



# **Kubernetes clusters documentation**

## **Kubernetes clusters**

NetApp  
June 02, 2022

This PDF was generated from <https://docs.netapp.com/us-en/cloud-manager-kubernetes/index.html> on June 02, 2022. Always check docs.netapp.com for the latest.

# Table of Contents

Kubernetes clusters documentation	1
What's new with Kubernetes in Cloud Manager	2
4 May 2022	2
4 April 2022	2
27 February 2022	2
11 January 2022	2
28 November 2021	3
Get started	4
Kubernetes data management in Cloud Manager	4
Get started with Kubernetes clusters	4
Requirements	6
Requirements for Kubernetes clusters in AWS	6
Requirements for Kubernetes clusters in Azure	15
Requirements for Kubernetes clusters in Google Cloud	22
Add Kubernetes clusters	29
Add an Amazon Kubernetes cluster to Cloud Manager	29
Add an Azure Kubernetes cluster to Cloud Manager	31
Add a Google Cloud Kubernetes cluster to Cloud Manager	34
Manage Kubernetes clusters	38
Features	38
Install Astra Trident	38
Manage storage classes	39
View persistent volumes	43
Remove Kubernetes clusters from the workspace	44
Use NetApp cloud data services with Kubernetes clusters	44
Knowledge and support	46
Register for support	46
Get help	47
Legal notices	49
Copyright	49
Trademarks	49
Patents	49
Privacy policy	49
Open source	49

# Kubernetes clusters documentation

# What's new with Kubernetes in Cloud Manager

Learn what's new in Kubernetes in Cloud Manager.

## 4 May 2022

### Drag and drop to add storage class

You can now drag your Kubernetes cluster and drop it onto the Cloud Volumes ONTAP working environment to add a storage class directly from the Canvas.

[Add storage class](#)

## 4 April 2022

### Manage Kubernetes clusters using the Cloud Manager resource page

Kubernetes cluster management now has enhanced integration directly from the cluster working environment. A new [Quick start](#) gets you up and running quickly.

You can now take the following actions from the cluster resource page.

- [Install Astra Trident](#)
- [Add storage classes](#)
- [View persistent volumes](#)
- [Remove clusters](#)
- [Enable data services](#)

## 27 February 2022

### Support for Kubernetes clusters in Google Cloud

You can now add and manage managed Google Kubernetes Engine (GKE) clusters and self-managed Kubernetes clusters in Google Cloud using Cloud Manager.

[Learn how to get started with Kubernetes clusters in Google Cloud.](#)

## 11 January 2022

### Support for Kubernetes clusters in Azure

You can now add and manage managed Azure Kubernetes clusters (AKS) and self-managed Kubernetes clusters in Azure using Cloud Manager.

[Getting started with Kubernetes clusters in Azure](#)

# 28 November 2021

## Support for Kubernetes clusters in AWS

You can now add your managed-Kubernetes clusters to Cloud Manager's Canvas for advanced data management.

- Discover Amazon EKS clusters
- Back up persistent volumes using Cloud Backup

[Learn more about Kubernetes support.](#)



The existing Kubernetes service (available through the **K8s** tab) has been deprecated and will be removed in a future release.

# Get started

## Kubernetes data management in Cloud Manager

Astra Trident is a fully-supported open source project maintained by NetApp. Astra Trident integrates natively with Kubernetes and its Persistent Volume framework to seamlessly provision and manage volumes from systems running any combination of NetApp storage platforms. [Learn more about Trident](#).

### Features

You can directly manage your Kubernetes clusters using Cloud Manager.

- Install Astra Trident.
- Add and manage clusters as part of your hybrid cloud infrastructure.
- Add and manage storage classes and connect them to Working Environments.
- Back up persistent volumes using Cloud Backup Service.

### Supported Kubernetes deployments

Cloud Manager supports managed-Kubernetes clusters running in:

- [Amazon Elastic Kubernetes Service \(Amazon EKS\)](#)
- [Microsoft Azure Kubernetes Service \(AKS\)](#)
- [Google Kubernetes Engine \(GKE\)](#)

### Supported Astra Trident deployments

One of the four most recent versions of Astra Trident is required. You can install Astra Trident directly from Cloud Manager. You should [review the prerequisites](#) prior to installation.

To upgrade Astra Trident, [upgrade with the operator](#).

### Supported backend storage

NetApp's Astra Trident must be installed on each Kubernetes cluster and Cloud Volumes ONTAP must be configured as backend storage for the clusters.

### Cost

There are no charges to *discover* your Kubernetes clusters in Cloud Manager, but you will be charged when you back up persistent volumes using Cloud Backup Service.

## Get started with Kubernetes clusters

Add Kubernetes clusters to Cloud Manager for advanced data management in a few quick steps.

## Quick start

Get started quickly by following these steps.

1

### Review prerequisites

Ensure your environment meets the prerequisites for your cluster type.

[Requirements for Kubernetes clusters in AWS](#)

[Requirements for Kubernetes clusters in Azure](#)

[Requirements for Kubernetes clusters in Google Cloud](#)

2

### Add your Kubernetes clusters to Cloud Manager

You can add Kubernetes clusters and connect them to a Working Environment using Cloud Manager.

[Add an Amazon Kubernetes cluster](#)

[Add an Azure Kubernetes cluster](#)

[Add a Google Cloud Kubernetes cluster](#)

3

### Start provisioning Persistent Volumes

Request and manage Persistent Volumes using native Kubernetes interfaces and constructs. Cloud Manager creates NFS and iSCSI storage classes that you can use when provisioning Persistent Volumes.

[Learn more about provisioning your first volume with Astra Trident.](#)

4

### Manage your clusters using Cloud Manager

After adding Kubernetes clusters to Cloud Manager, you can manage the clusters from the Cloud Manager resource page.

[Learn how to manage Kubernetes clusters.](#)

# Requirements

## Requirements for Kubernetes clusters in AWS

You can add managed Amazon Elastic Kubernetes Service (EKS) clusters or self-managed Kubernetes clusters on AWS to Cloud Manager. Before you can add the clusters to Cloud Manager, you need to ensure that the following requirements are met.



This topic uses *Kubernetes cluster* where configuration is the same for EKS and self-managed Kubernetes clusters. The cluster type is specified where configuration differs.

### Requirements

#### Astra Trident

One of the four most recent versions of Astra Trident is required. You can install Astra Trident directly from Cloud Manager. You should [review the prerequisites](#) prior to installing Astra Trident.

To upgrade Astra Trident, [upgrade with the operator](#).

#### Cloud Volumes ONTAP

Cloud Volumes ONTAP for AWS must be set up as backend storage for the cluster. [Go to the Astra Trident docs for configuration steps](#).

#### Cloud Manager Connector

A Connector must be running in AWS with the required permissions. [Learn more below](#).

#### Network connectivity

Network connectivity is required between the Kubernetes cluster and the Connector and between the Kubernetes cluster and Cloud Volumes ONTAP. [Learn more below](#).

#### RBAC authorization

The Cloud Manager Connector role must be authorized on each Kubernetes cluster. [Learn more below](#).

### Prepare a Connector

A Cloud Manager Connector is required in AWS to discover and manage Kubernetes clusters. You'll need to create a new Connector or use an existing Connector that has the required permissions.

#### Create a new Connector

Follow the steps in one of the links below.

- [Create a Connector from Cloud Manager](#) (recommended)
- [Create a Connector from the AWS Marketplace](#)
- [Install the Connector on an existing Linux host in AWS](#)

#### Add the required permissions to an existing Connector

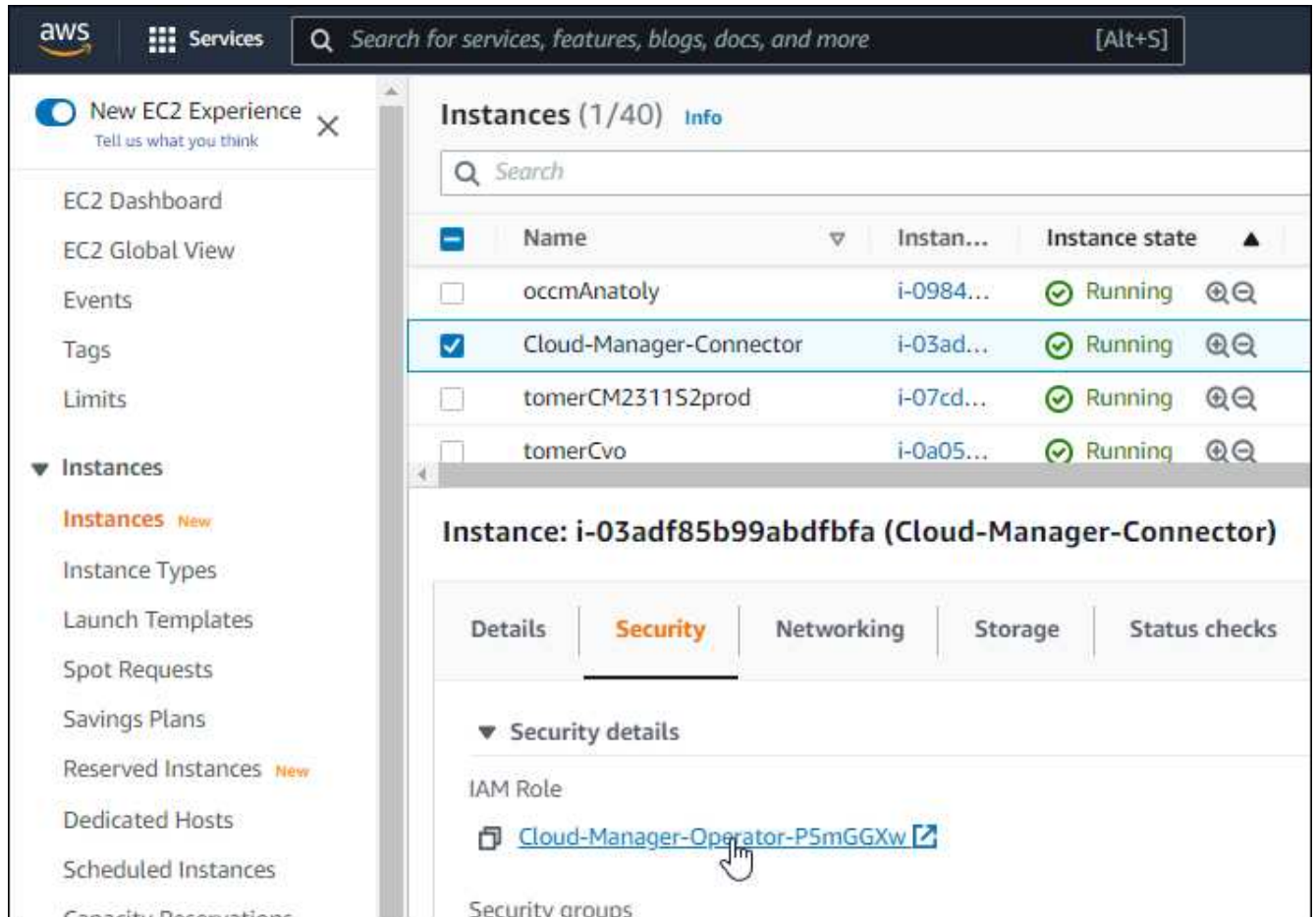
Starting in the 3.9.13 release, any *newly* created Connectors include three new AWS permissions that enable discovery and management of Kubernetes clusters. If you created a Connector prior to this release, then you'll



need to modify the existing policy for the Connector's IAM role to provide the permissions.

### Steps

1. Go the AWS console and open the EC2 service.
2. Select the Connector instance, click **Security**, and click the name of the IAM role to view the role in the IAM service.



3. In the **Permissions** tab, expand the policy and click **Edit policy**.



4. Click **JSON** and add the following permissions under the first set of actions:

```
"eks:ListClusters",  
"eks:DescribeCluster",  
"iam:GetInstanceProfile"
```

[View the full JSON format for the policy.](#)

5. Click **Review policy** and then click **Save changes**.

## Review networking requirements

You need to provide network connectivity between the Kubernetes cluster and the Connector and between the Kubernetes cluster and the Cloud Volumes ONTAP system that provides backend storage to the cluster.

- Each Kubernetes cluster must have an inbound connection from the Connector
- The Connector must have an outbound connection to each Kubernetes cluster over port 443

The simplest way to provide this connectivity is to deploy the Connector and Cloud Volumes ONTAP in the same VPC as the Kubernetes cluster. Otherwise, you need to set up a VPC peering connection between the different VPCs.

Here's an example that shows each component in the same VPC.



And here's another example that shows an EKS cluster running in a different VPC. In this example, VPC peering provides a connection between the VPC for the EKS cluster and the VPC for the Connector and Cloud Volumes ONTAP.



## Set up RBAC authorization

You need to authorize the Connector role on each Kubernetes cluster so the Connector can discover and manage a cluster.

Different authorization is required to enable different functionality.

## Backup and restore

Backup and restore requires only basic authorization.

## Add storage classes

Expanded authorization is required to add storage classes using Cloud Manager.

## Install Astra trident

You need to provide full authorization for Cloud Manager to install Astra Trident.



When installing Astra Trident, Cloud Manager installs the Astra Trident backend and Kubernetes secret that contains the credentials Astra Trident needs to communicate with the storage cluster.

## Steps

1. Create a cluster role and role binding.
  - a. Create a YAML file that includes the following text based on your authorization requirements.

## Backup/restore

Add basic authorization to enable backup and restore for Kubernetes clusters.

```
apiVersion: rbac.authorization.k8s.io/v1
kind: ClusterRole
metadata:
  name: cloudmanager-access-clusterrole
rules:
  - apiGroups:
      - ''
    resources:
      - namespaces
    verbs:
      - list
  - apiGroups:
      - ''
    resources:
      - persistentvolumes
    verbs:
      - list
  - apiGroups:
      - ''
    resources:
      - pods
      - pods/exec
    verbs:
      - get
      - list
  - apiGroups:
      - ''
    resources:
      - persistentvolumeclaims
    verbs:
      - list
      - create
  - apiGroups:
      - storage.k8s.io
    resources:
      - storageclasses
    verbs:
      - list
  - apiGroups:
      - trident.netapp.io
    resources:
      - tridentbackends
```

```

    verbs:
      - list
  - apiGroups:
      - trident.netapp.io
    resources:
      - tridentorchestrators
    verbs:
      - get
---
apiVersion: rbac.authorization.k8s.io/v1
kind: ClusterRoleBinding
metadata:
  name: k8s-access-binding
subjects:
  - kind: Group
    name: cloudmanager-access-group
    apiGroup: rbac.authorization.k8s.io
roleRef:
  kind: ClusterRole
  name: cloudmanager-access-clusterrole
  apiGroup: rbac.authorization.k8s.io

```

### Storage classes

Add expanded authorization to add storage classes using Cloud Manager.

```

apiVersion: rbac.authorization.k8s.io/v1
kind: ClusterRole
metadata:
  name: cloudmanager-access-clusterrole
rules:
  - apiGroups:
      - ''
    resources:
      - secrets
      - namespaces
      - persistentvolumeclaims
      - persistentvolumes
      - pods
      - pods/exec
    verbs:
      - get
      - list
      - create
      - delete
  - apiGroups:

```

```

      - storage.k8s.io
resources:
  - storageclasses
verbs:
  - get
  - create
  - list
  - delete
  - patch
- apiGroups:
  - trident.netapp.io
resources:
  - tridentbackends
  - tridentorchestrators
  - tridentbackendconfigs
verbs:
  - get
  - list
  - create
  - delete

---
apiVersion: rbac.authorization.k8s.io/v1
kind: ClusterRoleBinding
metadata:
  name: k8s-access-binding
subjects:
  - kind: Group
    name: cloudmanager-access-group
    apiGroup: rbac.authorization.k8s.io
roleRef:
  kind: ClusterRole
  name: cloudmanager-access-clusterrole
  apiGroup: rbac.authorization.k8s.io

```

### Install Trident

Use the command line to provide full authorization and enable Cloud Manager to install Astra Trident.

```

eksctl create iamidentitymapping --cluster < > --region < > --arn
< > --group "system:masters" --username
system:node:{{EC2PrivateDNSName}}

```

b. Apply the configuration to a cluster.

```
kubectl apply -f <file-name>
```

## 2. Create an identity mapping to the permissions group.

### Use eksctl

Use eksctl to create an IAM identity mapping between a cluster and the IAM role for the Cloud Manager Connector.

[Go to the eksctl documentation for full instructions.](#)

An example is provided below.

```
eksctl create iamidentitymapping --cluster <eksCluster> --region  
<us-east-2> --arn <ARN of the Connector IAM role> --group  
cloudmanager-access-group --username  
system:node:{{EC2PrivateDNSName}}
```

### Edit aws-auth

Directly edit the aws-auth ConfigMap to add RBAC access to the IAM role for the Cloud Manager Connector.

[Go to the AWS EKS documentation for full instructions.](#)

An example is provided below.

```
apiVersion: v1  
data:  
  mapRoles: |  
    - groups:  
      - cloudmanager-access-group  
      rolearn: <ARN of the Connector IAM role>  
      username: system:node:{{EC2PrivateDNSName}}  
kind: ConfigMap  
metadata:  
  creationTimestamp: "2021-09-30T21:09:18Z"  
  name: aws-auth  
  namespace: kube-system  
  resourceVersion: "1021"  
  selfLink: /api/v1/namespaces/kube-system/configmaps/aws-auth  
  uid: dcc31de5-3838-11e8-af26-02e00430057c
```



# Requirements for Kubernetes clusters in Azure

You can add and manage managed Azure Kubernetes clusters (AKS) and self-managed Kubernetes clusters in Azure using Cloud Manager. Before you can add the clusters to Cloud Manager, ensure the following requirements are met.



This topic uses *Kubernetes cluster* where configuration is the same for AKS and self-managed Kubernetes clusters. The cluster type is specified where configuration differs.

## Requirements

### Astra Trident

One of the four most recent versions of Astra Trident is required. You can install Astra Trident directly from Cloud Manager. You should [review the prerequisites](#) prior to installing Astra Trident.

To upgrade Astra Trident, [upgrade with the operator](#).

### Cloud Volumes ONTAP

Cloud Volumes ONTAP must be set up as backend storage for the cluster. [Go to the Astra Trident docs for configuration steps](#).

### Cloud Manager Connector

A Connector must be running in Azure with the required permissions. [Learn more below](#).

### Network connectivity

Network connectivity is required between the Kubernetes cluster and the Connector and between the Kubernetes cluster and Cloud Volumes ONTAP. [Learn more below](#).

### RBAC authorization

Cloud Manager supports RBAC-enabled clusters with and without Active Directory. The Cloud Manager Connector role must be authorized on each Azure cluster. [Learn more below](#).

## Prepare a Connector

A Cloud Manager Connector in Azure is required to discover and manage Kubernetes clusters. You'll need to create a new Connector or use an existing Connector that has the required permissions.

### Create a new Connector

Follow the steps in one of the links below.

- [Create a Connector from Cloud Manager](#) (recommended)
- [Create a Connector from the Azure Marketplace](#)
- [Install the Connector on an existing Linux host](#)

### Add the required permissions to an existing Connector (to discover a managed AKS cluster)

If you want to discover a managed AKS cluster, you might need to modify the custom role for the Connector to provide the permissions.

## Steps

1. Identify the role assigned to the Connector virtual machine:
  - a. In the Azure portal, open the Virtual machines service.
  - b. Select the Connector virtual machine.
  - c. Under Settings, select **Identity**.
  - d. Click **Azure role assignments**.
  - e. Make note of the custom role assigned to the Connector virtual machine.
2. Update the custom role:
  - a. In the Azure portal, open your Azure subscription.
  - b. Click **Access control (IAM) > Roles**.
  - c. Click the ellipsis (...) for the custom role and then click **Edit**.
  - d. Click JSON and add the following permissions:

```
"Microsoft.ContainerService/managedClusters/listClusterUserCredential/action"  
"Microsoft.ContainerService/managedClusters/read"
```

- e. Click **Review + update** and then click **Update**.

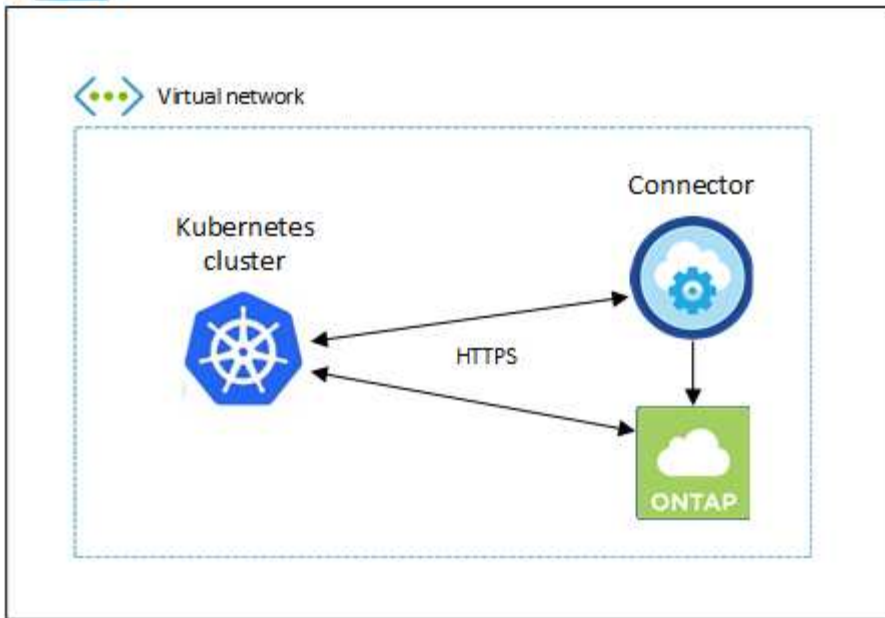
## Review networking requirements

You need to provide network connectivity between the Kubernetes cluster and the Connector and between the Kubernetes cluster and the Cloud Volumes ONTAP system that provides backend storage to the cluster.

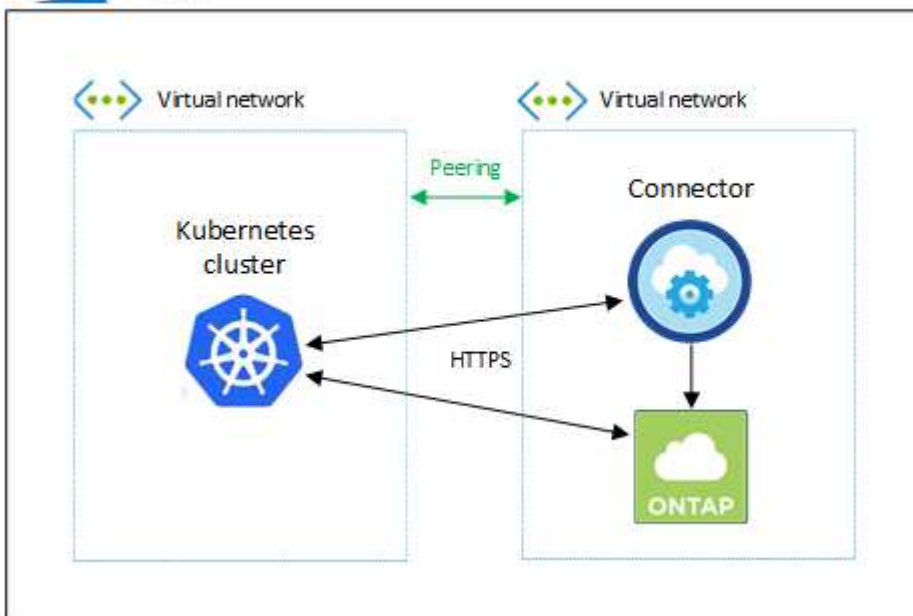
- Each Kubernetes cluster must have an inbound connection from the Connector
- The Connector must have an outbound connection to each Kubernetes cluster over port 443

The simplest way to provide this connectivity is to deploy the Connector and Cloud Volumes ONTAP in the same VNet as the Kubernetes cluster. Otherwise, you need to set up a peering connection between the different VNets.

Here's an example that shows each component in the same VNet.



And here's another example that shows a Kubernetes cluster running in a different VNet. In this example, peering provides a connection between the VNet for the Kubernetes cluster and the VNet for the Connector and Cloud Volumes ONTAP.



## Set up RBAC authorization

RBAC validation occurs only on Kubernetes clusters with Active Directory (AD) enabled. Kubernetes clusters without AD will pass validation automatically.

You need authorize the Connector role on each Kubernetes cluster so the Connector can discover and manage a cluster.

## Backup and restore

Backup and restore requires only basic authorization.

## Add storage classes

Expanded authorization is required to add storage classes using Cloud Manager.

## Install Astra trident

You need to provide full authorization for Cloud Manager to install Astra Trident.



When installing Astra Trident, Cloud Manager installs the Astra Trident backend and Kubernetes secret that contains the credentials Astra Trident needs to communicate with the storage cluster.

## Before you begin

Your RBAC `subjects: name:` configuration varies slightly based on your Kubernetes cluster type.

- If you are deploying a **managed AKS cluster**, you need the Object ID for the system-assigned managed identity for the Connector. This ID is available in Azure management portal.

The screenshot shows the Azure portal interface for a system-assigned managed identity. The 'System assigned' tab is selected. Below the header, there is a description: 'A system assigned managed identity is restricted to one per resource and is tied to the lifecycle of this resource. \n in code. [Learn more about Managed identities.](#)'. Below this, there are buttons for 'Save', 'Discard', 'Refresh', and 'Got feedback?'. The 'Status' is set to 'On'. The 'Object (principal) ID' field is highlighted with a red box, showing the value '0c28856-adea-485b-a4dc-c15b5ce2c401'. Below this, there is a 'Permissions' section with a button for 'Azure role assignments'.

- If you are deploying a **self-managed Kubernetes cluster**, you need the username of any authorized user.

## Steps

Create a cluster role and role binding.

1. Create a YAML file that includes the following text based on your authorization requirements. Replace the `subjects: kind: variable` with your username and `subjects: user:` with either the Object ID for the system-assigned managed identity or username of any authorized user as described above.

## Backup/restore

Add basic authorization to enable backup and restore for Kubernetes clusters.

```
apiVersion: rbac.authorization.k8s.io/v1
kind: ClusterRole
metadata:
  name: cloudmanager-access-clusterrole
rules:
  - apiGroups:
      - ''
    resources:
      - namespaces
    verbs:
      - list
  - apiGroups:
      - ''
    resources:
      - persistentvolumes
    verbs:
      - list
  - apiGroups:
      - ''
    resources:
      - pods
      - pods/exec
    verbs:
      - get
      - list
  - apiGroups:
      - ''
    resources:
      - persistentvolumeclaims
    verbs:
      - list
      - create
  - apiGroups:
      - storage.k8s.io
    resources:
      - storageclasses
    verbs:
      - list
  - apiGroups:
      - trident.netapp.io
    resources:
      - tridentbackends
```

```

    verbs:
      - list
  - apiGroups:
      - trident.netapp.io
    resources:
      - tridentorchestrators
    verbs:
      - get
---
apiVersion: rbac.authorization.k8s.io/v1
kind: ClusterRoleBinding
metadata:
  name: k8s-access-binding
subjects:
  - kind: User
    name:
    apiGroup: rbac.authorization.k8s.io
roleRef:
  kind: ClusterRole
  name: cloudmanager-access-clusterrole
  apiGroup: rbac.authorization.k8s.io

```

### Storage classes

Add expanded authorization to add storage classes using Cloud Manager.

```

apiVersion: rbac.authorization.k8s.io/v1
kind: ClusterRole
metadata:
  name: cloudmanager-access-clusterrole
rules:
  - apiGroups:
      - ''
    resources:
      - secrets
      - namespaces
      - persistentvolumeclaims
      - persistentvolumes
      - pods
      - pods/exec
    verbs:
      - get
      - list
      - create
      - delete
  - apiGroups:

```

```

      - storage.k8s.io
resources:
  - storageclasses
verbs:
  - get
  - create
  - list
  - delete
  - patch
- apiGroups:
  - trident.netapp.io
resources:
  - tridentbackends
  - tridentorchestrators
  - tridentbackendconfigs
verbs:
  - get
  - list
  - create
  - delete
---
apiVersion: rbac.authorization.k8s.io/v1
kind: ClusterRoleBinding
metadata:
  name: k8s-access-binding
subjects:
  - kind: User
    name:
    apiGroup: rbac.authorization.k8s.io
roleRef:
  kind: ClusterRole
  name: cloudmanager-access-clusterrole
  apiGroup: rbac.authorization.k8s.io

```

### Install Trident

Use the command line to provide full authorization and enable Cloud Manager to install Astra Trident.

```
kubectl create clusterrolebinding test --clusterrole cluster-admin
--user <Object (principal) ID>
```

2. Apply the configuration to a cluster.

```
kubectl apply -f <file-name>
```

# Requirements for Kubernetes clusters in Google Cloud

You can add and manage managed Google Kubernetes Engine (GKE) clusters and self-managed Kubernetes clusters in Google using Cloud Manager. Before you can add the clusters to Cloud Manager, ensure the following requirements are met.



This topic uses *Kubernetes cluster* where configuration is the same for GKE and self-managed Kubernetes clusters. The cluster type is specified where configuration differs.

## Requirements

### Astra Trident

One of the four most recent versions of Astra Trident is required. You can install Astra Trident directly from Cloud Manager. You should [review the prerequisites](#) prior to installing Astra Trident

To upgrade Astra Trident, [upgrade with the operator](#).

### Cloud Volumes ONTAP

Cloud Volumes ONTAP must be in Cloud Manager under the same tenancy account, workspace, and Connector as the Kubernetes cluster. [Go to the Astra Trident docs for configuration steps](#).

### Cloud Manager Connector

A Connector must be running in Google with the required permissions. [Learn more below](#).

### Network connectivity

Network connectivity is required between the Kubernetes cluster and the Connector and between the Kubernetes cluster and Cloud Volumes ONTAP. [Learn more below](#).

### RBAC authorization

Cloud Manager supports RBAC-enabled clusters with and without Active Directory. The Cloud Manager Connector role must be authorized on each GKE cluster. [Learn more below](#).

## Prepare a Connector

A Cloud Manager Connector in Google is required to discover and manage Kubernetes clusters. You'll need to create a new Connector or use an existing Connector that has the required permissions.

### Create a new Connector

Follow the steps in one of the links below.

- [Create a Connector from Cloud Manager](#) (recommended)
- [Install the Connector on an existing Linux host](#)

### Add the required permissions to an existing Connector (to discover a managed GKE cluster)

If you want to discover a managed GKE cluster, you might need to modify the custom role for the Connector to provide the permissions.

### Steps

1. In [Cloud Console](#), go to the **Roles** page.



2. Using the drop-down list at the top of the page, select the project or organization that contains the role that you want to edit.
3. Click a custom role.
4. Click **Edit Role** to update the role's permissions.
5. Click **Add Permissions** to add the following new permissions to the role.

```
container.clusters.get  
container.clusters.list
```

6. Click **Update** to save the edited role.

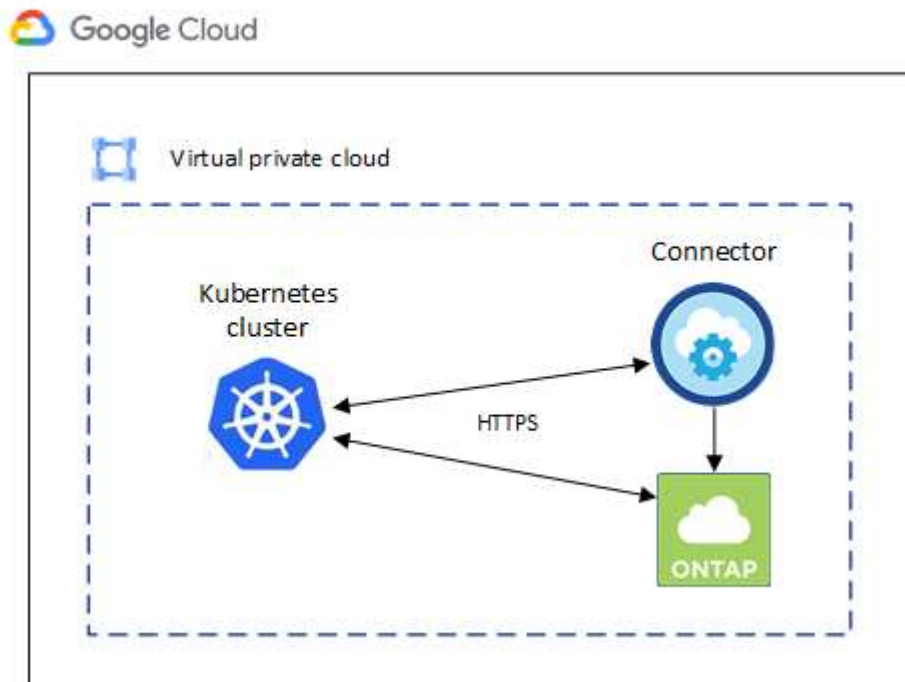
## Review networking requirements

You need to provide network connectivity between the Kubernetes cluster and the Connector and between the Kubernetes cluster and the Cloud Volumes ONTAP system that provides backend storage to the cluster.

- Each Kubernetes cluster must have an inbound connection from the Connector
- The Connector must have an outbound connection to each Kubernetes cluster over port 443

The simplest way to provide this connectivity is to deploy the Connector and Cloud Volumes ONTAP in the same VPC as the Kubernetes cluster. Otherwise, you need to set up a peering connection between the different VPC.

Here's an example that shows each component in the same VPC.



## Set up RBAC authorization

RBAC validation occurs only on Kubernetes clusters with Active Directory (AD) enabled. Kubernetes clusters without AD will pass validation automatically.

You need authorize the Connector role on each Kubernetes cluster so the Connector can discover and manage a cluster.

### Backup and restore

Backup and restore requires only basic authorization.

### Add storage classes

Expanded authorization is required to add storage classes using Cloud Manager.

### Install Astra trident

You need to provide full authorization for Cloud Manager to install Astra Trident.



When installing Astra Trident, Cloud Manager installs the Astra Trident backend and Kubernetes secret that contains the credentials Astra Trident needs to communicate with the storage cluster.

### Before you begin

To configure `subjects: name:` in the YAML file, you need to know the Cloud Manager Unique ID.

You can find the unique ID one of two ways:

- Using the command:

```
gcloud iam service-accounts list
gcloud iam service-accounts describe <service-account-email>
```

- In the Service Account Details on the [Cloud Console](#).

CloudSync-Dev

←

Cloud Manager Service Account

DETAILSPERMISSIONSKEYSMETRICSLOGS

Service account details

Name

Cloud Manager Service Account

SAVE

Description

SAVE

Email

cloudmanager-service-account@cloudsync-dev-214020.iam.gserviceaccount.com

Unique ID

102217358851946603445

## Steps

Create a cluster role and role binding.

1. Create a YAML file that includes the following text based on your authorization requirements. Replace the `subjects: kind: variable` with your username and `subjects: user:` with the unique ID for the authorized service account.

## Backup/restore

Add basic authorization to enable backup and restore for Kubernetes clusters.

```
apiVersion: rbac.authorization.k8s.io/v1
kind: ClusterRole
metadata:
  name: cloudmanager-access-clusterrole
rules:
  - apiGroups:
      - ''
    resources:
      - namespaces
    verbs:
      - list
  - apiGroups:
      - ''
    resources:
      - persistentvolumes
    verbs:
      - list
  - apiGroups:
      - ''
    resources:
      - pods
      - pods/exec
    verbs:
      - get
      - list
  - apiGroups:
      - ''
    resources:
      - persistentvolumeclaims
    verbs:
      - list
      - create
  - apiGroups:
      - storage.k8s.io
    resources:
      - storageclasses
    verbs:
      - list
  - apiGroups:
      - trident.netapp.io
    resources:
      - tridentbackends
```

```

    verbs:
      - list
  - apiGroups:
      - trident.netapp.io
    resources:
      - tridentorchestrators
    verbs:
      - get
---
apiVersion: rbac.authorization.k8s.io/v1
kind: ClusterRoleBinding
metadata:
  name: k8s-access-binding
subjects:
  - kind: User
    name:
    apiGroup: rbac.authorization.k8s.io
roleRef:
  kind: ClusterRole
  name: cloudmanager-access-clusterrole
  apiGroup: rbac.authorization.k8s.io

```

### Storage classes

Add expanded authorization to add storage classes using Cloud Manager.

```

apiVersion: rbac.authorization.k8s.io/v1
kind: ClusterRole
metadata:
  name: cloudmanager-access-clusterrole
rules:
  - apiGroups:
      - ''
    resources:
      - secrets
      - namespaces
      - persistentvolumeclaims
      - persistentvolumes
      - pods
      - pods/exec
    verbs:
      - get
      - list
      - create
      - delete
  - apiGroups:

```

```

      - storage.k8s.io
resources:
  - storageclasses
verbs:
  - get
  - create
  - list
  - delete
  - patch
- apiGroups:
  - trident.netapp.io
resources:
  - tridentbackends
  - tridentorchestrators
  - tridentbackendconfigs
verbs:
  - get
  - list
  - create
  - delete
---
apiVersion: rbac.authorization.k8s.io/v1
kind: ClusterRoleBinding
metadata:
  name: k8s-access-binding
subjects:
  - kind: User
    name:
    apiGroup: rbac.authorization.k8s.io
roleRef:
  kind: ClusterRole
  name: cloudmanager-access-clusterrole
  apiGroup: rbac.authorization.k8s.io

```

### Install Trident

Use the command line to provide full authorization and enable Cloud Manager to install Astra Trident.

```
kubectl create clusterrolebinding test --clusterrole cluster-admin
--user <Unique ID>
```

2. Apply the configuration to a cluster.

```
kubectl apply -f <file-name>
```

# Add Kubernetes clusters

## Add an Amazon Kubernetes cluster to Cloud Manager

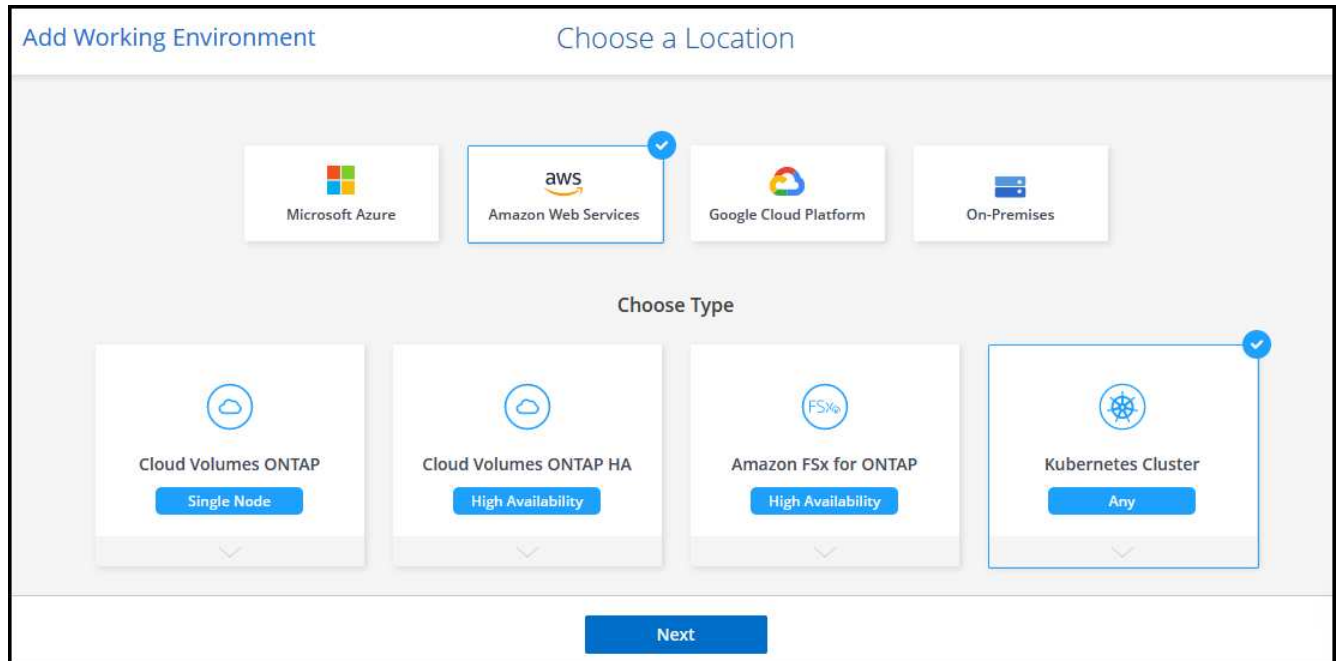
You can discover or import Kubernetes clusters to Cloud Manager so you can back up persistent volumes to Amazon S3.

### Discover a cluster

You can discover a fully-managed or self-managed Kubernetes cluster. Managed clusters must be discovered; they cannot be imported.

#### Steps

1. On the **Canvas**, click **Add Working Environment**.
2. Select **Amazon Web Services > Kubernetes Cluster** and click **Next**.



3. Select **Discover Cluster** and click **Next**.
4. Choose an AWS region, select a Kubernetes cluster, and then click **Next**.



## Result

Cloud Manager adds the Kubernetes cluster to the Canvas.



## Import a Cluster

You can import a self-managed Kubernetes cluster using a Kubernetes configuration file.

### Steps

1. On the **Canvas**, click **Add Working Environment**.
2. Select **Amazon Web Services > Kubernetes Cluster** and click **Next**.
3. Select **Import Cluster** and click **Next**.
4. Upload a Kubernetes configuration file in YAML format.



Add Existing Kubernetes Cluster

Import Kubernetes Cluster

Upload a Kubernetes configuration file that's in YAML format

Kubernetes configuration file

minicubeconfig.txt

Upload

1 Cluster

	Kubernetes Cluster Name	Kubernetes Type	Kubernetes Version
✓	test2	Self Managed	v1.24.0

5. Select the Kubernetes cluster and click **Next**.

### Result

Cloud Manager adds the Kubernetes cluster to the Canvas.

## Add an Azure Kubernetes cluster to Cloud Manager

You can discover or import Kubernetes clusters to Cloud Manager so that you can back up persistent volumes to Azure.

### Discover a cluster

You can discover a fully-managed or self-managed Kubernetes cluster. Managed clusters must be discovered; they cannot be imported.

### Steps

1. On the **Canvas**, click **Add Working Environment**.
2. Select **Microsoft Azure > Kubernetes Cluster** and click **Next**.

Add Working Environment

Choose a Location

Microsoft Azure

Amazon Web Services

Google Cloud Platform

On-Premises

Choose Type

Cloud Volumes ONTAP

Single Node

Cloud Volumes ONTAP HA

High Availability

Azure NetApp Files

High Availability

Kubernetes Cluster

Any

Next

3. Select **Discover Cluster** and click **Next**.
4. Select a Kubernetes cluster and click **Next**.

Add Existing Kubernetes Cluster

Discover a Kubernetes Cluster

AzureKeys

Credential Name

Subscription1

Azure Subscription

Switch Azure Subscription

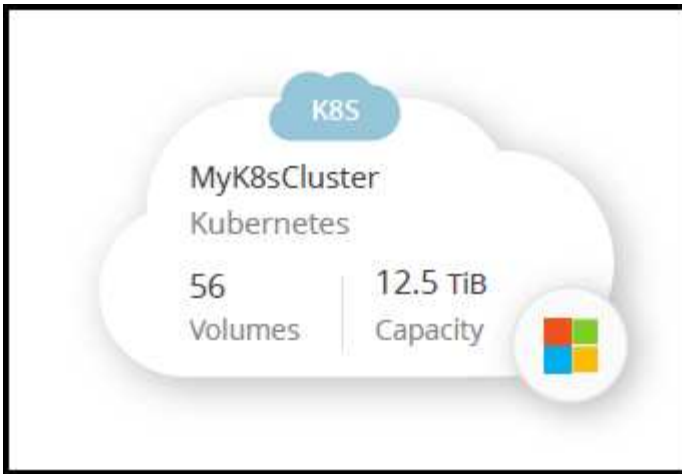
Select a Kubernetes cluster.

3 Kubernetes Clusters

Kubernetes Cluster Name	Status	Kubernetes Version	Resource Group	Location
<input checked="" type="radio"/> Cluster_1	Active	10.2.23.36	Cell text	Cell text
<input type="radio"/> Cluster_2	Active	10.2.23.36	Cell text	Cell text
<input type="radio"/> Cluster_2	Active	10.2.23.36	Cell text	Cell text

## Result

Cloud Manager adds the Kubernetes cluster to the Canvas.



## Import a Cluster

You can import a self-managed Kubernetes cluster using a Kubernetes configuration file.

### Before you get started

You will need Certificate Authority, Client Key, and Client Certificate certificates for the user specified in the cluster role YAML file to import Kubernetes clusters. The Kubernetes cluster administrator receives these certifications when creating users on the Kubernetes cluster.

#### Steps

1. On the **Canvas**, click **Add Working Environment**.
2. Select **Microsoft Azure > Kubernetes Cluster** and click **Next**.
3. Select **Import Cluster** and click **Next**.
4. Upload a Kubernetes configuration file in YAML format.

Add Existing Kubernetes Cluster

Import Kubernetes Cluster

Upload a Kubernetes configuration file that's in YAML format

Kubernetes configuration file

minicubeconfig.txt Upload

1 Cluster

Kubernetes Cluster Name	Kubernetes Type	Kubernetes Version
test2	Self Managed	v1.24.0

5. Upload the cluster certificates provided by your Kubernetes cluster administrator.

#### Result

Cloud Manager adds the Kubernetes cluster to the Canvas.

# Add a Google Cloud Kubernetes cluster to Cloud Manager

You can discover or import Kubernetes clusters to Cloud Manager so that you can back up persistent volumes to Google Cloud.

## Discover a cluster

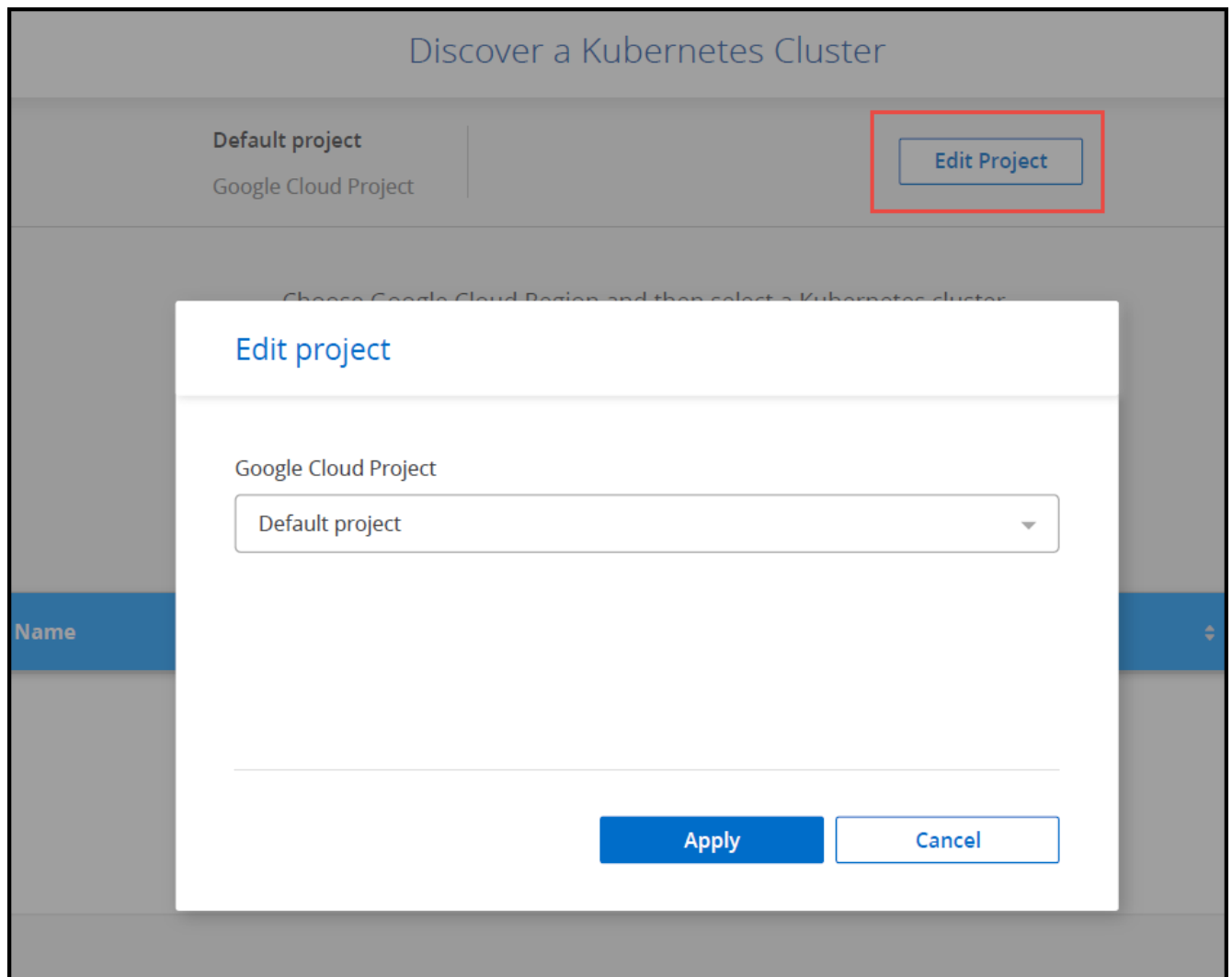
You can discover a fully-managed or self-managed Kubernetes cluster. Managed clusters must be discovered; they cannot be imported.

### Steps

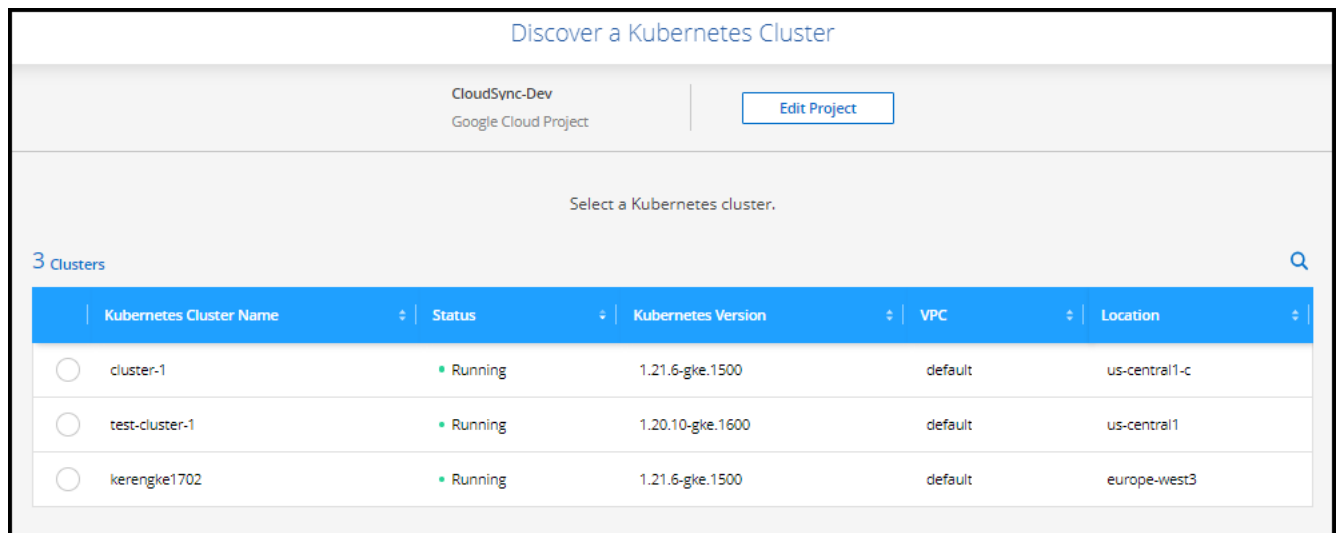
1. On the **Canvas**, click **Add Working Environment**.
2. Select **Google Cloud Platform > Kubernetes Cluster** and click **Next**.

The screenshot shows a two-step selection process. The first step, 'Choose Location & Type', has four options: Microsoft Azure, Amazon Web Services, Google Cloud Platform (selected with a blue checkmark), and OnPrem. The second step, 'Choose Type', has four options: Cloud Volumes ONTAP (Single Node), Cloud Volumes ONTAP HA (High Availability), Cloud Volumes Service (High Availability), and Kubernetes Cluster (Any) (selected with a blue checkmark).

3. Select **Discover Cluster** and click **Next**.
4. To select a Kubernetes cluster in a different Google Cloud Project, click **Edit project** and choose an available project.

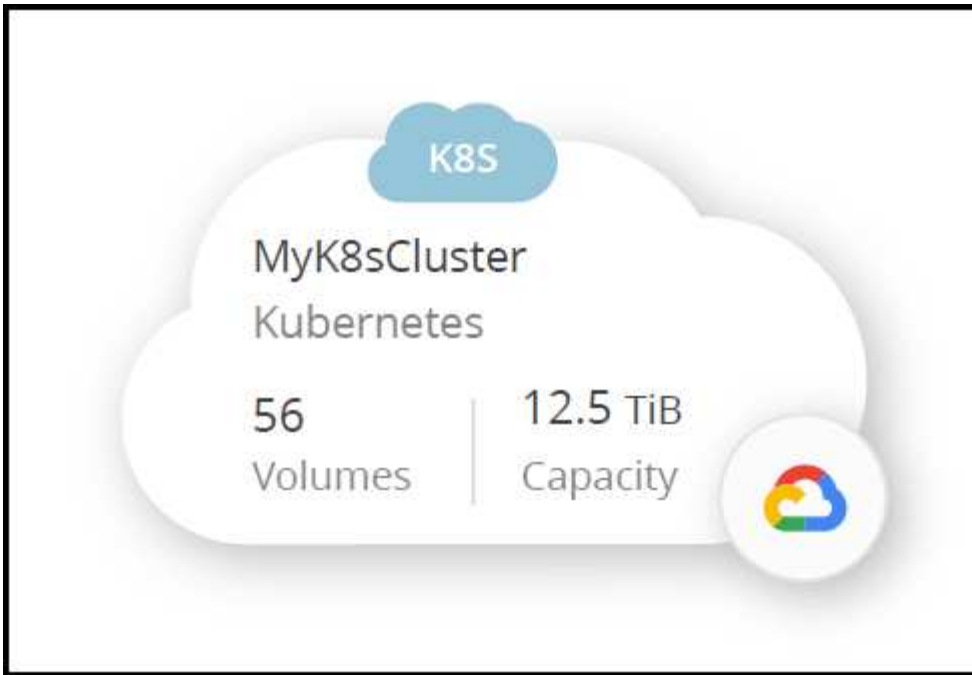


5. Select a Kubernetes cluster and click **Next**.



## Result

Cloud Manager adds the Kubernetes cluster to the Canvas.



## Import a Cluster

You can import a self-managed Kubernetes cluster using a Kubernetes configuration file.

### Before you get started

You will need Certificate Authority, Client Key, and Client Certificate certificates for the user specified in the cluster role YAML file to import Kubernetes clusters. The Kubernetes cluster administrator receives these certifications when creating users on the Kubernetes cluster.

#### Steps

1. On the **Canvas**, click **Add Working Environment**.
2. Select **Google Cloud Platform > Kubernetes Cluster** and click **Next**.
3. Select **Import Cluster** and click **Next**.
4. Upload a Kubernetes configuration file in YAML format.

Add Existing Kubernetes Cluster
Import Kubernetes Cluster

Upload a Kubernetes configuration file that's in YAML format and has the extension ".txt", ".kubeconfig", or ".config"

Kubernetes configuration file

3 Kubernetes Clusters

	Kubernetes Cluster Name	Kubernetes Type	Kubernetes Version
<input checked="" type="radio"/>	Cluster_1	???	10.2.23.36
<input type="radio"/>	Cluster_2	???	10.2.23.36
<input type="radio"/>	Cluster_2	???	10.2.23.36

**Result**

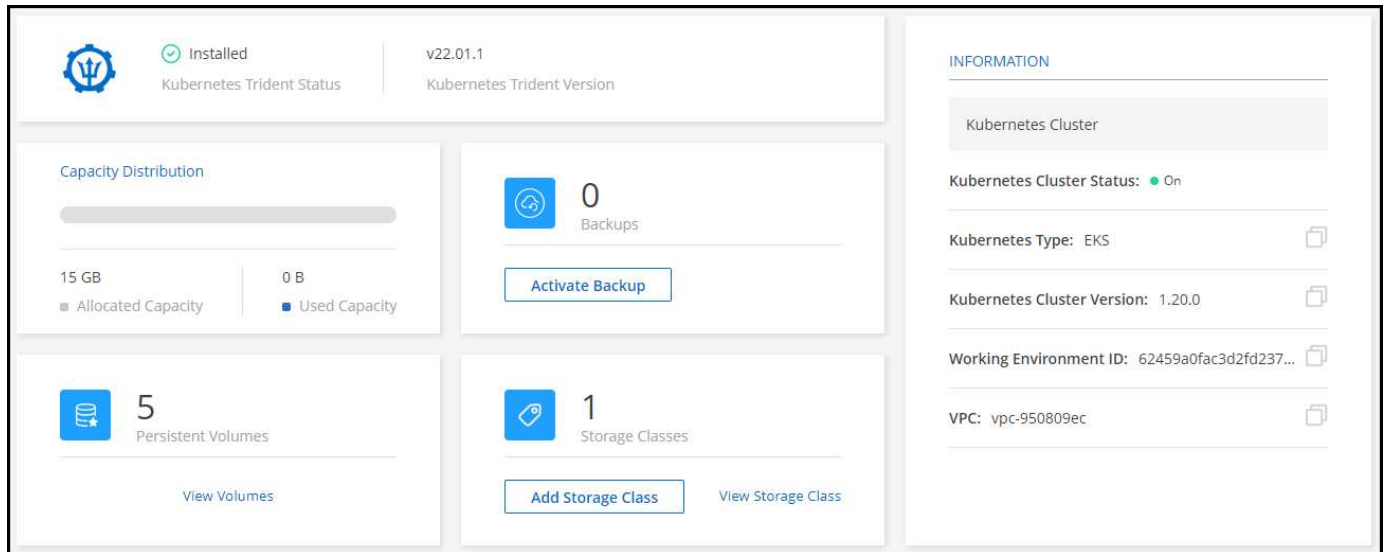
Cloud Manager adds the Kubernetes cluster to the Canvas.

# Manage Kubernetes clusters

You can use Cloud Manager to install Astra Trident, configure storage classes, remove clusters, and enable data services.

## Features

After adding Kubernetes clusters to Cloud Manager, you can manage the clusters from the resource page. To open the resource page, double-click the Kubernetes working environment on the Canvas.



From the resource page you can:

- View the Kubernetes cluster status.
- Confirm Astra Trident is installed. See [Install Astra Trident](#).
- Add and remove storage classes. See [Manage storage classes](#).
- View persistent volumes. See [View persistent volumes](#).
- Remove Kubernetes clusters from the workspace. See [Remove clusters](#).
- Activate or view Cloud Backup. See [Use NetApp cloud data services](#).

## Install Astra Trident

After you add a managed-Kubernetes cluster to the Canvas, you can use Cloud Manager to confirm a compatible Astra Trident installation or install Astra Trident. One of the four most recent versions of Astra Trident is required.

To learn more about Astra Trident, see [Astra Trident documentation](#).

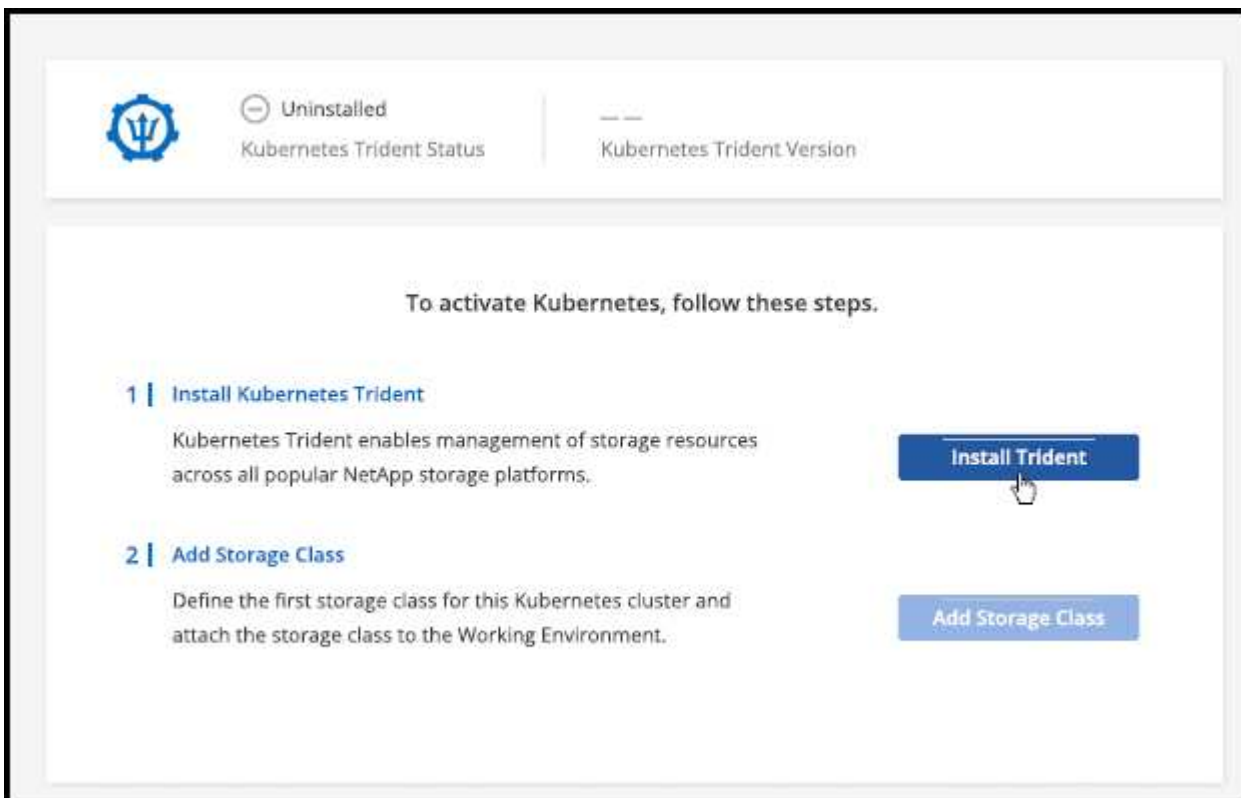


If Astra Trident is not installed, or an incompatible version of Astra Trident is installed, the cluster will show there is an action required.

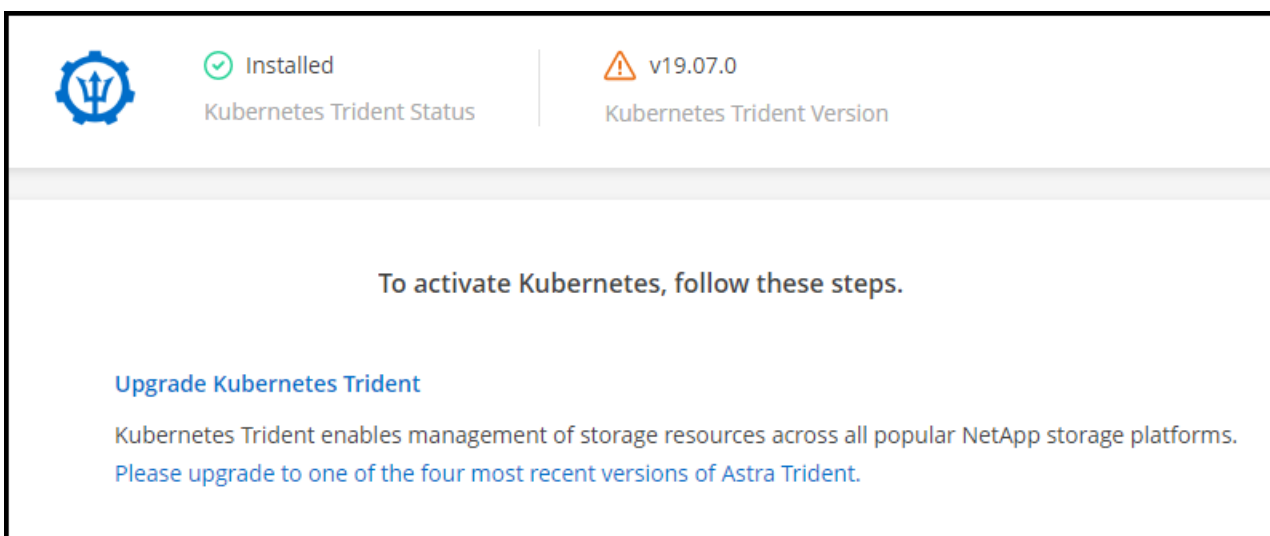
### Steps



1. Double-click the Kubernetes working environment on the Canvas or click **Enter Working Environment**.
  - a. If Astra Trident is not installed, click **Install Trident**.



- b. If a back level version of Astra Trident is installed, [go to the Astra Trident docs for upgrade steps](#).



## Results

The latest version of Astra Trident is installed. You can now add storage classes.

## Manage storage classes

After you add a managed-Kubernetes cluster to the Canvas, you can use Cloud Manager

to manage storage classes.



If no storage class is defined, the cluster will show there is an action required. Double-clicking the cluster on the Canvas will open the action page to add a storage class.

## Add storage class

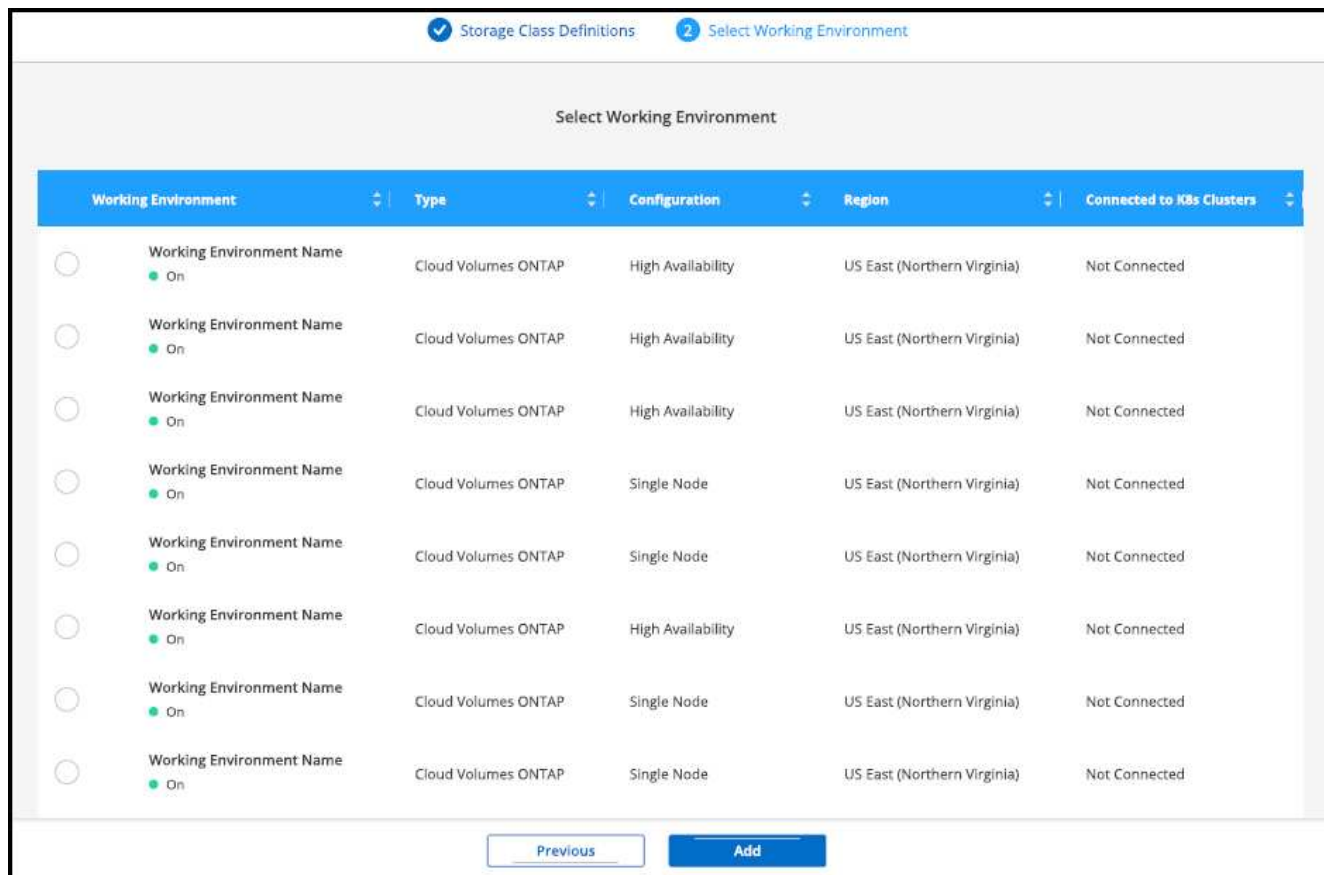
### Steps

1. From the Canvas, drag and drop the Kubernetes working environment on the Cloud Volumes ONTAP working environment to open the storage class wizard.
2. Provide a name for the storage class, select definition options, and click **Next**.

A screenshot of the 'Storage Class Definition' wizard. At the top, there are two tabs: '1 Storage Class Definitions' (active) and '2 Select Working Environment'. The main heading is 'Storage Class Definition for "Kubernetes Cluster Name"'. Below this is a text input field labeled 'Storage Class Name'. Underneath the input field is a white box containing four rows of options, each with a label and two radio buttons. The first row is 'Storage Class' with 'Block' (selected) and 'Filesystem'. The second row is 'Support Volume Expansion' with 'Yes' (selected) and 'No'. The third row is 'Volume Binding Mode' with 'Immediate' (selected) and 'WaitForFirstConsumer'. The fourth row is 'Set as Default Storage Class' with 'Yes' (selected) and 'No'.

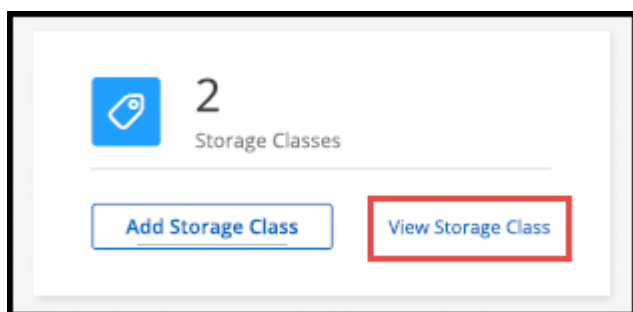
Storage Class	<input checked="" type="radio"/> Block	<input type="radio"/> Filesystem
Support Volume Expansion	<input checked="" type="radio"/> Yes	<input type="radio"/> No
Volume Binding Mode	<input checked="" type="radio"/> Immediate	<input type="radio"/> WaitForFirstConsumer
Set as Default Storage Class	<input checked="" type="radio"/> Yes	<input type="radio"/> No

3. Select a working environment to connect to the cluster. Click **Add**.



## Results

You can click to view the storage class from the resource page for the Kubernetes cluster.



## View working environment details

### Steps

1. Double-click the Kubernetes working environment on the Canvas or click **Enter Working Environment**.
2. Click the **Storage Classes** tab.
3. Click the information icon to view details for the working environment.

## Results

The working environment details panel opens.

2 Storage Classes

Storage Class Name #1

ID: 01234567890123456789

☆

Default Storage Class

csi.trident.netapp.com

Provisioner Name

Nas

Storage Class Type (Driver)

WaitForFirstConsumer

Volume Binding Mode

True

Volume Expansion

Working Environment Name

Type: Cloud Volumes ONTAP

Node: High Availability

Provider: AWS

Status : ON

Region: US East (Northern Virginia)

Storage Class Name #1

ID: 01234567890123456789

csi.trident.netapp.com

Provisioner Name

Nas

Storage Class Type (Driver)

WaitForFirstConsumer

Volume Binding Mode

True

Volume Expansion

## Set default storage class

### Steps

1. Double-click the Kubernetes working environment on the Canvas or click **Enter Working Environment**.
2. Click the **Storage Classes** tab.
3. Click the action menu for the storage class and click **Set as Default**.



### Results

The selected storage class is set as the default.

Storage Class Name #2

ID: 01234567890123456789

☆

Default Storage Class

csi.trident.netapp.com

Provisioner Name

Nas

Storage Class Type (Driver)

WaitForFirstConsumer

Volume Binding Mode

True

Volume Expansion

Working Environment Name

Attached Working Environment

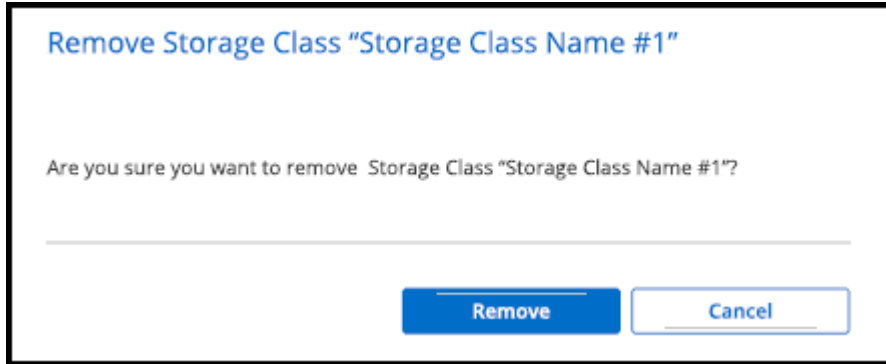
## Remove storage class

### Steps

1. Double-click the Kubernetes working environment on the Canvas or click **Enter Working Environment**.
2. Click the **Storage Classes** tab.
3. Click the action menu for the storage class and click **Set as Default**.



- Click **Remove** to confirm removal of the storage class.



## Results

The selected storage class is removed.

## View persistent volumes

After you add a managed-Kubernetes cluster to the Canvas, you can use Cloud Manager to view persistent volumes.

### Steps

- Double-click the Kubernetes working environment on the Canvas or click **Enter Working Environment**.
- Click **View Volumes** from the **Overview** tab or click the **Persistent Volumes** tab. If no persistent volumes are configured, see [Provisioning](#) for details on provisioning volumes in Astra Trident.

## Results

A table of the configured persistent volumes displays.

Volumes Summary

8

Total Volumes

400

GiB

Total Allocated Capacity

201.2

GiB

Total Used Capacity

8 Volumes

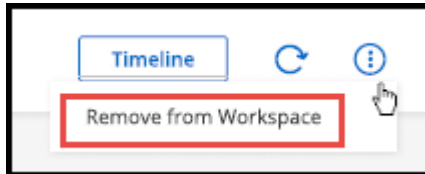
Volume Name	Name Space	Storage Class	Access Mode	Allocated Capacity	Used Capacity
<div>Volumes Very Long Name</div> <div>On</div>	Name Space	Storage Class Name	Access Mode	50 GiB	25.15 GiB
<div>Volumes Very Long Name</div> <div>On</div>	Name Space	Storage Class Name	Access Mode	50 GiB	25.15 GiB

## Remove Kubernetes clusters from the workspace

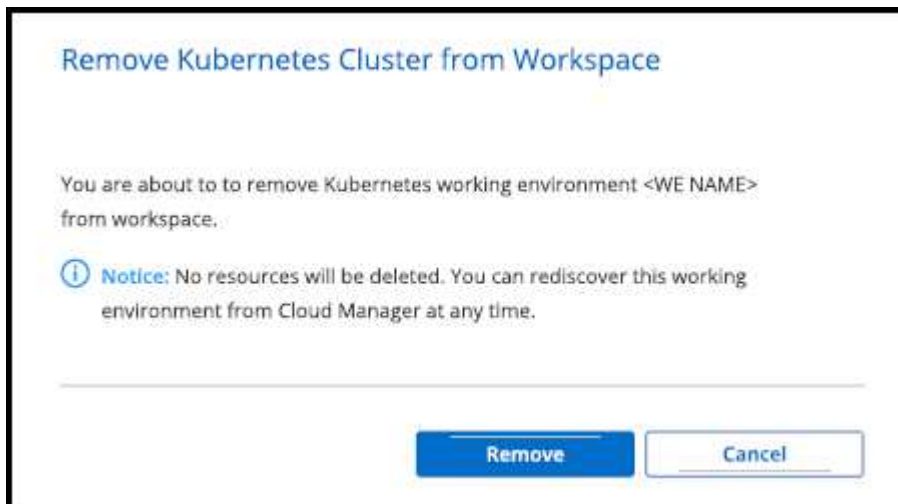
After you add a managed-Kubernetes cluster to the Canvas, you can use Cloud Manager to remove clusters from the workspace.

### Steps

1. Double-click the Kubernetes working environment on the Canvas or click **Enter Working Environment**.
2. At the top right of the page, select the actions menu and click **Remove from Workspace**.



3. Click **Remove** to confirm removal of the cluster from the workspace. You can rediscover this cluster at any time.



### Results

The Kubernetes cluster is removed from the workspace and is no longer visible on the Canvas.

## Use NetApp cloud data services with Kubernetes clusters

After you add a managed-Kubernetes cluster to the Canvas, you can use NetApp cloud data services for advanced data management.

At this time, Cloud Backup is supported with Kubernetes clusters. You can use Cloud Backup to back up persistent volumes to object storage.

[Learn how to protect your Kubernetes cluster data using Cloud Backup.](#)

1 Selected Kubernetes Clusters

Backup Settings



1

Kubernetes Clusters



5

Protected PVs



97.66 KB

Total Backups Size

## Protected Persistent Volumes Status

5

Healthy Backup

0

Failed Backup

## 5 Backup Jobs



Source K8s Cluster	Source Persistent Volume	Source Namespace	Last Backup	Backup Copies	Backup Status	
On	pvc-1704aa1f-af1d-49e9-87fd-6edd86125855 Online	default	Nov 25 2021, 14:56:3	2	Enabled	...
On	pvc-d1f839c1-d932-4f49-b620-33321dbe939e Online	trident	Nov 25 2021, 14:56:3	2	Enabled	...
On	pvc-f615f0a8-2d5d-44d0-b4e4-f365cc3fb4a6 Online	default	Nov 25 2021, 14:56:3	2	Enabled	...
On	pvc-1615f0a8-2d5d-44d0-b4e4-f365cc3fb4a6 Online	default	Nov 25 2021, 14:56:3	2	Enabled	...
On	pvc-05881c70-cf5f-4edc-8537-a0a5ce36f9a1 Online	default	Nov 25 2021, 14:56:3	2	Enabled	...

# Knowledge and support

## Register for support

Before you can open a support case with NetApp technical support, you need to add a NetApp Support Site account to Cloud Manager and then register for support.

### Add an NSS account

The Support Dashboard enables you to add and manage all of your NetApp Support Site accounts from a single location.

#### Steps

1. If you don't have a NetApp Support Site account yet, [register for one](#).
2. In the upper right of the Cloud Manager console, click the Help icon, and select **Support**.



3. Click **NSS Management > Add NSS Account**.
4. When you're prompted, click **Continue** to be redirected to a Microsoft login page.  
  
NetApp uses Microsoft Azure Active Directory as the identity provider for authentication services specific to support and licensing.
5. At the login page, provide your NetApp Support Site registered email address and password to perform the authentication process.

This action enables Cloud Manager to use your NSS account.

Note the account must be a customer-level account (not a guest or temp account).

### Register your account for support

Support registration is available from Cloud Manager in the Support Dashboard.

#### Steps



1. In the upper right of the Cloud Manager console, click the Help icon, and select **Support**.



2. In the **Resources** tab, click **Register for Support**.
3. Select the NSS credentials that you want to register and then click **Register**.

## Get help

NetApp provides support for Cloud Manager and its cloud services in a variety of ways. Extensive free self-support options are available 24x7, such as knowledgebase (KB) articles and a community forum. Your support registration includes remote technical support via web ticketing.

### Self support

These options are available for free, 24 hours a day, 7 days a week:

- [Knowledge base](#)

Search through the Cloud Manager knowledge base to find helpful articles to troubleshoot issues.

- [Communities](#)

Join the Cloud Manager community to follow ongoing discussions or create new ones.

- [Documentation](#)

The Cloud Manager documentation that you're currently viewing.

- [Feedback email](#)

We value your input. Submit feedback to help us improve Cloud Manager.

### NetApp support

In addition to the self-support options above, you can work with a NetApp Support Engineer to resolve any issues after you activate support.

## Steps

1. In Cloud Manager, click **Help > Support**.
2. Choose one of the available options under Technical Support:
  - a. Click **Call Us** to find phone numbers for NetApp technical support.
  - b. Click **Open an Issue**, select one the options, and then click **Send**.

A NetApp representative will review your case and get back to you soon.

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