Set up a Connector

Set up and administration

NetApp
April 03, 2022

Table of Contents

Set up a Connector

Learn about Connectors

In most cases, an Account Admin will need to deploy a *Connector* in your cloud or on-premises network. The Connector is a crucial component for the day-to-day use of Cloud Manager. The Connector enables Cloud Manager to manage the resources and processes within your public cloud environment.

When a Connector is required

A Connector is required to use many of the features and services in Cloud Manager.

Services

- Amazon FSx for ONTAP management features
- Amazon S3 bucket discovery
- Cloud Backup
- Cloud Data Sense
- Cloud Tiering
- Cloud Volumes ONTAP
- Global File Cache
- Kubernetes clusters
- Monitoring
- On-premises ONTAP clusters

A Connector is ***not*** required for the following services:

- Active IQ Digital Advisor
- Amazon FSx for ONTAP working environment creation
  While a Connector isn't required to create a working environment, it is required to create and manage volumes, replicate data, and integrate FSx for ONTAP with NetApp cloud services, such as Data Sense and Cloud Sync.
- Azure NetApp Files

  While a Connector isn't required to set up and manage Azure NetApp Files, a Connector is required if you want to use Cloud Data Sense to scan Azure NetApp Files data.
- Cloud Volumes Service for Google Cloud
- Cloud Sync

Digital Wallet

In almost all cases, you can add a license to the Digital Wallet without a Connector.

The only time that a Connector is required to add a license to the Digital Wallet is for Cloud Volumes ONTAP

node-based licenses. A Connector is required in this case because the data is taken from the licenses installed on Cloud Volumes ONTAP systems.

Supported locations

A Connector is supported in the following locations:

- Amazon Web Services
- Microsoft Azure
- Google Cloud
- On your premises
- On your premises, without internet access

Note about Azure deployments

If you deploy the Connector in Azure, it should be deployed in the same Azure region as the Cloud Volumes ONTAP systems that it manages, or in the Azure region pair for the Cloud Volumes ONTAP systems. This requirement ensures that an Azure Private Link connection is used between Cloud Volumes ONTAP and its associated storage accounts. Learn how Cloud Volumes ONTAP uses an Azure Private Link.

Note about Google Cloud deployments

If you want to create a Cloud Volumes ONTAP system in Google Cloud, then you must have a Connector that's running in Google Cloud as well. You can't use a Connector that's running in AWS, Azure, or on-prem.

Shared Linux hosts are not supported

The Connector isn't supported on a VM that is shared with other applications. The VM must be dedicated to the Connector software.

3rd-party agents and extensions

3rd-party agents or VM extensions are not supported on the Connector VM.

Connectors should remain running

A Connector should remain running at all times. It's important for the continued health and operation of the services that you enable.

For example, a Connector is a key component in the health and operation of Cloud Volumes ONTAP PAYGO systems. If a Connector is powered down, Cloud Volumes ONTAP PAYGO systems will shut down after losing communication with a Connector for longer than 14 days.

How to create a Connector

An Account Admin needs to create a Connector before a Workspace Admin can create a Cloud Volumes ONTAP working environment and use any of the other features listed above.

An Account Admin can create a Connector in a number of ways:

- Directly from Cloud Manager (recommended)

    - Create in AWS
    - Create in Azure
    - Create in GCP
- By manually installing the software on your own Linux host
    - On a host that has internet access
    - On an on-prem host that doesn't have internet access
- From your cloud provider's marketplace
    - AWS Marketplace
    - Azure Marketplace

Cloud Manager will prompt you to create a Connector if one is needed to complete an action.

Permissions

Specific permissions are needed to create the Connector and another set of permissions are needed for the Connector instance itself.

Permissions to create a Connector

The user who creates a Connector from Cloud Manager needs specific permissions to deploy the instance in your cloud provider of choice. Cloud Manager will remind you of the permissions requirements when you create a Connector.

View policies for each cloud provider.

Permissions for the Connector instance

The Connector needs specific cloud provider permissions to perform operations on your behalf. For example, to deploy and manage Cloud Volumes ONTAP.

When you create a Connector directly from Cloud Manager, Cloud Manager creates the Connector with the permissions that it needs. There's nothing that you need to do.

If you create the Connector yourself from the AWS Marketplace, the Azure Marketplace, or by manually installing the software, then you'll need to make sure that the right permissions are in place.

View policies for each cloud provider

Number of working environments per Connector

A Connector can manage multiple working environments in Cloud Manager. The maximum number of working environments that a single Connector should manage varies. It depends on the type of working environments, the number of volumes, the amount of capacity being managed, and the number of users.

If you have a large-scale deployment, work with your NetApp representative to size your environment. If you experience any issues along the way, reach out to us by using the in-product chat.

When to use multiple Connectors

In some cases, you might only need one Connector, but you might find yourself needing two or more

Connectors.

Here are a few examples:

- You're using a multi-cloud environment (AWS and Azure), so you have one Connector in AWS and another in Azure. Each manages the Cloud Volumes ONTAP systems running in those environments.
- A service provider might use one NetApp account to provide services for their customers, while using another account to provide disaster recovery for one of their business units. Each account would have separate Connectors.

Using multiple Connectors with the same working environment

You can manage a working environment with multiple Connectors at the same time for disaster recovery purposes. If one Connector goes down, you can switch to the other Connector to immediately manage the working environment.

To set up this configuration:

1. Switch to another Connector
2. Discover the existing working environment.
    - Add existing Cloud Volumes ONTAP systems to Cloud Manager
    - Discover ONTAP clusters
3. Set the Capacity Management Mode

    Only the main Connector should be set to **Automatic Mode**. If you switch to another Connector for DR purposes, then you can change the Capacity Management Mode as needed.

When to switch between Connectors

When you create your first Connector, Cloud Manager automatically uses that Connector for each additional working environment that you create. Once you create an additional Connector, you'll need to switch between them to see the working environments that are specific to each Connector.

Learn how to switch between Connectors.

The local user interface

While you should perform almost all tasks from the SaaS user interface, a local user interface is still available on the Connector. This interface is needed if you install the Connector in an environment that doesn't have internet access, and for a few tasks that need to be performed from the Connector itself, instead of the SaaS interface:

- Setting a proxy server
- Installing a patch (you'll typically work with NetApp personnel to install a patch)
- Downloading AutoSupport messages (usually directed by NetApp personnel when you have issues)

Learn how to access the local UI.

Connector upgrades

The Connector automatically updates its software to the latest version, as long as it has outbound internet access to obtain the software update.

Set up networking for the Connector

Set up your networking so the Connector can manage resources and processes within your public cloud environment. The most important step is ensuring outbound internet access to various endpoints.

The information on this page is for a typical deployment where the Connector has outbound internet access.

If your network uses a proxy server for all communication to the internet, you can specify the proxy server from the Settings page. Refer to Configuring the Connector to use a proxy server.

Connection to target networks

A Connector requires a network connection to the type of working environment that you're creating and the services that you're planning to enable.

For example, if you install a Connector in your corporate network, then you must set up a VPN connection to the VPC or VNet in which you launch Cloud Volumes ONTAP.

Possible conflict with IP addresses in the 172 range

Cloud Manager deploys the Connector with two interfaces that have IP addresses in the 172.17.0.0/16 and 172.18.0.0/16 ranges.

If your network has a subnet configured with either of these ranges, then you might experience connectivity failures from Cloud Manager. For example, discovering on-prem ONTAP clusters in Cloud Manager might fail.

The workaround is to change the IP addresses of the Connector's interfaces. Contact NetApp Support for help.

Outbound internet access

Outbound internet access is required from the Connector.

Endpoints to manage resources in your public cloud environment

The Connector requires outbound internet access to manage resources and processes within your public cloud environment.

Endpoints	Purpose
https://support.netapp.com	To obtain licensing information and to send AutoSupport messages to NetApp support.
https://*.cloudmanager.cloud.netapp.com	To provide SaaS features and services within Cloud Manager.

Endpoints	Purpose
https://cloudmanagerinfraprod.azurecr.io https://*.blob.core.windows.net	To upgrade the Connector and its Docker components.

Endpoints to install the Connector on a Linux host

You have the option to manually install the Connector software on your own Linux host. If you do, the installer for the Connector must access the following URLs during the installation process:

- https://dl.fedoraproject.org/pub/epel/epel-release-latest-7.noarch.rpm
- https://s3.amazonaws.com/aws-cli/awscli-bundle.zip
- https://*.blob.core.windows.net or https://hub.docker.com

The host might try to update operating system packages during installation. The host can contact different mirroring sites for these OS packages.

Ports and security groups

There's no incoming traffic to the Connector, unless you initiate it. HTTP and HTTPS provide access to the local UI, which you'll use in rare circumstances. SSH is only needed if you need to connect to the host for troubleshooting.

Rules for the Connector in AWS

The security group for the Connector requires both inbound and outbound rules.

Inbound rules

Protocol	Port	Purpose
SSH	22	Provides SSH access to the Connector host
HTTP	80	Provides HTTP access from client web browsers to the local user interface and connections from Cloud Data Sense
HTTPS	443	Provides HTTPS access from client web browsers to the local user interface
TCP	3128	Provides the Cloud Data Sense instance with internet access, if your AWS network doesn't use a NAT or proxy
TCP	9060	Provides the ability to enable and use Cloud Data Sense (required only for GovCloud deployments)

Outbound rules

The predefined security group for the Connector opens all outbound traffic. If that is acceptable, follow the basic outbound rules. If you need more rigid rules, use the advanced outbound rules.

Basic outbound rules

The predefined security group for the Connector includes the following outbound rules.

Protocol	Port	Purpose
All TCP	All	All outbound traffic
All UDP	All	All outbound traffic

Advanced outbound rules

If you need rigid rules for outbound traffic, you can use the following information to open only those ports that are required for outbound communication by the Connector.

The source IP address is the Connector host.

Service	Protocol	Port	Destination	Purpose
Active Directory	TCP	88	Active Directory forest	Kerberos V authentication
	TCP	139	Active Directory forest	NetBIOS service session
	TCP	389	Active Directory forest	LDAP
	TCP	445	Active Directory forest	Microsoft SMB/CIFS over TCP with NetBIOS framing
	TCP	464	Active Directory forest	Kerberos V change & set password (SET_CHANGE)
	TCP	749	Active Directory forest	Active Directory Kerberos V change & set password (RPCSEC_GSS)
	UDP	137	Active Directory forest	NetBIOS name service
	UDP	138	Active Directory forest	NetBIOS datagram service
	UDP	464	Active Directory forest	Kerberos key administration
API calls and AutoSupport	HTTPS	443	Outbound internet and ONTAP cluster management LIF	API calls to AWS and ONTAP, and sending AutoSupport messages to NetApp
API calls	TCP	3000	ONTAP HA mediator	Communication with the ONTAP HA mediator
	TCP	8088	Backup to S3	API calls to Backup to S3
DNS	UDP	53	DNS	Used for DNS resolve by Cloud Manager
Cloud Data Sense	HTTP	80	Cloud Data Sense instance	Cloud Data Sense for Cloud Volumes ONTAP

Rules for the Connector in Azure

The security group for the Connector requires both inbound and outbound rules.

Inbound rules

Port	Protocol	Purpose
22	SSH	Provides SSH access to the Connector host
80	HTTP	Provides HTTP access from client web browsers to the local user interface
443	HTTPS	Provides HTTPS access from client web browsers to the local user interface

Outbound rules

The predefined security group for the Connector opens all outbound traffic. If that is acceptable, follow the basic outbound rules. If you need more rigid rules, use the advanced outbound rules.

Basic outbound rules

The predefined security group for the Connector includes the following outbound rules.

Port	Protocol	Purpose
All	All TCP	All outbound traffic
All	All UDP	All outbound traffic

Advanced outbound rules

If you need rigid rules for outbound traffic, you can use the following information to open only those ports that are required for outbound communication by the Connector.

The source IP address is the Connector host.

Service	Port	Protocol	Destination	Purpose
Active Directory	88	TCP	Active Directory forest	Kerberos V authentication
	139	TCP	Active Directory forest	NetBIOS service session
	389	TCP	Active Directory forest	LDAP
	445	TCP	Active Directory forest	Microsoft SMB/CIFS over TCP with NetBIOS framing
	464	TCP	Active Directory forest	Kerberos V change & set password (SET_CHANGE)
	749	TCP	Active Directory forest	Active Directory Kerberos V change & set password (RPCSEC_GSS)
	137	UDP	Active Directory forest	NetBIOS name service
	138	UDP	Active Directory forest	NetBIOS datagram service
	464	UDP	Active Directory forest	Kerberos key administration
API calls and AutoSupport	443	HTTPS	Outbound internet and ONTAP cluster management LIF	API calls to AWS and ONTAP, and sending AutoSupport messages to NetApp
DNS	53	UDP	DNS	Used for DNS resolve by Cloud Manager

Rules for the Connector in GCP

The firewall rules for the Connector requires both inbound and outbound rules.

Inbound rules

Protocol	Port	Purpose
SSH	22	Provides SSH access to the Connector host
HTTP	80	Provides HTTP access from client web browsers to the local user interface
HTTPS	443	Provides HTTPS access from client web browsers to the local user interface

Outbound rules

The predefined firewall rules for the Connector opens all outbound traffic. If that is acceptable, follow the basic outbound rules. If you need more rigid rules, use the advanced outbound rules.

Basic outbound rules

The predefined firewall rules for the Connector includes the following outbound rules.

Protocol	Port	Purpose
All TCP	All	All outbound traffic
All UDP	All	All outbound traffic

Advanced outbound rules

If you need rigid rules for outbound traffic, you can use the following information to open only those ports that are required for outbound communication by the Connector.

The source IP address is the Connector host.

Service	Protocol	Port	Destination	Purpose
Active Directory	TCP	88	Active Directory forest	Kerberos V authentication
	TCP	139	Active Directory forest	NetBIOS service session
	TCP	389	Active Directory forest	LDAP
	TCP	445	Active Directory forest	Microsoft SMB/CIFS over TCP with NetBIOS framing
	TCP	464	Active Directory forest	Kerberos V change & set password (SET_CHANGE)
	TCP	749	Active Directory forest	Active Directory Kerberos V change & set password (RPCSEC_GSS)
	UDP	137	Active Directory forest	NetBIOS name service
	UDP	138	Active Directory forest	NetBIOS datagram service
	UDP	464	Active Directory forest	Kerberos key administration
API calls and AutoSupport	HTTPS	443	Outbound internet and ONTAP cluster management LIF	API calls to GCP and ONTAP, and sending AutoSupport messages to NetApp
DNS	UDP	53	DNS	Used for DNS resolve by Cloud Manager

Ports for the on-prem Connector

The Connector uses the following *inbound* ports when installed manually on an on-premises Linux host.

These inbound rules apply to both deployment models for the on-prem Connector: installed with internet access or without internet access.

Protocol	Port	Purpose
HTTP	80	Provides HTTP access from client web browsers to the local user interface

Protocol	Port	Purpose
HTTPS	443	Provides HTTPS access from client web browsers to the local user interface

Create a Connector in AWS from Cloud Manager

An Account Admin needs to deploy a *Connector* before you can use most Cloud Manager features. Learn when a Connector is required. The Connector enables Cloud Manager to manage resources and processes within your public cloud environment.

This page describes how to create a Connector in AWS directly from Cloud Manager. Learn about other ways to deploy a Connector.

These steps must be completed by a user who has the Account Admin role. A Workspace Admin can't create a Connector.

When you create your first Cloud Volumes ONTAP working environment, Cloud Manager will prompt you to create a Connector if you don't have one yet.

Setting up AWS permissions to create a Connector

Before you can deploy a Connector from Cloud Manager, you need to ensure that your AWS account has the correct permissions.

Steps

1. Download the Connector IAM policy from the following location:

   NetApp Cloud Manager: AWS, Azure, and GCP Policies

   For IAM user permissions for Amazon FSx for ONTAP, see Create an FSx for ONTAP working environment.

2. From the AWS IAM console, create your own policy by copying and pasting the text from the Connector IAM policy.
3. Attach the policy that you created in the previous step to the IAM user who will create the Connector from Cloud Manager.

Result

The AWS user now has the permissions required to create the Connector from Cloud Manager. You'll need to specify AWS access keys for this user when you're prompted by Cloud Manager.

Creating a Connector in AWS

Cloud Manager enables you to create a Connector in AWS directly from its user interface.

What you'll need

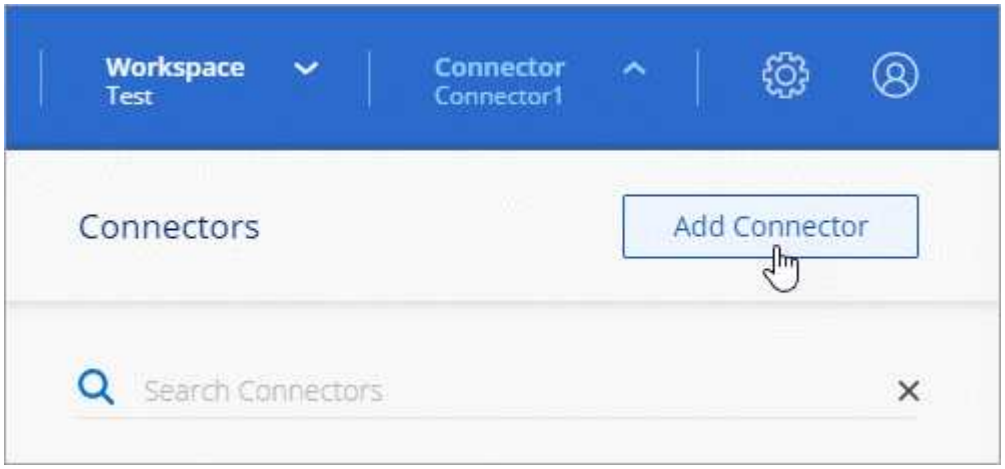
- An AWS access key and secret key for an IAM user who has the required permissions to create a Connector.
- A VPC, subnet, and keypair in your AWS region of choice.

- If you don’t want Cloud Manager to automatically create an IAM role for the Connector, then you’ll need to create your own using this policy.

  These permissions are for the Connector instance. It’s a different set of permissions than what’s provided in the first bullet above.

Steps

1. If you’re creating your first Working Environment, click **Add Working Environment** and follow the prompts. Otherwise, click the **Connector** drop-down and select **Add Connector**.



2. Choose **Amazon Web Services** as your cloud provider and click **Continue**.

   Remember that the Connector must have a network connection to the type of working environment that you’re creating and the services that you’re planning to enable.

   Learn more about networking requirements for the Connector.

3. Follow the steps in the wizard to create the Connector:
   - **Get Ready**: Review what you’ll need.
   - **AWS Credentials**: Specify the AWS access key and secret key that meet permissions requirements and then select your region.
   - **Details**: Provide details about the Connector.
     - Enter a name for the instance.
     - Add custom tags (metadata) to the instance.
     - Choose whether you want Cloud Manager to create a new role that has the required permissions, or if you want to select an existing role that you set up with the required permissions.
     - Choose whether you want to encrypt the Connector’s EBS disks. You have the option to use the default encryption key or to use a custom key.
   - **Network**: Specify a VPC, subnet, and key pair for the instance, choose whether to enable a public IP address, and optionally specify a proxy configuration.
   - **Security Group**: Choose whether to create a new security group or whether to select an existing security group that allows inbound HTTP, HTTPS, and SSH access.

There's no incoming traffic to the Connector, unless you initiate it. HTTP and HTTPS provide access to the local UI, which you'll use in rare circumstances. SSH is only needed if you need to connect to the host for troubleshooting.

- **Review**: Review your selections to verify that your set up is correct.

4. Click **Add**.

   The instance should be ready in about 7 minutes. You should stay on the page until the process is complete.

After you finish

You need to associate a Connector with workspaces so Workspace Admins can use those Connectors to create Cloud Volumes ONTAP systems. If you only have Account Admins, then associating the Connector with workspaces isn't required. Account Admins have the ability to access all workspaces in Cloud Manager by default. Learn more.

Create a Connector in Azure from Cloud Manager

An Account Admin needs to deploy a *Connector* before you can use most Cloud Manager features. The Connector enables Cloud Manager to manage resources and processes within your public cloud environment. Learn when a Connector is required.

This page describes how to create a Connector in Azure directly from Cloud Manager. Learn about other ways to deploy a Connector.

These steps must be completed by a user who has the Account Admin role. A Workspace Admin can't create a Connector.

When you create your first Cloud Volumes ONTAP working environment, Cloud Manager will prompt you to create a Connector if you don't have one yet.

Overview

To deploy a Connector, you need to provide Cloud Manager with a login that has the required permissions to create the Connector VM in Azure.

You have two options:

1. Sign in with your Microsoft account when prompted. This account must have specific Azure permissions. This is the default option.

   Follow the steps below to get started.

2. Provide details about an Azure AD service principal. This service principal also requires specific permissions.

   Follow the steps below to get started.

Note about Azure regions

The Connector should be deployed in the same Azure region as the Cloud Volumes ONTAP systems that it manages, or in the Azure region pair for the Cloud Volumes ONTAP systems. This requirement ensures that an Azure Private Link connection is used between Cloud Volumes ONTAP and its associated storage accounts. Learn how Cloud Volumes ONTAP uses an Azure Private Link.

Create a Connector using your Azure account

The default way to create a Connector in Azure is by logging in with your Azure account when prompted. The login form is owned and hosted by Microsoft. Your credentials are not provided to NetApp.

Set up permissions for your Azure account

Before you can deploy a Connector from Cloud Manager, you need to ensure that your Azure account has the correct permissions.

Steps

1. Download the Azure policy for the Connector.

   Right-click the link and click **Save link as…** to download the file.

2. Modify the JSON file by adding your Azure subscription ID to the assignable scope.

   Example

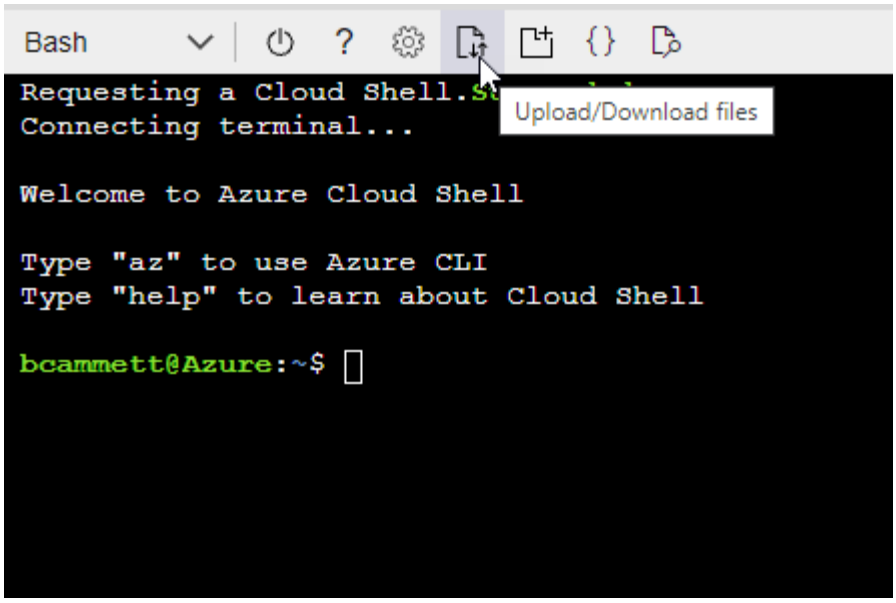
   ```
   "AssignableScopes": [
   "/subscriptions/d333af45-0d07-4154-943d-c25fbzzzzzzz"
   ],
   ```

3. Use the JSON file to create a custom role in Azure.

   The following steps describe how to create the role by using Bash in Azure Cloud Shell.

   a. Start Azure Cloud Shell and choose the Bash environment.

   b. Upload the JSON file.



c. Enter the following Azure CLI command:

```
az role definition create --role-definition
Policy_for_Setup_As_Service_Azure.json
```

You should now have a custom role called *Azure SetupAsService*.

4. Assign the role to the user who will deploy the Connector from Cloud Manager:
   a. Open the **Subscriptions** service and select the user's subscription.
   b. Click **Access control (IAM)**.
   c. Click **Add** > **Add role assignment** and then add the permissions:
      - Select the **Azure SetupAsService** role and click **Next**.

        Azure SetupAsService is the default name provided in the Connector deployment policy for Azure. If you chose a different name for the role, then select that name instead.

      - Keep **User, group, or service principal** selected.
      - Click **Select members**, choose your user account, and click **Select**.
      - Click **Next**.
      - Click **Review + assign**.

Result

The Azure user now has the permissions required to deploy the Connector from Cloud Manager.

Create the Connector by logging in with your Azure account

Cloud Manager enables you to create a Connector in Azure directly from its user interface.

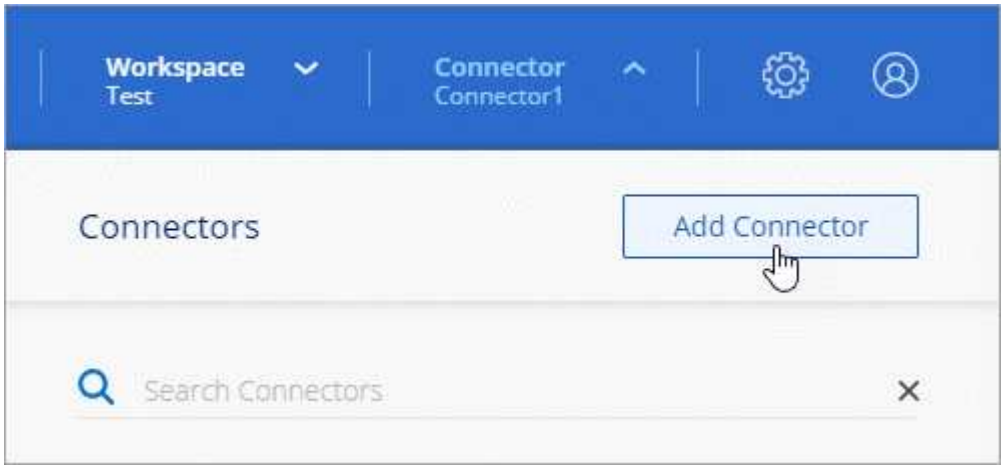
What you'll need

- An Azure subscription.
- A VNet and subnet in your Azure region of choice.
- If you don't want Cloud Manager to automatically create an Azure role for the Connector, then you'll need to create your own using this policy.

  These permissions are for the Connector instance itself. It's a different set of permissions than what you previously set up to simply deploy the Connector.

Steps

1. If you're creating your first Working Environment, click **Add Working Environment** and follow the prompts. Otherwise, click the **Connector** drop-down and select **Add Connector**.



2. Choose **Microsoft Azure** as your cloud provider.

   Remember that the Connector must have a network connection to the type of working environment that you're creating and the services that you're planning to enable.

   Learn more about networking requirements for the Connector.

3. Follow the steps in the wizard to create the Connector:
   - **Get Ready**: Review what you'll need and click **Next**.
   - If you're prompted, log in to your Microsoft account, which should have the required permissions to create the virtual machine.

     The form is owned and hosted by Microsoft. Your credentials are not provided to NetApp.

     If you're already logged in to an Azure account, then Cloud Manager will automatically use that account. If you have multiple accounts, then you might need to log out first to ensure that you're using the right account.

   - **VM Authentication**: Choose an Azure subscription, a location, a new resource group or an existing resource group, and then choose an authentication method.
   - **Details**: Enter a name for the instance, specify tags, and choose whether you want Cloud Manager to create a new role that has the required permissions, or if you want to select an existing role that you set up with the required permissions.

     Note that you can choose the subscriptions associated with this role. Each subscription that you

choose provides the Connector with permissions to deploy Cloud Volumes ONTAP in those subscriptions.

- **Network**: Choose a VNet and subnet, whether to enable a public IP address, and optionally specify a proxy configuration.
- **Security Group**: Choose whether to create a new security group or whether to select an existing security group that allows inbound HTTP, HTTPS, and SSH access.

  There's no incoming traffic to the Connector, unless you initiate it. HTTP and HTTPS provide access to the local UI, which you'll use in rare circumstances. SSH is only needed if you need to connect to the host for troubleshooting.

- **Review**: Review your selections to verify that your set up is correct.

4. Click **Add**.

   The virtual machine should be ready in about 7 minutes. You should stay on the page until the process is complete.

After you finish

You need to associate a Connector with workspaces so Workspace Admins can use those Connectors to create Cloud Volumes ONTAP systems. If you only have Account Admins, then associating the Connector with workspaces isn't required. Account Admins have the ability to access all workspaces in Cloud Manager by default. Learn more.

Create a Connector using a service principal

Rather than logging in with you Azure account, you also have the option to provide Cloud Manager with the credentials for an Azure service principal that has the required permissions.

Granting Azure permissions using a service principal

Grant the required permissions to deploy a Connector in Azure by creating and setting up a service principal in Azure Active Directory and by obtaining the Azure credentials that Cloud Manager needs.

Steps

1. Create an Azure Active Directory application.
2. Assign the application to a role.
3. Add Windows Azure Service Management API permissions.
4. Get the application ID and directory ID.
5. Create a client secret.

Create an Azure Active Directory application

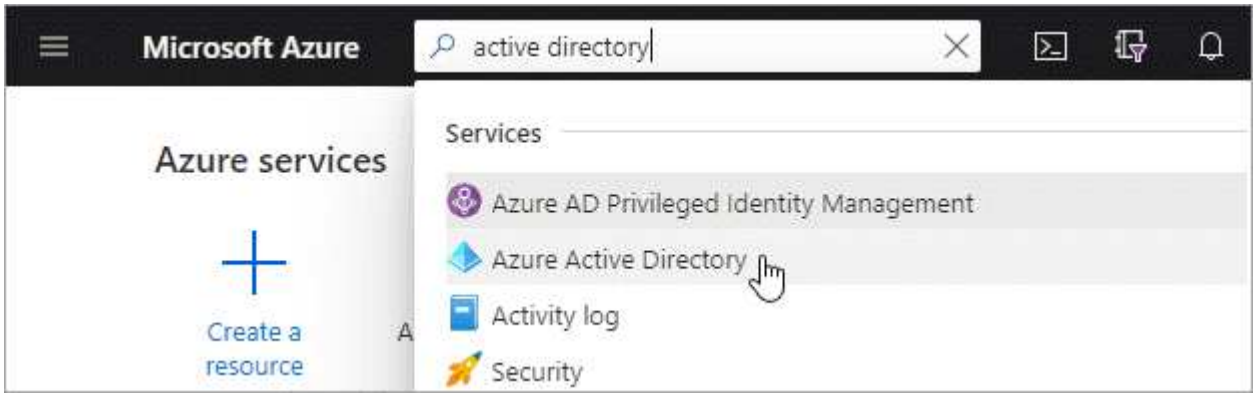
Create an Azure Active Directory (AD) application and service principal that Cloud Manager can use to deploy the Connector.

Before you begin

You must have the right permissions in Azure to create an Active Directory application and to assign the application to a role. For details, refer to Microsoft Azure Documentation: Required permissions.

Steps

1. From the Azure portal, open the **Azure Active Directory** service.



2. In the menu, click **App registrations**.
3. Click **New registration**.
4. Specify details about the application:
   - **Name**: Enter a name for the application.
   - **Account type**: Select an account type (any will work with Cloud Manager).
   - **Redirect URI**: You can leave this field blank.
5. Click **Register**.

Result

You've created the AD application and service principal.

Assign the application to a role

You must bind the service principal to the Azure subscription in which you plan to deploy the Connector and assign it the custom "Azure SetupAsService" role.

Steps

1. Download the Connector deployment policy for Azure.

   Right-click the link and click **Save link as…** to download the file.

2. Modify the JSON file by adding your Azure subscription ID to the assignable scope.

   Example

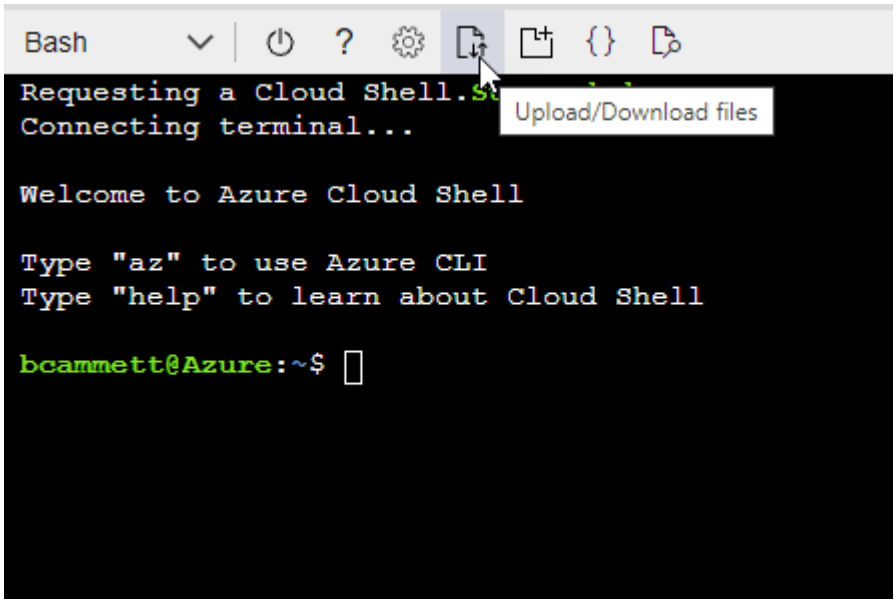
```
"AssignableScopes": [
"/subscriptions/398e471c-3b42-4ae7-9b59-ce5bbzzzzzzz"
```

3. Use the JSON file to create a custom role in Azure.

   The following steps describe how to create the role by using Bash in Azure Cloud Shell.

   a. Start Azure Cloud Shell and choose the Bash environment.

b. Upload the JSON file.

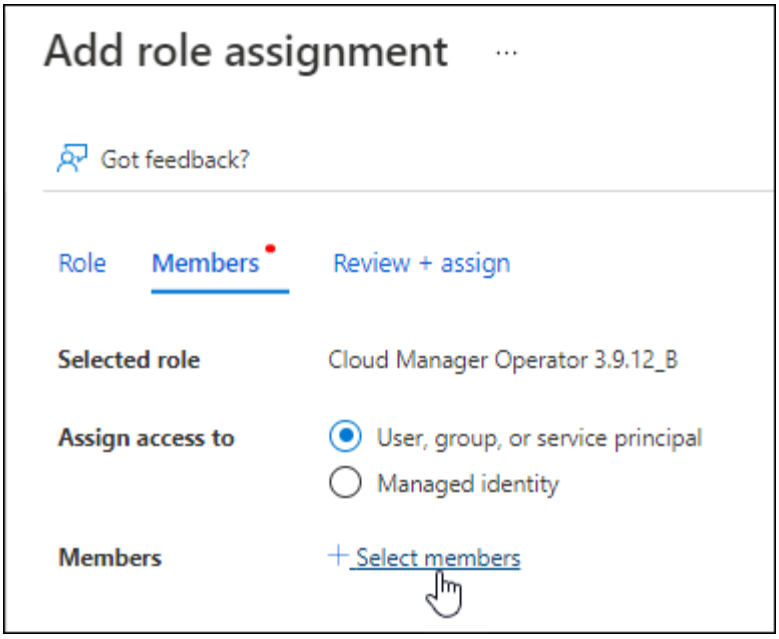


c. Enter the following Azure CLI command:

```
az role definition create --role-definition
Policy_for_Setup_As_Service_Azure.json
```

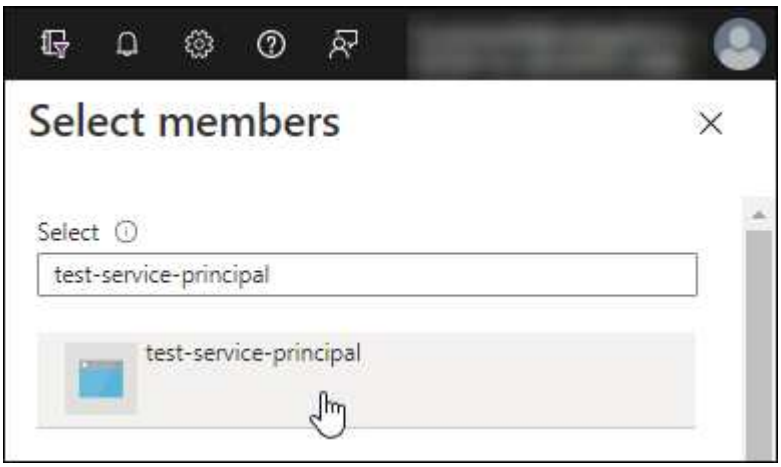
You should now have a custom role called *Azure SetupAsService*.

4. Assign the application to the role:
   a. From the Azure portal, open the **Subscriptions** service.
   b. Select the subscription.
   c. Click **Access control (IAM) > Add > Add role assignment**.
   d. In the **Role** tab, select the **Azure SetupAsService** role and click **Next**.
   e. In the **Members** tab, complete the following steps:
      - Keep **User, group, or service principal** selected.
      - Click **Select members**.



- Search for the name of the application.

  Here's an example:



- Select the application and click **Select**.
- Click **Next**.

f. Click **Review + assign**.

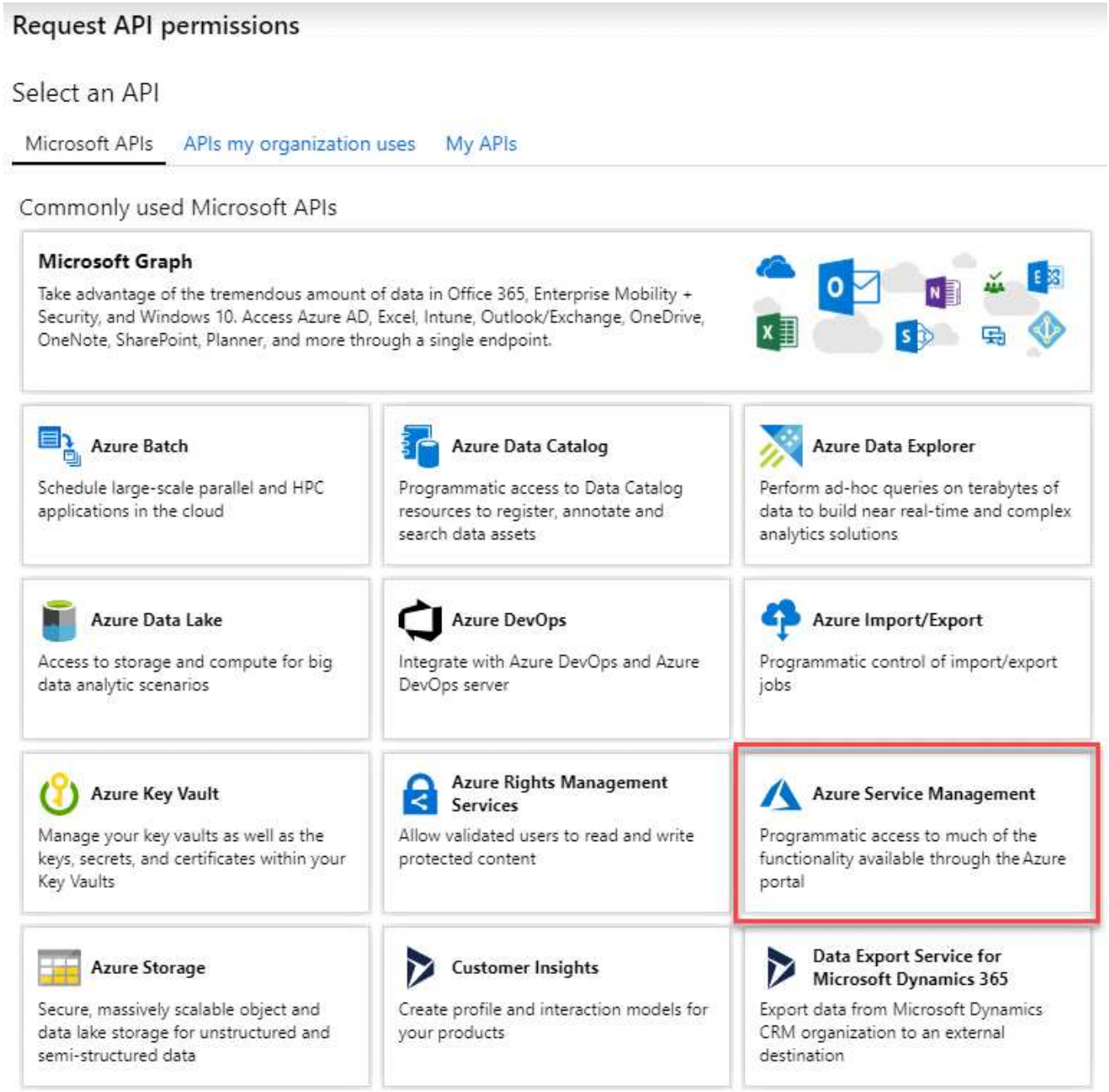
The service principal now has the required Azure permissions to deploy the Connector.

Add Windows Azure Service Management API permissions

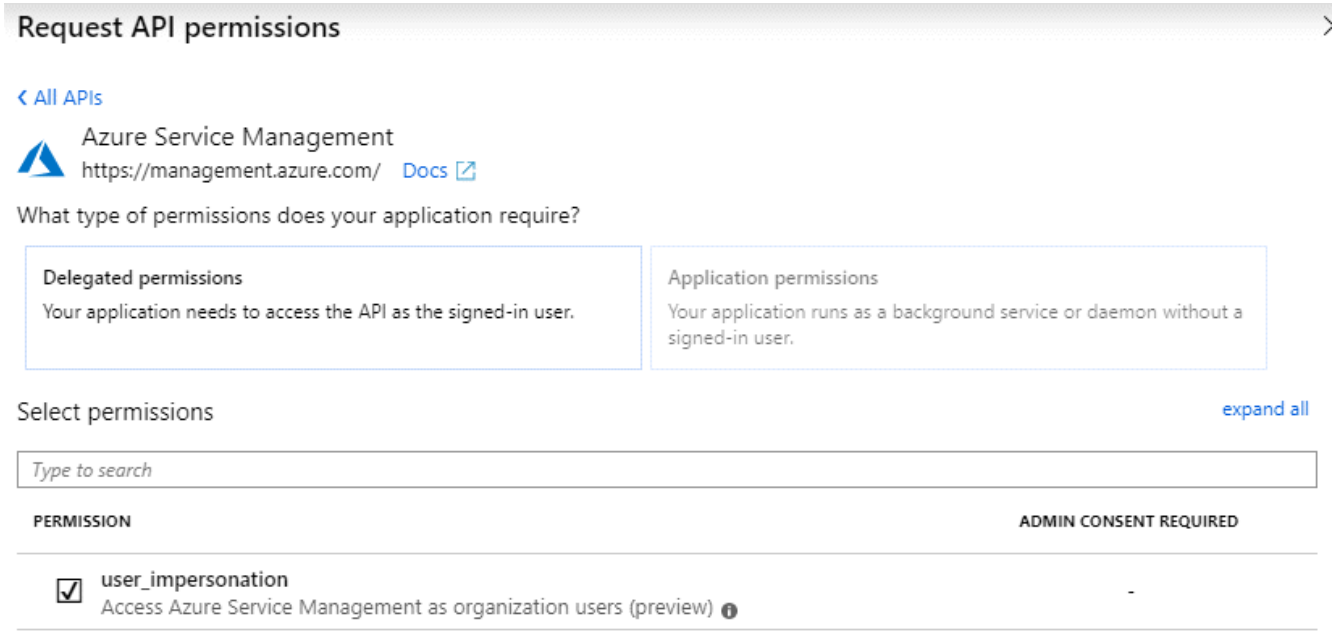
The service principal must have "Windows Azure Service Management API" permissions.

Steps

1. In the **Azure Active Directory** service, click **App registrations** and select the application.
2. Click **API permissions > Add a permission**.
3. Under **Microsoft APIs**, select **Azure Service Management**.



4. Click **Access Azure Service Management as organization users** and then click **Add permissions**.

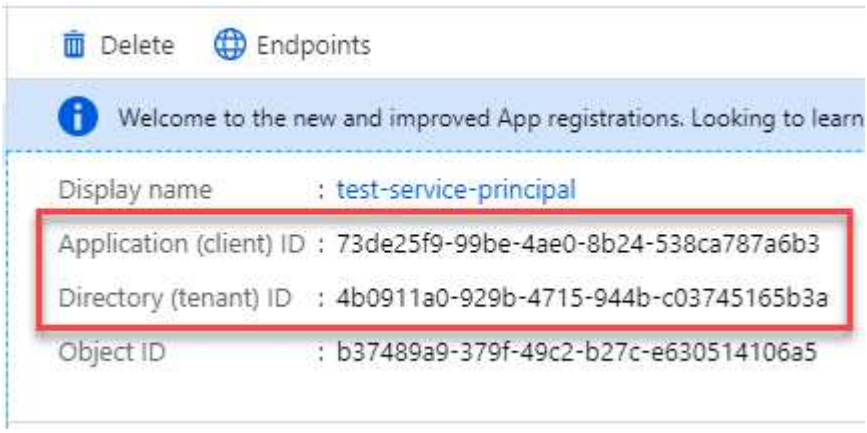


Get the application ID and directory ID

When you create the Connector from Cloud Manager, you need to provide the application (client) ID and the directory (tenant) ID for the application. Cloud Manager uses the IDs to programmatically sign in.

Steps

1. In the **Azure Active Directory** service, click **App registrations** and select the application.
2. Copy the **Application (client) ID** and the **Directory (tenant) ID**.



Create a client secret

You need to create a client secret and then provide Cloud Manager with the value of the secret so Cloud Manager can use it to authenticate with Azure AD.

Steps

1. Open the **Azure Active Directory** service.
2. Click **App registrations** and select your application.
3. Click **Certificates & secrets > New client secret**.

4. Provide a description of the secret and a duration.
5. Click **Add**.
6. Copy the value of the client secret.

Result

Your service principal is now setup and you should have copied the application (client) ID, the directory (tenant) ID, and the value of the client secret. You need to enter this information in Cloud Manager when you create the Connector.

Create the Connector by logging in with the service principal

Cloud Manager enables you to create a Connector in Azure directly from its user interface.

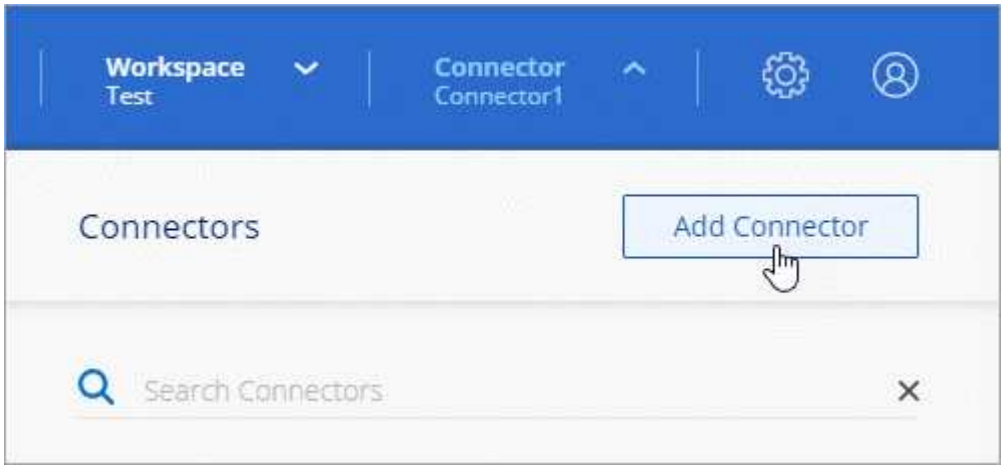
What you'll need

- An Azure subscription.
- A VNet and subnet in your Azure region of choice.
- If you don't want Cloud Manager to automatically create an Azure role for the Connector, then you'll need to create your own using this policy.

  These permissions are for the Connector instance itself. It's a different set of permissions than what you previously set up to simply deploy the Connector.

Steps

1. If you're creating your first Working Environment, click **Add Working Environment** and follow the prompts. Otherwise, click the **Connector** drop-down and select **Add Connector**.



2. Choose **Microsoft Azure** as your cloud provider.

Remember that the Connector must have a network connection to the type of working environment that you're creating and the services that you're planning to enable.

Learn more about networking requirements for the Connector.

3. Follow the steps in the wizard to create the Connector:
   - **Get Ready**: Click **Azure AD service principal** and enter information about the Azure Active Directory service principal that grants the required permissions:
   - Application (client) ID: See Get the application ID and directory ID.
   - Directory (tenant) ID: See Get the application ID and directory ID.
   - Client Secret: See Create a client secret.
   - **VM Authentication**: Choose an Azure subscription, a location, a new resource group or an existing resource group, and then choose an authentication method.
   - **Details**: Enter a name for the instance, specify tags, and choose whether you want Cloud Manager to create a new role that has the required permissions, or if you want to select an existing role that you set up with the required permissions.

     Note that you can choose the subscriptions associated with this role. Each subscription that you choose provides the Connector with permissions to deploy Cloud Volumes ONTAP in those subscriptions.

   - **Network**: Choose a VNet and subnet, whether to enable a public IP address, and optionally specify a proxy configuration.
   - **Security Group**: Choose whether to create a new security group or whether to select an existing security group that allows inbound HTTP, HTTPS, and SSH access.

     There's no incoming traffic to the Connector, unless you initiate it. HTTP and HTTPS provide access to the local UI, which you'll use in rare circumstances. SSH is only needed if you need to connect to the host for troubleshooting.

   - **Review**: Review your selections to verify that your set up is correct.
4. Click **Add**.

   The virtual machine should be ready in about 7 minutes. You should stay on the page until the process is complete.

After you finish

You need to associate a Connector with workspaces so Workspace Admins can use those Connectors to create Cloud Volumes ONTAP systems. If you only have Account Admins, then associating the Connector with workspaces isn't required. Account Admins have the ability to access all workspaces in Cloud Manager by default. Learn more.

Create a Connector in Google Cloud from Cloud Manager

An Account Admin needs to deploy a *Connector* before you can use most Cloud Manager features. Learn when a Connector is required. The Connector enables Cloud Manager to manage resources and processes within your public cloud environment.

This page describes how to create a Connector in GCP directly from Cloud Manager. Learn about other ways

to deploy a Connector.

These steps must be completed by a user who has the Account Admin role. A Workspace Admin can't create a Connector.

When you create your first Cloud Volumes ONTAP working environment, Cloud Manager will prompt you to create a Connector if you don't have one yet.

Setting up permissions

Before you can deploy a Connector, you need to ensure that your GCP account has the correct permissions and that a service account is set up for the Connector VM.

Steps

1. Ensure that the GCP user who deploys the Connector has the permissions in the Connector deployment policy for GCP.

   You can create a custom role using the YAML file and then attach it to the user. You'll need to use the gcloud command line to create the role.

2. Set up a service account that has the permissions that Cloud Manager needs to create and manage Cloud Volumes ONTAP systems in projects.

   You'll associate this service account with the Connector VM when you create it.

   a. Create a role in GCP that includes the permissions defined in the Cloud Manager policy for GCP. Again, you'll need to use the gcloud command line.

      The permissions contained in this YAML file are different than the permissions in step 1.

   b. Create a GCP service account and apply the custom role that you just created.

   c. If you want to deploy Cloud Volumes ONTAP in other projects, grant access by adding the service account with the Cloud Manager role to that project. You'll need to repeat this step for each project.

Result

The GCP user now has the permissions required to create the Connector and the service account for the Connector VM is set up.

Shared VPC permissions

If you are using a shared VPC to deploy resources into a service project, then the following permissions are required. This table is for reference and your environment should reflect the permissions table when IAM configuration is complete.

Service Account	Creator	Hosted in	Service project permissions	Host project permissions	Purpose
Cloud Manager service account	Custom	Service project	• The permissions found in this .yaml file	• compute.networkUser • deploymentmanager.editor	Deploying and maintaining Cloud Volumes ONTAP and services in the service project
Cloud Volumes ONTAP service account	Custom	Service project	• storage.admin • member: Cloud Manager service account as serviceAccount.user	N/A	(Optional) For data tiering and Cloud Backup
Google APIs service agent	GCP	Service project	• (Default) Editor	• compute.networkUser	Interacts with GCP APIs on behalf of deployment. Allows Cloud Manager to use the shared network.
Google Compute Engine default service account	GCP	Service project	• (Default) Editor	• compute.networkUser	Deploys GCP instances and compute infrastructure on behalf of deployment. Allows Cloud Manager to use the shared network.

Notes:

1. deploymentmanager.editor is only required at the host project if you are not passing firewall rules to the deployment and are choosing to let Cloud Manager create them for you. Cloud Manager will create a deployment in the host project which contains the VPC0 firewall rule if no rule is specified.
2. firewall.create and firewall.delete are only required if you are not passing firewall rules to the deployment and are choosing to let Cloud Manager create them for you. These permissions reside in the Cloud Manager service account .yaml file. If you are deploying an HA pair using a shared VPC, these permissions will be used to create the firewall rules for VPC1, 2 and 3. For all other deployments, these permissions will also be used to create rules for VPC0.
3. For data tiering, the tiering service account must have the serviceAccount.user role on the service account, not just at the project level. Currently if you assign serviceAccount.user at the project level, the permissions don't show when you query the service account with getIAMPolicy.

Enabling Google Cloud APIs

Several APIs are required to deploy the Connector and Cloud Volumes ONTAP.

Step

1. Enable the following Google Cloud APIs in your project.
    - Cloud Deployment Manager V2 API

- Cloud Logging API
- Cloud Resource Manager API
- Compute Engine API
- Identity and Access Management (IAM) API

Creating a Connector in GCP

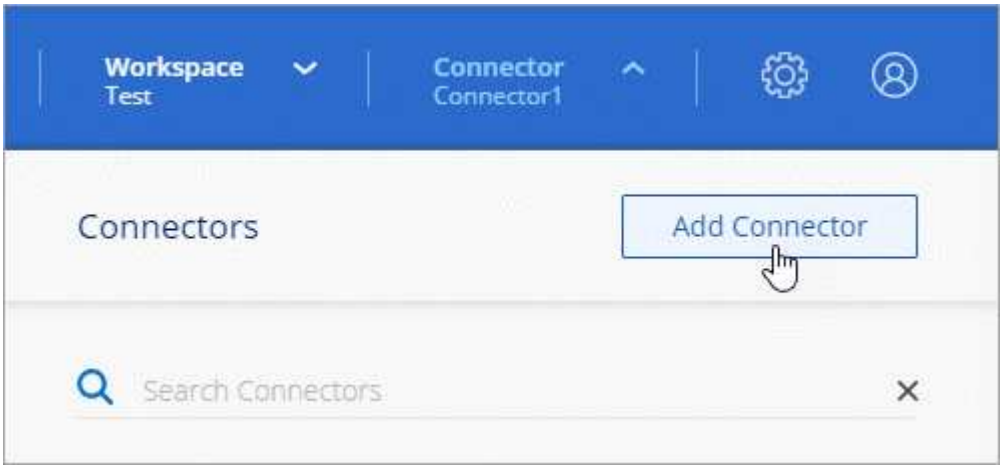
Create a Connector in Google Cloud directly from the Cloud Manager user interface or by using gcloud.

What you'll need

- The required permissions for your Google Cloud account, as described in the first section of this page.
- A Google Cloud project.
- A service account that has the required permissions to create and manage Cloud Volumes ONTAP, as described in the first section of this page.
- A VPC and subnet in your Google Cloud region of choice.

Cloud Manager

1. If you're creating your first Working Environment, click **Add Working Environment** and follow the prompts. Otherwise, click the **Connector** drop-down and select **Add Connector**.



2. Choose **Google Cloud Platform** as your cloud provider.

   Remember that the Connector must have a network connection to the type of working environment that you're creating and the services that you're planning to enable.

   Learn more about networking requirements for the Connector.

3. Follow the steps in the wizard to create the Connector:
   - **Get Ready**: Review what you'll need.
   - If you're prompted, log in to your Google account, which should have the required permissions to create the virtual machine instance.

     The form is owned and hosted by Google. Your credentials are not provided to NetApp.

   - **Basic Settings**: Enter a name for the virtual machine instance, specify tags, select a project, and then select the service account that has the required permissions (refer to the section above for details).
   - **Location**: Specify a region, zone, VPC, and subnet for the instance.
   - **Network**: Choose whether to enable a public IP address and optionally specify a proxy configuration.
   - **Firewall Policy**: Choose whether to create a new firewall policy or whether to select an existing firewall policy that allows inbound HTTP, HTTPS, and SSH access.

     There's no incoming traffic to the Connector, unless you initiate it. HTTP and HTTPS provide access to the local UI, which you'll use in rare circumstances. SSH is only needed if you need to connect to the host for troubleshooting.

   - **Review**: Review your selections to verify that your set up is correct.
4. Click **Add**.

   The instance should be ready in about 7 minutes. You should stay on the page until the process is complete.

gcloud

1. Log in to the gcloud SDK using your preferred methodology.

   In our examples, we'll use a local shell with the gcloud SDK installed, but you could use the native Google Cloud Shell in the GCP console.

   For more information about the Google Cloud SDK, visit the Google Cloud SDK documentation page.

2. Verify that you are logged in as a user who has the required permissions that are defined in the section above:

   ```
   gcloud auth list
   ```

   The output should show the following where the * user account is the desired user account to be logged in as:

   ```
   Credentialed Accounts
   ACTIVE  ACCOUNT
        some_user_account@domain.com
   *    desired_user_account@domain.com
   To set the active account, run:
    $ gcloud config set account `ACCOUNT`
   Updates are available for some Cloud SDK components. To install
   them,
   please run:
   $ gcloud components update
   ```

3. Run the `gcloud compute instances create` command:

   ```
   gcloud compute instances create <instance-name>
     --machine-type=n1-standard-4
     --image-project=netapp-cloudmanager
     --image-family=cloudmanager
     --scopes=cloud-platform
     --project=<project>
     --service-account=<<service-account>
     --zone=<zone>
     --no-address
     --tags <network-tag>
     --network <network-path>
     --subnet <subnet-path>
     --boot-disk-kms-key <kms-key-path>
   ```

instance-name
The desired instance name for the VM instance.

project
(Optional) The project where you want to deploy the VM.

service-account
The service account specified in the output from step 2.

zone
The zone where you want to deploy the VM

no-address
(Optional) No external IP address is used (you need a cloud NAT or proxy to route traffic to the public internet)

network-tag
(Optional) Add network tagging to link a firewall rule using tags to the Connector instance

network-path
(Optional) Add the name of the network to deploy the Connector into (for a Shared VPC, you need the full path)

subnet-path
(Optional) Add the name of the subnet to deploy the Connector into (for a Shared VPC, you need the full path)

kms-key-path
(Optional) Add a KMS key to encrypt the Connector's disks (IAM permissions also need to be applied)

For more information about these flags, visit the Google Cloud compute SDK documentation.

Running the command deploys the Connector using the NetApp golden image. The Connector instance and software should be running in approximately five minutes.

4. Open a web browser from a host that has a connection to the Connector instance and enter the following URL:

   http://*ipaddress*:80

5. After you log in, set up the Connector:
   a. Specify the NetApp account to associate with the Connector.

      Learn about NetApp accounts.

   b. Enter a name for the system.

Result

The Connector is now installed and set up with your NetApp account. Cloud Manager will automatically use this Connector when you create new working environments. But if you have more than one Connector, you'll need to switch between them.