`.

These files will be used in the vCenter KMS cluster configuration later.

2.4. Create the KMS cluster in vCenter

For more detail on how to do this, see [Adding a KMS Cluster in vSphere](#) in the Entrust online documentation.

1. Launch the vSphere Web Client and log into the vCenter server that you want to add to Entrust KeyControl.
2. Select the required vCenter Server in the **Global Inventory Lists**.
3. Select the **Configure** tab.
4. In the left-hand pane, select **Security > Key Providers**.
5. Select **Add Standard Key Provider**.
6. In the **Add Standard Key Provider** dialog, set the following configuration options:
 - a. For **Name**, enter the name of the cluster.
 - b. For each node in the KeyControl cluster, enter the **KMS** (node name), **IP Address** and **Port**. The default port is 5696.



Make sure that the KMIP server resides on a device that is not encrypted using the KeyControl Vault server cluster. The KMIP server must be available to provide the keys for the encrypted devices before the encrypted devices can be accessed.



To add an extra node line, select **Add KMS**.

Add Standard Key Provider ×

Name keycontrol

KMS	Address	Port	
<u>kms1</u>	<u>10. [REDACTED]</u>	<u>5696</u>	⊗
<u>kms2</u>	<u>10: [REDACTED]</u>	<u>5696</u>	⊗

ADD KMS

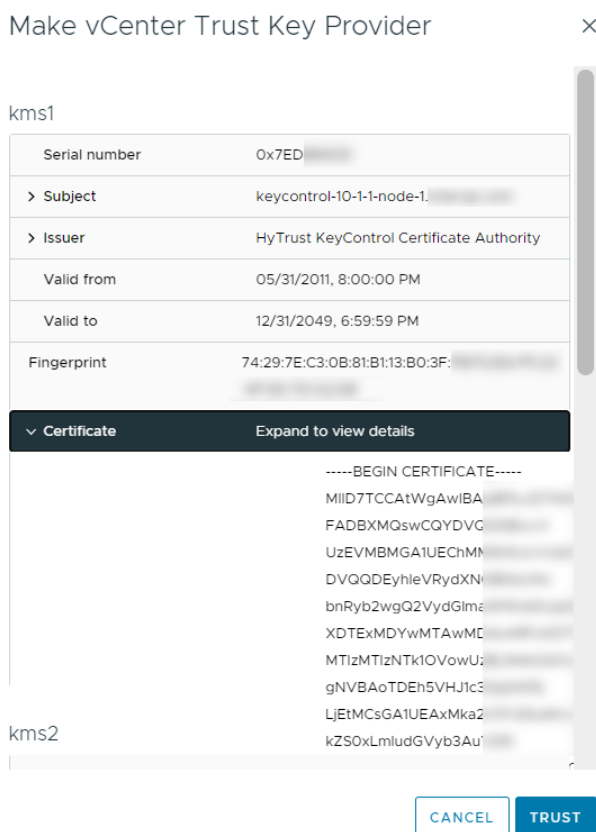
> Proxy configuration (optional)

> Password protection (optional)

CANCEL ADD KEY PROVIDER

- c. Open and set **Proxy Configuration** if you are using a proxy.
- d. **Password protection** is optional. Provide the information if the certificate created in the KeyControl KMIP Vault was created with authentication.

7. Select **Add Key Provider**.
8. In the **Make vCenter Trust Key Provider** dialog, confirm the details for each node and then select **Trust**. For example:



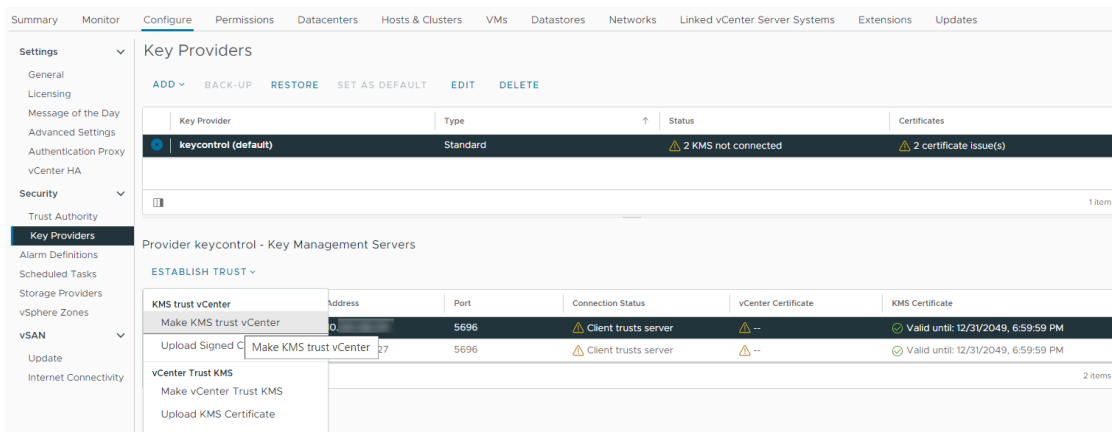
This adds the KMS cluster to vCenter, but the connection status will be **KMS not connected** with **Certificate issues**. For example:

Key Provider	Type	Status	Certificates
<input type="radio"/> keycontrol (default)	Standard	⚠ 2 KMS not connected	⚠ 2 certificate issue(s)

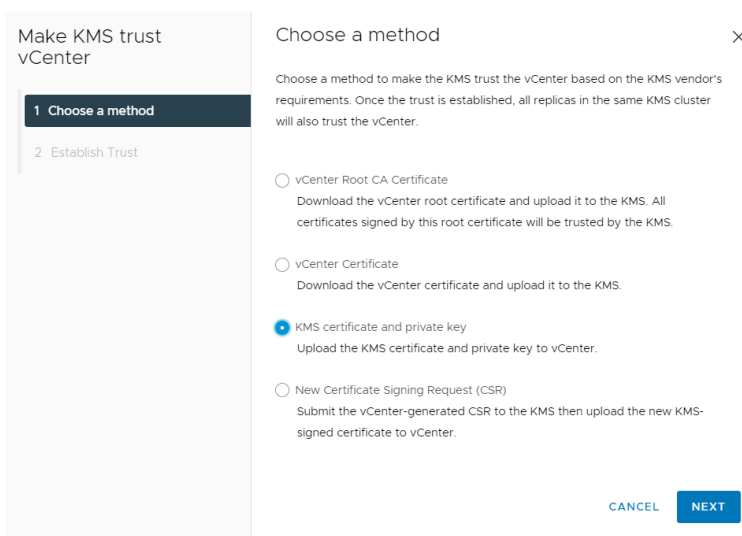
2.5. Establish a trusted connection between the KMS cluster and the Entrust KeyControl KMIP Vault

To establish a trusted connection between the KMS cluster and the Entrust KeyControl KMIP Vault:

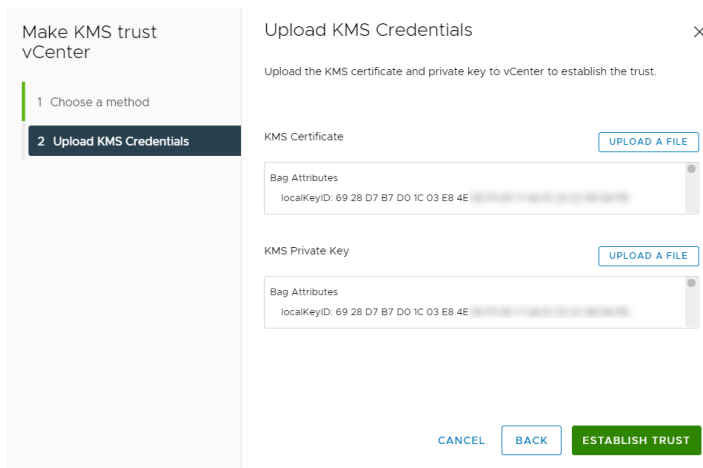
1. Continuing from the previous section, select the KeyControl KMS cluster in the list, then scroll down to where the nodes are listed.
2. Select one of the nodes, then select on **Establish Trust > Make KMS trust vCenter**. For example:



3. In the **Choose method** pane of the **Make KMS Trust vCenter** dialog, select **KMS certificate and private key**.



4. Select **Next**.
5. In the **Upload KMS Credentials** pane of the **Make KMS Trust vCenter** dialog, you must upload the **certname.pem** file created during the certificate creation process earlier. This file must be uploaded for the KMS certificate and then uploaded again for the private key. To do this:
 - a. For **KMS certificate**, select **Upload file**. Then select the **certname.pem** file and select **Open**.
 - b. For **Private key**, select **Upload file**. Then select the **certname.pem** file again and select **Open**.
 - c. Select **Establish Trust**.



- Wait until vCenter reports that the connection status for the KMS cluster has changed to **Connected**. For example:

Key Providers

ADD ▾ BACK-UP RESTORE SET AS DEFAULT EDIT DELETE

Key Provider	Type	Status	Certificates
keycontrol (default)	Standard	Healthy	Valid

1 item

Provider keycontrol - Key Management Servers

ESTABLISH TRUST ▾

	KMS	Address	Port	Connection Status	vCenter Certificate	KMS Certificate
○ >	kms1	10.10.10.10	5696	Connected	Valid until: 8/15/2024, 11:...	Valid until: 12/31/2049, 6:59:59 PM
○ >	kms2	10.10.10.10	5696	Connected	Valid until: 8/15/2024, 11:...	Valid until: 12/31/2049, 6:59:59 PM

2 items

2.6. Enable Encryption for virtual machines

Enable encryption using VMware Storage Policies:

- Launch the vSphere Web Client and log into the vCenter server.
- Locate a VM that you would like to encrypt.
- Make sure the **Power** state of the VM is **Powered Off**.
- Right-click the VM for which you would like to enable encryption and select **VM Policies > Edit VM Storage Policies**.
- Select the storage policy **VM Encryption Policy** and select **OK**.

This will trigger a reconfiguration of the VM. For example:

Task Name	Target	Status	Details	Initiator	Queued For	Start Time	Completion Time	Server
Reconfigure virtual mach...	test-encryption-vm	Completed	Reconfiguring Virtual Mach...	VSPHERELOCAL\Administrator	3 ms	04/17/2023, 2:32:30 ...	04/17/2023, 2:34:12 PM	10.194.148.11

After the reconfiguration is complete, the disks are encrypted and the keys are managed by the configured KMS (KeyControl).

2.6.1. Check encryption at the VM level

To check encryption at the VM level:

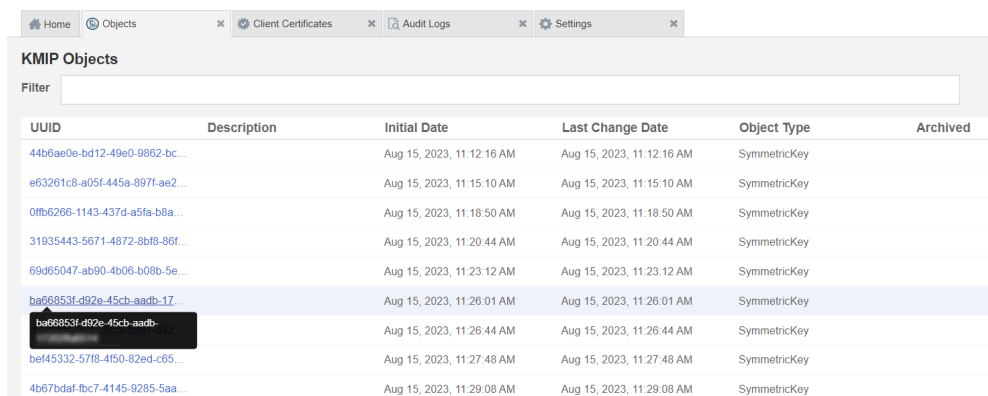
1. Launch the vSphere Web Client and log into the vCenter server.
2. Locate a VM and select it.
3. In **VM View**, select the **Summary** tab.
4. Under **Virtual Machine Details > Encryption**, the status should be:

Encrypted with standard key provider

2.6.2. Check encryption by looking for the Keys in the Entrust KeyControl KMIP Vault

To check encryption by looking for keys:

1. Log into the KMIP Vault using the login URL.
2. Select the **Objects** tab to view a list of **KMIP Objects**. This will include the newly-created keys. For example:



UUID	Description	Initial Date	Last Change Date	Object Type	Archived
44b6ae0e-bd12-49e0-9862-bc...		Aug 15, 2023, 11:12:16 AM	Aug 15, 2023, 11:12:16 AM	SymmetricKey	
e63261c8-a05f-445a-8971-ae2...		Aug 15, 2023, 11:15:10 AM	Aug 15, 2023, 11:15:10 AM	SymmetricKey	
0fb6266-1143-437d-a5fa-b8a...		Aug 15, 2023, 11:18:50 AM	Aug 15, 2023, 11:18:50 AM	SymmetricKey	
31935443-5671-4872-8bf8-86f...		Aug 15, 2023, 11:20:44 AM	Aug 15, 2023, 11:20:44 AM	SymmetricKey	
69d65047-ab90-4b06-b08b-5e...		Aug 15, 2023, 11:23:12 AM	Aug 15, 2023, 11:23:12 AM	SymmetricKey	
ba66853f-d92e-45cb-aadb-17...		Aug 15, 2023, 11:26:01 AM	Aug 15, 2023, 11:26:01 AM	SymmetricKey	
ba66853f-d92e-45cb-aadb-		Aug 15, 2023, 11:26:44 AM	Aug 15, 2023, 11:26:44 AM	SymmetricKey	
bel45332-57f8-4f50-82ed-c65...		Aug 15, 2023, 11:27:48 AM	Aug 15, 2023, 11:27:48 AM	SymmetricKey	
4b67bdaf-fbc7-4145-9285-5aa...		Aug 15, 2023, 11:29:08 AM	Aug 15, 2023, 11:29:08 AM	SymmetricKey	

3. Select one of the keys to display its **KMIP Object Details**. For example:

KMIP Object Details

	KMIP Attributes	Custom Attributes	KMIP Identifiers
UUID	ba66853f-d92e-45cb-aadb-...		
Object Type	Symmetric Key		
State	ACTIVE		
Activation Date	Aug 15, 2023, 11:26:01 AM		
Cryptographic Usage Mask	Encrypt,Decrypt		
Key Format Type	Raw		
Cryptographic Algorithm	AES		
Cryptographic Length	256		
Encrypted With KEK	✔ Yes		
Initial Date	Aug 15, 2023, 11:26:01 AM		
Last Change Date	Aug 15, 2023, 11:26:02 AM		

- Select the **Custom Attributes** tab to make sure it is the key used by VMware vSphere.

KMIP Object Details

KMIP Attributes		Custom Attributes	KMIP Identifiers
x-Component		ESXi Server	
x-Identifier		4c4c4544-0050-5310-804b- XXXXXXXXXX	
x-Name		10. XXXXXXXXXX	
x-Product		VMware vSphere	
x-Product_Version		8.0.0 build-21457384	
x-Vendor		VMware, Inc.	

- In the main screen, select the **Audit Logs** tab to view the log records related to the key creation process. For example:

The screenshot shows a web interface with a navigation bar containing 'Home', 'Objects', 'Client Certificates', 'Audit Logs', and 'Settings'. The 'Audit Logs' tab is active. Below the navigation bar is a 'Filter' input field. The main content area displays a table with the following columns: Time, Type, User, and Message. The table contains several log entries, all of which are 'Information' type and originate from the 'vcenter' user. The messages describe KMIP operations such as 'AddAttribute', 'Activate', and 'Create'.

Time	Type	User	Message
Aug 15, 2023, 2:53:02 PM	Information	vcenter	KMIP Response - Operation: AddAttribute, Object: None, UUID: acba249a-4...
Aug 15, 2023, 2:53:01 PM	Information	vcenter	KMIP Response - Operation: AddAttribute, Object: None, UUID: acba249a-4...
Aug 15, 2023, 2:53:01 PM	Information	vcenter	KMIP Response - Operation: AddAttribute, Object: None, UUID: acba249a-4...
Aug 15, 2023, 2:52:59 PM	Information	vcenter	KMIP Response - Operation: Activate, Object: None, UUID: acba249a-4...
Aug 15, 2023, 2:52:58 PM	Information	vcenter	KMIP Response - Operation: Create, Object: SymmetricKey, UUID: act...
Aug 15, 2023, 2:47:39 PM	Information	vcenter	KMIP Response - Operation: AddAttribute, Object: None, UUID: 28720f...
Aug 15, 2023, 2:47:39 PM	Information	vcenter	KMIP Response - Operation: AddAttribute, Object: None, UUID: 28720f...

For more information on this topic, refer to [Virtual Machine Encryption](#) on the VMware documentation site.

2.7. Enable Data-At-Rest encryption on an existing vSAN cluster

To enable Data-At-Rest encryption on an existing vSAN cluster, refer to [Using Encryption in a vSAN Cluster](#) on the VMware documentation site.