



Get started

Set up and administration

NetApp
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Get started

Learn about Cloud Manager

Cloud Manager enables IT experts and cloud architects to centrally manage their hybrid multi-cloud infrastructure using NetApp's cloud solutions.

Features

Cloud Manager is an enterprise-class, SaaS-based management platform that keeps you in control of your data no matter where it is.

- Set up and use [Cloud Volumes ONTAP](#) for efficient, multi-protocol data management across clouds.
- Set up and use file-storage services:
 - [Azure NetApp Files](#)
 - [Amazon FSx for ONTAP](#)
 - [Cloud Volumes Service for AWS](#)
 - [Cloud Volumes Service for Google Cloud](#)
- Discover and manage your on-prem ONTAP clusters by creating volumes, backing up to the cloud, replicating data across your hybrid cloud, and tiering cold data to the cloud.
- Enable integrated cloud services such as:
 - [Cloud Data Sense](#)
 - [Cloud Insights](#)
 - [Cloud Backup](#)

[Learn more about Cloud Manager.](#)

Supported object storage providers

Cloud Manager enables you to manage cloud storage and use cloud services in Amazon Web Services, Microsoft Azure, and Google Cloud.

Cost

Cloud Manager software is free of charge from NetApp.

For most tasks, Cloud Manager prompts you to deploy a Connector in your cloud network, which results in charges from your cloud provider for the compute instance and associated storage. You do have the option to run the Connector software on your premises.

How Cloud Manager works

Cloud Manager includes a SaaS-based interface that is integrated with NetApp Cloud Central, and Connectors that manage Cloud Volumes ONTAP and other cloud services.

Software-as-a-service

Cloud Manager is accessible through a [SaaS-based user interface](#) and APIs. This SaaS experience enables you to automatically access the latest features as they're released and to easily switch between your NetApp accounts and Connectors.

NetApp Cloud Central

[NetApp Cloud Central](#) provides a centralized location to access and manage [NetApp cloud services](#). With centralized user authentication, you can use the same set of credentials to access Cloud Manager and other cloud services like Cloud Insights.

NetApp account

When you log in to Cloud Manager for the first time, you're prompted to create a *NetApp account*. This account provides multi-tenancy and enables you to organize users and resources in isolated *workspaces*.

Connectors

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

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.

[Learn more about when Connectors are required and how they work.](#)

SOC 2 Type 2 certification

An independent certified public accountant firm and services auditor examined Cloud Manager, Cloud Sync, Cloud Tiering, Cloud Data Sense, and Cloud Backup (Cloud Manager platform), and affirmed that they have achieved SOC 2 Type 2 reports based on the applicable Trust Services criteria.

[View NetApp's SOC 2 reports](#)

Getting started checklist

Use this checklist to understand what's needed to get up and running with Cloud Manager in a typical deployment where the Connector has outbound internet access.

A NetApp Cloud Central login

You need to sign up to [NetApp Cloud Central](#) so that you can access Cloud Manager and other cloud services.

Network access from a web browser to several endpoints

The Cloud Manager user interface is accessible from a web browser. As you use the Cloud Manager user interface, it contacts several endpoints to complete data management tasks. The machine running the web browser must have connections to the following endpoints.

Endpoints	Purpose
http://cloudmanager.netapp.com	Your web browser contacts this URL when using the SaaS UI.
AWS services (amazonaws.com): <ul style="list-style-type: none"> • CloudFormation • Cognito • Elastic Compute Cloud (EC2) • Key Management Service (KMS) • Security Token Service (STS) • Simple Storage Service (S3) 	Required to deploy a Connector from Cloud Manager in AWS. The exact endpoint depends on the region in which you deploy the Connector. Refer to AWS documentation for details.
https://management.azure.com https://login.microsoftonline.com	Required to deploy a Connector from Cloud Manager in most Azure regions.
https://management.microsoftazure.de https://login.microsoftonline.de	Required to deploy a Connector from Cloud Manager in Azure Germany regions.
https://management.usgovcloudapi.net https://login.microsoftonline.com	Required to deploy a Connector from Cloud Manager in Azure US Gov regions.
https://www.googleapis.com	Required to deploy a Connector from Cloud Manager in Google Cloud.
https://signin.b2c.netapp.com	Required to update NetApp Support Site (NSS) credentials or to add new NSS credentials to Cloud Manager.
https://netapp-cloud-account.auth0.com https://cdn.auth0.com https://services.cloud.netapp.com	Your web browser connects to these endpoints for centralized user authentication through NetApp Cloud Central.
https://widget.intercom.io	For in-product chat that enables you to talk to NetApp cloud experts.

Endpoints	Purpose
The Connector's IP address	<p>In most cases, you should work with Cloud Manager from the SaaS UI, but if you use the local UI, then you must enter the host's IP address from a web browser.</p> <p>Depending on the connectivity to your cloud provider, use the private IP or a public IP assigned to the host:</p> <ul style="list-style-type: none"> • A private IP works if you have a VPN and direct access to your virtual network • A public IP works in any networking scenario <p>In either case, secure network access by ensuring that security group rules allow access from only authorized IPs or subnets.</p>

Outbound networking for a Connector

After logging in to Cloud Manager, an Account Admin will need to deploy a *Connector* in a cloud provider or in your on-premises network. The Connector enables Cloud Manager to manage resources and processes within your public cloud environment. A Connector isn't required for Azure NetApp Files, Cloud Volumes Service, or Cloud Sync, but it is required for all other services and features in Cloud Manager. [Learn more about Connectors and how they work.](#)

- The network location where you deploy the Connector must have an outbound internet connection.

The Connector requires outbound internet access to contact the following endpoints in order 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.
https://cloudmanagerinfraprod.azurecr.io	To upgrade the Connector and its Docker components.
https://*.blob.core.windows.net	

- If you choose to manually install the Connector on your own Linux host (and not do so directly from the Cloud Manager interface), the installer for the Connector requires access to the following endpoints 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.

- There's no incoming traffic to the Connector, unless you initiate it.

HTTP (80) and HTTPS (443) provide access to the local UI, which you'll use in rare circumstances. SSH (22) is only needed if you need to connect to the host for troubleshooting.

Cloud provider permissions

You need an account that has permissions to deploy the Connector in your cloud provider directly from Cloud Manager.



There are alternate ways to create a Connector: you can create a Connector from the [AWS Marketplace](#), the [Azure Marketplace](#), or you can [manually install the software](#).

Location	High-level steps	Detailed steps
AWS	<ol style="list-style-type: none"> 1. Use a JSON file that includes the required permissions to create an IAM policy in AWS. 2. Attach the policy to the IAM user who will create the Connector from Cloud Manager. 3. When you create the Connector, provide Cloud Manager with the AWS access key and secret key for the IAM user that has the required permissions. 	Click here to view detailed steps.
Azure	<ol style="list-style-type: none"> 1. Use a JSON file that includes the required permissions to create a custom role in Azure. 2. Assign the role to the user who will create the Connector from Cloud Manager. 3. When you create the Connector, log in with the Microsoft account that has the required permissions (the login prompt that is owned and hosted by Microsoft). 	Click here to view detailed steps.
Google Cloud	<ol style="list-style-type: none"> 1. Use a YAML file that includes the required permissions to create a custom role in Google Cloud. 2. Attach that role to the user who will create the Connector from Cloud Manager. 3. If you plan to use Cloud Volumes ONTAP, set up a service account that has the required permissions. 4. Enable Google Cloud APIs. 5. When you create the Connector, log in with the Google account that has the required permissions (the login prompt is owned and hosted by Google). 	Click here to view detailed steps.

Networking for individual services

Now that your setup is complete, you're ready to start using the services available from Cloud Manager. Note that each service has its own networking requirements. Refer to the following pages for more details.

- [Cloud Volumes ONTAP for AWS](#)

- Cloud Volumes ONTAP for Azure
- Cloud Volumes ONTAP for GCP
- Data replication between ONTAP systems
- Deploying Cloud Data Sense
 - Cloud Data Sense for Cloud Volumes ONTAP and on-premises ONTAP
 - Cloud Data Sense for Azure NetApp Files
 - Cloud Data Sense for Amazon FSx for ONTAP
 - Cloud Data Sense for Amazon S3
 - Cloud Data Sense for non-NetApp NFS or CIFS file shares
- On-prem ONTAP clusters
- Cloud Tiering
 - Data tiering from ONTAP clusters to Amazon S3
 - Data tiering from ONTAP clusters to Azure Blob storage
 - Data tiering from ONTAP clusters to Google Cloud Storage
 - Data tiering from ONTAP clusters to StorageGRID
 - Data tiering from ONTAP clusters to generic S3 object storage
- Cloud Backup
 - Data backup from ONTAP clusters to Amazon S3
 - Data backup from ONTAP clusters to Azure Blob storage
 - Data backup from ONTAP clusters to Google Cloud Storage
 - Data backup from ONTAP clusters to StorageGRID

Signing up to NetApp Cloud Central

Sign up to NetApp Cloud Central so you can access NetApp's cloud services.



You can use single sign-on to log in using credentials from your corporate directory (federated identity). To learn more, go to the [Cloud Central Help Center](#) and then click **Cloud Central sign-in options**.

Steps

1. Open a web browser and go to [NetApp Cloud Central](#).
2. Click **Sign Up**.
3. Fill out the form and click **Sign Up**.

Log In to NetApp Cloud Central

Already signed up? [Login](#)

**optional*

SIGN UP

☒ I accept the [terms and conditions](#).

4. Wait for an email from NetApp Cloud Central.
5. Click the link in the email to verify your email address.

Result

You now have an active Cloud Central user login.

Logging in to Cloud Manager

The Cloud Manager interface is accessible through a SaaS-based user interface by going to <https://cloudmanager.netapp.com>.



You can use single sign-on to log in using credentials from your corporate directory (federated identity). To learn more, go to the [Cloud Central Help Center](#) and then click **Cloud Central sign-in options**.

Steps

1. Open a web browser and go to <https://cloudmanager.netapp.com>.
2. Log in using your NetApp Cloud Central credentials.

The image shows a web page for logging into NetApp Cloud Central. At the top left is the NetApp logo. Below it is a link that says "Continue to Cloud Manager". The main heading is "Log In to NetApp Cloud Central". Below the heading is a horizontal line, followed by the text "Don't have an account yet?" and a link "Sign Up". There are two input fields: the first is labeled "Email" and the second is labeled "Password". Below these fields is a large blue button with the text "LOGIN" in white. At the bottom of the form area is a link that says "Forgot your password?".

NetApp

[Continue to Cloud Manager](#)

Log In to NetApp Cloud Central

Don't have an account yet? [Sign Up](#)

Email

Password

LOGIN

[Forgot your password?](#)

Result

You're now logged in and can start using Cloud Manager to manage your hybrid multi-cloud infrastructure.

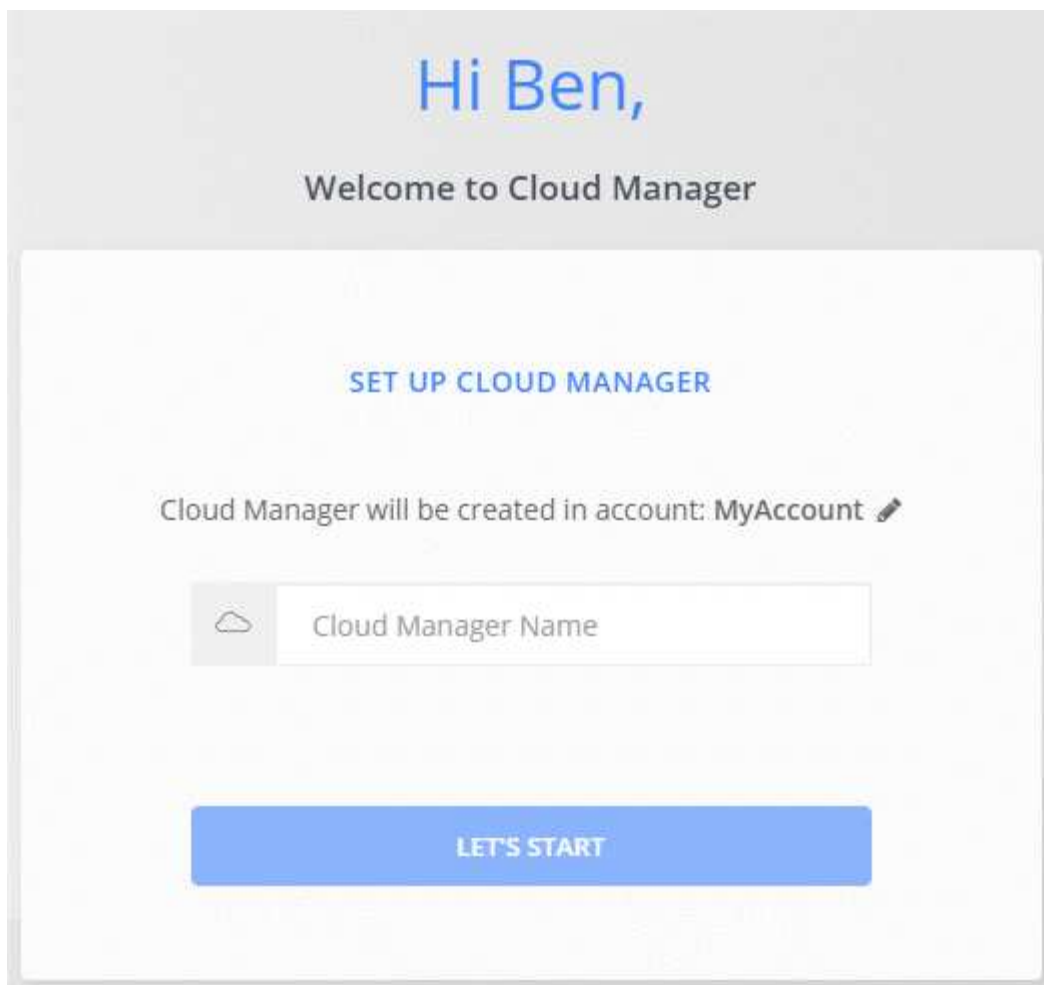
Set up a NetApp account

Learn about NetApp accounts

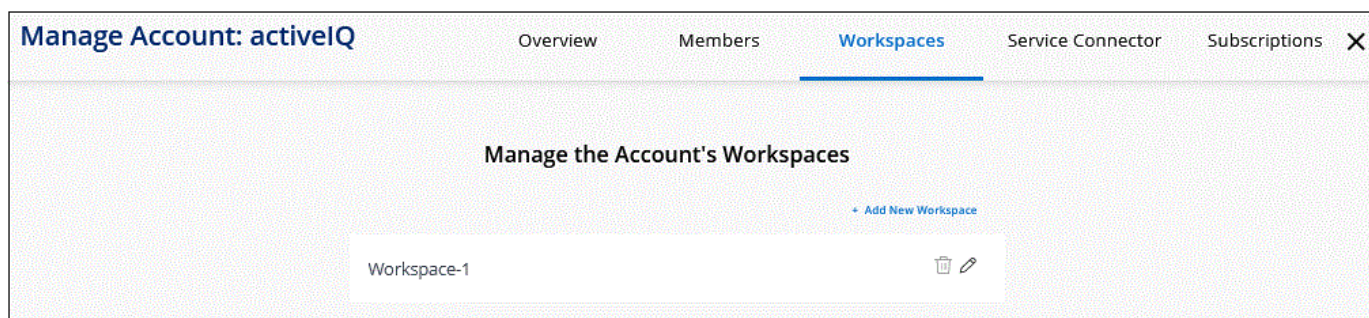
A *NetApp account* provides multi-tenancy and enables you to organize users and resources in isolated workspaces from within Cloud Manager.

For example, multiple users can deploy and manage Cloud Volumes ONTAP systems in isolated environments called *workspaces*. These workspaces are invisible to other users, unless they are shared.

When you first access Cloud Manager, you're prompted to select or create a NetApp account:



Account Admins can then modify the settings for this account by managing users (members), workspaces, Connectors, and subscriptions:



For step-by-step instructions, see [Setting up the NetApp account](#).

Max Cloud Volumes ONTAP systems

The maximum number of Cloud Volumes ONTAP systems is limited to 20 per NetApp account, regardless of the licensing model in use.

A *system* is either an HA pair or a single node system. For example, if you have two Cloud Volumes ONTAP HA pairs and two single node systems, you'd have a total of 4 systems, with room for 16 additional systems in your account.

If you have questions, reach out to your account rep or sales team.

Account Settings

The Manage Account widget in Cloud Manager enables Account Admins to manage a NetApp account. If you just created your account, then you'll start from scratch. But if you've already set up an account, then you'll see *all* the users, workspaces, Connectors, and subscriptions that are associated with the account.

Overview

The Overview page shows the Account Name and the Account ID. You may need to provide your Account ID when registering some services. This page also includes some Cloud Manager configuration options.

Members

The members are NetApp Cloud Central users that you associate with your NetApp account. Associating a user with an account and one or more workspaces in that account enables those users to create and manage working environments in Cloud Manager.

When you associate a user, you assign them a role:

- *Account Admin*: Can perform any action in Cloud Manager.
- *Workspace Admin*: Can create and manage resources in the assigned workspace.
- *Compliance Viewer*: Can only view Cloud Data Sense compliance information and generate reports for systems that they have permission to access.
- *SnapCenter Admin*: Can use the SnapCenter Service to create application consistent backups and restore data using those backups. *This service is currently in Beta.*

[Learn more about these roles.](#)

Workspaces

In Cloud Manager, a workspace isolates any number of *working environments* from other working environments. Workspace Admins can't access the working environments in a workspace unless the Account Admin associates the admin with that workspace.

A working environment represents a storage system:

- A single-node Cloud Volumes ONTAP system or an HA pair
- An on-premises ONTAP cluster in your network
- An ONTAP cluster in a NetApp Private Storage configuration

[Learn how to add a workspace.](#)

Connectors

A Connector enables Cloud Manager to manage resources and processes within your public cloud environment. The Connector runs on a virtual machine instance that you deploy in your cloud provider, or on an on-prem host that you configured.

You can use a Connector with more than one NetApp cloud data service. For example, if you already have a Connector for Cloud Manager, you can select it when you set up the Cloud Tiering service.

[Learn more about Connectors.](#)

Subscriptions

These are the NetApp subscriptions associated with the selected account.

When you subscribe to Cloud Manager from a cloud provider's marketplace, you're redirected to Cloud Central where you need to save your subscription and associate it with specific accounts.

After you've subscribed, each subscription is available from the Manage Account widget. You'll only see the subscriptions that are associated with the account that you're currently viewing.

You have the option to rename a subscription and to disassociate the subscription from one or more accounts.

For example, let's say that you have two accounts and each is billed through separate subscriptions. You might disassociate a subscription from one of the accounts so the users in that account don't accidentally choose the wrong subscription when creating a Cloud Volume ONTAP working environment.

[Learn how to manage subscriptions.](#)

Examples

The following examples depict how you might set up your accounts.



In both example images that follow, the Connector and the Cloud Volumes ONTAP systems don't actually reside *in* the NetApp account—they're running in a cloud provider. This is a conceptual representation of the relationship between each component.

Example 1

The following example shows an account that uses two workspaces to create isolated environments. The first workspace is for a production environment and the second is for a dev environment.

Account



Example 2

Here's another example that shows the highest level of multi-tenancy by using two separate NetApp accounts. For example, a service provider might use Cloud Manager in one account to provide services for their customers, while using another account to provide disaster recovery for one of their business units.

Note that account 2 includes two separate Connectors. This might happen if you have systems in separate regions or in separate cloud providers.



Set up workspaces and users in your NetApp account

When you log in to Cloud Manager for the first time, you're prompted to create a *NetApp account*. This account provides multi-tenancy and enables you to organize users and resources in isolated *workspaces*.

[Learn more about how NetApp accounts work.](#)

Set up your NetApp account so users can access Cloud Manager and access the working environments in a workspace. Just add a single user or add multiple users and workspaces.

Add workspaces

In Cloud Manager, workspaces enable you to isolate a set of working environments from other working environments and from other users. For example, you can create two workspaces and associate separate users with each workspace.

Steps

1. From the top of [Cloud Manager](#), click the **Account** drop-down.



2. Click **Manage Account** next to the currently selected account.



3. Click **Workspaces**.
4. Click **Add New Workspace**.
5. Enter a name for the workspace and click **Add**.

After you finish

If a Workspace Admin needs access to this workspace, then you'll need to associate the user. You'll also need to associate Connectors with the workspace so Workspace Admins can use those Connectors.

Add users

Associate Cloud Central users with the NetApp account so those users can create and manage working environments in Cloud Manager.

Steps

1. If the user hasn't already done so, ask the user to go to [NetApp Cloud Central](#) and sign up.
2. From the top of [Cloud Manager](#), click the **Account** drop-down and click **Manage Account**.



3. From the Members tab, click **Associate User**.
4. Enter the user's email address and select a role for the user:
 - **Account Admin**: Can perform any action in Cloud Manager.
 - **Workspace Admin**: Can create and manage resources in assigned workspaces.
 - **Compliance Viewer**: Can only view Cloud Data Sense governance and compliance information and generate reports for workspaces that they have permission to access.
 - **SnapCenter Admin**: Can use the SnapCenter Service to create application consistent backups and restore data using those backups. This service is currently in Beta.
5. If you selected an account other than Account Admin, select one or more workspaces to associate with that user.



Associate User

To add a user to your NetApp Cloud Account, that user must already have signed up at [NetApp Cloud Central](#). Enter the email address that they used when signing up with Cloud Central.

User's Email

Role

Associate User to Workspaces

Cancel

Associate User

6. Click **Associate**.

Result

The user should receive an email from NetApp Cloud Central titled "Account Association." The email includes the information needed to access Cloud Manager.

Associate Workspace Admins with workspaces

You can associate Workspace Admins with additional workspaces at any time. Associating the user enables them to create and view the working environments in that workspace.

Steps

1. From the top of Cloud Manager, click the **Account** drop-down and click **Manage Account**.



2. From the Members tab, click the action menu in the row that corresponds to the user.



3. Click **Manage Workspaces**.
4. Select one or more workspaces and click **Apply**.

Result

The user can now access those workspaces from Cloud Manager, as long as the Connector was also associated with the workspaces.

Associate Connectors with workspaces

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 about users, workspaces, and Connectors.](#)

Steps

1. From the top of Cloud Manager, click the **Account** drop-down and click **Manage Account**.



2. Click **Connector**.
3. Click **Manage Workspaces** for the Connector that you want to associate.
4. Select one or more workspaces and click **Apply**.

Result

Workspace Admins can now use those Connectors to create Cloud Volumes ONTAP systems.

What's next?

Now that you've set up your account, you can manage it any time by removing users, managing workspaces, Connectors, and subscriptions. [Learn how to manage your account.](#)

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.
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

Protocol	Port	Purpose
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

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

Amazon Web Services

Required permissions for the Connector in AWS

Cloud Manager requires permissions to perform actions in your cloud provider. These permissions are included in [the policies provided by NetApp](#). You might want to understand what Cloud Manager does with these permissions.

Cloud Manager uses an AWS account to make API calls to several AWS services, including EC2, S3, CloudFormation, IAM, the Security Token Service (STS), and the Key Management Service (KMS).

Actions	Purpose
"ec2:StartInstances", "ec2:StopInstances", "ec2:DescribeInstances", "ec2:DescribeInstanceStatus", "ec2:RunInstances", "ec2:TerminateInstances", "ec2:ModifyInstanceAttribute",	Launches a Cloud Volumes ONTAP instance and stops, starts, and monitors the instance.
"ec2:DescribeInstanceAttribute",	Verifies that enhanced networking is enabled for supported instance types.
"ec2:DescribeRouteTables", "ec2:DescribeImages",	Launches a Cloud Volumes ONTAP HA configuration.
"ec2:CreateTags",	Tags every resource that Cloud Manager creates with the "WorkingEnvironment" and "WorkingEnvironmentId" tags. Cloud Manager uses these tags for maintenance and cost allocation.
"ec2:CreateVolume", "ec2:DescribeVolumes", "ec2:ModifyVolumeAttribute", "ec2:AttachVolume", "ec2:DeleteVolume", "ec2:DetachVolume",	Manages the EBS volumes that Cloud Volumes ONTAP uses as back-end storage.
"ec2:CreateSecurityGroup", "ec2>DeleteSecurityGroup", "ec2:DescribeSecurityGroups", "ec2:RevokeSecurityGroupEgress", "ec2:AuthorizeSecurityGroupEgress", "ec2:AuthorizeSecurityGroupIngress", "ec2:RevokeSecurityGroupIngress",	Creates predefined security groups for Cloud Volumes ONTAP.
"ec2:CreateNetworkInterface", "ec2:DescribeNetworkInterfaces", "ec2>DeleteNetworkInterface", "ec2:ModifyNetworkInterfaceAttribute",	Creates and manages network interfaces for Cloud Volumes ONTAP in the target subnet.
"ec2:DescribeSubnets", "ec2:DescribeVpcs",	Gets the list of destination subnets and security groups, which is needed when creating a new working environment for Cloud Volumes ONTAP.

Actions	Purpose
"ec2:DescribeDhcpOptions",	Determines DNS servers and the default domain name when launching Cloud Volumes ONTAP instances.
"ec2:CreateSnapshot", "ec2:DeleteSnapshot", "ec2:DescribeSnapshots",	Takes snapshots of EBS volumes during initial setup and whenever a Cloud Volumes ONTAP instance is stopped.
"ec2:GetConsoleOutput",	Captures the Cloud Volumes ONTAP console, which is attached to AutoSupport messages.
"ec2:DescribeKeyPairs",	Obtains the list of available key pairs when launching instances.
"ec2:DescribeRegions",	Gets a list of available AWS regions.
"ec2:DeleteTags", "ec2:DescribeTags",	Manages tags for resources associated with Cloud Volumes ONTAP instances.
"cloudformation:CreateStack", "cloudformation>DeleteStack", "cloudformation:DescribeStacks", "cloudformation:DescribeStackEvents", "cloudformation:ValidateTemplate",	Launches Cloud Volumes ONTAP instances.
"iam:PassRole", "iam:CreateRole", "iam>DeleteRole", "iam:PutRolePolicy", "iam:CreateInstanceProfile", "iam>DeleteRolePolicy", "iam:AddRoleToInstanceProfile", "iam:RemoveRoleFromInstanceProfile", "iam:DeleteInstanceProfile",	Launches a Cloud Volumes ONTAP HA configuration.
"iam:ListInstanceProfiles", "sts:DecodeAuthorizationMessage", "ec2:AssociateIamInstanceProfile", "ec2:DescribeIamInstanceProfileAssociations", "ec2:DisassociateIamInstanceProfile",	Manages instance profiles for Cloud Volumes ONTAP instances.
"s3:GetBucketTagging", "s3:GetBucketLocation", "s3:ListAllMyBuckets", "s3:ListBucket"	Obtains information about AWS S3 buckets so Cloud Manager can integrate with the NetApp Data Fabric Cloud Sync service.

Actions	Purpose
"s3:CreateBucket", "s3:DeleteBucket", "s3:GetLifecycleConfiguration", "s3:PutLifecycleConfiguration", "s3:PutBucketTagging", "s3:ListBucketVersions", "s3:GetBucketPolicyStatus", "s3:GetBucketPublicAccessBlock", "s3:GetBucketAcl", "s3:GetBucketPolicy", "s3:PutBucketPublicAccessBlock"	Manages the S3 bucket that a Cloud Volumes ONTAP system uses as a capacity tier for data tiering.
"kms:List*", "kms:ReEncrypt*", "kms:Describe*", "kms:CreateGrant",	Enables data encryption of Cloud Volumes ONTAP using the AWS Key Management Service (KMS).
"ce:GetReservationUtilization", "ce:GetDimensionValues", "ce:GetCostAndUsage", "ce:GetTags"	Obtains AWS cost data for Cloud Volumes ONTAP.
"ec2:CreatePlacementGroup", "ec2:DeletePlacementGroup"	When you deploy an HA configuration in a single AWS Availability Zone, Cloud Manager launches the two HA nodes and the mediator in an AWS spread placement group.
"ec2:DescribeReservedInstancesOfferings"	Cloud Manager uses the permission as part of Cloud Data Sense deployment to choose which instance type to use.
"ec2:CreateTags", "ec2:DeleteTags", "ec2:DescribeTags", "tag:getResources", "tag:getTagKeys", "tag:getTagValues", "tag:TagResources", "tag:UntagResources"	Enables you to manage tags on your AWS resources using the Cloud Manager Tagging service.

Actions	Purpose
"s3:DeleteBucket", "s3:GetLifecycleConfiguration", "s3:PutLifecycleConfiguration", "s3:PutBucketTagging", "s3:ListBucketVersions", "s3:GetObject", "s3:ListBucket", "s3:ListAllMyBuckets", "s3:GetBucketTagging", "s3:GetBucketLocation", "s3:GetBucketPolicyStatus", "s3:GetBucketPublicAccessBlock", "s3:GetBucketAcl", "s3:GetBucketPolicy", "s3:PutBucketPublicAccessBlock"	Cloud Manager uses these permissions when you enable the Backup to S3 service.
"eks:ListClusters", "eks:DescribeCluster", "iam:GetInstanceProfile"	Enables discovery of Amazon EKS clusters.

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.

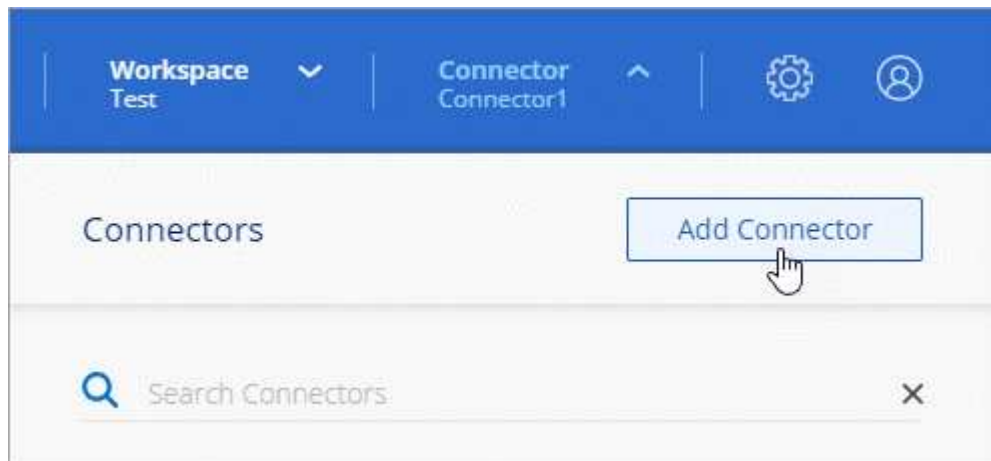
What you'll need

- 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 from the AWS Marketplace

It's best to create a Connector directly from Cloud Manager, but you can launch a Connector from the AWS Marketplace, if you'd rather not specify AWS access keys. After you create and set up the Connector, Cloud Manager will automatically use it when you create new working environments.

Steps

1. Create an IAM policy and role for the EC2 instance:
 - a. Download the Cloud Manager IAM policy from the following location:

[NetApp Cloud Manager: AWS, Azure, and GCP Policies](#)
 - b. From the IAM console, create your own policy by copying and pasting the text from the Cloud Manager IAM policy.
 - c. Create an IAM role with the role type Amazon EC2 and attach the policy that you created in the previous step to the role.
2. Now go to the [Cloud Manager page on the AWS Marketplace](#) to deploy Cloud Manager from an AMI.

The IAM user must have AWS Marketplace permissions to subscribe and unsubscribe.

3. On the Marketplace page, click **Continue to Subscribe** and then click **Continue to Configuration**.

The image contains two screenshots of the AWS Marketplace page for NetApp Cloud Manager. Screenshot 'a' shows the product page with the 'Continue to Subscribe' button highlighted by a red arrow. Screenshot 'b' shows the 'Subscribe to this software' page with the 'Continue to Configuration' button highlighted by a red arrow.

Screenshot a: The page title is 'Cloud Manager - Manual Installation without access keys'. It is by NetApp, Inc. (Latest Version: 3.8.4). The page includes a 'Continue to Subscribe' button, a 'Save to List' button, and a pricing box showing a typical total price of \$0.226/hr. The page also has tabs for Overview, Pricing, Usage, Support, and Reviews.

Screenshot b: The page title is 'Cloud Manager - Manual Installation without access keys'. It shows the 'Continue to Configuration' button. Below the title, there is a 'Subscribe to this software' section with a 'Subscribe' button. The page also includes a 'Terms and Conditions' section with a 'NetApp, Inc. Offer'.

4. Change any of the default options and click **Continue to Launch**.
5. Under **Choose Action**, select **Launch through EC2** and then click **Launch**.

These steps describe how to launch the instance from the EC2 Console because the console enables you to attach an IAM role to the Cloud Manager instance. This isn't possible using the **Launch from Website** action.

6. Follow the prompts to configure and deploy the instance:
- **Choose Instance Type:** Depending on region availability, choose one of the supported instance types (t3.xlarge is recommended).

[Review the instance requirements.](#)

- **Configure Instance:** Select a VPC and subnet, choose the IAM role that you created in step 1, enable termination protection (recommended), and choose any other configuration options that meet your requirements.

Number of instances	<input type="text" value="1"/>	Launch into Auto Scaling Group
Purchasing option	<input type="checkbox"/> Request Spot instances	
Network	<input type="text" value="vpc-a76d91c2 VPC4QA (default)"/>	Create new VPC
Subnet	<input type="text" value="subnet-39536c13 QASubnet1 us-east-1b"/> 155 IP Addresses available	Create new subnet
Auto-assign Public IP	<input type="text" value="Enable"/>	
Placement group	<input type="checkbox"/> Add instance to placement group	
Capacity Reservation	<input type="text" value="Open"/>	Create new Capacity Reservation
IAM role	<input type="text" value="Cloud_Manager"/>	Create new IAM role
CPU options	<input type="checkbox"/> Specify CPU options	
Shutdown behavior	<input type="text" value="Stop"/>	
Enable termination protection	<input checked="" type="checkbox"/> Protect against accidental termination	
Monitoring	<input type="checkbox"/> Enable CloudWatch detailed monitoring Additional charges apply.	

- **Add Storage:** Keep the default storage options.
- **Add Tags:** Enter tags for the instance, if desired.
- **Configure Security Group:** Specify the required connection methods for the Connector instance: SSH, HTTP, and HTTPS.
- **Review:** Review your selections and click **Launch**.

AWS launches the software with the specified settings. The Connector instance and software should be running in approximately five minutes.

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

`http://ipaddress:80`

8. 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](#).

Google Cloud

Required permissions for the Connector in Google Cloud

Cloud Manager requires permissions to perform actions in your cloud provider. These permissions are included in [the policies provided by NetApp](#). You might want to understand what Cloud Manager does with these permissions.

The Cloud Manager policy for GCP includes the permissions that Cloud Manager needs to deploy and manage Cloud Volumes ONTAP.

Actions	Purpose
<ul style="list-style-type: none"> - compute.disks.create - compute.disks.createSnapshot - compute.disks.delete - compute.disks.get - compute.disks.list - compute.disks.setLabels - compute.disks.use 	To create and manage disks for Cloud Volumes ONTAP.
<ul style="list-style-type: none"> - compute.firewalls.create - compute.firewalls.delete - compute.firewalls.get - compute.firewalls.list 	To create firewall rules for Cloud Volumes ONTAP.
<ul style="list-style-type: none"> - compute.globalOperations.get 	To get the status of operations.
<ul style="list-style-type: none"> - compute.images.get - compute.images.getFromFamily - compute.images.list - compute.images.useReadOnly 	To get images for VM instances.
<ul style="list-style-type: none"> - compute.instances.attachDisk - compute.instances.detachDisk 	To attach and detach disks to Cloud Volumes ONTAP.
<ul style="list-style-type: none"> - compute.instances.create - compute.instances.delete 	To create and delete Cloud Volumes ONTAP VM instances.
<ul style="list-style-type: none"> - compute.instances.get 	To list VM instances.
<ul style="list-style-type: none"> - compute.instances.getSerialPortOutput 	To get console logs.
<ul style="list-style-type: none"> - compute.instances.list 	To retrieve the list of instances in a zone.
<ul style="list-style-type: none"> - compute.instances.setDeletionProtection 	To set deletion protection on the instance.
<ul style="list-style-type: none"> - compute.instances.setLabels 	To add labels.
<ul style="list-style-type: none"> - compute.instances.setMachineType - compute.instances.setMinCpuPlatform 	To change the machine type for Cloud Volumes ONTAP.
<ul style="list-style-type: none"> - compute.instances.setMetadata 	To add metadata.
<ul style="list-style-type: none"> - compute.instances.setTags 	To add tags for firewall rules.
<ul style="list-style-type: none"> - compute.instances.start - compute.instances.stop - compute.instances.updateDisplayDevice 	To start and stop Cloud Volumes ONTAP.
<ul style="list-style-type: none"> - compute.machineTypes.get 	To get the numbers of cores to check quotas.
<ul style="list-style-type: none"> - compute.projects.get 	To support multi-projects.
<ul style="list-style-type: none"> - compute.snapshots.create - compute.snapshots.delete - compute.snapshots.get - compute.snapshots.list - compute.snapshots.setLabels 	To create and manage persistent disk snapshots.

Actions	Purpose
<ul style="list-style-type: none"> - compute.networks.get - compute.networks.list - compute.regions.get - compute.regions.list - compute.subnetworks.get - compute.subnetworks.list - compute.zoneOperations.get - compute.zones.get - compute.zones.list 	To get the networking information needed to create a new Cloud Volumes ONTAP virtual machine instance.
<ul style="list-style-type: none"> - deploymentmanager.compositeTypes.get - deploymentmanager.compositeTypes.list - deploymentmanager.deployments.create - deploymentmanager.deployments.delete - deploymentmanager.deployments.get - deploymentmanager.deployments.list - deploymentmanager.manifests.get - deploymentmanager.manifests.list - deploymentmanager.operations.get - deploymentmanager.operations.list - deploymentmanager.resources.get - deploymentmanager.resources.list - deploymentmanager.typeProviders.get - deploymentmanager.typeProviders.list - deploymentmanager.types.get - deploymentmanager.types.list 	To deploy the Cloud Volumes ONTAP virtual machine instance using Google Cloud Deployment Manager.
<ul style="list-style-type: none"> - logging.logEntries.list - logging.privateLogEntries.list 	To get stack log drives.
<ul style="list-style-type: none"> - resourcemanager.projects.get 	To support multi-projects.
<ul style="list-style-type: none"> - storage.buckets.create - storage.buckets.delete - storage.buckets.get - storage.buckets.list - storage.buckets.update 	To create and manage a Google Cloud Storage bucket for data tiering.
<ul style="list-style-type: none"> - cloudkms.cryptoKeyVersions.useToEncrypt - cloudkms.cryptoKeys.get - cloudkms.cryptoKeys.list - cloudkms.keyRings.list 	To use customer-managed encryption keys from the Cloud Key Management Service with Cloud Volumes ONTAP.
<ul style="list-style-type: none"> - compute.instances.setServiceAccount - iam.serviceAccounts.actAs - iam.serviceAccounts.getIamPolicy - iam.serviceAccounts.list - storage.objects.get - storage.objects.list 	To set a service account on the Cloud Volumes ONTAP instance. This service account provides permissions for data tiering to a Google Cloud Storage bucket.

Actions	Purpose
<ul style="list-style-type: none"> - compute.addresses.list - compute.backendServices.create - compute.networks.updatePolicy - compute.regionBackendServices.create - compute.regionBackendServices.get - compute.regionBackendServices.list 	To deploy HA pairs.
<ul style="list-style-type: none"> - compute.subnetworks.use - compute.subnetworks.useExternallp - compute.instances.addAccessConfig 	To enable Cloud Data Sense.
<ul style="list-style-type: none"> - container.clusters.get - container.clusters.list 	To discover Kubernetes clusters running in Google Kubernetes Engine.

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	<ul style="list-style-type: none"> The permissions found in this .yaml file 	<ul style="list-style-type: none"> compute.networkUser deploymentmanager.editor 	Deploying and maintaining Cloud Volumes ONTAP and services in the service project
Cloud Volumes ONTAP service account	Custom	Service project	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> (Default) Editor 	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> (Default) Editor 	<ul style="list-style-type: none"> compute.networkUser 	Deploys GCP instances and compute infrastructure on behalf of deployment. Allows Cloud Manager to use the shared network.

Notes:

- 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.
- 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.

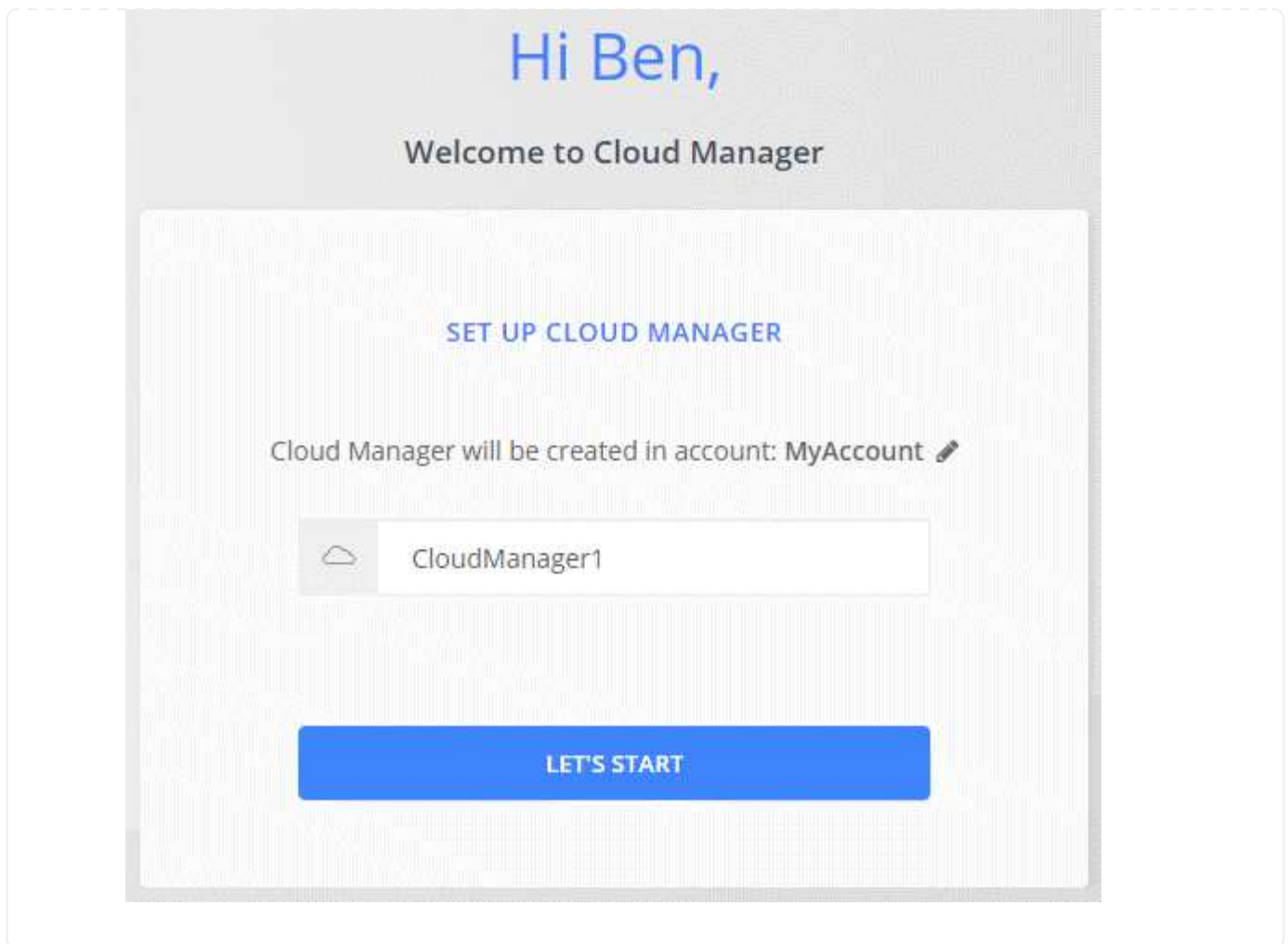
4. Open a web browser from a host that has a connection to the Connector instance and enter the following URL:

`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](#).

Microsoft Azure

Required permissions for the Connector in Azure

Cloud Manager requires permissions to perform actions in your cloud provider. These permissions are included in [the policies provided by NetApp](#). You might want to understand what Cloud Manager does with these permissions.

The Cloud Manager Azure policy includes the permissions that Cloud Manager needs to deploy and manage Cloud Volumes ONTAP in Azure.

Actions	Purpose
"Microsoft.Compute/locations/operations/read", "Microsoft.Compute/locations/vmSizes/read", "Microsoft.Compute/operations/read", "Microsoft.Compute/virtualMachines/instanceView/read", "Microsoft.Compute/virtualMachines/powerOff/action", "Microsoft.Compute/virtualMachines/read", "Microsoft.Compute/virtualMachines/restart/action", "Microsoft.Compute/virtualMachines/start/action", "Microsoft.Compute/virtualMachines/deallocate/action", "Microsoft.Compute/virtualMachines/vmSizes/read", "Microsoft.Compute/virtualMachines/write",	Creates Cloud Volumes ONTAP and stops, starts, deletes, and obtains the status of the system.
"Microsoft.Compute/images/write", "Microsoft.Compute/images/read",	Enables Cloud Volumes ONTAP deployment from a VHD.
"Microsoft.Compute/disks/delete", "Microsoft.Compute/disks/read", "Microsoft.Compute/disks/write", "Microsoft.Storage/checknameavailability/read", "Microsoft.Storage/operations/read", "Microsoft.Storage/storageAccounts/listkeys/action", "Microsoft.Storage/storageAccounts/read", "Microsoft.Storage/storageAccounts/regeneratekey/action", "Microsoft.Storage/storageAccounts/write", "Microsoft.Storage/storageAccounts/delete", "Microsoft.Storage/usages/read",	Manages Azure storage accounts and disks, and attaches the disks to Cloud Volumes ONTAP.
"Microsoft.Storage/storageAccounts/blobServices/containers/read", "Microsoft.KeyVault/vaults/read", "Microsoft.KeyVault/vaults/accessPolicies/write"	Enables backups to Azure Blob storage and encryption of storage accounts
"Microsoft.Network/networkInterfaces/read", "Microsoft.Network/networkInterfaces/write", "Microsoft.Network/networkInterfaces/join/action",	Creates and manages network interfaces for Cloud Volumes ONTAP in the target subnet.
"Microsoft.Network/networkSecurityGroups/read", "Microsoft.Network/networkSecurityGroups/write", "Microsoft.Network/networkSecurityGroups/join/action",	Creates predefined network security groups for Cloud Volumes ONTAP.

Actions	Purpose
"Microsoft.Resources/subscriptions/locations/read", "Microsoft.Network/locations/operationResults/read", "Microsoft.Network/locations/operations/read", "Microsoft.Network/virtualNetworks/read", "Microsoft.Network/virtualNetworks/checkIpAddressAvailability/read", "Microsoft.Network/virtualNetworks/subnets/read", "Microsoft.Network/virtualNetworks/subnets/virtualMachines/read", "Microsoft.Network/virtualNetworks/virtualMachines/read", "Microsoft.Network/virtualNetworks/subnets/join/action",	Gets network information about regions, the target VNet and subnet, and adds Cloud Volumes ONTAP to VNets.
"Microsoft.Network/virtualNetworks/subnets/write", "Microsoft.Network/routeTables/join/action",	Enables VNet service endpoints for data tiering.
"Microsoft.Resources/deployments/operations/read", "Microsoft.Resources/deployments/read", "Microsoft.Resources/deployments/write",	Deploys Cloud Volumes ONTAP from a template.
"Microsoft.Resources/deployments/operations/read", "Microsoft.Resources/deployments/read", "Microsoft.Resources/deployments/write", "Microsoft.Resources/resources/read", "Microsoft.Resources/subscriptions/operationresults/read", "Microsoft.Resources/subscriptions/resourceGroups/delete", "Microsoft.Resources/subscriptions/resourceGroups/read", "Microsoft.Resources/subscriptions/resourcegroups/resources/read", "Microsoft.Resources/subscriptions/resourceGroups/write",	Creates and manages resource groups for Cloud Volumes ONTAP.
"Microsoft.Compute/snapshots/write", "Microsoft.Compute/snapshots/read", "Microsoft.Compute/snapshots/delete", "Microsoft.Compute/disks/beginGetAccess/action",	Creates and manages Azure managed snapshots.
"Microsoft.Compute/availabilitySets/write", "Microsoft.Compute/availabilitySets/read",	Creates and manages availability sets for Cloud Volumes ONTAP.
"Microsoft.MarketplaceOrdering/offertypes/publishers/offers/plans/agreements/read", "Microsoft.MarketplaceOrdering/offertypes/publishers/offers/plans/agreements/write",	Enables programmatic deployments from the Azure Marketplace.

Actions	Purpose
"Microsoft.Network/loadBalancers/read", "Microsoft.Network/loadBalancers/write", "Microsoft.Network/loadBalancers/delete", "Microsoft.Network/loadBalancers/backendAddressPools/read", "Microsoft.Network/loadBalancers/backendAddressPools/join/action", "Microsoft.Network/loadBalancers/frontendIPConfigurations/read", "Microsoft.Network/loadBalancers/loadBalancingRules/read", "Microsoft.Network/loadBalancers/probes/read", "Microsoft.Network/loadBalancers/probes/join/action",	Manages an Azure load balancer for HA pairs.
"Microsoft.Authorization/locks/*",	Enables management of locks on Azure disks.
"Microsoft.Authorization/roleDefinitions/write", "Microsoft.Authorization/roleAssignments/write", "Microsoft.Web/sites/*"	Manages failover for HA pairs.
"Microsoft.Network/privateEndpoints/write", "Microsoft.Storage/storageAccounts/PrivateEndpointConnectionsApproval/action", "Microsoft.Storage/storageAccounts/privateEndpointConnections/read", "Microsoft.Network/privateEndpoints/read", "Microsoft.Network/privateDnsZones/write", "Microsoft.Network/privateDnsZones/virtualNetworkLinks/write", "Microsoft.Network/virtualNetworks/join/action", "Microsoft.Network/privateDnsZones/A/write", "Microsoft.Network/privateDnsZones/read", "Microsoft.Network/privateDnsZones/virtualNetworkLinks/read",	Enables the management of private endpoints. Private endpoints are used when connectivity isn't provided to outside the subnet. Cloud Manager creates the storage account for HA with only internal connectivity within the subnet.
"Microsoft.NetApp/netAppAccounts/capacityPools/volumes/delete",	Enables Cloud Manager to delete volumes for Azure NetApp Files.
"Microsoft.Resources/deployments/operationStatuses/read"	Azure requires this permission for some virtual machine deployments (it depends on the underlying physical hardware that's used during deployment).
"Microsoft.Resources/deployments/operationStatuses/read", "Microsoft.Insights/Metrics/Read", "Microsoft.Compute/virtualMachines/extensions/write", "Microsoft.Compute/virtualMachines/extensions/read", "Microsoft.Compute/virtualMachines/extensions/delete", "Microsoft.Compute/virtualMachines/delete", "Microsoft.Network/networkInterfaces/delete", "Microsoft.Network/networkSecurityGroups/delete", "Microsoft.Resources/deployments/delete",	Enables you to use Global File Cache.

Actions	Purpose
"Microsoft.Network/privateEndpoints/delete", "Microsoft.Compute/availabilitySets/delete",	Enables Cloud Manager to remove resources from a resource group that belong to Cloud Volumes ONTAP in case of deployment failure or deletion.
"Microsoft.Compute/diskEncryptionSets/read", "Microsoft.Compute/diskEncryptionSets/write", "Microsoft.Compute/diskEncryptionSets/delete", "Microsoft.KeyVault/vaults/deploy/action", "Microsoft.KeyVault/vaults/read", "Microsoft.KeyVault/vaults/accessPolicies/write",	Enables use of customer-managed encryption keys with Cloud Volumes ONTAP. This feature is supported using APIs.
"Microsoft.Resources/tags/read", "Microsoft.Resources/tags/write", "Microsoft.Resources/tags/delete"	Enables you to manage tags on your Azure resources using the Cloud Manager Tagging service.
"Microsoft.Network/applicationSecurityGroups/write", "Microsoft.Network/applicationSecurityGroups/read", "Microsoft.Network/applicationSecurityGroups/joinIpConfiguration/action", "Microsoft.Network/networkSecurityGroups/securityRules/write", "Microsoft.Network/applicationSecurityGroups/delete", "Microsoft.Network/networkSecurityGroups/securityRules/delete"	Enables Cloud Manager to configure an application security group for an HA pair, which isolates the HA interconnect and cluster network NICs.

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.

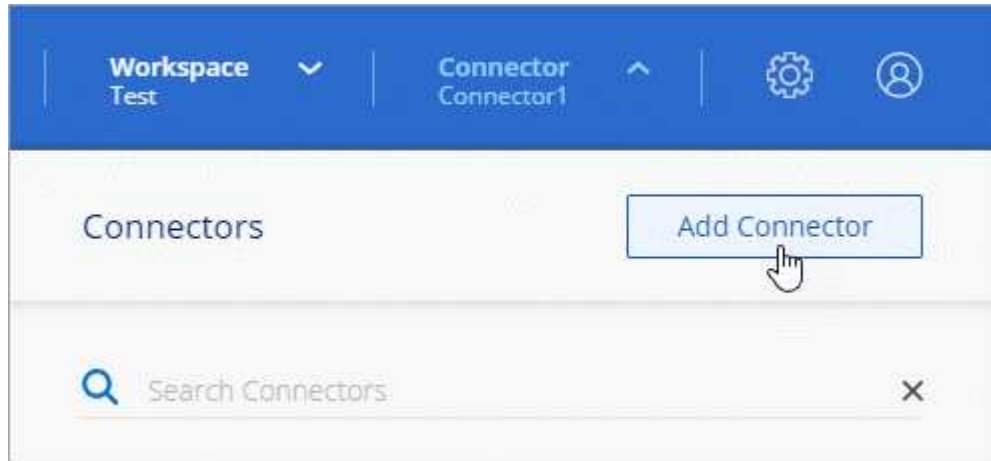
What you'll need

- 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 your 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

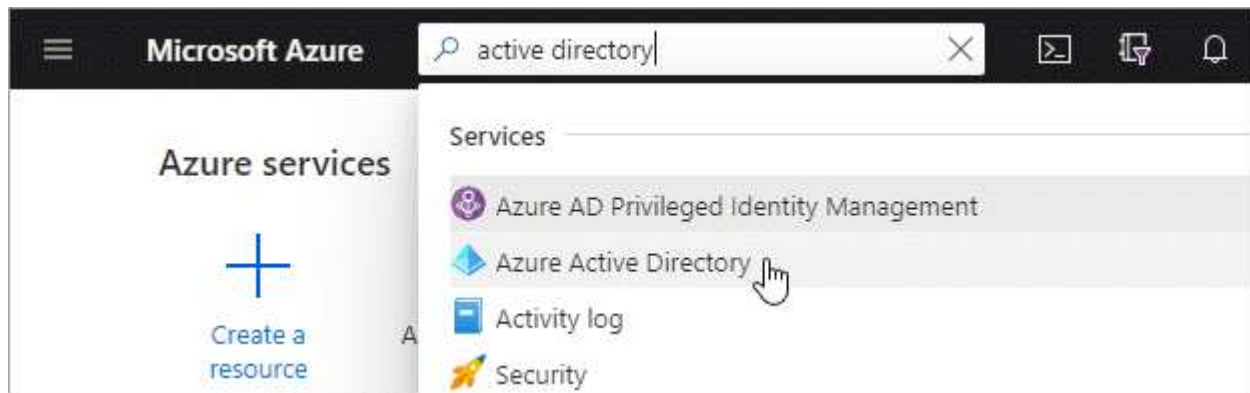
Create an Azure Active Directory (AD) application and service principal that Cloud Manager can use to deploy the Connector.

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.

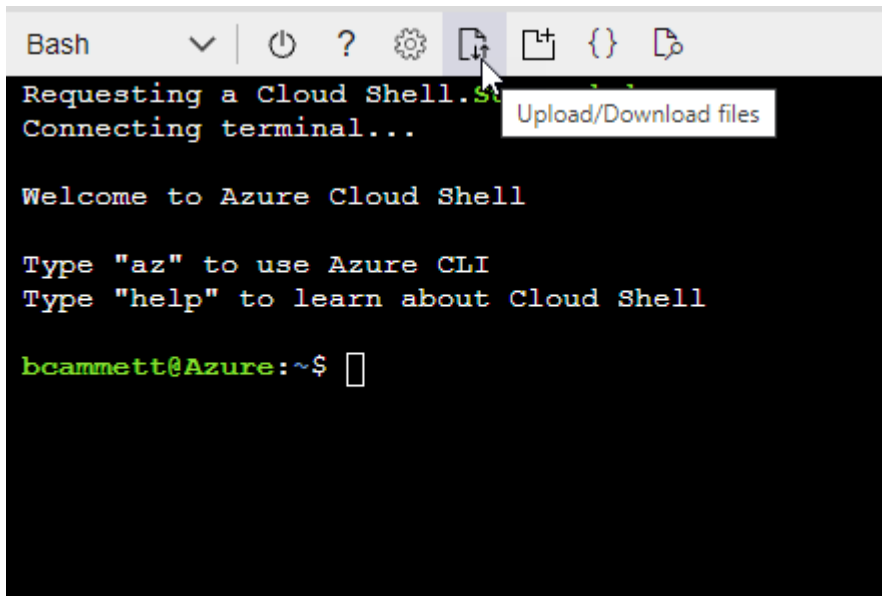
Example

```
"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 **Cloud Manager Operator** role and click **Next**.
 - e. In the **Members** tab, complete the following steps:
 - Keep **User, group, or service principal** selected.
 - Click **Select members**.

Add role assignment ...

[Got feedback?](#)

Role **Members** Review + assign

Selected role Cloud Manager Operator 3.9.12_B

Assign access to ☒ User, group, or service principal
☐ Managed identity

Members [+ Select members](#)

- Search for the name of the application.

Here's an example:

Select members ✕

Select ⓘ

test-service-principal

test-service-principal

- 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**.

Request API permissions

Select an API

[Microsoft APIs](#) [APIs my organization uses](#) [My APIs](#)

Commonly used Microsoft APIs

Microsoft Graph
Take advantage of the tremendous amount of data in Office 365, Enterprise Mobility + Security, and Windows 10. Access Azure AD, Excel, Intune, Outlook/Exchange, OneDrive, OneNote, SharePoint, Planner, and more through a single endpoint.



**Azure Batch**
Schedule large-scale parallel and HPC applications in the cloud

**Azure Data Catalog**
Programmatic access to Data Catalog resources to register, annotate and search data assets

**Azure Data Explorer**
Perform ad-hoc queries on terabytes of data to build near real-time and complex analytics solutions

**Azure Data Lake**
Access to storage and compute for big data analytic scenarios

**Azure DevOps**
Integrate with Azure DevOps and Azure DevOps server

**Azure Import/Export**
Programmatic control of import/export jobs

**Azure Key Vault**
Manage your key vaults as well as the keys, secrets, and certificates within your Key Vaults

**Azure Rights Management Services**
Allow validated users to read and write protected content

**Azure Service Management**
Programmatic access to much of the functionality available through the Azure portal

**Azure Storage**
Secure, massively scalable object and data lake storage for unstructured and semi-structured data

**Customer Insights**
Create profile and interaction models for your products

**Data Export Service for Microsoft Dynamics 365**
Export data from Microsoft Dynamics CRM organization to an external destination

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

Request API permissions

[← All APIs](#)



Azure Service Management

<https://management.azure.com/> [Docs](#)

What type of permissions does your application require?

Delegated permissions

Your application needs to access the API as the signed-in user.

Application permissions

Your application runs as a background service or daemon without a signed-in user.

Select permissions

[expand all](#)

Type to search	
PERMISSION	ADMIN CONSENT REQUIRED
<input checked="" type="checkbox"/> user_impersonation Access Azure Service Management as organization users (preview) ⓘ	-

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.

Client secrets

A secret string that the application uses to prove its identity when requesting a token. Also can be referred to as application password.

+ New client secret		
DESCRIPTION	EXPIRES	VALUE
test secret	8/16/2020	*sZ1jSe2By:D*-ZRoV4NLfdAcY7:+0vA

Copy to clipboard

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.

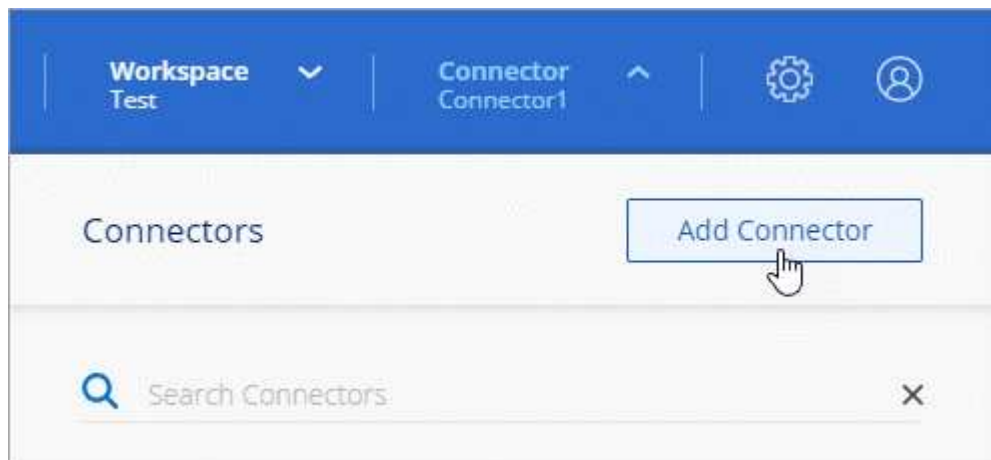
What you'll need

- 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 from the Azure Marketplace

It's best to create a Connector directly from Cloud Manager, but you can launch a Connector from the Azure Marketplace, if you prefer. After you create and set up the Connector, Cloud Manager will automatically use it when you create new working environments.

Creating a Connector in Azure

Deploy the Connector in Azure using the image in the Azure Marketplace and then log in to the Connector to specify your NetApp account.

Steps

1. [Go to the Azure Marketplace page for Cloud Manager.](#)
2. Click **Get it now** and then click **Continue**.
3. From the Azure portal, click **Create** and follow the steps to configure the virtual machine.

Note the following as you configure the VM:

- Cloud Manager can perform optimally with either HDD or SSD disks.
- Choose a VM size that meets CPU and RAM requirements. We recommend DS3 v2.

[Review the VM requirements.](#)

- For the network security group, the Connector requires inbound connections using SSH, HTTP, and HTTPS.

[Learn more about security group rules for the Connector.](#)

- Under **Management**, enable **System assigned managed identity** for the Connector by selecting **On**.

This setting is important because a managed identity allows the Connector virtual machine to identify itself to Azure Active Directory without providing any credentials. [Learn more about managed identities for Azure resources.](#)

4. On the **Review + create** page, review your selections and click **Create** to start the deployment.

Azure deploys the virtual machine with the specified settings. The virtual machine and Connector software should be running in approximately five minutes.

5. Open a web browser from a host that has a connection to the Connector virtual machine and enter the following URL:

`http://ipaddress:80`

6. 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. You must grant Azure permissions before users can deploy Cloud Volumes ONTAP in Azure.

Granting Azure permissions

When you deployed the Connector in Azure, you should have enabled a [system-assigned managed identity](#). You must now grant the required Azure permissions by creating a custom role and then by assigning the role to the Connector virtual machine for one or more subscriptions.

Steps

1. Create a custom role using the Cloud Manager policy:
 - a. Download the [Cloud Manager Azure policy](#).
 - b. Modify the JSON file by adding Azure subscription IDs to the assignable scope.

You should add the ID for each Azure subscription from which users will create Cloud Volumes ONTAP systems.

Example

```
"AssignableScopes": [  
  "/subscriptions/d333af45-0d07-4154-943d-c25fbzzzzzzz",  
  "/subscriptions/54b91999-b3e6-4599-908e-416e0zzzzzzz",  
  "/subscriptions/398e471c-3b42-4ae7-9b59-ce5bbzzzzzzz"
```


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

The following example shows how to create a custom role using the Azure CLI 2.0:

```
az role definition create --role-definition
C:\Policy_for_cloud_Manager_Azure_3.9.8.json
```

You should now have a custom role called Cloud Manager Operator that you can assign to the Connector virtual machine.

2. Assign the role to the Connector virtual machine for one or more subscriptions:

- a. Open the **Subscriptions** service and then select the subscription in which you want to deploy Cloud Volumes ONTAP systems.
- b. Click **Access control (IAM) > Add > Add role assignment**.
- c. In the **Role** tab, select the **Cloud Manager Operator** role and click **Next**.



Cloud Manager Operator is the default name provided in the [Cloud Manager policy](#). If you chose a different name for the role, then select that name instead.

- d. In the **Members** tab, complete the following steps:
 - Assign access to a **Managed identity**.
 - Click **Select members**, select the subscription in which the Connector virtual machine was created, choose **Virtual machine**, and then select the Connector virtual machine.
 - Click **Select**.
 - Click **Next**.
- e. Click **Review + assign**.
- f. If you want to deploy Cloud Volumes ONTAP from additional subscriptions, switch to that subscription and then repeat these steps.

Result

The Connector now has the permissions that it needs to manage resources and processes within your public cloud environment. 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](#).

Installation on your own host

Install the Connector on an existing Linux host that has internet access

The most common way to create a Connector is directly from Cloud Manager or from a cloud provider's marketplace. But you have the option to download and install the Connector software on an existing Linux host in your network or in the cloud. These steps are specific to hosts that have internet access.

[Learn about other ways to deploy a Connector.](#)



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.

Verify host requirements

The Connector software must run on a host that meets specific operating system requirements, RAM requirements, port requirements, and so on.

A dedicated host is required

The Connector is not supported on a host that is shared with other applications. The host must be a dedicated host.

CPU

4 cores or 4 vCPUs

RAM

16 GB

AWS EC2 instance type

An instance type that meets the CPU and RAM requirements above. We recommend t3.xlarge and use that instance type when you deploy the Connector directly from Cloud Manager.

Azure VM size

An instance type that meets the CPU and RAM requirements above. We recommend DS3 v2 and use that VM size when you deploy the Connector directly from Cloud Manager.

GCP machine type

An instance type that meets the CPU and RAM requirements above. We recommend n1-standard-4 and use that machine type when you deploy the Connector directly from Cloud Manager.

Supported operating systems

- CentOS 7.6
- CentOS 7.7
- CentOS 7.8
- CentOS 7.9
- Red Hat Enterprise Linux 7.6
- Red Hat Enterprise Linux 7.7
- Red Hat Enterprise Linux 7.8
- Red Hat Enterprise Linux 7.9

The Red Hat Enterprise Linux system must be registered with Red Hat Subscription Management. If it is not registered, the system cannot access repositories to update required 3rd party software during Connector installation.

The Connector is supported on English-language versions of these operating systems.

Hypervisor

A bare metal or hosted hypervisor that is certified to run CentOS or Red Hat Enterprise Linux
[Red Hat Solution: Which hypervisors are certified to run Red Hat Enterprise Linux?](#)

Disk space in /opt

100 GiB of space must be available

Disk space in /var

20 GiB of space must be available

Outbound internet access

Outbound internet access is required to install the Connector and for the Connector to manage resources and processes within your public cloud environment. For a list of endpoints, see [Networking requirements for the Connector](#).

Install the Connector

After you verify that you have a supported Linux host, you can obtain the Connector software and then install it.

Required privileges

Root privileges are required to install the Connector.

About this task

- The installation installs the AWS command line tools (awscli) to enable recovery procedures from NetApp support.

If you receive a message that installing the awscli failed, you can safely ignore the message. The Connector can operate successfully without the tools.

- The installer that is available on the NetApp Support Site might be an earlier version. After installation, the Connector automatically updates itself if a new version is available.

Steps

1. Download the Cloud Manager software from the [NetApp Support Site](#), and then copy it to the Linux host.

For help with connecting and copying the file to an EC2 instance in AWS, see [AWS Documentation: Connecting to Your Linux Instance Using SSH](#).

2. Assign permissions to run the script.

```
chmod +x OnCommandCloudManager-V3.9.14.sh
```

3. Run the installation script.

If you have a proxy server, you will need to enter the command parameters as shown below. The installer doesn't prompt you to provide information about a proxy.

```
./OnCommandCloudManager-V3.9.14.sh [silent] [proxy=ipaddress]  
[proxyport=port] [proxyuser=user_name] [proxypwd=password]
```

silent runs the installation without prompting you for information.

proxy is required if the host is behind a proxy server.

proxyport is the port for the proxy server.

proxyuser is the user name for the proxy server, if basic authentication is required.

proxypwd is the password for the user name that you specified.

4. Unless you specified the silent parameter, enter **Y** to continue with the installation.

Cloud Manager is now installed. At the end of the installation, the Cloud Manager service (occm) restarts twice if you specified a proxy server.

5. Open a web browser and enter the following URL:

`https://ipaddress`

ipaddress can be localhost, a private IP address, or a public IP address, depending on the configuration of the host. For example, if the Connector is in the public cloud without a public IP address, you must enter a private IP address from a host that has a connection to the Connector host.

6. Sign up at NetApp Cloud Central or log in.
7. If you installed the Connector in Google Cloud, set up a service account that has the permissions that Cloud Manager needs to create and manage Cloud Volumes ONTAP systems in projects.
 - a. [Create a role in GCP](#) that includes the permissions defined in the [Cloud Manager policy for GCP](#).
 - b. [Create a GCP service account and apply the custom role that you just created](#).
 - c. [Associate this service account with the Connector VM](#).
 - d. 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.
8. After you log in, set up Cloud Manager:
 - 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.

After you finish

Set up permissions so Cloud Manager can manage resources and processes within your public cloud environment:

- AWS: [Set up an AWS account and then add it to Cloud Manager](#)
- Azure: [Set up an Azure account and then add it to Cloud Manager](#)
- Google Cloud: See step 7 above

Install the Connector on-prem without internet access

You can install the Connector on an on-premises Linux host that doesn't have internet access. You can then discover on-prem ONTAP clusters, replicate data between them, and scan the data with Cloud Data Sense.

These installation instructions are specifically for the use case described above. [Learn about other ways to deploy a Connector.](#)

Verify host requirements

The Connector software must run on a host that meets specific operating system requirements, RAM requirements, port requirements, and so on.

A dedicated host is required

The Connector is not supported on a host that is shared with other applications. The host must be a dedicated host.

CPU

4 cores or 4 vCPUs

RAM

16 GB

Supported operating systems

- CentOS 7.6
- CentOS 7.7
- CentOS 7.8
- CentOS 7.9
- Red Hat Enterprise Linux 7.6
- Red Hat Enterprise Linux 7.7
- Red Hat Enterprise Linux 7.8
- Red Hat Enterprise Linux 7.9

The Red Hat Enterprise Linux system must be registered with Red Hat Subscription Management. If it is not registered, the system cannot access repositories to update required 3rd party software during Connector installation.

The Connector is supported on English-language versions of these operating systems.

Hypervisor

A bare metal or hosted hypervisor that is certified to run CentOS or Red Hat Enterprise Linux
[Red Hat Solution: Which hypervisors are certified to run Red Hat Enterprise Linux?](#)

Disk type

An SSD is required

Disk space in /opt

100 GiB of space must be available

Disk space in /var

20 GiB of space must be available

Docker Engine

Docker Engine version 19 or later is required on the host before you install the Connector. [View installation instructions.](#)

Install the Connector

After you verify that you have a supported Linux host, you can obtain the Connector software and then install it.

Required privileges

Root privileges are required to install the Connector.

Steps

1. Verify that docker is enabled and running.

```
sudo systemctl enable docker && sudo systemctl start docker
```

2. Download the Cloud Manager software from the [NetApp Support Site](#).
3. Copy the installer to the Linux host.
4. Assign permissions to run the script.

```
chmod +x /path/cloud-manager-connector-offline-v3.9.14
```

5. Run the installation script:

```
sudo /path/cloud-manager-connector-offline-v3.9.14
```

6. Open a web browser and enter `https://ipaddress` where *ipaddress* is the IP address of the Linux host.

You should see the following screen.



7. Click **Set Up New Cloud Manager** and follow the prompts to set up the system.
 - **System Details:** Enter a name for the Cloud Manager system and your company name.



1 System Details 2 Create Admin User 3 Review

System Details

To help us provide better support, enter a name for Cloud Manager and your company name.

Cloud Manager Name

Company Name

- **Create Admin User:** Create the admin user for the system.

This user account runs locally on the system. There's no connection to NetApp Cloud Central.

- **Review:** Review the details, accept the license agreement, and then click **Set Up**.

8. Log in to Cloud Manager using the admin user that you just created.

Result

The Connector is now installed and you can start using the Cloud Manager features that are available in a dark site deployment.

What's next?

- [Discover on-prem ONTAP clusters](#)
- [Replicate data between on-prem ONTAP clusters](#)
- [Scan volume data using Cloud Data Sense](#)

When new versions of the Connector software are available, they'll be posted to the NetApp Support Site. [Learn how to upgrade the Connector.](#)

Where to go next

Now that you've logged in and set up Cloud Manager, users can start creating and discovering working environments.

- [Get started with Cloud Volumes ONTAP for AWS](#)
- [Get started with Cloud Volumes ONTAP for Azure](#)
- [Get started with Cloud Volumes ONTAP for Google Cloud](#)
- [Set up Azure NetApp Files](#)
- [Set up Amazon FSx for ONTAP](#)
- [Set up Cloud Volumes Service for AWS](#)
- [Discover an on-premises ONTAP cluster](#)
- [Discover your Amazon S3 buckets](#)

If you're an administrator, you can manage Cloud Manager settings after you create your first Connector.

- [Learn about Connectors](#)
- [Manage an HTTPS certificate for secure access](#)
- [Configure proxy settings](#)

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