Amazon Web Services KMS External Key Store (XKS)

KeyControl Cloud Key Management Vault (HYOK) Integration Guide

07 Sep 2023

Contents

1. Introduction

This guide describes the integration of the Entrust KeyControl Cloud Key Management Vault with Amazon Web Services KMS External Key Store (XKS).

Entrust KeyControl Cloud Key Management Vault provides an External Key Store Proxy inside KeyControl Vault. This feature allows the KeyControl Vault administrator to protect their data within Amazon Web Services (AWS) with 256-bit AES keys residing in KeyControl Vault. KeyControl Vault generates the keys and the keys are stored in KeyControl Vault only.

1.1. Product configuration

Entrust has successfully tested the following software version:

Product	Version	Certification
KeyControl Vault	10.1.1	FIPS 140-2 Level 1

1.2. Requirements

To integrate Entrust KeyControl Cloud Key Management Vault and Amazon Web Services KMS External Key Store (XKS), the server must be set up as follows.

- You must have an AWS account with KMS access allowed.
- There is a minimum of 2 KeyControl instances within a cluster. These instances must be accessible through a load balancer, typically realized using Elastic Load Balancer in the AWS environment.

This integration uses a public endpoint connectivity for AWS XKS. The following are required:

- Your external key store proxy must be reachable at a publicly routable endpoint.
- You must obtain a TLS certificate issued by a public certificate authority supported for external key stores. For a list, see https://github.com/aws/aws-kms-xksproxy-api-spec/blob/main/TrustedCertificateAuthorities.
- The subject common name (CN) on the TLS certificate must match the domain name in the proxy URI endpoint for the external key store proxy. For example, if the public endpoint is https://myproxy.xks.example.com, the TLS, the CN on the TLS certificate must be `myproxy.xks.example.com` or `*.xks.example.com`.
- Ensure that any firewalls between AWS KMS and the external key store proxy allow traffic to and from port 443 on the proxy. AWS KMS communicates on port 443 and

this value is not configurable.

Familiarize yourself with:

- Entrust KeyControl and AWS External Key Store (XKS) Overview
- The Amazon Web Services KMS External Key Store (XKS) Documentation

1.3. Overview

Entrust KeyControl Cloud Key Management Vault provides an External Key Store Proxy within KeyControl. This feature allows KeyControl administrators to safeguard their data within Amazon Web Services (AWS) using 256-bit AES keys housed in the KeyControl Vault. KeyControl generates the keys, which are exclusively stored in KeyControl.

In this guide:

- BYOK (Bring Your Own Key): This approach involves generating and managing encryption keys within an external key management system, such as the Amazon Web Services Key Management Service (AWS KMS). BYOK allows you to maintain control over your encryption keys while utilizing the services provided by AWS.
- HYOK (Hold Your Own Key): This method takes data security a step further by enabling you to retain absolute control over encryption keys, even when data is processed in cloud environments. With HYOK, the encryption keys are stored outside the cloud provider’s infrastructure.

Entrust supports both BYOK and HYOK approaches to data security. This integration is HYOK implementation, ensuring that encryption keys are held within our control while still harnessing the benefits of cloud services.

For more information about the BYOK approach, refer to *Bring Your Own Key for AWS Key Management Service and Entrust KeyControl Integration Guide*.

2. Procedures

Integration steps:

1. Prerequisites
2. Adding an Elastic Load Balancer
3. Configure certificates and DNS
4. Key Administrators - AWS IAM user
5. Create a Cloud Key Management Vault
6. Create a CSP Account in the Cloud Key Management Vault
7. Create the Key Set
8. Create an External Key Store in AWS
9. Test the integration

2.1. Prerequisites

Before integrating Entrust KeyControl Vault server and AWS External Key Store (XKS), ensure the following:

- Entrust KeyControl Vault server is deployed and configured. For details, see KeyControl Installation.
- Entrust KeyControl Compliance Manager is deployed and configured.

For this integration, the KeyControl Vault servers were deployed using AWS EC2 instances. To learn more about deploying KeyControl Vault in Amazon Web Services, refer to Creating KC Cluster AWS.

However, KeyControl Vault servers can also be deployed outside of AWS EC2, provided they fulfill the requirements outlined in Requirements.

2.2. Adding an Elastic Load Balancer

After cluster set-up is complete, you must use AWS elastic load balancing for the KeyControl load balancing.

For more information on AWS ELB, refer to AWS ELB Documentation.

2.2.1. Configure target group

To configure the target group:

1. Sign in the Amazon EC2 console.

2. In the navigation pane, under Load Balancing, select **Target Groups**.
3. Select **Create target group**.
4. Under **Basic configuration**:

    a. Select **Instances** as target type.

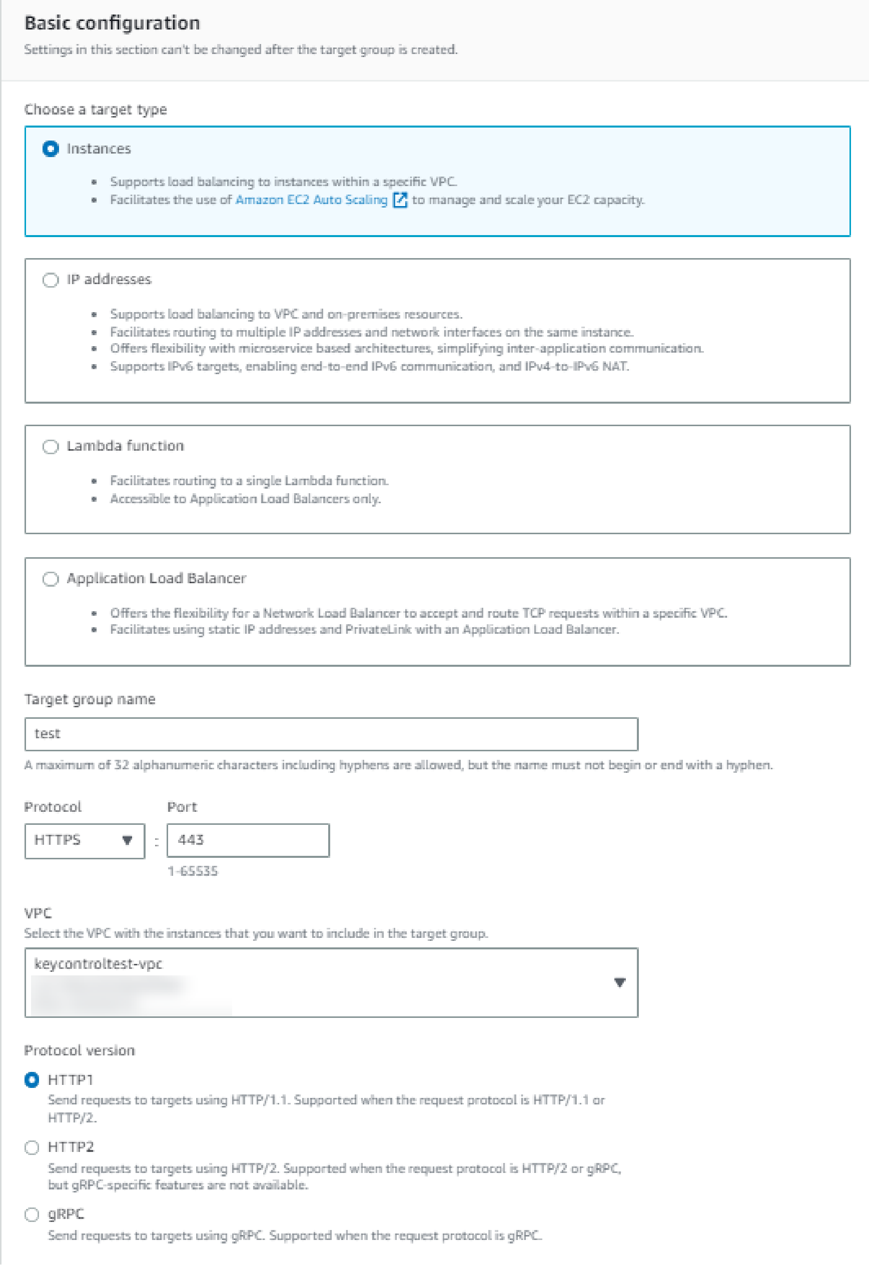
    b. For **Target group name**, enter a name for the new target group.

    c. For **Protocol**, select **HTTPS**.

    d. For **Port**, select **443**.

    e. Select the VPC containing your instances.

    f. For **Protocol version**, retain the default.



Basic configuration

Settings in this section can't be changed after the target group is created.

Choose a target type

● Instances

- Supports load balancing to instances within a specific VPC.
- Facilitates the use of Amazon EC2 Auto Scaling to manage and scale your EC2 capacity.

○ IP addresses

- Supports load balancing to VPC and on-premises resources.
- Facilitates routing to multiple IP addresses and network interfaces on the same instance.
- Offers flexibility with microservice based architectures, simplifying inter-application communication.
- Supports IPv6 targets, enabling end-to-end IPv6 communication, and IPv4-to-IPv6 NAT.

○ Lambda function

- Facilitates routing to a single Lambda function.
- Accessible to Application Load Balancers only.

○ Application Load Balancer

- Offers the flexibility for a Network Load Balancer to accept and route TCP requests within a specific VPC.
- Facilitates using static IP addresses and PrivateLink with an Application Load Balancer.

Target group name

test

A maximum of 32 alphanumeric characters including hyphens are allowed, but the name must not begin or end with a hyphen.

Protocol: HTTPS ▼ : Port: 443

1-65535

VPC

Select the VPC with the instances that you want to include in the target group.

keycontroltest-vpc ▼

[redacted]

Protocol version

● HTTP1

Send requests to targets using HTTP/1.1. Supported when the request protocol is HTTP/1.1 or HTTP/2.

○ HTTP2

Send requests to targets using HTTP/2. Supported when the request protocol is HTTP/2 or gRPC, but gRPC-specific features are not available.

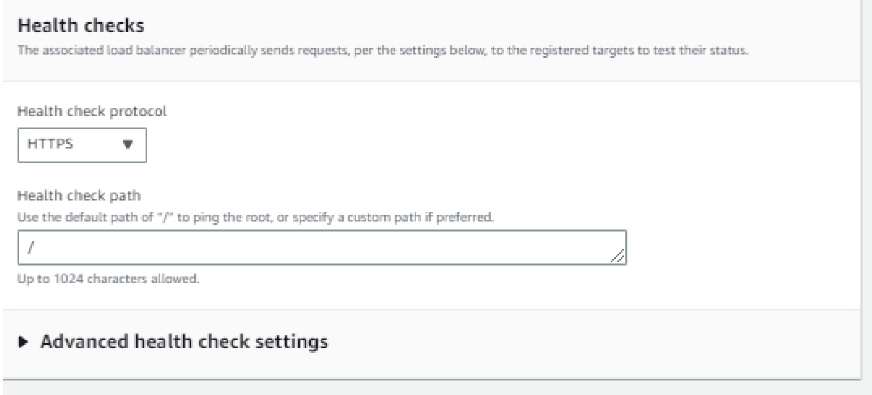
○ gRPC

Send requests to targets using gRPC. Supported when the request protocol is gRPC.

5. Under **Health checks**:

a. For **Health check protocol**, select **HTTPS**.

b. Retain the default settings for other properties.



Health checks

The associated load balancer periodically sends requests, per the settings below, to the registered targets to test their status.

Health check protocol: HTTPS

Health check path

Use the default path of "/" to ping the root, or specify a custom path if preferred.

/

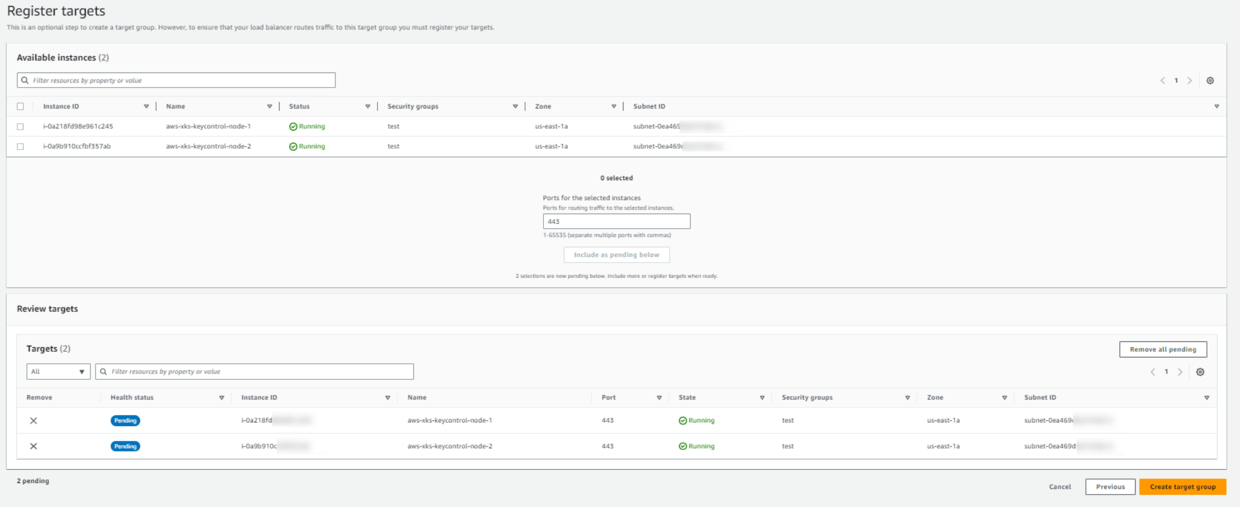
Up to 1024 characters allowed.

6. Select **Next**.
7. On the **Register Targets** page, complete the following steps. This is an optional step for creating the load balancer. However, you must register this target if you want to test your load balancer and ensure that it is routing traffic to this target.

   a. For **Available instances**, select the two KeyControl instances.

   b. For **Port for the selected instances**, enter **443**, and select **Include as pending** below.

   c. Select **Create target group**.



Register targets

This is an optional step to create a target group. However, to ensure that your load balancer routes traffic to this target group you must register your targets.

Available instances (2)

	Instance ID	Name	Status	Security groups	Zone	Subnet ID
□	i-0a218fd98e961c245	aws-xks-keycontrol-node-1	Running	test	us-east-1a	subnet-0ea469[redacted]
□	i-0a9b910ccfbf357ab	aws-xks-keycontrol-node-2	Running	test	us-east-1a	subnet-0ea469[redacted]

0 selected

Ports for the selected instances

Ports for routing traffic to the selected instances.

443

1-65535 (separate multiple ports with commas)

2 selections are now pending below. Include more or register targets when ready.

Review targets

Targets (2)

Remove	Health status	Instance ID	Name	Port	State	Security groups	Zone	Subnet ID
×	Pending	i-0a218fd[redacted]	aws-xks-keycontrol-node-1	443	Running	test	us-east-1a	subnet-0ea469[redacted]
×	Pending	i-0a9b910c[redacted]	aws-xks-keycontrol-node-2	443	Running	test	us-east-1a	subnet-0ea469d[redacted]

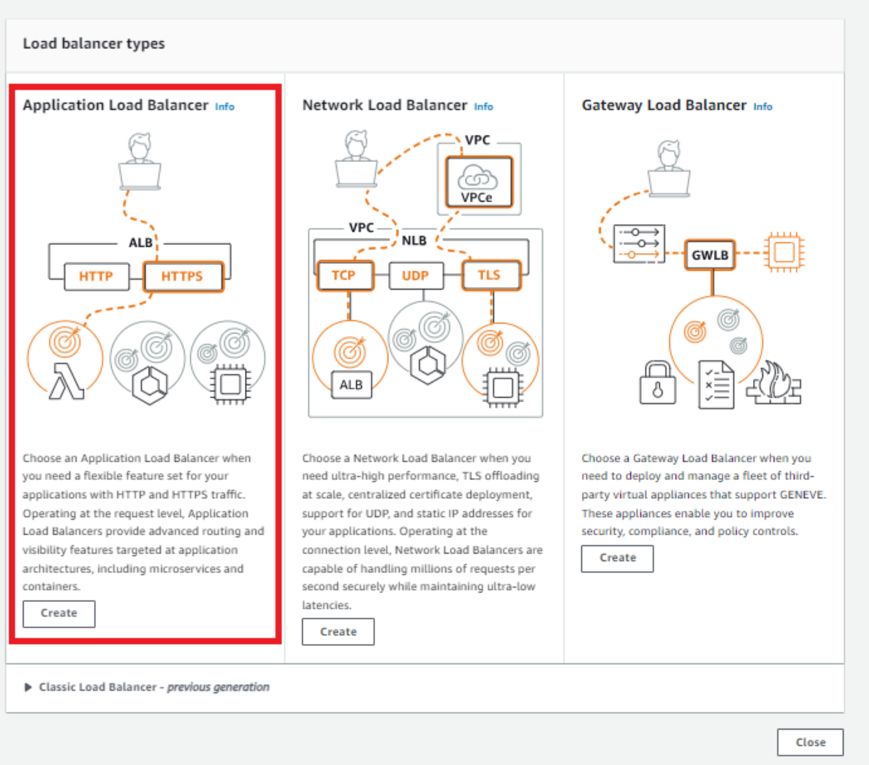
2 pending

2.2.2. Create an Elastic Load Balancer

To create an Elastic Load Balancer:

1. Sign in to the Amazon EC2 console.
2. On the navigation bar, select a region for your load balancer. You must select the same region that you used for your EC2 instances.

3. In the navigation pane, under **Load Balancing**, select **Load Balancers**.
4. Select **Create Load Balancer**.
5. Select **Application Load Balancer**, select **Create**.



Load balancer types

Application Load Balancer Info

Choose an Application Load Balancer when you need a flexible feature set for your applications with HTTP and HTTPS traffic. Operating at the request level, Application Load Balancers provide advanced routing and visibility features targeted at application architectures, including microservices and containers.

Create

Network Load Balancer Info

Choose a Network Load Balancer when you need ultra-high performance, TLS offloading at scale, centralized certificate deployment, support for UDP, and static IP addresses for your applications. Operating at the connection level, Network Load Balancers are capable of handling millions of requests per second securely while maintaining ultra-low latencies.

Create

Gateway Load Balancer Info

Choose a Gateway Load Balancer when you need to deploy and manage a fleet of third-party virtual appliances that support GENEVE. These appliances enable you to improve security, compliance, and policy controls.

Create

▶ Classic Load Balancer - *previous generation*

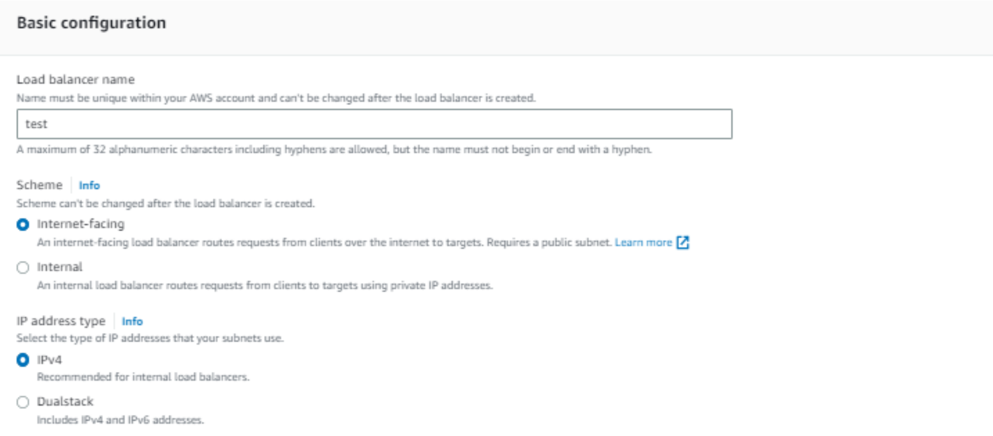
Close

6. Under **Basic configuration**:

   a. For **Load balancer name**, enter a name for your load balancer.

   b. For **Scheme**, select **Internet-facing**.

   c. Retain the **IP address** type default.



Basic configuration

Load balancer name
Name must be unique within your AWS account and can't be changed after the load balancer is created.

test

A maximum of 32 alphanumeric characters including hyphens are allowed, but the name must not begin or end with a hyphen.

Scheme | Info
Scheme can't be changed after the load balancer is created.

● Internet-facing
An internet-facing load balancer routes requests from clients over the internet to targets. Requires a public subnet. Learn more

○ Internal
An internal load balancer routes requests from clients to targets using private IP addresses.

IP address type | Info
Select the type of IP addresses that your subnets use.

● IPv4
Recommended for internal load balancers.

○ Dualstack
Includes IPv4 and IPv6 addresses.

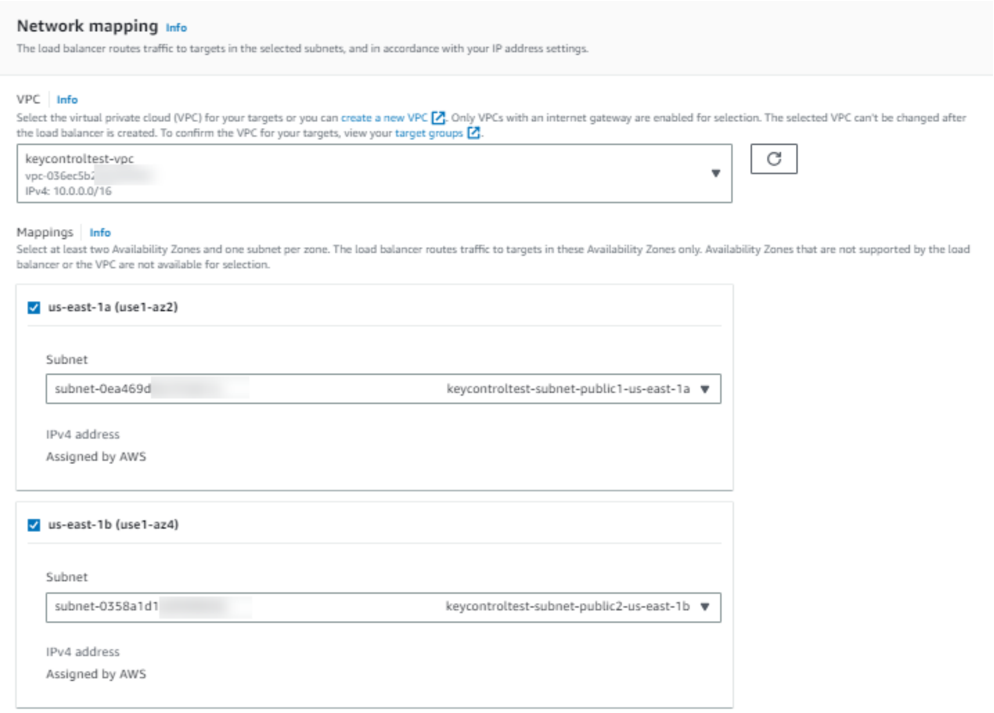
7. Under **Network mapping**:

   a. For **VPC**, select the VPC that you used for your EC2 instances.

   b. For **Mappings**, select at least two Availability Zones and one subnet per zone.

c. For each Availability Zone that you used to launch your EC2 instances, select the Availability Zone and then select one public subnet for that Availability Zone.

d. You must select at least one Availability Zone that was used when launching your instances.



Network mapping Info

The load balancer routes traffic to targets in the selected subnets, and in accordance with your IP address settings.

VPC | Info

Select the virtual private cloud (VPC) for your targets or you can create a new VPC. Only VPCs with an internet gateway are enabled for selection. The selected VPC can't be changed after the load balancer is created. To confirm the VPC for your targets, view your target groups.

keycontroltest-vpc
vpc-036ec5b2[redacted]
IPv4: 10.0.0.0/16

Mappings | Info

Select at least two Availability Zones and one subnet per zone. The load balancer routes traffic to targets in these Availability Zones only. Availability Zones that are not supported by the load balancer or the VPC are not available for selection.

☑ us-east-1a (use1-az2)

Subnet: subnet-0ea469d[redacted] keycontroltest-subnet-public1-us-east-1a

IPv4 address: Assigned by AWS

☑ us-east-1b (use1-az4)

Subnet: subnet-0358a1d1[redacted] keycontroltest-subnet-public2-us-east-1b

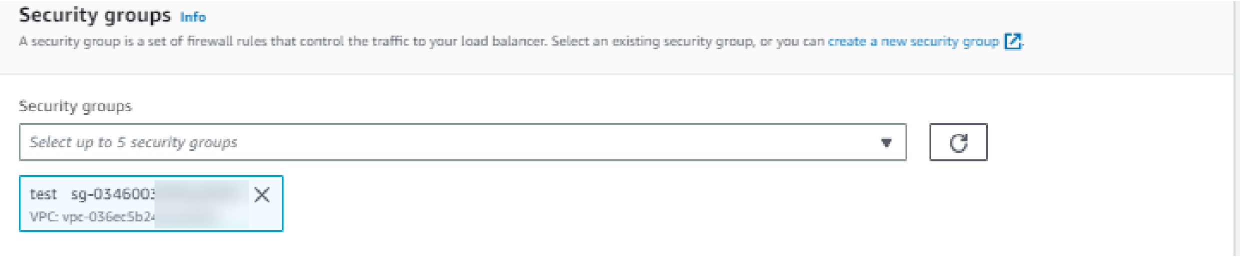
IPv4 address: Assigned by AWS

8. Under **Security groups**:

a. For **Security group**, select the default security group for the VPC that you selected in the previous step. Alternatively, you can select a different security group.

b. Ensure that the security group includes rules that allow the load balancer to communicate with registered targets on both the listener port and the health check port.

c. You must include the VPC source in the inbound rule to allow access to all ports or the port you are using as a listener.



Security groups Info

A security group is a set of firewall rules that control the traffic to your load balancer. Select an existing security group, or you can create a new security group.

Security groups

Select up to 5 security groups

test sg-034600[redacted]
VPC: vpc-036ec5b2[redacted]

9. Under **Listeners and routing**:

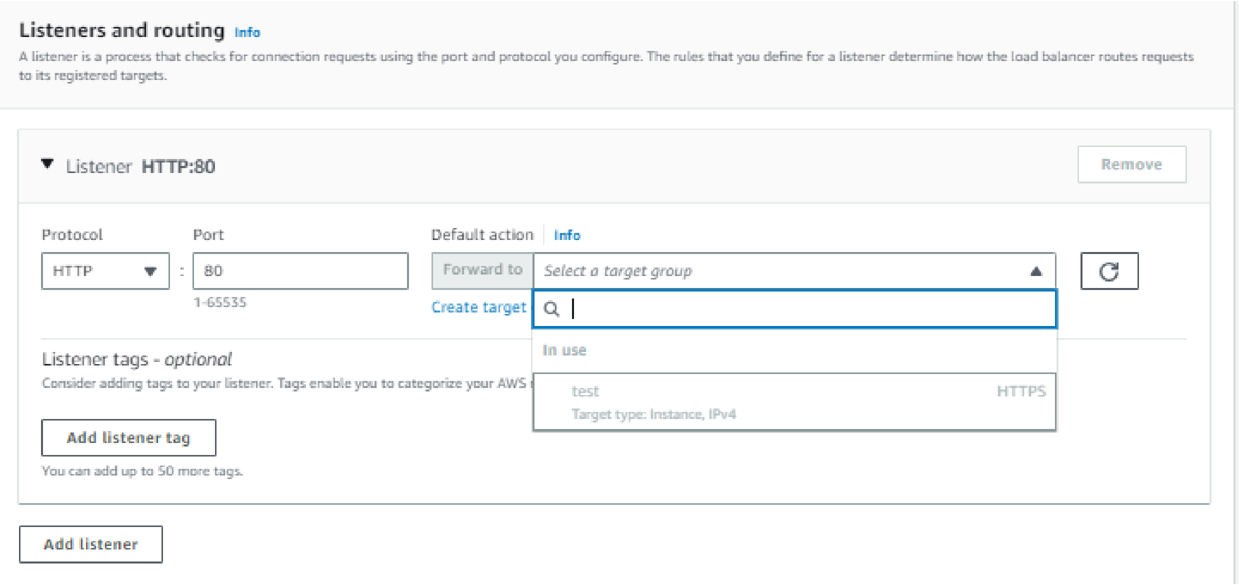
a. For **Protocol**, retain the default setting.

b. For **Port**, retain the default setting.

c. For **Default action**, select the **Forward to** action and select the target group that you created and registered.

d. Keep the **Add-on services** and **Load balancer** tags unchecked and left as default.

This configures a listener that accepts HTTP traffic on port 80 and forwards traffic to the selected target group by default.



Listeners and routing Info

A listener is a process that checks for connection requests using the port and protocol you configure. The rules that you define for a listener determine how the load balancer routes requests to its registered targets.

▼ Listener **HTTP:80**

Protocol: HTTP

Port: 80 (1-65535)

Default action: Forward to — *Select a target group*

Create target group

In use

test — HTTPS — Target type: Instance, IPv4

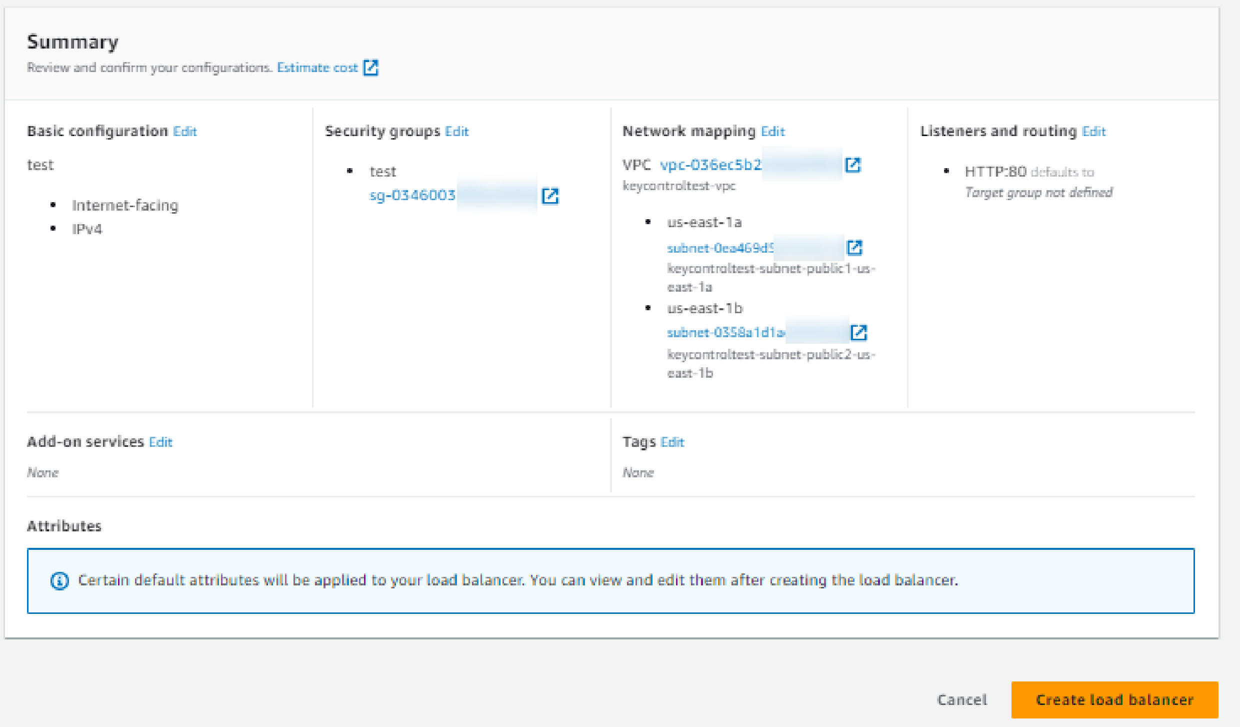
Listener tags - *optional*

Consider adding tags to your listener. Tags enable you to categorize your AWS

You can add up to 50 more tags.

10. Review your configuration and select **Create load balancer**. A few default attributes are applied to your load balancer during creation. You can view and edit them after creating the load balancer.

11. Select **Create load balancer**.



Summary

Review and confirm your configurations. Estimate cost

Basic configuration Edit

test

- Internet-facing
- IPv4

Security groups Edit

- test
  sg-0346003[redacted]

Network mapping Edit

VPC vpc-036ec5b2[redacted]
keycontroltest-vpc

- us-east-1a
  subnet-0ea469d[redacted]
  keycontroltest-subnet-public1-us-east-1a
- us-east-1b
  subnet-0358a1d1a[redacted]
  keycontroltest-subnet-public2-us-east-1b

Listeners and routing Edit

- HTTP:80 defaults to
  Target group not defined

Add-on services Edit

None

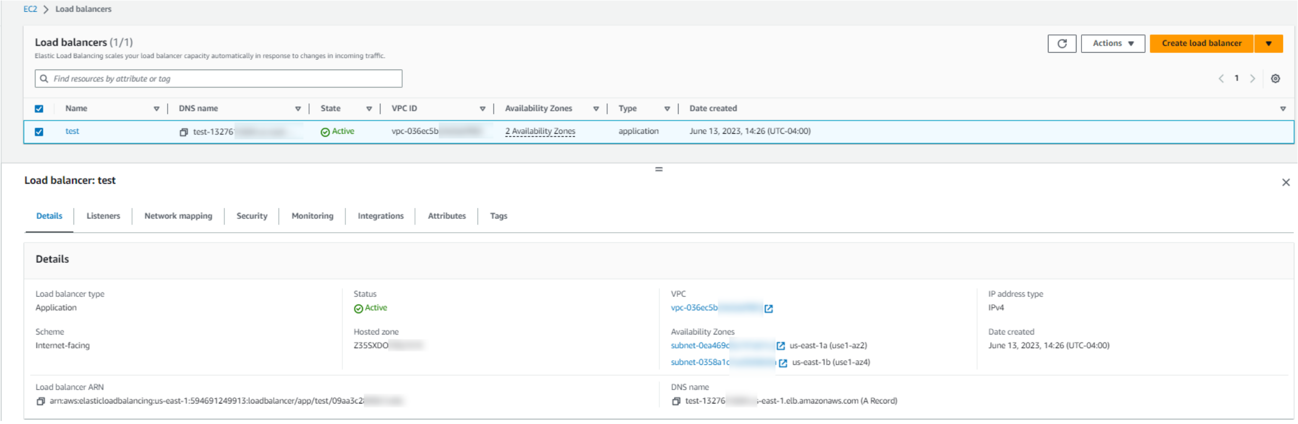
Tags Edit

None

Attributes

Certain default attributes will be applied to your load balancer. You can view and edit them after creating the load balancer.

After you receive the notification confirming the successful creation of your load balancer, follow the steps below to verify the status of your instances and test the load balancer.



Load balancers (1/1)

Elastic Load Balancing scales your load balancer capacity automatically in response to changes in incoming traffic.

Find resources by attribute or tag

☑	Name	DNS name	State	VPC ID	Availability Zones	Type	Date created
☑	test	test-13276[redacted]	Active	vpc-036ec5b[redacted]	2 Availability Zones	application	June 13, 2023, 14:26 (UTC-04:00)

Load balancer: test

Details

Load balancer type
Application

Scheme
Internet-facing

Status
Active

Hosted zone
Z35SXDO[redacted]

VPC
vpc-036ec5b[redacted]

Availability Zones
subnet-0ea469c[redacted] us-east-1a (use1-az2)
subnet-0358a1c[redacted] us-east-1b (use1-az4)

IP address type
IPv4

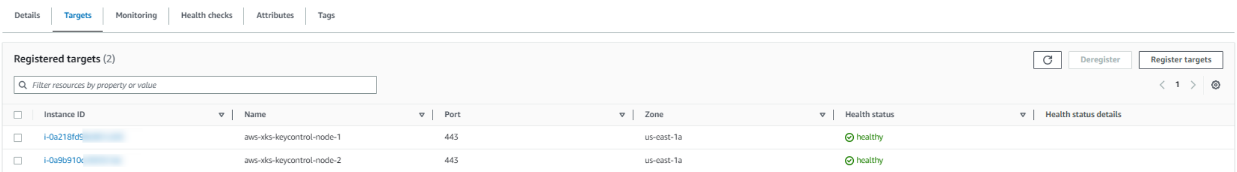
Date created
June 13, 2023, 14:26 (UTC-04:00)

Load balancer ARN
arn:aws:elasticloadbalancing:us-east-1:594691249913:loadbalancer/app/test/09aa3c2[redacted]

DNS name
test-13276[redacted]-east-1.elb.amazonaws.com (A Record)

1. After you are notified that your load balancer was created successfully, select **Close**.
2. In the navigation pane, under **Load Balancing**, select **Target Groups**.
3. Select the newly created target group.
4. Select **Targets** and verify that your instances are ready.

   If the status of an instance is `Initial`, the instance is either in the process of being registered or has not passed the minimum number of health checks to be considered healthy. Wait until the status of at least one instance is `Healthy`. For example:



Registered targets (2)

□	Instance ID	Name	Port	Zone	Health status	Health status details
□	i-0a218fd[redacted]	aws-xks-keycontrol-node-1	443	us-east-1a	✓ healthy	
□	i-0a9b910[redacted]	aws-xks-keycontrol-node-2	443	us-east-1a	✓ healthy	

2.3. Configure certificates and DNS

For the successful set-up of AWS External Key Store (XKS), note that the DNS record and TLS certificate relate to the Fully Qualified Domain Name (FQDN) of the load-balanced endpoint utilized for accessing the service. This is distinct from the KeyControl instances.

Ensure the KeyControl Vault server possesses a publicly accessible IP address and that a DNS record is in place for the designated common name within the public DNS server.

> Amazon recommends a round-trip time latency of under 35 milliseconds between the AWS region and the KeyControl.

You must obtain a TLS certificate issued by a public certificate authority supported for external key stores. For a list, see https://github.com/aws/aws-kms-xksproxy-api-spec/blob/main/TrustedCertificateAuthorities

To ensure seamless access across the cluster nodes, you must install the TLS certificate on all nodes of the cluster, especially if users plan to access the cluster through other nodes. If an Elastic Load Balancer (ELB) is part of the set-up, the certificate handling process will differ. When using an ELB, the TLS certificate must be managed according to ELB requirements.

1. In the KeyControl Appliance Management:

   a. Navigate to **Cluster** > **Servers**.

   b. Select the server to install the certificate.

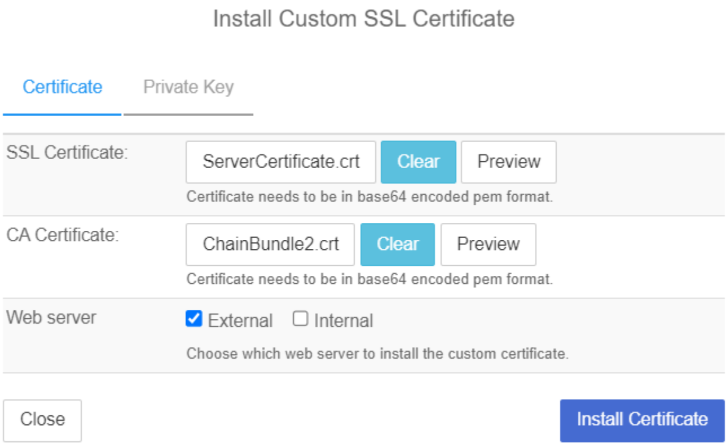
   c. Select **Actions** > **Install Certificate**. The **Install Custom SSL Certificate** dialog appears.

   d. Locate and select the **SSL Certificate** file.

   e. Locate and select the **CA certificate** chain file.

   f. Select **External** for the Web server.

   g. Select **Install Certificate**.



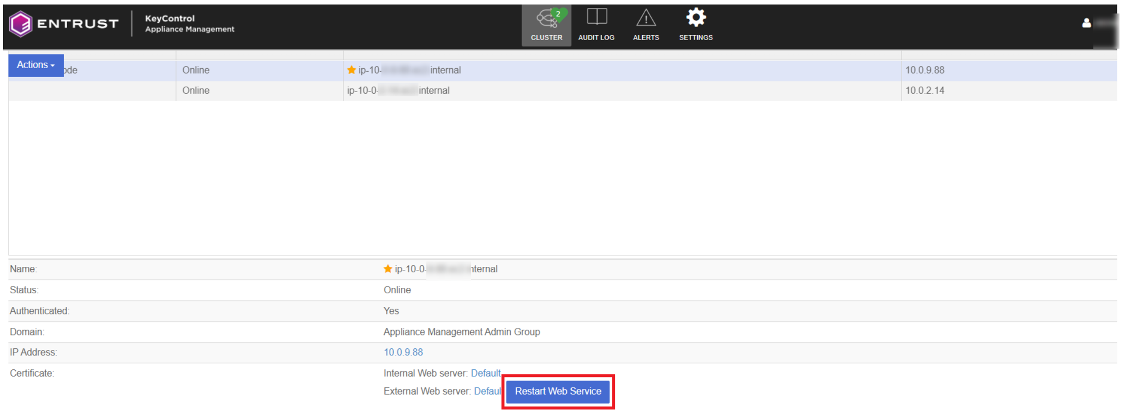
Install Custom SSL Certificate

SSL Certificate: ServerCertificate.crt Clear Preview
Certificate needs to be in base64 encoded pem format.

CA Certificate: ChainBundle2.crt Clear Preview
Certificate needs to be in base64 encoded pem format.

Web server ☑ External □ Internal
Choose which web server to install the custom certificate.

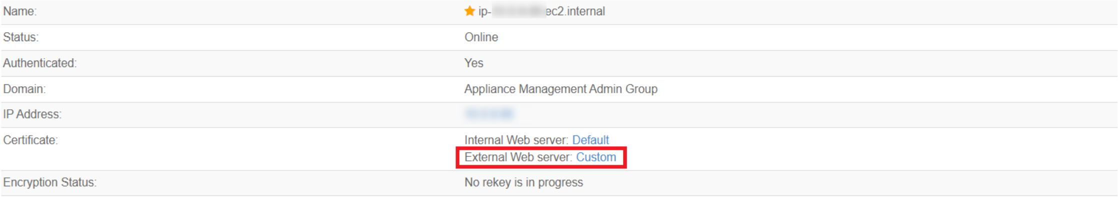
2. After installation, restart the Web service



ode	Online	★ ip-10-[redacted]internal	10.0.9.88
	Online	ip-10-0-[redacted]internal	10.0.2.14

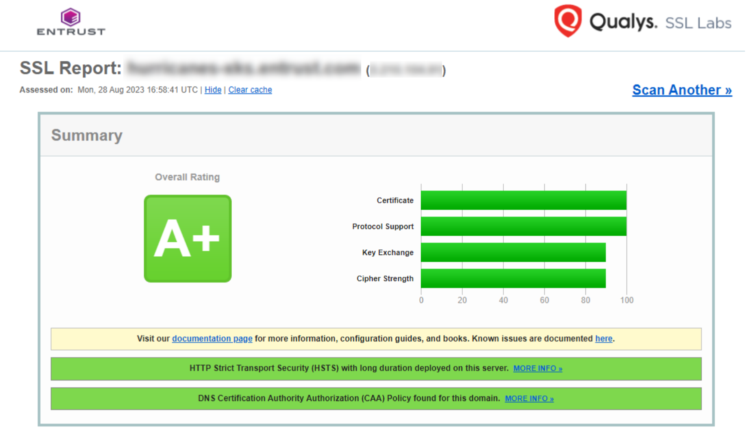
Name:	★ ip-10-0-[redacted]nternal
Status:	Online
Authenticated:	Yes
Domain:	Appliance Management Admin Group
IP Address:	10.0.9.88
Certificate:	Internal Web server: Default External Web server: Defaul Restart Web Service

3. Confirm the installation. The External Web server will now show as `Custom` for the certificate.



Name:	★ ip-[redacted]ec2.internal
Status:	Online
Authenticated:	Yes
Domain:	Appliance Management Admin Group
IP Address:	[redacted]
Certificate:	Internal Web server: Default External Web server: Custom
Encryption Status:	No rekey is in progress

4. You can validate the certificate using https://entrust.ssllabs.com/ or a similar tool. For example:



SSL Report: [redacted] ([redacted])
Assessed on: Mon, 28 Aug 2023 16:58:41 UTC | Hide | Clear cache

Visit our documentation page for more information, configuration guides, and books. Known issues are documented here.

HTTP Strict Transport Security (HSTS) with long duration deployed on this server. MORE INFO »

DNS Certification Authority Authorization (CAA) Policy found for this domain. MORE INFO »

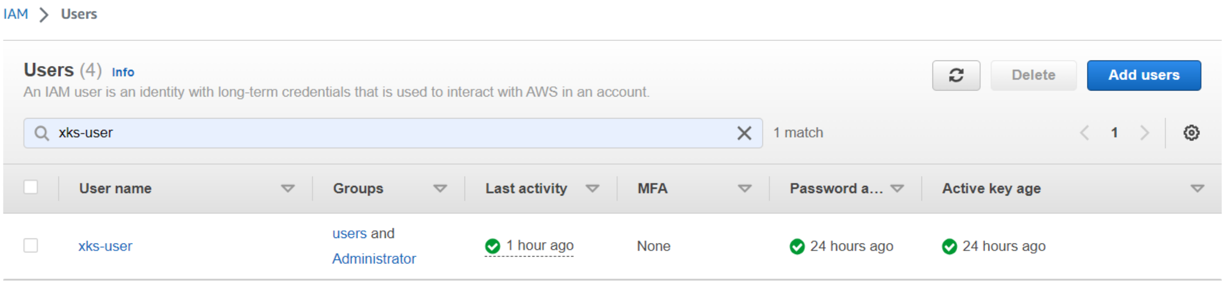
If you are not able to verify the server hostname, ensure that any firewalls between AWS KMS and the external key store proxy allow traffic to and from port 443 on the proxy.

2.4. Key Administrators - AWS IAM user

To enable the integration, you must designate an IAM user as a Key Administrator. This user is required to generate an access key that will be used in a later step.

This user must have permissions to manage and use the KMS key for cryptographic operations.

1. Sign in to the AWS Management Console.
2. Search for the **Identity and Access Management (IAM)** service and select it.
3. In the IAM console, select **Access Management** in the left tab and then select **Users**.
4. Create a new user or use an existing user to generate an access key. In this example integration, a new user named `xks-user` is created as the Key Administrator.

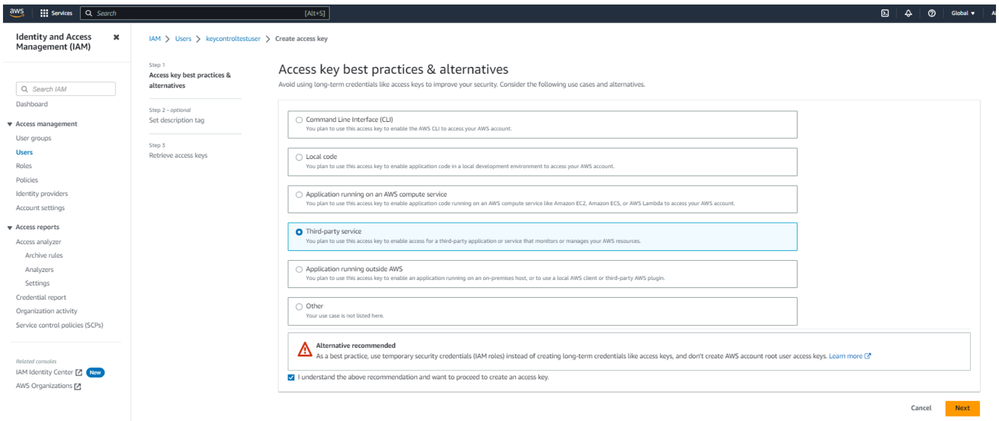


An IAM user is an identity with long-term credentials that is used to interact with AWS in an account.

xks-user

□	User name	Groups	Last activity	MFA	Password a...	Active key age
□	xks-user	users and Administrator	✓ 1 hour ago	None	✓ 24 hours ago	✓ 24 hours ago

5. In the user settings, select **Create access key** and select **third-party service**.



Access key best practices & alternatives

Avoid using long-term credentials like access keys to improve your security. Consider the following use cases and alternatives.

○ Command Line Interface (CLI)
You plan to use this access key to enable the AWS CLI to access your AWS account.

○ Local code
You plan to use this access key to enable application code in a local development environment to access your AWS account.

○ Application running on an AWS compute service
You plan to use this access key to enable application code running on an AWS compute service like Amazon EC2, Amazon ECS, or AWS Lambda to access your AWS account.

● Third-party service
You plan to use this access key to enable access for a third-party application or service that monitors or manages your AWS resources.

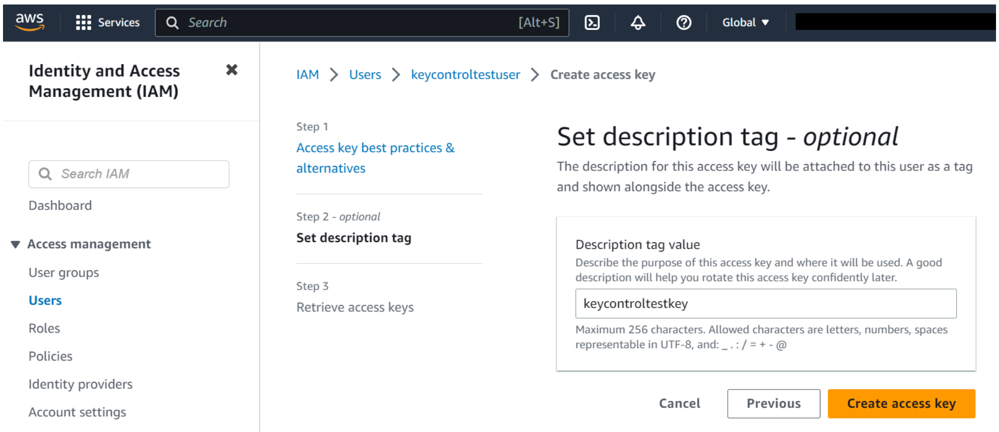
○ Application running outside AWS
You plan to use this access key to enable an application running on an on-premises host, or to use a local AWS client or third-party AWS plugin.

○ Other
Your use case is not listed here.

Alternative recommended
As a best practice, use temporary security credentials (IAM roles) instead of creating long-term credentials like access keys, and don't create AWS account root user access keys. Learn more

☑ I understand the above recommendation and want to proceed to create an access key.

6. Create the access key.



Set description tag - *optional*

The description for this access key will be attached to this user as a tag and shown alongside the access key.

Description tag value

Describe the purpose of this access key and where it will be used. A good description will help you rotate this access key confidently later.

keycontroltestkey

Maximum 256 characters. Allowed characters are letters, numbers, spaces representable in UTF-8, and: _ . : / = + - @

Ensure that you securely store the Access ID and Secret Access Key, as they are required for accessing and managing your AWS resources.

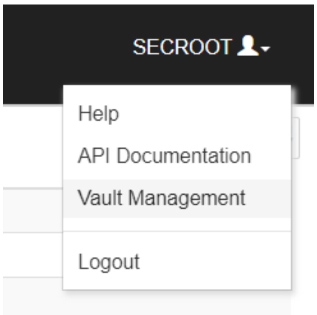
2.5. Create a Cloud Key Management Vault

The KeyControl Vault appliance supports the following types of vaults:

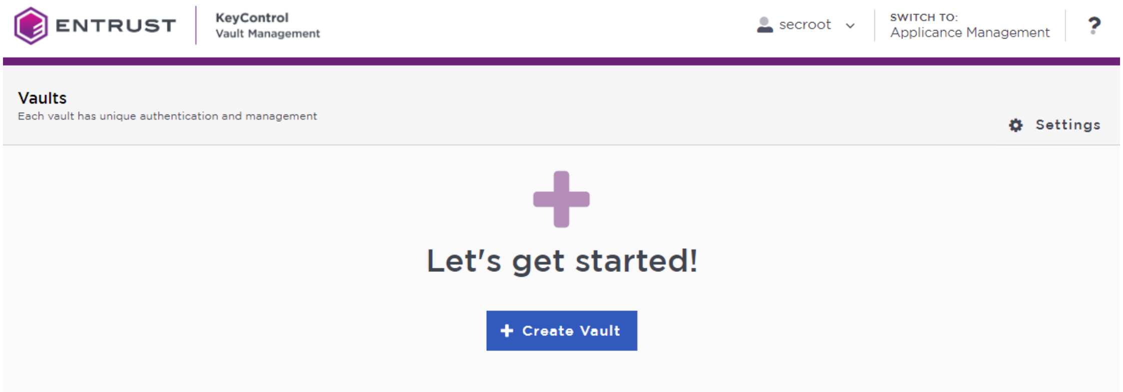
- **Cloud Key Management** - Vault for cloud keys such as BYOK and HYOK.
- **KMIP Vault** - Vault for KMIP Objects.
- **PASM** - Vault for objects such as passwords, files, SSH keys, and so on.
- **Database** - Vault for database keys.
- **Tokenization** - Vault for tokenization policies.
- **VM Encryption**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

To create a Cloud Key Management Vault:

1. Sign in to the KeyControl Vault Server Appliance Manager.
2. Open the drop-down menu and select **Vault Management**.



The KeyControl Vault Management interface appears.



Vaults

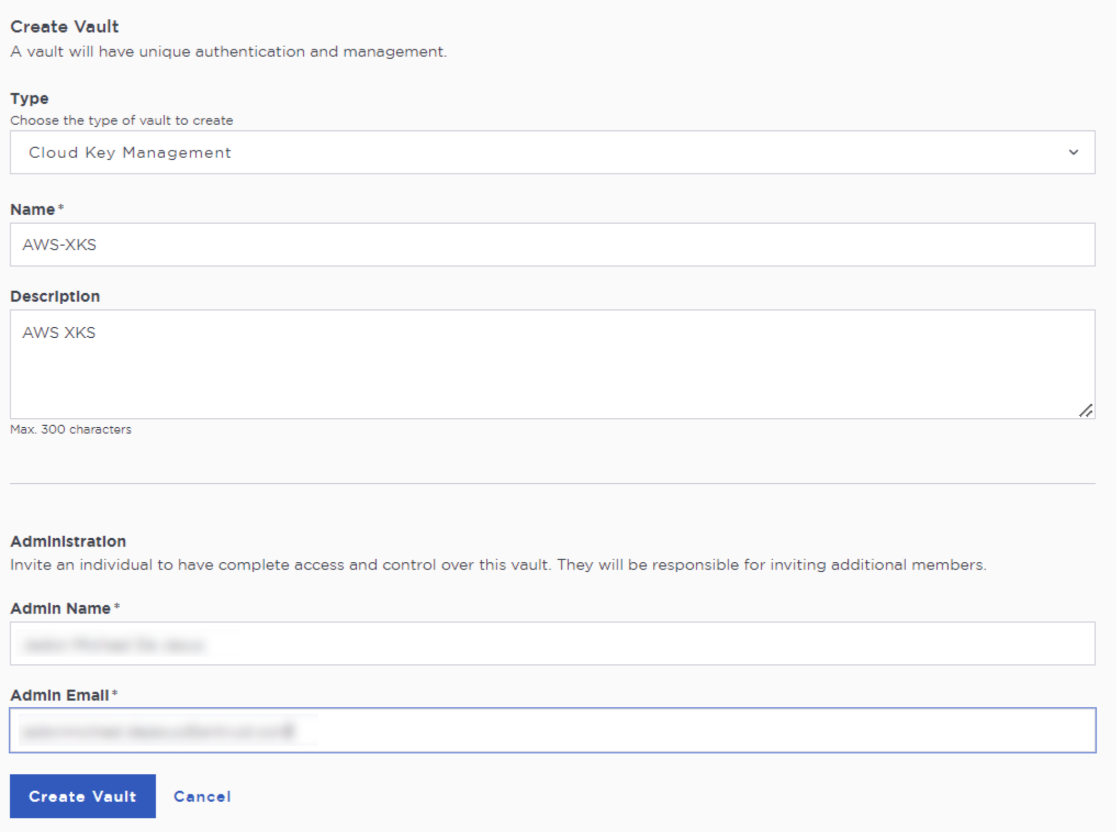
Each vault has unique authentication and management

Let's get started!

3. Select **Create Vault**.

   The **Create Vault** page appears.

4. On the **Create Vault** page:
   a. For **Type**, select **Cloud Key Management**.
   b. Enter a **Name** for the vault.
   c. Provide a **Description** for the vault.
5. Under **Administration**:
   a. Enter the **Admin Name** who will be responsible for the vault.
   b. Enter a valid **Admin Email** address.



Create Vault

A vault will have unique authentication and management.

Type

Choose the type of vault to create

Cloud Key Management

Name*

AWS-XKS

Description

AWS XKS

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*

[redacted]

Admin Email*

[redacted]

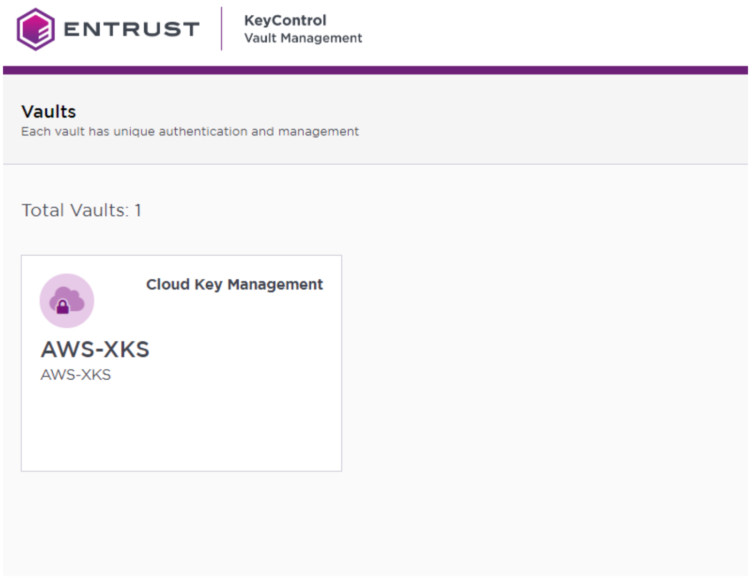
6. Select **Create Vault**.

If you set up an administrator email address when you logged in for the first time, a temporary password is mailed to that address. This is the password you must use when you sign in for the first time to Vaults space in KeyControl.

If you did not set up an email configuration when you logged in for the first time, a password is shown in the Vault Details when you create a Vault for the first time. You must make a note of the password at this time, as it will not be included in the Vault Details afterwards.

7. Select **Close**.

The newly created vault is displayed in the **Vaults** dashboard.

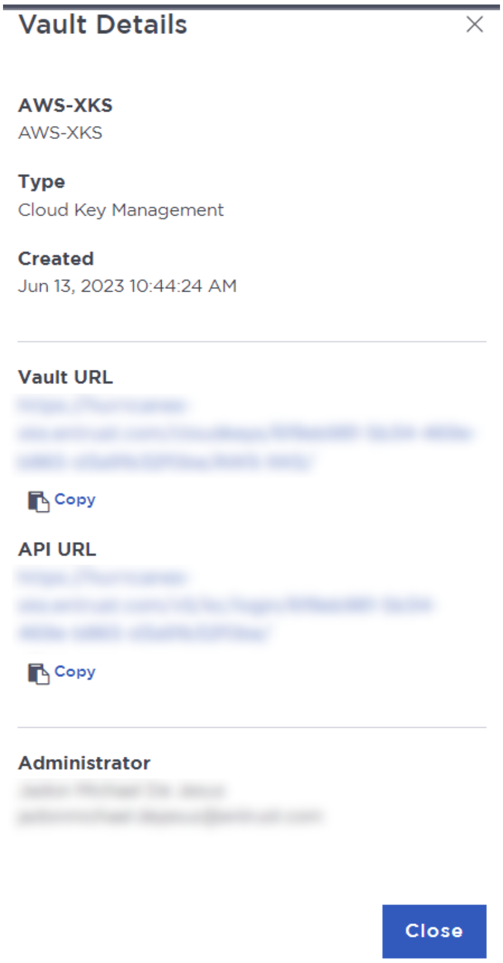


Vaults
Each vault has unique authentication and management

Total Vaults: 1

Cloud Key Management
AWS-XKS
AWS-XKS

8. To view the details of a vault, hover over the vault and select **View Details**.



Vault Details

AWS-XKS
AWS-XKS

Type
Cloud Key Management

Created
Jun 13, 2023 10:44:24 AM

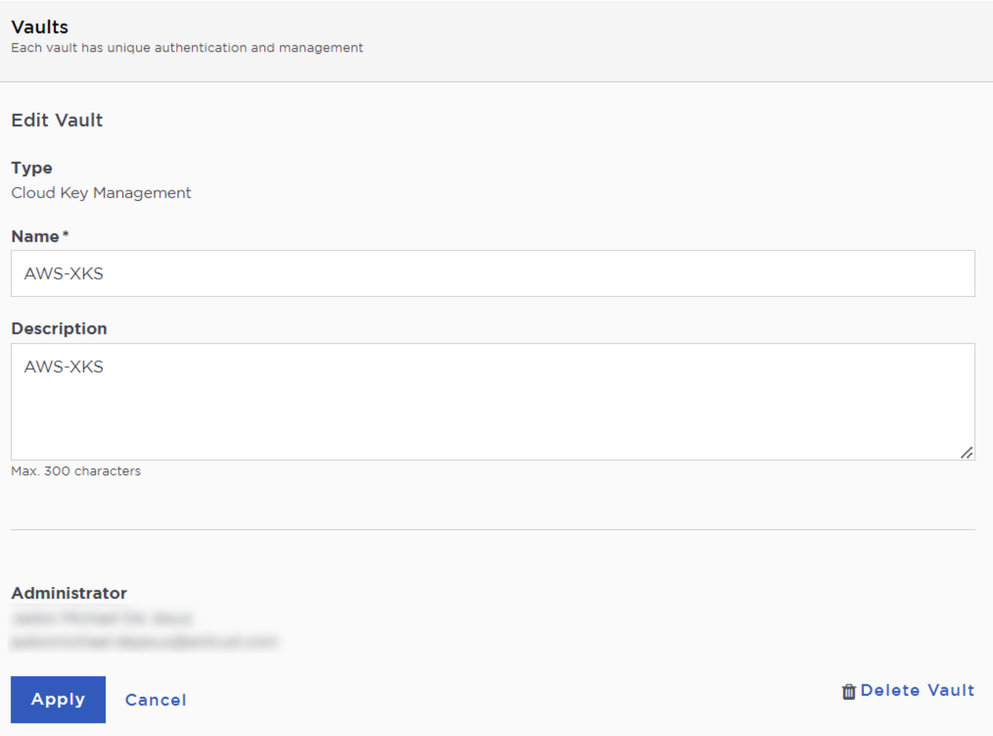
Vault URL
[redacted]

API URL
[redacted]

Administrator
[redacted]

To edit the details of a vault:

1. Hover over the vault and select **Edit**.
2. Make the required changes and select **Apply**.



Vaults
Each vault has unique authentication and management

Edit Vault

Type
Cloud Key Management

Name *
AWS-XKS

Description
AWS-XKS

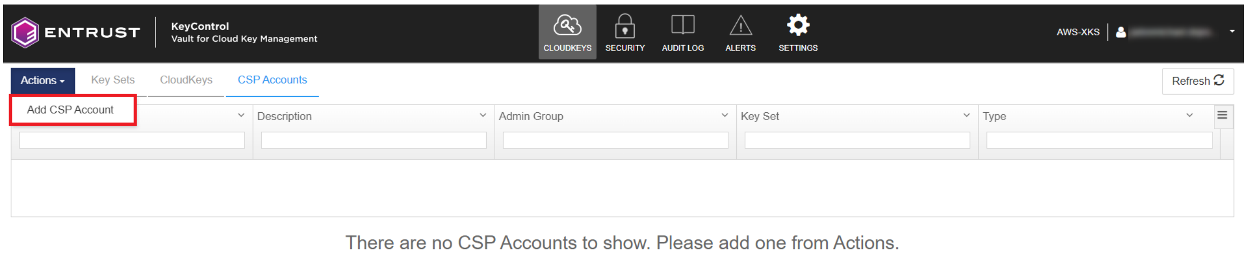
Max. 300 characters

Administrator
[redacted]

2.6. Create a CSP Account in the Cloud Key Management Vault

To create a CSP Account in the Cloud Key Management Vault:

1. Sign into the newly created vault.
2. Select **Cloud Keys** > **CSP Accounts** > **Actions** > **Add CSP Account**.



There are no CSP Accounts to show. Please add one from Actions.

The **Add CSP Account** dialog appears.

3. In the **Details** page:

   a. For **Name**, enter a name for the CSP account.

   b. Add a **Description**.

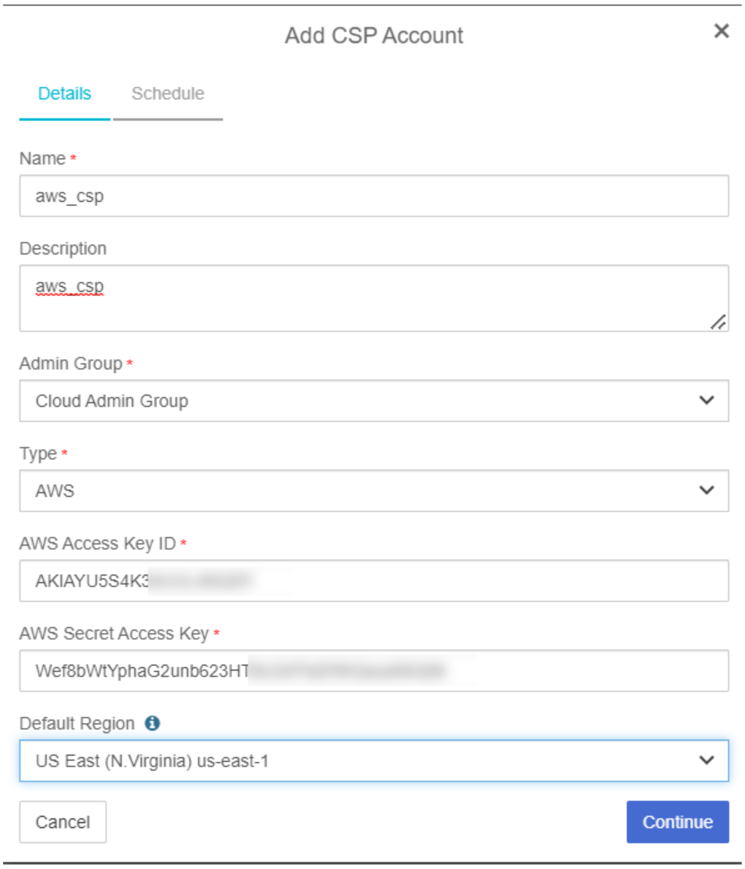
   c. For **Admin Group** select **Cloud Admin Group**.

   d. For **Type** select **AWS**.

   e. Enter the **AWS Access Key ID** and **AWS Secret Access Key** from earlier.

   f. Select the target region as the default region.

   g. Select **Continue**.



Add CSP Account ✕

Details | Schedule

Name *

aws_csp

Description

aws_csp

Admin Group *

Cloud Admin Group

Type *

AWS

AWS Access Key ID *

AKIAYU5S4K3[redacted]

AWS Secret Access Key *

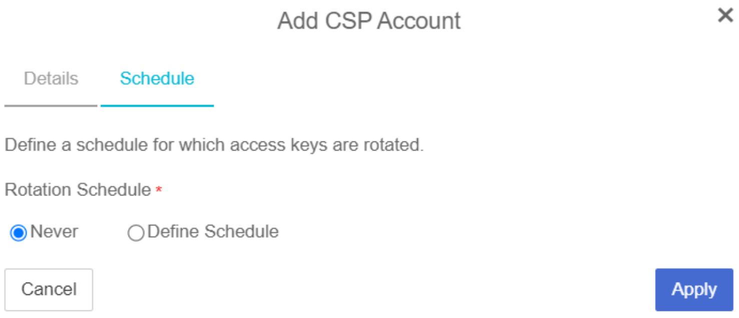
Wef8bWtYphaG2unb623HT[redacted]

Default Region ℹ

US East (N.Virginia) us-east-1

Cancel | Continue

4. In the **Schedule** page:
   a. Select the required **Rotation Schedule**.
   b. Select **Apply**.



Add CSP Account ✕

Details | Schedule

Define a schedule for which access keys are rotated.

Rotation Schedule *

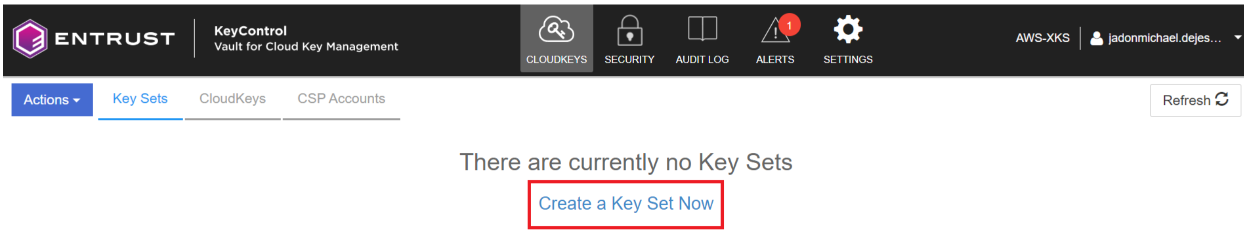
● Never ○ Define Schedule

Cancel | Apply

2.7. Create the Key Set

To create the Key Set:

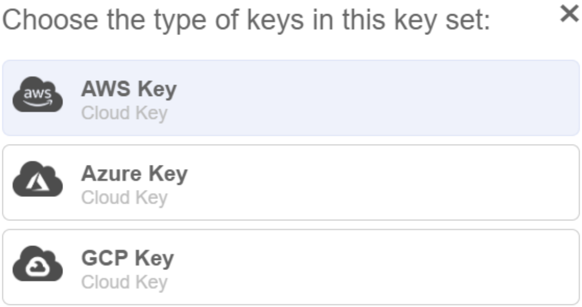
1. Under **CloudKeys**, select **Key Sets** > **Create a Key Set Now**.



There are currently no Key Sets

Create a Key Set Now

2. Select **AWS Key** for the type of keys in key set.



Choose the type of keys in this key set:

The **Create Key Set** dialog appears.

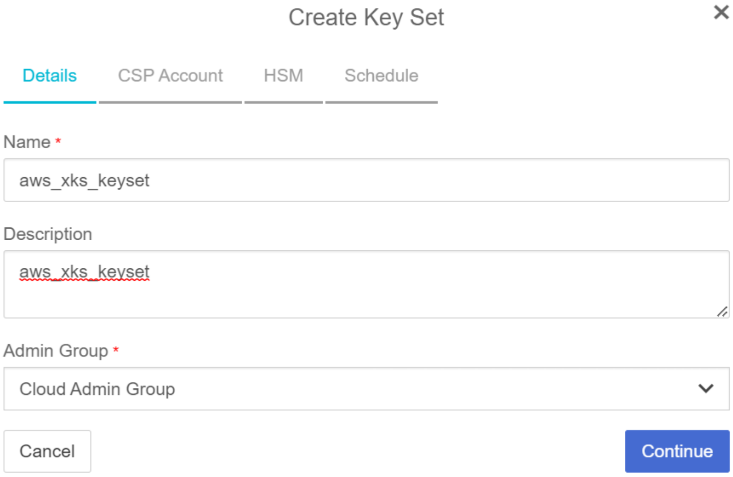
3. In the **Details** page:

   a. Enter a **Name**.

   b. Enter a **Description**.

   c. For **Admin Group**, select **Cloud Admin Group**.

   d. Select **Continue**.



Create Key Set

Name * aws_xks_keyset

Description aws_xks_keyset

Admin Group * Cloud Admin Group

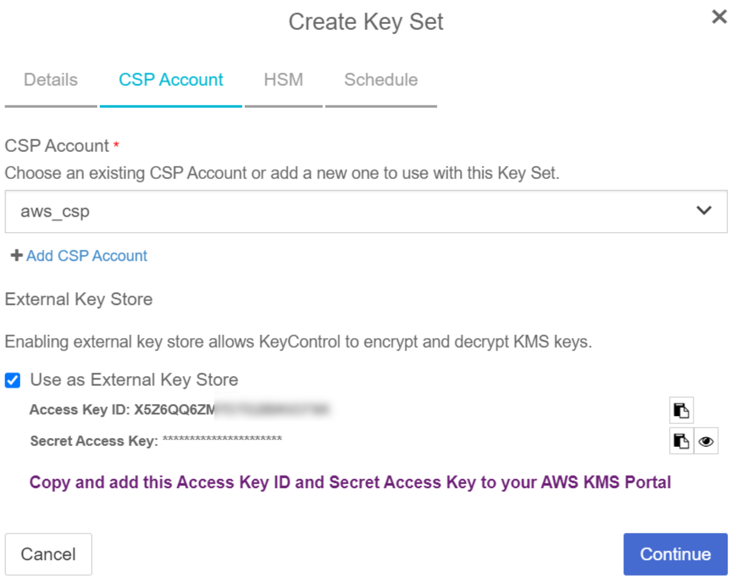
4. In the **CSP Account** page:

   a. For **CSP Account**, select the `aws_csp` account created earlier.

   b. Select **Use as External Key Store**.

   c. Make a note of the XKS credentials, as these are required later.

d. Select **Continue**.



Create Key Set

CSP Account *

Choose an existing CSP Account or add a new one to use with this Key Set.

aws_csp

External Key Store

Enabling external key store allows KeyControl to encrypt and decrypt KMS keys.

☑ Use as External Key Store

Access Key ID: X5Z6QQ6ZM[redacted]

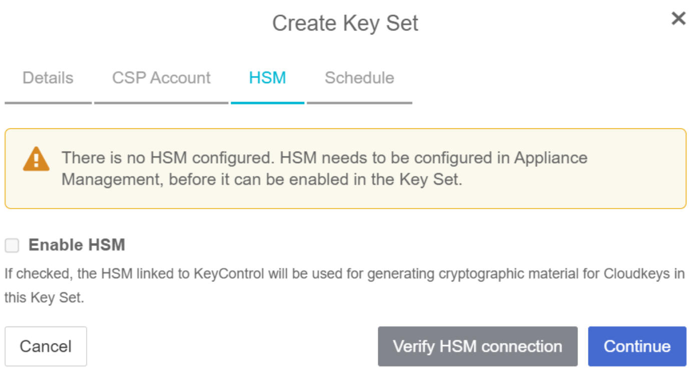
Secret Access Key: **********************

Copy and add this Access Key ID and Secret Access Key to your AWS KMS Portal

5. In the **HSM** page:

   a. Optionally select **Enable HSM**.

   b. Select **Continue**.



Create Key Set

There is no HSM configured. HSM needs to be configured in Appliance Management, before it can be enabled in the Key Set.

☐ Enable HSM

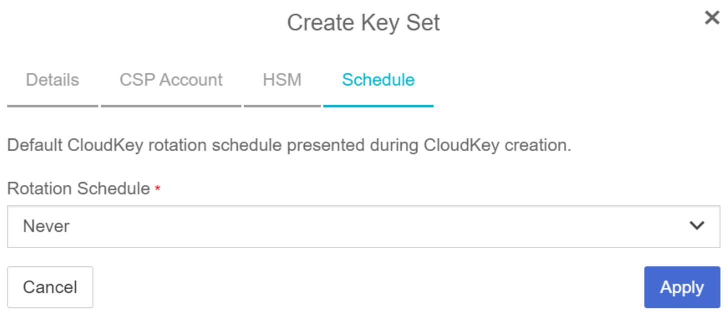
If checked, the HSM linked to KeyControl will be used for generating cryptographic material for Cloudkeys in this Key Set.

> To set up an HSM linked to KeyControl, follow the installation and set-up instructions in the *Entrust KeyControl nShield HSM Integration Guide*.

6. In the **Schedule** page:

   a. For **Rotation Schedule**, select your required CloudKey rotation.

   b. Select **Apply**.



Create Key Set

Details | CSP Account | HSM | Schedule

Default CloudKey rotation schedule presented during CloudKey creation.

Rotation Schedule *

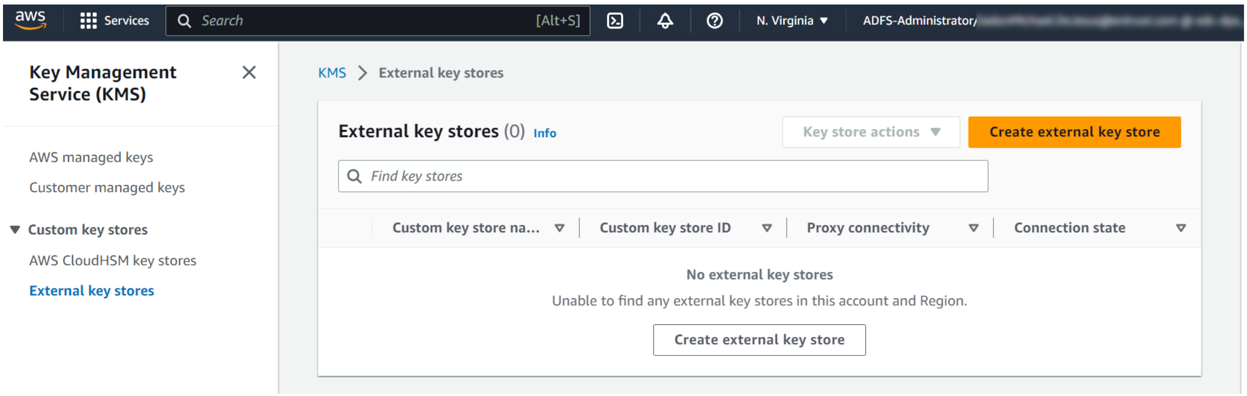
Never

Cancel | Apply

2.8. Create an External Key Store in AWS

To create an External Key Store in AWS:

1. Sign in to the AWS console and navigate to **Key Management Service (KMS)**.
2. In the left panel, select **Custom key stores** > **External key stores**.
3. For **Key store name**, enter the required name.
4. Select **Create external key store**.



External key stores (0) Info

Key store actions | Create external key store

Find key stores

Custom key store na...	Custom key store ID	Proxy connectivity	Connection state

No external key stores

Unable to find any external key stores in this account and Region.

Create external key store

The **Create external key store** page appears.

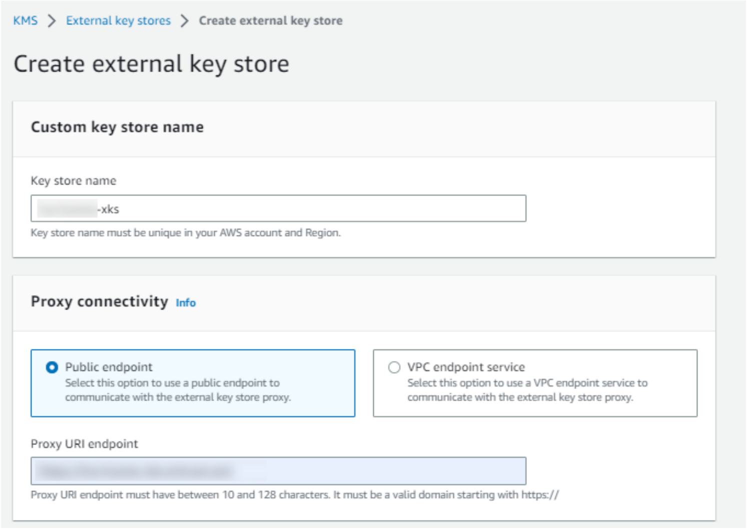
5. Under **Custom key store name**, provide a descriptive name for the external key store.
6. Under **Proxy connectivity**:

   a. Select **Public endpoint**.

   b. For **Proxy URI endpoint**, enter the Proxy URI endpoint in the following format:

   ```
   https://<FQDN of Load Balanced Endpoint>
   ```

   Substitute `<FQDN of Load Balanced Endpoint>` with the fully qualified domain name of the load-balanced endpoint utilized for accessing the service, distinct from any of the KeyControl instances.



KMS > External key stores > Create external key store

Create external key store

Custom key store name

Key store name

[redacted]-xks

Key store name must be unique in your AWS account and Region.

Proxy connectivity Info

● Public endpoint
Select this option to use a public endpoint to communicate with the external key store proxy.

○ VPC endpoint service
Select this option to use a VPC endpoint service to communicate with the external key store proxy.

Proxy URI endpoint

[redacted]

Proxy URI endpoint must have between 10 and 128 characters. It must be a valid domain starting with https://

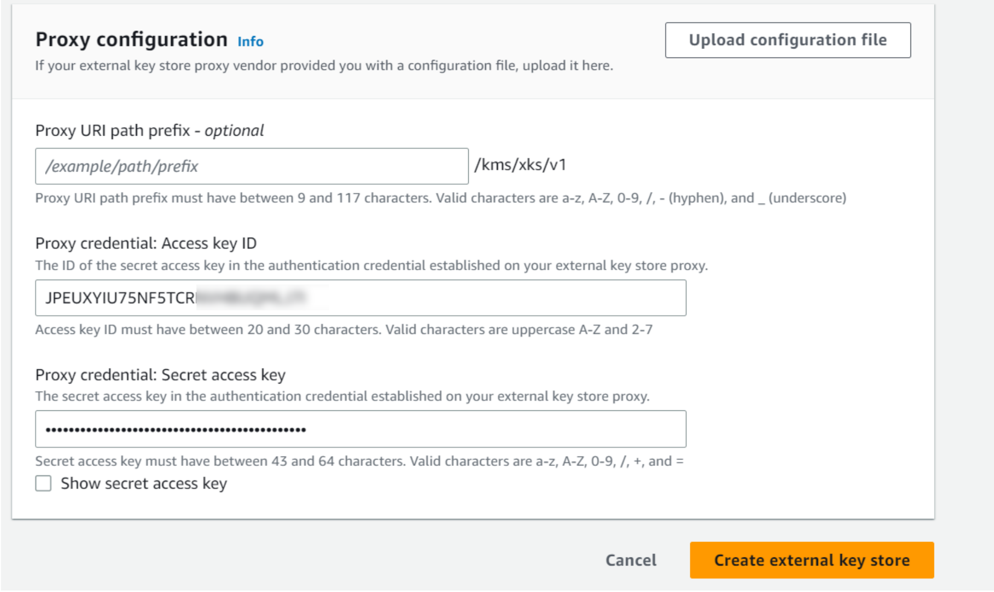
7. Under **Proxy configuration**:

   a. Leave **Proxy URI path prefix** empty.

   b. For **Proxy credential: Access key ID**, enter the previously-saved proxy access key ID.

   c. For **Proxy credential: Secret access key**, enter the previously-saved proxy secret access key.

   d. Select **Create external key store**.



Proxy configuration Info

If your external key store proxy vendor provided you with a configuration file, upload it here.

Proxy URI path prefix - *optional*

/example/path/prefix /kms/xks/v1

Proxy URI path prefix must have between 9 and 117 characters. Valid characters are a-z, A-Z, 0-9, /, - (hyphen), and _ (underscore)

Proxy credential: Access key ID

The ID of the secret access key in the authentication credential established on your external key store proxy.

JPEUXYIU75NF5TCR[redacted]

Access key ID must have between 20 and 30 characters. Valid characters are uppercase A-Z and 2-7

Proxy credential: Secret access key

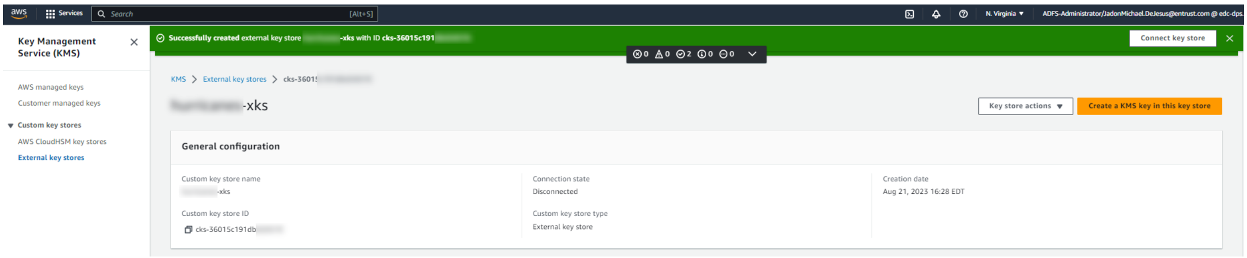
The secret access key in the authentication credential established on your external key store proxy.

••

Secret access key must have between 43 and 64 characters. Valid characters are a-z, A-Z, 0-9, /, +, and =

□ Show secret access key

A details page for the new external key store appears.



Successfully created external key store [redacted]-xks with ID cks-36015c191[redacted]

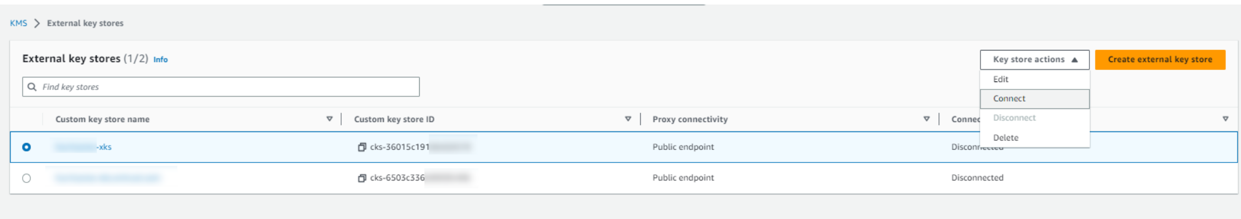
KMS > External key stores > cks-3601[redacted]

[redacted]-xks

General configuration

Custom key store name [redacted]-xks	Connection state Disconnected	Creation date Aug 21, 2023 16:28 EDT
Custom key store ID cks-36015c191db[redacted]	Custom key store type External key store	

8. Select **External key stores** to view all external key stores.
9. Select **Key store actions** > **Connect** to connect to the external key store.



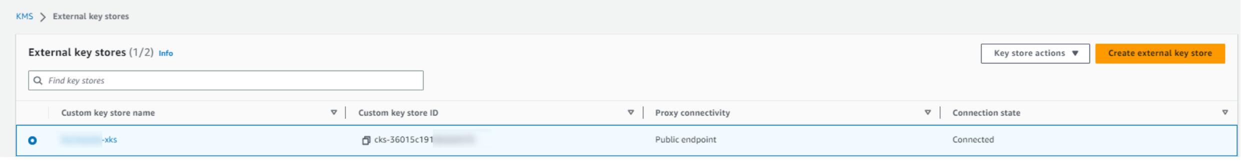
KMS > External key stores

External key stores (1/2) Info

Find key stores

	Custom key store name	Custom key store ID	Proxy connectivity	Connection state
●	[redacted]-xks	cks-36015c191[redacted]	Public endpoint	Disconnected
○	[redacted]	cks-6503c336[redacted]	Public endpoint	Disconnected

10. Wait for the Connection state to display as `Connected`.



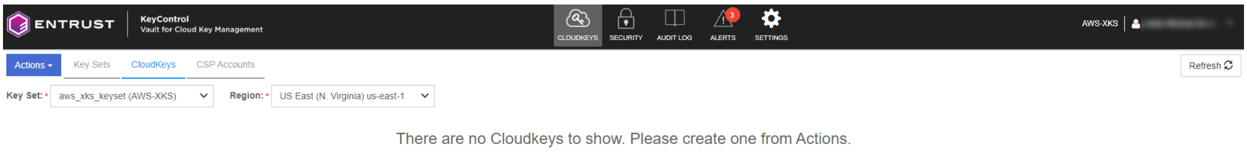
KMS > External key stores

External key stores (1/2) Info

Find key stores

	Custom key store name	Custom key store ID	Proxy connectivity	Connection state
●	[redacted]-xks	cks-36015c191[redacted]	Public endpoint	Connected

11. Return to KeyControl Cloud Key Management Vault and select **CLOUDKEYS** > **CloudKeys**.
12. Select the **Key Set** created earlier along with the **Region**.



Key Set: * aws_xks_keyset (AWS-XKS)   Region: * US East (N. Virginia) us-east-1

There are no Cloudkeys to show. Please create one from Actions.

13. Select **Actions** > **Create CloudKey**.

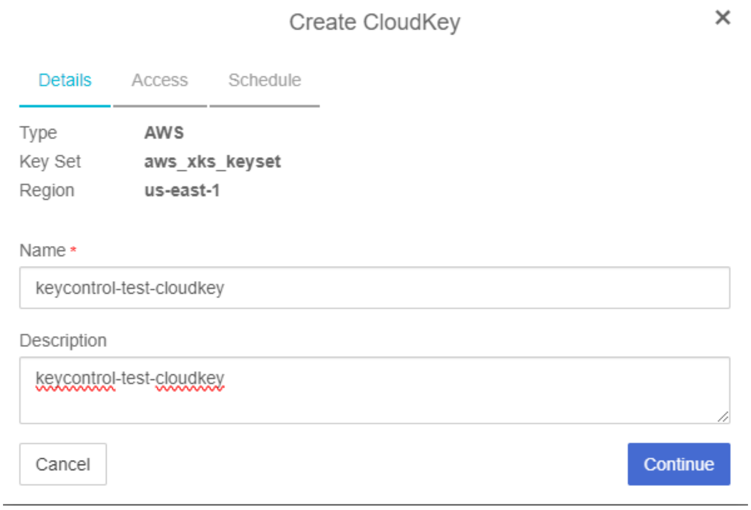
    The **Create CloudKey** dialog appears.

14. In the **Details** page:

    a. For **Name**, enter a name for the CloudKey.

    b. Enter a **Description**.

    c. Select **Continue**



Create CloudKey

Type AWS
Key Set aws_xks_keyset
Region us-east-1

Name * keycontrol-test-cloudkey

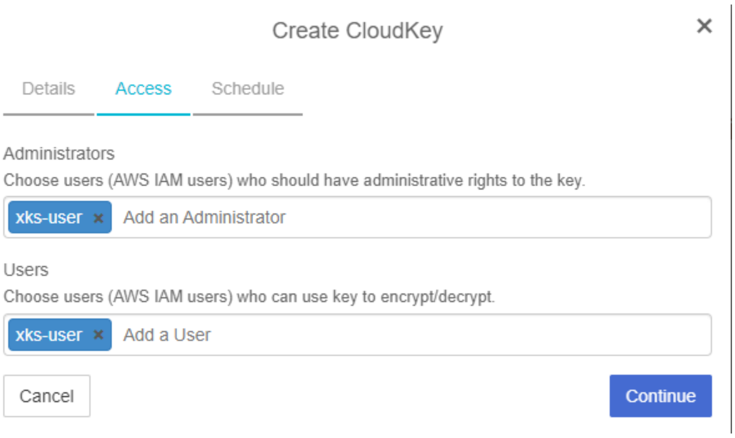
Description keycontrol-test-cloudkey

15. In the **Access** page:

    a. For **Administrators**, select AWS IAM users who will have administrative rights.

    b. For **Users**, select AWS IAM users who will be able to use the key to encrypt/decrypt.

    c. Select **Continue**.



Create CloudKey

Administrators

Choose users (AWS IAM users) who should have administrative rights to the key.

xks-user × Add an Administrator

Users

Choose users (AWS IAM users) who can use key to encrypt/decrypt.

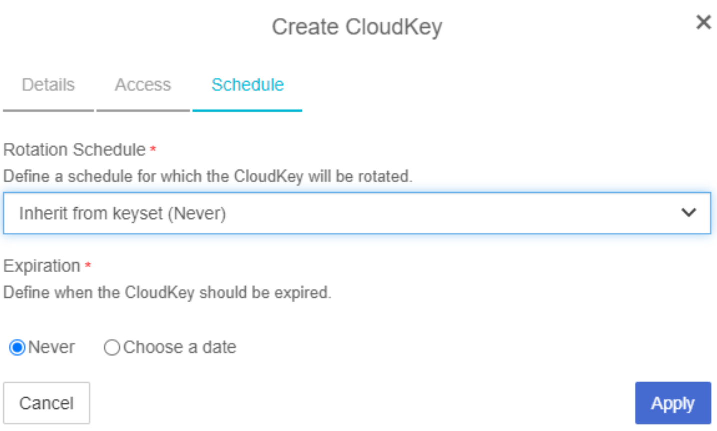
xks-user × Add a User

16. In the **Schedule** page:

    a. For **Rotation Schedule**, select a rotation schedule for the CloudKey.

    b. For **Expiration**, select the required condition.

    c. Select **Apply** to finish the process.



Create CloudKey

Rotation Schedule *

Define a schedule for which the CloudKey will be rotated.

Inherit from keyset (Never)

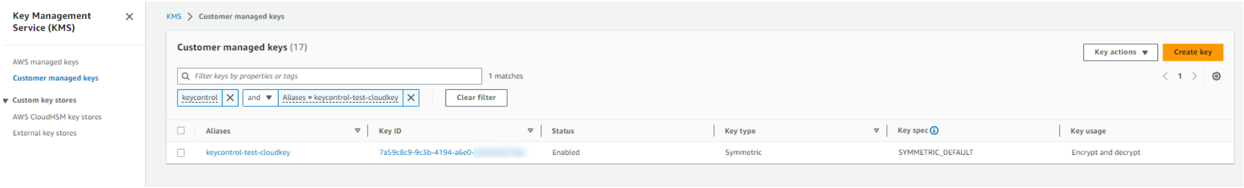
Expiration *

Define when the CloudKey should be expired.

● Never ○ Choose a date

After the XKS CloudKey is created in KeyControl, a KMS key pointer is automatically created in AWS KMS with a key alias that matches the KeyControl CloudKey name. This KMS key pointer can be utilized by AWS services to encrypt or decrypt user objects.

17. Return to AWS KMS > **Customer managed keys** to find the created CloudKey.



Key Management Service (KMS)

AWS managed keys
Customer managed keys
Custom key stores
AWS CloudHSM key stores
External key stores

KMS > Customer managed keys

Customer managed keys (17)

Filter keys by properties or tags — 1 matches

keycontrol | and | Aliases = keycontrol-test-cloudkey | Clear filter

Aliases	Key ID	Status	Key type	Key spec	Key usage
keycontrol-test-cloudkey	7a59c8c9-9c3b-4194-a6e0-[redacted]	Enabled	Symmetric	SYMMETRIC_DEFAULT	Encrypt and decrypt

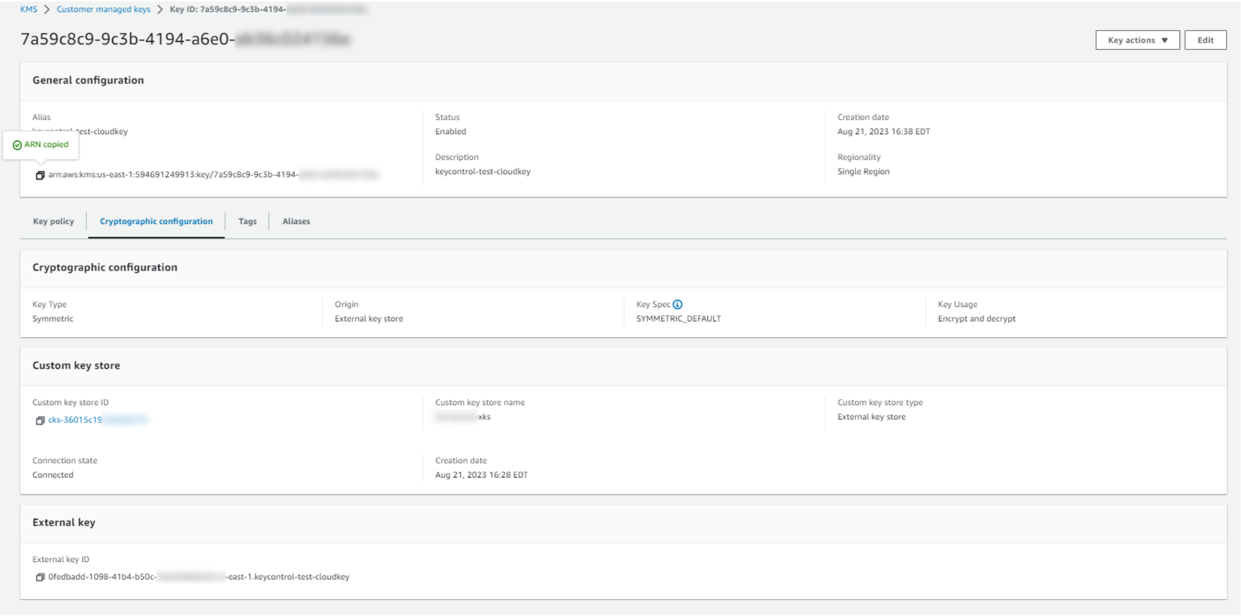
18. Select either the **Aliases** or **Key ID** hyperlink for the CloudKey.

    A details page for the CloudKey appears.

19. Select **Cryptographic configuration**.

    Note that under **Custom key store**, the **Custom key store name** appears and the **Custom key store type** as listed as **External**.

20. Under **General configuration**, copy the AWS KMS ARN for a later step.



KMS > Customer managed keys > Key ID: 7a59c8c9-9c3b-4194-[redacted]

7a59c8c9-9c3b-4194-a6e0-[redacted]

General configuration

Alias: keycontrol-test-cloudkey

arn:aws:kms:us-east-1:594691249913:key/7a59c8c9-9c3b-4194-[redacted]

Status: Enabled

Description: keycontrol-test-cloudkey

Creation date: Aug 21, 2023 16:38 EDT

Regionality: Single Region

Key policy | Cryptographic configuration | Tags | Aliases

Cryptographic configuration

Key Type: Symmetric

Origin: External key store

Key Spec: SYMMETRIC_DEFAULT

Key Usage: Encrypt and decrypt

Custom key store

Custom key store ID: cks-36015c19[redacted]

Custom key store name: [redacted]xks

Custom key store type: External key store

Connection state: Connected

Creation date: Aug 21, 2023 16:28 EDT

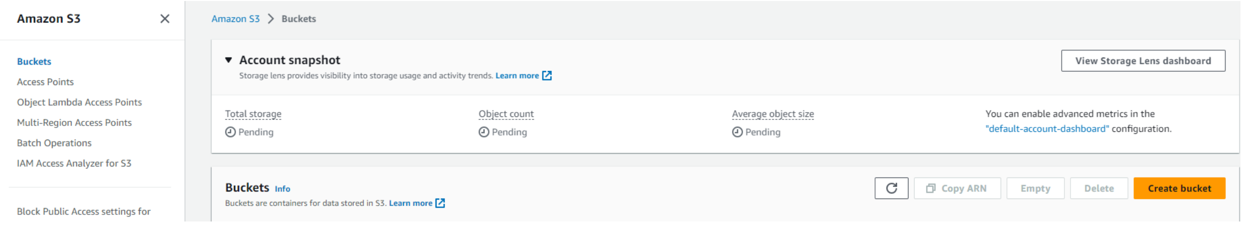
External key

External key ID: 0fedbadd-1098-41b4-b50c-[redacted]-east-1.keycontrol-test-cloudkey

2.9. Test the integration

To test the integration:

1. Sign in to the AWS Console and access **S3** services.
2. From the left panel, select **Buckets** and then select **Create bucket**.



Amazon S3

Buckets
Access Points
Object Lambda Access Points
Multi-Region Access Points
Batch Operations
IAM Access Analyzer for S3

Block Public Access settings for

Amazon S3 > Buckets

Account snapshot

Storage lens provides visibility into storage usage and activity trends. Learn more

Total storage: Pending

Object count: Pending

Average object size: Pending

You can enable advanced metrics in the "default-account-dashboard" configuration.

Buckets Info

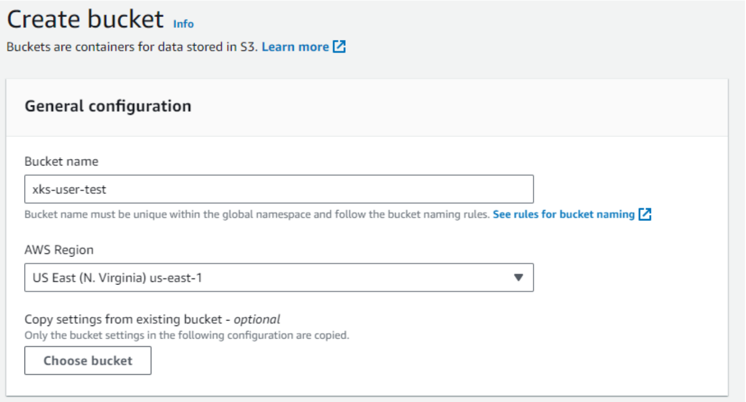
Buckets are containers for data stored in S3. Learn more

The **Create bucket** page appears.

3. Under **General configuration**:

   a. For **Bucket name**, enter the required name for the bucket.

   b. Select an appropriate **AWS Region**.



Create bucket Info

Buckets are containers for data stored in S3. Learn more

General configuration

Bucket name

xks-user-test

Bucket name must be unique within the global namespace and follow the bucket naming rules. See rules for bucket naming

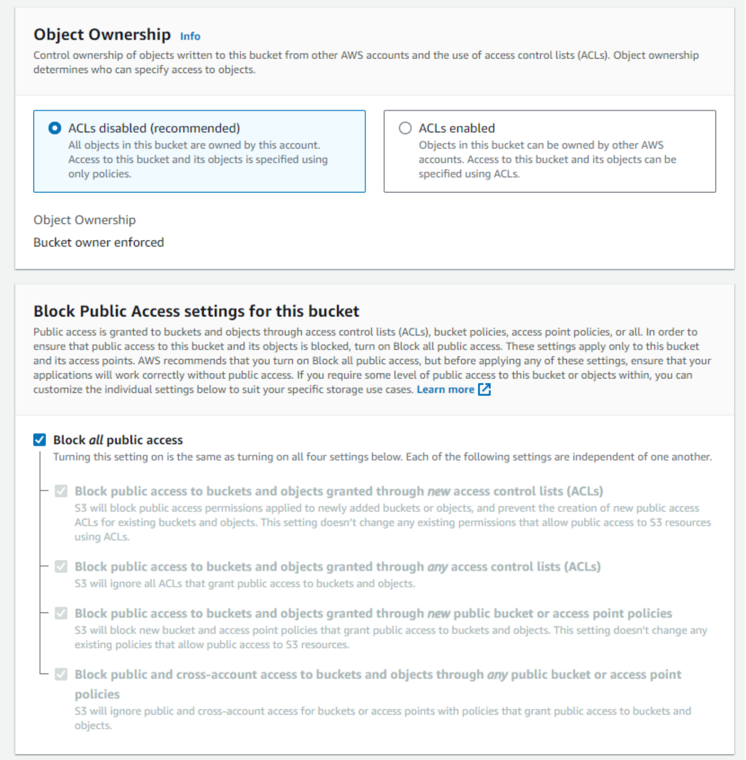
AWS Region

US East (N. Virginia) us-east-1

Copy settings from existing bucket - *optional*

Only the bucket settings in the following configuration are copied.

4. Under **Object Ownership**, select **ACLs disabled**.



Object Ownership Info

Control ownership of objects written to this bucket from other AWS accounts and the use of access control lists (ACLs). Object ownership determines who can specify access to objects.

● ACLs disabled (recommended)
All objects in this bucket are owned by this account. Access to this bucket and its objects is specified using only policies.

○ ACLs enabled
Objects in this bucket can be owned by other AWS accounts. Access to this bucket and its objects can be specified using ACLs.

Object Ownership

Bucket owner enforced

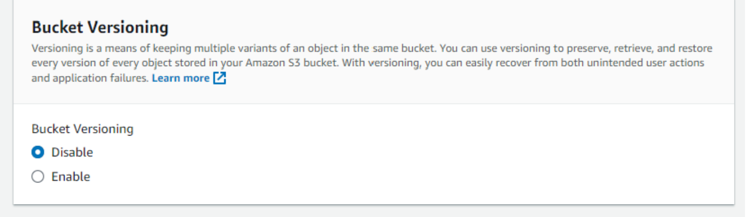
Block Public Access settings for this bucket

Public access is granted to buckets and objects through access control lists (ACLs), bucket policies, access point policies, or all. In order to ensure that public access to this bucket and its objects is blocked, turn on Block all public access. These settings apply only to this bucket and its access points. AWS recommends that you turn on Block all public access, but before applying any of these settings, ensure that your applications will work correctly without public access. If you require some level of public access to this bucket or objects within, you can customize the individual settings below to suit your specific storage use cases. Learn more

☑ Block *all* public access
Turning this setting on is the same as turning on all four settings below. Each of the following settings are independent of one another.

- ☑ Block public access to buckets and objects granted through *new* access control lists (ACLs)
  S3 will block public access permissions applied to newly added buckets or objects, and prevent the creation of new public access ACLs for existing buckets and objects. This setting doesn't change any existing permissions that allow public access to S3 resources using ACLs.
- ☑ Block public access to buckets and objects granted through *any* access control lists (ACLs)
  S3 will ignore all ACLs that grant public access to buckets and objects.
- ☑ Block public access to buckets and objects granted through *new* public bucket or access point policies
  S3 will block new bucket and access point policies that grant public access to buckets and objects. This setting doesn't change any existing policies that allow public access to S3 resources.
- ☑ Block public and cross-account access to buckets and objects through *any* public bucket or access point policies
  S3 will ignore public and cross-account access for buckets or access points with policies that grant public access to buckets and objects.

5. Under **Bucket Versioning**, set **Bucket Versioning** to **Disable**.



Bucket Versioning

Versioning is a means of keeping multiple variants of an object in the same bucket. You can use versioning to preserve, retrieve, and restore every version of every object stored in your Amazon S3 bucket. With versioning, you can easily recover from both unintended user actions and application failures. Learn more

Bucket Versioning

● Disable

○ Enable

6. Under **Default encryption**:

a. For **Encryption type**, select **Server-side encryption with AWS Key Management Service keys (SSE-KMS)**.

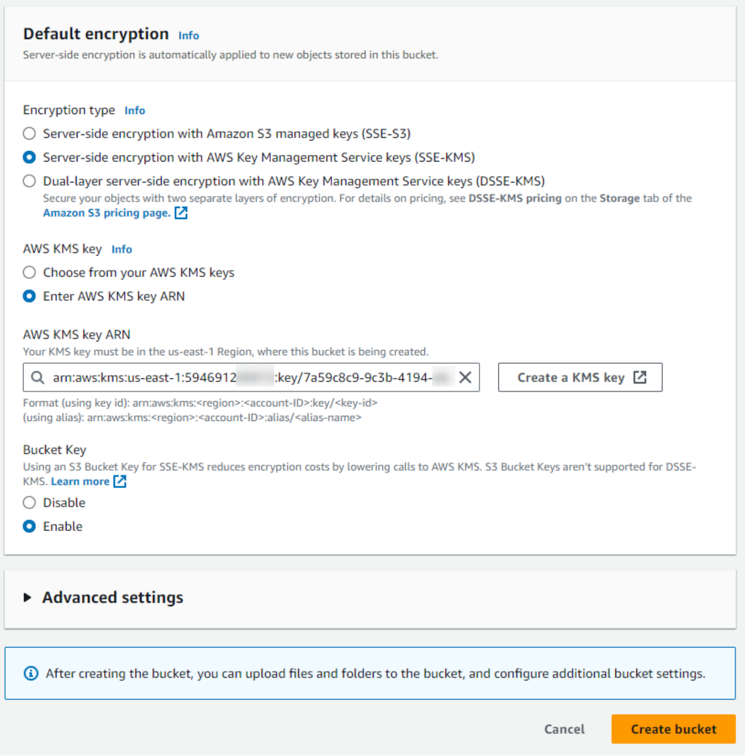
b. For **AWS KMS key**:

   i. Select **Enter AWS KMS key ARN**.

   ii. Paste the AWS KMS ARN from the previously created CloudKey.

c. For **Bucket Key**, select **Enable**.

d. Select **Create bucket** to complete the process.



Default encryption Info

Server-side encryption is automatically applied to new objects stored in this bucket.

Encryption type Info

○ Server-side encryption with Amazon S3 managed keys (SSE-S3)

● Server-side encryption with AWS Key Management Service keys (SSE-KMS)

○ Dual-layer server-side encryption with AWS Key Management Service keys (DSSE-KMS)
Secure your objects with two separate layers of encryption. For details on pricing, see **DSSE-KMS pricing** on the **Storage** tab of the **Amazon S3 pricing page.**

AWS KMS key Info

○ Choose from your AWS KMS keys

● Enter AWS KMS key ARN

AWS KMS key ARN

Your KMS key must be in the us-east-1 Region, where this bucket is being created.

arn:aws:kms:us-east-1:5946912[redacted]:key/7a59c8c9-9c3b-4194-[redacted]

Format (using key id): arn:aws:kms:<region>:<account-ID>:key/<key-id>
(using alias): arn:aws:kms:<region>:<account-ID>:alias/<alias-name>

Bucket Key

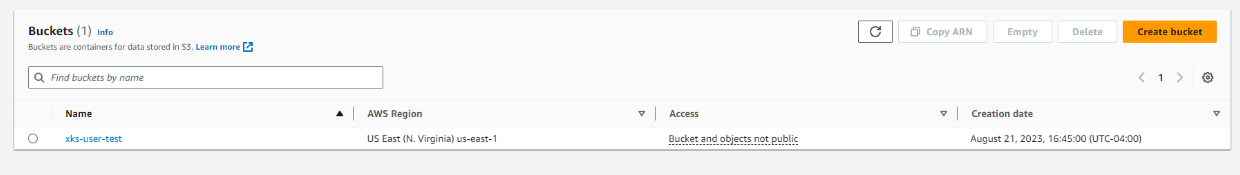
Using an S3 Bucket Key for SSE-KMS reduces encryption costs by lowering calls to AWS KMS. S3 Bucket Keys aren't supported for DSSE-KMS. **Learn more**

○ Disable

● Enable

After creating the bucket, you can upload files and folders to the bucket, and configure additional bucket settings.

The bucket is created.



Buckets (1) Info

Buckets are containers for data stored in S3. **Learn more**

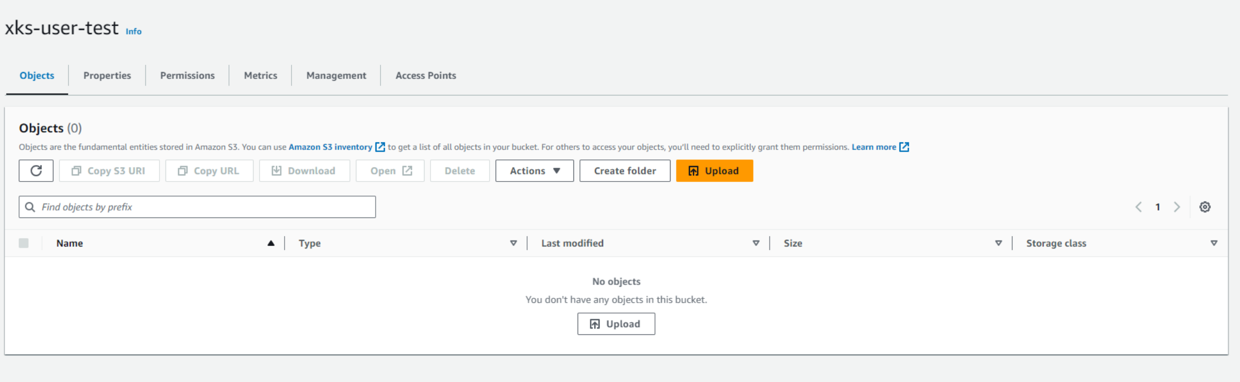
	Name	AWS Region	Access	Creation date
○	xks-user-test	US East (N. Virginia) us-east-1	Bucket and objects not public	August 21, 2023, 16:45:00 (UTC-04:00)

7. Select the hyperlink for the bucket.

   A details page for the bucket appears.

8. Select **Objects**.

9. To test the encryption, select **Upload**.



Objects (0)

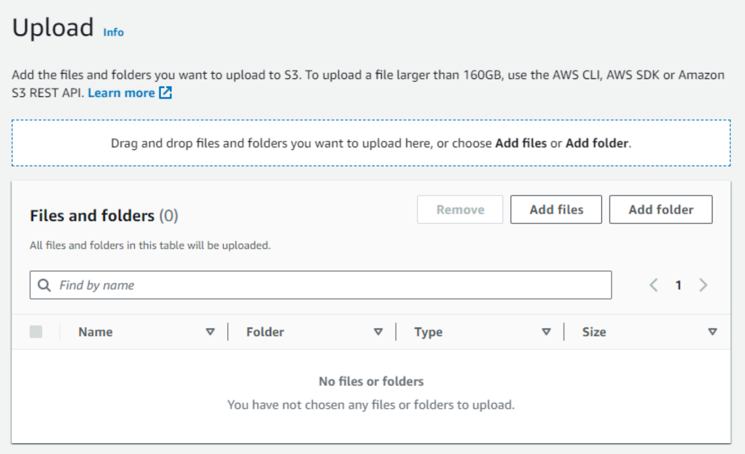
Objects are the fundamental entities stored in Amazon S3. You can use Amazon S3 inventory to get a list of all objects in your bucket. For others to access your objects, you'll need to explicitly grant them permissions. Learn more

No objects

You don't have any objects in this bucket.

The **Upload** dialog appears.

10. Select **Add files**.



Add the files and folders you want to upload to S3. To upload a file larger than 160GB, use the AWS CLI, AWS SDK or Amazon S3 REST API. Learn more

Drag and drop files and folders you want to upload here, or choose **Add files** or **Add folder**.

Files and folders (0)

All files and folders in this table will be uploaded.

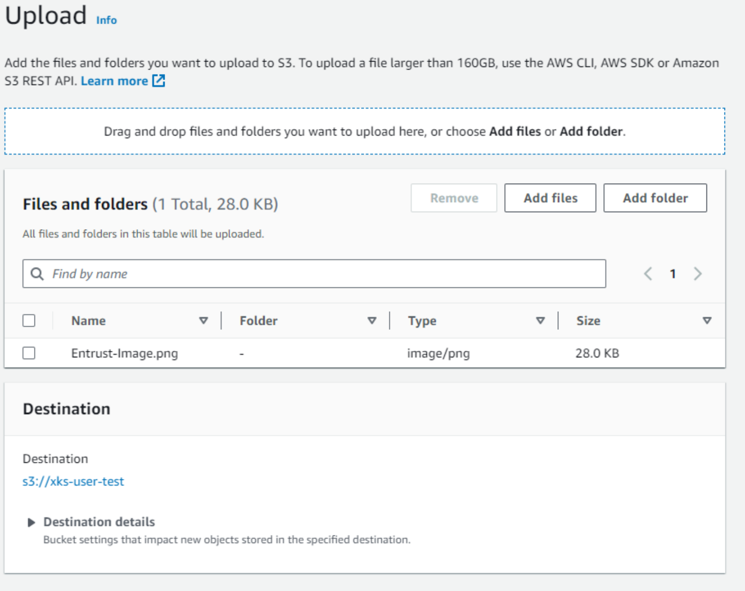
No files or folders

You have not chosen any files or folders to upload.

11. Locate and select an image to upload.

    The file is added to the list of available images.

12. Select the check box for the image file and select **Upload**.



Add the files and folders you want to upload to S3. To upload a file larger than 160GB, use the AWS CLI, AWS SDK or Amazon S3 REST API. Learn more

Drag and drop files and folders you want to upload here, or choose **Add files** or **Add folder**.

Files and folders (1 Total, 28.0 KB)

All files and folders in this table will be uploaded.

	Name	Folder	Type	Size
□	Entrust-Image.png	-	image/png	28.0 KB

Destination

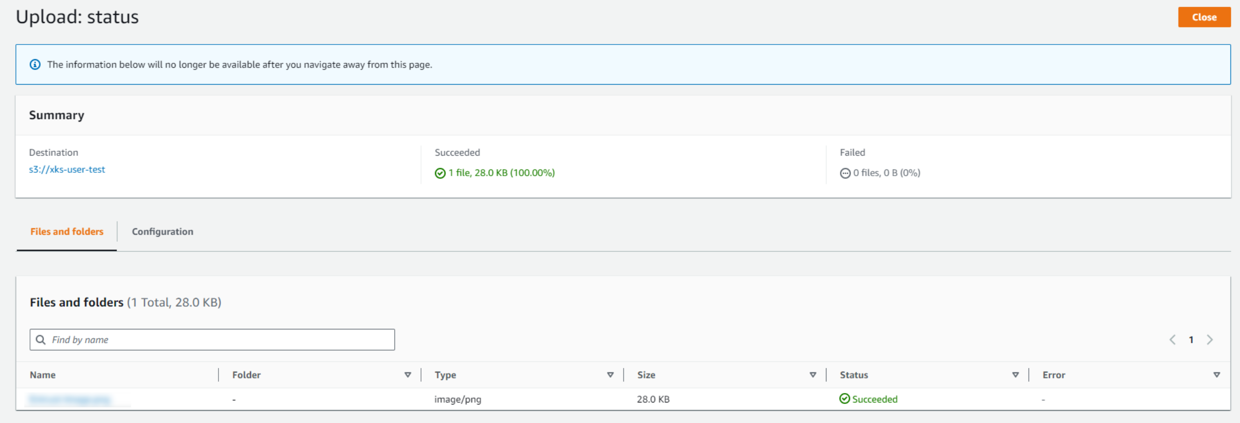
Destination

s3://xks-user-test

Bucket settings that impact new objects stored in the specified destination.

In this example, the `Entrust-Image.png` file was added and can be selected and uploaded.

The newly uploaded image is listed within the bucket.



Upload: status

The information below will no longer be available after you navigate away from this page.

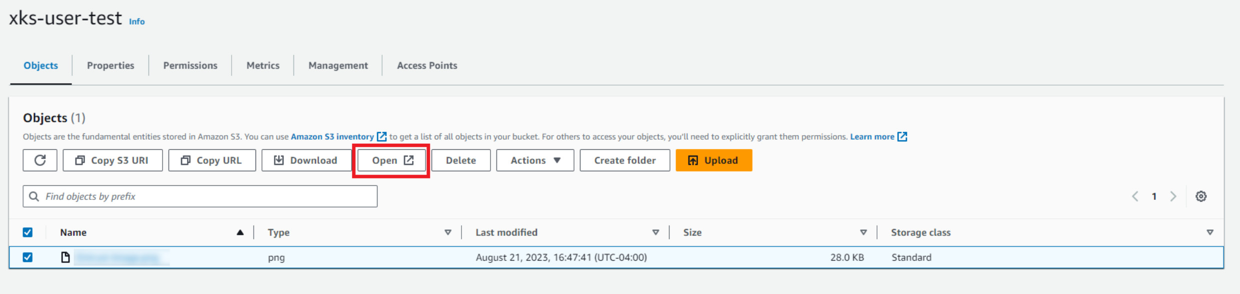
Summary

Destination	Succeeded	Failed
s3://xks-user-test	1 file, 28.0 KB (100.00%)	0 files, 0 B (0%)

Files and folders (1 Total, 28.0 KB)

Name	Folder	Type	Size	Status	Error
[redacted]	-	image/png	28.0 KB	Succeeded	-

13. Select the new image and select **Open** to view it.



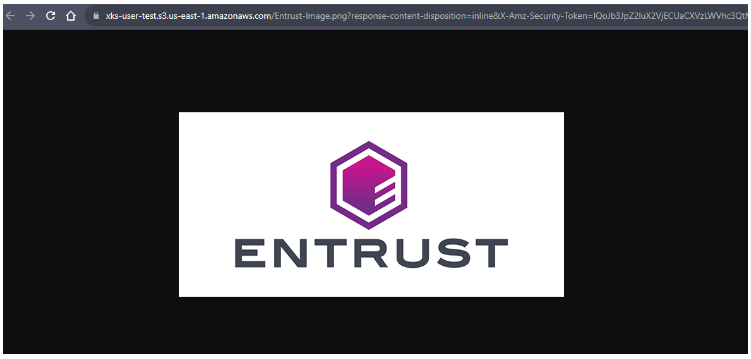
xks-user-test

Objects (1)

Objects are the fundamental entities stored in Amazon S3. You can use Amazon S3 inventory to get a list of all objects in your bucket. For others to access your objects, you'll need to explicitly grant them permissions. Learn more

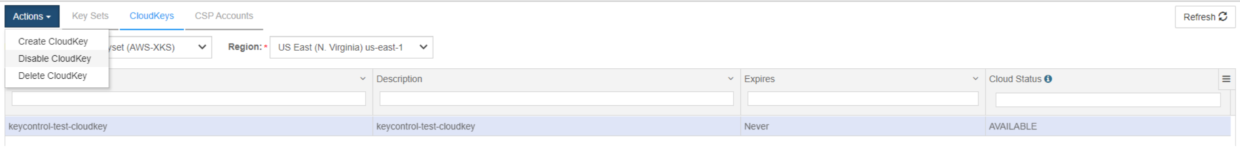
☑	Name	Type	Last modified	Size	Storage class
☑	[redacted]	png	August 21, 2023, 16:47:41 (UTC-04:00)	28.0 KB	Standard

The image starts in a browser window.



xks-user-test.s3.us-east-1.amazonaws.com/Entrust-Image.png?response-content-disposition=inline&X-Amz-Security-Token=IQoJb3JpZ2luX2VjECUaCXVzLWVhc3Qt

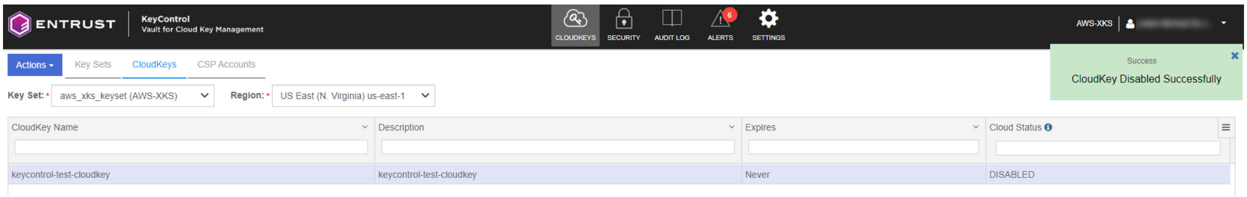
14. Return to KeyControl Cloud Key Management Vault and select **CLOUDKEYS** > **CloudKeys**.
15. Select the CloudKey and then select **Actions** > **Disable CloudKey**.



yset (AWS-XKS) Region: * US East (N. Virginia) us-east-1

	Description	Expires	Cloud Status
keycontrol-test-cloudkey	keycontrol-test-cloudkey	Never	AVAILABLE

The CloudKey is disabled.



Success

CloudKey Disabled Successfully

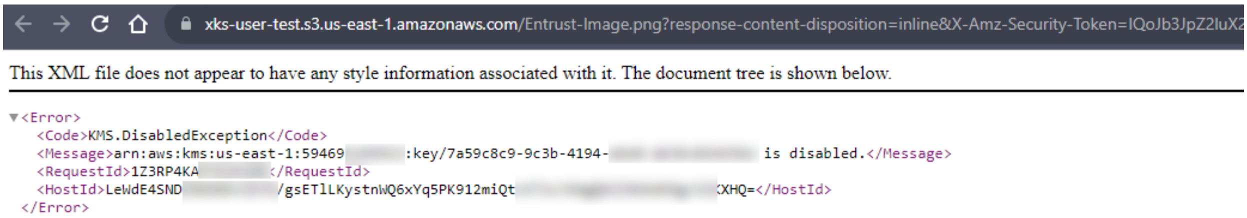
Key Set: * aws_xks_keyset (AWS-XKS)

Region: * US East (N. Virginia) us-east-1

CloudKey Name	Description	Expires	Cloud Status
keycontrol-test-cloudkey	keycontrol-test-cloudkey	Never	DISABLED

16. Return to the AWS S3 bucket and attempt to open the uploaded image.

    The image is not viewable as the CloudKey was disabled.

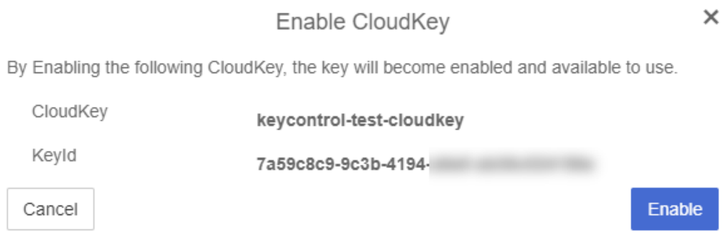


xks-user-test.s3.us-east-1.amazonaws.com/Entrust-Image.png?response-content-disposition=inline&X-Amz-Security-Token=IQoJb3JpZ2luX2

This XML file does not appear to have any style information associated with it. The document tree is shown below.

```
▼<Error>
   <Code>KMS.DisabledException</Code>
   <Message>arn:aws:kms:us-east-1:59469[redacted]:key/7a59c8c9-9c3b-4194-[redacted] is disabled.</Message>
   <RequestId>1Z3RP4KA[redacted]</RequestId>
   <HostId>LeWdE4SND[redacted]/gsETlLKystnWQ6xYq5PK912miQt[redacted]XHQ=</HostId>
 </Error>
```

17. Re-enable the **CloudKey** in the KeyControl CloudKey Management Vault.



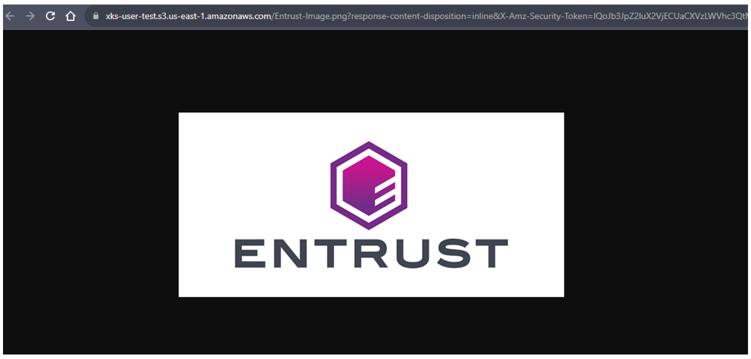
Enable CloudKey

By Enabling the following CloudKey, the key will become enabled and available to use.

CloudKey keycontrol-test-cloudkey

KeyId 7a59c8c9-9c3b-4194-[redacted]

18. Return to the AWS S3 bucket.
19. Open the uploaded image again. It is now viewable.



xks-user-test.s3.us-east-1.amazonaws.com/Entrust-Image.png?response-content-disposition=inline&X-Amz-Security-Token=IQoJb3JpZ2luX2VjECUaCXVzLWVhc3Qt

This concludes the integration process.