



# **Manage data for Kubernetes clusters**

## **Cloud Manager**

NetApp

February 22, 2022

# Table of Contents

- Manage data for Kubernetes clusters ..... 1
  - Kubernetes overview ..... 1
  - Get started with Kubernetes clusters in AWS..... 2
  - Get started with Kubernetes clusters in Azure ..... 10
  - Use NetApp’s cloud data services with Kubernetes clusters ..... 17

# Manage data for Kubernetes clusters

## Kubernetes overview

Add managed-Kubernetes clusters to Cloud Manager for advanced data management.

### Features

- Add clusters to the Canvas to view and manage them as part of your hybrid cloud infrastructure
- Back up persistent volumes using Cloud Backup Service

The screenshot shows the 'Kubernetes' tab in the Cloud Manager interface. At the top, there's a 'Restore' button and a 'Kubernetes' tab. Below the tab, a dropdown menu shows '1 Selected Kubernetes Clusters'. To the right is a 'Backup Settings' button. The main content area has three summary cards: '1 Kubernetes Clusters', '5 Protected PVs', and '97.66 KB Total Backups Size'. To the right of these is a 'Protected Persistent Volumes Status' section showing '5 Healthy Backup' and '0 Failed Backup'. Below this is a '5 Backup Jobs' section with a table of backup jobs.

Source K8s Cluster	Source Persistent Volume	Source Namespace	Last Backup	Backup Copies	Backup Status
eks1 On	pvc-1704aa1f-af1d-49e9-87fd-6edd86125855 Online	default	Nov 25 2021, 14:56:3	2	Enabled
eks1 On	pvc-d1f839c1-d932-4f49-b620-33321dbe939e Online	trident	Nov 25 2021, 14:56:3	2	Enabled
eks1 On	pvc-f615f0a8-2d5d-44d0-b4e4-f365cc3fb4a6 Online	default	Nov 25 2021, 14:56:3	2	Enabled
eks1 On	pvc-1615f0a8-2d5d-44d0-b4e4-f365cc3fb4a6 Online	default	Nov 25 2021, 14:56:3	2	Enabled
eks1 On	pvc-05881c70-cf5f-4edc-8537-e0a5ce36f9a1 Online	default	Nov 25 2021, 14:56:3	2	Enabled

### Supported Kubernetes deployments

Cloud Manager supports managed-Kubernetes clusters running in Amazon Elastic Kubernetes Service (Amazon EKS) and Microsoft Azure Kubernetes Service (AKS).

### 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 in AWS

## 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

The Kubernetes cluster must have NetApp Astra Trident installed. One of the four most recent versions of Astra Trident is required. [Go to the Astra Trident docs for installation steps.](#)

#### 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.

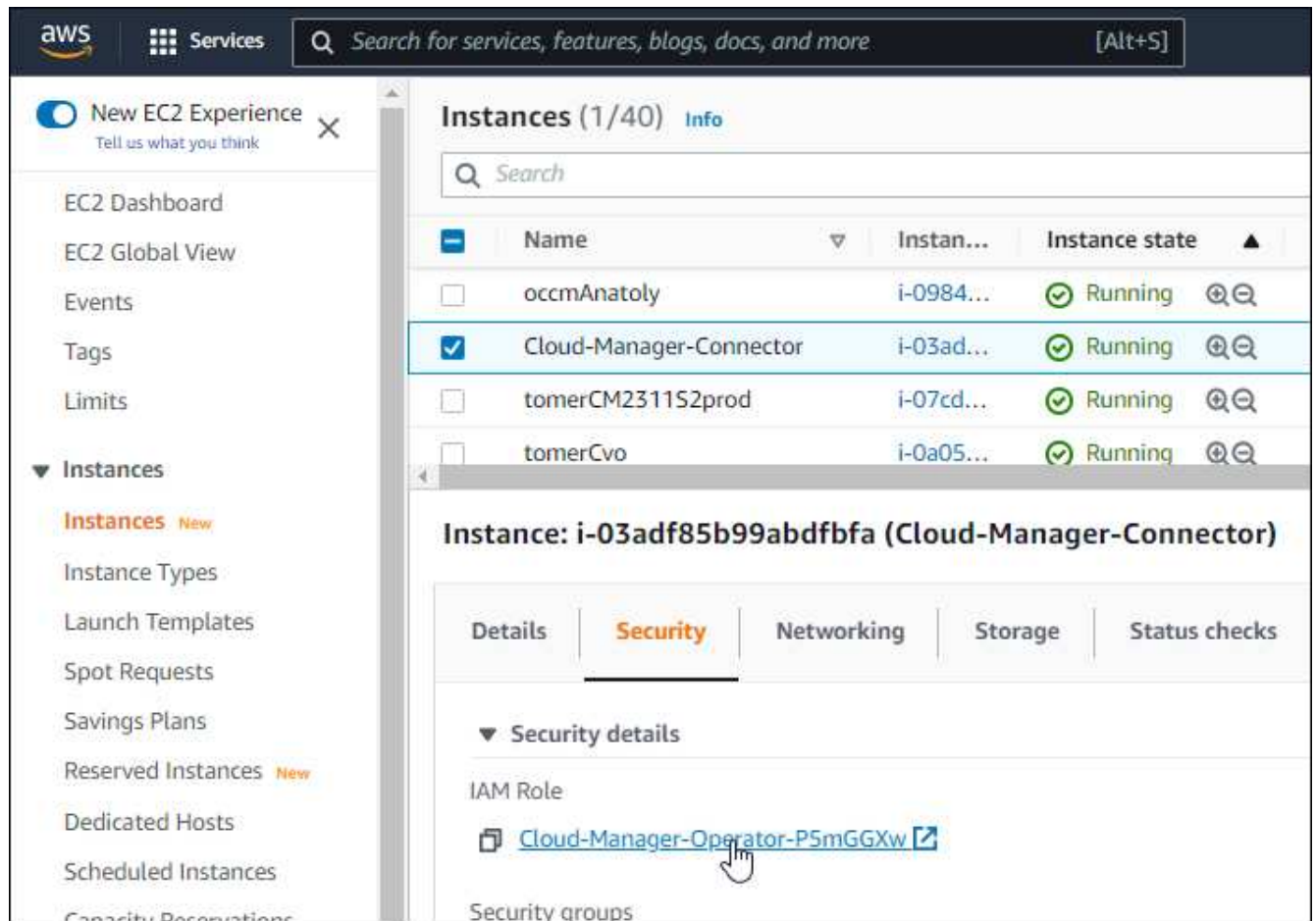
- [Create a Connector from Cloud Manager](#) (recommended)
- [Create a Connector from the AWS Marketplace](#)
- [Install the Connector on an existing Linux host in AWS](#)

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

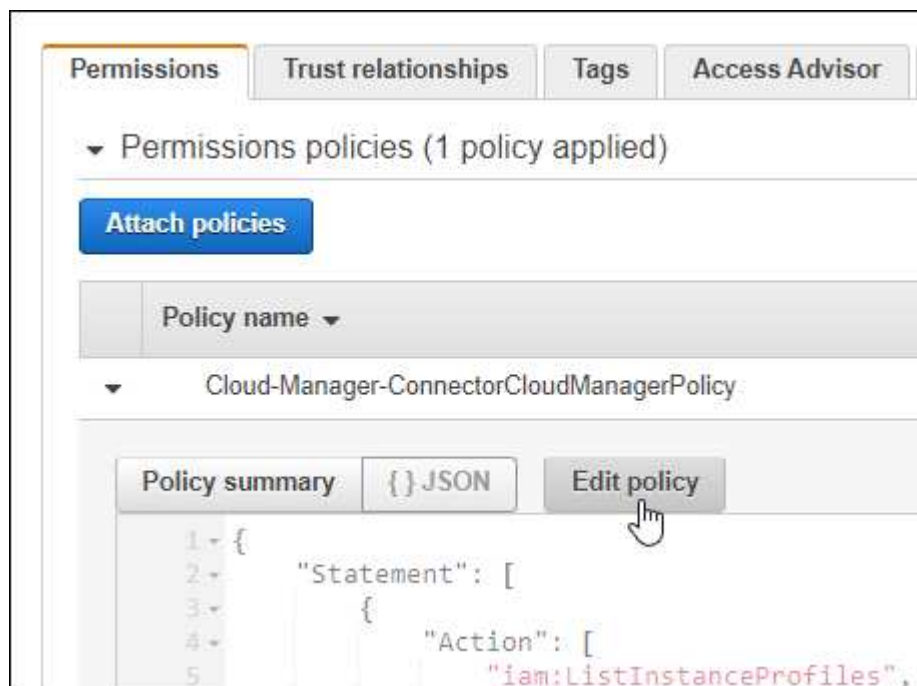
Starting in the 3.9.13 release, any *newly* created Connectors include three new AWS permissions that enable discovery and management of Kubernetes clusters. If you created a Connector prior to this release, then you'll need to modify the existing policy for the Connector's IAM role to provide the permissions.

### 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**.

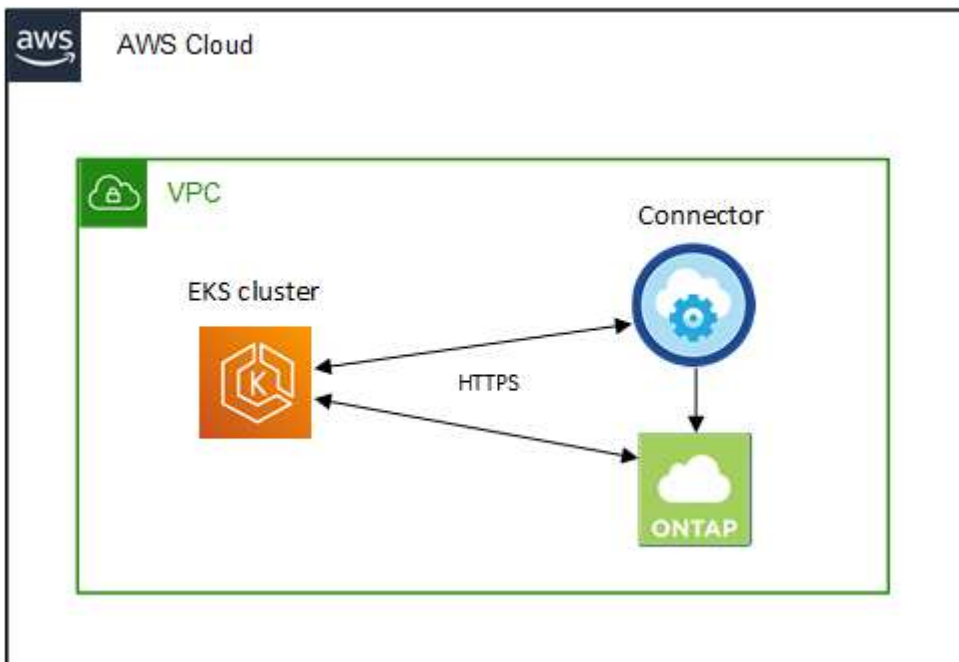
### Review networking requirements

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.

#### Steps

1. Create a cluster role and role binding.
  - a. Create a YAML file that includes the following text.

```

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

```



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
```

## 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**.

The screenshot shows the 'Add Working Environment' wizard in AWS Cloud Manager. The interface is divided into two main sections: 'Choose a Location' and 'Choose Type'. In the 'Choose a Location' section, four options are displayed: Microsoft Azure, Amazon Web Services, Google Cloud Platform, and On-Premises. Microsoft Azure is selected, indicated by a blue checkmark in the top right corner. In the 'Choose Type' section, four options are displayed: Cloud Volumes ONTAP (Single Node), Cloud Volumes ONTAP HA (High Availability), Azure NetApp Files (High Availability), and Kubernetes Cluster (Any). The Kubernetes Cluster option is selected, indicated by a blue checkmark in the top right corner. A blue 'Next' button is located at the bottom center of the wizard.

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

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.

# Get started with Kubernetes clusters in Azure

## 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

The Kubernetes cluster must have NetApp Astra Trident deployed. Install one of the four most recent versions of Astra Trident using Helm. [Go to the Astra Trident docs for installation steps using Helm.](#)

### 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

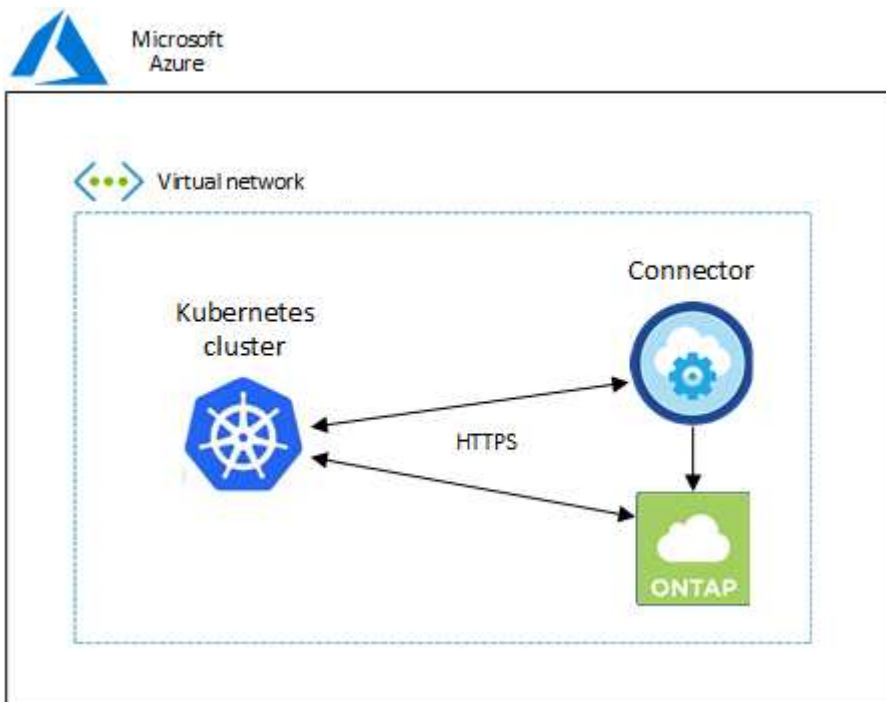
You need to provide network connectivity between the Kubernetes cluster and the Connector and between the Kubernetes cluster and the Cloud Volumes ONTAP system that provides backend storage to the cluster.

- 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

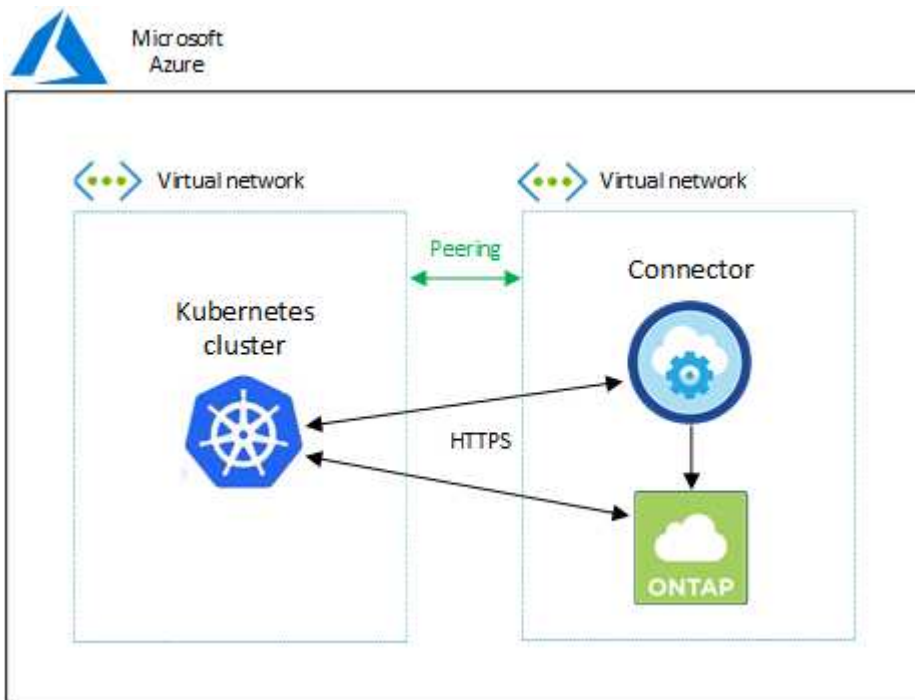
The simplest way to provide this connectivity is to deploy the Connector and Cloud Volumes ONTAP in the same VNet as the Kubernetes cluster. Otherwise, you need to set up a peering connection between the

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.

### 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.



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

### Steps

1. Create a cluster role and role binding.
  - a. Create a YAML file that includes the following text. 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.

```

apiVersion: rbac.authorization.k8s.io/v1
kind: ClusterRole
metadata:
  name: cloudmanager-access-clusterrole
rules:
  - apiGroups:
      - ''
    resources:
      - secrets
      - namespaces
      - persistentvolumeclaims
      - persistentvolumes
    verbs:
      - get
      - list
      - create
  - apiGroups:
      - storage.k8s.io
    resources:
      - storageclasses
    verbs:
      - get
      - list
  - apiGroups:
      - trident.netapp.io
    resources:
      - tridentbackends
      - tridentorchestrators
    verbs:
      - get
      - list
---
apiVersion: rbac.authorization.k8s.io/v1
kind: ClusterRoleBinding
metadata:
  name: k8s-access-binding
subjects:
  - kind: User
    name: Object (principal) ID (for AKS) or username (for self-
managed)
    apiGroup: rbac.authorization.k8s.io
roleRef:
  kind: ClusterRole
  name: cloudmanager-access-clusterrole
  apiGroup: rbac.authorization.k8s.io

```



- b. Apply the configuration to a cluster.

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

## 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**.

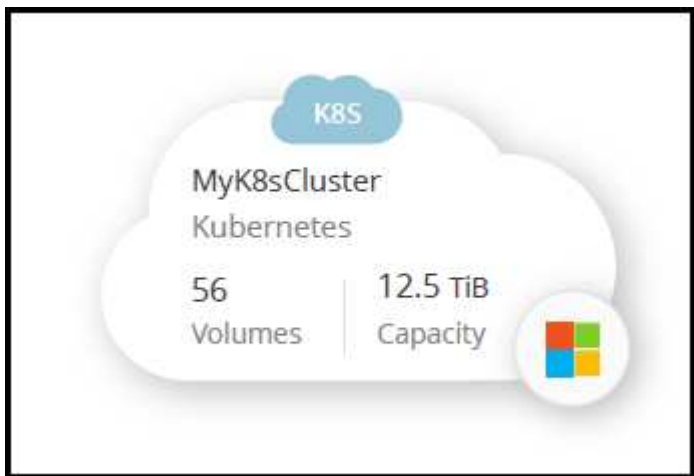
The screenshot shows the 'Add Working Environment' wizard. The 'Choose a Location' section has four options: Microsoft Azure (selected), Amazon Web Services, Google Cloud Platform, and On-Premises. The 'Choose Type' section has four options: Cloud Volumes ONTAP Single Node, Cloud Volumes ONTAP HA High Availability, Azure NetApp Files High Availability, and Kubernetes Cluster (selected). A 'Next' button is at the bottom.

3. Select **Discover Cluster** and click **Next**.
4. 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 **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.

# Use NetApp's cloud data services with Kubernetes clusters

After you add a managed-Kubernetes cluster to the Canvas, you can use NetApp's 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.

[Go to the Cloud Backup docs to learn how to back up persistent volumes.](#)

Restore

Kubernetes

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	
<div>eks1</div> <div>On</div>	<div>pvc-1704aa1f-af1d-49e9-87fd-6edd86125855</div> <div>Online</div>	default	Nov 25 2021, 14:56:3	2	<div>Enabled</div>	...
<div>eks1</div> <div>On</div>	<div>pvc-d1f839c1-d932-4f49-b620-33321dbe939e</div> <div>Online</div>	trident	Nov 25 2021, 14:56:3	2	<div>Enabled</div>	...
<div>eks1</div> <div>On</div>	<div>pvc-f615f0a8-2d5d-44d0-b4e4-f365cc3fb4a6</div> <div>Online</div>	default	Nov 25 2021, 14:56:3	2	<div>Enabled</div>	...
<div>eks1</div> <div>On</div>	<div>pvc-1615f0a8-2d5d-44d0-b4e4-f365cc3fb4a6</div> <div>Online</div>	default	Nov 25 2021, 14:56:3	2	<div>Enabled</div>	...
<div>eks1</div> <div>On</div>	<div>pvc-05881c70-cf5f-4edc-8537-a0a5ce36f9a1</div> <div>Online</div>	default	Nov 25 2021, 14:56:3	2	<div>Enabled</div>	...

18

## Copyright Information

Copyright © 2022 NetApp, Inc. All rights reserved. Printed in the U.S. No part of this document covered by copyright may be reproduced in any form or by any means-graphic, electronic, or mechanical, including photocopying, recording, taping, or storage in an electronic retrieval system-without prior written permission of the copyright owner.

Software derived from copyrighted NetApp material is subject to the following license and disclaimer:

THIS SOFTWARE IS PROVIDED BY NETAPP "AS IS" AND WITHOUT ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, WHICH ARE HEREBY DISCLAIMED. IN NO EVENT SHALL NETAPP BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

NetApp reserves the right to change any products described herein at any time, and without notice. NetApp assumes no responsibility or liability arising from the use of products described herein, except as expressly agreed to in writing by NetApp. The use or purchase of this product does not convey a license under any patent rights, trademark rights, or any other intellectual property rights of NetApp.

The product described in this manual may be protected by one or more U.S. patents, foreign patents, or pending applications.

RESTRICTED RIGHTS LEGEND: Use, duplication, or disclosure by the government is subject to restrictions as set forth in subparagraph (c)(1)(ii) of the Rights in Technical Data and Computer Software clause at DFARS 252.277-7103 (October 1988) and FAR 52-227-19 (June 1987).

## Trademark Information

NETAPP, the NETAPP logo, and the marks listed at <http://www.netapp.com/TM> are trademarks of NetApp, Inc. Other company and product names may be trademarks of their respective owners.