



Cloud Manager documentation

Cloud Manager

NetApp
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Table of Contents

Cloud Manager documentation	1
Release notes	2
Cloud Manager	2
Important changes in Cloud Manager	62
Cloud Volumes ONTAP AMI change	62
SaaS changes	62
Machine type changes	62
Account settings	62
New permissions	63
Get started with Cloud Manager	68
Learn about Cloud Manager	68
Getting started checklist	69
Signing up to NetApp Cloud Central	73
Logging in to Cloud Manager	74
Set up a NetApp account	75
Set up a Connector	85
Where to go next	127
Manage Cloud Volumes ONTAP	129
Learn	129
Get started in AWS	167
Get started in Azure	218
Get started in GCP	239
Provision and manage storage	274
Manage storage VMs	304
Monitor performance	317
Optimize your Cloud Volumes ONTAP systems using Active IQ Digital Advisor	324
Improving protection against ransomware	326
Administer	327
Provision volumes using a file service	358
Azure NetApp Files	358
Amazon FSx for ONTAP	370
Cloud Volumes Service for AWS	394
Cloud Volumes Service for GCP	416
Manage on-prem ONTAP clusters	432
Discovering on-premises ONTAP clusters	432
Managing storage for on-prem ONTAP clusters	437
Optimize your clusters using Active IQ Digital Advisor	441
Using Active IQ data to manage ONTAP clusters	442
Connecting to on-premises ONTAP systems	447
Remove an on-prem ONTAP working environment	448
Manage data for Kubernetes clusters	450
Kubernetes overview	450
Get started with Kubernetes clusters in AWS	451

Get started with Kubernetes clusters in Azure	459
Get started with Kubernetes clusters in Google Cloud	466
Use NetApp's cloud data services with Kubernetes clusters	474
Replicate ONTAP data	475
Learn about the Replication service	475
Replicating data between systems	476
Managing data replication schedules and relationships	479
Learn about replication policies	480
Use templates to standardize resource creation	484
Learn about Application Templates	484
Template building blocks	486
Build application templates for your organization	489
Check resources for template compliance	516
Create or modify resources using templates	521
Back up data to the cloud	527
Learn about Cloud Backup	527
Back up Cloud Volumes ONTAP data	535
Back up on-premises ONTAP data	555
Back up Kubernetes cluster data	587
Set up licensing for Cloud Backup	603
Managing backups for your ONTAP and Kubernetes systems	607
Restoring data from backup files	621
Reference	631
Protect data using SnapCenter Service	649
Learn about SnapCenter Service	649
Get started	651
Prerequisites to create Connector and enable SnapCenter Service	652
Create a Connector in Azure for SnapCenter Service	655
Enable SnapCenter Service for Azure NetApp Files	656
Install the HDBSQL client	660
Protect SAP HANA systems	661
Manage operations	664
Troubleshoot issues	665
Copy and synchronize data	668
Cloud Sync overview	668
Get started	671
Tutorials	711
Managing sync relationships	722
Manage data broker groups	726
Creating and viewing reports to tune your configuration	732
Uninstalling the data broker	734
Cloud Sync APIs	734
Cloud Sync technical FAQ	738
Gain insight into data privacy	746
Learn about Cloud Data Sense	746

Get started	752
Integrate your Active Directory with Cloud Data Sense	812
Set up licensing for Cloud Data Sense	814
Viewing governance details about the data stored in your organization	821
Viewing compliance details about the data stored in your organization	825
Organizing your private data	836
Managing your private data	852
Adding personal data identifiers using Data Fusion	863
Viewing compliance reports	865
Responding to a Data Subject Access Request	871
Categories of private data	873
Removing data sources from Cloud Data Sense	879
Frequently asked questions about Cloud Data Sense	882
Secure your data from ransomware and internal attacks	887
Learn about Ransomware Protection	887
Managing cyber security recommendations for your data sources	888
Tier on-premises data to the cloud	895
Learn about Cloud Tiering	895
Get started	900
Set up licensing for Cloud Tiering	928
Measure network latency and throughput performance	933
Managing data tiering from your clusters	934
Get an overview of data tiering from your clusters	942
Cloud Tiering technical FAQ	943
Reference	946
Organize your resources using tags	950
Learn about tagging	950
Manage tags for your resources	953
Enable real-time global file sharing	957
Learn about Global File Cache	957
Before you begin to deploy Global File Cache	962
Getting started	966
Before you begin to deploy Global File Cache Edge instances	977
Deploy Global File Cache Edge instances	983
End-user training	986
Additional information	986
Optimize cloud compute costs	988
Learn about the Compute service	988
Start optimizing your cloud compute costs	989
Viewing your Amazon S3 buckets	992
Administer Cloud Manager	994
Manage Connectors	994
Manage cloud provider credentials	1002
Add and manage NetApp Support Site accounts in Cloud Manager	1034
Managing your account	1040

Monitoring operations in your account	1049
Managing an HTTPS certificate for secure access	1052
Removing Cloud Volumes ONTAP working environments	1053
Configuring a Connector to use an HTTP proxy server	1054
Reference	1056
Automate with the REST API	1067
Automation using the Cloud Manager REST API platform	1067
Automation resources for infrastructure as code	1067
Where to get help and find more information	1068
Earlier versions of Cloud Manager documentation	1070
Legal notices	1071
Copyright	1071
Trademarks	1071
Patents	1071
Privacy policy	1071
Open source	1071

Cloud Manager documentation

Release notes

Cloud Manager

What's new in Cloud Manager 3.9

Cloud Manager typically introduces a new release every month to bring you new features, enhancements, and bug fixes.



Looking for a previous release?

[What's new in 3.8](#)

[What's new in 3.7](#)

Cloud Manager 3.9.16 update (03 Mar 2022)

Cloud Backup enhancements

- Now you can back up persistent volumes from your Google GKE Kubernetes clusters to Google Cloud storage.

If your GKE cluster has NetApp Astra Trident installed, and it is using Cloud Volumes ONTAP for GCP as backend storage for the cluster, then you can back up and restore your persistent volumes to and from Google Cloud storage. [Go here for details](#).

- The capability to use Cloud Data Sense to scan your backup files has been removed in this release.

Application Template enhancements

- Now you can build a Template to find specific working environments.

Using the "Find Existing Resources" action you can identify the working environment, and then use other template actions, such as creating a volume, to easily perform actions on existing working environments.

- The existing support for creating a Cloud Volumes ONTAP working environment in AWS has been expanded to include creating a high-availability system in addition to a single-node system. [See how to create a template for a Cloud Volumes ONTAP working environment](#).

Cloud Manager 3.9.16 (27 Feb 2022)

This update includes enhancements to several features and services.

Cloud Volumes ONTAP enhancement

The create new volume wizard that we recently introduced is now available when creating a volume on a specific aggregate from the **Advanced allocation** option.

[Learn how to create volumes on a specific aggregate](#).

Kubernetes enhancement

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

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

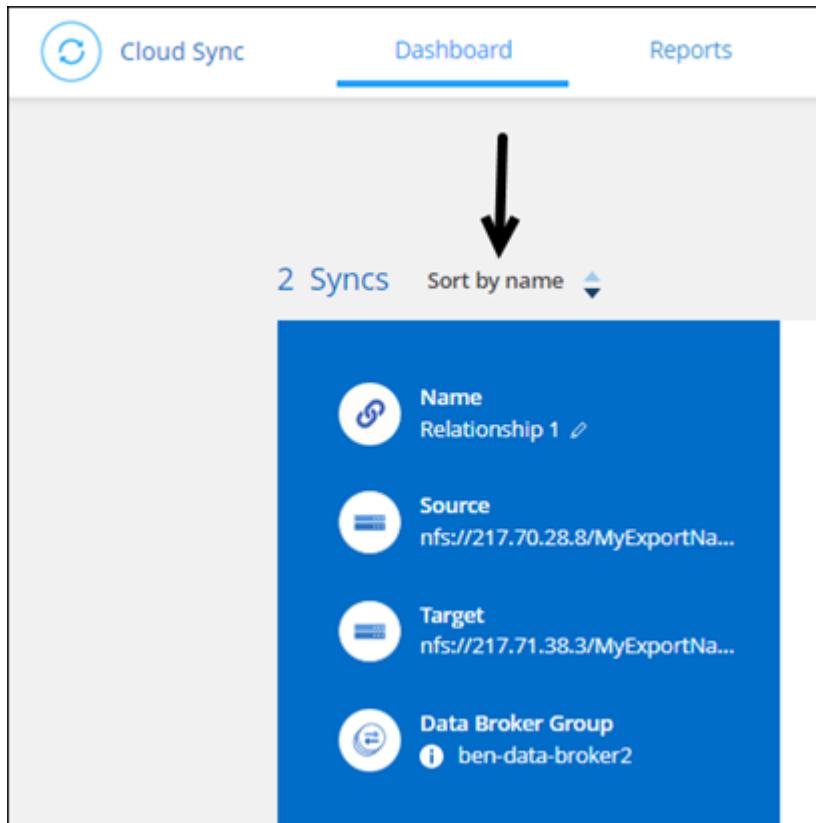
Amazon FSx for ONTAP enhancement

When you create an FSx for ONTAP working environment, you now must provide the ARN of an IAM role that Cloud Manager can assume to create an FSx for ONTAP working environment. You previously needed to provide AWS access keys.

[Learn how to set up permissions for FSx for ONTAP.](#)

Cloud Sync enhancements

- You now sort the dashboard by sync relationship name.



- In the previous release, we introduced Cloud Sync integration with Cloud Data Sense. In this update, we enhanced the integration by making it easier to create the sync relationship. After you initiate a data sync from Cloud Data Sense, all of the source information is contained in a single step and only requires you to enter a few key details.

Connector enhancement

When you create a new Connector in Google Cloud, Cloud Manager will now display all of your existing firewall policies. Previously, Cloud Manager wouldn't display any policies that didn't have a target tag.

[Learn how to create a Connector in Google Cloud.](#)

Digital Wallet enhancement

- A new "On-Premises ONTAP" tab is available so you can view an inventory of your on-prem ONTAP clusters along with their hardware and service contracts expiration dates. Additional details about the clusters are also available.

[See how to view this important on-prem cluster information.](#) You'll need to have a NetApp Support Site account (NSS) for the clusters, and the NSS credentials will need to be attached to your Cloud Manager account.

Cloud Manager 3.9.15 update (14 Feb 2022)

Cloud Backup enhancements

- Now you can assign backup policies for individual volumes in a single cluster.

In the past you could assign only a single backup policy to all volumes in a cluster. Now you can create multiple backup policies for a single cluster and apply different policies to different volumes. [See how to create new backup policies for a cluster and assign them to selected volumes.](#)

- A new option enables you to automatically apply a default backup policy to newly created volumes.

In the past, new volumes created in a working environment after Cloud Backup was activated required that you manually apply a backup policy. Now, regardless of if the volume was created in Cloud Manager, System Manager, the CLI, or by using APIs, Cloud Backup will discover the volume and apply the backup policy you have chosen as the default policy.

This option is available when enabling backup in a new working environment, or from the *Manage Volumes* page for existing working environments.

- New Job Monitor is available so you can see the in-process status of all backup and restore jobs.

The Job Monitor can be very helpful when you have initiated an operation against multiple volumes, like changing the backup policy, or deleting backups, so you can see when the operation has completed on all volumes. [See how to use the Job Monitor](#).

Cloud Manager 3.9.15 build 2 (10 Feb 2022)

We updated the URL for AWS Marketplace listings.

Cloud Manager 3.9.15 update (9 Feb 2022)

This update includes enhancements to several features and services.

Cloud provider marketplace changes for Cloud Volumes ONTAP

- The Essentials package and Professional package are now available in the AWS and Google Cloud Marketplaces.

These by-capacity charging methods enable you to pay by the hour or to purchase an annual contract directly from your cloud provider. You still have the option to purchase a by-capacity license directly from NetApp.

If you have an existing subscription in a cloud marketplace, you're automatically subscribed to these new offerings as well. You can choose by-capacity charging when you deploy a new Cloud Volumes ONTAP working environment.

If you're a new customer, Cloud Manager will prompt you to subscribe when you create a new working environment.

- By-node licensing via the AWS and Google Cloud Marketplaces is deprecated and no longer available for new subscribers. This includes annual contracts and hourly subscriptions (Explore, Standard, and Premium).

This charging method is still available for existing customers who have an active subscription.

[Learn more about the licensing options for Cloud Volumes ONTAP](#).

Cloud Data Sense enhancements

- Added support for scanning Microsoft SharePoint online accounts.

Now you can add your SharePoint online accounts to Data Sense in order to scan the documents and files from your SharePoint sites. [See how to scan your SharePoint accounts](#).

- You can use Data Sense to copy files from a single source repository (ONTAP volume, S3 bucket, NFS share, etc.) to a target location and synchronize those files.

This is helpful for situations where you're migrating data and you want to catch any last changes that are made to the files. This action uses the [NetApp Cloud Sync](#) functionality to copy and sync data from a source to a target.

[See how to copy and sync files](#).

- German and Spanish are now supported when searching for names of data subjects in order to create Data Subject Access Request (DSAR) reports. This report is designed to aid in your organization's requirement to comply with GDPR or similar data privacy laws.
- New personal data types. Data Sense can now find French social security numbers, French IDs, and French driver license numbers in files. [See the list of all personal data types that Data Sense finds in scans.](#)
- The security group for the Cloud Manager Connector will use port 443 instead of port 80 for inbound and outbound traffic to and from the Data Sense instance for added security. Both ports remain open at this time, so you shouldn't see any issues, but you should update the security group in any older deployments of the Connector as port 80 will be deprecated in a future release.

New Ransomware Protection service has been released for Beta

- The new Ransomware Protection service enables you to view relevant information about cybersecurity and assess how resilient your data is to a cyber attack. It also provides you with a list of alerts and remediations for making your data more secure.

[Learn more about this new service.](#)

Resource Tagging enhancements

- Now you can build a Template to find specific existing volumes and then enable Cloud Backup.

Using the new "Find Resource" action you can identify all the volumes on which you want to enable Cloud Backup, and then use the Cloud Backup action to enable backup on those volumes.

Current support is for volumes on Cloud Volumes ONTAP and on-premises ONTAP systems. [Go here for details.](#)

Cloud Manager 3.9.15 update (6 Feb 2022)

This update includes enhancements to several features and services.

Cloud Volumes ONTAP

If you have an unassigned node-based license for Cloud Volumes ONTAP that you haven't used, you can now exchange the license by converting it to a Cloud Backup license, Cloud Data Sense license, or Cloud Tiering license.

This action revokes the Cloud Volumes ONTAP license and creates a dollar-equivalent license for the service with the same expiry date.

[Learn how to exchange unassigned node-based licenses.](#)

Cloud Sync

- We changed how you interact with data brokers by emphasizing data broker *groups*.

For example, when you create a new sync relationship, you select the data broker *group* to use with the relationship, rather than a specific data broker.

The screenshot shows a user interface for selecting a Data Broker Group. At the top, there are four tabs: 'Sync Relationship' (with a circular icon), 'SMB Server' (with a checkmark icon), 'Data Broker Group' (with a blue circle icon containing a number 2), 'Shares' (with a blue circle icon containing a number 3), and 'Target SMB Server' (with a blue circle icon containing a number 4). A right-pointing arrow is also present. Below the tabs, a button labeled 'How does it work?' is visible. The main area is titled 'Select a Data Broker Group' and shows '1 Data Broker Group'. A box labeled 'group1' contains the following information: '1 Data Brokers', '928.43 B/s Transfer Rate', '0 Relationships', and '1 Active Data Brokers Status' (indicated by a green checkmark). A blue plus sign button is located in the top right corner.

In the **Manage Data Brokers** tab, we also show the number of sync relationships that a data broker group is managing.

The screenshot shows the 'Manage Data Brokers' tab. At the top, there are tabs for 'Licensing' (blue) and 'Manage Data Brokers' (blue, underlined). A green 'Free Trial' button is on the right. Below, '1 Data Broker Group' is listed. The group 'group1' has the following details: '1 Data Brokers', '187.77 B/s Transfer Rate', '1 Relationships' (with a black arrow pointing to this value), and '1 Active Data Brokers Status' (green checkmark). On the right side of the group card, there are three icons: a gear, a right-pointing arrow, and a circle with a dot.

- You can now download a PDF of a report.

[Learn about reports.](#)

Cloud Manager 3.9.15 (30 Jan 2022)

This update includes enhancements to several features and services.

Cloud Volumes ONTAP

- We redesigned the licensing selection screen when creating a new Cloud Volumes ONTAP working environment. The changes highlight the by-capacity charging methods that were introduced in July 2021 and support upcoming offerings through the cloud provider marketplaces.
- We updated the **Digital Wallet** by consolidating Cloud Volumes ONTAP licenses in a single tab.
- 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.

[Learn more about NetApp accounts.](#)

NetApp Support Site accounts

As a reminder, NetApp now uses Microsoft Azure Active Directory as the identity provider for authentication services specific to support and licensing. As a result of this update, Cloud Manager will prompt you to update the NetApp Support Site (NSS) credentials for any existing accounts that you previously added.

If you haven't yet migrated your NSS account to IDaaS, you first need to migrate the account and then update your credentials in Cloud Manager.

- [Learn more about NetApp's use of Microsoft Azure AD for identity management.](#)
- [Learn how to update an NSS account to the new authentication method.](#)

Cloud Manager 3.9.14 (2 Jan 2022)

This update includes enhancements to several features and services.

Cloud Volumes ONTAP enhancements

- Cloud Volumes ONTAP is now supported with the following VM types in Microsoft Azure, starting with the 9.10.1 release:
 - E4ds_v4
 - E8ds_v4
 - E32ds_v4
 - E48ds_v4

Go to the [Cloud Volumes ONTAP Release Notes](#) for more details about supported configurations.

- If you use a [capacity-based license](#) for Cloud Volumes ONTAP, you are no longer charged for the capacity used by FlexClone volumes.
- Cloud Manager now shows the charging method for each Cloud Volumes ONTAP working environment in the right panel of the Canvas.

CloudVolumesONTAP1

On

DETAILS

Cloud Volumes ONTAP | AWS | Single

Charged by node (Standard package)

NOTIFICATIONS

New Version Available

SERVICES

Replication Off

Enable

- When you create a Cloud Volumes ONTAP working environment, you now have the option to enter your preferred user name, instead of the default admin user name.

Credentials

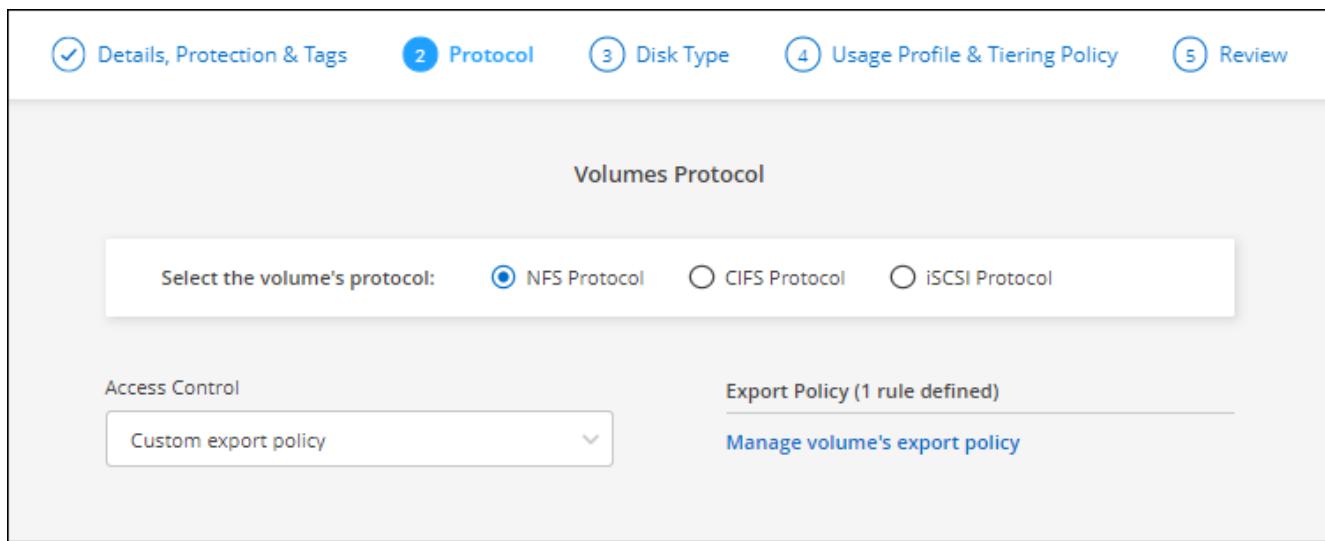
User Name

customusername

Password

Confirm Password

- We made a few enhancements to volume creation:
 - We redesigned the create volume wizard for ease of use.
 - Tags that you add to a volume are now associated with the [Application Templates service](#), which can help you organize and simplify the management of your resources.
 - You can now choose a custom export policy for NFS.



Cloud Manager support for Kubernetes clusters in Azure (11 Jan 2022)

You can now add and manage managed Azure Kubernetes clusters (AKS) and self-managed Kubernetes clusters in Azure using Cloud Manager. [Getting started with Kubernetes clusters in Azure](#)

On-prem ONTAP cluster enhancements

Tags that you add to a volume are now associated with the [Application Templates service](#), which can help you organize and simplify the management of your resources.

Digital Wallet enhancement

If you change the capacity or term for any of your licenses, the license terms now automatically update in the Digital Wallet. You don't need to manually update the license yourself.

The automatic license update works with all types of Cloud Volumes ONTAP licenses and all licenses for data services.

Cloud Backup enhancements

- Now you can back up persistent volumes from your AKS Kubernetes clusters to Azure Blob storage.

If your AKS cluster has NetApp Astra Trident installed, and it is using Cloud Volumes ONTAP for Azure as backend storage for the cluster, then you can back up and restore volumes to and from Azure Blob storage. [Go here for details](#).

- Cloud Backup service charges have been changed in this release to align more closely with industry standards.

Instead of paying NetApp for capacity based on the size of your backup files, now you pay only for the data that you protect, calculated by the logical used capacity (before ONTAP efficiencies) of the source ONTAP volumes which are being backed up. This capacity is also known as Front-End Terabytes (FETB).

Cloud Data Sense enhancements

- Now you can integrate a global Active Directory with Cloud Data Sense to enhance the results that Data Sense reports about file owners and which users and groups have access to your files.

In addition to the Active Directory credentials you enter so that Data Sense can scan CIFS volumes from certain data sources, this new integration provides as additional integration for other users and systems. Data Sense will look in all integrated Active Directories for user and permission details. [See how to set up your global Active Directory](#).

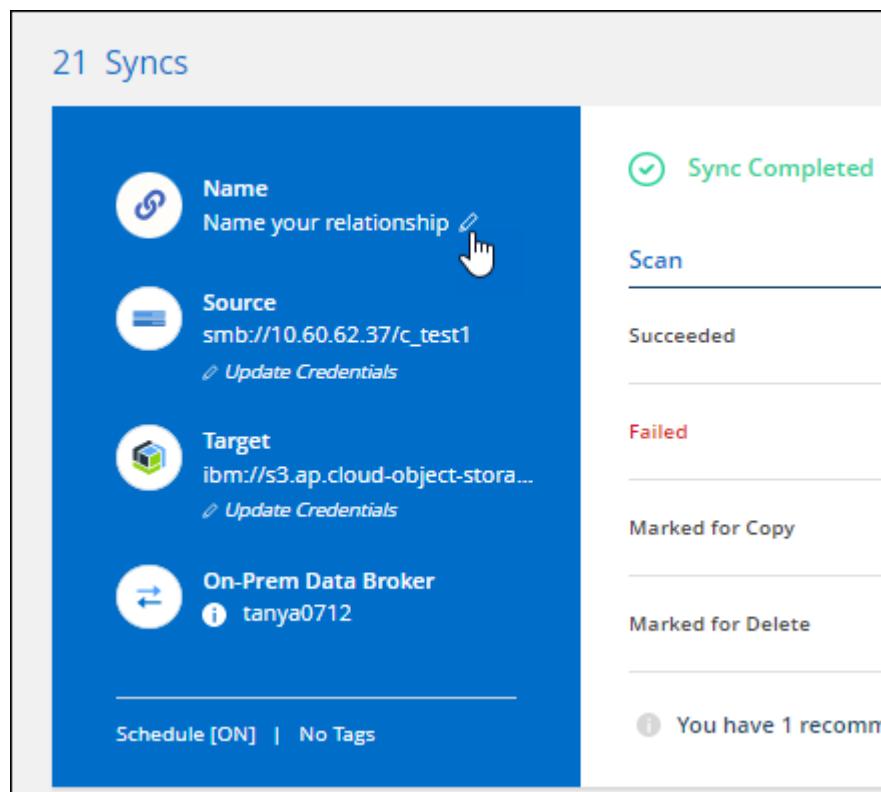
- Data Sense can automatically delete files that match the query that you define in a Policy. [See how to create custom Policies](#).
- The security group for the Cloud Manager Connector will use port 443 instead of port 80 for inbound and outbound traffic to and from the Data Sense instance for added security. Both ports remain open at this time, so you shouldn't see any issues, but you should update the security group in any older deployments of the Connector as port 80 will be deprecated in a future release.

Cloud Sync enhancements

- Two new sync relationships are supported:
 - Box to Azure NetApp Files
 - Box to Amazon FSx for ONTAP

[View the complete list of supported sync relationships](#).

- You can now provide a meaningful name to each of your sync relationships to more easily identify the purpose of each relationship. You can add the name when you create the relationship and any time after.



- When you sync data to or from Amazon S3, you can choose whether to use an S3 private link. When the data broker copies data from the source to the target, it goes through the private link.

Note that the IAM role associated with your data broker will need the following permission to use this feature:

"ec2 : DescribeVpcEndpoints"

This permission is automatically added to any new data brokers that you create.

- You can now choose the *Glacier Instant Retrieval* storage class when Amazon S3 is the target in a sync relationship.
- Cloud Sync now supports copying ACLs from object storage to SMB shares. Previously, we only supported copying ACLs from an SMB share to object storage.
- Creating a sync relationship from SFTP to Amazon S3 is now supported in the user interface. This sync relationship was previously supported with the API only.
- We redesigned the table view on the Dashboard for ease of use. If you click **More info**, Cloud Sync filters the dashboard to show you more information about that specific relationship.

4 Syncs				
Name	Source	Target	Sync Status	More
bill	s3://phoebe	ibm://1.1.1.1:80/medium/test	Sync Completed	More info
test	s3://small	s3://phoebe	Sync Completed	More info
Name your relationship	s3://medium	s3://joey	Sync Completed	More info
Name your relationship	s3://small	s3://joey	Sync Completed	More info

- Cloud Sync now supports deploying the data broker in the AWS Asia Pacific (Jakarta) region.

Connector enhancements

- We reduced the number of endpoints that a Connector needs to contact in order to manage resources and processes within your public cloud environment.

[View the list of required endpoints.](#)

- When you deploy a new Connector in AWS from Cloud Manager, you can now choose to encrypt the Connector's EBS disks using the default master key or a managed key.

Get Ready AWS Credentials 3 Details 4 Network 5 Security Group 6 Review

Details

Connector Instance Name Connector Role

Create Role Select an existing Role

Role Name

[Add Tags to Connector Instance](#)



AWS Managed Encryption

Master Key: aws/ebs (default) [Change Key](#)

Support Dashboard enhancements

Cloud Manager can now display the email address that's associated with a NetApp Support Site account.

The screenshot shows the NSS Management Connector interface. At the top, there are tabs for 'NSS Management' and 'Connector'. Below the tabs, there is a search bar with a magnifying glass icon. A blue button labeled 'Add NSS Account' is visible. A link 'Learn about NetApp Support Site (NSS) Accounts' is also present. The main area is titled 'Attached Working Environments'. It lists one environment: 'd6da6b9b6' which contains '1 Working Environment'. A context menu is open over this entry, showing options: 'Update Credentials', 'Display Email Address' (with a hand cursor icon), 'Copy Account ID' (with a copy icon), and 'Delete'.

Cloud Manager 3.9.13 update (16 Dec 2021)

This update includes enhancements to several features and services.

Cloud Manager and Cloud Data Sense enhancements

This update provides support for Cloud Manager and Cloud Data Sense to be deployed in an on-premises site that doesn't have internet access. Now your secure sites can use Cloud Manager to manage your on-prem ONTAP clusters, replicate data between clusters, and scan data from those clusters using Cloud Data Sense.

- See how to deploy the Cloud Manager Connector in a site with no internet access.
- See how to deploy Cloud Data Sense in a site with no internet access.

SnapCenter Service 1.0.1 (21 Dec)

This update includes security fixes for Apache Log4j vulnerabilities.

SnapCenter Service 1.0.1 upgrades Apache Log4j from version 2.9.1 to 2.17 to address the following vulnerabilities: CVE-2021-44228, CVE-2021-4104, and CVE-2021-45105.

The SnapCenter Service cluster should auto-update to the latest version. You should ensure that the version in the SnapCenter Service UI shows that the cluster is 1.0.1.1251 or later.

Cloud Manager 3.9.13 (28 Nov 2021)

This update includes enhancements to several features and services.

Cloud Volumes ONTAP enhancements

- Cloud Manager can now deploy and manage Cloud Volumes ONTAP 9.10.1.

[Learn about the new features included in this release of Cloud Volumes ONTAP.](#)

- You can now use Keystone Flex Subscriptions to pay for Cloud Volumes ONTAP HA pairs.

A Keystone Flex Subscription is a pay-as-you-grow subscription-based service that delivers a seamless hybrid cloud experience for those preferring OpEx consumption models to upfront CapEx or leasing.

A Keystone Flex Subscription is supported with all new versions of Cloud Volumes ONTAP that you can deploy from Cloud Manager.

- [Learn more about Keystone Flex Subscriptions.](#)
- [Learn how to get started with Keystone Flex Subscriptions in Cloud Manager.](#)

- Cloud Volumes ONTAP is now supported in the AWS Asia Pacific (Osaka) region (ap-northeast-3).
- Ports 8023 and 49000 are no longer open on Cloud Volumes ONTAP systems in Azure for both single node systems and HA pairs.

This change applies to *new* Cloud Volumes ONTAP systems starting with the 3.9.13 release of the Connector.

On-prem ONTAP cluster enhancements

We redesigned the create volume wizard for ease of use and you can now choose a custom export policy.

Add volume in onprem 1 Details & Protection 2 Protocol 3 Usage Profile 4 Review

Volume Details and Protection

Volume Name	Aggregate	
vol2	aggr1	
Volume Size	Unit	Storage VM (SVM)
100	GB	svm_onprem
Snapshot Policy		
default		
default policy		

Next

Cloud Sync enhancements

- Cloud Sync can now copy access control lists (ACLs) when setting up a sync relationship from a source SMB share to object storage (except for ONTAP S3).

Cloud Sync doesn't support copying ACLs from object storage to SMB shares.

[Learn how to copy ACLs from an SMB share.](#)

- You can now update Cloud Sync licenses that you extended.

If you extended a Cloud Sync license that you purchased from NetApp, you can add the license again to refresh the expiration date.

[Learn how to update a license.](#)

- You can now update the Box credentials for an existing sync relationship.

[Learn how to update credentials.](#)

New Kubernetes support

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

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

[Learn more about Kubernetes support.](#)



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

Cloud Backup enhancements

- Now you can back up persistent volumes from your Kubernetes clusters to Amazon S3.

If your EKS cluster has NetApp Astra Trident installed, and it is using Cloud Volumes ONTAP for AWS as backend storage for the cluster, then you can back up and restore volumes to and from Amazon S3. [Go here for details.](#)

- Cloud Backup now supports creating backups of DP volumes that exist on the target ONTAP system in an SVM-DR relationship. There are a few restrictions, so see [the limitations](#) for details.

Cloud Data Sense enhancements

- You can use Data Sense to clone an ONTAP volume, but include only selected files from the source volume in the new cloned volume. This is helpful for situations where you're migrating data and you want to exclude certain files, or if you want to create a copy of a volume for testing.

[See how to clone a volume.](#)

- The [GCP Marketplace subscription for Cloud Manager](#) now includes support for Cloud Data Sense. So now you can use this pay-as-you-go (PAYGO) subscription to scan data from Cloud Volumes ONTAP systems deployed on Google Cloud storage in addition to using a BYOL license from NetApp.
- Now you can view the status of your long-running compliance actions.

When you run an action from the Investigation Results pane across many files, for example, deleting 50 files, the process can take some time. Now you can monitor the status of these asynchronous actions so you'll know when it has been applied to all files.

[See how to view the status of your ongoing compliance actions.](#)

- Data Sense can now find the personal data types "British Passport" and "National Health Service (NHS Number" in files. [See the list of all personal data types that Data Sense finds in scans.](#)
- When filtering data in the Data Investigation page, a new filter for "Working Environment Type" has been added. This allows you to filter the Results for Cloud Volumes ONTAP systems, FSx for ONTAP systems, on-premises ONTAP systems, and more.

Full Active IQ Digital Advisor integration

[Active IQ Digital Advisor](#) is integrated into the Cloud Manager UI so that you can optimize the operations, security, and performance of your ONTAP clusters in a single pane of glass. Just select the "Active IQ" service in Cloud Manager.

You may need to register, or update, your NSS account in Cloud Manager. [Go here for details.](#)

NetApp Support Site account enhancements

- Starting in December 2021, NetApp now uses Microsoft Azure Active Directory as the identity provider for authentication services specific to support and licensing. As a result of this update, Cloud Manager will prompt you to update the credentials for any existing NetApp Support Site accounts that you previously added.

- Learn how to update an NSS account to the new authentication method.
- Learn more about NetApp's use of Microsoft Azure AD for identity management.
- If your organization has multiple NetApp Support Site accounts, you can now change which account is associated with a Cloud Volumes ONTAP system.

[Learn how to attach a working environment to a different NSS account.](#)

Cloud Manager 3.9.12 build 2 (10 Nov 2021)

This patch update includes bug fixes.

Cloud Manager 3.9.12 update (5 Nov 2021)

Cloud Backup enhancements

- When restoring a volume to an on-premises ONTAP system from a backup file that resides on Amazon S3 or Azure Blob, now you can select a private endpoint that connects to your on-prem system privately and securely.
- Now you can tier older backup files to archival storage after a certain number of days to save costs.

If your cluster is running ONTAP 9.10.1 or greater, and you are using AWS or Azure cloud storage, you can enable tiering of backups to archival storage. See more information about [AWS S3 archival storage classes](#) and [Azure Blob archival access tiers](#).

- BYOL licensing for Cloud Backup has moved from the Cloud Backup Licenses tab to the Data Services Licenses tab in the Cloud Manager Digital Wallet.

Cloud Data Sense enhancements (7 Nov)

- Now you can choose to map or classify individual volumes in your working environments.

In the past you could either map all volumes or map & classify all volumes in each working environment. Now you can choose to map or map & classify individual volumes. This option is available for Cloud Volumes ONTAP volumes, ANF volumes, on-prem ONTAP volumes, and FSx for ONTAP volumes.

- You can copy any source files that Data Sense is scanning to a destination NFS share. This is helpful if you want to make a copy of certain data and move it to a different NFS location. [Learn more](#).
- Now you can scan data protection volumes on FSx for ONTAP file systems. [Learn more](#).
- A new Filter in the Investigation page called "Discovered Time" enables you to view files by the date range when Data Sense first discovered the files. Discovered Time has also been added to the File Details page and to reports that you output in CSV format for a file.

Recent updates (4 Nov 2021)

- [SOC 2 Type 2 certification](#)
- [Connector no longer supported as a proxy](#)

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.](#)

Connector no longer supported as a proxy

You can no longer use the Cloud Manager Connector as a proxy server to send AutoSupport messages from Cloud Volumes ONTAP. This functionality has been removed and is no longer supported. You will need to provide AutoSupport connectivity through a NAT instance or your environment's proxy services.

[Learn more about configuring AutoSupport with Cloud Volumes ONTAP.](#)

Cloud Manager 3.9.12 (31 Oct 2021)

This update includes enhancements to several features and services.

Amazon FSx for ONTAP enhancements

- You can create iSCSI volumes for FSx for ONTAP using the Cloud Manager API and manage them in your working environment.
- You can [select volume units \(GiB or TiB\) when creating volumes](#) in FSx for ONTAP.

Cloud Sync enhancements

- Box support is now available in the Cloud Sync user interface as a preview.

Box can be the source or target in several types of sync relationships. [View supported sync relationships.](#)

- When an SMB server is the source, a new sync relationship setting called *Date Created* enables you to sync files that were created after a specific date, before a specific date, or between a specific time range.

[Learn more about Cloud Sync settings.](#)

Connector enhancements

When you create a new Connector in Microsoft Azure, you can now authenticate with an Azure service principal, rather than with Azure account credentials.

[Learn how to authenticate with an Azure service principal.](#)

Resource Tagging enhancement

Now you can tag your Sync relationships so you can group or categorize them for easy access. [Learn more about resource tagging.](#)

Credentials enhancement

We redesigned the Credentials page for ease of use and to match the current look and feel of the Cloud Manager interface.

Cloud Manager 3.9.11 (4 Oct 2021)

This update includes enhancements to several features and services.

Amazon FSx for ONTAP enhancements

- Now you can create CIFS volumes in FSx for ONTAP using Cloud Manager.
- Now you can edit FSx for ONTAP volumes using Cloud Manager.

Cloud Volumes ONTAP enhancements

- Cloud Manager can now deploy and manage Cloud Volumes ONTAP 9.10.0.

[Learn about the new features included in this release of Cloud Volumes ONTAP.](#)

- We reduced the amount of time that it takes to deploy a Cloud Volumes ONTAP working environment in Microsoft Azure or in Google Cloud when normal write speed is enabled. The deployment time is now 3-4 minutes shorter on average.

Cloud Backup enhancements

- The size of each backup file is now displayed in the Backup List page and when performing a volume or file restore operation.

This is useful if you want to delete large backup files that are unnecessary, or so you can compare backup file sizes to identify any abnormal backup files that could be the result of a malicious software attack.

- A new TCO calculator is available to help you understand the total cost of ownership for Cloud Backup, and to compare these costs to traditional backup solutions and estimate potential savings. Check it out [here](#).
- Now you can easily [unregister Cloud Backup for a working environment](#) if you no longer want to use backup functionality (or be charged) for that working environment.

Cloud Sync enhancements

- Cloud Sync now supports additional sync relationships for [Box](#) when using the Cloud Sync API:
 - Amazon S3 to Box
 - IBM Cloud Object Storage to Box
 - StorageGRID to Box
 - Box to an NFS server
 - Box to an SMB server

[Learn how to set up a sync relationship using the API.](#)

- You can now [create a report](#) for SFTP paths.

Cloud Data Sense enhancements

- Support for BYOL licensing from NetApp.

In addition to licensing Data Sense through your cloud provider marketplaces, now you can purchase a bring-your-own-license (BYOL) from NetApp that you can use across all your working environments and data sources in your Cloud Manager account.

[Learn more about the new Cloud Data Sense BYOL license.](#)

- Support for the Google Cloud Platform.

Now Cloud Data Sense can scan data from your Cloud Volumes ONTAP systems that are deployed on GCP. Data Sense must be deployed on GCP, and the Connector must be deployed on GCP or on-premises.

The GCP service account associated with the Connector needs the latest permissions to deploy Cloud Data Sense to GCP. [See the 3 new permissions that are required.](#)

- Data Sense can now scan CIFS volumes from FSx for ONTAP systems. [See how to scan Amazon FSx for ONTAP volumes.](#)

Application Templates enhancements (11 Oct)

- Now you can create a duplicate of an existing template. This can save a lot of time in case you want to create a new template that is very similar to an existing template. Just make the duplicate with a new name and change the couple items that make the template unique. [See how to create a copy of a template.](#)
- Enabling services on volumes created with templates is much easier now. Before you needed to select variables to identify the working environment, storage VM, and volume name. Now the template adds this information for you. This simplifies adding services for Cloud Backup, Cloud Compliance, and Replication to newly created volumes.

Resource Tagging enhancements (11 Oct)

- Support has been added so you can label certain GCP resources.

Now you can manage labels on your GCP resources using the Cloud Manager Tagging service. You can view GCP labels and label values that have been applied to resources, and you can apply those labels to other GCP resources that you are managing. [See the GCP resources that you can label.](#)

Support for SnapCenter Service (13 Oct)

- SnapCenter Service provides data protection capabilities for applications running on NetApp® Cloud Storage. SnapCenter Service enabled within NetApp Cloud Manager offers efficient, application consistent, policy-based backup and restore of SAP HANA® Systems residing on Azure NetApp Files (ANF).

[Learn about SnapCenter Service](#)

- You should create a Connector, enable SnapCenter Service, add SAP HANA systems, and then perform backup and restore operations.

[Get started](#)

Cloud Manager 3.9.10 build 2 (12 September 2021)

We fixed a Cloud Backup bug where a volume restore operation failed when the language code for the volume was different than the language code for the storage VM.

Cloud Manager 3.9.10 (2 September 2021)

This update includes enhancements to several features and services.

Support for Amazon FSx for ONTAP

- [Amazon FSx for ONTAP](#) is a fully managed service allowing customers to launch and run file systems powered by NetApp's ONTAP storage operating system. FSx for ONTAP provides the same features, performance, and administrative capabilities NetApp customers use on premises, with the simplicity, agility, security, and scalability of a native AWS service.

[Learn about Amazon FSx for ONTAP.](#)

- You can configure an FSx for ONTAP working environment in Cloud Manager.

[Create an Amazon FSx for ONTAP working environment.](#)

- Using a Connector in AWS and Cloud Manager, you can create and manage volumes, replicate data, and integrate FSx for ONTAP with NetApp cloud services, such as Data Sense and Cloud Sync.

[Get started with Cloud Data Sense for Amazon FSx for ONTAP.](#)

Cloud Volumes ONTAP enhancement

Data is automatically encrypted on Cloud Volumes ONTAP in Azure using [Azure Storage Service Encryption](#) with a Microsoft-managed key. But you can now use your own customer-managed encryption key instead by completing the following steps:

1. From Azure, create a key vault and then generate a key in that vault.
2. From Cloud Manager, use the API to create a Cloud Volumes ONTAP working environment that uses the key.

[Learn more about these steps.](#)

Cloud Data Sense enhancements

- Added support for scanning data on NFS volumes on Amazon FSx for ONTAP systems. [See how to configure scanning for your FSx for ONTAP systems.](#)
- The capability to add "Status" information to your files using Data Sense has changed terminology to use "Tags". These are file level tags - not to be confused with resource level tagging that can be applied to volumes, EC2 instances, virtual machines, etc.

Cloud Sync enhancements

You can now sync data to or from an Amazon FSx for ONTAP file system.

- [Learn about Amazon FSx for ONTAP](#)
- [View supported sync relationships](#)
- [Learn how to create a sync relationship for Amazon FSx for ONTAP](#)

Cloud Tiering enhancements

- New Cloud Tiering BYOL license replaces FabricPool license

A new **Cloud Tiering** license is now available for tiering configurations that are supported within Cloud Manager using the Cloud Tiering service. It is a floating license that you can use across multiple on-premises ONTAP clusters. The **FabricPool** license that you may have used in the past is retained only for configurations that aren't supported within Cloud Manager.

[Learn more about the new Cloud Tiering license.](#)

- Now you can tier inactive data from your on-prem ONTAP clusters to any Object Storage service which uses the Simple Storage Service (S3) protocol.

[See how to tier data to S3-compatible object storage.](#)

Replication enhancements

You can now replicate data from a Cloud Volumes ONTAP system or an on-premises ONTAP cluster to an Amazon FSx for ONTAP file system.

[Learn about the Replication service.](#)

Cloud Backup enhancements

- Now you can create an on-demand backup at any time to capture the current state of a volume. This is useful if important changes have been made to a volume and you don't want to wait for the next scheduled backup to protect that data.

[See how to create an on-demand backup.](#)

- When configuring backups to Amazon S3 from an on-premises ONTAP system, now you can define a connection to a Private Interface Endpoint in the activation wizard. This allows you to use a network interface that connects your on-prem system privately and securely to a service powered by AWS PrivateLink. [See details about this option.](#)
- For additional security and control, you can choose your own customer-managed keys for data encryption in the activation wizard instead of using the default Amazon S3 encryption keys.

This is available when configuring backups from an on-premises ONTAP system or from a Cloud Volumes ONTAP system in AWS.

- The restriction of being able to browse a single directory with flat files up to a maximum of 30,000 files has been removed. Now you can restore files from directories that have a larger number of files.

Resource Tagging enhancements

- Now you can manage tags on your Azure resources using the Cloud Manager Tagging service. You can view Azure tags and tag values that have been applied to resources, and you can apply those tags to other Azure resources that you are managing.

[See the Azure resources that you can tag.](#)

The Cloud Manager Operator IAM role associated with the Connector needs the latest permissions to tag Azure resources. [See the new permissions that are required.](#)

- Some additional AWS EC2 resources can now be tagged. [See the AWS resources that you can tag.](#)

The Cloud Manager IAM role associated with the Connector needs the latest permissions to tag AWS EC2 instances. [See the new permissions that are required.](#)

A new Notification Service has been added

The Notification service has been introduced so you can view the status of Cloud Manager operations that you

have initiated during your current login session. You can verify whether the operation was successful, or if it failed. [See how to monitor operations in your account.](#)

Cloud Manager 3.9.9 build 2 (18 Aug 2021)

This patch update includes bug fixes.

Cloud Manager 3.9.9 update (8 Aug 2021)

This update includes enhancements to several features and services.

Application Template enhancements

- Now you can create a Cloud Volumes ONTAP working environment, and your first volume, using templates. This support is provided only for AWS environments at this time, and only for single-node clusters. See how to [create a template for a Cloud Volumes ONTAP working environment](#).
- A new feature enables you to add tags to a volume in a volume template. Tagging enables you to group different resources to identify applications, regions, or departments in order to perform automation or to allocate costs to certain departments or regions.

Resource Tagging enhancements

Now you can manage tags from your AWS EC2 Instances in Cloud Manager. You can view AWS tags and tag values that have been applied to EC2 Instances, and you can apply those tags to other EC2 Instances that you are managing. [Learn more about tagging](#).

Cloud Manager 3.9.9 (1 Aug 2021)

This update includes enhancements to several features and services.

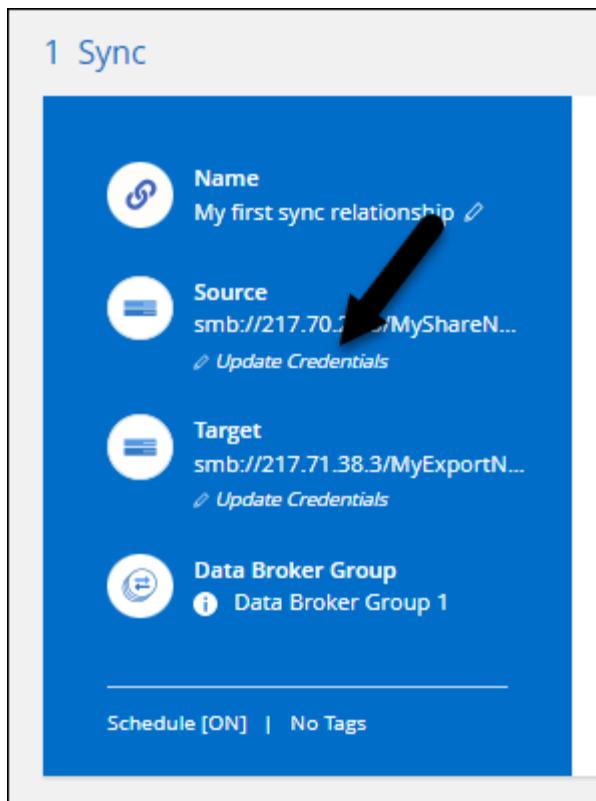
Cloud Backup enhancements

- When configuring backups to Azure Blob from an on-premises ONTAP system, you can define a connection to an Azure Private Endpoint in the activation wizard. This allows you to use a network interface that connects you privately and securely to a service powered by Azure Private Link.
- An Hourly backup policy is now supported in addition to the existing Daily, Weekly, and Monthly policies. The Hourly backup policy provides a minimal Recovery Point Objective (RPO).

Cloud Sync enhancements

- Cloud Sync now enables you to update the data broker with the latest credentials of the source or target in an existing sync relationship.

This enhancement can help if your security policies require you to update credentials on a periodic basis. [Learn how to update credentials](#).



- When creating a sync relationship, you can now add tags to the object storage target in a sync relationship.

Adding tags is supported with Amazon S3, Azure Blob, Google Cloud Storage, IBM Cloud Object Storage, and StorageGRID.

- Cloud Sync now supports [Box](#) as the source in a sync relationship to Amazon S3, StorageGRID, and IBM Cloud Object Storage when using the Cloud Sync API.

[Learn how to set up a sync relationship using the API.](#)

- When you deploy a data broker in Google Cloud, you can now choose whether to enable or disable a public IP address for the virtual machine instance.

[Learn how to deploy a data broker in Google Cloud.](#)

- When you choose the source or target volume for Azure NetApp Files, Cloud Sync now displays a dual-protocol volume no matter which protocol you chose for the sync relationship.

Cloud Data Sense enhancements

- Ability to manage file settings for multiple files at a time.

In earlier versions of Cloud Data Sense you could perform the following actions on one file at a time: add a status tag, assign a user, and add an AIP label. Now you can select multiple files from the Data Investigation page and perform these actions on multiple files.

- When viewing the Age of Data graph in the Governance dashboard, in addition to viewing data based on the last time it was modified, now you can view the data by when it was created or by when it was last accessed (when it was read).

This information is provided in the Data Mapping Report as well.

- When deploying Data Sense on-premises, now you can install scanning software on additional on-prem hosts when you plan to scan configurations that include petabytes of data. These additional *scanner nodes* provide increased processing power when scanning very large configurations.

See how to [deploy Data Sense software on multiple hosts](#).

Monitoring enhancement

We changed the default name of the Acquisition Unit instance to CloudInsights-AU-*UUID* so that the name is more descriptive (the UUID is a generated hash).

Cloud Manager deploys this instance when you enable the Monitoring service on a Cloud Volumes ONTAP working environment.

[Learn more about the Monitoring service.](#)

Connector enhancement

The Connector is now supported on a host that's running Red Hat Enterprise Linux 7.9.

[View system requirements for the Connector.](#)

Cloud Manager 3.9.8 build 3 (25 July 2021)

This patch update includes bug fixes and security improvements.

Cloud Manager 3.9.8 update (13 July 2021)

This update includes enhancements to several features and services.

Application Template enhancements

- Support has been added so you can add in the template that you want to [replicate the data in the volume you are creating](#) to another volume using the [Replication service](#). When you replicate data to other NetApp storage systems and continually update the secondary data, your data is kept current and remains available whenever you need it.

- Now you can download a report that includes all the volumes that have "drifted" from your template settings instead of just viewing this information for a single volume in the Dashboard. In this manner you can identify these volumes and assign someone to bring the volumes back into compliance. See [how to download your drift report](#).

New Resource Tagging feature

- A new Cloud Manager feature enables you to apply tags to your existing ONTAP resources to help organize and manage those resources. Tags are metadata that you can use to group resources to identify applications, environments, regions, billing codes, cloud providers, and more.

[Learn more about tagging.](#)

Cloud Manager 3.9.8 (7 July 2021)

This update includes enhancements to several features and services.

Cloud Volumes ONTAP enhancements

This release of Cloud Manager includes enhancements to the management of Cloud Volumes ONTAP.

Enhancements available in all cloud providers

- New charging methods are available for Cloud Volumes ONTAP.
 - Capacity-based BYOL:** A capacity-based license enables you to pay for Cloud Volumes ONTAP per TiB of capacity. The license is associated with your NetApp account and enables you to create as many Cloud Volumes ONTAP systems, as long as enough capacity is available through your license. Capacity-based licensing is available in the form of a package, either *Essentials* or *Professional*.
 - Freemium offering:** Freemium enables you to use all Cloud Volumes ONTAP features free of charge from NetApp (cloud provider charges still apply). You're limited to 500 GiB of provisioned capacity per system and there's no support contract. You can have up to 10 Freemium systems.

[Learn more about these licensing options.](#)

Here's an example of the charging methods that you can choose from when deploying a new Cloud Volumes ONTAP system in Azure:

Cloud Volumes ONTAP Charging Methods

[Learn more about our charging methods](#)



Pay-As-You-Go by the hour



Bring your own license

Bring your own license type

Capacity-Based

Package

Professional



Freemium (Up to 500GB)

- Write once, read many (WORM) storage is no longer in Preview and is now available for general use with Cloud Volumes ONTAP. [Learn more about WORM storage](#).

Enhancements available in AWS

Starting with the 9.9.1 release, Cloud Volumes ONTAP now supports the m5dn.24xlarge instance type with the following charging methods: PAYGO Premium, bring your own license (BYOL), and Freemium.

[View supported configurations for Cloud Volumes ONTAP in AWS.](#)

Enhancements available in Azure

- When creating a Cloud Volumes ONTAP system in Azure, you now have the option to select an existing resource group for the VM and its associated resources.

Location & Connectivity

Location Azure Region <div style="border: 1px solid #ccc; padding: 5px; width: 100%;">WEST US</div> Availability Zone <div style="border: 1px solid #ccc; padding: 5px; width: 100%;">Select an Availability Zone</div>	Connectivity Resource Group <div style="border: 1px solid #ccc; padding: 5px; width: 100%;"> <input type="radio"/> Create a new group <input checked="" type="radio"/> Use an existing group Resource Group Name <div style="border: 1px solid #ccc; padding: 5px; width: 100%;">RG1</div> </div>
--	--

The following permissions enable Cloud Manager to remove Cloud Volumes ONTAP resources from a resource group, in case of deployment failure or deletion:

```
"Microsoft.Network/privateEndpoints/delete",
"Microsoft.Compute/availabilitySets/delete",
```

Be sure to provide these permissions to each set of Azure credentials that you've added to Cloud Manager. You can find the latest list of permissions on the [Cloud Manager policies page](#).

- As a security enhancement, Cloud Manager now disables **Blob public access** when creating a storage account for Cloud Volumes ONTAP.
- By default, Cloud Manager now enables an Azure Private Link connection on the boot diagnostics storage account for new Cloud Volumes ONTAP systems.

This means *all* storage accounts for Cloud Volumes ONTAP will now use a private link.

[Learn more about using an Azure Private Link with Cloud Volumes ONTAP.](#)

Enhancements available in Google Cloud

- Starting with the 9.9.1 release, Cloud Volumes ONTAP now supports Balanced persistent disks (pd-balanced).

These SSDs balance performance and cost by providing lower IOPS per GiB.

- The custom-4-16384 machine type is no longer supported with new Cloud Volumes ONTAP systems.

If you have an existing system running on this machine type, you can keep using it, but we recommend switching to the n2-standard-4 machine type.

[View supported configurations for Cloud Volumes ONTAP in GCP.](#)

Cloud Backup enhancements

- Cloud Backup now allows you to create backups using a different account/subscription than the one you

are using for your Cloud Volumes ONTAP system. You can also create backup files in a different region than the one in which your Cloud Volumes ONTAP system is deployed.

This capability is available when using AWS or Azure, and only when enabling backup on an existing working environment - it is not available when creating a new Cloud Volumes ONTAP working environment.

- For additional security and control, you can choose your own customer-managed keys for data encryption in the activation wizard instead of using the default Microsoft-managed encryption keys.

This is available when configuring backups from an on-premises ONTAP system or from a Cloud Volumes ONTAP system in Azure.

- The restriction of restoring only 8 files at a time using single-file restore from your backup files has been removed. Now you can restore up to 100 files at a time.

Cloud Tiering enhancements

When tiering data to Azure Blob storage, now your Connector can be running on your premises. You are no longer required to use a Connector installed in an Azure VNet.

Cloud Data Sense enhancements

- A new feature enables you to [move any source files that Data Sense is scanning to any NFS share](#). This allows you to move sensitive or security-related files to a special area so you can do more analysis.
- You can now choose to quickly map data into categories instead of doing a full classification scan. This enables you to [view the Data Mapping report](#) from the Governance Dashboard to get an overview of your data when there are certain data sources that you do not need to run a complete scan on.
- Now you can [assign a file to a specific Cloud Manager user](#) so that person can be responsible for any follow-up actions that need to be done on the file. This capability can be used with the existing feature to add custom Status tags to a file.

A new Filter in the Investigation page enables you to easily view all files that have the same person in the "Assigned To" field.

- Some users with smaller scanning requirements have asked to be able to use a smaller Cloud Data Sense instance. Now you can. There are some limitations when using these smaller instances, so [see what these restrictions are first](#).
- Data scans have a negligible impact on your storage systems and on your data. However, if you are concerned with even a very small impact, you can configure Data Sense to perform "slow" scans now.
- The Last Accessed Time value has been added to the File Details page and to reports that you output in CSV format so you can see when users have last accessed the file.

Cloud Sync enhancements

- Cloud Sync now supports sync relationships between ONTAP S3 Storage and a Google Cloud Storage bucket from the user interface.

[View supported sync relationships](#).

- Cloud Sync can now copy object metadata and tags between object-based storage when you create a sync relationship and enable a setting.

[Learn more about the Copy for Objects setting](#).

- You can now set up the data broker to access credentials from an external HashiCorp Vault by authenticating with a Google Cloud service account.

[Learn more about using a HashiCorp Vault with a data broker.](#)

- When setting up a sync relationship to an AWS S3 bucket, the Sync Relationship wizard now enables you to define the tags or metadata that you want to save on the objects in the target S3 bucket.

The tagging option was previously part of the sync relationship's settings.

Connector enhancement

We redesigned the **Add Connector** wizard to add new options and to make it easier to use. You can now add tags, specify a role (for AWS or Azure), upload a root certificate for a proxy server, view code for Terraform automation, view progress details, and more.

- [Create a Connector in AWS](#)
- [Create a Connector in Azure](#)
- [Create a Connector in GCP](#)

Support Dashboard enhancement

NetApp Support Site (NSS) accounts are now managed from the Support Dashboard, rather than from the Settings menu. This change makes it easier to find and manage all support-related information from a single location.

NSS User Name	NSS User ID	Attached Working Environments
testcloud2	61e6b48b-371e-4681-a...	—

Digital Wallet enhancement

The Digital Wallet page is now located in its own tab under the Resources section. [Learn how to manage licenses from your Digital Wallet.](#)

The screenshot shows the Cloud Manager dashboard. At the top, there are account and workspace dropdowns, and a connector dropdown. Below the header, a navigation bar includes links for Canvas, Replication, Backup & Restore, K8s, Data Sense, File Cache, Compute, Sync, and All Services (+8). A red arrow points to the 'Digital Wallet' link in the 'View & Manage Digital Wallet' section of the navigation bar.

Cloud Manager 3.9.7 update (7 June 2021)

This update includes enhancements to several features and services.

Cloud Sync support for storage classes in Google Cloud

When a Google Cloud Storage bucket is the target in a sync relationship, you can now choose the storage class that you want to use. Cloud Sync supports the following storage classes:

- Standard
- Nearline
- Coldline
- Archive

Cloud Tiering enhancements

- In earlier releases you could transition tiered data from the Standard storage class to another storage class after 30 days when using Amazon S3 or Google Cloud object storage. This release adds some new functionality:
 - You can choose the number of days when tiered data will move to a more cost-effective tier. This is called data "life cycle management".
 - Azure Blob now supports the *Cool* access tier.
 - Google Cloud Storage supports moving tiered data to multiple storage tiers over time. For example, you can move tiered data from the *Standard* class to the *Nearline* class after 45 days, and then to the *Coldline* class after 75 days, and then to the *Archive* class after 270 days.
- Now you can proactively move data back to the performance tier from the cloud tier if you want to stop using tiering on a volume, or if you decide to keep all user data on the performance tier, but keep Snapshot copies on the cloud tier. This capability is available when using ONTAP 9.8 and greater.

See how to [migrate data back to the performance tier](#).

Cloud Backup enhancements

- Two known limitations for backing up data protection (DP) volumes have been resolved. Your systems must have ONTAP 9.8 or greater installed:
 - Before, cascaded backup worked only if the SnapMirror relationship type was Mirror-Vault or Vault. Now you can make backups if the relationship type is MirrorAllSnapshots.
 - Cloud Backup now can use any label for the backup as long as it is configured in the SnapMirror policy. The restriction of requiring labels with the names daily, weekly, or monthly is gone.

Application Templates enhancements

- A new feature enables you to conditionally enable certain actions when the user is running the template.

For example, if a Cloud Volumes ONTAP volume is created with NetApp storage efficiency enabled, then Cloud Backup is also enabled on that volume. If storage efficiency is not enabled, then Cloud Backup is not enabled.

- You can now create a volume on an on-premises ONTAP system using templates.
- New functionality called "drift" has been added as an option when creating your templates.

This feature enables Cloud Manager to monitor the hard-coded values you entered for a parameter in a template. After a storage admin has created a volume using that template, if Cloud Manager later sees that the parameter value has been changed so that it no longer aligns with the template definition, you can see all the volumes that have "drifted" from the designed template. In this manner you can identify these volumes and make changes to bring them back into compliance.

- Now you can run a template from the Template Dashboard instead of having to open a working environment to launch the template there.

Cloud Data Sense (Cloud Compliance) enhancements

- Cloud Compliance has been renamed as **Cloud Data Sense** as of this release. With all the new Governance and other capabilities that have been included in the product, the Compliance name was not promoting the full set of capabilities.
- A new *Full Data Mapping* report is available from the Governance Dashboard to provide an overview of the data being stored in your corporate data sources to assist you with decisions of migration, back up, security, and compliance processes.

The report provides overview pages that summarize all your working environments and data sources, and then provides a breakdown for each working environment. Go [here](#) for more details.

- A new filter in the Data Investigation page enables you to view a list of all files that are duplicated across your storage systems.

This is helpful to identify areas where you can save storage space, or identify files that have specific permissions or sensitive information that you do not want duplicated across your storage. [See how to viewing all duplicated files](#).

- You can add a custom Status tags to files that Data Sense is scanning. The Status is not added to the file in the same way as AIP Labels are added. The Status is just seen by Cloud Manager users so you can indicate if a file needs to be deleted, or checked for some reason. [See how to apply and view Status tags in your files](#).

A new Filter in the Investigation page enables you to easily view all files that have a Status assigned.

- Cloud Data Sense can scan for Personal Identifiable Information (PII) in two additional types of files: .DCM and .DICOM.
- The File Size, Created Date, and Last Modified Date values have been added to reports that you output in CSV format. Created Date is also a new filter you can use to narrow down Investigation page search results.

Global File Cache enhancements

Global File Cache software version 1.1.0 has been released. A new "Edge Synchronization" feature is available that keeps multiple Edges at a remote office synchronized. When a file is fetched at one Edge, then the same file on all Edges participating in Edge Sync is updated and cached. See the [new and fixed issues in this release](#).

Cloud Manager 3.9.7 (30 May 2021)

This update includes enhancements to several features and services.

Cloud Volumes ONTAP enhancements

This release of Cloud Manager includes enhancements to the management of Cloud Volumes ONTAP.

Enhancements available in AWS

- A new Professional Package enables you to bundle Cloud Volumes ONTAP and Cloud Backup Service by using an annual contract from the AWS Marketplace. Payment is per TiB. This subscription doesn't enable you to back up on-prem data.

If you choose this payment option, you can provision up to 2 PiB per Cloud Volumes ONTAP system through EBS disks and tiering to S3 object storage (single node or HA).

Go to the [AWS Marketplace page](#) to view pricing details and go to the [Cloud Volumes ONTAP Release Notes](#) to learn more about this licensing option.

- Cloud Manager now adds tags to EBS volumes when it creates a new Cloud Volumes ONTAP working environment. The tags were previously created after Cloud Volumes ONTAP was deployed.

This change can help if your organization uses service control policies (SCPs) to manage permissions.

Enhancements available in all cloud providers

- If you enabled data tiering on a volume using the *auto* tiering policy, you can now adjust the minimum cooling period using the API.

[Learn how to adjust the minimum cooling period.](#)

- When you create a new NFS volume, Cloud Manager now displays custom export policies in ascending order, making it easier for you to find the export policy that you need.
- Cloud Manager now deletes older cloud snapshots of root and boot disks that are created when a Cloud Volumes ONTAP system is deployed and every time its powered down. Only the two most recent snapshots are retained for both the root and boot volumes.

This enhancement helps reduce cloud provider costs by removing snapshots that are no longer needed.

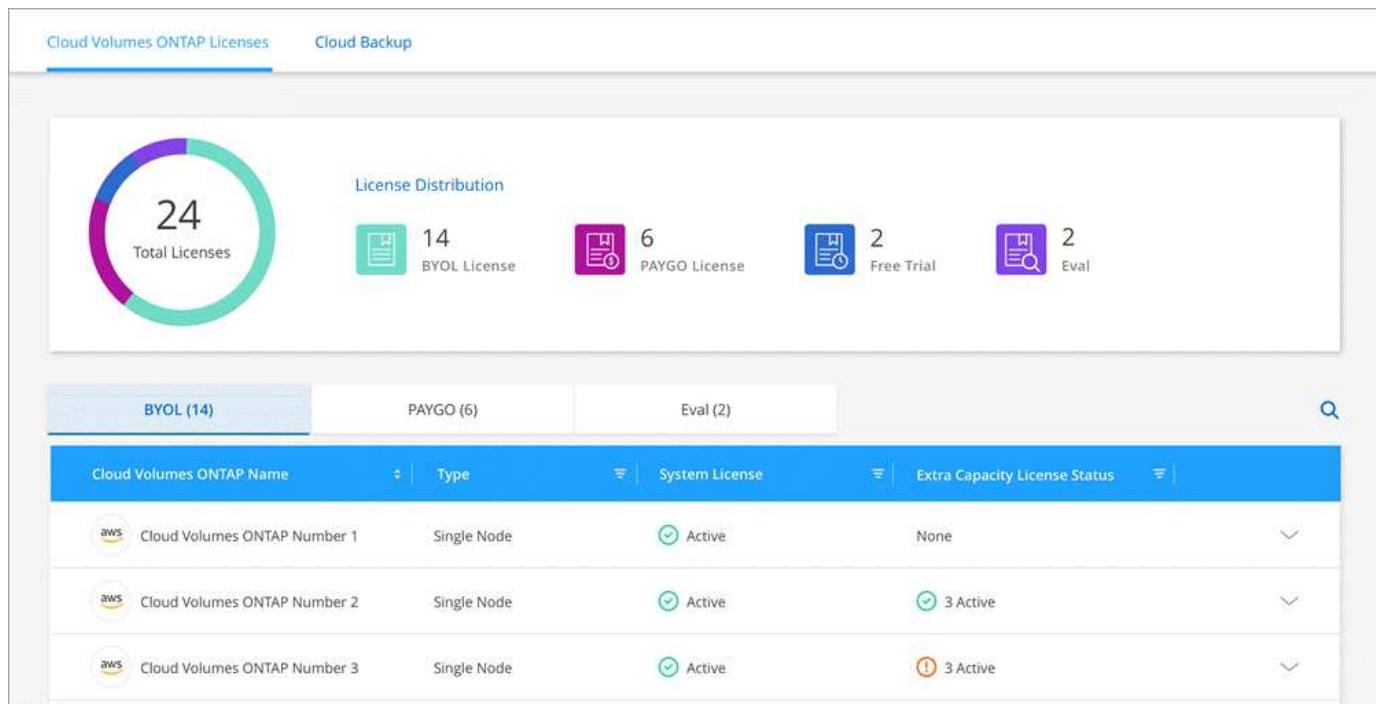
Note that a Connector requires a new permission to delete Azure snapshots. [View the latest Cloud Manager policy for Azure.](#)

"Microsoft.Compute/snapshots/delete"

Digital Wallet

A new **Digital Wallet** feature enables you to more easily view and manage your Cloud Volumes ONTAP licenses and Cloud Backup licenses from a single location.

[Learn more about Digital Wallet.](#)



Cloud Manager 3.9.6 update (24 May 2021)

Cloud Manager was updated to include the latest version of Cloud Volumes ONTAP.

Cloud Volumes ONTAP 9.9.1

Cloud Manager can now deploy and manage Cloud Volumes ONTAP 9.9.1.

[Learn about the new features included in this release of Cloud Volumes ONTAP.](#)

Cloud Manager 3.9.6 build 2 (11 May 2021)

We fixed a bug that caused failures when creating a Cloud Volumes ONTAP working environment in Azure.

Cloud Manager 3.9.6 update (5 May 2021)

This update includes enhancements to several features and services.

Cloud Backup enhancements

- The separate Backup and Restore Dashboards have been combined under a new **Backup & Restore** tab to make it easier for you to manage all your backup and restore operations from a single location. See [the Backup & Restore Dashboard](#) for details.
- Now you can create backups from your on-premises ONTAP systems to Google Cloud Storage or to your NetApp StorageGRID systems. See [Backing up to Google Cloud Storage](#) and [Backing up to StorageGRID](#) for details.

- A new feature in ONTAP 9.9.1 enables you to use System Manager to send backups of your on-premises ONTAP volumes to object storage you've set up through Cloud Backup. [See how to use System Manager to back up your volumes to the cloud using Cloud Backup.](#)
- Backup policies have been improved with the following enhancements:
 - Now you can create a custom policy that includes a combination of daily, weekly, and monthly backups.
 - When you change a backup policy, the change applies to all new backups **and** to all volumes using the original backup policy. In the past the change only applied to new volume backups.
- Some smaller improvements have also been made:
 - When configuring the cloud destination for your backup files, now you can select a different region than the region in which the Cloud Volumes ONTAP system resides.
 - The number of backup files you can create for a single volume has been increased from 1,019 to 4,000.
 - In addition to the earlier ability to delete all backup files for a single volume, now you can delete just a single backup file for a volume, or you can delete all backup files for an entire working environment, if needed.

Monitoring enhancements

- You can now enable the Monitoring service on a Cloud Volumes ONTAP working environment even if you have an existing Cloud Insights tenant.
- When you enable the Monitoring service, Cloud Manager sets up a free trial of Cloud Insights. On the 29th day, your plan now automatically transitions from the Trial Version to the [Basic Edition](#).

[Learn more about using the Monitoring service with Cloud Volumes ONTAP.](#)

Replication enhancement

We redesigned the Replication tab for ease of use and to match the current look and feel of the Cloud Manager user interface.

The screenshot shows the Cloud Manager interface with the Replication tab selected. At the top, there are five summary metrics: 5 Volumes Relationship, 32 TB Applied Capacity, 0 Community Monitoring, 5 Pending, and 0 Failed. Below this is a table titled "5 volume relationships". The columns are: Health Status, Source Volume, Target Volume, Log Duration, Status, Mirror State, and Last Successful Transfer. The table lists one relationship:

Health Status	Source Volume	Target Volume	Log Duration	Status	Mirror State	Last Successful Transfer
Healthy	Volume1 (WE Name) Source volume	Volume1_copy (WE Name) Target volume	A day	idle	unmirrored	Jan 1, 1970 02:00:10 am 10 GB

Below the table is a section titled "Transfers (1/2)" with a table showing transfer details:

File Transferred	File Transfer Type	Total Transfer Size	Transfer Total Transfer Time	File Transfer Priority
100 MB (100 MB)	Log Transfer	10 TB (Total Transfer Size)	Jan 1, 1970 02:00:10 am (Total Transfer Time)	Low (File Transfer Priority)

Account enhancement

The Timeline in Cloud Manager now shows actions and events related to account management. The actions include things like associating users, creating workspaces, and creating Connectors. Checking the Timeline can be helpful if you need to identify who performed a specific action, or if you need to identify the status of an action.

[Learn how to filter the Timeline to the Tenancy service.](#)

Cloud Compliance enhancements

- Cloud Compliance has been renamed to “Governance & Compliance”. There are two tabs in Cloud Manager: “Governance” and “Compliance”. The “Governance” tab brings you to the [Governance Dashboard](#) within the “Governance & Compliance” service, and the “Compliance” tab brings you to the [Compliance Dashboard](#).
- Scanning of data stored on Azure Blob is now supported when using the [MinIO service](#). See [Scanning object storage that uses S3 protocol](#) for details.
- New personal data type. Cloud Compliance can now find Austrian SSNs in files.

Cloud Manager 3.9.6 (2 May 2021)

This update includes enhancements to several features and services.

Cloud Tiering enhancements

- When selecting the volumes that you want to tier from an ONTAP system, now there’s a checkbox in the Tier Volumes page to select **all** volumes to make it easier to apply the same policy to all volumes. [See how to select all volumes in the cluster](#).
- If you need to change the number of "cooling days" that determine how long data in a volume must remain inactive before it is moved to object storage, now you can specify up to 183 days (up from 63 days) when using ONTAP 9.8 or greater.

Application Template enhancements

- The user interface has been enhanced in the AppTemplates service so that it is easier for template designers to move between actions and to see which action they are currently defining.
- Now you can integrate Cloud Compliance when creating a volume template for either Cloud Volumes ONTAP or Azure NetApp Files. So you can enable Compliance for each newly created volume, or enable Cloud Backup for each newly created volume... or create a template that enables both Backup and Compliance on the created volume.

Cloud Sync enhancements

- You can now view the errors found in reports and you can delete the last report or all reports.

[Learn more about creating and viewing reports to tune your configuration.](#)

- A new **Compare by** setting is now available for each sync relationship.

This advanced setting enables you to choose whether Cloud Sync should compare certain attributes when determining whether a file or directory has changed and should be synced again.

[Learn more about changing the settings for a sync relationship.](#)

Cloud Manager 3.9.5 (11 Apr 2021)

This update includes enhancements to several features and services.

Cloud Volumes ONTAP enhancements

This release of Cloud Manager includes enhancements to the management of Cloud Volumes ONTAP.

Enhancement available in all cloud providers

Cloud Manager now enables logical space reporting on the initial storage VM that it creates for Cloud Volumes ONTAP.

When space is reported logically, ONTAP reports the volume space such that all the physical space saved by the storage efficiency features are also reported as used.

Enhancements available in AWS

- Cloud Volumes ONTAP now supports *General Purpose SSD (gp3)* disks, starting with the 9.7 release. gp3 disks are the lowest-cost SSDs that balance cost and performance for a broad range of workloads.

[Learn more about using gp3 disks with Cloud Volumes ONTAP.](#)

- Cloud Volumes ONTAP no longer supports Cold HDD (sc1) disks.

Enhancement available in Azure

When Cloud Manager creates storage accounts in Azure for Cloud Volumes ONTAP, the TLS version for the storage account is now version 1.2.

Cloud Sync enhancements

- The standalone Cloud Sync service has been retired. You should now access Cloud Sync directly from Cloud Manager where all of the same features and functionality are available.

After logging in to Cloud Manager, you can switch to the Sync tab at the top and view your relationships, just like before.

- When setting up a sync relationship, you can choose from Google Cloud buckets in different projects, if you provide the required permissions to the data broker's service account.

[Learn how to set up the service account.](#)

- Cloud Sync now copies metadata between Google Cloud Storage and S3 providers (AWS S3, StorageGRID, and IBM Cloud Object Storage).
- You can now restart a data broker from Cloud Sync.

1 Data Broker Group

Add New Data Broker

data-broker1

1 Data Brokers | N/A Transfer Rate | 0 Relationships | 1 Active Data Brokers Status

AWS data-broker1 | AWS | Transfer Rate: N/A | Active

Restart Data Broker

- Cloud Sync now identifies when a data broker isn't running the latest software release. This message can help to ensure that you're getting the latest features and functionalities.

My First Azure Data Broker | Azure | Transfer Rate: 30 mbps

Active

Notice: This Data Broker isn't running the latest software release (1.8). If you experience performance problems please [contact us](#).

Cloud Compliance enhancements

- Added support for scanning NFS or CIFS file shares that reside on-premises or in the cloud.

Now you can scan file shares that reside on non-NetApp storage systems. See [scanning file shares](#) for details.

- Added support for scanning object storage that uses the S3 protocol.

In addition to scanning Amazon S3 buckets, now you can scan data from any Object Storage service which uses the S3 protocol. This includes NetApp StorageGRID, IBM Cloud Object Store, and more. See [scanning object storage](#) for details.

- The feature called "Highlights" has been renamed to "Policies". See [how to use Policies](#) to help in your compliance and governance efforts.
- Now you can see if there are duplicates of certain files in your storage systems. This is useful to identify areas where you can save storage space. It can also help to ensure that files containing sensitive information are not unnecessarily duplicated in your storage systems.

[Learn how to search for duplicate files.](#)

- The [Governance dashboard](#) has added charts to show [top data repositories listed by data sensitivity](#) and [data listed by types of Open Permissions](#).

New Application Templates feature

Templates enable you to standardize resource creation in your working environments. For example, you can hard-code required parameters in a "volume template" that are later applied when a storage admin creates a

volume. This can include required disk type, size, protocol, cloud provider, and more. You can also turn on certain services, like Cloud Backup, for every created volume.

This makes it easy for your storage admins to create volumes that are optimized for specialized workload requirements; such as databases or streaming services. And it makes life easier for your storage architects knowing that each volume is created optimally for each application. Learn about [Application Templates](#) and how you can use them in your environment.

Connector enhancement

If you configured a proxy server, you can now enable an option to send API calls directly to Cloud Manager without going through the proxy. This option is supported with Connectors that are running in AWS or in Google Cloud.

[Learn more about this setting.](#)

Account enhancements

- You can now create a service account user.

A service account acts as a "user" that can make authorized API calls to Cloud Manager for automation purposes. This makes it easier to manage automation because you don't need to build automation scripts based on a real person's user account who can leave the company at any time. And if you're using federation, you can create a token without generating a refresh token from the cloud.

[Learn more about using service accounts.](#)

- You can now allow private previews in your account to get access to new NetApp cloud services as they are made available as a preview in Cloud Manager.
- You can also allow third-party services in your account to get access to third-party services that are available in Cloud Manager.

[Learn more about these options.](#)

Cloud Manager 3.9.4 update (8 Apr 2021)

Active IQ enhancements

- If Active IQ discovers unused Cloud Volumes ONTAP licenses in your account, you can click a button to create a new Cloud Volumes ONTAP system using the license. Or you can apply the license to an existing Cloud Volumes ONTAP system to extend the capacity of that license by 368 TB.

[See how to use your available licenses.](#)

Cloud Manager 3.9.4 update (15 Mar 2021)

Cloud Compliance enhancements

- A new [Governance dashboard](#) is now available so that you can increase the efficiency and control the costs related to the data on your organizations' storage resources.

For example, the dashboard identifies the amount of stale data, non-business data, and very large files in your systems so you can decide whether you want to move, delete, or tier some files to less expensive object storage.

- You can view a list of [all users or groups who have access to a file](#).
- Cloud Compliance is now supported in Government regions in AWS.

Cloud Manager 3.9.4 (8 Mar 2021)

This update includes enhancements to several features and services.

Cloud Volumes ONTAP enhancements

This release of Cloud Manager includes enhancements to the management of Cloud Volumes ONTAP.

Enhancement available in all cloud providers

Cloud Manager can now deploy and manage Cloud Volumes ONTAP 9.9.0.

[Learn about the new features included in this release of Cloud Volumes ONTAP](#).

Enhancements available in AWS

- You can now deploy Cloud Volumes ONTAP 9.8 in the AWS Commercial Cloud Services (C2S) environment.

[Learn how to get started in C2S](#).

- Cloud Manager has always enabled you to encrypt Cloud Volumes ONTAP data using the AWS Key Management Service (KMS). Starting with Cloud Volumes ONTAP 9.9.0, data on EBS disks and data tiered to S3 are encrypted if you select a customer-managed CMK. Previously, only EBS data would be encrypted.

Note that you'll need to provide the Cloud Volumes ONTAP IAM role with access to use the CMK.

[Learn more about setting up the AWS KMS with Cloud Volumes ONTAP](#).

Enhancement available in Azure

You can now deploy Cloud Volumes ONTAP 9.8 in the Azure Department of Defense (DoD) Impact Level 6 (IL6).

Enhancements available in Google Cloud

- We've reduced the number of IP addresses that are required for Cloud Volumes ONTAP 9.8 and later in Google Cloud. By default, one less IP address is required (we unified the intercluster LIF with the node management LIF). You also have the option to skip the creation of the SVM management LIF when using the API, which would reduce the need for an additional IP address.

[Learn more about IP address requirements in Google Cloud](#).

- When you deploy a Cloud Volumes ONTAP HA pair in Google Cloud, you can now choose shared VPCs for VPC-1, VPC-2, and VPC-3. Previously, only VPC-0 could be a shared VPC. This change is supported with Cloud Volumes ONTAP 9.8 and later.

[Learn more about Google Cloud networking requirements](#).

Connector enhancements

- Cloud Manager now notifies Admin users through an email when a Connector isn't running.

Keeping your Connectors up and running helps to ensure the best management of Cloud Volumes ONTAP and other NetApp Cloud Services.
- Cloud Manager now displays a notification if you need to change the instance type for your Connector.

Changing the instance type ensures that you can use the new features and capabilities that you're currently missing. [Learn more about machine type changes](#).

Cloud Sync enhancements

- Cloud Sync now supports sync relationships between ONTAP S3 Storage and SMB servers:
 - ONTAP S3 Storage to an SMB server
 - An SMB server to ONTAP S3 Storage

[View supported sync relationships](#).
- Cloud Sync now enables you to unify a data broker group's configuration directly from the user interface.

We don't recommend changing the configuration on your own. You should consult with NetApp to understand when to change the configuration and how to change it.

[Learn more about defining a unified configuration](#).

Cloud Tiering enhancements

- When tiering to Google Cloud Storage, you can apply a lifecycle rule so that the tiered data transitions from the Standard storage class to lower-cost Nearline, Coldline, or Archive storage after 30 days.
- Cloud Tiering now displays if you have any undiscovered on-prem ONTAP clusters so that you can add them to Cloud Manager to enable tiering or other services on those clusters.

[Learn how to discover these additional clusters](#).

Active IQ enhancements

- When Active IQ displays the list of your on-prem clusters (based on your NSS account), you can click a button to [discover the cluster](#) and add it to the Cloud Manager Canvas. This makes it easier to manage all your storage systems from Cloud Manager.
- When Active IQ determines that one or more clusters require firmware updates, you can click a button to [download the Ansible playbook and upgrade the cluster firmware](#).
- A new [Cloud-Ready Workloads tab](#) provides a list of the workloads or volumes that we have identified as ideal to move to the cloud from your on-prem ONTAP clusters. Moving some of these volumes could reduce your costs and improve performance and resiliency.

See [What is Lift and Shift?](#)

ANF enhancements

- Now you can dynamically change the service level for a volume to meet workload needs and optimize your costs. The volume is moved to the other capacity pool with no impact to the volume. [Learn more](#).

Cloud Manager 3.9.3 update (16 Feb 2021)

Cloud Backup Service enhancements

- Now you can restore volumes to on-premises ONTAP systems from backup files that reside in Amazon S3, Azure Blob, and Google Cloud Storage.
- A new Restore Dashboard has been added that provides details about all the volumes and files you have restored.

The Dashboard is also the starting place to perform all volume and file restore operations. See [the Restore Dashboard](#) for details. In previous releases the restore volumes option was included in the Backup Dashboard.

- Cloud Backup is now supported on Cloud Volumes ONTAP HA systems in Google Cloud.

Cloud Manager 3.9.3 update (14 Feb 2021)

Cloud Compliance enhancements

- View and manage Azure Information Protection (AIP) labels in files you are scanning.
 - After you integrate the AIP label functionality into Cloud Compliance, you can view the labels that are assigned to files, add labels to files, and change labels. See [how to integrate AIP labels](#) in your workspace.
 - Assign labels individually to files, or use the Policies functionality to [add labels to all files that match the Policy criteria](#). With Policies, labels are updated continuously as Cloud Compliance finds matches in your files.
 - Filter data in the Investigation page by AIP label to view all files that match the label.
- Send email alerts to Cloud Manager users (daily, weekly, or monthly) when any of your Policies return results so you can get notifications to protect your data.

Select this option when [creating or editing any Policy](#).

- View File Owner and Permission information when [viewing individual file details](#).

You can also use this criteria to further filter your data in the Investigation page.

- Delete files directly from Cloud Compliance.

You can [permanently remove files](#) that seem insecure or risky to leave in your storage system.

Cloud Manager 3.9.3 update (10 Feb 2021)

This update includes enhancements to several features and services.

Cloud Tiering enhancements

- Cloud Tiering now activates write-back prevention on a cluster when an aggregate is at >90% capacity (70% for ONTAP 9.6 and earlier). By preventing cold data write-backs on heavily utilized local tiers, Cloud

Tiering preserves the local tier for active data.

When this happens, an indication appears in the Manage Aggregates table.

Manage Aggregates				
6 Aggregates				
Aggregate Name	Total Size	Used Size	Cold Data	Tiered Size
agg10fg1	0 B	0 B	0 B (Estimated)	0 B
agg11fg1	0 B	0 B	0 B (Estimated)	0 B
agg12fg2soft	3.52 GB	3.28 GB	2.96 GB	5.62 GB
Notice: If the local tier is at >90% capacity, cold data is read directly from the cloud tier without being written back to the local tier. By preventing cold data write-backs on heavily utilized local tiers, FabricPool preserves the local tier for active data. To resolve that, you can change the value (0-99%), add disks to the aggregate, or move volumes.				
	0 B	0 B	0 B (Estimated)	0 B
	2.64 GB	2.52 GB	1.76 GB (Estimated)	0 B
	2.64 GB	1.52 GB	1.06 GB (Estimated)	0 B

- You can now add on-prem ONTAP clusters more easily from the Cloud Tiering service.

When you click **Add cluster** from the Cloud Tiering page, you're now sent directly to the **Add Working Environment** wizard.

- You can now filter the Timeline to show actions specific to the Cloud Tiering service.

The screenshot shows the 'Timeline' section of the Cloud Tiering interface. At the top, there's a 'Filters:' button with a dropdown menu open. The menu includes several filter categories: 'Time (1)', 'Service (1)', 'Action', 'Agent (1)', 'Resource', 'User', 'Status', and 'Reason'. Under 'Service (1)', the 'Cloud Tiering' option is selected, indicated by a checked checkbox. Below the dropdown, there are buttons for 'Clear' and 'Apply'.

Cloud Sync enhancements

- We've simplified the process for syncing data to or from Cloud Volumes ONTAP. You can now select a Cloud Volumes ONTAP working environment and choose an option to sync data to or from this working environment.

The screenshot shows the Cloud Manager interface. On the left, there's a 'Canvas' section with a 'CloudVolumesONTAP' resource icon and a 'Cloud Volumes ONTAP' button. Below it is a cloud icon labeled 'SINGLE' containing 'CloudVolumesONTAP' and 'Cloud Volumes ONTAP', with '51 GiB Capacity' and an 'aws' logo. On the right, there's a detailed view for 'CloudVolumesONTAP'. It shows the status 'On' with a green square. Below it are four service sections: 'Compliance' (Off, red square), 'Monitoring' (On, green square), 'File Cache' (Off, red square), and 'Sync' (On, green square). To the right of these are buttons for 'Enable', 'Sync data from this location', 'Sync data to this location', 'View Dashboard', and a 'More' options menu. A hand cursor is hovering over the 'More' menu.

- In the last release, we introduced a new Reports feature that provides information that you can use with the help of NetApp personnel to tune a data broker's configuration and improve performance. These reports are now supported with object storage.

Cloud Manager 3.9.3 (9 Feb 2021)

This update includes enhancements to several features and services.

Monitoring enhancements

- The Monitoring service is now supported with Cloud Volumes ONTAP for Azure.
- The Monitoring service is also supported in Government regions in AWS and Azure.

The Monitoring service gives you complete visibility into your Cloud Volumes ONTAP infrastructure. Enable the service to monitor, troubleshoot, and optimize your Cloud Volumes ONTAP resources.

[Learn more about the Monitoring service.](#)

Support improvements

We've updated the Support Dashboard by enabling you to add your NetApp Support Site credentials, which registers you for support. You can also initiate a NetApp Support case directly from the dashboard. Just click the Help icon and then **Support**.

The screenshot shows the NetApp Support Dashboard. At the top, there's a navigation bar with 'Support Dashboard' (with a question mark icon), 'Account' (which is underlined in blue), and 'Connector'. Below this, there are several sections:

- Account Information:** Shows a blue square icon with a white document symbol, the serial number '960002998664...', and the text 'Account serial number'.
- Support Registration:** Shows a green checkmark icon and the text 'Registered for Support' followed by 'Support Registration'.
- Credentials:** Buttons for 'View Active NSS Credentials' (blue), 'Learn More' (light blue), and 'Add NSS Credentials' (blue).
- Documentation:** Shows a blue book icon and the text 'Documentation'. Below it, a brief description of Cloud Manager documentation and a link to 'Cloud Manager Documentation'.
- Knowledge Base:** Shows a blue microphone icon and the text 'Knowledge Base'. Below it, a brief description of the knowledge base and a link to 'Knowledge Base'.
- Communities:** Shows a blue gear icon and the text 'Communities'. Below it, a brief description of joining the community and a link to 'Communities'.
- Feedback:** Shows a blue smiley face icon and the text 'Feedback'. Below it, a brief description of submitting feedback and a link to 'Feedback'.
- API:** Shows a blue API icon and the text 'API'. Below it, a brief description of the Cloud Manager API and a link to 'API Documentation'.
- Support:** Shows a blue support ticket icon and the text 'Support'. Below it, a brief description of creating a support case via web form and a link to 'Open an Issue'.
- Contact:** Buttons for 'Contact NetApp Support' (light blue) and 'Call Us' (blue).

Cloud Manager 3.9.2 update (11 Jan 2021)

This update includes enhancements to several features and services.

Cloud Compliance enhancements

- Added support for scanning Microsoft OneDrive accounts.

Now you can add your corporate OneDrive accounts to Cloud Compliance in order to scan folders and files from all your OneDrive users. See [scanning OneDrive accounts](#) for details.

- The "Policies" feature now allows you to create your own custom Policies that provide results for searches specific to your organization.

In the last release, Cloud Compliance provided a set predefined Policy filters that all users could use. Now you can create your own Policies to return specific scan results in the Investigation page. See how to [create your own custom policies](#).

- Ability to scan backup files from on-premises ONTAP systems for free.

If you don't want Cloud Compliance to scan volumes directly on your on-prem ONTAP systems, a new Beta feature released this month allows you to run compliance scans on backup files created from your on-prem ONTAP volumes. So if you're already creating backups of your on-prem ONTAP volumes using [Cloud Backup](#), you can use this new feature to run compliance scans on those backup files - for **FREE**.

See how to [back up on-prem ONTAP volumes to object storage](#) and how you can [scan those backup files](#).

- Cloud Compliance can now find the personal data type "IP Address" in files. See the list of all [personal data types](#) that Cloud Compliance finds in scans.

Cloud Backup enhancements

You can restore individual files to additional destination working environments:

- Backup files in Azure Blob can be used to restore individual files to Cloud Volumes ONTAP systems installed on Azure, and to on-premises ONTAP systems.
- Backup files in Amazon S3 can be used to restore individual files to on-premises ONTAP systems (restoring files to Cloud Volumes ONTAP systems installed on AWS was already supported).

View the [backup and restore matrix](#) to see which working environments are supported for creating backups, restoring volumes, and restoring files.

Cloud Manager 3.9.2 (4 Jan 2021)

This update includes enhancements to several features and services.

Cloud Volumes ONTAP enhancements

This release of Cloud Manager introduces the following enhancements for Cloud Volumes ONTAP.

Support for AWS Outposts

A few months ago, we announced that Cloud Volumes ONTAP had achieved the Amazon Web Services (AWS) Outposts Ready designation. Today, we're pleased to announce that we've validated Cloud Manager and Cloud Volumes ONTAP with AWS Outposts.

If you have an AWS Outpost, you can deploy Cloud Volumes ONTAP in that Outpost by selecting the Outpost VPC in the Working Environment wizard. The experience is the same as any other VPC that resides in AWS. Note that you will need to first deploy a Connector in your AWS Outpost.

There are a few limitations to point out:

- Only single node Cloud Volumes ONTAP systems are supported at this time
- The EC2 instances that you can use with Cloud Volumes ONTAP are limited to what's available in your Outpost
- Only General Purpose SSDs (gp2) are supported at this time

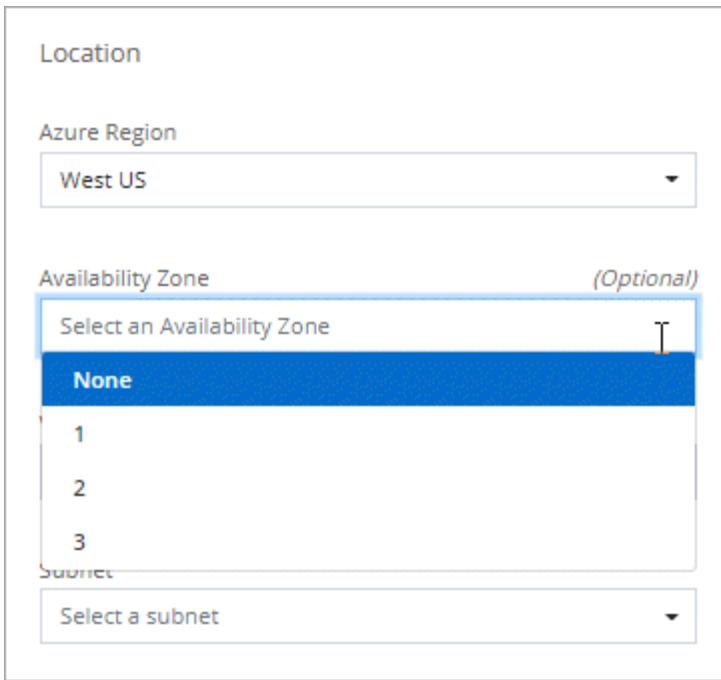
Support for Ultra SSD VNVRAM in all supported Azure regions

Cloud Volumes ONTAP can now use an Ultra SSD as VNVRAM when you use the E32s_v3 VM type with a single node system [in any supported Azure region](#).

VNVRAM provides better write performance.

Ability to choose an Availability Zone in Azure

You can now choose the Availability Zone in which you'd like to deploy a single node Cloud Volumes ONTAP system. If you don't select an AZ, Cloud Manager will select one for you.



Support for bigger disks and new instances in GCP

- Cloud Volumes ONTAP now supports 64 TB disks in GCP.



The maximum system capacity with disks alone remains at 256 TB due to GCP limits.

- Cloud Volumes ONTAP now supports the following machine types:
 - n2-standard-4 with the Explore license and with BYOL
 - n2-standard-8 with the Standard license and with BYOL
 - n2-standard-32 with the Premium license and with BYOL

Cloud Tiering enhancements

- A new Cloud Performance Test gives you the ability to measure network latency and throughput performance from an ONTAP cluster to an object store before and after setting up data tiering.

Your cluster performance results			
Node: Node A	Last Check: 11/14/2020 08:54 am		Recheck Performance
Operation	Size	Avg. Latency (ms)	Throughput
Write	4 KB	17687	337.5 MB
Read	8 KB	5348	14.33 MB
Read	8 KB	5568	27.98 MB
Read	32 KB	5668	108.5 MB
Read	256 KB	5809	706.8 MB

Notice: We recommend that you run this check when the cluster is under 50% CPU utilization.

- The Tiering Setup wizards were redesigned for ease of use.

Additional enhancements

- New Support Dashboard

In the Help menu, a new Support Dashboard includes links to resources that can enable you to get help, submit feedback, and contact NetApp Support. You can also send and download AutoSupport messages from the **Connector AutoSupport** tab.

Support Dashboard

Account

Connector

960002998664...
Account serial number

Registered for Support
Support Registration

View Active NSS Credentials

Learn More

Add NSS Credentials

Documentation

To help you get the most out of Cloud Manager, visit the Cloud Manager documentation for step-by-step instructions.

Cloud Manager Documentation

Knowledge Base

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

Knowledge Base

Communities

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

Communities

Feedback

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

Feedback

API

Get help using the Cloud Manager API.

API Documentation

Support

Create a NetApp Support case via our web form.

Open an Issue

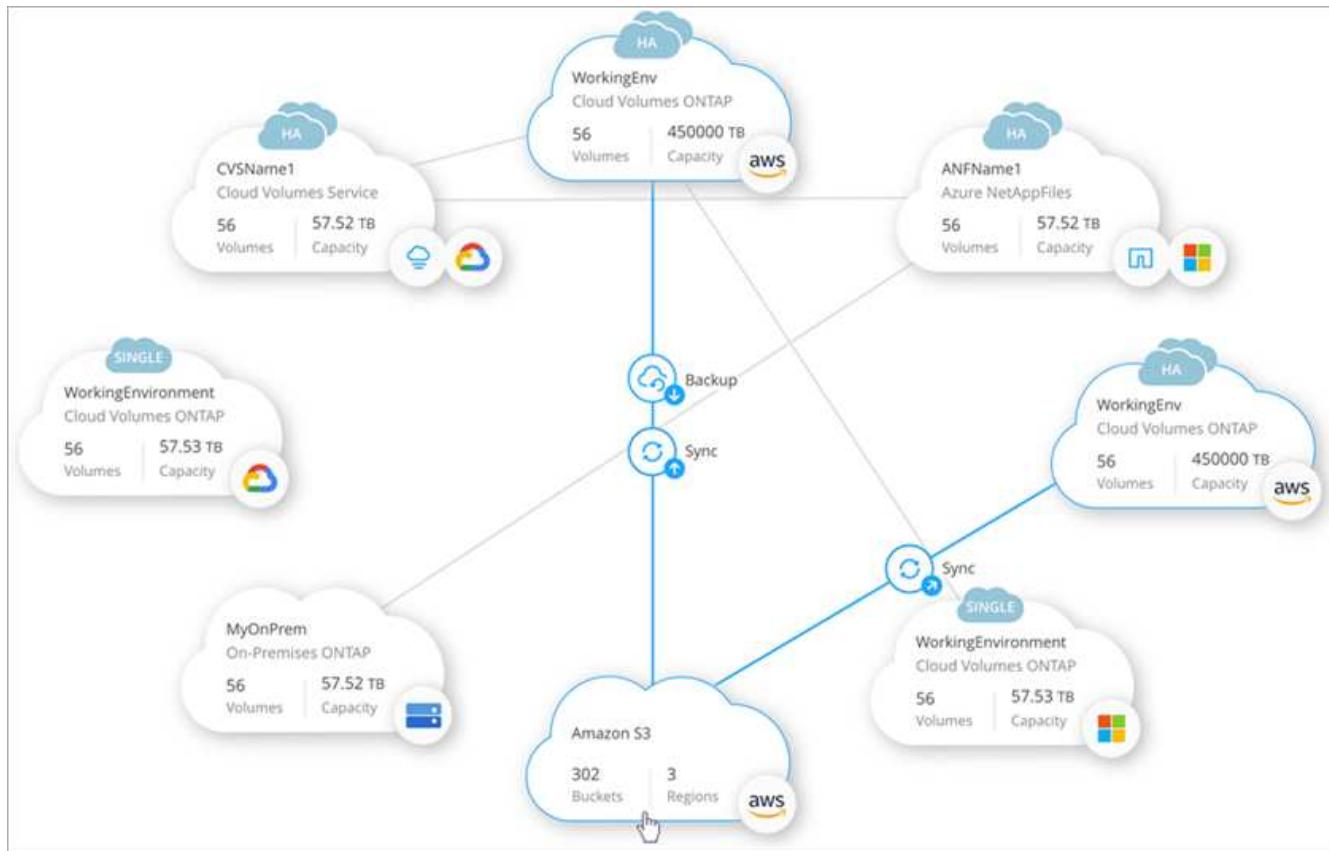
Contact NetApp Support.

Call Us

- Visual representation between working environments

Cloud Manager makes it easier to view the relationships between the services enabled on your working environments.

For example, the following image shows an example of two working environments where data is backed up from Cloud Volumes ONTAP to Amazon S3, and where data is synced between Amazon S3 and two Cloud Volumes ONTAP systems.



Cloud Manager 3.9.1 (7 Dec 2020)

This update includes enhancements to several features and services.

General enhancements

- We've renamed the **Working Environments** tab to **Canvas**.

This tab starts as a blank canvas and enables you to add your working environments by deploying, allocating, and discovering storage across your hybrid cloud.

The screenshot shows the Cloud Manager interface with the 'Canvas' tab selected. On the left, there's a 'Cloud Volumes ONTAP PAYGO' environment in AWS (CVONATA1) with 0.59 TB allocated capacity. Next to it is an 'On-Prem' environment (OnPrem1) with 1 TB allocated capacity. Below these are two Azure environments: 'CVOAzure' with 0.29 TB allocated capacity and 'AzureNetAppFiles' with 1 volume and 500.00 GB capacity. To the right, a 'Working Environments' sidebar lists five items: 1 On-Premises (1 TB Allocated Capacity), 1 Cloud Volume ONTAP (High-Availability) (0.59 TB Allocated Capacity), 1 Cloud Volumes ONTAP (0.29 TB Allocated Capacity), 1 Azure NetApp Files (0.00 Byte Allocated Capacity), and 1 Amazon S3 (89 Buckets). At the bottom left, a footer note says 'Cloud Manager 3.9.0 Build: 1 Nov 1, 2020 09:22:53 am UTC Demo'.

- It's now easier to navigate between Cloud Manager and Spot.

A new **Storage Operations** section in Spot enables you to navigate directly to Cloud Manager. After you're done, you can get back to Spot from the **Compute** tab in Cloud Manager.

Cloud Volumes ONTAP AMI change

Starting with the 9.8 release, the Cloud Volumes ONTAP PAYGO AMI is no longer available in the AWS Marketplace. If you use the Cloud Manager API to deploy Cloud Volumes ONTAP PAYGO, you'll need to [subscribe to the Cloud Manager subscription in the AWS Marketplace](#) before deploying a 9.8 system.

Cloud Backup enhancements

- You now have the ability to restore individual files from a backup file.
 - If you need to restore a few files from a certain point in time, now you can just restore those files instead of having to restore the whole volume.
 - You can restore the files to a volume in the same working environment, or to a volume in a different working environment that's using the same cloud account.
 - This single file restore option relies on a new Cloud Restore instance that is deployed in your environment. [Go here for details about this new functionality.](#)
- You can configure Cloud Backup in a Google Cloud environment now while deploying a new Cloud Volumes ONTAP system. In the past you could only configure Cloud Backup on existing Cloud Volumes ONTAP systems.
- Now you can restore volumes that you had backed up from on-prem ONTAP systems to Cloud Volumes ONTAP systems deployed in AWS or Azure.

Cloud Compliance enhancements

- Ability to scan data directly from your on-premises ONTAP clusters

If you have discovered your on-prem clusters in Cloud Manager, now you can run Compliance scans directly on those volumes. No longer do you have to copy those volumes to a Cloud Volumes ONTAP system before you can run a Compliance scan.

- Ability to install Cloud Compliance in your on-premises location

If you plan to scan on-premises ONTAP cluster data, now you can install Cloud Compliance on-premises as well. It is still integrated in the Cloud Manager UI and it can still be used to scan other working environments, including cloud based volumes, buckets, and databases.

[See the prerequisites and installation steps here.](#)

- Ability to easily scan CIFS data protection volumes

In the past you have been able to scan NFS DP volumes. This release allows you to easily scan CIFS DP volumes directly within Cloud Compliance. [Learn how.](#)

- A new "Policies" feature provides a predefined selection of combination filters that return results in the Investigation page

Ten Policies are available with this release. For example, the "HIPAA – Stale data over 30 days" Policy identifies files that contain Health information that is over 30 days old. [See the full list of predefined policies.](#)

You can select Policies from a tab in the Compliance Dashboard and as a filter in the Investigation page.

- Cloud Compliance can now find the sensitive personal data type "Political Opinions Reference" in files. See the list of all [sensitive personal data types](#) that Cloud Compliance finds in scans.
- A new filter for "file size" is available from the Investigation page to refine your search results for files of a certain size

Note that the list of required endpoints for Cloud Compliance deployments has been revised based on cloud provider. [Review this list for AWS, Azure, and on-prem requirements.](#)

Cloud Tiering enhancements

- You can now change the tiering policy and minimum cooling days for multiple volumes at the same time.

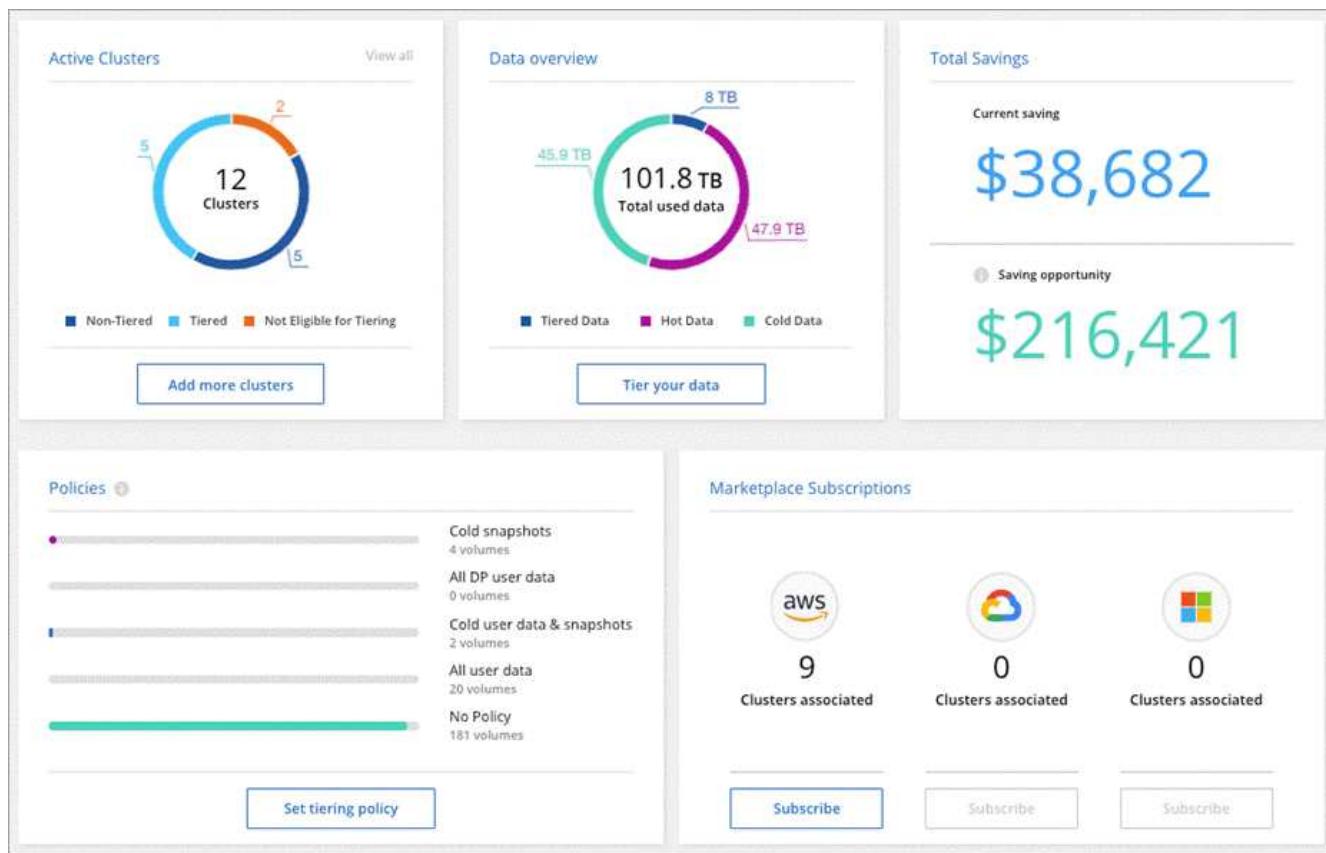
The screenshot shows a 'Configure volumes' dialog with three numbered callouts:

- Callout 1: Points to the 'Configure volumes' button at the top right of the dialog.
- Callout 2: Points to the 'Selected' checkbox in the volume selection row for 'vol2'.
- Callout 3: Points to the 'Tiering Policy' dropdown menu icon in the volume selection row for 'vol1'.

The dialog displays a table of volumes with the following data:

Volume Name	SVM Name	Volume Size	Used Size	Snapshot Used Size	Cold Data	Tier Status	Tiering Policy
vol2	svm_AFF1	200 GB	4.11 MB	424 KB	2.88 MB	70 %	<input checked="" type="checkbox"/> Tiered Volume
vol1	svm_AFF1	200 GB	1 MB	0 B	716.8 KB	70 %	<input checked="" type="checkbox"/> Tiered Volume
vol3	svm_AFF1	200 GB	1 MB	0 B	716.8 KB	70 %	<input checked="" type="checkbox"/> Tiered Volume

- Cloud Tiering now provides an aggregated view of data tiering from each of your on-premises clusters. This overview provides a clear picture of your environment and enables you to take proper actions. [Learn more about this page.](#)



Cloud Sync enhancements

- You can now manage data broker groups.

Grouping data brokers together can help improve the performance of sync relationships. Manage groups by adding a new data broker to a group, viewing information about data brokers, and more.

[Learn how to manage data brokers.](#)

- Cloud Sync now supports an ONTAP S3 Storage to ONTAP S3 Storage sync relationship.

[View the entire list of supported sources and targets.](#)

Cloud Manager 3.9 Update (18 Nov 2020)

Cloud Backup is now supported on Cloud Volumes ONTAP in Google Cloud. Click [here](#) for details.

Note: Only single-node systems are currently supported.

Cloud Volumes ONTAP 9.8 (16 Nov 2020)

Cloud Volumes ONTAP 9.8 is available in AWS, Azure, and Google Cloud Platform. This release includes support for [HA pairs in GCP](#).



The GCP service account associated with the Connector [needs the latest permissions](#) to deploy an HA pair in GCP.

[Learn what else is new in Cloud Volumes ONTAP 9.8.](#)

Cloud Manager 3.9 update (8 Nov 2020)

We released an enhancement to Cloud Manager 3.9.

Cloud Compliance enhancements

- Now you can create custom personal data identifiers from your databases. This gives you the full picture about where potentially sensitive data resides in **all** your files.

A feature we call "Data Fusion" allows you to scan your files to identify whether unique identifiers from your databases are found in those files—basically making your own list of "personal data" that is identified in Cloud Compliance scans.

[Learn how to create custom personal identifiers from your databases.](#)

- Added support for scanning MySQL database schemas.

Go to [scanning database schemas](#) for the list of all supported databases and for instructions.

Cloud Manager 3.9 (3 Nov 2020)

This update includes enhancements to several features and services.

Azure Private Link for Cloud Volumes ONTAP

By default, Cloud Manager now enables an Azure Private Link connection between Cloud Volumes ONTAP and its associated storage accounts. A Private Link secures connections between endpoints in Azure.

- [Learn more about Azure Private Links](#)
- [Learn more about using an Azure Private Link with Cloud Volumes ONTAP](#)

Active IQ cluster insights

Active IQ cluster insights are now available within Cloud Manager. This initial release provides the following functionality:

- Shows a list of your on-prem clusters based on your NetApp Support Site (NSS) credentials.
- Identifies which of those clusters have been discovered within Cloud Manager, and those that have not been discovered.
- Enables you to view unused Cloud Volumes ONTAP licenses.
- Identifies if any of your discovered ONTAP clusters need to have their shelf or disk firmware updated.

Go to [Monitoring ONTAP clusters](#) for details. This information is provided to Cloud Manager from the [Active IQ Digital Advisor](#).

Cloud Tiering enhancements

- When you set up data tiering from your volumes, Cloud Tiering now identifies the Snapshot used size for each volume. This information can help you decide which type of data to tier to the cloud.

Tier Volumes		Tier volumes				Learn how much you can save with each Tiering Policy	
50 Volumes							
Volume Name	SVM Name	Volume Size	Used Size	Snapshot used size	Cold Data (Estimated)	Tier Status	TieringPolicy
Volume 1	SVMNameB...	462 TB	100 TB	50 TB	70 TB 70%	Available for Tiering	Cold User Data

- Cloud Tiering now enables inactive data reporting on HDD aggregates, if the cluster is running ONTAP 9.6 or later.

This enhancement makes it easier for Cloud Tiering to show you the potential savings from tiering cold data.

- Cloud Tiering now prompts you to change thick-provisioned volumes to thin-provisioned volumes, if that's required to enable data tiering on the volumes in an aggregate.

Cloud Manager transition to SaaS

We've introduced a software-as-a-service experience for Cloud Manager. This new experience makes it easier for you to use Cloud Manager and enables us to provide additional features to manage your hybrid cloud infrastructure.

The previous Cloud Manager experience

Cloud Manager software was previously comprised of a user interface and a management layer that sent requests to cloud providers. To get started, you would deploy Cloud Manager in your cloud network or on-premises network and then access the user interface that runs on that instance.

That experience has changed.

The new SaaS experience

The Cloud Manager interface is now accessible through a SaaS-based user interface that you log in to from NetApp Cloud Central. You no longer need to access a user interface from software that runs in your network.

In most cases, you need to deploy a *Connector* in your cloud or on-premises network. The Connector is software that's needed to manage Cloud Volumes ONTAP and other cloud data services. (The Connector is actually the same as the existing Cloud Manager software that you have installed.)

Benefits

This SaaS-based approach provides several benefits:

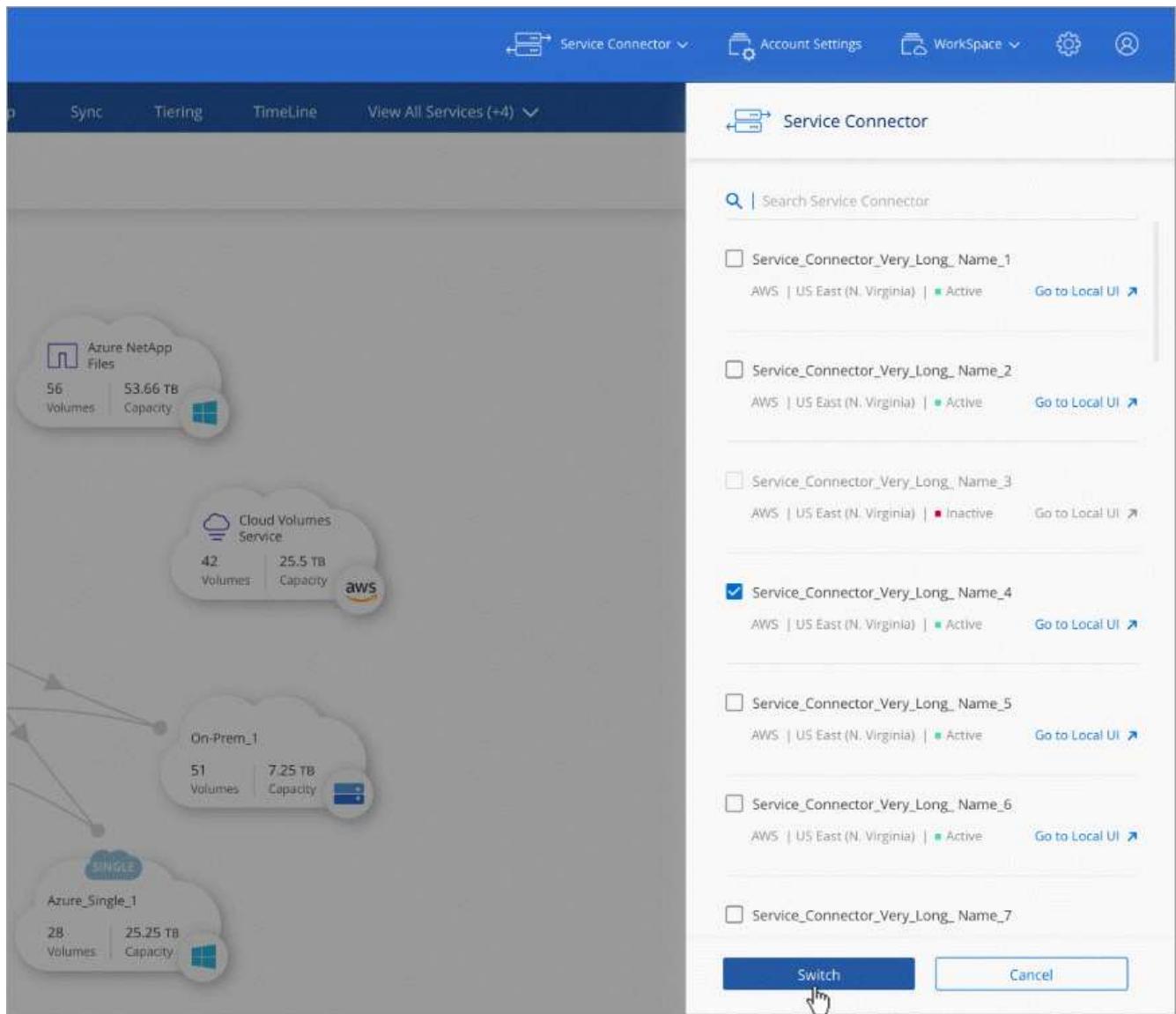
- It enables us to offer additional management capabilities for Azure NetApp Files and Cloud Volumes Service without needing to deploy software in your environment.
- You can easily switch between your NetApp accounts.

If a user is associated with multiple NetApp accounts, they can change to a different account at any time

from the User Settings menu. They can then see the Connectors and working environments that are associated with that account.

The screenshot shows the 'User Settings' page with a blue header bar containing icons for 'Account Settings', 'WorkSpace', 'Settings', and a search bar. Below the header, there's a 'Logout' button. The main content area displays user information: Name (James Elliott) and Email (james.elliott@netapp.com). Under 'Company', it shows NetApp. A modal window titled 'Account 1' is open, showing a list of accounts: Account Name 1, Account Name 2, Account Name 3 (with a hand cursor icon pointing to it), Account Name 4, and Account Name 5. There is also a 'Switch Account' button at the top right of the modal.

- You can easily switch between Connectors (what you know today as the Cloud Manager software) that are installed in different networks or different cloud providers.

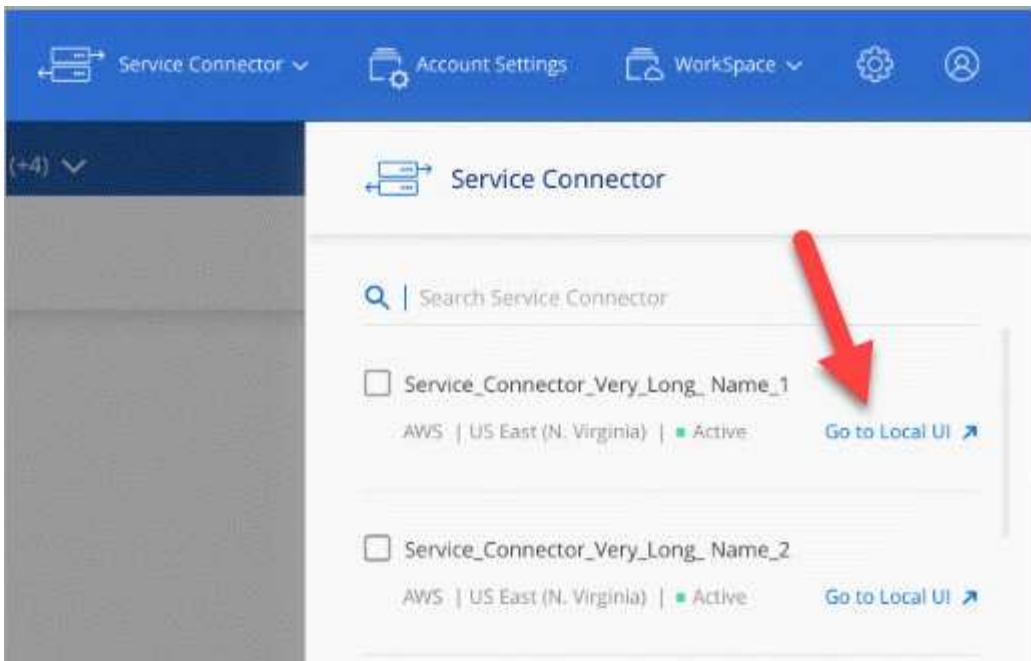


The local user interface

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 for a few tasks that need to be performed from the Connector itself:

- Setting a proxy server
- Installing a patch
- Downloading AutoSupport messages

You can access the local user interface directly from the SaaS user interface:



Instance, VM, and machine type changes

To ensure that adequate resources are available for new and upcoming features in Cloud Manager, we've changed the minimum required instance, VM, and machine type as follows:

- AWS: t3.xlarge
- Azure: DS3 v2
- GCP: n1-standard-4

When you upgrade the machine type, you'll get access to features like a new Kubernetes experience, Global File Cache, Monitoring, and more.

These default sizes are the minimum supported [based on CPU and RAM requirements](#).

Cloud Manager will prompt you with instructions to change the machine type of the Connector.

Known issues

Known issues identify problems that might prevent you from using this release of the product successfully.

You can find known issues for Cloud Volumes ONTAP in the [Cloud Volumes ONTAP Release Notes](#) and for ONTAP software in general in the [ONTAP Release Notes](#).

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.

Known limitations

Known limitations identify platforms, devices, or functions that are not supported by this release of the product, or that do not interoperate correctly with it. Review these limitations carefully.

Only an HTTP proxy server is supported

If your corporate policies require you to use a proxy server for all HTTP communication to the internet, then you must configure your Connectors to use that HTTP proxy server. The proxy server can be in the cloud or in your network.

Cloud Manager doesn't support using an HTTPS proxy with the Connector.

SSL decryption isn't supported

Cloud Manager doesn't support firewall configurations that have SSL decryption enabled. If SSL decryption is enabled, error messages appear in Cloud Manager and the Connector instance displays as inactive.

For enhanced security, you have the option to [install an HTTPS certificate signed by a certificate authority \(CA\)](#).

Blank page when loading the local UI

If you load the local user interface for a Connector, the UI might fail to display sometimes, and you just get a blank page.

This issue is related to a caching problem. The workaround is to use an incognito or private web browser session.

Pay-as-you-go not available for Azure and Google Cloud partners

If you are a Microsoft Cloud Solution Provider (CSP) partner or a Google Cloud partner, NetApp pay-as-you-go subscriptions are not available. You must purchase a license and deploy NetApp cloud solutions with a BYOL license.

Pay-as-you-go subscriptions are not available for the following NetApp cloud services:

- Cloud Volumes ONTAP
- Cloud Tiering
- Cloud Backup
- Cloud Data Sense

Only one HA pair in an Azure resource group

You must use a dedicated resource group for each Cloud Volumes ONTAP HA pair that you deploy in Azure. Only one HA pair is supported in a resource group.

Cloud Manager experiences connection issues if you try to deploy a second Cloud Volumes ONTAP HA pair in an Azure resource group.

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.

SaaS platform is disabled for Government regions

If you deploy a Connector in an AWS GovCloud region, an Azure Gov region, or an Azure DoD region, access to Cloud Manager is available only through a Connector's host IP address. Access to the SaaS platform is disabled for the entire account.

This means that only privileged users who can access the end-user internal VPC/VNet can use Cloud Manager's UI or API.

It also means that the following services aren't available from Cloud Manager:

- Kubernetes
- Cloud Tiering
- Global File Cache

The SaaS platform is required to use these services.



Cloud Backup, Cloud Data Sense, and the Monitoring service are supported and available in Government regions.

Cloud Manager doesn't support downgrades of Cloud Volumes ONTAP

Cloud Manager doesn't support downgrading Cloud Volumes ONTAP to a previous version. Contact NetApp technical support for help with downgrades.

Shared Linux hosts are not supported

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

Cloud Manager doesn't support FlexGroup volumes

While Cloud Volumes ONTAP supports FlexGroup volumes, Cloud Manager does not. If you create a FlexGroup volume from System Manager or from the CLI, then you should set Cloud Manager's Capacity Management mode to Manual. Automatic mode might not work properly with FlexGroup volumes.

Cloud Manager doesn't support ONTAP S3

While Cloud Volumes ONTAP in Azure supports objects using S3, Cloud Manager doesn't provide any management capabilities for this feature. Using the CLI is the best practice to configure S3 client access from Cloud Volumes ONTAP. For details, refer to the [S3 Configuration Power Guide](#).

Important changes in Cloud Manager

This page highlights important changes in Cloud Manager that can help you use the service as we introduce new enhancements. You should continue to read the [What's new](#) page to learn about all new features and enhancements.

Cloud Volumes ONTAP AMI change

Starting with the 9.8 release, the Cloud Volumes ONTAP PAYGO AMI is no longer available in the AWS Marketplace. If you use the Cloud Manager API to deploy Cloud Volumes ONTAP PAYGO, you'll need to [subscribe to the Cloud Manager subscription in the AWS Marketplace](#) before deploying a 9.8 system.

SaaS changes

We have introduced a software-as-a-service experience for Cloud Manager. This new experience makes it easier for you to use Cloud Manager and enables us to provide additional features to manage your hybrid cloud infrastructure.

- [Cloud Manager transition to SaaS](#)
- [Learn how Cloud Manager works](#)

Machine type changes

To ensure that adequate resources are available for new and upcoming features in Cloud Manager, we've changed the minimum required instance, VM, and machine type as follows:

- AWS: t3.xlarge
- Azure: DS3 v2
- GCP: n1-standard-4

When you upgrade the machine type, you'll get access to features like a new Kubernetes experience, Global File Cache, Monitoring, and more.

These default sizes are the minimum supported [based on CPU and RAM requirements](#).

Cloud Manager will prompt you with instructions to change the machine type of the Connector.

Account settings

We introduced NetApp accounts to provide multi-tenancy, to help you organize users and resources in isolated workspaces, and to manage access to Connectors and subscriptions.

- [Learn about NetApp accounts: users, workspaces, Connectors, and subscriptions](#)
- [Learn how to get started with your account](#)
- [Learn how to manage your account after you set it up](#)

New permissions

Cloud Manager occasionally requires additional cloud provider permissions as we introduce new features and enhancements. This section identifies new permissions that are now required.

You can find the latest list of permissions on the [Cloud Manager policies page](#).

AWS

- Starting with the 3.9.13 release, the following permissions are required for discovery of Amazon EKS clusters:

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

- Starting with the 3.9.9 release, the following permissions are required for the tagging service:

```
{
    "Action": [
        "ec2>CreateTags",
        "ec2>DeleteTags",
        "ec2>DescribeTags",
        "tag:getResources",
        "tag:getTagKeys",
        "tag:getTagValues",
        "tag:TagResources",
        "tag:UntagResources"
    ],
    "Resource": "*",
    "Effect": "Allow",
    "Sid": "tagServicePolicy"
},
```

- Starting with the 3.8.1 release, the following permissions are required to use Cloud Backup with Cloud Volumes ONTAP. [Learn more](#).

```

{
    "Sid": "backupPolicy",
    "Effect": "Allow",
    "Action": [
        "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"
    ],
    "Resource": [
        "arn:aws:s3:::netapp-backup-*"
    ]
},
}

```

Azure

- Starting with the 3.9.12 release, Cloud Manager configures an application security group for a Cloud Volumes ONTAP HA pair, which isolates the HA interconnect and cluster network NICs. A Connector requires the following new permissions to enable this configuration:

```

"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"

```

- Starting with the 3.9.10 release, you can use customer-managed encryption keys with Cloud Volumes ONTAP. A Connector requires these new permissions to set up an encryption key with a single node Cloud Volumes ONTAP system:

```
"Microsoft.Compute/diskEncryptionSets/write",
"Microsoft.KeyVault/vaults/deploy/action",
"Microsoft.Compute/diskEncryptionSets/delete"
```

- Starting with the 3.9.10 release, you can manage tags on your Azure resources using the Cloud Manager Tagging service. A Connector requires these new permissions for this service:

```
"Microsoft.Resources/tags/read",
"Microsoft.Resources/tags/write",
"Microsoft.Resources/tags/delete"
```

- Starting with the 3.9.8 release, Cloud Manager can remove Cloud Volumes ONTAP resources from a resource group, in case of deployment failure or deletion. Be sure to provide these permissions to each set of Azure credentials that you've added to Cloud Manager:

```
"Microsoft.Network/privateEndpoints/delete",
"Microsoft.Compute/availabilitySets/delete",
```

- Starting with the 3.9.7 release, Cloud Manager can now delete older cloud snapshots of root and boot disks that are created when a Cloud Volumes ONTAP system is deployed and every time its powered down. A Connector requires a new permission to delete Azure snapshots:

```
"Microsoft.Compute/snapshots/delete"
```

- To avoid Azure deployment failures, make sure that your Cloud Manager policy in Azure includes the following permission:

```
"Microsoft.Resources/deployments/operationStatuses/read"
```

- Starting with the 3.8.7 release, the following permission is required to encrypt Azure managed disks on single node Cloud Volumes ONTAP systems using external keys from another account. [Learn more](#).

```
"Microsoft.Compute/diskEncryptionSets/read"
```

- The following permissions are required to enable Global File Cache on Cloud Volumes ONTAP. [Learn more](#).

```
"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",
```

GCP

New permissions to discover GKE clusters

The following permissions are now required to discover Kubernetes clusters running in Google Kubernetes Engine:

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

New permissions to deploy Cloud Data Sense in Google Cloud

Starting with the 3.9.10 release, the following permissions are required to deploy Cloud Data Sense in Google Cloud:

- `compute.subnetworks.use`
- `compute.subnetworks.useExternalIp`
- `compute.instances.addAccessConfig`

New permission for changing machine type

We recently discovered that the following permission is required for Cloud Volumes ONTAP machine type changes when switching between machine type families.

- `compute.instances.setMinCpuPlatform`

New permissions for HA pairs

Starting with the 3.9 release, the service account for a Connector requires additional permissions to deploy a Cloud Volumes ONTAP HA pair in GCP:

- `compute.addresses.list`
- `compute.backendServices.create`
- `compute.networks.updatePolicy`
- `compute.regionBackendServices.create`
- `compute.regionBackendServices.get`
- `compute.regionBackendServices.list`

New permissions for data tiering

Starting with the 3.9 release, additional permissions are required 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.

- `iam.serviceAccounts.actAs`
- `storage.objects.get`
- `storage.objects.list`

New permissions for Kubernetes management

Starting with the 3.8.8 release, the service account for a Connector requires additional permissions to discover and manage Kubernetes clusters running in Google Kubernetes Engine (GKE):

- `container.*`

New permissions for data tiering

Starting with the 3.8 release, the following permissions are now required to use a service account for data tiering. [Learn more about this change](#).

- `storage.buckets.update`
- `compute.instances.setServiceAccount`
- `iam.serviceAccounts.getIamPolicy`
- `iam.serviceAccounts.list`

Get started with Cloud Manager

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](#), and [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 and software like [Cloud Data Sense](#), [Cloud Insights](#), [Cloud Backup service](#), [Trident](#), and more.

[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.

Endpoints	Purpose
AWS services (amazonaws.com): <ul style="list-style-type: none"> <li data-bbox="197 228 421 259">• CloudFormation <li data-bbox="197 280 323 312">• Cognito <li data-bbox="197 333 589 365">• Elastic Compute Cloud (EC2) <li data-bbox="197 386 638 418">• Key Management Service (KMS) <li data-bbox="197 439 589 470">• Security Token Service (STS) <li data-bbox="197 492 572 523">• 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 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**.

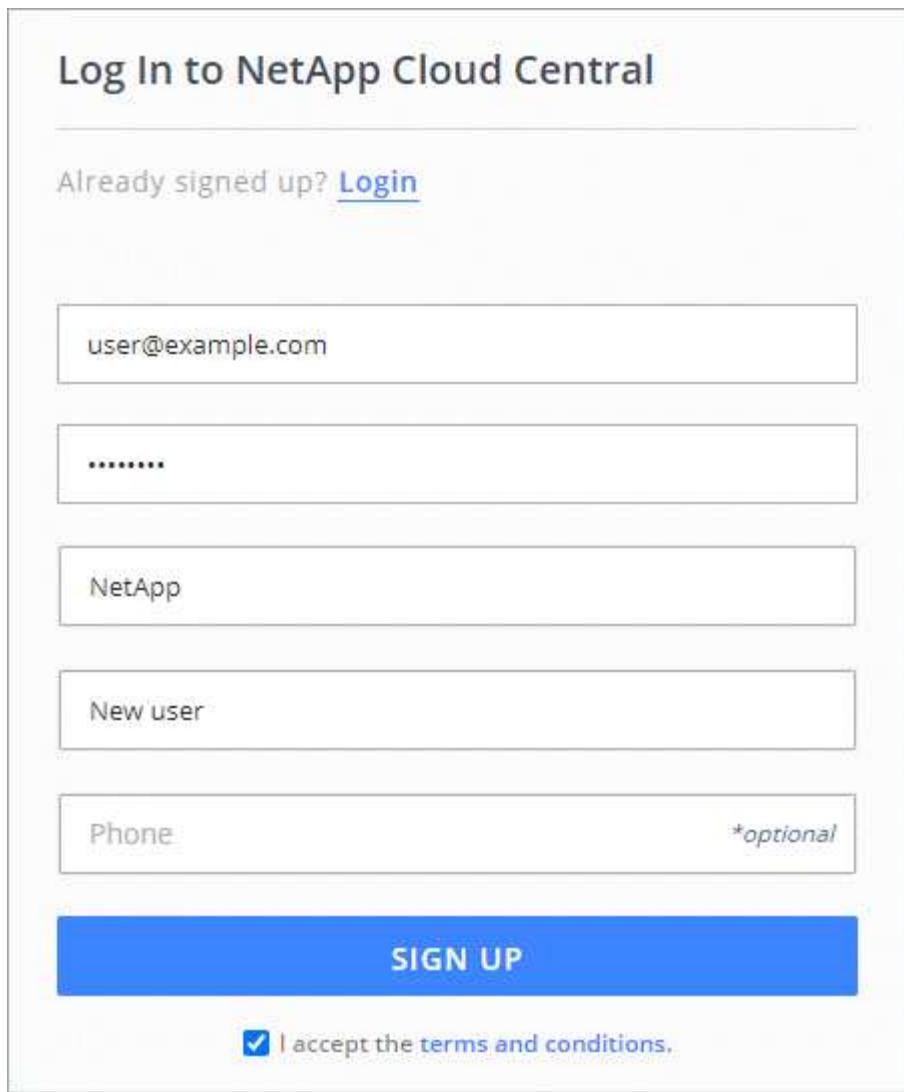
Log In to NetApp Cloud Central

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.



[Continue to Cloud Manager](#)

Log In to NetApp Cloud Central

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

Email

Password

[Forgot your password?](#)

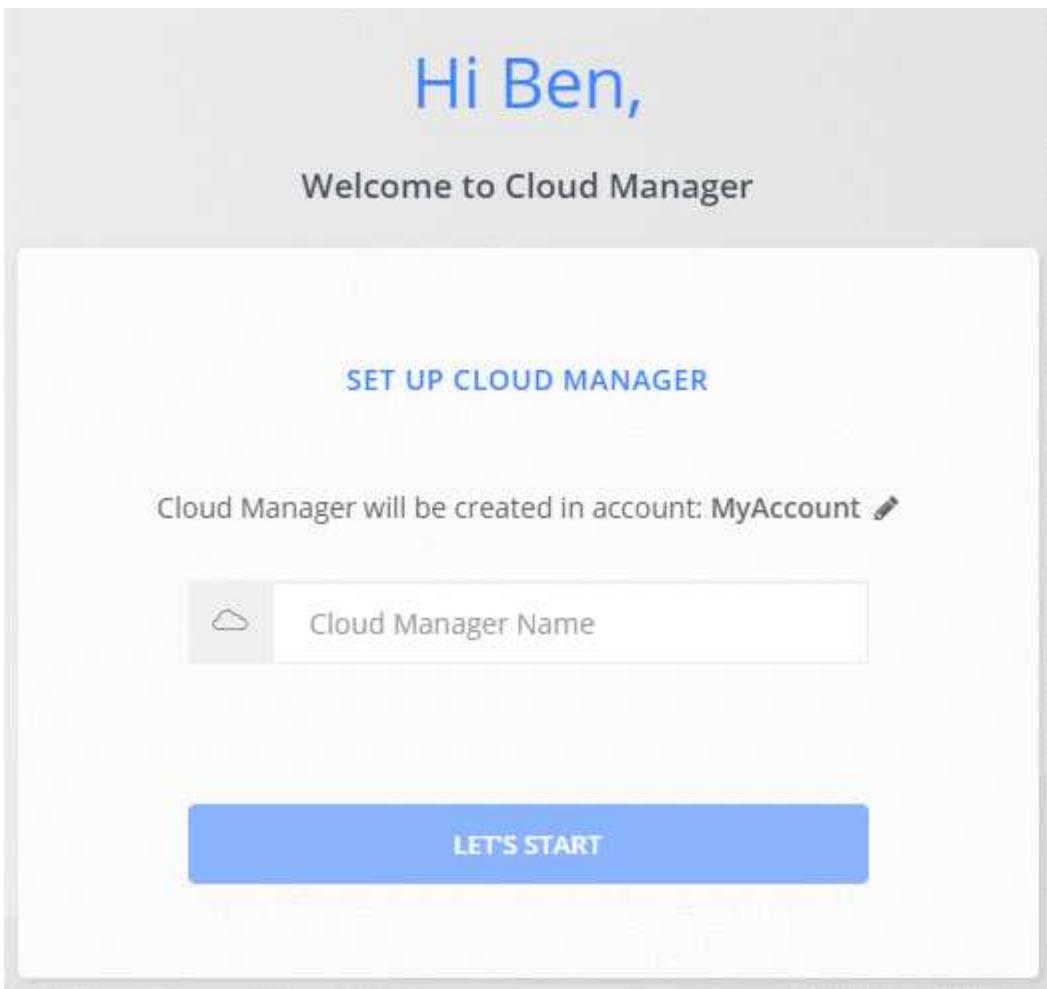
Set up a NetApp account

Account settings: users, workspaces, Connectors, and subscriptions

A *NetApp account* (formerly Cloud Central 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:

A screenshot of the "Manage Account" interface for "activeIQ". The top navigation bar includes tabs for Overview, Members, Workspaces (which is underlined in blue), Service Connector, Subscriptions, and a close button (X). The main content area is titled "Manage the Account's Workspaces" and includes a "+ Add New Workspace" button. A single workspace entry named "Workspace-1" is listed, with icons for delete and edit.

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

Max Cloud Volumes ONTAP systems per account

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.

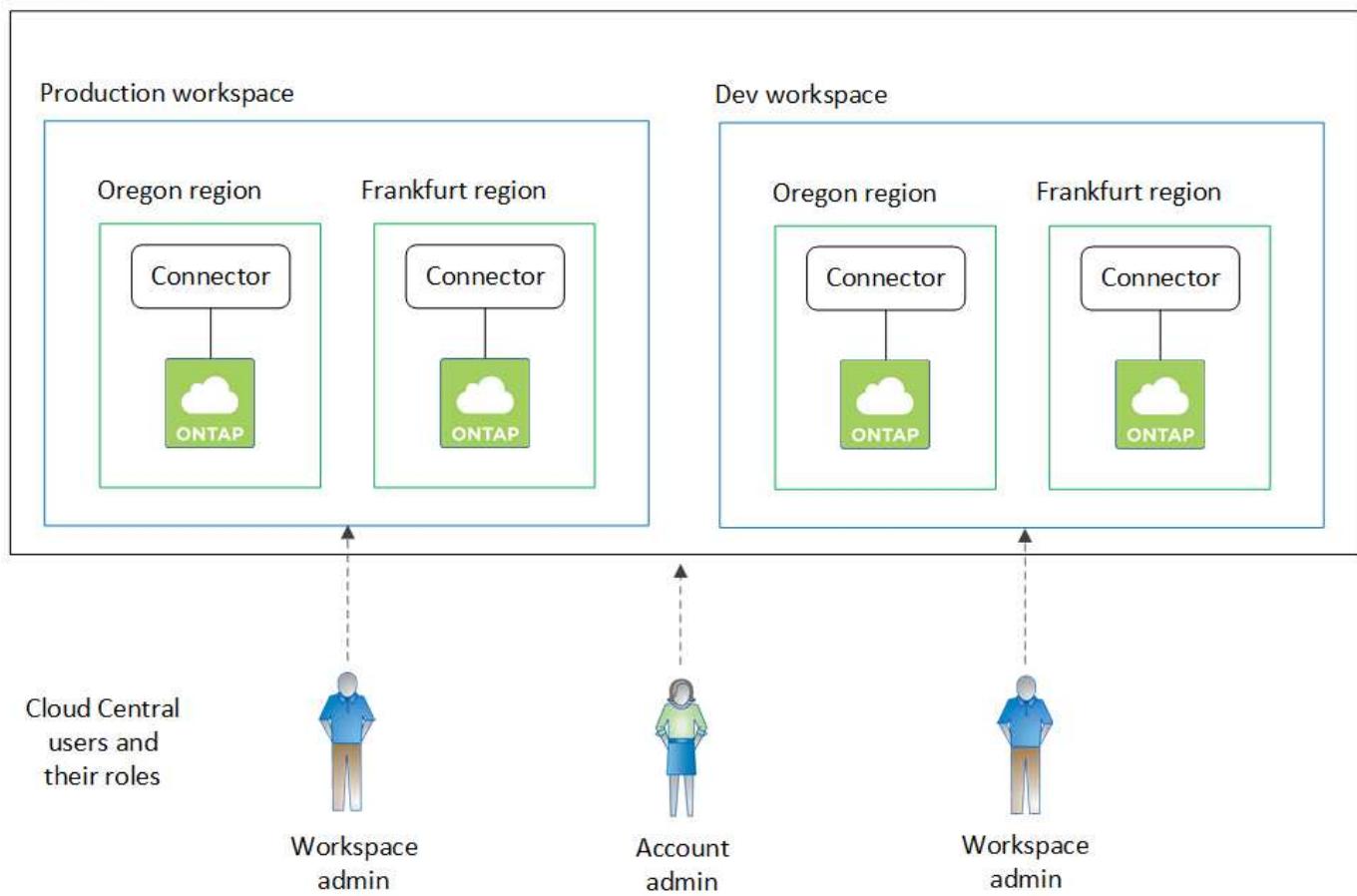


In both example images that follow, the Connector and the Cloud Volumes ONTAP systems don't actually reside *in* the NetApp account—they're running in a cloud provider. This is a conceptual representation of the relationship between each component.

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

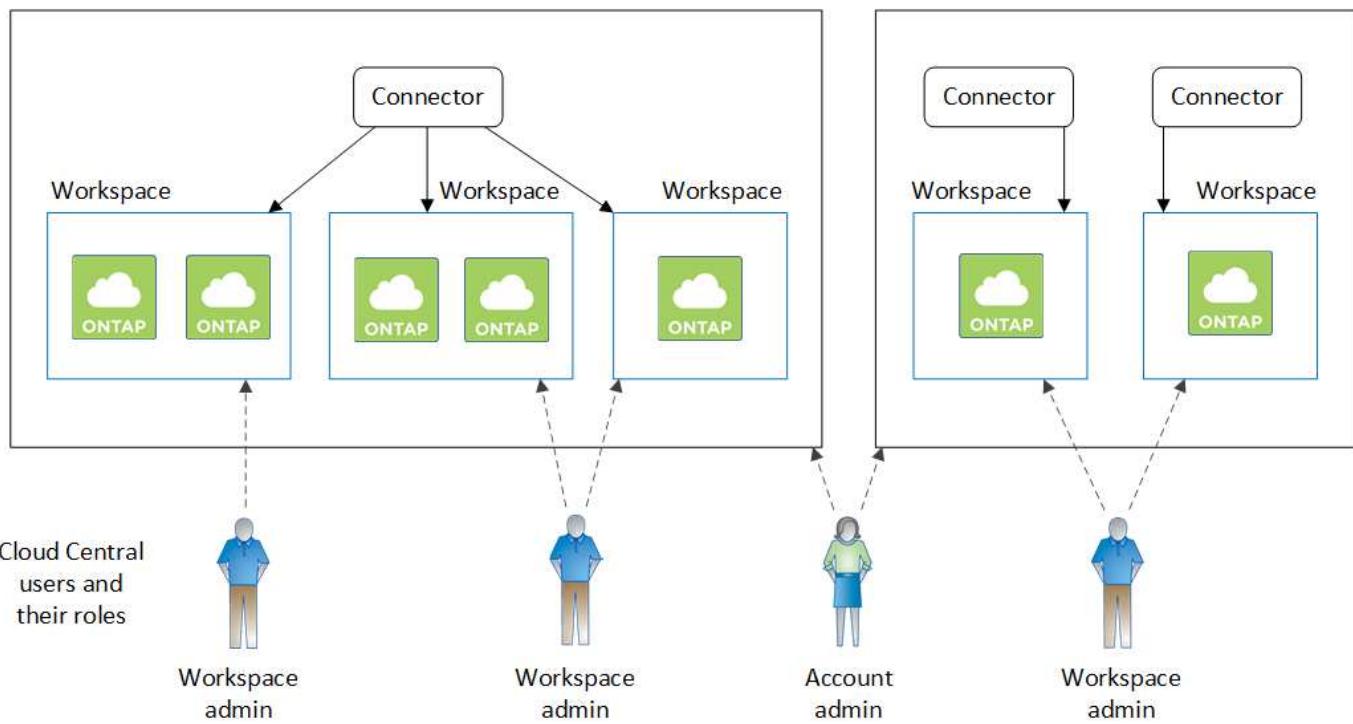


Example 2

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.

Account #1



Setting 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.](#)

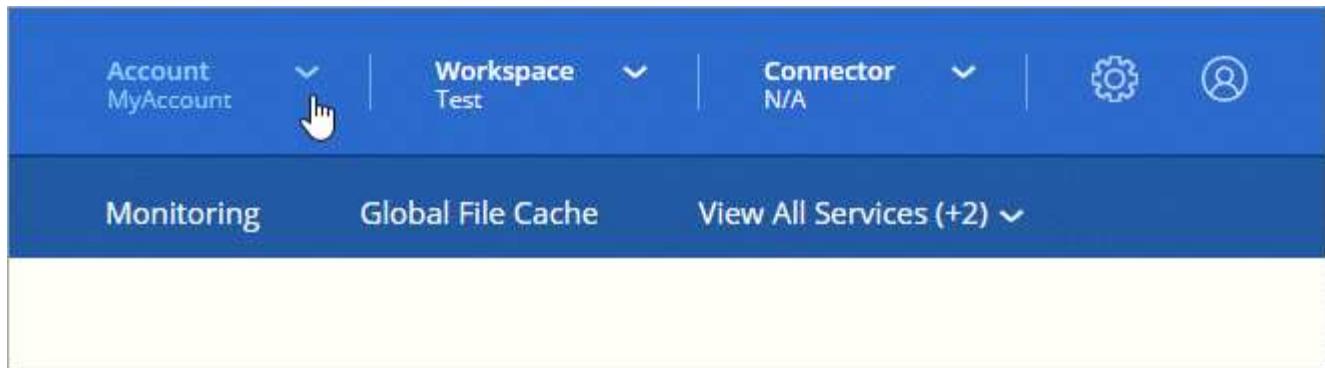
Set up your NetApp account so users can access Cloud Manager and access the working environments in a workspace. Just add a single user or add multiple users and workspaces.

Adding workspaces

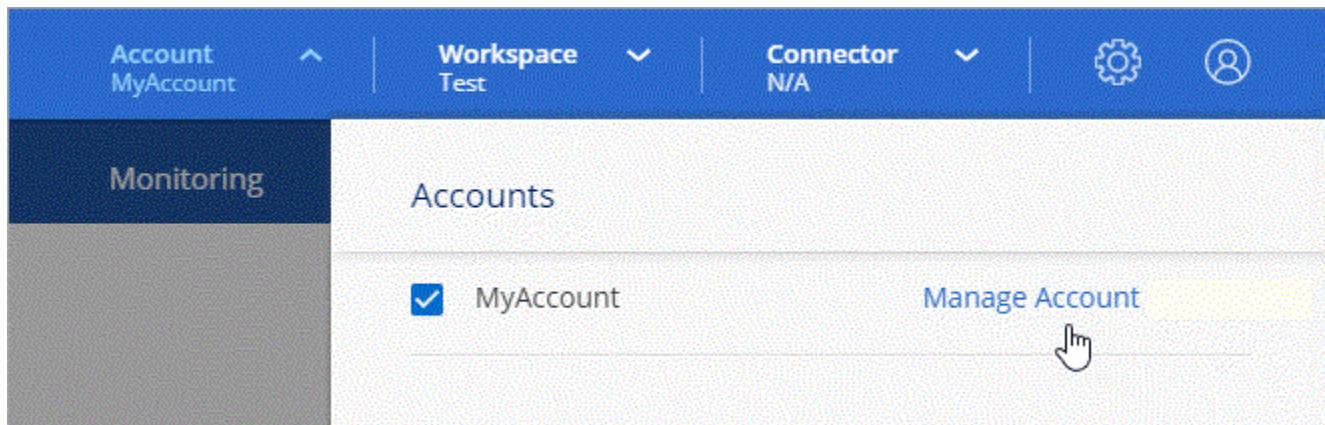
In Cloud Manager, workspaces enable you to isolate a set of working environments from other working environments and from other users. For example, you can create two workspaces and associate separate users with each workspace.

Steps

- 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

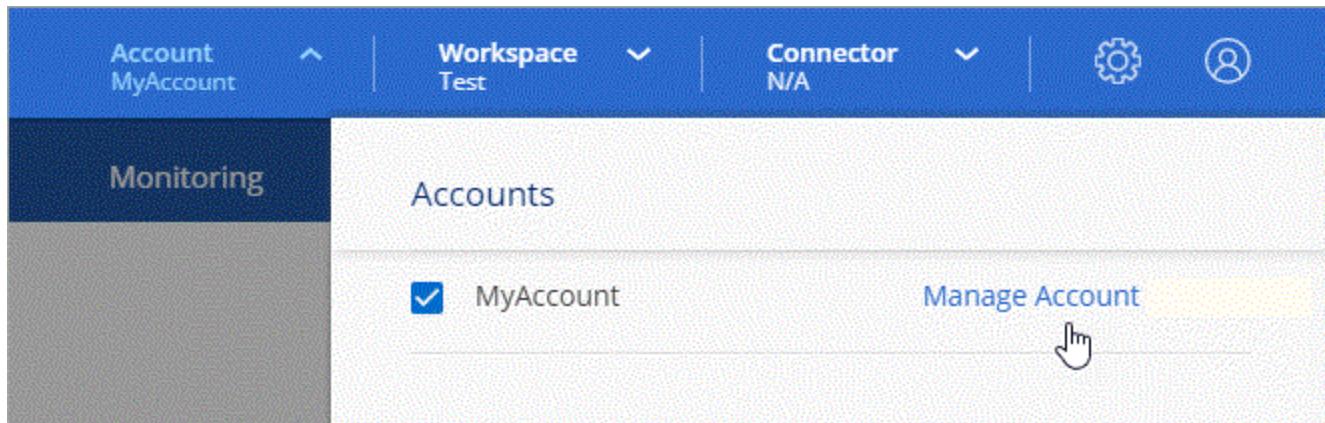
If a Workspace Admin needs access to this workspace, then you'll need to associate the user. You'll also need to associate Connectors with the workspace so Workspace Admins can use those Connectors.

Adding users

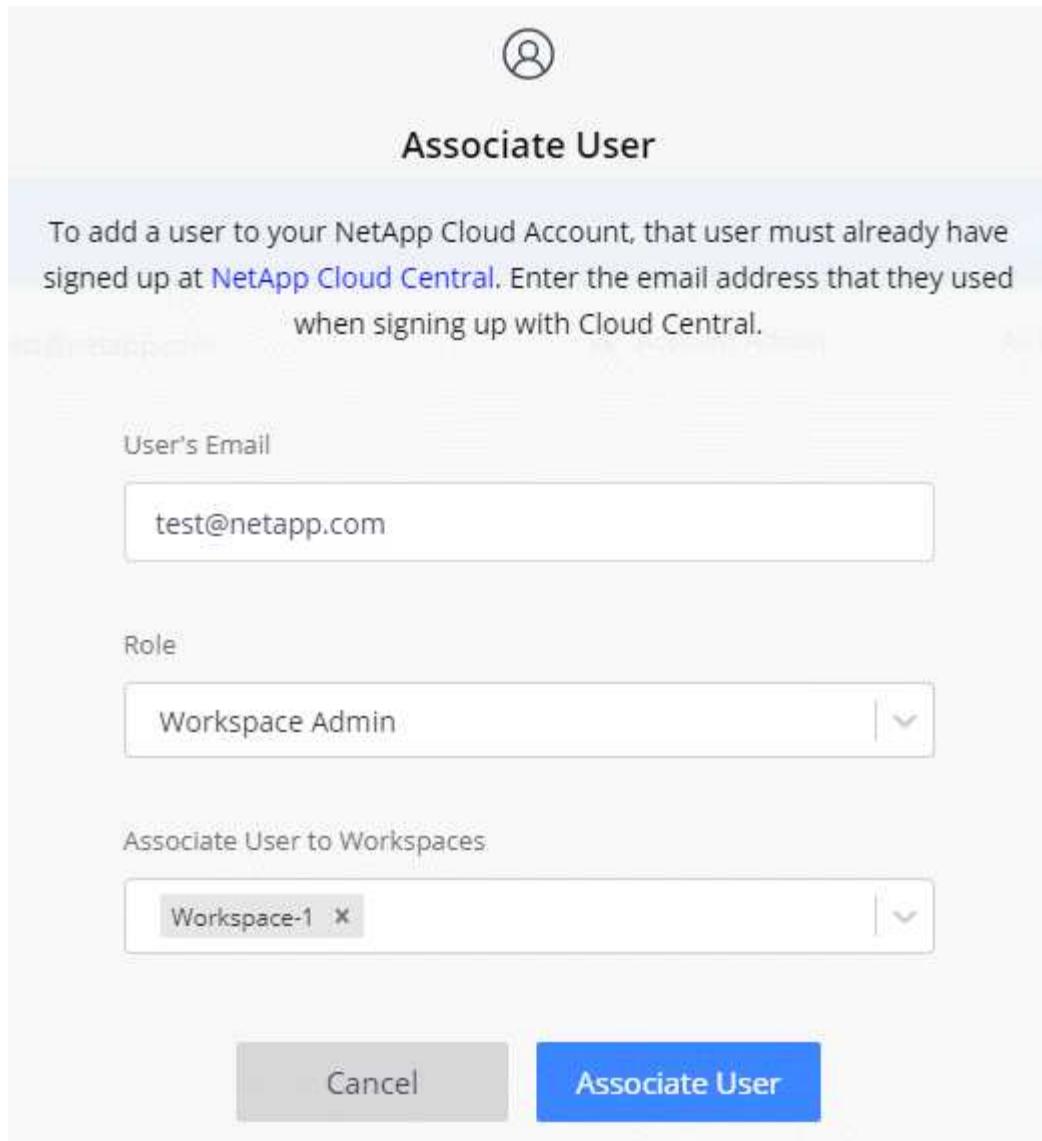
Associate Cloud Central users with the NetApp account so those users can create and manage working environments in Cloud Manager.

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.



The screenshot shows a 'Associate User' dialog box. At the top is a user icon. Below it is the title 'Associate User'. A descriptive text states: '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.' There is a 'User's Email' input field containing 'test@netapp.com'. A 'Role' dropdown menu is set to 'Workspace Admin'. An 'Associate User to Workspaces' dropdown menu contains 'Workspace-1' with an 'X' button. At the bottom are 'Cancel' and 'Associate User' buttons.

User's Email

test@netapp.com

Role

Workspace Admin

Associate User to Workspaces

Workspace-1 X

Cancel Associate User

6. Click **Associate**.

Result

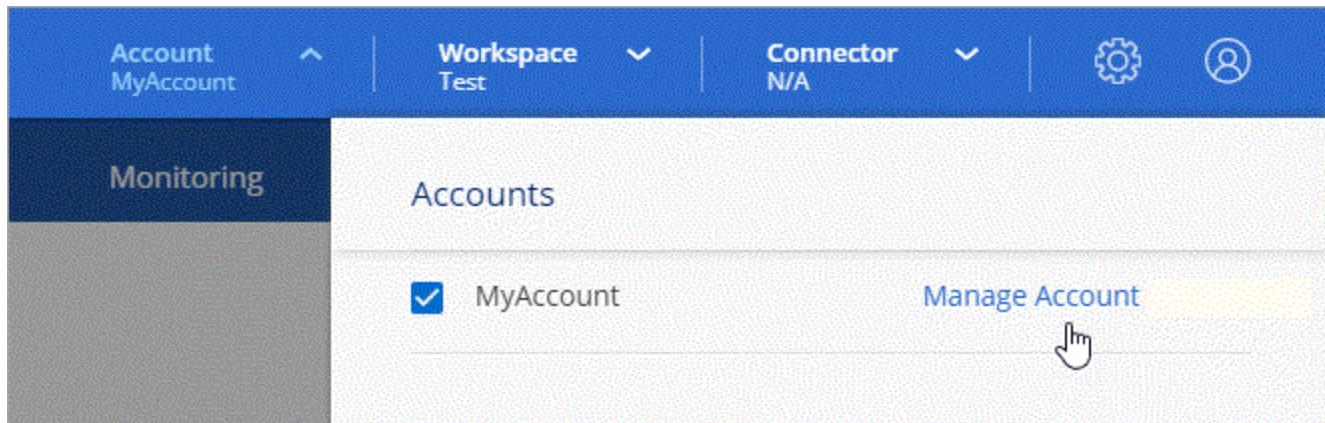
The user should receive an email from NetApp Cloud Central titled "Account Association." The email includes the information needed to access Cloud Manager.

Associating 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.

5 Members						Q
Type	Name	Email	Role	Workspace	...	
👤	Ben	[REDACTED]	⭐ Account Admin	All Workspaces	...	
👤	Tom	[REDACTED]	⭐ Account Admin	All Workspaces	...	
👤	Ben	[REDACTED]	Workspace Admin	Newone		

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.

Associating Connectors with workspaces

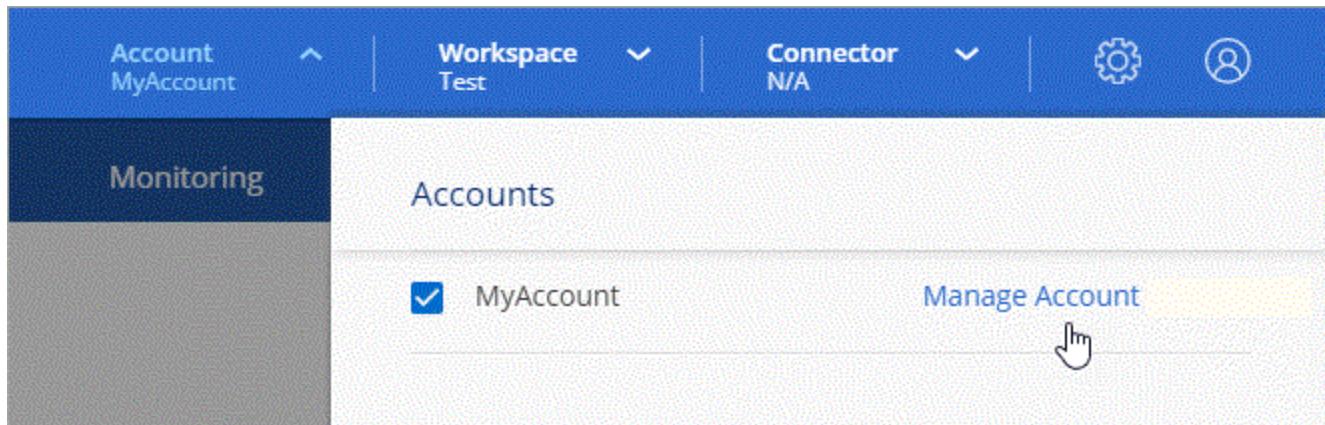
You need to associate a Connector with workspaces so Workspace Admins can use those Connectors to create Cloud Volumes ONTAP systems.

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 more](#).

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 any of the following services within Cloud Manager:

- 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

A Connector 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
- Cloud Volumes Service for Google Cloud
- Cloud Sync



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.

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.

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](#)
- [Learn how Cloud Manager uses cloud provider permissions](#)

 After you create a Connector in AWS, you can add an additional set of AWS credentials to enable the Connector to deploy and manage Cloud Volumes ONTAP in other AWS accounts. [Learn how to manage AWS credentials and subscriptions.](#)

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.
 - [Adding existing Cloud Volumes ONTAP systems to Cloud Manager](#)
 - [Discovering ONTAP clusters](#)
3. Set the **Capacity Management Mode** to **Manual** on any additional Connectors.

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.

Networking requirements 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

If your network has a subnet configured in the 172 range, then you might experience connectivity failures from Cloud Manager. [Learn more about this known issue](#).

Outbound internet access

Outbound internet access is required from the Connector.

Endpoints to manage resources in your public cloud environment

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

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

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

Endpoints to install the Connector on a Linux host

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

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

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

Ports and security groups

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

Rules for the Connector in AWS

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

Inbound rules

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

Outbound rules

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

Basic outbound rules

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

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

Advanced outbound rules

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



The source IP address is the Connector host.

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

Rules for the Connector in Azure

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

Inbound rules

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

Outbound rules

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

Basic outbound rules

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

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

Advanced outbound rules

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



The source IP address is the Connector host.

Service	Port	Protocol	Destination	Purpose
Active Directory	88	TCP	Active Directory forest	Kerberos V authentication
	139	TCP	Active Directory forest	NetBIOS service session
	389	TCP	Active Directory forest	LDAP
	445	TCP	Active Directory forest	Microsoft SMB/CIFS over TCP with NetBIOS framing
	464	TCP	Active Directory forest	Kerberos V change & set password (SET_CHANGE)
	749	TCP	Active Directory forest	Active Directory Kerberos V change & set password (RPCSEC_GSS)
	137	UDP	Active Directory forest	NetBIOS name service
	138	UDP	Active Directory forest	NetBIOS datagram service
	464	UDP	Active Directory forest	Kerberos key administration
API calls and AutoSupport	443	HTTP	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

Creating 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.

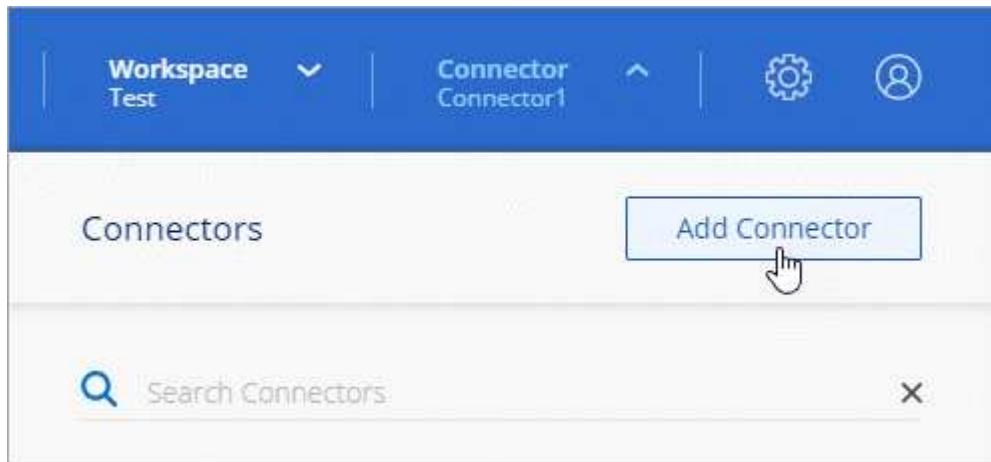
What you'll need

- 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](#).

Creating 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.

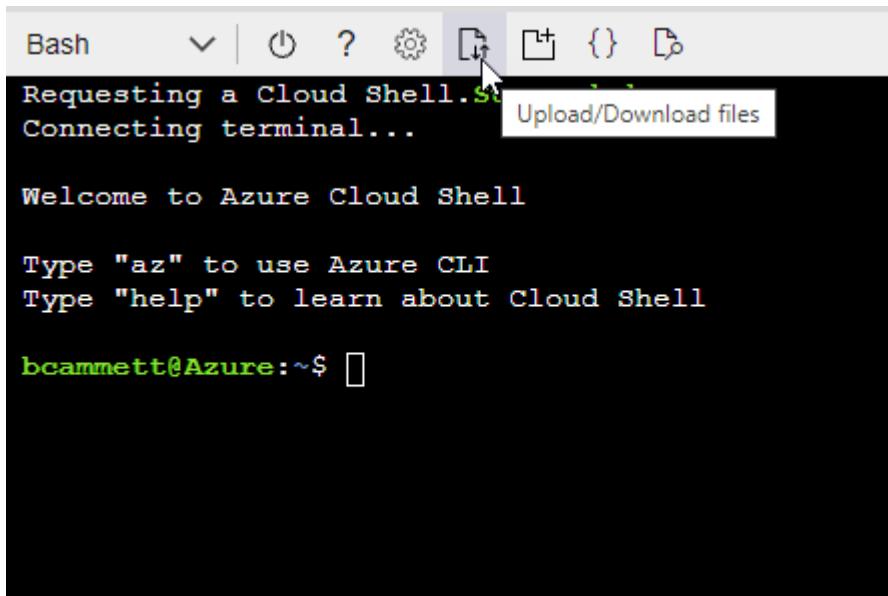
Example

```
"AssignableScopes": [  
  "/subscriptions/d333af45-0d07-4154-943d-c25fbzzzzzz"  
,
```

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.

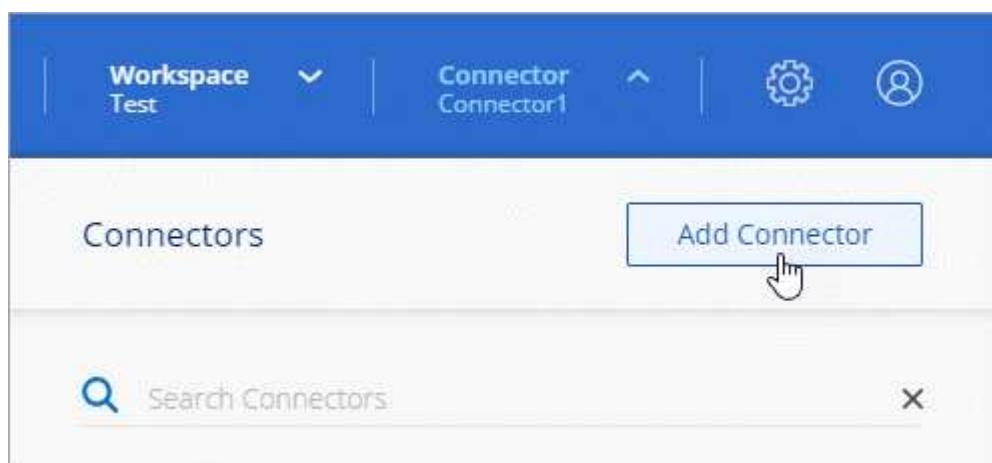
What you'll need

- 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

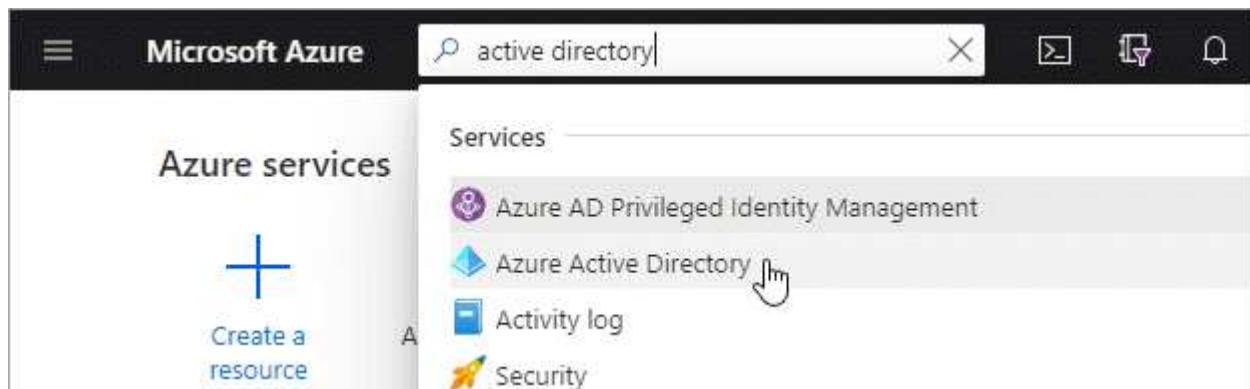
Create an Azure Active Directory (AD) application and service principal that Cloud Manager can use to deploy the Connector.

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.

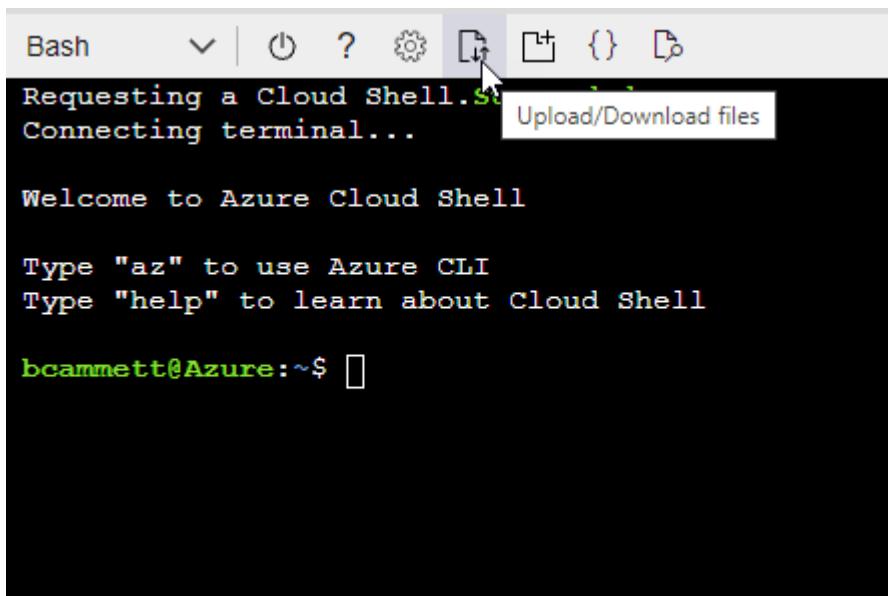
Example

```
"AssignableScopes": [  
  "/subscriptions/398e471c-3b42-4ae7-9b59-ce5bbzzzzzz"
```

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.



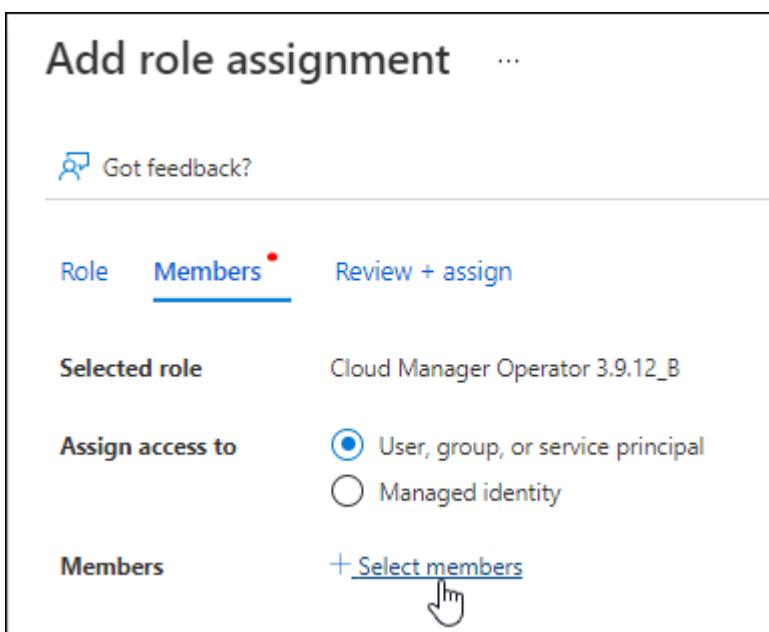
- c. Enter the following Azure CLI command:

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

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

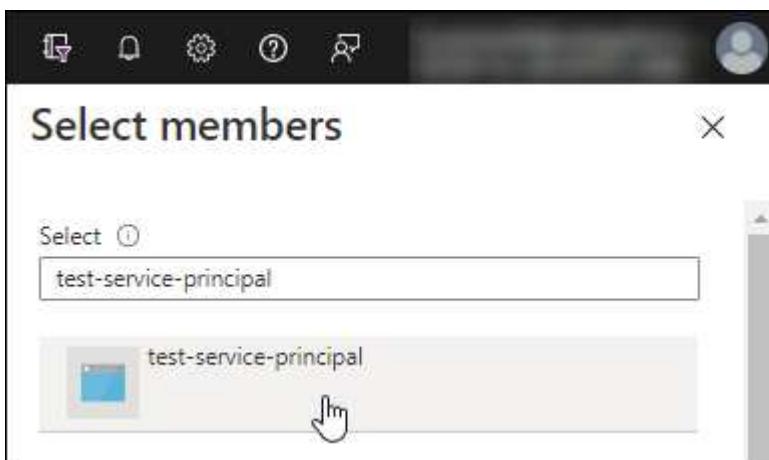
4. Assign the application to the role:

- 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**.



- Search for the name of the application.

Here's an example:



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

f. Click **Review + assign**.

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

Add Windows Azure Service Management API permissions

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

Steps

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

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

4. 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**.

Delete Endpoints

Welcome to the new and improved App registrations. Looking to learn

Display name : test-service-principal
Application (client) ID : 73de25f9-99be-4ae0-8b24-538ca787a6b3
Directory (tenant) ID : 4b0911a0-929b-4715-944b-c03745165b3a
Object ID : b37489a9-379f-49c2-b27c-e630514106a5

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.



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.

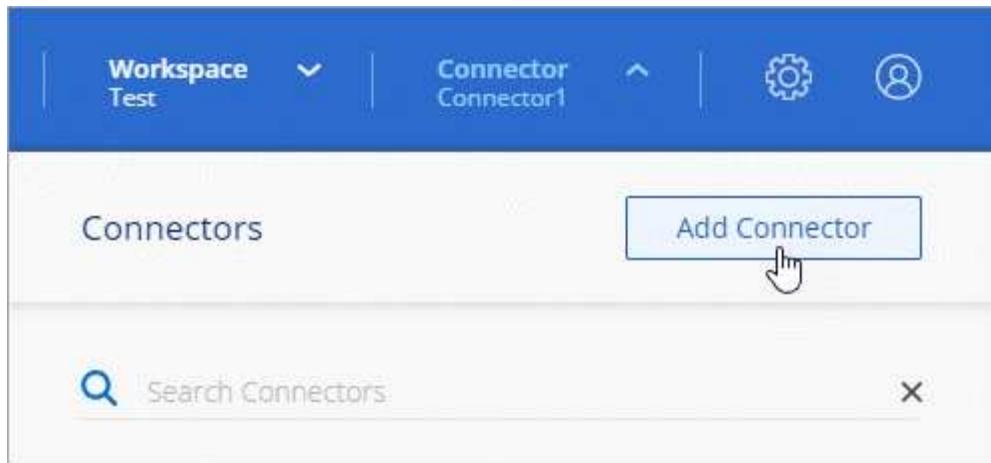
What you'll need

- 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](#).

Creating a Connector in GCP from Cloud Manager

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

This page describes how to create a Connector in GCP directly from Cloud Manager. [Learn about other ways to deploy a Connector](#).

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



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

Setting up permissions

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

Steps

1. Ensure that the GCP user who deploys the Connector has the permissions in the [Connector deployment policy for GCP](#).

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

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

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

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

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

- b. [Create a GCP service account and apply the custom role that you just created](#).
- c. If you want to deploy Cloud Volumes ONTAP in other projects, [grant access by adding the service account with the Cloud Manager role to that project](#). You'll need to repeat this step for each project.

Result

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

Shared VPC permissions

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

Service Account	Creator	Hosted in	Service project permissions	Host project permissions	Purpose
Cloud Manager service account	Custom	Service project	• The permissions found in this .yaml file	<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	• (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	• (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:

1. deploymentmanager.editor is only required at the host project if you are not passing firewall rules to the deployment and are choosing to let Cloud Manager create them for you.
2. firewall.create and firewall.delete are only required if you are not passing firewall rules to the deployment and are choosing to let Cloud Manager create them for you.
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

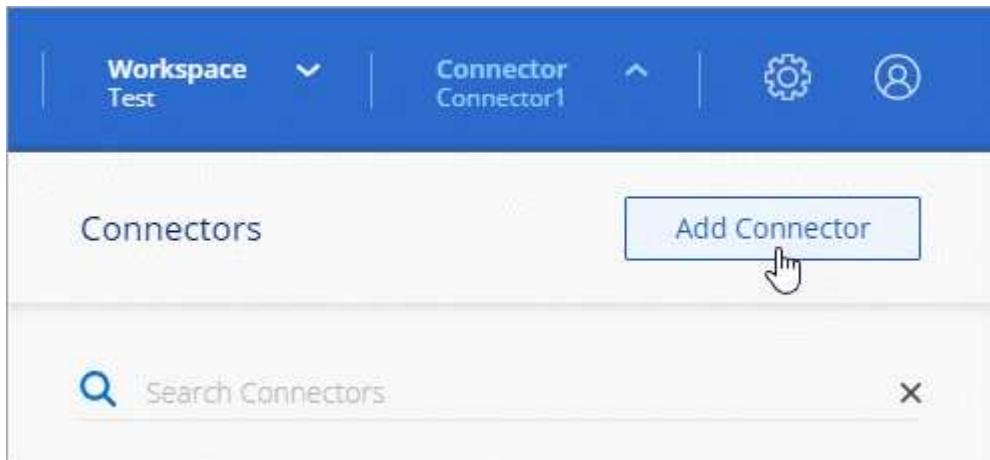
Create a Connector in Google Cloud directly from the Cloud Manager user interface or by using gcloud.

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)

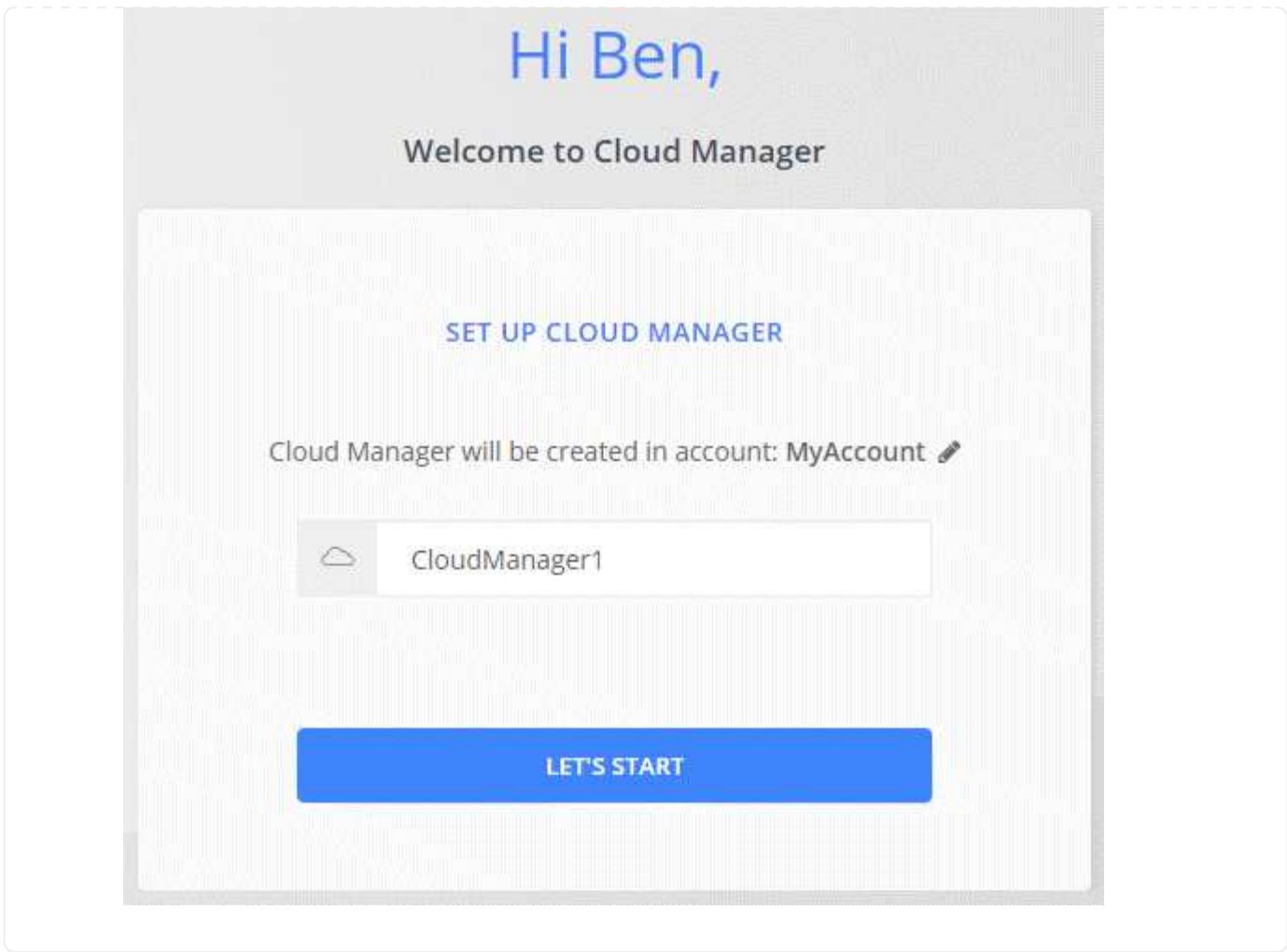
For more information about these flags, visit the [Google Cloud compute SDK documentation](#).

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](#).

Install 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

- 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](#).

- Assign permissions to run the script.

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

- 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.

- 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.

- 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.

- Sign up at NetApp Cloud Central or log in.

- 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.

- Create a role in GCP that includes the permissions defined in the [Cloud Manager policy for GCP](#).
- Create a GCP service account and apply the custom role that you just created.
- Associate this service account with the Connector VM.
- 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.

- After you log in, set up Cloud Manager:

- Specify the NetApp account to associate with the Connector.

[Learn about NetApp accounts.](#)

- 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 them 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 sysctl enable docker && sudo sysctl 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
```

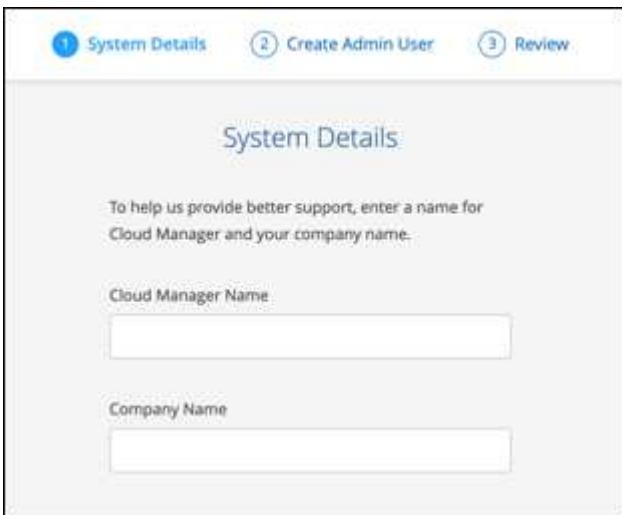
6. Open a web browser and enter `https://ipaddress` where `ipaddress` is the IP address of the Linux host.

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.



- **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](#).

Create from the marketplace

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

a

Cloud Manager - Manual Installation without access keys

By: [NetApp, Inc.](#) Latest Version: 3.8.4

Read below for instructions on how to deploy Cloud Volumes ONTAP.

Linux/Unix ★★★★★ 6 AWS reviews

Overview **Pricing** **Usage** **Support** **Review**

Product Overview

Do NOT subscribe on this page unless instructed by NetApp or redirected here from the NetApp website.

This listing lets you manually launch a Cloud Manager instance without providing your AWS credentials. After launching the Cloud Manager software in AWS, you can access it by entering the instance's IP address in a web browser. If you subscribe here, you still need to subscribe on the listing below for PAYGO charges.

Highlights

- See Product Overview for instructions on how to deploy NetApp Cloud Manager.

b

Cloud Manager - Manual Installation without access keys

< Product Detail [Subscribe](#)

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- Change any of the default options and click **Continue to Launch**.
- 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.

The screenshot shows the 'Launch Instances' configuration page. Key settings include:

- Number of instances:** 1
- Purchasing option:** Request Spot instances (unchecked)
- Network:** vpc-a76d91c2 | VPC4QA (default) | [Create new VPC](#)
- Subnet:** subnet-39536c13 | QASubnet1 | us-east-1b | 155 IP Addresses available | [Create new subnet](#)
- Auto-assign Public IP:** Enable
- Placement group:** Add instance to placement group (unchecked)
- Capacity Reservation:** Open | [Create new Capacity Reservation](#)
- IAM role:** Cloud_Manager | [Create new IAM role](#) (highlighted with a red box)
- CPU options:** Specify CPU options (unchecked)
- Shutdown behavior:** Stop
- Enable termination protection:** Protect against accidental termination (checked) | [Create new IAM role](#) (highlighted with a red box)
- Monitoring:** Enable CloudWatch detailed monitoring (unchecked) | 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:

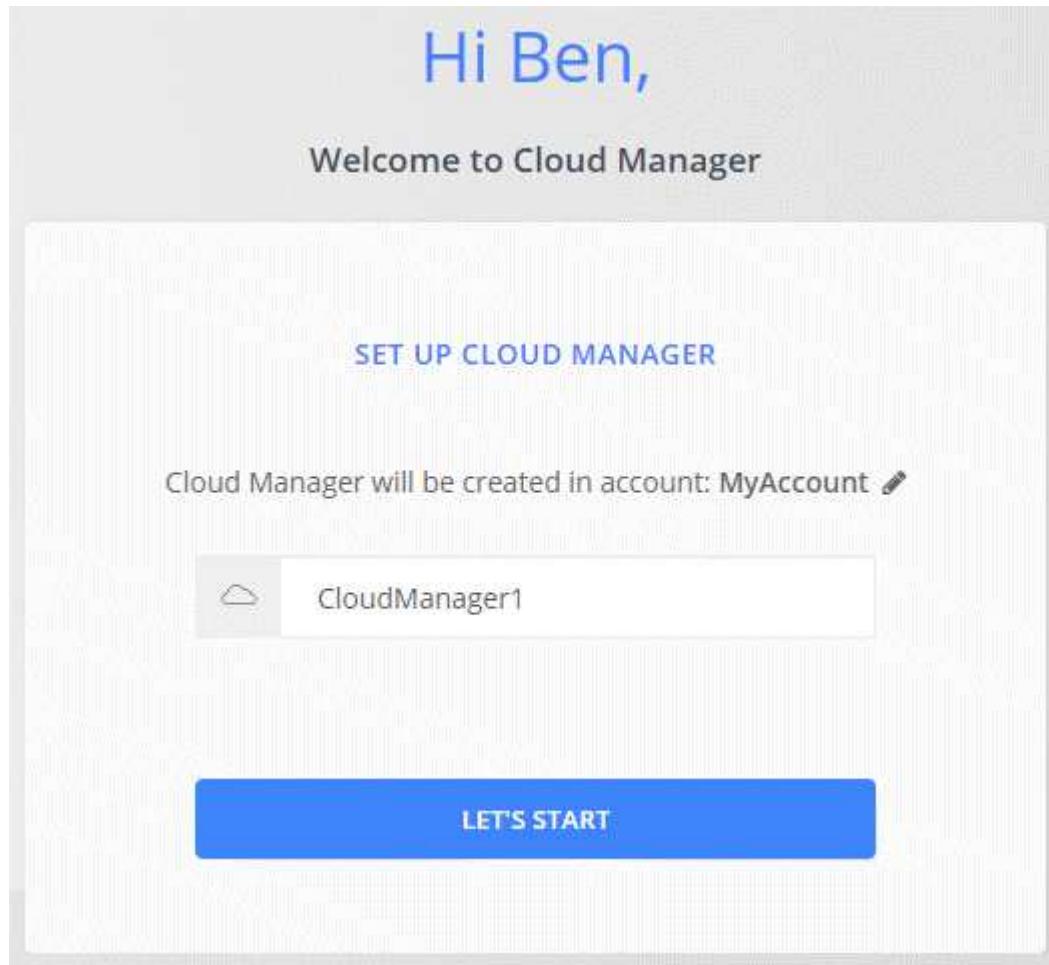
<http://ipaddress:80>

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](#).

Creating 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-c25fbzzzzzz",  
    "/subscriptions/54b91999-b3e6-4599-908e-416e0zzzzzz",  
    "/subscriptions/398e471c-3b42-4ae7-9b59-ce5bbzzzzzz"
```

- 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](#).

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](#)

Manage Cloud Volumes ONTAP

Learn

Learn about Cloud Volumes ONTAP

Cloud Volumes ONTAP enables you to optimize your cloud storage costs and performance while enhancing data protection, security, and compliance.

Cloud Volumes ONTAP is a software-only storage appliance that runs ONTAP data management software in the cloud. It provides enterprise-grade storage with the following key features:

- Storage efficiencies

Leverage built-in data deduplication, data compression, thin provisioning, and cloning to minimize storage costs.

- High availability

Ensure enterprise reliability and continuous operations in case of failures in your cloud environment.

- Data protection

Cloud Volumes ONTAP leverages SnapMirror, NetApp's industry-leading replication technology, to replicate on-premises data to the cloud so it's easy to have secondary copies available for multiple use cases.

Cloud Volumes ONTAP also integrates with Cloud Backup service to deliver backup and restore capabilities for protection, and long-term archive of your cloud data.

- Data tiering

Switch between high and low-performance storage pools on-demand without taking applications offline.

- Application consistency

Ensure consistency of NetApp Snapshot copies using NetApp SnapCenter.

- Data security

Cloud Volumes ONTAP supports data encryption and provides protection against viruses and ransomware.

- Privacy compliance controls

Integration with Cloud Data Sense helps you understand data context and identify sensitive data.



Licenses for ONTAP features are included with Cloud Volumes ONTAP.

[View supported Cloud Volumes ONTAP configurations](#)

[Learn more about Cloud Volumes ONTAP](#)

Storage

Disks and aggregates

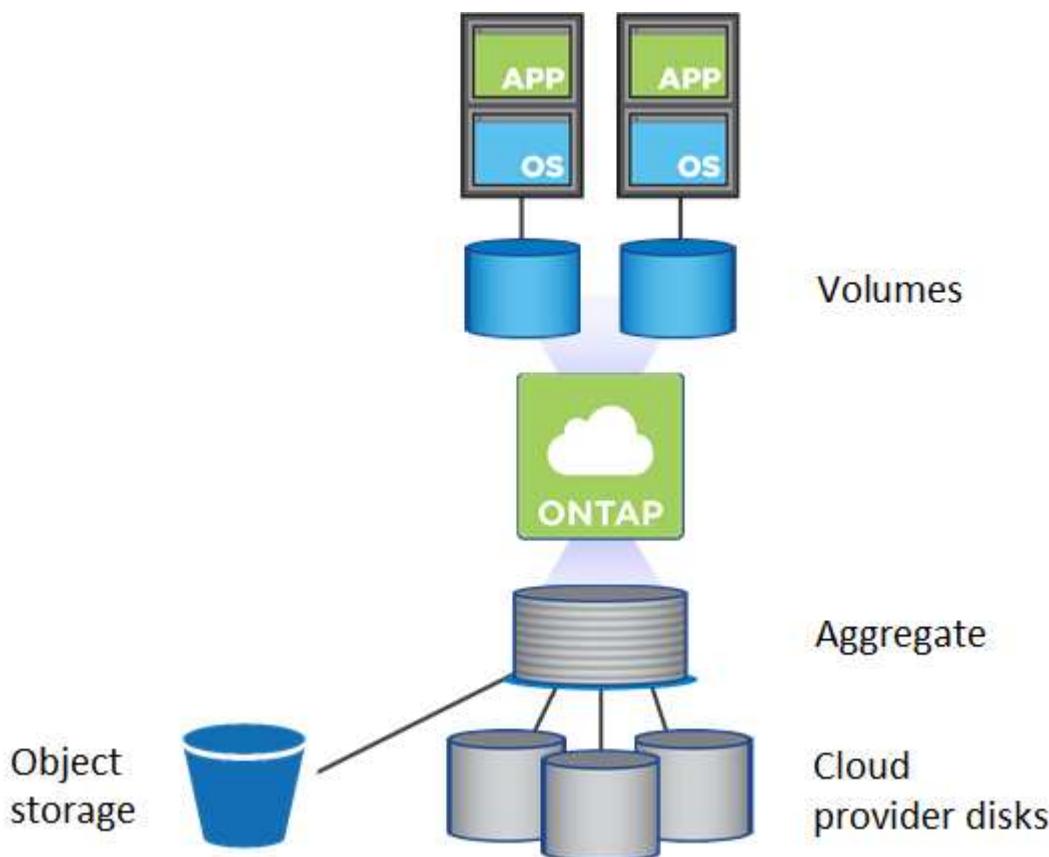
Understanding how Cloud Volumes ONTAP uses cloud storage can help you understand your storage costs.



All disks and aggregates must be created and deleted directly from Cloud Manager. You should not perform these actions from another management tool. Doing so can impact system stability, hamper the ability to add disks in the future, and potentially generate redundant cloud provider fees.

Overview

Cloud Volumes ONTAP uses cloud provider storage as disks and groups them into one or more aggregates. Aggregates provide storage to one or more volumes.



Several types of cloud disks are supported. You choose the disk type when you create a volume and the default disk size when you deploy Cloud Volumes ONTAP.



The total amount of storage purchased from a cloud provider is the *raw capacity*. The *usable capacity* is less because approximately 12 to 14 percent is overhead that is reserved for Cloud Volumes ONTAP use. For example, if Cloud Manager creates a 500 GiB aggregate, the usable capacity is 442.94 GiB.

AWS storage

In AWS, Cloud Volumes ONTAP uses EBS storage for user data and local NVMe storage as Flash Cache on some EC2 instance types.

EBS storage

In AWS, an aggregate can contain up to 6 disks that are all the same size. The maximum disk size is 16 TiB.

The underlying EBS disk type can be either General Purpose SSDs (gp3 or gp2), Provisioned IOPS SSD (io1), or Throughput Optimized HDD (st1). You can pair an EBS disk with Amazon S3 to [tier inactive data to low-cost object storage](#).



Tiering data to object storage is not recommended when using Throughput Optimized HDDs (st1).

Local NVMe storage

Some EC2 instance types include local NVMe storage, which Cloud Volumes ONTAP uses as [Flash Cache](#).

Related links

- [AWS documentation: EBS Volume Types](#)
- [Learn how to choose disk types and disk sizes for your systems in AWS](#)
- [Review storage limits for Cloud Volumes ONTAP in AWS](#)
- [Review supported configurations for Cloud Volumes ONTAP in AWS](#)

Azure storage

In Azure, an aggregate can contain up to 12 disks that are all the same size. The disk type and maximum disk size depends on whether you use a single node system or an HA pair:

Single node systems

Single node systems can use three types of Azure Managed Disks:

- *Premium SSD Managed Disks* provide high performance for I/O-intensive workloads at a higher cost.
- *Standard SSD Managed Disks* provide consistent performance for workloads that require low IOPS.
- *Standard HDD Managed Disks* are a good choice if you don't need high IOPS and want to reduce your costs.

Each managed disk type has a maximum disk size of 32 TiB.

You can pair a managed disk with Azure Blob storage to [tier inactive data to low-cost object storage](#).

HA pairs

HA pairs use Premium page blobs, which have a maximum disk size of 8 TiB.

Related links

- [Microsoft Azure documentation: Azure managed disk types](#)
- [Microsoft Azure documentation: Overview of Azure page blobs](#)

- Learn how to choose disk types and disk sizes for your systems in Azure
- Review storage limits for Cloud Volumes ONTAP in Azure

GCP storage

In GCP, an aggregate can contain up to 6 disks that are all the same size. The maximum disk size is 64 TiB.

The disk type can be either *Zonal SSD persistent disks*, *Zonal Balanced persistent disks*, or *Zonal standard persistent disks*. You can pair persistent disks with a Google Storage bucket to [tier inactive data to low-cost object storage](#).

Related links

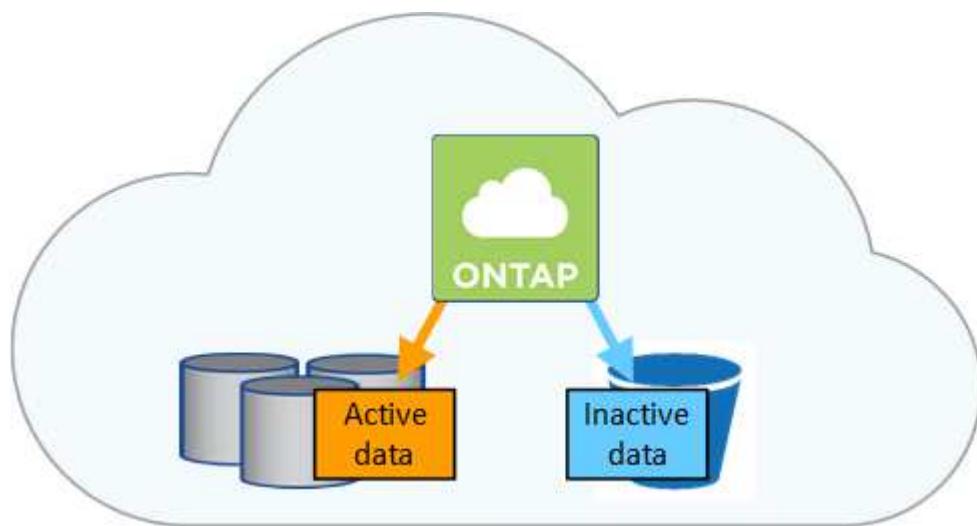
- [Google Cloud Platform documentation: Storage Options](#)
- [Review storage limits for Cloud Volumes ONTAP in GCP](#)

RAID type

The RAID type for each Cloud Volumes ONTAP aggregate is RAID0 (striping). No other RAID types are supported. Cloud Volumes ONTAP relies on the cloud provider for disk availability and durability.

Data tiering overview

Reduce your storage costs by enabling automated tiering of inactive data to low-cost object storage. Active data remains in high-performance SSDs or HDDs, while inactive data is tiered to low-cost object storage. This enables you to reclaim space on your primary storage and shrink secondary storage.



Cloud Volumes ONTAP supports data tiering in AWS, Azure, and Google Cloud Platform. Data tiering is powered by FabricPool technology.



You don't need to install a feature license to enable data tiering (FabricPool).

Data tiering in AWS

When you enable data tiering in AWS, Cloud Volumes ONTAP uses EBS as a performance tier for hot data

and AWS S3 as a capacity tier for inactive data.

Performance tier

The performance tier can be General Purpose SSDs (gp3 or gp2) or Provisioned IOPS SSDs (io1).



Tiering data to object storage is not recommended when using Throughput Optimized HDDs (st1).

Capacity tier

A Cloud Volumes ONTAP system tiers inactive data to a single S3 bucket using the *Standard* storage class. Standard is ideal for frequently accessed data stored across multiple Availability Zones.



Cloud Manager creates a single S3 bucket for each working environment and names it *fabric-pool-cluster unique identifier*. A different S3 bucket is not created for each volume.

Storage classes

The default storage class for tiered data in AWS is *Standard*. If you don't plan to access the inactive data, you can reduce your storage costs by changing the storage class to one of the following: *Intelligent Tiering*, *One-Zone Infrequent Access*, or *Standard-Infrequent Access*. When you change the storage class, inactive data starts in the Standard storage class and transitions to the storage class that you selected, if the data is not accessed after 30 days.

The access costs are higher if you do access the data, so take that into consideration before you change the storage class. [Learn more about Amazon S3 storage classes](#).

You can select a storage class when you create the working environment and you can change it any time after. For details about changing the storage class, see [Tiering inactive data to low-cost object storage](#).

The storage class for data tiering is system wide—it's not per volume.

Data tiering in Azure

When you enable data tiering in Azure, Cloud Volumes ONTAP uses Azure managed disks as a performance tier for hot data and Azure Blob storage as a capacity tier for inactive data.

Performance tier

The performance tier can be either SSDs or HDDs.

Capacity tier

A Cloud Volumes ONTAP system tiers inactive data to a single Blob container using the Azure *hot* storage tier. The hot tier is ideal for frequently accessed data.



Cloud Manager creates a new storage account with a single container for each Cloud Volumes ONTAP working environment. The name of the storage account is random. A different container is not created for each volume.

Storage access tiers

The default storage access tier for tiered data in Azure is the *hot* tier. If you don't plan to access the inactive data, you can reduce your storage costs by changing to the *cool* storage tier. When you change the storage tier, inactive data starts in the hot storage tier and transitions to the cool storage tier, if the data is not accessed after 30 days.

The access costs are higher if you do access the data, so take that into consideration before you change the storage tier. [Learn more about Azure Blob storage access tiers](#).

You can select a storage tier when you create the working environment and you can change it any time after. For details about changing the storage tier, see [Tiering inactive data to low-cost object storage](#).

The storage access tier for data tiering is system wide—it's not per volume.

Data tiering in GCP

When you enable data tiering in GCP, Cloud Volumes ONTAP uses persistent disks as a performance tier for hot data and a Google Cloud Storage bucket as a capacity tier for inactive data.

Performance tier

The performance tier can be either SSD persistent disks, balanced persistent disks, or standard persistent disks.

Capacity tier

A Cloud Volumes ONTAP system tiers inactive data to a single Google Cloud Storage bucket using the *Regional* storage class.



Cloud Manager creates a single bucket for each working environment and names it fabric-*pool-cluster unique identifier*. A different bucket is not created for each volume.

Storage classes

The default storage class for tiered data is the *Standard Storage* class. If the data is infrequently accessed, you can reduce your storage costs by changing to *Nearline Storage* or *Coldline Storage*. When you change the storage class, inactive data starts in the Standard Storage class and transitions to the storage class that you selected, if the data is not accessed after 30 days.

The access costs are higher if you do access the data, so take that into consideration before you change the storage class. [Learn more about storage classes for Google Cloud Storage](#).

You can select a storage tier when you create the working environment and you can change it any time after. For details about changing the storage class, see [Tiering inactive data to low-cost object storage](#).

The storage class for data tiering is system wide—it's not per volume.

Data tiering and capacity limits

If you enable data tiering, a system's capacity limit stays the same. The limit is spread across the performance tier and the capacity tier.

Volume tiering policies

To enable data tiering, you must select a volume tiering policy when you create, modify, or replicate a volume. You can select a different policy for each volume.

Some tiering policies have an associated minimum cooling period, which sets the time that user data in a volume must remain inactive for the data to be considered "cold" and moved to the capacity tier. The cooling period starts when data is written to the aggregate.



You can change the minimum cooling period and default aggregate threshold of 50% (more on that below). [Learn how to change the cooling period](#) and [learn how to change the threshold](#).

Cloud Manager enables you to choose from the following volume tiering policies when you create or modify a volume:

Snapshot Only

After an aggregate has reached 50% capacity, Cloud Volumes ONTAP tiers cold user data of Snapshot copies that are not associated with the active file system to the capacity tier. The cooling period is approximately 2 days.

If read, cold data blocks on the capacity tier become hot and are moved to the performance tier.

All

All data (not including metadata) is immediately marked as cold and tiered to object storage as soon as possible. There is no need to wait 48 hours for new blocks in a volume to become cold. Note that blocks located in the volume prior to the All policy being set require 48 hours to become cold.

If read, cold data blocks on the cloud tier stay cold and are not written back to the performance tier. This policy is available starting with ONTAP 9.6.

Auto

After an aggregate has reached 50% capacity, Cloud Volumes ONTAP tiers cold data blocks in a volume to a capacity tier. The cold data includes not just Snapshot copies but also cold user data from the active file system. The cooling period is approximately 31 days.

This policy is supported starting with Cloud Volumes ONTAP 9.4.

If read by random reads, the cold data blocks in the capacity tier become hot and move to the performance tier. If read by sequential reads, such as those associated with index and antivirus scans, the cold data blocks stay cold and do not move to the performance tier.

None

Keeps data of a volume in the performance tier, preventing it from being moved to the capacity tier.

When you replicate a volume, you can choose whether to tier the data to object storage. If you do, Cloud Manager applies the **Backup** policy to the data protection volume. Starting with Cloud Volumes ONTAP 9.6, the **All** tiering policy replaces the backup policy.

Turning off Cloud Volumes ONTAP impacts the cooling period

Data blocks are cooled by cooling scans. During this process, blocks that haven't been used have their block temperature moved (cooled) to the next lower value. The default cooling time depends on the volume tiering policy:

- Auto: 31 days
- Snapshot Only: 2 days

Cloud Volumes ONTAP must be running for the cooling scan to work. If Cloud Volumes ONTAP is turned off, cooling will stop, as well. As a result, you can experience longer cooling times.



When Cloud Volumes ONTAP is turned off, the temperature of each block is preserved until you restart the system. For example, if the temperature of a block is 5 when you turn the system off, the temp is still 5 when you turn the system back on.

Setting up data tiering

For instructions and a list of supported configurations, see [Tiering inactive data to low-cost object storage](#).

Storage management

Cloud Manager provides simplified and advanced management of Cloud Volumes ONTAP storage.



All disks and aggregates must be created and deleted directly from Cloud Manager. You should not perform these actions from another management tool. Doing so can impact system stability, hamper the ability to add disks in the future, and potentially generate redundant cloud provider fees.

Storage provisioning

Cloud Manager makes storage provisioning for Cloud Volumes ONTAP easy by purchasing disks and managing aggregates for you. You simply need to create volumes. You can use an advanced allocation option to provision aggregates yourself, if desired.

Simplified provisioning

Aggregates provide cloud storage to volumes. Cloud Manager creates aggregates for you when you launch an instance, and when you provision additional volumes.

When you create a volume, Cloud Manager does one of three things:

- It places the volume on an existing aggregate that has sufficient free space.
- It places the volume on an existing aggregate by purchasing more disks for that aggregate.
- It purchases disks for a new aggregate and places the volume on that aggregate.

Cloud Manager determines where to place a new volume by looking at several factors: an aggregate's maximum size, whether thin provisioning is enabled, and free space thresholds for aggregates.



The Account Admin can modify free space thresholds from the **Settings** page.

Disk size selection for aggregates in AWS

When Cloud Manager creates new aggregates for Cloud Volumes ONTAP in AWS, it gradually increases the disk size in an aggregate, as the number of aggregates in the system increases. Cloud Manager does this to ensure that you can utilize the system's maximum capacity before it reaches the maximum number of data disks allowed by AWS.

For example, Cloud Manager might choose the following disk sizes for aggregates in a Cloud Volumes ONTAP Premium or BYOL system:

Aggregate number	Disk size	Max aggregate capacity
1	500 GiB	3 TiB
4	1 TiB	6 TiB

Aggregate number	Disk size	Max aggregate capacity
6	2 TiB	12 TiB

You can choose the disk size yourself by using the advanced allocation option.

Advanced allocation

Rather than let Cloud Manager manage aggregates for you, you can do it yourself. [From the Advanced allocation page](#), you can create new aggregates that include a specific number of disks, add disks to an existing aggregate, and create volumes in specific aggregates.

Capacity management

The Account Admin can choose whether Cloud Manager notifies you of storage capacity decisions or whether Cloud Manager automatically manages capacity requirements for you. It might help for you to understand how these modes work.

Automatic capacity management

The Capacity Management Mode is set to automatic by default. In this mode, Cloud Manager automatically purchases new disks for Cloud Volumes ONTAP instances when more capacity is needed, deletes unused collections of disks (aggregates), moves volumes between aggregates when needed, and attempts to unfail disks.

The following examples illustrate how this mode works:

- If an aggregate with 5 or fewer EBS disks reaches the capacity threshold, Cloud Manager automatically purchases new disks for that aggregate so volumes can continue to grow.

Cloud Manager checks the free space ratio every 15 minutes to determine if it needs to purchase additional disks.

- If an aggregate with 12 Azure disks reaches the capacity threshold, Cloud Manager automatically moves a volume from that aggregate to an aggregate with available capacity or to a new aggregate.

If Cloud Manager creates a new aggregate for the volume, it chooses a disk size that accommodates the size of that volume.

Note that free space is now available on the original aggregate. Existing volumes or new volumes can use that space. The space can't be returned to AWS, Azure, or GCP in this scenario.

- If an aggregate contains no volumes for more than 12 hours, Cloud Manager deletes it.

Management of LUNs with automatic capacity management

Cloud Manager's automatic capacity management doesn't apply to LUNs. When Cloud Manager creates a LUN, it disables the autogrow feature.

Manual capacity management

If the Account Admin set the Capacity Management Mode to manual, Cloud Manager displays Action Required messages when capacity decisions must be made. The same examples described in the automatic mode apply to the manual mode, but it is up to you to accept the actions.

Write speed

Cloud Manager enables you to choose normal or high write speed for Cloud Volumes ONTAP. Before you choose a write speed, you should understand the differences between the normal and high settings and risks and recommendations when using high write speed.

High write speed is supported with all types of single node systems. It's also supported with HA pairs in AWS and Azure when using a specific instance or VM type (refer to the sections below for the list of supported instances and VM types). High write speed is not supported with HA pairs in GCP.

Normal write speed

When you choose normal write speed, data is written directly to disk. When data is written directly to disk, reduces the likelihood of data loss in the event of an unplanned system outage, or a cascading failure involving an unplanned system outage (HA pairs only).

Normal write speed is the default option.

High write speed

When you choose high write speed, data is buffered in memory before it is written to disk, which provides faster write performance. Due to this caching, there is the potential for data loss if an unplanned system outage occurs.

The amount of data that can be lost in the event of an unplanned system outage is the span of the last two consistency points. A consistency point is the act of writing buffered data to disk. A consistency point occurs when the write log is full or after 10 seconds (whichever comes first). However, the performance of the storage provided by your cloud provider can affect consistency point processing time.

When to use high write speed

High write speed is a good choice if fast write performance is required for your workload and you can withstand the risk of data loss in the event of an unplanned system outage, or a cascading failure involving an unplanned system outage (HA pairs only).

Recommendations when using high write speed

If you enable high write speed, you should ensure write protection at the application layer, or that the applications can tolerate data loss, if it occurs.

Configurations that support high write speed

Not all Cloud Volumes ONTAP configurations support high write speed. Those configurations use normal write speed by default.

AWS

If you use a single node system, Cloud Volumes ONTAP supports high write speed with all instance types.

Starting with the 9.8 release, Cloud Volumes ONTAP supports high write speed with HA pairs when using almost all supported EC2 instance types, except for m5.xlarge and r5.xlarge.

[Learn more about the Amazon EC2 instances that Cloud Volumes ONTAP supports.](#)

Azure

If you use a single node system, Cloud Volumes ONTAP supports high write speed with all VM types.

If you use an HA pair, Cloud Volumes ONTAP supports high write speed with several VM types, starting with the 9.8 release. Go to the [Cloud Volumes ONTAP Release Notes](#) to view the VM types that support high write speed.

Google Cloud

If you use a single node system, Cloud Volumes ONTAP supports high write speed with all machine types.

Cloud Volumes ONTAP doesn't support high write speed with HA pairs in Google Cloud.

[Learn more about the Google Cloud machine types that Cloud Volumes ONTAP supports.](#)

How to select a write speed

You can choose a write speed when you create a new working environment and you can [change the write speed for an existing system](#).

What to expect if data loss occurs

If you choose high write speed and data loss occurs, the system should be able to boot up and continue to serve data without user intervention. Two EMS messages will be reported when a node runs into data loss. One is wafl.root.content.changed with the ERROR severity level event, the other is nv.check.failed with the DEBUG severity level event. Both messages must be present as an indication of data loss.

How to stop data access if data loss occurs

If you are concerned about data loss, want the applications to stop running upon data loss, and the data access to be resumed after the data loss issue is properly addressed, you can use the NVFAIL option from the CLI to achieve that goal.

To enable the NVFAIL option

```
vol modify -volume <vol-name> -nvfail on
```

To check NVFAIL settings

```
vol show -volume <vol-name> -fields nvfail
```

To disable the NVFAIL option

```
vol modify -volume <vol-name> -nvfail off
```

When data loss occurs, an NFS or iSCSI volume with NVFAIL enabled should stop serving data (there's no impact to CIFS which is a stateless protocol). For more details, refer to [How NVFAIL impacts access to NFS volumes or LUNs](#).

To check the NVFAIL state

```
vol show -fields in-nvfailed-state
```

After the data loss issue is properly addressed, you can clear the NVFAIL state and the volume will be available for data access.

To clear the NVFAIL state

```
vol modify -volume <vol-name> -in-nvfailed-state false
```

Flash Cache

Some Cloud Volumes ONTAP configurations in AWS and Azure include local NVMe storage, which Cloud Volumes ONTAP uses as *Flash Cache* for better performance.

What's Flash Cache?

Flash Cache speeds access to data through real-time intelligent caching of recently read user data and NetApp metadata. It's effective for random read-intensive workloads, including databases, email, and file services.

Supported instances in AWS

Select one of the following EC2 instance types with a new or existing Cloud Volumes ONTAP Premium or BYOL system:

- c5d.4xlarge
- c5d.9xlarge
- c5d.18xlarge
- m5d.8xlarge
- m5d.12xlarge
- r5d.2xlarge

Supported VM type in Azure

Select the Standard_L8s_v2 VM type with a single node Cloud Volumes ONTAP BYOL system in Azure.

Limitations

- Compression must be disabled on all volumes to take advantage of the Flash Cache performance improvements.

Choose no storage efficiency when creating a volume from Cloud Manager, or create a volume and then [disable data compression by using the CLI](#).

- Cache rewarming after a reboot is not supported with Cloud Volumes ONTAP.

WORM storage

You can activate write once, read many (WORM) storage on a Cloud Volumes ONTAP system to retain files in unmodified form for a specified retention period. Cloud WORM storage is powered by SnapLock technology, which means WORM files are protected at the file level.

Once a file has been committed to WORM storage, it can't be modified, even after the retention period has expired. A tamper-proof clock determines when the retention period for a WORM file has elapsed.

After the retention period has elapsed, you are responsible for deleting any files that you no longer need.

Activating WORM storage

You can activate WORM storage on a Cloud Volumes ONTAP system when you create a new working environment. This includes setting the default retention period for files.



You can't activate WORM storage on individual volumes—WORM must be activated at the system level.

The following image shows how to activate WORM storage when creating a working environment:

The screenshot shows the Cloud Manager interface with the title 'Cloud Manager'. The top navigation bar includes 'Account MyAccount', 'Workspace Newone', 'Connector ben-connector39', and various icons. The main content area is titled 'Create a New Working Environment' and shows the 'WORM (write once, read many)' option selected. Below this, there's a section for 'Write Speed' with two options: 'Normal' (selected) and 'High'. A note states: 'Data is written directly to disk, reducing the likelihood of data loss in the event of an unplanned system outage.' Another note says: 'Data is buffered in memory before it is written to disk, which provides faster write performance. Due to this caching, there is the potential for data loss in the event of an unplanned system outage.' To the right, there are buttons for 'Disable WORM' and 'Activate WORM', with 'Activate WORM' being selected. A yellow notice states: 'Notice: If you activate WORM storage, data tiering to object storage will be disabled on the system.' At the bottom, a 'Retention Period' field is set to '15 years'. A 'Continue' button is at the bottom left, and a blue circular icon with a white envelope is at the bottom right. The footer indicates 'Cloud Manager 3.9.9 - Build: 0 Jun 30, 2021 02:52:27 pm UTC Environment: staging'.

Committing files to WORM

You can use an application to commit files to WORM over NFS or CIFS, or use the ONTAP CLI to autocommit files to WORM automatically. You can also use a WORM appendable file to retain data that is written incrementally, like log information.

After you activate WORM storage on a Cloud Volumes ONTAP system, you must use the ONTAP CLI for all management of WORM storage. For instructions, refer to [ONTAP documentation](#).

Limitations

- WORM storage in Cloud Volumes ONTAP operates under a "trusted storage administrator" model. While WORM files are protected from alteration or modification, volumes can be deleted by a cluster administrator even if those volumes contain unexpired WORM data.
- In addition to the trusted storage administrator model, WORM storage in Cloud Volumes ONTAP also implicitly operates under a "trusted cloud administrator" model. A cloud administrator could delete WORM data before its expiry date by removing or editing cloud storage directly from the cloud provider.
- When WORM storage is activated, data tiering to object storage can't be enabled.
- Cloud Backup Service must be disabled in order to enable WORM storage.

High-availability pairs

High-availability pairs in AWS

A Cloud Volumes ONTAP high availability (HA) configuration provides nondisruptive operations and fault tolerance. In AWS, data is synchronously mirrored between the two nodes.

Overview

In AWS, Cloud Volumes ONTAP HA configurations include the following components:

- Two Cloud Volumes ONTAP nodes whose data is synchronously mirrored between each other.
- A mediator instance that provides a communication channel between the nodes to assist in storage takeover and giveback processes.



The mediator instance runs the Linux operating system on a t2.micro instance and uses one EBS magnetic disk that is approximately 8 GiB.

Storage takeover and giveback

If a node goes down, the other node can serve data for its partner to provide continued data service. Clients can access the same data from the partner node because the data was synchronously mirrored to the partner.

After the node reboots, the partner must resync data before it can return the storage. The time that it takes to resync data depends on how much data was changed while the node was down.

Storage takeover, resync, and giveback are all automatic by default. No user action is required.

RPO and RTO

An HA configuration maintains high availability of your data as follows:

- The recovery point objective (RPO) is 0 seconds.
Your data is transactionally consistent with no data loss.
- The recovery time objective (RTO) is 60 seconds.
In the event of an outage, data should be available in 60 seconds or less.

HA deployment models

You can ensure the high availability of your data by deploying an HA configuration across multiple Availability Zones (AZs) or in a single AZ. You should review more details about each configuration to choose which best fits your needs.

Multiple Availability Zones

Deploying an HA configuration in multiple Availability Zones (AZs) ensures high availability of your data if a failure occurs with an AZ or an instance that runs a Cloud Volumes ONTAP node. You should understand how NAS IP addresses impact data access and storage failover.

NFS and CIFS data access

When an HA configuration is spread across multiple Availability Zones, *floating IP addresses* enable NAS client access. The floating IP addresses, which must be outside of the CIDR blocks for all VPCs in the region, can migrate between nodes when failures occur. They aren't natively accessible to clients that are outside of the

VPC, unless you [set up an AWS transit gateway](#).

If you can't set up a transit gateway, private IP addresses are available for NAS clients that are outside the VPC. However, these IP addresses are static—they can't failover between nodes.

You should review requirements for floating IP addresses and route tables before you deploy an HA configuration across multiple Availability Zones. You must specify the floating IP addresses when you deploy the configuration. The private IP addresses are automatically created by Cloud Manager.

For details, see [AWS networking requirements for Cloud Volumes ONTAP HA in multiple AZs](#).

iSCSI data access

Cross-VPC data communication is not an issue since iSCSI does not use floating IP addresses.

Takeover and giveback for iSCSI

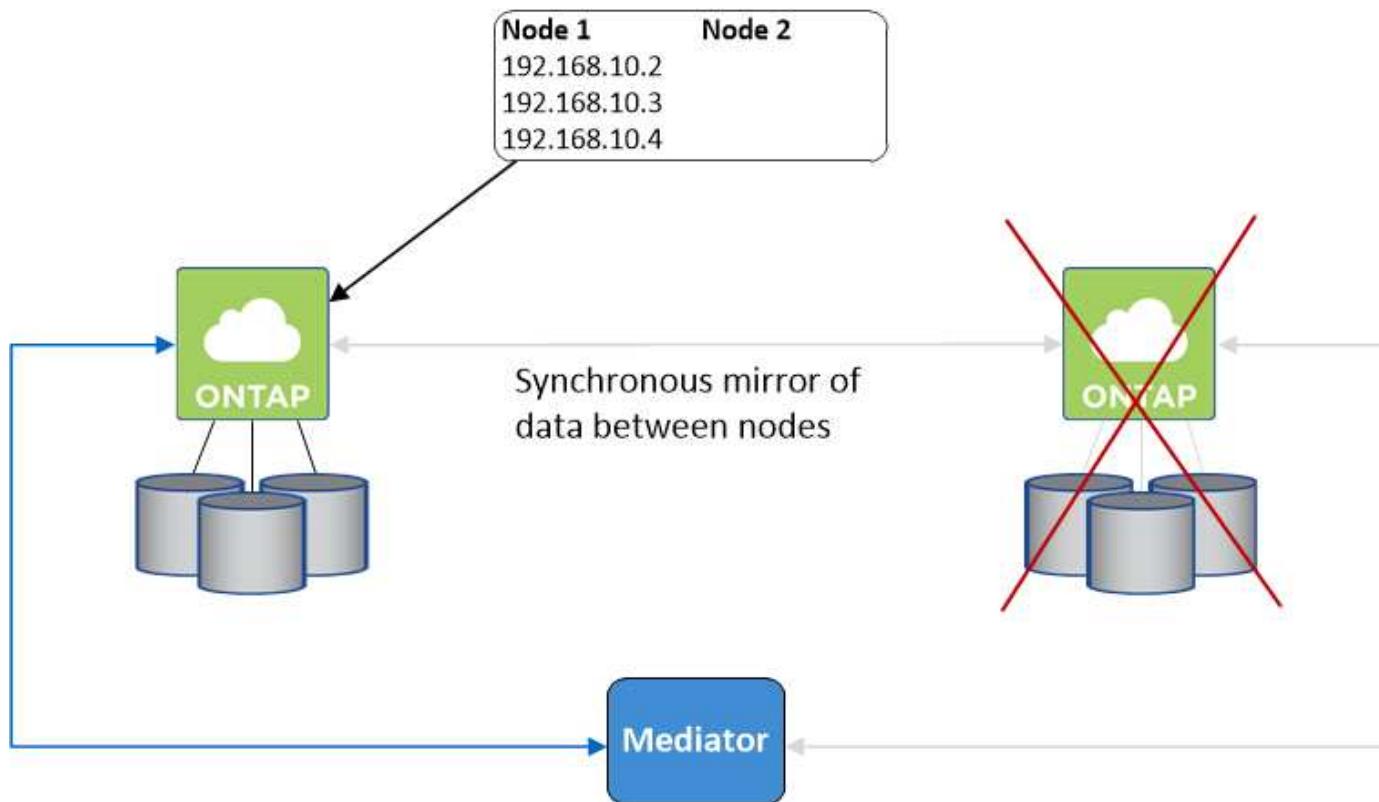
For iSCSI, Cloud Volumes ONTAP uses multipath I/O (MPIO) and Asymmetric Logical Unit Access (ALUA) to manage path failover between the active-optimized and non-optimized paths.



For information about which specific host configurations support ALUA, see the [NetApp Interoperability Matrix Tool](#) and the Host Utilities Installation and Setup Guide for your host operating system.

Takeover and giveback for NAS

When takeover occurs in a NAS configuration using floating IPs, the node's floating IP address that clients use to access data moves to the other node. The following image depicts storage takeover in a NAS configuration using floating IPs. If node 2 goes down, the floating IP address for node 2 moves to node 1.



NAS data IPs used for external VPC access cannot migrate between nodes if failures occur. If a node goes offline, you must manually remount volumes to clients outside the VPC by using the IP address on the other node.

After the failed node comes back online, remount clients to volumes using the original IP address. This step is needed to avoid transferring unnecessary data between two HA nodes, which can cause significant performance and stability impact.

You can easily identify the correct IP address from Cloud Manager by selecting the volume and clicking **Mount Command**.

Cloud Volumes ONTAP HA in a single Availability Zone

Deploying an HA configuration in a single Availability Zone (AZ) can ensure high availability of your data if an instance that runs a Cloud Volumes ONTAP node fails. All data is natively accessible from outside of the VPC.

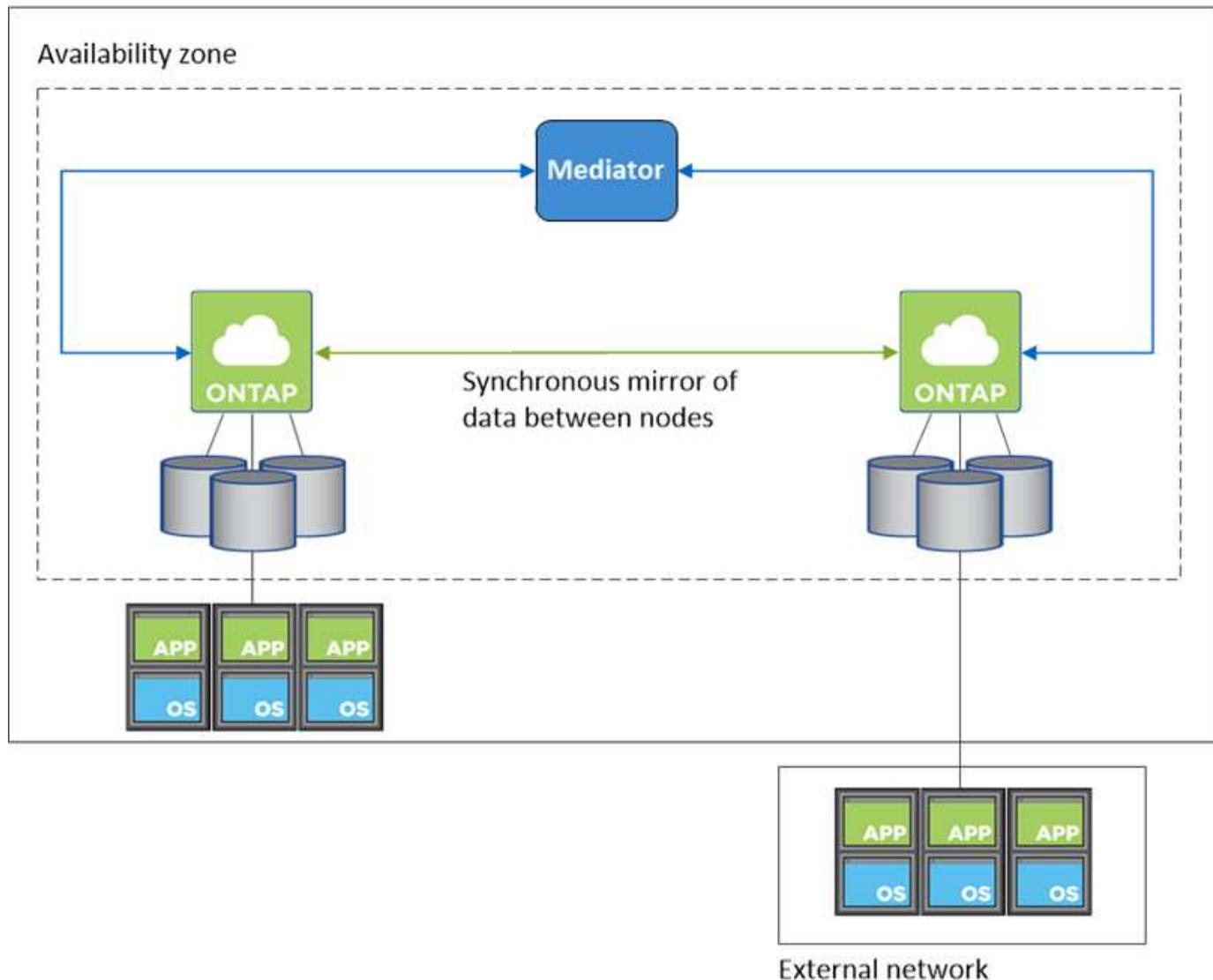
 Cloud Manager creates an [AWS spread placement group](#) and launches the two HA nodes in that placement group. The placement group reduces the risk of simultaneous failures by spreading the instances across distinct underlying hardware. This feature improves redundancy from a compute perspective and not from disk failure perspective.

Data access

Because this configuration is in a single AZ, it does not require floating IP addresses. You can use the same IP address for data access from within the VPC and from outside the VPC.

The following image shows an HA configuration in a single AZ. Data is accessible from within the VPC and from outside the VPC.

VPC in AWS



Takeover and giveback

For iSCSI, Cloud Volumes ONTAP uses multipath I/O (MPIO) and Asymmetric Logical Unit Access (ALUA) to manage path failover between the active-optimized and non-optimized paths.



For information about which specific host configurations support ALUA, see the [NetApp Interoperability Matrix Tool](#) and the Host Utilities Installation and Setup Guide for your host operating system.

For NAS configurations, the data IP addresses can migrate between HA nodes if failures occur. This ensures client access to storage.

How storage works in an HA pair

Unlike an ONTAP cluster, storage in a Cloud Volumes ONTAP HA pair is not shared between nodes. Instead, data is synchronously mirrored between the nodes so that the data is available in the event of failure.

Storage allocation

When you create a new volume and additional disks are required, Cloud Manager allocates the same number of disks to both nodes, creates a mirrored aggregate, and then creates the new volume. For example, if two disks are required for the volume, Cloud Manager allocates two disks per node for a total of four disks.

Storage configurations

You can use an HA pair as an active-active configuration, in which both nodes serve data to clients, or as an active-passive configuration, in which the passive node responds to data requests only if it has taken over storage for the active node.



You can set up an active-active configuration only when using Cloud Manager in the Storage System View.

Performance expectations

A Cloud Volumes ONTAP HA configuration synchronously replicates data between nodes, which consumes network bandwidth. As a result, you can expect the following performance in comparison to a single-node Cloud Volumes ONTAP configuration:

- For HA configurations that serve data from only one node, read performance is comparable to the read performance of a single-node configuration, whereas write performance is lower.
- For HA configurations that serve data from both nodes, read performance is higher than the read performance of a single-node configuration, and write performance is the same or higher.

For more details about Cloud Volumes ONTAP performance, see [Performance](#).

Client access to storage

Clients should access NFS and CIFS volumes by using the data IP address of the node on which the volume resides. If NAS clients access a volume by using the IP address of the partner node, traffic goes between both nodes, which reduces performance.

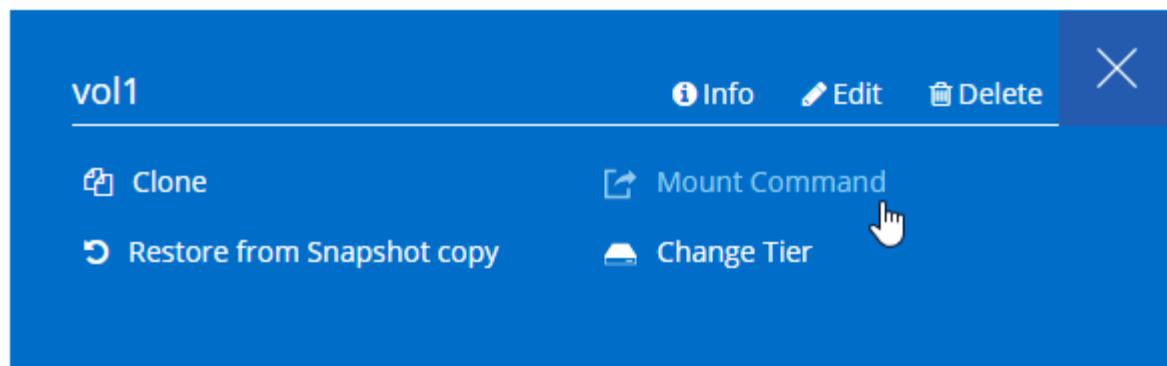


If you move a volume between nodes in an HA pair, you should remount the volume by using the IP address of the other node. Otherwise, you can experience reduced performance. If clients support NFSv4 referrals or folder redirection for CIFS, you can enable those features on the Cloud Volumes ONTAP systems to avoid remounting the volume. For details, see ONTAP documentation.

You can easily identify the correct IP address from Cloud Manager:

Volumes

2 Volumes | 0.22 TB Allocated | < 0.01 TB Used (0 TB in S3)

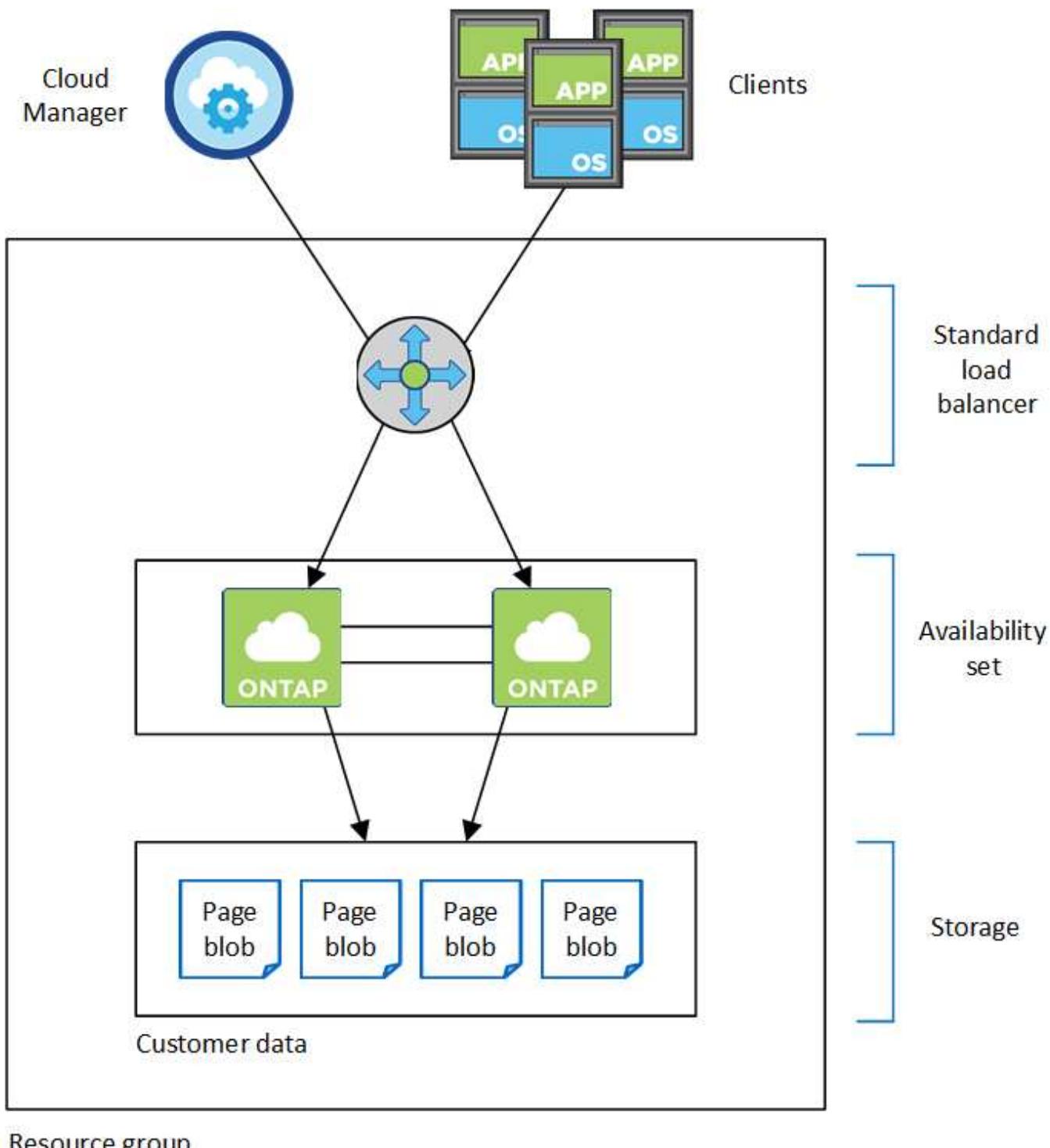


High-availability pairs in Azure

A Cloud Volumes ONTAP high availability (HA) pair provides enterprise reliability and continuous operations in case of failures in your cloud environment. In Azure, storage is shared between the two nodes.

HA components

A Cloud Volumes ONTAP HA configuration in Azure includes the following components:



Resource group

Note the following about the Azure components that Cloud Manager deploys for you:

Azure Standard Load Balancer

The load balancer manages incoming traffic to the Cloud Volumes ONTAP HA pair.

Availability Set

The Azure Availability Set is a logical grouping of the Cloud Volumes ONTAP nodes. The Availability Set ensures that the nodes are in different fault and update domains to provide redundancy and availability. [Learn more about Availability Sets in the Azure docs.](#)

Disks

Customer data resides on Premium Storage page blobs. Each node has access to the other node's storage. Additional storage is also required for [boot, root, and core data](#).

Storage accounts

- One storage account is required for managed disks.
- One or more storage accounts are required for the Premium Storage page blobs, as the disk capacity limit per storage account is reached.

[Azure documentation: Azure Storage scalability and performance targets for storage accounts](#).

- One storage account is required for data tiering to Azure Blob storage.
- Starting with Cloud Volumes ONTAP 9.7, the storage accounts that Cloud Manager creates for HA pairs are general-purpose v2 storage accounts.
- You can enable an HTTPS connection from a Cloud Volumes ONTAP 9.7 HA pair to Azure storage accounts when creating a working environment. Note that enabling this option can impact write performance. You can't change the setting after you create the working environment.

RPO and RTO

An HA configuration maintains high availability of your data as follows:

- The recovery point objective (RPO) is 0 seconds.
Your data is transactionally consistent with no data loss.
- The recovery time objective (RTO) is 60 seconds.
In the event of an outage, data should be available in 60 seconds or less.

Storage takeover and giveback

Similar to a physical ONTAP cluster, storage in an Azure HA pair is shared between nodes. Connections to the partner's storage allows each node to access the other's storage in the event of a *takeover*. Network path failover mechanisms ensure that clients and hosts continue to communicate with the surviving node. The partner *gives back* storage when the node is brought back on line.

For NAS configurations, data IP addresses automatically migrate between HA nodes if failures occur.

For iSCSI, Cloud Volumes ONTAP uses multipath I/O (MPIO) and Asymmetric Logical Unit Access (ALUA) to manage path failover between the active-optimized and non-optimized paths.



For information about which specific host configurations support ALUA, see the [NetApp Interoperability Matrix Tool](#) and the Host Utilities Installation and Setup Guide for your host operating system.

Storage takeover, resync, and giveback are all automatic by default. No user action is required.

Storage configurations

You can use an HA pair as an active-active configuration, in which both nodes serve data to clients, or as an active-passive configuration, in which the passive node responds to data requests only if it has taken over storage for the active node.

High-availability pairs in Google Cloud Platform

A Cloud Volumes ONTAP high availability (HA) configuration provides nondisruptive operations and fault tolerance. In Google Cloud Platform, data is synchronously mirrored between the two nodes.

HA components

Cloud Volumes ONTAP HA configurations in GCP include the following components:

- Two Cloud Volumes ONTAP nodes whose data is synchronously mirrored between each other.
- A mediator instance that provides a communication channel between the nodes to assist in storage takeover and giveback processes.

The mediator runs the Linux operating system on a f1-micro instance and uses two standard persistent disks that are 10 GB each.

- One zone or three zones (recommended).

If you choose three zones, the two nodes and mediator are in separate Google Cloud zones.

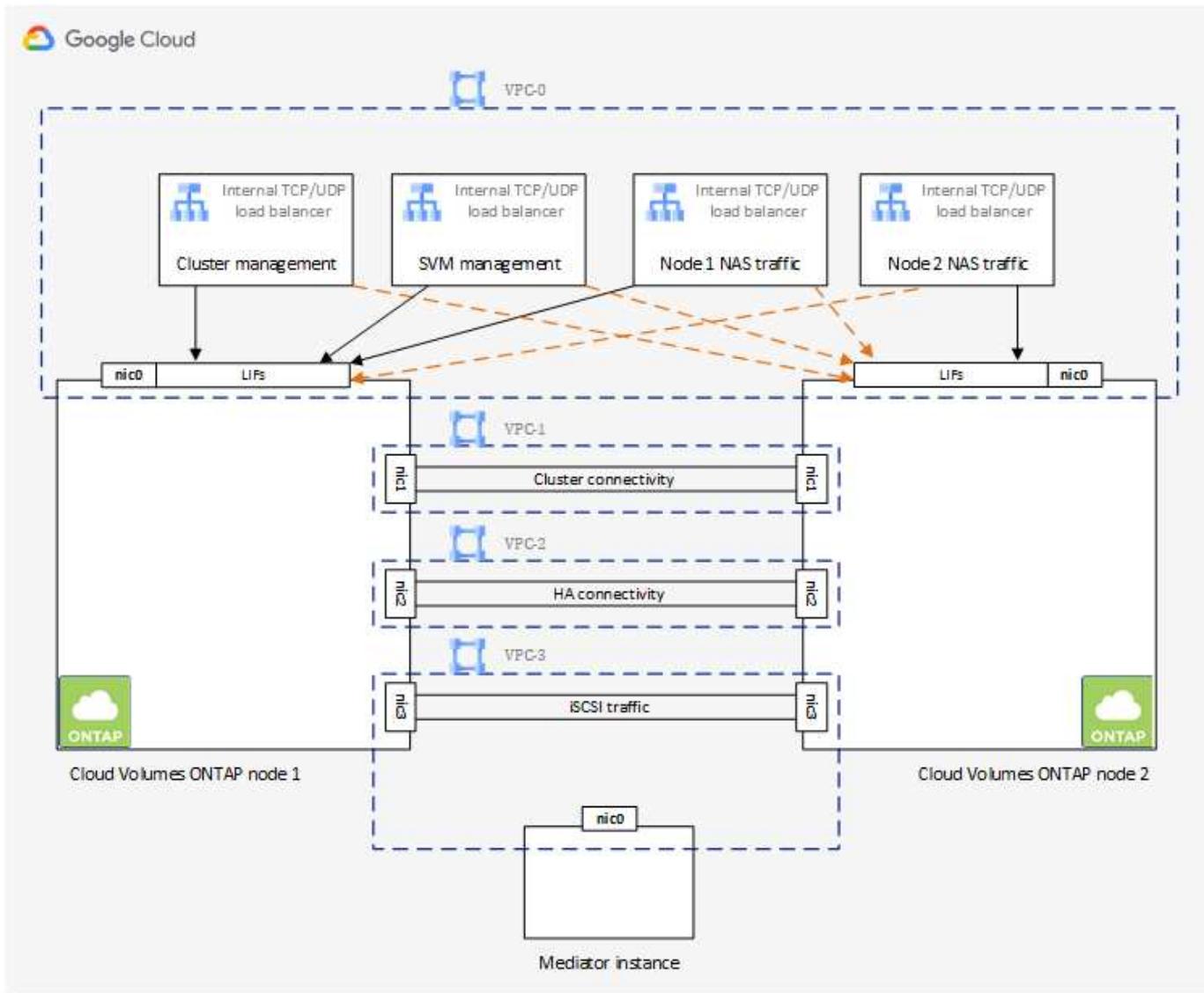
- Four Virtual Private Clouds (VPCs).

The configuration uses four VPCs because GCP requires that each network interface resides in a separate VPC network.

- Four Google Cloud internal load balancers (TCP/UDP) that manage incoming traffic to the Cloud Volumes ONTAP HA pair.

[Learn about networking requirements](#), including more details about load balancers, VPCs, internal IP addresses, subnets, and more.

The following conceptual image shows a Cloud Volumes ONTAP HA pair and its components:



Storage takeover and giveback

If a node goes down, the other node can serve data for its partner to provide continued data service. Clients can access the same data from the partner node because the data was synchronously mirrored to the partner.

After the node reboots, the partner must resync data before it can return the storage. The time that it takes to resync data depends on how much data was changed while the node was down.

Storage takeover, resync, and giveback are all automatic by default. No user action is required.

RPO and RTO

An HA configuration maintains high availability of your data as follows:

- The recovery point objective (RPO) is 0 seconds.

Your data is transactionally consistent with no data loss.

- The recovery time objective (RTO) is 60 seconds.

In the event of an outage, data should be available in 60 seconds or less.

HA deployment models

You can ensure the high availability of your data by deploying an HA configuration in multiple zones or in a single zone.

Multiple zones (recommended)

Deploying an HA configuration across three zones ensures continuous data availability if a failure occurs within a zone. Note that write performance is slightly lower compared to using a single zone, but it's minimal.

Single zone

When deployed in a single zone, a Cloud Volumes ONTAP HA configuration uses a spread placement policy. This policy ensures that an HA configuration is protected from a single point of failure within the zone, without having to use separate zones to achieve fault isolation.

This deployment model does lower your costs because there are no data egress charges between zones.

How storage works in an HA pair

Unlike an ONTAP cluster, storage in a Cloud Volumes ONTAP HA pair in GCP is not shared between nodes. Instead, data is synchronously mirrored between the nodes so that the data is available in the event of failure.

Storage allocation

When you create a new volume and additional disks are required, Cloud Manager allocates the same number of disks to both nodes, creates a mirrored aggregate, and then creates the new volume. For example, if two disks are required for the volume, Cloud Manager allocates two disks per node for a total of four disks.

Storage configurations

You can use an HA pair as an active-active configuration, in which both nodes serve data to clients, or as an active-passive configuration, in which the passive node responds to data requests only if it has taken over storage for the active node.

Performance expectations for an HA configuration

A Cloud Volumes ONTAP HA configuration synchronously replicates data between nodes, which consumes network bandwidth. As a result, you can expect the following performance in comparison to a single-node Cloud Volumes ONTAP configuration:

- For HA configurations that serve data from only one node, read performance is comparable to the read performance of a single-node configuration, whereas write performance is lower.
- For HA configurations that serve data from both nodes, read performance is higher than the read performance of a single-node configuration, and write performance is the same or higher.

For more details about Cloud Volumes ONTAP performance, see [Performance](#).

Client access to storage

Clients should access NFS and CIFS volumes by using the data IP address of the node on which the volume resides. If NAS clients access a volume by using the IP address of the partner node, traffic goes between both nodes, which reduces performance.



If you move a volume between nodes in an HA pair, you should remount the volume by using the IP address of the other node. Otherwise, you can experience reduced performance. If clients support NFSv4 referrals or folder redirection for CIFS, you can enable those features on the Cloud Volumes ONTAP systems to avoid remounting the volume. For details, see ONTAP documentation.

You can easily identify the correct IP address from Cloud Manager:

Volumes

2 Volumes | 0.22 TB Allocated | < 0.01 TB Used (0 TB in S3)

The screenshot shows a blue-themed interface for managing volumes. At the top, it displays '2 Volumes | 0.22 TB Allocated | < 0.01 TB Used (0 TB in S3)'. Below this, a volume named 'vol1' is listed. To the right of 'vol1' are three buttons: 'Info' (with a blue info icon), 'Edit' (with a blue edit icon), and 'Delete' (with a blue trash icon). A large blue button labeled 'X' is positioned to the right of the delete button. Below the volume name, there are four options: 'Clone' (with a blue clone icon), 'Mount Command' (with a blue mount icon, currently highlighted with a white cursor icon over it), 'Restore from Snapshot copy' (with a blue restore icon), and 'Change Tier' (with a blue tier icon).

Related links

- [Learn about networking requirements](#)
- [Learn how to get started in GCP](#)

Actions unavailable during takeover

When a node in an HA pair isn't available, the other node serves data for its partner to provide continued data service. This is called *storage takeover*. Several actions are unavailable until storage giveback is complete.



When a node in an HA pair is unavailable, the state of the working environment in Cloud Manager is *Degraded*.

The following actions are unavailable from Cloud Manager during storage takeover:

- Support registration
- License changes
- Instance or VM type changes
- Write speed changes
- CIFS setup
- Changing the location of configuration backups
- Setting the cluster password

- Managing disks and aggregates (advanced allocation)

These actions are available again after storage giveback completes and the state of the working environment changes back to normal.

Cloud Volumes ONTAP licensing

Several licensing options are available for Cloud Volumes ONTAP. Each option enables you to choose a consumption model that meets your needs.

Licensing overview

The following licensing options are available for new customers.

Freemium offering

Free of charge up to 500 GiB of provisioned capacity without purchasing a license or contract. Includes limited support.

Essentials package

Pay by capacity for Cloud Volumes ONTAP in a number of different configurations.

Professional package

Pay by capacity for any type of Cloud Volumes ONTAP configuration. Includes unlimited backups with Cloud Backup.

Keystone Flex Subscription

A pay-as-you-grow subscription-based service that delivers a seamless hybrid cloud experience for HA pairs.

The previous by-node licensing model remains available for existing customers who have already purchased a license or who have an active marketplace subscription.

The following sections provide more details about each of these options.

Freemium offering

Provides all Cloud Volumes ONTAP features free of charge from NetApp (cloud provider charges still apply).

- No license or contract is needed.
- Support from NetApp is not included.
- You're limited to 500 GiB of provisioned capacity per Cloud Volumes ONTAP system.
- You can use up to 10 Cloud Volumes ONTAP systems with the Freemium offering per NetApp account, in any cloud provider.
- If the provisioned capacity for a Cloud Volumes ONTAP system exceeds 500 GiB, Cloud Manager converts the system to the Essentials package.

Any other systems that have less than 500 GiB of provisioned capacity stay on Freemium (as long as they were deployed using the Freemium offering).

To get started with the Freemium offering, create a new Cloud Volumes ONTAP working environment and select **Freemium** when prompted to choose a charging method.

- [Launching Cloud Volumes ONTAP in AWS](#)
- [Launching Cloud Volumes ONTAP in Azure](#)
- [Launching Cloud Volumes ONTAP in Google Cloud](#)

Capacity-based licensing packages

Capacity-based licensing enables you to pay for Cloud Volumes ONTAP per TiB of capacity. The license is associated with your NetApp account and enables you to charge multiple systems against the license, as long as enough capacity is available through the license.

For example, you could purchase a single 20 TiB license, deploy four Cloud Volumes ONTAP systems, and then allocate a 5 TiB volume to each system, for a total of 20 TiB. The capacity is available to the volumes on each Cloud Volumes ONTAP system deployed in that account.

Capacity-based licensing is available in the form of a *package*. When you deploy a Cloud Volumes ONTAP system, you can choose the *Essentials* package or the *Professional* package.

Essentials package

- Choose your Cloud Volumes ONTAP configuration:
 - A single node or HA system
 - File and block storage or secondary data for disaster recovery (DR)
- Add on any of NetApp's cloud data services at extra cost

Professional package

- Provides licensing for any Cloud Volumes ONTAP configuration (single node or HA with any storage type)
- Includes volume backups using Cloud Backup (only for volumes charged against this license)
- Add on any of NetApp's cloud data services at extra cost

Consumption models

The Essentials and Professional packages are available with the following consumption models:

- A license (BYOL) purchased from NetApp that can be used to deploy Cloud Volumes ONTAP in any cloud provider.

The license is not restricted to a single cloud provider.

- An annual contract from your cloud provider's marketplace (AWS and Google Cloud only).
- An hourly subscription (PAYGO) from your cloud provider's marketplace.

Note the following:

- If you purchase a license from NetApp (BYOL), you also need to subscribe to the PAYGO offering from your cloud provider's marketplace.

Your license is always charged first, but you'll be charged from the hourly rate in the marketplace in these cases:

- If you exceed your licensed capacity

- If the term of your license expires
- If you have an annual contract from a marketplace, *all* Cloud Volumes ONTAP systems that you deploy are charged against that contract. You can't mix and match an annual marketplace contract with BYOL.

Pricing

For details about pricing, go to [NetApp Cloud Central](#).

Free trials

A 30-day free trial is available from the pay-as-you-go subscription in your cloud provider's marketplace. The free trial includes Cloud Volumes ONTAP and Cloud Backup and starts at the time that you subscribe to the marketplace listing.

There are no hourly software license charges for the instance, but infrastructure charges from your cloud provider still apply.

A free trial automatically converts to a paid hourly subscription when it expires. If you terminate the instance within the time limit, the next instance that you deploy is not part of the free trial (even if it's deployed within those 30 days).

You can start a 30-day free trial of Cloud Volumes ONTAP from Cloud Manager by creating your first Cloud Volumes ONTAP system in a payer's account.

Pay-as-you-go trials are awarded through a cloud provider and are not extendable by any means.

Supported configurations

Capacity-based licensing packages are available with Cloud Volumes ONTAP 9.7 and later.

Capacity limit

With this licensing model, each individual Cloud Volumes ONTAP system supports up to 2 PiB of capacity through disks and tiering to object storage.

There is no maximum capacity limitation when it comes to the license itself.

License conversions

Conversions to another licensing option isn't supported. If you want to transition to capacity-based licensing, you can deploy a new Cloud Volumes ONTAP system that uses capacity-based charging and then replicate the data to that new system.

Notes about charging

- If you exceed your BYOL capacity or if your license expires, you'll be charged for overages at the hourly rate based on your marketplace subscription.
- For each package, there is a minimum 4 TiB capacity charge. Any Cloud Volumes ONTAP instance that has less than 4 TiB of capacity will be charged at a rate of 4 TiB.
- There are no extra licensing costs for additional data serving storage VMs (SVMs), but there is a 4 TiB minimum capacity charge per SVM.
- For HA pairs, you're only charged for the provisioned capacity on a node. You aren't charged for data that is synchronously mirrored to the partner node.

- You won't be charged for the capacity used by FlexClone volumes.
- Source and destination FlexCache volumes are considered primary data and charged according to the provisioned space.

How to get started

1. [Contact NetApp Sales to obtain a license.](#)
2. [Add your license to Cloud Manager.](#)
3. Select the capacity-based BYOL charging method when you create a Cloud Volumes ONTAP system.
 - [Launching Cloud Volumes ONTAP in AWS](#)
 - [Launching Cloud Volumes ONTAP in Azure](#)
 - [Launching Cloud Volumes ONTAP in Google Cloud](#)

Keystone Flex Subscription

A pay-as-you-grow subscription-based service that delivers a seamless hybrid cloud experience for those preferring OpEx consumption models to upfront CapEx or leasing.

Charging is based on the size of your committed capacity for one or more Cloud Volumes ONTAP HA pairs in your Keystone Flex Subscription.

The provisioned capacity for each volume is aggregated and compared to the committed capacity on your Keystone Flex Subscription periodically, and any overages are charged as burst on your Keystone Flex Subscription.

[Learn more about Keystone Flex Subscriptions.](#)

Supported configurations

Keystone Flex Subscriptions are supported with HA pairs. This licensing option isn't supported with single node systems at this time.

Capacity limit

Each individual Cloud Volumes ONTAP system supports up to 2 PiB of capacity through disks and tiering to object storage.

How to get started

1. If you don't have a subscription yet, [contact NetApp](#).
2. [Contact NetApp](#) to authorize your Cloud Manager user account with one or more Keystone Flex Subscriptions.
3. After NetApp authorizes your account, [link your subscriptions for use with Cloud Volumes ONTAP](#).
4. Select the Keystone Flex Subscription charging method when you create a Cloud Volumes ONTAP system.
 - [Launching Cloud Volumes ONTAP in AWS](#)
 - [Launching Cloud Volumes ONTAP in Azure](#)
 - [Launching Cloud Volumes ONTAP in Google Cloud](#)

Node-based licensing

Node-based licensing is the previous generation licensing model that enabled you to license Cloud Volumes ONTAP by node. This licensing model is not available for new customers and no free trials are available. By-node charging has been replaced with the by-capacity charging methods described above.

Node-based licensing is still available for existing customers:

- If you have an active license, BYOL is available for license renewals only.
- If you have an active marketplace subscription, charging is still available through that subscription.

Conversions to another licensing option isn't supported. If you want to transition to capacity-based licensing, you can purchase a license, deploy a new Cloud Volumes ONTAP system, and then replicate the data to that new system.

Max number of 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.

[Learn more about NetApp accounts.](#)

License management for node-based BYOL

Each Cloud Volumes ONTAP system that has a node-based BYOL must have a system license installed with an active subscription. Cloud Manager simplifies the process by managing licenses for you and by displaying a warning before they expire.



A node-based license is the previous generation BYOL for Cloud Volumes ONTAP. A node-based license is available for license renewals only.

[Learn more about Cloud Volumes ONTAP licensing options.](#)

BYOL system licenses

A node-based license provides up to 368 TiB of capacity for a single node or HA pair.

You can purchase multiple licenses for a Cloud Volumes ONTAP BYOL system to allocate more than 368 TiB of capacity. For example, you might purchase two licenses to allocate up to 736 TiB of capacity to Cloud Volumes ONTAP. Or you could purchase four licenses to get up to 1.4 PiB.

The number of licenses that you can purchase for a single node system or HA pair is unlimited.



Some on-premises ONTAP storage systems that you purchased may have included a free Cloud Volumes ONTAP license. You can use the license to create a new Cloud Volumes ONTAP system, or you can apply the license to an existing Cloud Volumes ONTAP system to expand the capacity. [See if you have any available licenses to use.](#)

Be aware that disk limits can prevent you from reaching the capacity limit by using disks alone. You can go beyond the disk limit by [tiering inactive data to object storage](#). For information about disk limits, refer to [storage limits in the Cloud Volumes ONTAP Release Notes](#).

License management for a new system

When you create a node-based BYOL system, Cloud Manager prompts you for the serial number of your license and your NetApp Support Site account. Cloud Manager uses the account to download the license file from NetApp and to install it on the Cloud Volumes ONTAP system.

[Learn how to add NetApp Support Site accounts to Cloud Manager.](#)

If Cloud Manager can't access the license file over the secure internet connection, you can [obtain the file yourself and then manually upload the file to Cloud Manager](#).

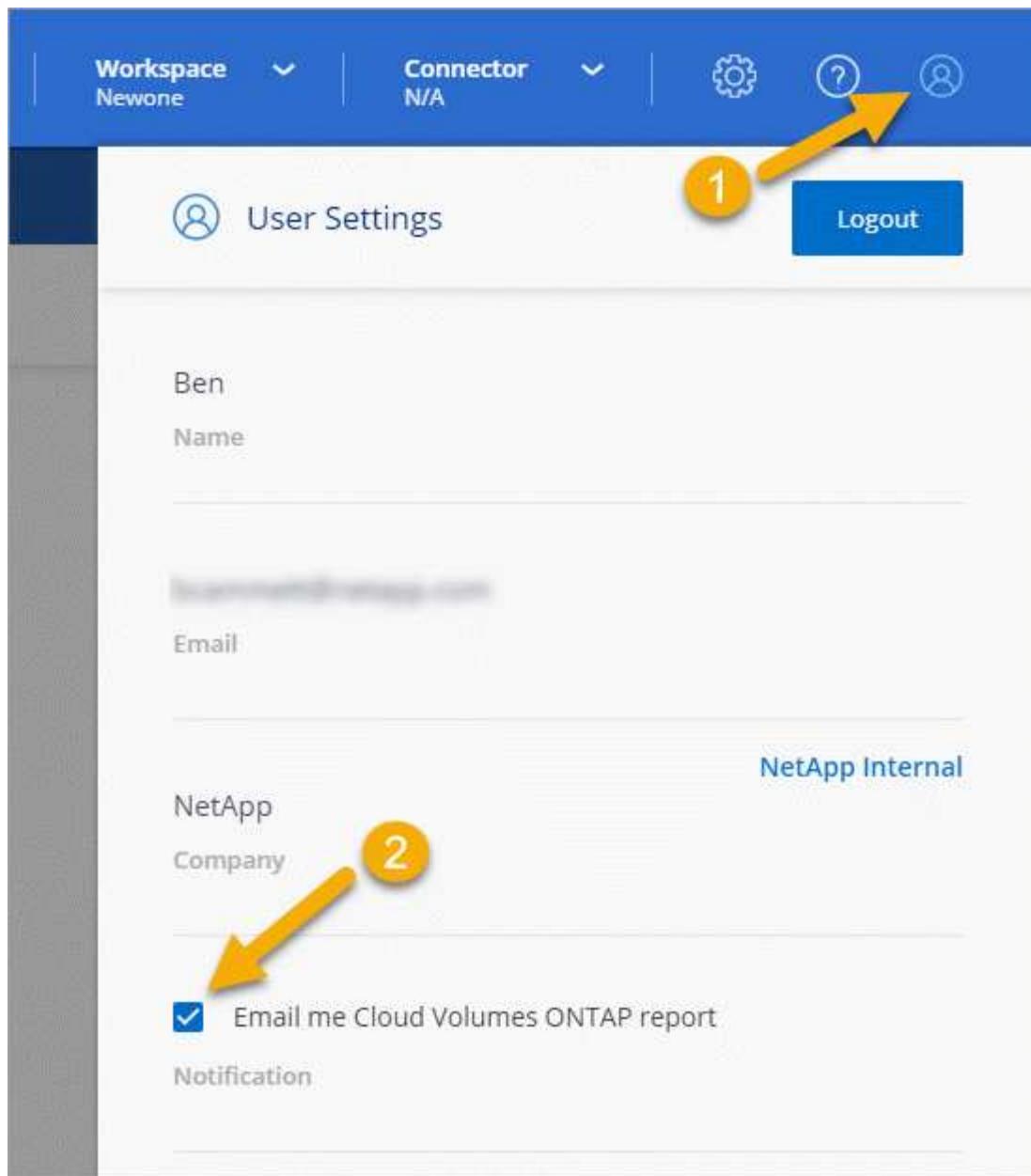
License expiration

Cloud Manager displays a warning 30 days before a node-based license is due to expire and again when the license expires. The following image shows a 30-day expiration warning that appears in the user interface:



You can select the working environment to review the message.

Cloud Manager includes a license expiration warning in the Cloud Volumes ONTAP report that's emailed to you, if you are an Account Admin and you enabled the option:



The emailed report includes the license expiration warning every 2 weeks.

If you don't renew the license in time, the Cloud Volumes ONTAP system shuts itself down. If you restart it, it shuts itself down again.

License renewal

When you renew a node-based BYOL subscription by contacting a NetApp representative, Cloud Manager automatically obtains the new license from NetApp and installs it on the Cloud Volumes ONTAP system.

If Cloud Manager can't access the license file over the secure internet connection, you can [obtain the file yourself and then manually upload the file to Cloud Manager](#).

License transfer to a new system

A node-based BYOL license is transferable between Cloud Volumes ONTAP systems when you delete an existing system and then create a new one using the same license.

For example, you might want to delete an existing licensed system and then use the license with a new BYOL system in a different VPC/VNet or cloud provider. Note that only *cloud-agnostic* serial numbers work in any cloud provider. Cloud-agnostic serial numbers start with the 908xxxx prefix.

It's important to note that your BYOL license is tied to your company and a specific set of NetApp Support Site credentials.

Security

Cloud Volumes ONTAP supports data encryption and provides protection against viruses and ransomware.

Encryption of data at rest

Cloud Volumes ONTAP supports the following encryption technologies:

- NetApp encryption solutions (NVE and NAE)
- AWS Key Management Service
- Azure Storage Service Encryption
- Google Cloud Platform default encryption

You can use NetApp encryption solutions with native encryption from AWS, Azure, or GCP, which encrypt data at the hypervisor level. Doing so would provide double encryption, which might be desired for very sensitive data. When the encrypted data is accessed, it's unencrypted twice—once at the hypervisor-level (using keys from the cloud provider) and then again using NetApp encryption solutions (using keys from an external key manager).

NetApp encryption solutions (NVE and NAE)

Cloud Volumes ONTAP supports [NetApp Volume Encryption \(NVE\)](#) and [NetApp Aggregate Encryption \(NAE\)](#). NVE and NAE are software-based solutions that enable (FIPS) 140-2-compliant data-at-rest encryption of volumes. Both NVE and NAE use AES 256-bit encryption.

- NVE encrypts data at rest one volume at a time. Each data volume has its own unique encryption key.
- NAE is an extension of NVE—it encrypts data for each volume, and the volumes share a key across the aggregate. NAE also allows common blocks across all volumes in the aggregate to be deduplicated.

Both NVE and NAE are supported with an external key manager. If you use NVE, you have the option to use Azure Key Vault (AKV) or the Google Cloud Key Management Service to protect ONTAP encryption keys.

New aggregates have NetApp Aggregate Encryption (NAE) enabled by default after you set up an external key manager. New volumes that aren't part of an NAE aggregate will have NetApp Volume Encryption (NVE) enabled by default (for example, if you have existing aggregates that were created before setting up an external key manager).

Setting up a supported key manager is the only required step. For set up instructions, refer to [Encrypting volumes with NetApp encryption solutions](#).

AWS Key Management Service

When you launch a Cloud Volumes ONTAP system in AWS, you can enable data encryption using the [AWS Key Management Service \(KMS\)](#). Cloud Manager requests data keys using a customer master key (CMK).



You can't change the AWS data encryption method after you create a Cloud Volumes ONTAP system.

If you want to use this encryption option, then you must ensure that the AWS KMS is set up appropriately. For details, see [Setting up the AWS KMS](#).

Azure Storage Service Encryption

Data is automatically encrypted on Cloud Volumes ONTAP in Azure using [Azure Storage Service Encryption](#) with a Microsoft-managed key.

You can use your own encryption keys if you prefer. [Learn how to set up Cloud Volumes ONTAP to use a customer-managed key in Azure](#).

Google Cloud Platform default encryption

[Google Cloud Platform data-at-rest encryption](#) is enabled by default for Cloud Volumes ONTAP. No setup is required.

While Google Cloud Storage always encrypts your data before it's written to disk, you can use Cloud Manager APIs to create a Cloud Volumes ONTAP system that uses *customer-managed encryption* keys. These are keys that you generate and manage in GCP using the Cloud Key Management Service. [Learn more](#).

ONTAP virus scanning

You can use integrated antivirus functionality on ONTAP systems to protect data from being compromised by viruses or other malicious code.

ONTAP virus scanning, called *Vscan*, combines best-in-class third-party antivirus software with ONTAP features that give you the flexibility you need to control which files get scanned and when.

For information about the vendors, software, and versions supported by Vscan, see the [NetApp Interoperability Matrix](#).

For information about how to configure and manage the antivirus functionality on ONTAP systems, see the [ONTAP 9 Antivirus Configuration Guide](#).

Ransomware protection

Ransomware attacks can cost a business time, resources, and reputation. Cloud Manager enables you to implement the NetApp solution for ransomware, which provides effective tools for visibility, detection, and remediation.

- Cloud Manager identifies volumes that are not protected by a Snapshot policy and enables you to activate the default Snapshot policy on those volumes.

Snapshot copies are read-only, which prevents ransomware corruption. They can also provide the granularity to create images of a single file copy or a complete disaster recovery solution.

- Cloud Manager also enables you to block common ransomware file extensions by enabling ONTAP's FPolicy solution.

Ransomware Protection

Ransomware attacks can cost a business time, resources, and reputation. The NetApp solution for ransomware provides effective tools for visibility, detection, and remediation. [Learn More](#)

1 Enable Snapshot Copy Protection 



50 %
Protection

1 Volumes without a Snapshot Policy

To protect your data, activate the default Snapshot policy for these volumes 

[Activate Snapshot Policy](#)

2 Block Ransomware File Extensions 



ONTAP's native FPolicy configuration monitors and blocks file operations based on a file's extension.

[View Denied File Names](#) 

[Activate FPolicy](#)

[Learn how to implement the NetApp solution for ransomware.](#)

Performance

You can review performance results to help you decide which workloads are appropriate for Cloud Volumes ONTAP.

Performance technical reports

- Cloud Volumes ONTAP for AWS

[NetApp Technical Report 4383: Performance Characterization of Cloud Volumes ONTAP in Amazon Web Services with Application Workloads.](#)

- Cloud Volumes ONTAP for Microsoft Azure

[NetApp Technical Report 4671: Performance Characterization of Cloud Volumes ONTAP in Azure with Application Workloads.](#)

- Cloud Volumes ONTAP for Google Cloud

[NetApp Technical Report 4816: Performance Characterization of Cloud Volumes ONTAP for Google Cloud.](#)

CPU performance

Cloud Volumes ONTAP nodes show as highly utilized (over 90%) from your cloud provider's monitoring tools. This is because ONTAP reserves all vCPUs presented to the virtual machine so that they are available when needed.

[Learn how to monitor Cloud Volumes ONTAP performance](#), or check out this [NetApp knowledgebase article](#) about how to monitor ONTAP CPU utilization using the CLI.

AutoSupport and Active IQ Digital Advisor

The AutoSupport component of ONTAP collects telemetry and sends it for analysis. Active IQ Digital Advisor analyzes the data from AutoSupport and provides proactive care

and optimization. Using artificial intelligence, Active IQ can identify potential problems and help you resolve them before they impact your business.

Active IQ enables you to optimize your data infrastructure across your global hybrid cloud by delivering actionable predictive analytics and proactive support through a cloud-based portal and mobile app. Data-driven insights and recommendations from Active IQ are available to all NetApp customers with an active SupportEdge contract (features vary by product and support tier).

Here are some things you can do with Active IQ:

- Plan upgrades.

Active IQ identifies issues in your environment that can be resolved by upgrading to a newer version of ONTAP and the Upgrade Advisor component helps you plan for a successful upgrade.

- View system wellness.

Your Active IQ dashboard reports any issues with wellness and helps you correct those issues. Monitor system capacity to make sure you never run out of storage space. View support cases for your system.

- Manage performance.

Active IQ shows system performance over a longer period than you can see in ONTAP System Manager. Identify configuration and system issues that are impacting your performance.

Maximize efficiency. View storage efficiency metrics and identify ways to store more data in less space.

- View inventory and configuration.

Active IQ displays complete inventory and software and hardware configuration information. See when service contracts are expiring and renew them to ensure you remain supported.

Related information

- [NetApp Documentation: Active IQ Digital Advisor](#)
- [Launch Active IQ](#)
- [SupportEdge Services](#)

Default configuration for Cloud Volumes ONTAP

Understanding how Cloud Volumes ONTAP is configured by default can help you set up and administer your systems, especially if you are familiar with ONTAP because the default setup for Cloud Volumes ONTAP is different than ONTAP.

Defaults

- Cloud Volumes ONTAP is available as a single-node system and as an HA pair in AWS, Azure, and GCP.
- Cloud Manager creates one data-serving storage VM when it deploys Cloud Volumes ONTAP. Some configurations support additional storage VMs. [Learn more about managing storage VMs](#).

Starting with the Cloud Manager 3.9.5 release, logical space reporting is enabled on the initial storage VM. When space is reported logically, ONTAP reports the volume space such that all the physical space saved by the storage efficiency features are also reported as used.

- Cloud Manager automatically installs the following ONTAP feature licenses on Cloud Volumes ONTAP:
 - CIFS
 - FlexCache
 - FlexClone
 - iSCSI
 - NetApp Volume Encryption (only for BYOL or registered PAYGO systems)
 - NFS
 - SnapMirror
 - SnapRestore
 - SnapVault
- Several network interfaces are created by default:
 - A cluster management LIF
 - An intercluster LIF
 - An SVM management LIF on HA systems in Azure and in GCP, on single node systems in AWS, and optionally on HA systems in multiple AWS Availability Zones
 - A node management LIF (in GCP, this LIF is combined with the intercluster LIF)
 - An iSCSI data LIF
 - A CIFS and NFS data LIF



LIF failover is disabled by default for Cloud Volumes ONTAP due to EC2 requirements. Migrating a LIF to a different port breaks the external mapping between IP addresses and network interfaces on the instance, making the LIF inaccessible.

- Cloud Volumes ONTAP sends configuration backups to the Connector using HTTPS.

The backups are accessible from <https://ipaddress/occm/offboxconfig> where *ipaddress* is the IP address of the Connector host.

- Cloud Manager sets a few volume attributes differently than other management tools (System Manager or the CLI, for example).

The following table lists the volume attributes that Cloud Manager sets differently from the defaults:

Attribute	Value set by Cloud Manager
Autosize mode	grow
Maximum autosize	1,000 percent <div style="display: flex; align-items: center;"> i The Account Admin can modify this value from the Settings page. </div>
Security style	NTFS for CIFS volumes UNIX for NFS volumes

Attribute	Value set by Cloud Manager
Space guarantee style	none
UNIX permissions (NFS only)	777

See the *volume create* man page for information about these attributes.

Internal disks for system data

In addition to the storage for user data, Cloud Manager also purchases cloud storage for system data.

AWS

- Three disks per node for boot, root, and core data:
 - 45 GiB io1 disk for boot data
 - 140 GiB gp3 disk for root data
 - 540 GiB gp2 disk for core data
- One EBS snapshot for each boot disk and root disk
- For HA pairs, one EBS volume for the Mediator instance, which is approximately 8 GiB



In AWS, NVRAM is on the boot disk.

Azure (single node)

- Three Premium SSD disks:
 - One 10 GiB disk for boot data
 - One 140 GiB disk for root data
 - One 512 GiB disk for NVRAM

If the virtual machine that you chose for Cloud Volumes ONTAP supports Ultra SSDs, then the system uses a 32 GiB Ultra SSD for NVRAM, rather than a Premium SSD.

- One 1024 GiB Standard HDD disk for saving cores
- One Azure snapshot for each boot disk and root disk

Azure (HA pair)

- Two 10 GiB Premium SSD disks for the boot volume (one per node)
- Two 140 GiB Premium Storage page blobs for the root volume (one per node)
- Two 1024 GiB Standard HDD disks for saving cores (one per node)
- Two 512 GiB Premium SSD disks for NVRAM (one per node)
- One Azure snapshot for each boot disk and root disk

Google Cloud (single node)

- One 10 GiB SSD persistent disk for boot data
- One 64 GiB SSD persistent disk for root data
- One 500 GiB SSD persistent disk for NVRAM
- One 315 GiB Standard persistent disk for saving cores
- Snapshots for boot and root data

Google Cloud (HA pair)

- Two 10 GiB SSD persistent disks for boot data
- Four 64 GiB SSD persistent disk for root data
- Two 500 GiB SSD persistent disk for NVRAM
- Two 315 GiB Standard persistent disk for saving cores
- One 10 GiB Standard persistent disk for mediator data
- Snapshots for boot and root data

Where the disks reside

Cloud Manager lays out the storage as follows:

- Boot data resides on a disk attached to the instance or virtual machine.

This disk, which contains the boot image, is not available to Cloud Volumes ONTAP.

- Root data, which contains the system configuration and logs, resides in aggr0.
- The storage virtual machine (SVM) root volume resides in aggr1.
- Data volumes also reside in aggr1.

Encryption

Boot and root disks are always encrypted in Azure and Google Cloud Platform because encryption is enabled by default in those cloud providers.

When you enable data encryption in AWS using the Key Management Service (KMS), the boot and root disks for Cloud Volumes ONTAP are encrypted, as well. This includes the boot disk for the mediator instance in an HA pair. The disks are encrypted using the CMK that you select when you create the working environment.

Get started in AWS

Getting started with Cloud Volumes ONTAP for AWS

Get started with Cloud Volumes ONTAP for AWS in a few steps.

1

Create a Connector

If you don't have a [Connector](#) yet, an Account Admin needs to create one. [Learn how to create a Connector in AWS.](#)

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

2

Plan your configuration

Cloud Manager offers preconfigured packages that match your workload requirements, or you can create your own configuration. If you choose your own configuration, you should understand the options available to you. [Learn more.](#)

3

Set up your networking

- a. Ensure that your VPC and subnets will support connectivity between the Connector and Cloud Volumes ONTAP.
- b. Enable outbound internet access from the target VPC so the Connector and Cloud Volumes ONTAP can contact several endpoints.

This step is important because the Connector can't manage Cloud Volumes ONTAP without outbound internet access. If you need to limit outbound connectivity, refer to the list of endpoints for [the Connector and Cloud Volumes ONTAP](#).

- c. Set up a VPC endpoint to the S3 service.

A VPC endpoint is required if you want to tier cold data from Cloud Volumes ONTAP to low-cost object storage.

[Learn more about networking requirements.](#)

4

Set up the AWS KMS

If you want to use Amazon encryption with Cloud Volumes ONTAP, then you need to ensure that an active Customer Master Key (CMK) exists. You also need to modify the key policy for each CMK by adding the IAM role that provides permissions to the Connector as a *key user*. [Learn more.](#)

5

Launch Cloud Volumes ONTAP using Cloud Manager

Click **Add Working Environment**, select the type of system that you would like to deploy, and complete the steps in the wizard. [Read step-by-step instructions.](#)

Related links

- [Creating a Connector from Cloud Manager](#)
- [Launching a Connector from the AWS Marketplace](#)
- [Installing the Connector software on a Linux host](#)
- [What Cloud Manager does with AWS permissions](#)

Planning your Cloud Volumes ONTAP configuration in AWS

When you deploy Cloud Volumes ONTAP in AWS, you can choose a preconfigured system that matches your workload requirements, or you can create your own

configuration. If you choose your own configuration, you should understand the options available to you.

Viewing supported regions

Cloud Volumes ONTAP is supported in most AWS regions. [View the full list of supported regions](#).

Newer AWS regions must be enabled before you can create and manage resources in those regions. [Learn how to enable a region](#).

Choosing a license

Several licensing options are available for Cloud Volumes ONTAP. Each option enables you to choose a consumption model that meets your needs. [Learn about licensing options for Cloud Volumes ONTAP](#).

Choosing a supported instance

Cloud Volumes ONTAP supports several instance types, depending on the license type that you choose.

[Supported configurations for Cloud Volumes ONTAP in AWS](#)

Choosing a configuration that supports Flash Cache

Some Cloud Volumes ONTAP configurations in AWS include local NVMe storage, which Cloud Volumes ONTAP uses as *Flash Cache* for better performance. [Learn more about Flash Cache](#).

Understanding storage limits

The raw capacity limit for a Cloud Volumes ONTAP system is tied to the license. Additional limits impact the size of aggregates and volumes. You should be aware of these limits as you plan your configuration.

[Storage limits for Cloud Volumes ONTAP in AWS](#)

Sizing your system in AWS

Sizing your Cloud Volumes ONTAP system can help you meet requirements for performance and capacity. You should be aware of a few key points when choosing an instance type, disk type, and disk size:

Instance type

- Match your workload requirements to the maximum throughput and IOPS for each EC2 instance type.
- If several users write to the system at the same time, choose an instance type that has enough CPUs to manage the requests.
- If you have an application that is mostly reads, then choose a system with enough RAM.
 - [AWS Documentation: Amazon EC2 Instance Types](#)
 - [AWS Documentation: Amazon EBS–Optimized Instances](#)

EBS disk type

At a high level, the differences between EBS disk types are as follows. To learn more about the use cases for EBS disks, refer to [AWS Documentation: EBS Volume Types](#).

- *General Purpose SSD (gp3)* disks are the lowest-cost SSDs that balance cost and performance for a broad range of workloads. Performance is defined in terms of IOPS and throughput. gp3 disks are

supported with Cloud Volumes ONTAP 9.7 and later.

When you select a gp3 disk, Cloud Manager fills in default IOPS and throughput values that provide performance that is equivalent to a gp2 disk based on the selected disk size. You can increase the values to get better performance at a higher cost, but we do not support lower values because it can result in inferior performance. In short, stick with the default values or increase them. Don't lower them. [Learn more about gp3 disks and their performance](#).

- *General Purpose SSD (gp2)* disks balance cost and performance for a broad range of workloads. Performance is defined in terms of IOPS.
- *Provisioned IOPS SSD (io1)* disks are for critical applications that require the highest performance at a higher cost.
- *Throughput Optimized HDD (st1)* disks are for frequently accessed workloads that require fast and consistent throughput at a lower price.



Tiering data to object storage is not recommended when using Throughput Optimized HDDs (st1).

EBS disk size

You need to choose an initial disk size when you launch a Cloud Volumes ONTAP system. After that, you can [let Cloud Manager manage a system's capacity for you](#), but if you want to [build aggregates yourself](#), be aware of the following:

- All disks in an aggregate must be the same size.
- The performance of EBS disks is tied to disk size. The size determines the baseline IOPS and maximum burst duration for SSD disks and the baseline and burst throughput for HDD disks.
- Ultimately, you should choose the disk size that gives you the *sustained performance* that you need.
- Even if you do choose larger disks (for example, six 4 TiB disks), you might not get all of the IOPS because the EC2 instance can reach its bandwidth limit.

For more details about EBS disk performance, refer to [AWS Documentation: EBS Volume Types](#).

Watch the following video for more details about sizing your Cloud Volumes ONTAP system in AWS:



Viewing default system disks

In addition to the storage for user data, Cloud Manager also purchases cloud storage for Cloud Volumes ONTAP system data (boot data, root data, core data, and NVRAM). For planning purposes, it might help for you to review these details before you deploy Cloud Volumes ONTAP.

[View the default disks for Cloud Volumes ONTAP system data in AWS.](#)



The Connector also requires a system disk. [View details about the Connector's default configuration.](#)

Preparing to deploy Cloud Volumes ONTAP in an AWS Outpost

If you have an AWS Outpost, you can deploy Cloud Volumes ONTAP in that Outpost by selecting the Outpost VPC in the Working Environment wizard. The experience is the same as any other VPC that resides in AWS. Note that you will need to first deploy a Connector in your AWS Outpost.

There are a few limitations to point out:

- Only single node Cloud Volumes ONTAP systems are supported at this time
- The EC2 instances that you can use with Cloud Volumes ONTAP are limited to what's available in your Outpost
- Only General Purpose SSDs (gp2) are supported at this time

AWS network information worksheet

When you launch Cloud Volumes ONTAP in AWS, you need to specify details about your VPC network. You can use a worksheet to collect the information from your administrator.

Network information for Cloud Volumes ONTAP

AWS information	Your value
Region	
VPC	
Subnet	
Security group (if using your own)	

Network information for an HA pair in multiple AZs

AWS information	Your value
Region	
VPC	
Security group (if using your own)	
Node 1 availability zone	
Node 1 subnet	
Node 2 availability zone	
Node 2 subnet	
Mediator availability zone	
Mediator subnet	
Key pair for the mediator	
Floating IP address for cluster management port	
Floating IP address for data on node 1	
Floating IP address for data on node 2	
Route tables for floating IP addresses	

Choosing a write speed

Cloud Manager enables you to choose a write speed setting for Cloud Volumes ONTAP. Before you choose a write speed, you should understand the differences between the normal and high settings and risks and recommendations when using high write speed. [Learn more about write speed](#).

Choosing a volume usage profile

ONTAP includes several storage efficiency features that can reduce the total amount of storage that you need. When you create a volume in Cloud Manager, you can choose a profile that enables these features or a profile that disables them. You should learn more about these features to help you decide which profile to use.

NetApp storage efficiency features provide the following benefits:

Thin provisioning

Presents more logical storage to hosts or users than you actually have in your physical storage pool. Instead of preallocating storage space, storage space is allocated dynamically to each volume as data is written.

Deduplication

Improves efficiency by locating identical blocks of data and replacing them with references to a single shared block. This technique reduces storage capacity requirements by eliminating redundant blocks of data that reside in the same volume.

Compression

Reduces the physical capacity required to store data by compressing data within a volume on primary, secondary, and archive storage.

Set up your networking

Networking requirements for Cloud Volumes ONTAP in AWS

Cloud Manager handles the set up of networking components for Cloud Volumes ONTAP, such as IP addresses, netmasks, and routes. You need to make sure that outbound internet access is available, that enough private IP addresses are available, that the right connections are in place, and more.

General requirements

The following requirements must be met in AWS.

Outbound internet access for Cloud Volumes ONTAP nodes

Cloud Volumes ONTAP nodes require outbound internet access to send messages to NetApp AutoSupport, which proactively monitors the health of your storage.

Routing and firewall policies must allow AWS HTTP/HTTPS traffic to the following endpoints so Cloud Volumes ONTAP can send AutoSupport messages:

- <https://support.netapp.com/aods/asupmessage>
- <https://support.netapp.com/asupprod/post/1.0/postAsup>

If you have a NAT instance, you must define an inbound security group rule that allows HTTPS traffic from the private subnet to the internet.

[Learn how to configure AutoSupport.](#)

Outbound internet access for the HA mediator

The HA mediator instance must have an outbound connection to the AWS EC2 service so it can assist with storage failover. To provide the connection, you can add a public IP address, specify a proxy server, or use a manual option.

The manual option can be a NAT gateway or an interface VPC endpoint from the target subnet to the AWS EC2 service. For details about VPC endpoints, refer to [AWS Documentation: Interface VPC Endpoints \(AWS\)](#)

[PrivateLink](#)).

Private IP addresses

Cloud Manager automatically allocates the required number of private IP addresses to Cloud Volumes ONTAP. You need to ensure that your networking has enough private IP addresses available.

The number of LIFs that Cloud Manager allocates for Cloud Volumes ONTAP depends on whether you deploy a single node system or an HA pair. A LIF is an IP address associated with a physical port.

IP addresses for a single node system

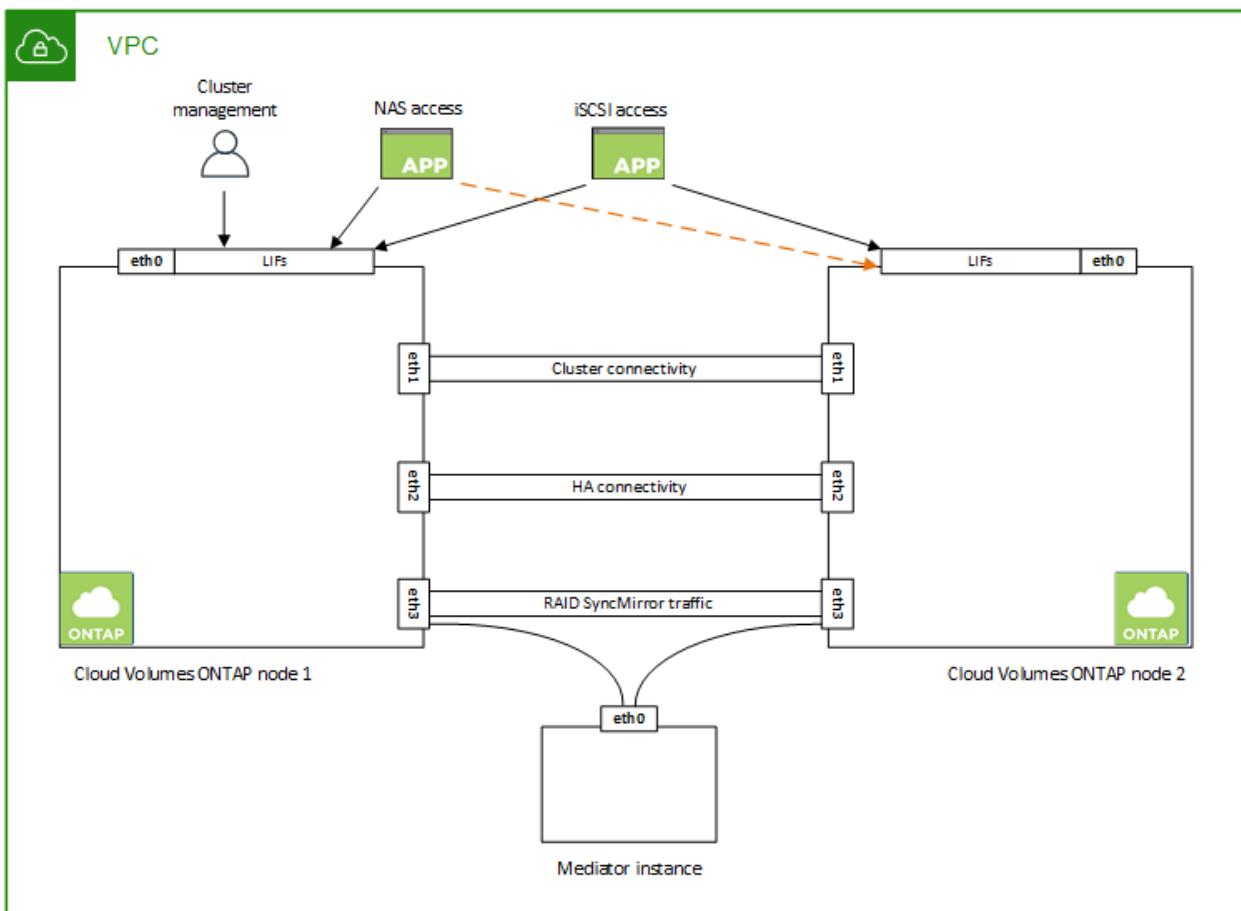
Cloud Manager allocates 6 IP addresses to a single node system:

- Cluster management LIF
- Node management LIF
- Intercluster LIF
- NAS data LIF
- iSCSI data LIF
- Storage VM management LIF

A storage VM management LIF is used with management tools like SnapCenter.

IP addresses for HA pairs

HA pairs require more IP addresses than a single node system does. These IP addresses are spread across different ethernet interfaces, as shown in the following image:



The number of private IP addresses required for an HA pair depends on which deployment model you choose. An HA pair deployed in a *single* AWS Availability Zone (AZ) requires 15 private IP addresses, while an HA pair deployed in *multiple* AZs requires 13 private IP addresses.

The following tables provide details about the LIFs that are associated with each private IP address.

LIFs for HA pairs in a single AZ

LIF	Interface	Node	Purpose
Cluster management	eth0	node 1	Administrative management of the entire cluster (HA pair).
Node management	eth0	node 1 and node 2	Administrative management of a node.
Intercluster	eth0	node 1 and node 2	Cross-cluster communication, backup, and replication.
NAS data	eth0	node 1	Client access over NAS protocols.
iSCSI data	eth0	node 1 and node 2	Client access over the iSCSI protocol.

LIF	Interface	Node	Purpose
Cluster connectivity	eth1	node 1 and node 2	Enables the nodes to communicate with each other and to move data within the cluster.
HA connectivity	eth2	node 1 and node 2	Communication between the two nodes in case of failover.
RSM iSCSI traffic	eth3	node 1 and node 2	RAID SyncMirror iSCSI traffic, as well as communication between the two Cloud Volumes ONTAP nodes and the mediator.
Mediator	eth0	Mediator	A communication channel between the nodes and the mediator to assist in storage takeover and giveback processes.

LIFs for HA pairs in multiple AZs

LIF	Interface	Node	Purpose
Node management	eth0	node 1 and node 2	Administrative management of a node.
Intercluster	eth0	node 1 and node 2	Cross-cluster communication, backup, and replication.
iSCSI data	eth0	node 1 and node 2	Client access over the iSCSI protocol. This LIF also manages the migration of floating IP addresses between nodes.
Cluster connectivity	eth1	node 1 and node 2	Enables the nodes to communicate with each other and to move data within the cluster.
HA connectivity	eth2	node 1 and node 2	Communication between the two nodes in case of failover.
RSM iSCSI traffic	eth3	node 1 and node 2	RAID SyncMirror iSCSI traffic, as well as communication between the two Cloud Volumes ONTAP nodes and the mediator.
Mediator	eth0	Mediator	A communication channel between the nodes and the mediator to assist in storage takeover and giveback processes.



When deployed in multiple Availability Zones, several LIFs are associated with [floating IP addresses](#), which don't count against the AWS private IP limit.

Security groups

You do not need to create security groups because Cloud Manager does that for you. If you need to use your own, refer to [Security group rules](#).

Connection for data tiering

If you want to use EBS as a performance tier and AWS S3 as a capacity tier, you must ensure that Cloud Volumes ONTAP has a connection to S3. The best way to provide that connection is by creating a VPC

Endpoint to the S3 service. For instructions, see [AWS Documentation: Creating a Gateway Endpoint](#).

When you create the VPC Endpoint, be sure to select the region, VPC, and route table that corresponds to the Cloud Volumes ONTAP instance. You must also modify the security group to add an outbound HTTPS rule that enables traffic to the S3 endpoint. Otherwise, Cloud Volumes ONTAP cannot connect to the S3 service.

If you experience any issues, see [AWS Support Knowledge Center: Why can't I connect to an S3 bucket using a gateway VPC endpoint?](#)

Connections to ONTAP systems

To replicate data between a Cloud Volumes ONTAP system in AWS and ONTAP systems in other networks, you must have a VPN connection between the AWS VPC and the other network—for example, an Azure VNet or your corporate network. For instructions, see [AWS Documentation: Setting Up an AWS VPN Connection](#).

DNS and Active Directory for CIFS

If you want to provision CIFS storage, you must set up DNS and Active Directory in AWS or extend your on-premises setup to AWS.

The DNS server must provide name resolution services for the Active Directory environment. You can configure DHCP option sets to use the default EC2 DNS server, which must not be the DNS server used by the Active Directory environment.

For instructions, refer to [AWS Documentation: Active Directory Domain Services on the AWS Cloud: Quick Start Reference Deployment](#).

Requirements for HA pairs in multiple AZs

Additional AWS networking requirements apply to Cloud Volumes ONTAP HA configurations that use multiple Availability Zones (AZs). You should review these requirements before you launch an HA pair because you must enter the networking details in Cloud Manager when you create the working environment.

To understand how HA pairs work, see [High-availability pairs](#).

Availability Zones

This HA deployment model uses multiple AZs to ensure high availability of your data. You should use a dedicated AZ for each Cloud Volumes ONTAP instance and the mediator instance, which provides a communication channel between the HA pair.

A subnet should be available in each Availability Zone.

Floating IP addresses for NAS data and cluster/SVM management

HA configurations in multiple AZs use floating IP addresses that migrate between nodes if failures occur. They are not natively accessible from outside the VPC, unless you [set up an AWS transit gateway](#).

One floating IP address is for cluster management, one is for NFS/CIFS data on node 1, and one is for NFS/CIFS data on node 2. A fourth floating IP address for SVM management is optional.



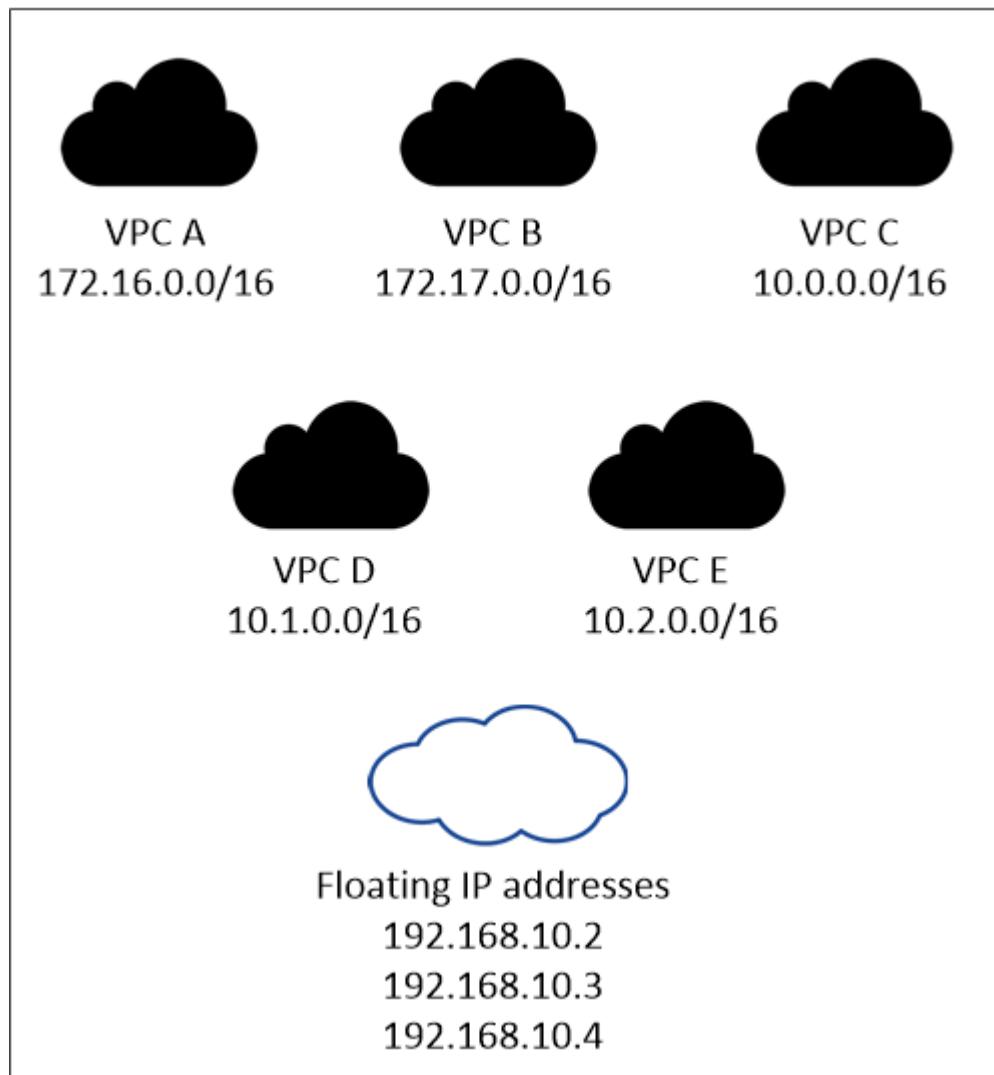
A floating IP address is required for the SVM management LIF if you use SnapDrive for Windows or SnapCenter with the HA pair. If you don't specify the IP address when you deploy the system, you can create the LIF later. For details, see [Setting up Cloud Volumes ONTAP](#).

You need to enter the floating IP addresses in Cloud Manager when you create a Cloud Volumes ONTAP HA working environment. Cloud Manager allocates the IP addresses to the HA pair when it launches the system.

The floating IP addresses must be outside of the CIDR blocks for all VPCs in the AWS region in which you deploy the HA configuration. Think of the floating IP addresses as a logical subnet that's outside of the VPCs in your region.

The following example shows the relationship between floating IP addresses and the VPCs in an AWS region. While the floating IP addresses are outside the CIDR blocks for all VPCs, they're routable to subnets through route tables.

AWS region



Cloud Manager automatically creates static IP addresses for iSCSI access and for NAS access from clients outside the VPC. You don't need to meet any requirements for these types of IP addresses.

Transit gateway to enable floating IP access from outside the VPC

If needed, [set up an AWS transit gateway](#) to enable access to an HA pair's floating IP addresses from outside the VPC where the HA pair resides.

Route tables

After you specify the floating IP addresses in Cloud Manager, you are then prompted to select the route tables that should include routes to the floating IP addresses. This enables client access to the HA pair.

If you have just one route table for the subnets in your VPC (the main route table), then Cloud Manager automatically adds the floating IP addresses to that route table. If you have more than one route table, it's very important to select the correct route tables when launching the HA pair. Otherwise, some clients might not have access to Cloud Volumes ONTAP.

For example, you might have two subnets that are associated with different route tables. If you select route table A, but not route table B, then clients in the subnet associated with route table A can access the HA pair, but clients in the subnet associated with route table B can't.

For more information about route tables, refer to [AWS Documentation: Route Tables](#).

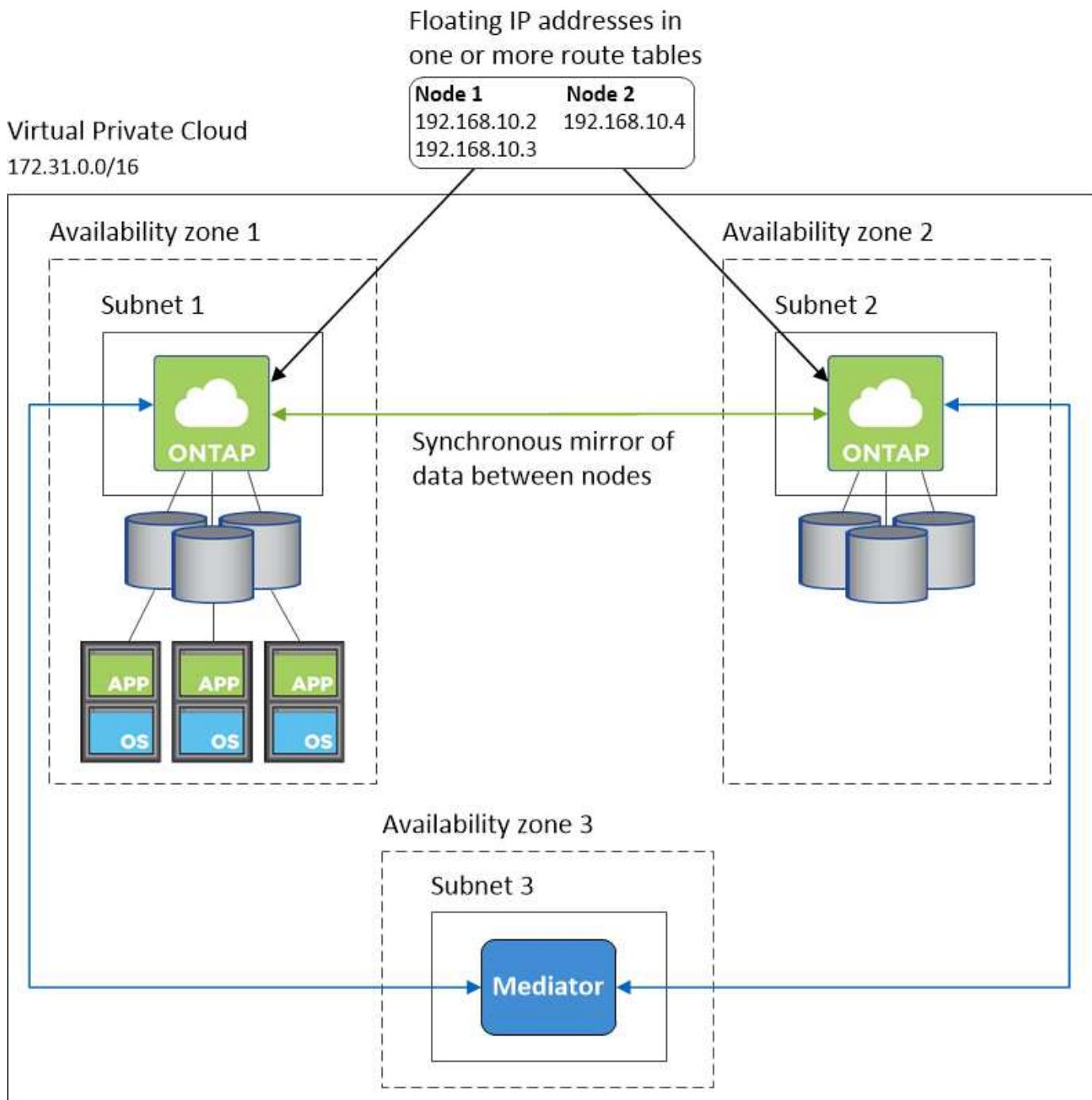
Connection to NetApp management tools

To use NetApp management tools with HA configurations that are in multiple AZs, you have two connection options:

1. Deploy the NetApp management tools in a different VPC and [set up an AWS transit gateway](#). The gateway enables access to the floating IP address for the cluster management interface from outside the VPC.
2. Deploy the NetApp management tools in the same VPC with a similar routing configuration as NAS clients.

Example HA configuration

The following image illustrates the networking components specific to an HA pair in multiple AZs: three Availability Zones, three subnets, floating IP addresses, and a route table.



Requirements for the Connector

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



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 VPCs and VNets in which you want to deploy Cloud Volumes ONTAP.

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.

Outbound internet access

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	To upgrade the Connector and its Docker components.
https://*.blob.core.windows.net	

Setting up an AWS transit gateway for HA pairs in multiple AZs

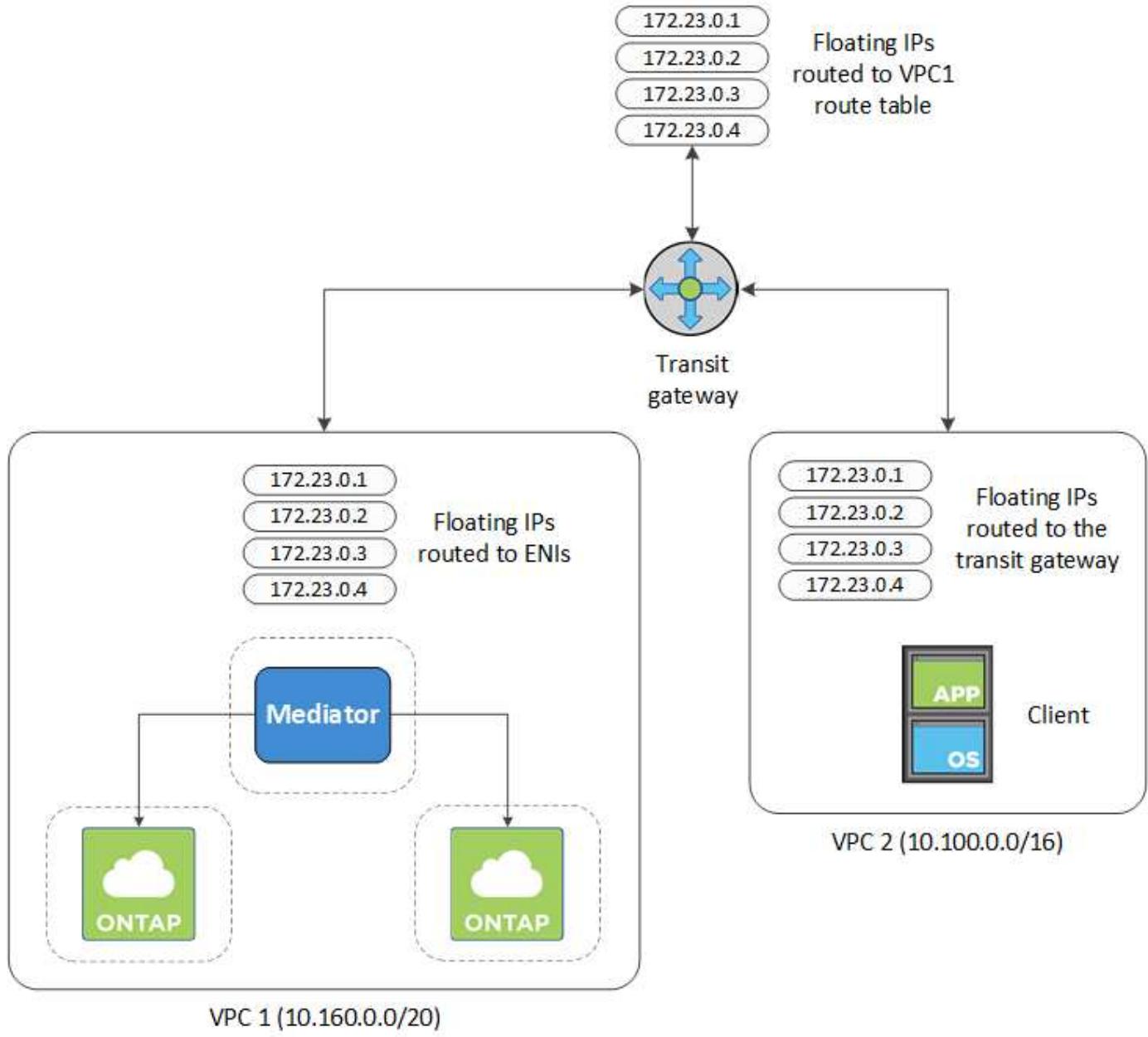
Set up an AWS transit gateway to enable access to an HA pair's [floating IP addresses](#) from outside the VPC where the HA pair resides.

When a Cloud Volumes ONTAP HA configuration is spread across multiple AWS Availability Zones, floating IP addresses are required for NAS data access from within the VPC. These floating IP addresses can migrate between nodes when failures occur, but they are not natively accessible from outside the VPC. Separate private IP addresses provide data access from outside the VPC, but they don't provide automatic failover.

Floating IP addresses are also required for the cluster management interface and the optional SVM management LIF.

If you set up an AWS transit gateway, you enable access to the floating IP addresses from outside the VPC where the HA pair resides. That means NAS clients and NetApp management tools outside the VPC can access the floating IPs.

Here's an example that shows two VPCs connected by a transit gateway. An HA system resides in one VPC, while a client resides in the other. You could then mount a NAS volume on the client using the floating IP address.



The following steps illustrate how to set up a similar configuration.

Steps

1. [Create a transit gateway and attach the VPCs to the gateway.](#)
2. Associate the VPCs with the transit gateway route table.
 - a. In the **VPC** service, click **Transit Gateway Route Tables**.
 - b. Select the route table.
 - c. Click **Associations** and then select **Create association**.
 - d. Choose the attachments (the VPCs) to associate and then click **Create association**.
3. Create routes in the transit gateway's route table by specifying the HA pair's floating IP addresses.

You can find the floating IP addresses on the Working Environment Information page in Cloud Manager. Here's an example:

NFS & CIFS access from within the VPC using Floating IP

Auto failover

Cluster Management : 172.23.0.1

Data (nfs,cifs) : Node 1: 172.23.0.2 | Node 2: 172.23.0.3

Access

SVM Management : 172.23.0.4

The following sample image shows the route table for the transit gateway. It includes routes to the CIDR blocks of the two VPCs and four floating IP addresses used by Cloud Volumes ONTAP.

Transit Gateway Route Table: tgw-rtb-0ea8ee291c7aeddd3					
Details	Associations	Propagations	Routes	Tags	
The table below will return a maximum of 1000 routes. Narrow the filter or use export routes to view more routes.					
Create route	Replace route	Delete route			
<input type="text"/> Filter by attributes or search by keyword					
CIDR	Attachment		Resource type	Route type	Route state
10.100.0.0/16	tgw-attach-05e77bd34e2ff91f8 vpc-0b2bc30e0dc8e0db1		VPC2	propagated	active
10.160.0.0/20	tgw-attach-00eba3eac3250d7db vpc-673ae603		VPC1	propagated	active
172.23.0.1/32	tgw-attach-00eba3eac3250d7db vpc-673ae603	VPC	static	active	
172.23.0.2/32	tgw-attach-00eba3eac3250d7db vpc-673ae603	VPC	static	active	
172.23.0.3/32	tgw-attach-00eba3eac3250d7db vpc-673ae603	VPC	static	active	
172.23.0.4/32	tgw-attach-00eba3eac3250d7db vpc-673ae603	VPC	static	active	

4. Modify the route table of VPCs that need to access the floating IP addresses.

- Add route entries to the floating IP addresses.
- Add a route entry to the CIDR block of the VPC where the HA pair resides.

The following sample image shows the route table for VPC 2, which includes routes to VPC 1 and the floating IP addresses.

Route Table: rtb-0569a1bd740ed033f				
Summary	Routes	Subnet Associations	Route Propagation	Tags
Edit routes				
View All routes				
Destination	Target	Status	Propagated	
10.100.0.0/16	local	active	No	
0.0.0.0/0	igw-07250bd01781e67df	active	No	
10.160.0.0/20	tgw-015b7c249661ac279	active	No	VPC1
172.23.0.1/32	tgw-015b7c249661ac279	active	No	Floating IP Addresses
172.23.0.2/32	tgw-015b7c249661ac279	active	No	
172.23.0.3/32	tgw-015b7c249661ac279	active	No	
172.23.0.4/32	tgw-015b7c249661ac279	active	No	

5. Modify the route table for the HA pair's VPC by adding a route to the VPC that needs access to the floating IP addresses.

This step is important because it completes the routing between the VPCs.

The following sample image shows the route table for VPC 1. It includes a route to the floating IP addresses and to VPC 2, which is where a client resides. Cloud Manager automatically added the floating IPs to the route table when it deployed the HA pair.

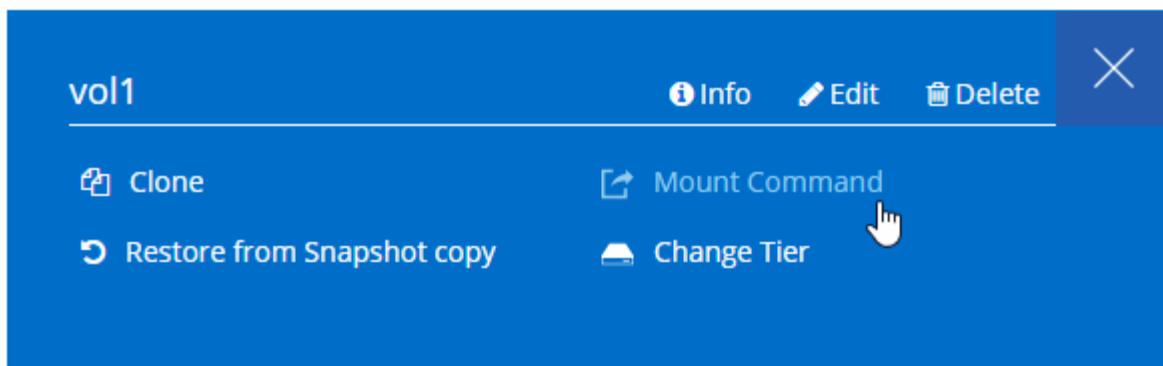
Route Table: rtb-0569a1bd740ed033f				
Summary	Routes	Subnet Associations	Route Propagation	Tags
Edit routes				
View All routes				
Destination	Target	Status		
10.160.0.0/20	local	active		
pl-68a54001 (com.amazonaws.us-west-2.s3, 54.231.160.0/19, 52.218.128.0/17, 52.92.32.0/22)	vpce-cb51a0a2	active		
0.0.0.0/0	igw-b2182dd7	active		
10.60.29.0/25	pcx-589c3331	active		
10.100.0.0/16	tgw-015b7c249661ac279	active		VPC2
10.129.0.0/20	pcx-ff7e1396	active		Floating IP Addresses
172.23.0.1/32	eni-0854d4715559c3cdb	active		
172.23.0.2/32	eni-0854d4715559c3cdb	active		
172.23.0.3/32	eni-0f76681216c3108ed	active		
172.23.0.4/32	eni-0854d4715559c3cdb	active		

6. Mount volumes to clients using the floating IP address.

You can find the correct IP address in Cloud Manager by selecting a volume and clicking **Mount Command**.

Volumes

2 Volumes | 0.22 TB Allocated | < 0.01 TB Used (0 TB in S3)



7. If you're mounting an NFS volume, configure the export policy to match the subnet of the client VPC.

[Learn how to edit a volume.](#)

Related links

- [High-availability pairs in AWS](#)
- [Networking requirements for Cloud Volumes ONTAP in AWS](#)

Security group rules for AWS

Cloud Manager creates AWS security groups that include the inbound and outbound rules that the Connector and Cloud Volumes ONTAP need to operate successfully. You might want to refer to the ports for testing purposes or if you prefer your own security groups.

Rules for Cloud Volumes ONTAP

The security group for Cloud Volumes ONTAP requires both inbound and outbound rules.

Inbound rules

The source for inbound rules in the predefined security group is 0.0.0.0/0.

Protocol	Port	Purpose
All ICMP	All	Pinging the instance
HTTP	80	HTTP access to the System Manager web console using the IP address of the cluster management LIF
HTTPS	443	HTTPS access to the System Manager web console using the IP address of the cluster management LIF
SSH	22	SSH access to the IP address of the cluster management LIF or a node management LIF

Protocol	Port	Purpose
TCP	111	Remote procedure call for NFS
TCP	139	NetBIOS service session for CIFS
TCP	161-162	Simple network management protocol
TCP	445	Microsoft SMB/CIFS over TCP with NetBIOS framing
TCP	635	NFS mount
TCP	749	Kerberos
TCP	2049	NFS server daemon
TCP	3260	iSCSI access through the iSCSI data LIF
TCP	4045	NFS lock daemon
TCP	4046	Network status monitor for NFS
TCP	10000	Backup using NDMP
TCP	11104	Management of intercluster communication sessions for SnapMirror
TCP	11105	SnapMirror data transfer using intercluster LIFs
UDP	111	Remote procedure call for NFS
UDP	161-162	Simple network management protocol
UDP	635	NFS mount
UDP	2049	NFS server daemon
UDP	4045	NFS lock daemon
UDP	4046	Network status monitor for NFS
UDP	4049	NFS rquotad protocol

Outbound rules

The predefined security group for Cloud Volumes ONTAP 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 Cloud Volumes ONTAP includes the following outbound rules.

Protocol	Port	Purpose
All ICMP	All	All outbound traffic
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 Cloud Volumes ONTAP.



The source is the interface (IP address) on the Cloud Volumes ONTAP system.

Service	Protocol	Port	Source	Destination	Purpose
Active Directory	TCP	88	Node management LIF	Active Directory forest	Kerberos V authentication
	UDP	137	Node management LIF	Active Directory forest	NetBIOS name service
	UDP	138	Node management LIF	Active Directory forest	NetBIOS datagram service
	TCP	139	Node management LIF	Active Directory forest	NetBIOS service session
	TCP & UDP	389	Node management LIF	Active Directory forest	LDAP
	TCP	445	Node management LIF	Active Directory forest	Microsoft SMB/CIFS over TCP with NetBIOS framing
	TCP	464	Node management LIF	Active Directory forest	Kerberos V change & set password (SET_CHANGE)
	UDP	464	Node management LIF	Active Directory forest	Kerberos key administration
	TCP	749	Node management LIF	Active Directory forest	Kerberos V change & set Password (RPCSEC_GSS)
	TCP	88	Data LIF (NFS, CIFS, iSCSI)	Active Directory forest	Kerberos V authentication
	UDP	137	Data LIF (NFS, CIFS)	Active Directory forest	NetBIOS name service
	UDP	138	Data LIF (NFS, CIFS)	Active Directory forest	NetBIOS datagram service
	TCP	139	Data LIF (NFS, CIFS)	Active Directory forest	NetBIOS service session
	TCP & UDP	389	Data LIF (NFS, CIFS)	Active Directory forest	LDAP
	TCP	445	Data LIF (NFS, CIFS)	Active Directory forest	Microsoft SMB/CIFS over TCP with NetBIOS framing
	TCP	464	Data LIF (NFS, CIFS)	Active Directory forest	Kerberos V change & set password (SET_CHANGE)
	UDP	464	Data LIF (NFS, CIFS)	Active Directory forest	Kerberos key administration
	TCP	749	Data LIF (NFS, CIFS)	Active Directory forest	Kerberos V change & set password (RPCSEC_GSS)

Service	Protocol	Port	Source	Destination	Purpose
AutoSupport	HTTPS	443	Node management LIF	support.netapp.com	AutoSupport (HTTPS is the default)
	HTTP	80	Node management LIF	support.netapp.com	AutoSupport (only if the transport protocol is changed from HTTPS to HTTP)
Backup to S3	TCP	5010	Intercluster LIF	Backup endpoint or restore endpoint	Back up and restore operations for the Backup to S3 feature
Cluster	All traffic	All traffic	All LIFs on one node	All LIFs on the other node	Intercluster communications (Cloud Volumes ONTAP HA only)
	TCP	3000	Node management LIF	HA mediator	ZAPI calls (Cloud Volumes ONTAP HA only)
	ICMP	1	Node management LIF	HA mediator	Keep alive (Cloud Volumes ONTAP HA only)
DHCP	UDP	68	Node management LIF	DHCP	DHCP client for first-time setup
DHCPS	UDP	67	Node management LIF	DHCP	DHCP server
DNS	UDP	53	Node management LIF and data LIF (NFS, CIFS)	DNS	DNS
NDMP	TCP	1860 0–18 699	Node management LIF	Destination servers	NDMP copy
SMTP	TCP	25	Node management LIF	Mail server	SMTP alerts, can be used for AutoSupport
SNMP	TCP	161	Node management LIF	Monitor server	Monitoring by SNMP traps
	UDP	161	Node management LIF	Monitor server	Monitoring by SNMP traps
	TCP	162	Node management LIF	Monitor server	Monitoring by SNMP traps
	UDP	162	Node management LIF	Monitor server	Monitoring by SNMP traps
SnapMirror	TCP	1110 4	Intercluster LIF	ONTAP intercluster LIFs	Management of intercluster communication sessions for SnapMirror
	TCP	1110 5	Intercluster LIF	ONTAP intercluster LIFs	SnapMirror data transfer
Syslog	UDP	514	Node management LIF	Syslog server	Syslog forward messages

Rules for the HA mediator external security group

The predefined external security group for the Cloud Volumes ONTAP HA mediator includes the following inbound and outbound rules.

Inbound rules

The source for inbound rules is 0.0.0.0/0.

Protocol	Port	Purpose
SSH	22	SSH connections to the HA mediator
TCP	3000	RESTful API access from the Connector

Outbound rules

The predefined security group for the HA mediator 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 HA mediator 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 HA mediator.

Protocol	Port	Destination	Purpose
HTTP	80	Connector IP address	Download upgrades for the mediator
HTTPS	443	AWS API services	Assist with storage failover
UDP	53	AWS API services	Assist with storage failover



Rather than open ports 443 and 53, you can create an interface VPC endpoint from the target subnet to the AWS EC2 service.

Rules for the HA mediator internal security group

The predefined internal security group for the Cloud Volumes ONTAP HA mediator includes the following rules. Cloud Manager always creates this security group. You do not have the option to use your own.

Inbound rules

The predefined security group includes the following inbound rules.

Protocol	Port	Purpose
All traffic	All	Communication between the HA mediator and HA nodes

Outbound rules

The predefined security group includes the following outbound rules.

Protocol	Port	Purpose
All traffic	All	Communication between the HA mediator and HA nodes

Rules for the Connector

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

Inbound rules

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

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	HTTP	443	Outbound internet and ONTAP cluster management LIF	API calls to AWS and ONTAP, and sending AutoSupport messages to NetApp
API calls	TCP	3000	ONTAP HA mediator	Communication with the ONTAP HA mediator
	TCP	8088	Backup to S3	API calls to Backup to S3
DNS	UDP	53	DNS	Used for DNS resolve by Cloud Manager
Cloud Data Sense	HTTP	80	Cloud Data Sense instance	Cloud Data Sense for Cloud Volumes ONTAP

Setting up the AWS KMS

If you want to use Amazon encryption with Cloud Volumes ONTAP, then you need to set up the AWS Key Management Service (KMS).

Steps

1. Ensure that an active Customer Master Key (CMK) exists.

The CMK can be an AWS-managed CMK or a customer-managed CMK. It can be in the same AWS account as Cloud Manager and Cloud Volumes ONTAP or in a different AWS account.

[AWS Documentation: Customer Master Keys \(CMKs\)](#)

2. Modify the key policy for each CMK by adding the IAM role that provides permissions to Cloud Manager as a key user.

Adding the IAM role as a key user gives Cloud Manager permissions to use the CMK with Cloud Volumes ONTAP.

AWS Documentation: Editing Keys

3. If the CMK is in a different AWS account, complete the following steps:

- a. Go to the KMS console from the account where the CMK resides.
- b. Select the key.
- c. In the **General configuration** pane, copy the ARN of the key.

You'll need to provide the ARN to Cloud Manager when you create the Cloud Volumes ONTAP system.

- d. In the **Other AWS accounts** pane, add the AWS account that provides Cloud Manager with permissions.

In most cases, this is the account where Cloud Manager resides. If Cloud Manager wasn't installed in AWS, it would be the account for which you provided AWS access keys to Cloud Manager.

The screenshot shows two parts of the AWS KMS interface. The top part is a modal window titled 'Other AWS accounts' with a red arrow pointing to its 'Add other AWS accounts' button. The bottom part is a larger window also titled 'Other AWS accounts' with a red arrow pointing to the 'arn:aws:iam::' input field, which contains placeholder text 'Enter the ID of another AWS account'. Both windows have standard 'Cancel' and 'Save changes' buttons at the bottom.

- e. Now switch to the AWS account that provides Cloud Manager with permissions and open the IAM console.
- f. Create an IAM policy that includes the permissions listed below.
- g. Attach the policy to the IAM role or IAM user that provides permissions to Cloud Manager.

The following policy provides the permissions that Cloud Manager needs to use the CMK from the external AWS account. Be sure to modify the region and account ID in the "Resource" sections.

```

{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Sid": "AllowUseOfTheKey",
            "Effect": "Allow",
            "Action": [
                "kms:Encrypt",
                "kms:Decrypt",
                "kms:ReEncrypt*",
                "kms:GenerateDataKey*",
                "kms:DescribeKey"
            ],
            "Resource": [
                "arn:aws:kms:us-east-
1:externalaccountid:key/externalkeyid"
            ]
        },
        {
            "Sid": "AllowAttachmentOfPersistentResources",
            "Effect": "Allow",
            "Action": [
                "kms>CreateGrant",
                "kms>ListGrants",
                "kms:RevokeGrant"
            ],
            "Resource": [
                "arn:aws:kms:us-east-
1:externalaccountid:key/externalaccountid"
            ],
            "Condition": {
                "Bool": {
                    "kms:GrantIsForAWSResource": true
                }
            }
        }
    ]
}

```

For additional details about this process, see [AWS Documentation: Allowing External AWS Accounts to Access a CMK](#).

4. If you are using a customer-managed CMK, modify the key policy for the CMK by adding the Cloud Volumes ONTAP IAM role as a *key user*.

This step is required if you enabled data tiering on Cloud Volumes ONTAP and want to encrypt the data

stored in the S3 bucket.

You'll need to perform this step *after* you deploy Cloud Volumes ONTAP because the IAM role is created when you create a working environment. (Of course, you do have the option to use an existing Cloud Volumes ONTAP IAM role, so it's possible to perform this step before.)

[AWS Documentation: Editing Keys](#)

Launching Cloud Volumes ONTAP in AWS

You can launch Cloud Volumes ONTAP in a single-system configuration or as an HA pair in AWS.

Before you get started

You need the following to create a working environment.

- A Connector that's up and running.
 - You should have a [Connector that is associated with your workspace](#).
 - [You should be prepared to leave the Connector running at all times](#).
- An understanding of the configuration that you want to use.

You should have prepared by choosing a configuration and by obtaining AWS networking information from your administrator. For details, see [Planning your Cloud Volumes ONTAP configuration](#).

- DNS and Active Directory for CIFS configurations.

For details, see [Networking requirements for Cloud Volumes ONTAP in AWS](#).

- An understanding of what's required to choose a specific licensing option in the Add Working Environment wizard. [Learn more about Cloud Volumes ONTAP licensing](#).

Licensing option	Requirement	How to meet the requirement
Freemium	A Marketplace subscription or NetApp Support Site (NSS) account is required.	You'll have the option to subscribe to your cloud provider's marketplace from the Details & Credentials page. You can enter your NSS account on the Charging Methods and NSS Account page.
Professional or Essential package	A Marketplace subscription or capacity-based license (BYOL) is required. A Marketplace subscription is recommended for capacity-based charging in the event that your account doesn't have a valid capacity-based license, or in the event that your provisioned capacity exceeds the licensed capacity.	You'll have the option to subscribe to your cloud provider's marketplace from the Details & Credentials page. If you want to use a capacity-based license (BYOL) that you purchased from NetApp, you must first add it to the Digital Wallet . Learn how to add capacity-based BYOL licenses .

Licensing option	Requirement	How to meet the requirement
Keystone Flex Subscription	Your account must be authorized and the subscription must be enabled for use with Cloud Volumes ONTAP.	<ol style="list-style-type: none"> 1. Contact NetApp to authorize your Cloud Manager user account with one or more Keystone Flex Subscriptions. 2. After NetApp authorizes your account, link your subscriptions for use with Cloud Volumes ONTAP. 3. Select the Keystone Flex Subscription charging method when you create a Cloud Volumes ONTAP HA pair.
Per node licensing	A Marketplace subscription is required or you need to bring your own license (BYOL). This option is available for customers with existing subscriptions or existing licenses. It's not available for new customers.	<p>If you want to use a node-based license (BYOL) that you purchased from NetApp, you must first add it to the Digital Wallet. Learn how to add node-based BYOL licenses.</p> <p>You can enter your NSS account on the Charging Methods and NSS Account page.</p>

Launching a single-node Cloud Volumes ONTAP system in AWS

If you want to launch Cloud Volumes ONTAP in AWS, you need to create a new working environment in Cloud Manager.

About this task

Immediately after you create the working environment, Cloud Manager launches a test instance in the specified VPC to verify connectivity. If successful, Cloud Manager immediately terminates the instance and then starts deploying the Cloud Volumes ONTAP system. If Cloud Manager cannot verify connectivity, creation of the working environment fails. The test instance is either a t2.nano (for default VPC tenancy) or m3.medium (for dedicated VPC tenancy).

Steps

1. On the Canvas page, click **Add Working Environment** and follow the prompts.
2. **Choose a Location:** Select **Amazon Web Services** and **Cloud Volumes ONTAP Single Node**.
3. If you're prompted, [create a Connector](#).
4. **Details and Credentials:** Optionally change the AWS credentials and subscription, enter a working environment name, add tags if needed, and then enter a password.

Some of the fields in this page are self-explanatory. The following table describes fields for which you might need guidance:

Field	Description
Working Environment Name	Cloud Manager uses the working environment name to name both the Cloud Volumes ONTAP system and the Amazon EC2 instance. It also uses the name as the prefix for the predefined security group, if you select that option.

Field	Description
Add tags	<p>AWS tags are metadata for your AWS resources. Cloud Manager adds the tags to the Cloud Volumes ONTAP instance and each AWS resource associated with the instance.</p> <p>You can add up to four tags from the user interface when creating a working environment, and then you can add more after its created. Note that the API does not limit you to four tags when creating a working environment.</p> <p>For information about tags, refer to AWS Documentation: Tagging your Amazon EC2 Resources.</p>
User name and password	<p>These are the credentials for the Cloud Volumes ONTAP cluster administrator account. You can use these credentials to connect to Cloud Volumes ONTAP through System Manager or its CLI. Keep the default <i>admin</i> user name or change it to a custom user name.</p>
Edit Credentials	<p>Choose the AWS credentials associated with the account where you want to deploy this system. You can also associate the AWS Marketplace subscription to use with this Cloud Volumes ONTAP system.</p> <p>Click Add Subscription to associate the selected credentials with a new AWS Marketplace subscription. The subscription can be for an annual contract or to pay for Cloud Volumes ONTAP at an hourly rate.</p> <p>Learn how to add additional AWS credentials to Cloud Manager.</p>

The following video shows how to associate a pay-as-you-go Marketplace subscription to your AWS credentials:

- https://docs.netapp.com/us-en/occm//media/video_subscribing_aws.mp4 (video)

If multiple IAM users work in the same AWS account, then each user needs to subscribe. After the first user subscribes, the AWS Marketplace informs subsequent users that they're already subscribed, as shown in the image below. While a subscription is in place for the AWS *account*, each IAM user needs to associate themselves with that subscription. If you see the message shown below, click the **click here** link to go to Cloud Central and complete the process.



Cloud Manager (for Cloud Volumes ONTAP)

You are currently subscribed to this product and will be charged for your accumulated usage at the end of your next billing cycle, based on the costs listed in Pricing information on the right.



Having issues signing up for your product?

If you were unable to complete the set-up process for this software, please [click here](#) to be taken to the product's registration area.

[Subscribe](#)

You are already subscribed to this product

Pricing Details

Software Fees

5. **Services:** Keep the services enabled or disable the individual services that you don't want to use with Cloud Volumes ONTAP.

- [Learn more about Cloud Data Sense](#).
- [Learn more about Cloud Backup](#).

- Learn more about Monitoring.
6. **Location & Connectivity:** Enter the network information that you recorded in the [AWS worksheet](#).

If you have an AWS Outpost, you can deploy a single node Cloud Volumes ONTAP system in that Outpost by selecting the Outpost VPC. The experience is the same as any other VPC that resides in AWS.

The following image shows the page filled out:

Location	Connectivity
AWS Region US West Oregon	Security Group <input checked="" type="radio"/> Generated security group <input type="radio"/> Use existing security group
VPC vpc-3a01e05f - 172.31.0.0/16	SSH Authentication Method <input checked="" type="radio"/> Password <input type="radio"/> Key Pair
Subnet 172.31.5.0/24 (OCCM subnet)	

7. **Data Encryption:** Choose no data encryption or AWS-managed encryption.

For AWS-managed encryption, you can choose a different Customer Master Key (CMK) from your account or another AWS account.



You can't change the AWS data encryption method after you create a Cloud Volumes ONTAP system.

[Learn how to set up the AWS KMS for Cloud Volumes ONTAP.](#)

[Learn more about supported encryption technologies.](#)

8. **Charging Methods and NSS Account:** Specify which charging option would you like to use with this system, and then specify a NetApp Support Site account.

- [Learn about these charging methods.](#)
- [Learn what's required in the wizard for the licensing method that you want to use.](#)

9. **Cloud Volumes ONTAP Configuration** (annual AWS Marketplace contract only): Review the default configuration and click **Continue** or click **Change Configuration** to select your own configuration.

If you keep the default configuration, then you only need to specify a volume and then review and approve the configuration.

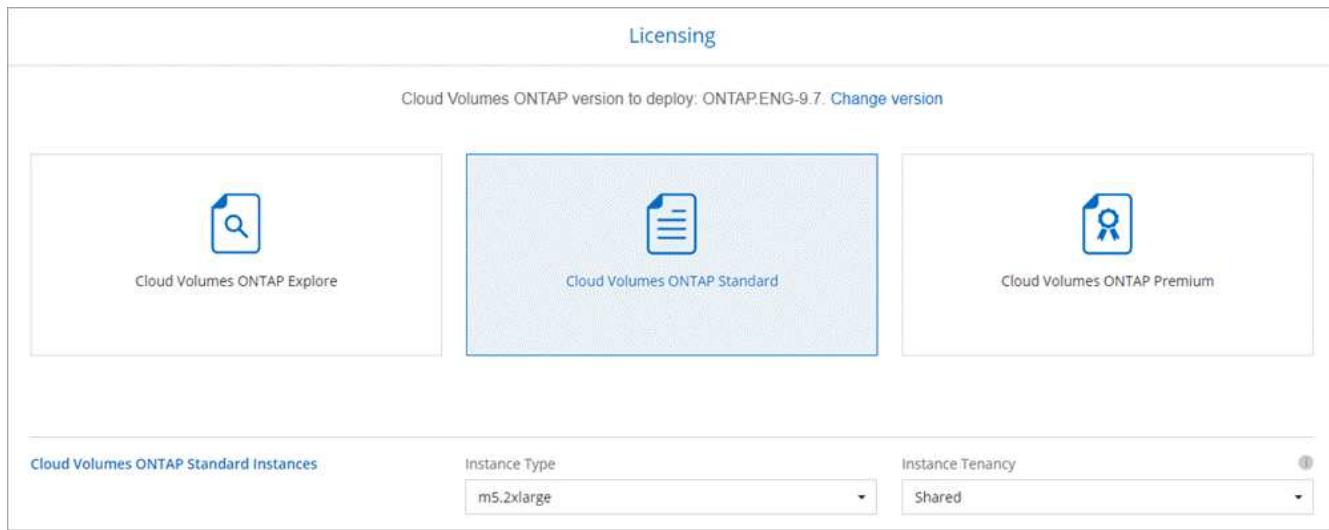
10. **Preconfigured Packages** (hourly or BYOL only): Select one of the packages to quickly launch Cloud Volumes ONTAP, or click **Change Configuration** to select your own configuration.

If you choose one of the packages, then you only need to specify a volume and then review and approve the configuration.

11. **IAM Role:** It's best to keep the default option to let Cloud Manager create the role for you.

If you prefer to use your own policy, it must meet [policy requirements for Cloud Volumes ONTAP nodes](#).

12. **Licensing:** Change the Cloud Volumes ONTAP version as needed, select a license, an instance type, and the instance tenancy.



If your needs change after you launch the instance, you can modify the license or instance type later.



If a newer Release Candidate, General Availability, or patch release is available for the selected version, then Cloud Manager updates the system to that version when creating the working environment. For example, the update occurs if you select Cloud Volumes ONTAP 9.6 RC1 and 9.6 GA is available. The update does not occur from one release to another—for example, from 9.6 to 9.7.

13. **Underlying Storage Resources:** Choose settings for the initial aggregate: a disk type, a size for each disk, and whether data tiering should be enabled.

Note the following:

- The disk type is for the initial volume. You can choose a different disk type for subsequent volumes.
- The disk size is for all disks in the initial aggregate and for any additional aggregates that Cloud Manager creates when you use the simple provisioning option. You can create aggregates that use a different disk size by using the advanced allocation option.

For help choosing a disk type and size, see [Sizing your system in AWS](#).

- You can choose a specific volume tiering policy when you create or edit a volume.
- If you disable data tiering, you can enable it on subsequent aggregates.

[Learn how data tiering works.](#)

14. **Write Speed & WORM:** Choose **Normal** or **High** write speed, and activate write once, read many (WORM) storage, if desired.

[Learn more about write speed.](#)

WORM can't be enabled if Cloud Backup was enabled or if data tiering was enabled.

[Learn more about WORM storage.](#)

15. **Create Volume:** Enter details for the new volume or click **Skip**.

Some of the fields in this page are self-explanatory. The following table describes fields for which you might need guidance:

Field	Description
Size	The maximum size that you can enter largely depends on whether you enable thin provisioning, which enables you to create a volume that is bigger than the physical storage currently available to it.
Access control (for NFS only)	An export policy defines the clients in the subnet that can access the volume. By default, Cloud Manager enters a value that provides access to all instances in the subnet.
Permissions and Users / Groups (for CIFS only)	These fields enable you to control the level of access to a share for users and groups (also called access control lists or ACLs). You can specify local or domain Windows users or groups, or UNIX users or groups. If you specify a domain Windows user name, you must include the user's domain using the format domain\username.
Snapshot Policy	A Snapshot copy policy specifies the frequency and number of automatically created NetApp Snapshot copies. A NetApp Snapshot copy is a point-in-time file system image that has no performance impact and requires minimal storage. You can choose the default policy or none. You might choose none for transient data: for example, tempdb for Microsoft SQL Server.
Advanced options (for NFS only)	Select an NFS version for the volume: either NFSv3 or NFSv4.
Initiator group and IQN (for iSCSI only)	<p>iSCSI storage targets are called LUNs (logical units) and are presented to hosts as standard block devices.</p> <p>Initiator groups are tables of iSCSI host node names and control which initiators have access to which LUNs.</p> <p>iSCSI targets connect to the network through standard Ethernet network adapters (NICs), TCP offload engine (TOE) cards with software initiators, converged network adapters (CNAs) or dedicated host bus adapters (HBAs) and are identified by iSCSI qualified names (IQNs).</p> <p>When you create an iSCSI volume, Cloud Manager automatically creates a LUN for you. We've made it simple by creating just one LUN per volume, so there's no management involved. After you create the volume, use the IQN to connect to the LUN from your hosts.</p>

The following image shows the Volume page filled out for the CIFS protocol:

Volume Details, Protection & Protocol

Details & Protection Volume Name: <input type="text" value="vol"/> Size (GB): <input type="text" value="250"/> Snapshot Policy: <input type="text" value="default"/> <small>Default Policy</small>	Protocol NFS CIFS iSCSI Share name: <input type="text" value="vol_share"/> Permissions: <input type="text" value="Full Control"/> Users / Groups: <input type="text" value="engineering"/> <small>Valid users and groups separated by a semicolon</small>
--	---

16. **CIFS Setup:** If you chose the CIFS protocol, set up a CIFS server.

Field	Description
DNS Primary and Secondary IP Address	The IP addresses of the DNS servers that provide name resolution for the CIFS server. The listed DNS servers must contain the service location records (SRV) needed to locate the Active Directory LDAP servers and domain controllers for the domain that the CIFS server will join.
Active Directory Domain to join	The FQDN of the Active Directory (AD) domain that you want the CIFS server to join.
Credentials authorized to join the domain	The name and password of a Windows account with sufficient privileges to add computers to the specified Organizational Unit (OU) within the AD domain.
CIFS server NetBIOS name	A CIFS server name that is unique in the AD domain.
Organizational Unit	The organizational unit within the AD domain to associate with the CIFS server. The default is CN=Computers. If you configure AWS Managed Microsoft AD as the AD server for Cloud Volumes ONTAP, you should enter OU=Computers,OU=corp in this field.
DNS Domain	The DNS domain for the Cloud Volumes ONTAP storage virtual machine (SVM). In most cases, the domain is the same as the AD domain.
NTP Server	Select Use Active Directory Domain to configure an NTP server using the Active Directory DNS. If you need to configure an NTP server using a different address, then you should use the API. See the Cloud Manager automation docs for details.

17. **Usage Profile, Disk Type, and Tiering Policy:** Choose whether you want to enable storage efficiency features and edit the volume tiering policy, if needed.

For more information, see [Understanding volume usage profiles](#) and [Data tiering overview](#).

18. **Review & Approve:** Review and confirm your selections.

- Review details about the configuration.

- b. Click **More information** to review details about support and the AWS resources that Cloud Manager will purchase.
- c. Select the **I understand...** check boxes.
- d. Click **Go**.

Result

Cloud Manager launches the Cloud Volumes ONTAP instance. You can track the progress in the timeline.

If you experience any issues launching the Cloud Volumes ONTAP instance, review the failure message. You can also select the working environment and click Re-create environment.

For additional help, go to [NetApp Cloud Volumes ONTAP Support](#).

After you finish

- If you provisioned a CIFS share, give users or groups permissions to the files and folders and verify that those users can access the share and create a file.
- If you want to apply quotas to volumes, use System Manager or the CLI.

Quotas enable you to restrict or track the disk space and number of files used by a user, group, or qtree.

Launching a Cloud Volumes ONTAP HA pair in AWS

If you want to launch a Cloud Volumes ONTAP HA pair in AWS, you need to create an HA working environment in Cloud Manager.

Limitation

At this time, HA pairs are not supported with AWS Outposts.

About this task

Immediately after you create the working environment, Cloud Manager launches a test instance in the specified VPC to verify connectivity. If successful, Cloud Manager immediately terminates the instance and then starts deploying the Cloud Volumes ONTAP system. If Cloud Manager cannot verify connectivity, creation of the working environment fails. The test instance is either a t2.nano (for default VPC tenancy) or m3.medium (for dedicated VPC tenancy).

Steps

1. On the Canvas page, click **Add Working Environment** and follow the prompts.
2. **Choose a Location:** Select **Amazon Web Services** and **Cloud Volumes ONTAP Single Node**.
3. **Details and Credentials:** Optionally change the AWS credentials and subscription, enter a working environment name, add tags if needed, and then enter a password.

Some of the fields in this page are self-explanatory. The following table describes fields for which you might need guidance:

Field	Description
Working Environment Name	Cloud Manager uses the working environment name to name both the Cloud Volumes ONTAP system and the Amazon EC2 instance. It also uses the name as the prefix for the predefined security group, if you select that option.

Field	Description
Add tags	<p>AWS tags are metadata for your AWS resources. Cloud Manager adds the tags to the Cloud Volumes ONTAP instance and each AWS resource associated with the instance.</p> <p>You can add up to four tags from the user interface when creating a working environment, and then you can add more after its created. Note that the API does not limit you to four tags when creating a working environment.</p> <p>For information about tags, refer to AWS Documentation: Tagging your Amazon EC2 Resources.</p>
User name and password	<p>These are the credentials for the Cloud Volumes ONTAP cluster administrator account. You can use these credentials to connect to Cloud Volumes ONTAP through System Manager or its CLI. Keep the default <i>admin</i> user name or change it to a custom user name.</p>
Edit Credentials	<p>Choose the AWS credentials and marketplace subscription to use with this Cloud Volumes ONTAP system.</p> <p>Click Add Subscription to associate the selected credentials with a new AWS Marketplace subscription. The subscription can be for an annual contract or to pay for Cloud Volumes ONTAP at an hourly rate.</p> <p>If purchased a license directly from NetApp (BYOL), then an AWS subscription isn't required.</p> <p>Learn how to add additional AWS credentials to Cloud Manager.</p>

The following video shows how to associate a pay-as-you-go Marketplace subscription to your AWS credentials:

- ▶ https://docs.netapp.com/us-en/occm//media/video_subscribing_aws.mp4 (video)



If multiple IAM users work in the same AWS account, then each user needs to subscribe. After the first user subscribes, the AWS Marketplace informs subsequent users that they're already subscribed, as shown in the image below. While a subscription is in place for the AWS account, each IAM user needs to associate themselves with that subscription. If you see the message shown below, click the **click here** link to go to Cloud Central and complete the process.

4. Services: Keep the services enabled or disable the individual services that you don't want to use with this Cloud Volumes ONTAP system.

- [Learn more about Cloud Data Sense](#).
- [Learn more about Cloud Backup](#).
- [Learn more about Monitoring](#).

5. HA Deployment Models: Choose an HA configuration.

For an overview of the deployment models, see [Cloud Volumes ONTAP HA for AWS](#).

6. Region & VPC: Enter the network information that you recorded in the AWS worksheet.

The following image shows the page filled out for a multiple AZ configuration:

The screenshot displays the 'Region & VPC' configuration interface. At the top, there are dropdown menus for 'AWS Region' (set to 'US East | N. Virginia'), 'VPC' (set to 'vpc-a76d91c2 - 172.31.0.0/16'), and 'Security group' (set to 'Use a generated security group'). Below these, three separate configuration boxes are shown for 'Node 1:', 'Node 2:', and 'Mediator:'. Each box contains fields for 'Availability Zone' (Node 1: 'us-east-1a', Node 2: 'us-east-1b', Mediator: 'us-east-1c') and 'Subnet' (Node 1: '172.31.8.0/24', Node 2: '172.31.9.0/24', Mediator: '172.31.2.0/24').

7. Connectivity and SSH Authentication: Choose connection methods for the HA pair and the mediator.

8. Floating IPs: If you chose multiple AZs, specify the floating IP addresses.

The IP addresses must be outside of the CIDR block for all VPCs in the region. For additional details, see [AWS networking requirements for Cloud Volumes ONTAP HA in multiple AZs](#).

9. Route Tables: If you chose multiple AZs, select the route tables that should include routes to the floating IP addresses.

If you have more than one route table, it is very important to select the correct route tables. Otherwise, some clients might not have access to the Cloud Volumes ONTAP HA pair. For more information about route tables, refer to [AWS Documentation: Route Tables](#).

10. Data Encryption: Choose no data encryption or AWS-managed encryption.

For AWS-managed encryption, you can choose a different Customer Master Key (CMK) from your account or another AWS account.



You can't change the AWS data encryption method after you create a Cloud Volumes ONTAP system.

[Learn how to set up the AWS KMS for Cloud Volumes ONTAP.](#)

[Learn more about supported encryption technologies.](#)

11. Charging Methods and NSS Account: Specify which charging option would you like to use with this system, and then specify a NetApp Support Site account.

- [Learn about these charging methods.](#)
- [Learn what's required in the wizard for the licensing method that you want to use.](#)

12. **Cloud Volumes ONTAP Configuration** (annual AWS Marketplace contract only): Review the default configuration and click **Continue** or click **Change Configuration** to select your own configuration.

If you keep the default configuration, then you only need to specify a volume and then review and approve the configuration.

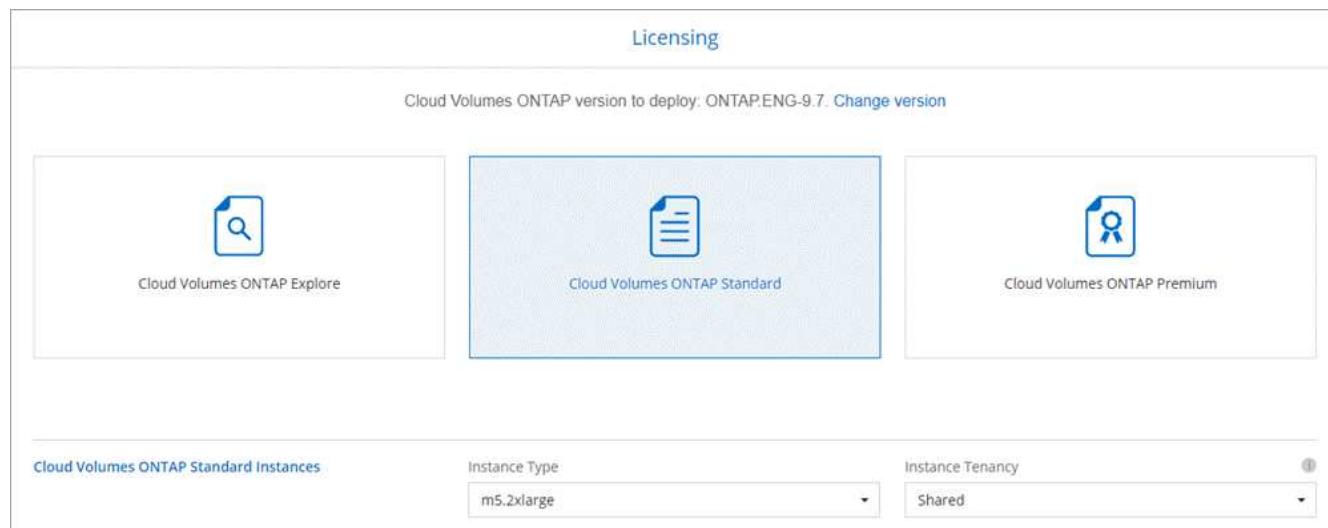
13. **Preconfigured Packages** (hourly or BYOL only): Select one of the packages to quickly launch Cloud Volumes ONTAP, or click **Change Configuration** to select your own configuration.

If you choose one of the packages, then you only need to specify a volume and then review and approve the configuration.

14. **IAM Role**: It's best to keep the default option to let Cloud Manager create the role for you.

If you prefer to use your own policy, it must meet [policy requirements for Cloud Volumes ONTAP nodes and the HA mediator](#).

15. **Licensing**: Change the Cloud Volumes ONTAP version as needed, select a license, an instance type, and the instance tenancy.



If your needs change after you launch the instances, you can modify the license or instance type later.



If a newer Release Candidate, General Availability, or patch release is available for the selected version, then Cloud Manager updates the system to that version when creating the working environment. For example, the update occurs if you select Cloud Volumes ONTAP 9.6 RC1 and 9.6 GA is available. The update does not occur from one release to another—for example, from 9.6 to 9.7.

16. **Underlying Storage Resources**: Choose settings for the initial aggregate: a disk type, a size for each disk, and whether data tiering should be enabled.

Note the following:

- The disk type is for the initial volume. You can choose a different disk type for subsequent volumes.
- The disk size is for all disks in the initial aggregate and for any additional aggregates that Cloud Manager creates when you use the simple provisioning option. You can create aggregates that use a different disk size by using the advanced allocation option.

For help choosing a disk type and size, see [Sizing your system in AWS](#).

- You can choose a specific volume tiering policy when you create or edit a volume.
- If you disable data tiering, you can enable it on subsequent aggregates.

[Learn how data tiering works.](#)

17. Write Speed & WORM: Choose **Normal** or **High** write speed, and activate write once, read many (WORM) storage, if desired.

[Learn more about write speed.](#)

WORM can't be enabled if Cloud Backup was enabled or if data tiering was enabled.

[Learn more about WORM storage.](#)

18. Create Volume: Enter details for the new volume or click **Skip**.

Some of the fields in this page are self-explanatory. The following table describes fields for which you might need guidance:

Field	Description
Size	The maximum size that you can enter largely depends on whether you enable thin provisioning, which enables you to create a volume that is bigger than the physical storage currently available to it.
Access control (for NFS only)	An export policy defines the clients in the subnet that can access the volume. By default, Cloud Manager enters a value that provides access to all instances in the subnet.
Permissions and Users / Groups (for CIFS only)	These fields enable you to control the level of access to a share for users and groups (also called access control lists or ACLs). You can specify local or domain Windows users or groups, or UNIX users or groups. If you specify a domain Windows user name, you must include the user's domain using the format domain\username.
Snapshot Policy	A Snapshot copy policy specifies the frequency and number of automatically created NetApp Snapshot copies. A NetApp Snapshot copy is a point-in-time file system image that has no performance impact and requires minimal storage. You can choose the default policy or none. You might choose none for transient data: for example, tempdb for Microsoft SQL Server.
Advanced options (for NFS only)	Select an NFS version for the volume: either NFSv3 or NFSv4.

Field	Description
Initiator group and IQN (for iSCSI only)	<p>iSCSI storage targets are called LUNs (logical units) and are presented to hosts as standard block devices.</p> <p>Initiator groups are tables of iSCSI host node names and control which initiators have access to which LUNs.</p> <p>iSCSI targets connect to the network through standard Ethernet network adapters (NICs), TCP offload engine (TOE) cards with software initiators, converged network adapters (CNAs) or dedicated host bus adapters (HBAs) and are identified by iSCSI qualified names (IQNs).</p> <p>When you create an iSCSI volume, Cloud Manager automatically creates a LUN for you. We've made it simple by creating just one LUN per volume, so there's no management involved. After you create the volume, use the IQN to connect to the LUN from your hosts.</p>

The following image shows the Volume page filled out for the CIFS protocol:

The screenshot shows the 'Volume Details, Protection & Protocol' page. On the left, under 'Details & Protection', there are fields for 'Volume Name' (vol) and 'Size (GB)' (250). Below these are 'Snapshot Policy' (default) and a note about 'Default Policy'. On the right, under 'Protocol', the 'CIFS' tab is selected, showing 'Share name' (vol_share), 'Permissions' (Full Control), and 'Users / Groups' (engineering). A note at the bottom states 'Valid users and groups separated by a semicolon'.

19. CIFS Setup: If you selected the CIFS protocol, set up a CIFS server.

Field	Description
DNS Primary and Secondary IP Address	The IP addresses of the DNS servers that provide name resolution for the CIFS server. The listed DNS servers must contain the service location records (SRV) needed to locate the Active Directory LDAP servers and domain controllers for the domain that the CIFS server will join.
Active Directory Domain to join	The FQDN of the Active Directory (AD) domain that you want the CIFS server to join.
Credentials authorized to join the domain	The name and password of a Windows account with sufficient privileges to add computers to the specified Organizational Unit (OU) within the AD domain.
CIFS server NetBIOS name	A CIFS server name that is unique in the AD domain.

Field	Description
Organizational Unit	The organizational unit within the AD domain to associate with the CIFS server. The default is CN=Computers. If you configure AWS Managed Microsoft AD as the AD server for Cloud Volumes ONTAP, you should enter OU=Computers,OU=corp in this field.
DNS Domain	The DNS domain for the Cloud Volumes ONTAP storage virtual machine (SVM). In most cases, the domain is the same as the AD domain.
NTP Server	Select Use Active Directory Domain to configure an NTP server using the Active Directory DNS. If you need to configure an NTP server using a different address, then you should use the API. See the Cloud Manager automation docs for details.

20. **Usage Profile, Disk Type, and Tiering Policy:** Choose whether you want to enable storage efficiency features and edit the volume tiering policy, if needed.

For more information, see [Understanding volume usage profiles](#) and [Data tiering overview](#).

21. **Review & Approve:** Review and confirm your selections.

- Review details about the configuration.
- Click **More information** to review details about support and the AWS resources that Cloud Manager will purchase.
- Select the **I understand...** check boxes.
- Click **Go**.

Result

Cloud Manager launches the Cloud Volumes ONTAP HA pair. You can track the progress in the timeline.

If you experience any issues launching the HA pair, review the failure message. You can also select the working environment and click Re-create environment.

For additional help, go to [NetApp Cloud Volumes ONTAP Support](#).

After you finish

- If you provisioned a CIFS share, give users or groups permissions to the files and folders and verify that those users can access the share and create a file.
- If you want to apply quotas to volumes, use System Manager or the CLI.

Quotas enable you to restrict or track the disk space and number of files used by a user, group, or qtree.

Get started with Cloud Volumes ONTAP in the AWS C2S environment

Similar to a standard AWS region, you can use Cloud Manager in the [AWS Commercial Cloud Services \(C2S\)](#) environment to deploy Cloud Volumes ONTAP, which provides enterprise-class features for your cloud storage. AWS C2S is a closed region specific to the U.S. Intelligence Community; the instructions on this page only apply to AWS C2S region users.

Supported features in C2S

The following features are available from Cloud Manager in the C2S environment:

- Cloud Volumes ONTAP
- Data replication
- A timeline for auditing

For Cloud Volumes ONTAP, you can create a single node system or an HA pair. Both licensing options are available: pay-as-you-go and bring your own license (BYOL).

Data tiering to S3 is also supported with Cloud Volumes ONTAP in C2S.

Limitations

None of NetApp's cloud services are available from Cloud Manager.

Because there's no internet access in the C2S environment, the following features aren't available either:

- Integration with NetApp Cloud Central
- Automated software upgrades from Cloud Manager
- NetApp AutoSupport
- AWS cost information for Cloud Volumes ONTAP resources

Deployment overview

Getting started with Cloud Volumes ONTAP in C2S includes a few steps.

1. Preparing your AWS environment.

This includes setting up networking, subscribing to Cloud Volumes ONTAP, setting up permissions, and optionally setting up the AWS KMS.

2. Installing the Connector and setting up Cloud Manager.

Before you can start using Cloud Manager to deploy Cloud Volumes ONTAP, you'll need to create a *Connector*. The Connector enables Cloud Manager to manage resources and processes within your public cloud environment (this includes Cloud Volumes ONTAP).

You'll log in to Cloud Manager from the software that gets installed on the Connector instance.

3. Launching Cloud Volumes ONTAP from Cloud Manager.

Each of these steps are described below.

Prepare your AWS environment

Your AWS environment must meet a few requirements.

Set up your networking

Set up your AWS networking so Cloud Volumes ONTAP can operate properly.

Steps

1. Choose the VPC and subnets in which you want to launch the Connector instance and Cloud Volumes ONTAP instances.
 2. Ensure that your VPC and subnets will support connectivity between the Connector and Cloud Volumes ONTAP.
 3. Set up a VPC endpoint to the S3 service.

A VPC endpoint is required if you want to tier cold data from Cloud Volumes ONTAP to low-cost object storage.

Subscribe to Cloud Volumes ONTAP

A Marketplace subscription is required to deploy Cloud Volumes ONTAP from Cloud Manager.

Steps

1. Go to the AWS Intelligence Community Marketplace and search for Cloud Volumes ONTAP.
 2. Select the offering that you plan to deploy.
 3. Review the terms and click **Accept**.
 4. Repeat these steps for the other offerings, if you plan to deploy them.

You must use Cloud Manager to launch Cloud Volumes ONTAP instances. You must not launch Cloud Volumes ONTAP instances from the EC2 console.

Set up permissions

Set up IAM policies and roles that provide Cloud Manager and Cloud Volumes ONTAP with the permissions that they need to perform actions in the AWS Commercial Cloud Services environment.

You need an IAM policy and IAM role for each of the following:

- The Connector instance
 - Cloud Volumes ONTAP instances
 - The Cloud Volumes ONTAP HA mediator instance (if you want to deploy HA pairs)

Steps

1. Go to the AWS IAM console and click **Policies**.
 2. Create a policy for the Connector instance.

```
{  
    "Version": "2012-10-17",  
    "Statement": [{  
        "Effect": "Allow",  
        "Action": [  
            "ec2:DescribeInstances",  
            "ec2:DescribeInstanceStatus",  
            "ec2:RunInstances",  
            "ec2:ModifyInstanceAttribute"]  
    }]  
}
```

```
"ec2:DescribeRouteTables",
"ec2:DescribeImages",
"ec2:CreateTags",
"ec2>CreateVolume",
"ec2:DescribeVolumes",
"ec2:ModifyVolumeAttribute",
"ec2:DeleteVolume",
"ec2:CreateSecurityGroup",
"ec2:DeleteSecurityGroup",
"ec2:DescribeSecurityGroups",
"ec2:RevokeSecurityGroupEgress",
"ec2:RevokeSecurityGroupIngress",
"ec2:AuthorizeSecurityGroupEgress",
"ec2:AuthorizeSecurityGroupIngress",
"ec2:CreateNetworkInterface",
"ec2:DescribeNetworkInterfaces",
"ec2:DeleteNetworkInterface",
"ec2:ModifyNetworkInterfaceAttribute",
"ec2:DescribeSubnets",
"ec2:DescribeVpcs",
"ec2:DescribeDhcpOptions",
"ec2:CreateSnapshot",
"ec2:DeleteSnapshot",
"ec2:DescribeSnapshots",
"ec2:GetConsoleOutput",
"ec2:DescribeKeyPairs",
"ec2:DescribeRegions",
"ec2:DeleteTags",
"ec2:DescribeTags",
"cloudformation>CreateStack",
"cloudformation>DeleteStack",
"cloudformation:DescribeStacks",
"cloudformation:DescribeStackEvents",
"cloudformation:ValidateTemplate",
"iam:PassRole",
"iam:CreateRole",
"iam:DeleteRole",
"iam:PutRolePolicy",
"iam:CreateInstanceProfile",
"iam:DeleteRolePolicy",
"iam:AddRoleToInstanceProfile",
"iam:RemoveRoleFromInstanceProfile",
"iam:DeleteInstanceProfile",
"s3:GetObject",
"s3>ListBucket",
"s3:GetBucketTagging",
```

```

        "s3:GetBucketLocation",
        "s3>ListAllMyBuckets",
        "kms>List*",
        "kms>Describe*",
        "ec2>AssociateIamInstanceProfile",
        "ec2>DescribeIamInstanceProfileAssociations",
        "ec2>DisassociateIamInstanceProfile",
        "ec2>DescribeInstanceAttribute",
        "ec2>CreatePlacementGroup",
        "ec2>DeletePlacementGroup"
    ],
    "Resource": "*"
},
{
    "Sid": "fabricPoolPolicy",
    "Effect": "Allow",
    "Action": [
        "s3>DeleteBucket",
        "s3>GetLifecycleConfiguration",
        "s3>PutLifecycleConfiguration",
        "s3>PutBucketTagging",
        "s3>ListBucketVersions"
    ],
    "Resource": [
        "arn:aws-iso:s3:::fabric-pool*"
    ]
},
{
    "Effect": "Allow",
    "Action": [
        "ec2>StartInstances",
        "ec2>StopInstances",
        "ec2>TerminateInstances",
        "ec2>AttachVolume",
        "ec2>DetachVolume"
    ],
    "Condition": {
        "StringLike": {
            "ec2:ResourceTag/WorkingEnvironment": "*"
        }
    },
    "Resource": [
        "arn:aws-iso:ec2:*:*:instance/*"
    ]
},
{

```

```

        "Effect": "Allow",
        "Action": [
            "ec2:AttachVolume",
            "ec2:DetachVolume"
        ],
        "Resource": [
            "arn:aws-iso:ec2:*:*:volume/*"
        ]
    }
]
}

```

3. Create a policy for Cloud Volumes ONTAP.

```

{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Action": "s3>ListAllMyBuckets",
            "Resource": "arn:aws-iso:s3::::*",
            "Effect": "Allow"
        },
        {
            "Action": [
                "s3>ListBucket",
                "s3:GetBucketLocation"
            ],
            "Resource": "arn:aws-iso:s3::::fabric-pool-*",
            "Effect": "Allow"
        },
        {
            "Action": [
                "s3GetObject",
                "s3PutObject",
                "s3DeleteObject"
            ],
            "Resource": "arn:aws-iso:s3::::fabric-pool-*",
            "Effect": "Allow"
        }
    ]
}

```

4. If you plan to deploy a Cloud Volumes ONTAP HA pair, create a policy for the HA mediator.

```
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Effect": "Allow",
            "Action": [
                "ec2:AssignPrivateIpAddresses",
                "ec2>CreateRoute",
                "ec2>DeleteRoute",
                "ec2:DescribeNetworkInterfaces",
                "ec2:DescribeRouteTables",
                "ec2:DescribeVpcs",
                "ec2:ReplaceRoute",
                "ec2:UnassignPrivateIpAddresses"
            ],
            "Resource": "*"
        }
    ]
}
```

5. Create IAM roles with the role type Amazon EC2 and attach the policies that you created in the previous steps.

Similar to the policies, you should have one IAM role for the Connector, one for the Cloud Volumes ONTAP nodes, and one for the HA mediator (if you want to deploy HA pairs).

You must select the Connector IAM role when you launch the Connector instance.

You can select the IAM roles for Cloud Volumes ONTAP and the HA mediator when you create a Cloud Volumes ONTAP working environment from Cloud Manager.

Set up the AWS KMS

If you want to use Amazon encryption with Cloud Volumes ONTAP, ensure that requirements are met for the AWS Key Management Service.

Steps

1. Ensure that an active Customer Master Key (CMK) exists in your account or in another AWS account.

The CMK can be an AWS-managed CMK or a customer-managed CMK.

2. If the CMK is in an AWS account separate from the account where you plan to deploy Cloud Volumes ONTAP, then you need to obtain the ARN of that key.

You'll need to provide the ARN to Cloud Manager when you create the Cloud Volumes ONTAP system.

3. Add the IAM role for the Cloud Manager instance to the list of key users for a CMK.

This gives Cloud Manager permissions to use the CMK with Cloud Volumes ONTAP.

Install and set up Cloud Manager

Before you can launch Cloud Volumes ONTAP systems in AWS, you must first launch the Connector instance from the AWS Marketplace and then log in and set up Cloud Manager.

Steps

1. Obtain a root certificate signed by a certificate authority (CA) in the Privacy Enhanced Mail (PEM) Base-64 encoded X.509 format. Consult your organization's policies and procedures for obtaining the certificate.

You'll need to upload the certificate during the setup process. Cloud Manager uses the trusted certificate when sending requests to AWS over HTTPS.

2. Launch the Connector instance:

- a. Go to the AWS Intelligence Community Marketplace page for Cloud Manager.
- b. On the Custom Launch tab, choose the option to launch the instance from the EC2 console.
- c. Follow the prompts to configure the instance.

Note the following as you configure the instance:

- We recommend t3.xlarge.
- You must choose the IAM role that you created when preparing your AWS environment.
- You should keep the default storage options.
- The required connection methods for the Connector are as follows: SSH, HTTP, and HTTPS.

3. Set up Cloud Manager from a host that has a connection to the Connector instance:

- a. Open a web browser and enter the following URL: <http://ipaddress:80>
- b. Specify a proxy server for connectivity to AWS services.
- c. Upload the certificate that you obtained in step 1.
- d. Complete the steps in the Setup wizard to set up Cloud Manager.
 - **System Details:** Enter a name for this instance of Cloud Manager and provide your company name.
 - **Create User:** Create the Admin user that you'll use to administer Cloud Manager.
 - **Review:** Review the details and approve the end user license agreement.

- e. To complete installation of the CA-signed certificate, restart the Connector instance from the EC2 console.

4. After the Connector restarts, log in using the administrator user account that you created in the Setup wizard.

Launch Cloud Volumes ONTAP

You can launch Cloud Volumes ONTAP instances in the AWS Commercial Cloud Services environment by creating new working environments in Cloud Manager.

What you'll need

- If you purchased a license, you must have the license file that you received from NetApp. The license file is a .NLF file in JSON format.
- A key pair is required to enable key-based SSH authentication to the HA mediator.

Steps

1. On the Working Environments page, click **Add Working Environment**.
2. Under Create, select Cloud Volumes ONTAP or Cloud Volumes ONTAP HA.
3. Complete the steps in the wizard to launch the Cloud Volumes ONTAP system.

Note the following as you complete the wizard:

- If you want to deploy Cloud Volumes ONTAP HA in multiple Availability Zones, deploy the configuration as follows because only two AZs were available in the AWS Commercial Cloud Services environment at the time of publication:
 - Node 1: Availability Zone A
 - Node 2: Availability Zone B
 - Mediator: Availability Zone A or B
- You should leave the default option to use a generated security group.

The predefined security group includes the rules that Cloud Volumes ONTAP needs to operate successfully. If you have a requirement to use your own, you can refer to the security group section below.

- You must choose the IAM role that you created when preparing your AWS environment.
- The underlying AWS disk type is for the initial Cloud Volumes ONTAP volume.

You can choose a different disk type for subsequent volumes.

- The performance of AWS disks is tied to disk size.

You should choose the disk size that gives you the sustained performance that you need. Refer to AWS documentation for more details about EBS performance.

- The disk size is the default size for all disks on the system.



If you need a different size later, you can use the Advanced allocation option to create an aggregate that uses disks of a specific size.

- Storage efficiency features can improve storage utilization and reduce the total amount of storage that you need.

Result

Cloud Manager launches the Cloud Volumes ONTAP instance. You can track the progress in the timeline.

Security group rules

Cloud Manager creates security groups that include the inbound and outbound rules that Cloud Manager and Cloud Volumes ONTAP need to operate successfully in the cloud. You might want to refer to the ports for testing purposes or if you prefer to use your own security groups.

Security group for the Connector

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

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

Security group for Cloud Volumes ONTAP

The security group for Cloud Volumes ONTAP nodes requires both inbound and outbound rules.

Inbound rules

The source for inbound rules in the predefined security group is 0.0.0.0/0.

Protocol	Port	Purpose
All ICMP	All	Pinging the instance
HTTP	80	HTTP access to the System Manager web console using the IP address of the cluster management LIF
HTTPS	443	HTTPS access to the System Manager web console using the IP address of the cluster management LIF
SSH	22	SSH access to the IP address of the cluster management LIF or a node management LIF
TCP	111	Remote procedure call for NFS
TCP	139	NetBIOS service session for CIFS
TCP	161-162	Simple network management protocol
TCP	445	Microsoft SMB/CIFS over TCP with NetBIOS framing
TCP	635	NFS mount
TCP	749	Kerberos
TCP	2049	NFS server daemon
TCP	3260	iSCSI access through the iSCSI data LIF
TCP	4045	NFS lock daemon
TCP	4046	Network status monitor for NFS

Protocol	Port	Purpose
TCP	10000	Backup using NDMP
TCP	11104	Management of intercluster communication sessions for SnapMirror
TCP	11105	SnapMirror data transfer using intercluster LIFs
UDP	111	Remote procedure call for NFS
UDP	161-162	Simple network management protocol
UDP	635	NFS mount
UDP	2049	NFS server daemon
UDP	4045	NFS lock daemon
UDP	4046	Network status monitor for NFS
UDP	4049	NFS rquotad protocol

Outbound rules

The predefined security group for Cloud Volumes ONTAP includes the following outbound rules.

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

External security group for the HA mediator

The predefined external security group for the Cloud Volumes ONTAP HA mediator includes the following inbound and outbound rules.

Inbound rules

The source for inbound rules is traffic from the VPC where the Connector resides.

Protocol	Port	Purpose
SSH	22	SSH connections to the HA mediator
TCP	3000	RESTful API access from the Connector

Outbound rules

The predefined security group for the HA mediator includes the following outbound rules.

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

Internal security group for the HA mediator

The predefined internal security group for the Cloud Volumes ONTAP HA mediator includes the following rules. Cloud Manager always creates this security group. You don't have the option to use your own.

Inbound rules

The predefined security group includes the following inbound rules.

Protocol	Port	Purpose
All traffic	All	Communication between the HA mediator and HA nodes

Outbound rules

The predefined security group includes the following outbound rules.

Protocol	Port	Purpose
All traffic	All	Communication between the HA mediator and HA nodes

Get started in Azure

Getting started with Cloud Volumes ONTAP for Azure

Get started with Cloud Volumes ONTAP for Azure in a few steps.

1

Create a Connector

If you don't have a [Connector](#) yet, an Account Admin needs to create one. [Learn how to create a Connector in Azure.](#)

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

2

Plan your configuration

Cloud Manager offers preconfigured packages that match your workload requirements, or you can create your own configuration. If you choose your own configuration, you should understand the options available to you. [Learn more.](#)

3

Set up your networking

- a. Ensure that your VNet and subnets will support connectivity between the Connector and Cloud Volumes ONTAP.
- b. Enable outbound internet access from the target VNet so the Connector and Cloud Volumes ONTAP can contact several endpoints.

This step is important because the Connector can't manage Cloud Volumes ONTAP without outbound internet access. If you need to limit outbound connectivity, refer to the list of endpoints for [the Connector and Cloud Volumes ONTAP](#).

Learn more about networking requirements.

4

Launch Cloud Volumes ONTAP using Cloud Manager

Click **Add Working Environment**, select the type of system that you would like to deploy, and complete the steps in the wizard. [Read step-by-step instructions](#).

Related links

- [Creating a Connector from Cloud Manager](#)
- [Creating a Connector from the Azure Marketplace](#)
- [Installing the Connector software on a Linux host](#)
- [What Cloud Manager does with Azure permissions](#)

Planning your Cloud Volumes ONTAP configuration in Azure

When you deploy Cloud Volumes ONTAP in Azure, you can choose a preconfigured system that matches your workload requirements, or you can create your own configuration. If you choose your own configuration, you should understand the options available to you.

Viewing supported regions

Cloud Volumes ONTAP is supported in most Microsoft Azure regions. [View the full list of supported regions](#).

Choosing a license

Several licensing options are available for Cloud Volumes ONTAP. Each option enables you to choose a consumption model that meets your needs. [Learn about licensing options for Cloud Volumes ONTAP](#).

Supported VM types

Cloud Volumes ONTAP supports several VM types, depending on the license type that you choose.

[Supported configurations for Cloud Volumes ONTAP in Azure](#)

Understanding storage limits

The raw capacity limit for a Cloud Volumes ONTAP system is tied to the license. Additional limits impact the size of aggregates and volumes. You should be aware of these limits as you plan your configuration.

[Storage limits for Cloud Volumes ONTAP in Azure](#)

Sizing your system in Azure

Sizing your Cloud Volumes ONTAP system can help you meet requirements for performance and capacity. You should be aware of a few key points when choosing a VM type, disk type, and disk size:

Virtual machine type

Look at the supported virtual machine types in the [Cloud Volumes ONTAP Release Notes](#) and then review details about each supported VM type. Be aware that each VM type supports a specific number of data disks.

- [Azure documentation: General purpose virtual machine sizes](#)
- [Azure documentation: Memory optimized virtual machine sizes](#)

Azure disk type

When you create volumes for Cloud Volumes ONTAP, you need to choose the underlying cloud storage that Cloud Volumes ONTAP uses as a disk.

HA systems use Premium page blobs. Meanwhile, single node systems can use two types of Azure Managed Disks:

- *Premium SSD Managed Disks* provide high performance for I/O-intensive workloads at a higher cost.
- *Standard SSD Managed Disks* provide consistent performance for workloads that require low IOPS.
- *Standard HDD Managed Disks* are a good choice if you don't need high IOPS and want to reduce your costs.

For additional details about the use cases for these disks, see [Microsoft Azure Documentation: What disk types are available in Azure?](#).

Azure disk size

When you launch Cloud Volumes ONTAP instances, you must choose the default disk size for aggregates. Cloud Manager uses this disk size for the initial aggregate, and for any additional aggregates that it creates when you use the simple provisioning option. You can create aggregates that use a disk size different from the default by [using the advanced allocation option](#).



All disks in an aggregate must be the same size.

When choosing a disk size, you should take several factors into consideration. The disk size impacts how much you pay for storage, the size of volumes that you can create in an aggregate, the total capacity available to Cloud Volumes ONTAP, and storage performance.

The performance of Azure Premium Storage is tied to the disk size. Larger disks provide higher IOPS and throughput. For example, choosing 1 TiB disks can provide better performance than 500 GiB disks, at a higher cost.

There are no performance differences between disk sizes for Standard Storage. You should choose disk size based on the capacity that you need.

Refer to Azure for IOPS and throughput by disk size:

- [Microsoft Azure: Managed Disks pricing](#)
- [Microsoft Azure: Page Blobs pricing](#)

Choosing a configuration that supports Flash Cache

A Cloud Volumes ONTAP configuration in Azure includes local NVMe storage, which Cloud Volumes ONTAP uses as *Flash Cache* for better performance. [Learn more about Flash Cache](#).

Viewing default system disks

In addition to the storage for user data, Cloud Manager also purchases cloud storage for Cloud Volumes ONTAP system data (boot data, root data, core data, and NVRAM). For planning purposes, it might help for you to review these details before you deploy Cloud Volumes ONTAP.

[View the default disks for Cloud Volumes ONTAP system data in Azure.](#)



The Connector also requires a system disk. [View details about the Connector's default configuration.](#)

Azure network information worksheet

When you deploy Cloud Volumes ONTAP in Azure, you need to specify details about your virtual network. You can use a worksheet to collect the information from your administrator.

Azure information	Your value
Region	
Virtual network (VNet)	
Subnet	
Network security group (if using your own)	

Choosing a write speed

Cloud Manager enables you to choose a write speed setting for Cloud Volumes ONTAP. Before you choose a write speed, you should understand the differences between the normal and high settings and risks and recommendations when using high write speed. [Learn more about write speed.](#)

Choosing a volume usage profile

ONTAP includes several storage efficiency features that can reduce the total amount of storage that you need. When you create a volume in Cloud Manager, you can choose a profile that enables these features or a profile that disables them. You should learn more about these features to help you decide which profile to use.

NetApp storage efficiency features provide the following benefits:

Thin provisioning

Presents more logical storage to hosts or users than you actually have in your physical storage pool. Instead of preallocating storage space, storage space is allocated dynamically to each volume as data is written.

Deduplication

Improves efficiency by locating identical blocks of data and replacing them with references to a single shared block. This technique reduces storage capacity requirements by eliminating redundant blocks of data that reside in the same volume.

Compression

Reduces the physical capacity required to store data by compressing data within a volume on primary, secondary, and archive storage.

Networking requirements for Cloud Volumes ONTAP in Azure

Set up your Azure networking so Cloud Volumes ONTAP systems can operate properly. This includes networking for the Connector and Cloud Volumes ONTAP.

Cloud Volumes ONTAP networking

The following networking requirements must be met in Azure.

Outbound internet access

Cloud Volumes ONTAP requires outbound internet access to send messages to NetApp AutoSupport, which proactively monitors the health of your storage.

Routing and firewall policies must allow HTTP/HTTPS traffic to the following endpoints so Cloud Volumes ONTAP can send AutoSupport messages:

- <https://support.netapp.com/aods/asupmessage>
- <https://support.netapp.com/asupprod/post/1.0/postAsup>

[Learn how to configure AutoSupport.](#)

Security groups

You don't need to create security groups because Cloud Manager does that for you. If you need to use your own, refer to the security group rules listed below.

IP addresses

Cloud Manager allocates the following number of IP addresses to Cloud Volumes ONTAP in Azure:

- Single node: 5 IP addresses
- HA pair: 16 IP addresses

Note that Cloud Manager creates an SVM management LIF on HA pairs, but not on single node systems in Azure.



A LIF is an IP address associated with a physical port. An SVM management LIF is required for management tools like SnapCenter.

Secure connections to Azure services

Cloud Manager sets up a VNet service endpoint and an Azure Private Link endpoint so that Cloud Volumes ONTAP can privately connect to Azure services.

Service endpoint

Cloud Manager enables a VNet service endpoint to create a secure connection from Cloud Volumes ONTAP to Azure Blob storage for data tiering. No additional service endpoints are supported from Cloud Volumes ONTAP to Azure services.

Cloud Manager enables a VNet service endpoint for you if the Cloud Manager policy has these permissions:

```
"Microsoft.Network/virtualNetworks/subnets/write",  
"Microsoft.Network/routeTables/join/action",
```

These permissions are included in the latest Cloud Manager policy.

For details about setting up data tiering, see [Tiering cold data to low-cost object storage](#).

Private endpoint

By default, Cloud Manager enables an Azure Private Link connection between Cloud Volumes ONTAP and its associated storage accounts. A Private Link secures connections between endpoints in Azure and provides performance benefits. In most cases, there's nothing that you need to do—Cloud Manager manages the Azure Private Link for you. But if you use Azure Private DNS, then you'll need to edit a configuration file. You can also disable the Private Link connection, if desired.

[Learn more about using an Azure Private Link with Cloud Volumes ONTAP](#).

Connections to other ONTAP systems

To replicate data between a Cloud Volumes ONTAP system in Azure and ONTAP systems in other networks, you must have a VPN connection between the Azure VNet and the other network—for example, an AWS VPC or your corporate network.

For instructions, refer to [Microsoft Azure Documentation: Create a Site-to-Site connection in the Azure portal](#).

Requirements for the Connector

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



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](#).

Connections to target networks

A Connector requires a network connection to the VPCs and VNets in which you want to deploy Cloud Volumes ONTAP.

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.

Outbound internet access

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

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

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

Security group rules for Cloud Volumes ONTAP

Cloud Manager creates Azure security groups that include the inbound and outbound rules that Cloud Volumes ONTAP needs to operate successfully. You might want to refer to the ports for testing purposes or if you prefer your own security groups.

The security group for Cloud Volumes ONTAP requires both inbound and outbound rules.

Inbound rules for single node systems

The rules listed below allow traffic, unless the description notes that it blocks specific inbound traffic.

Priority and name	Port and protocol	Source and destination	Description
1000 inbound_ssh	22 TCP	Any to Any	SSH access to the IP address of the cluster management LIF or a node management LIF
1001 inbound_http	80 TCP	Any to Any	HTTP access to the System Manager web console using the IP address of the cluster management LIF
1002 inbound_111_tcp	111 TCP	Any to Any	Remote procedure call for NFS
1003 inbound_111_udp	111 UDP	Any to Any	Remote procedure call for NFS
1004 inbound_139	139 TCP	Any to Any	NetBIOS service session for CIFS
1005 inbound_161-162 _tcp	161-162 TCP	Any to Any	Simple network management protocol
1006 inbound_161-162 _udp	161-162 UDP	Any to Any	Simple network management protocol
1007 inbound_443	443 TCP	Any to Any	HTTPS access to the System Manager web console using the IP address of the cluster management LIF
1008 inbound_445	445 TCP	Any to Any	Microsoft SMB/CIFS over TCP with NetBIOS framing
1009 inbound_635_tcp	635 TCP	Any to Any	NFS mount
1010 inbound_635_udp	635 UDP	Any to Any	NFS mount

Priority and name	Port and protocol	Source and destination	Description
1011 inbound_749	749 TCP	Any to Any	Kerberos
1012 inbound_2049_tcp	2049 TCP	Any to Any	NFS server daemon
1013 inbound_2049_udp	2049 UDP	Any to Any	NFS server daemon
1014 inbound_3260	3260 TCP	Any to Any	iSCSI access through the iSCSI data LIF
1015 inbound_4045-4046_tcp	4045-4046 TCP	Any to Any	NFS lock daemon and network status monitor
1016 inbound_4045-4046_udp	4045-4046 UDP	Any to Any	NFS lock daemon and network status monitor
1017 inbound_10000	10000 TCP	Any to Any	Backup using NDMP
1018 inbound_11104-11105	11104-11105 TCP	Any to Any	SnapMirror data transfer
3000 inbound_deny_all_tcp	Any port TCP	Any to Any	Block all other TCP inbound traffic
3001 inbound_deny_all_udp	Any port UDP	Any to Any	Block all other UDP inbound traffic
65000 AllowVnetInBound	Any port Any protocol	VirtualNetwork to VirtualNetwork	Inbound traffic from within the VNet
65001 AllowAzureLoadBalancerInBound	Any port Any protocol	AzureLoadBalancer to Any	Data traffic from the Azure Standard Load Balancer
65500 DenyAllInBound	Any port Any protocol	Any to Any	Block all other inbound traffic

Inbound rules for HA systems

The rules listed below allow traffic, unless the description notes that it blocks specific inbound traffic.



HA systems have less inbound rules than single node systems because inbound data traffic goes through the Azure Standard Load Balancer. Because of this, traffic from the Load Balancer should be open, as shown in the "AllowAzureLoadBalancerInBound" rule.

Priority and name	Port and protocol	Source and destination	Description
100 inbound_443	443 Any protocol	Any to Any	HTTPS access to the System Manager web console using the IP address of the cluster management LIF
101 inbound_111_tcp	111 Any protocol	Any to Any	Remote procedure call for NFS
102 inbound_2049_tcp	2049 Any protocol	Any to Any	NFS server daemon
111 inbound_ssh	22 Any protocol	Any to Any	SSH access to the IP address of the cluster management LIF or a node management LIF
121 inbound_53	53 Any protocol	Any to Any	DNS and CIFS
65000 AllowVnetInBound	Any port Any protocol	VirtualNetwork to VirtualNetwork	Inbound traffic from within the VNet
65001 AllowAzureLoadBalancerInBound	Any port Any protocol	AzureLoadBalancer to Any	Data traffic from the Azure Standard Load Balancer
65500 DenyAllInBound	Any port Any protocol	Any to Any	Block all other inbound traffic

Outbound rules

The predefined security group for Cloud Volumes ONTAP 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 Cloud Volumes ONTAP 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 Cloud Volumes ONTAP.



The source is the interface (IP address) on the Cloud Volumes ONTAP system.

Service	Port	Protocol	Source	Destination	Purpose
Active Directory	88	TCP	Node management LIF	Active Directory forest	Kerberos V authentication
	137	UDP	Node management LIF	Active Directory forest	NetBIOS name service
	138	UDP	Node management LIF	Active Directory forest	NetBIOS datagram service
	139	TCP	Node management LIF	Active Directory forest	NetBIOS service session
	389	TCP & UDP	Node management LIF	Active Directory forest	LDAP
	445	TCP	Node management LIF	Active Directory forest	Microsoft SMB/CIFS over TCP with NetBIOS framing
	464	TCP	Node management LIF	Active Directory forest	Kerberos V change & set password (SET_CHANGE)
	464	UDP	Node management LIF	Active Directory forest	Kerberos key administration
	749	TCP	Node management LIF	Active Directory forest	Kerberos V change & set Password (RPCSEC_GSS)
	88	TCP	Data LIF (NFS, CIFS, iSCSI)	Active Directory forest	Kerberos V authentication
	137	UDP	Data LIF (NFS, CIFS)	Active Directory forest	NetBIOS name service
	138	UDP	Data LIF (NFS, CIFS)	Active Directory forest	NetBIOS datagram service
	139	TCP	Data LIF (NFS, CIFS)	Active Directory forest	NetBIOS service session
	389	TCP & UDP	Data LIF (NFS, CIFS)	Active Directory forest	LDAP
	445	TCP	Data LIF (NFS, CIFS)	Active Directory forest	Microsoft SMB/CIFS over TCP with NetBIOS framing
	464	TCP	Data LIF (NFS, CIFS)	Active Directory forest	Kerberos V change & set password (SET_CHANGE)
	464	UDP	Data LIF (NFS, CIFS)	Active Directory forest	Kerberos key administration
	749	TCP	Data LIF (NFS, CIFS)	Active Directory forest	Kerberos V change & set password (RPCSEC_GSS)

Service	Port	Protocol	Source	Destination	Purpose
AutoSupport	HTTPS	443	Node management LIF	support.netapp.com	AutoSupport (HTTPS is the default)
	HTTP	80	Node management LIF	support.netapp.com	AutoSupport (only if the transport protocol is changed from HTTPS to HTTP)
DHCP	68	UDP	Node management LIF	DHCP	DHCP client for first-time setup
DHCPS	67	UDP	Node management LIF	DHCP	DHCP server
DNS	53	UDP	Node management LIF and data LIF (NFS, CIFS)	DNS	DNS
NDMP	18600–18699	TCP	Node management LIF	Destination servers	NDMP copy
SMTP	25	TCP	Node management LIF	Mail server	SMTP alerts, can be used for AutoSupport
SNMP	161	TCP	Node management LIF	Monitor server	Monitoring by SNMP traps
	161	UDP	Node management LIF	Monitor server	Monitoring by SNMP traps
	162	TCP	Node management LIF	Monitor server	Monitoring by SNMP traps
	162	UDP	Node management LIF	Monitor server	Monitoring by SNMP traps
SnapMirror	11104	TCP	Intercluster LIF	ONTAP intercluster LIFs	Management of intercluster communication sessions for SnapMirror
	11105	TCP	Intercluster LIF	ONTAP intercluster LIFs	SnapMirror data transfer
Syslog	514	UDP	Node management LIF	Syslog server	Syslog forward messages

Security group rules for the Connector

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

Port	Protocol	Purpose
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
	13	TCP	Active Directory forest	NetBIOS service session
	38	TCP	Active Directory forest	LDAP
	44	TCP	Active Directory forest	Microsoft SMB/CIFS over TCP with NetBIOS framing
	46	TCP	Active Directory forest	Kerberos V change & set password (SET_CHANGE)
	74	TCP	Active Directory forest	Active Directory Kerberos V change & set password (RPCSEC_GSS)
	13	UDP	Active Directory forest	NetBIOS name service
	13	UDP	Active Directory forest	NetBIOS datagram service
	46	UDP	Active Directory forest	Kerberos key administration

Service	Port	Protocol	Destination	Purpose
API calls and AutoSupport	443	HTTP	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

Set up Cloud Volumes ONTAP to use a customer-managed key in Azure

Data is automatically encrypted on Cloud Volumes ONTAP in Azure using [Azure Storage Service Encryption](#) with a Microsoft-managed key. But you can use your own encryption key instead by following the steps on this page.

Data encryption overview

Cloud Volumes ONTAP data is automatically encrypted in Azure using [Azure Storage Service Encryption](#). The default implementation uses a Microsoft-managed key. No setup is required.

If you want to use a customer-managed key with Cloud Volumes ONTAP, then you need to complete the following steps:

1. From Azure, create a key vault and then generate a key in that vault
2. From Cloud Manager, use the API to create a Cloud Volumes ONTAP working environment that uses the key

Key rotation

If you create a new version of your key, Cloud Volumes ONTAP automatically uses the latest key version.

How data is encrypted

After you create a Cloud Volumes ONTAP working environment that is configured to use a customer-managed key, Cloud Volumes ONTAP data is encrypted as follows.

HA pairs

- All Azure storage accounts for Cloud Volumes ONTAP are encrypted using a customer-managed key.
- Any new storage accounts (for example, when you add disks or aggregates) also use the same key.

Single node

- All Azure storage accounts for Cloud Volumes ONTAP are encrypted using a customer-managed key.
- For root, boot, and data disks, Cloud Manager uses a [disk encryption set](#), which enables management of encryption keys with managed disks.
- Any new data disks also use the same disk encryption set.
- NVRAM and the core disk are encrypted using a Microsoft-managed key, instead of the customer-managed key.

Create a key vault and generate a key

The key vault must reside in the same Azure subscription and region in which you plan to create the Cloud Volumes ONTAP system.

Steps

1. [Create a key vault in your Azure subscription.](#)

Note the following requirements for the key vault:

- The key vault must reside in the same region as the Cloud Volumes ONTAP system.
- The following options should be enabled:
 - **Soft-delete** (this option is enabled by default, but must *not* be disabled)
 - **Purge protection**
 - **Azure Disk Encryption for volume encryption** (for single node Cloud Volumes ONTAP systems only)

2. [Generate a key in the key vault.](#)

Note the following requirements for the key:

- The key type must be **RSA**.
- The recommended RSA key size is **2048**, but other sizes are supported.

Create a working environment that uses the encryption key

After you create the key vault and generate an encryption key, you can create a new Cloud Volumes ONTAP system that is configured to use the key. These steps are supported by using the Cloud Manager API.

Required permissions

If you want to use a customer-managed key with a single node Cloud Volumes ONTAP system, ensure that the Cloud Manager Connector has the following permissions:

```
"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"
```

You can find the latest list of permissions on the [Cloud Manager policies page](#).

These permissions aren't required for HA pairs.

Steps

1. Obtain the list of key vaults in your Azure subscription by using the following Cloud Manager API call.

For an HA pair: GET /azure/ha/metadata/vaults

For single node: GET /azure/vsa/metadata/vaults

Make note of the **name** and **resourceGroup**. You'll need to specify those values in the next step.

[Learn more about this API call.](#)

2. Obtain the list of keys within the vault by using the following Cloud Manager API call.

For an HA pair: GET /azure/ha/metadata/keys-vault

For single node: GET /azure/vsa/metadata/keys-vault

Make note of the **keyName**. You'll need to specify that value (along with the vault name) in the next step.

[Learn more about this API call.](#)

3. Create a Cloud Volumes ONTAP system by using the following Cloud Manager API call.

- a. For an HA pair:

POST /azure/ha/working-environments

The request body must include the following fields:

```
"azureEncryptionParameters": {  
    "key": "keyName",  
    "vaultName": "vaultName"  
}
```

[Learn more about this API call.](#)

- b. For a single node system:

POST /azure/vsa/working-environments

The request body must include the following fields:

```
"azureEncryptionParameters": {  
    "key": "keyName",  
    "vaultName": "vaultName"  
}
```

[Learn more about this API call.](#)

Result

You have a new Cloud Volumes ONTAP system that is configured to use your customer-managed key for data encryption.

Launching Cloud Volumes ONTAP in Azure

You can launch a single node system or an HA pair in Azure by creating a Cloud Volumes ONTAP working environment in Cloud Manager.

What you'll need

You need the following to create a working environment.

- A Connector that's up and running.
 - You should have a [Connector that is associated with your workspace](#).
 - [You should be prepared to leave the Connector running at all times](#).
- An understanding of the configuration that you want to use.

You should have chose a configuration and obtained Azure networking information from your administrator. For details, see [Planning your Cloud Volumes ONTAP configuration](#).

- An understanding of what's required to choose a specific licensing option in the Add Working Environment wizard. [Learn more about Cloud Volumes ONTAP licensing](#).

Licensing option	Requirement	How to meet the requirement
Freemium	A Marketplace subscription or NetApp Support Site (NSS) account is required.	<p>You'll have the option to subscribe to your cloud provider's marketplace from the Details & Credentials page.</p> <p>You can enter your NSS account on the Charging Methods and NSS Account page.</p>
Professional or Essential package	<p>A Marketplace subscription or capacity-based license (BYOL) is required.</p> <p>A Marketplace subscription is recommended for capacity-based charging in the event that your account doesn't have a valid capacity-based license, or in the event that your provisioned capacity exceeds the licensed capacity.</p>	<p>You'll have the option to subscribe to your cloud provider's marketplace from the Details & Credentials page.</p> <p>If you want to use a capacity-based license (BYOL) that you purchased from NetApp, you must first add it to the Digital Wallet. Learn how to add capacity-based BYOL licenses.</p>
Keystone Flex Subscription	Your account must be authorized and the subscription must be enabled for use with Cloud Volumes ONTAP.	<ol style="list-style-type: none"> 1. Contact NetApp to authorize your Cloud Manager user account with one or more Keystone Flex Subscriptions. 2. After NetApp authorizes your account, link your subscriptions for use with Cloud Volumes ONTAP. 3. Select the Keystone Flex Subscription charging method when you create a Cloud Volumes ONTAP HA pair.

Licensing option	Requirement	How to meet the requirement
Per node licensing	A Marketplace subscription is required or you need to bring your own license (BYOL). This option is available for customers with existing subscriptions or existing licenses. It's not available for new customers.	If you want to use a node-based license (BYOL) that you purchased from NetApp, you must first add it to the Digital Wallet . Learn how to add node-based BYOL licenses. You can enter your NSS account on the Charging Methods and NSS Account page.

About this task

When Cloud Manager creates a Cloud Volumes ONTAP system in Azure, it creates several Azure objects, such as a resource group, network interfaces, and storage accounts. You can review a summary of the resources at the end of the wizard.

Potential for Data Loss

The best practice is to use a new, dedicated resource group for each Cloud Volumes ONTAP system.



Deploying Cloud Volumes ONTAP in an existing, shared resource group is not recommended due to the risk of data loss. While Cloud Manager can remove Cloud Volumes ONTAP resources from a shared resource group in case of deployment failure or deletion, an Azure user might accidentally delete Cloud Volumes ONTAP resources from a shared resource group.

Steps

1. On the Canvas page, click **Add Working Environment** and follow the prompts.
2. **Choose a Location:** Select **Microsoft Azure** and **Cloud Volumes ONTAP Single Node** or **Cloud Volumes ONTAP High Availability**.
3. If you're prompted, [create a Connector](#).
4. **Details and Credentials:** Optionally change the Azure credentials and subscription, specify a cluster name, add tags if needed, and then specify credentials.

The following table describes fields for which you might need guidance:

Field	Description
Working Environment Name	Cloud Manager uses the working environment name to name both the Cloud Volumes ONTAP system and the Azure virtual machine. It also uses the name as the prefix for the predefined security group, if you select that option.
Resource Group Tags	<p>Tags are metadata for your Azure resources. When you enter tags in this field, Cloud Manager adds them to the resource group associated with the Cloud Volumes ONTAP system.</p> <p>You can add up to four tags from the user interface when creating a working environment, and then you can add more after its created. Note that the API does not limit you to four tags when creating a working environment.</p> <p>For information about tags, refer to Microsoft Azure Documentation: Using tags to organize your Azure resources.</p>

Field	Description
User name and password	These are the credentials for the Cloud Volumes ONTAP cluster administrator account. You can use these credentials to connect to Cloud Volumes ONTAP through System Manager or its CLI. Keep the default <i>admin</i> user name or change it to a custom user name.
Edit Credentials	You can choose different Azure credentials and a different Azure subscription to use with this Cloud Volumes ONTAP system. You need to associate an Azure Marketplace subscription with the selected Azure subscription in order to deploy a pay-as-you-go Cloud Volumes ONTAP system. Learn how to add credentials .

The following video shows how to associate a Marketplace subscription to an Azure subscription:

- ▶ https://docs.netapp.com/us-en/occm//media/video_subscribing_azure.mp4 (video)

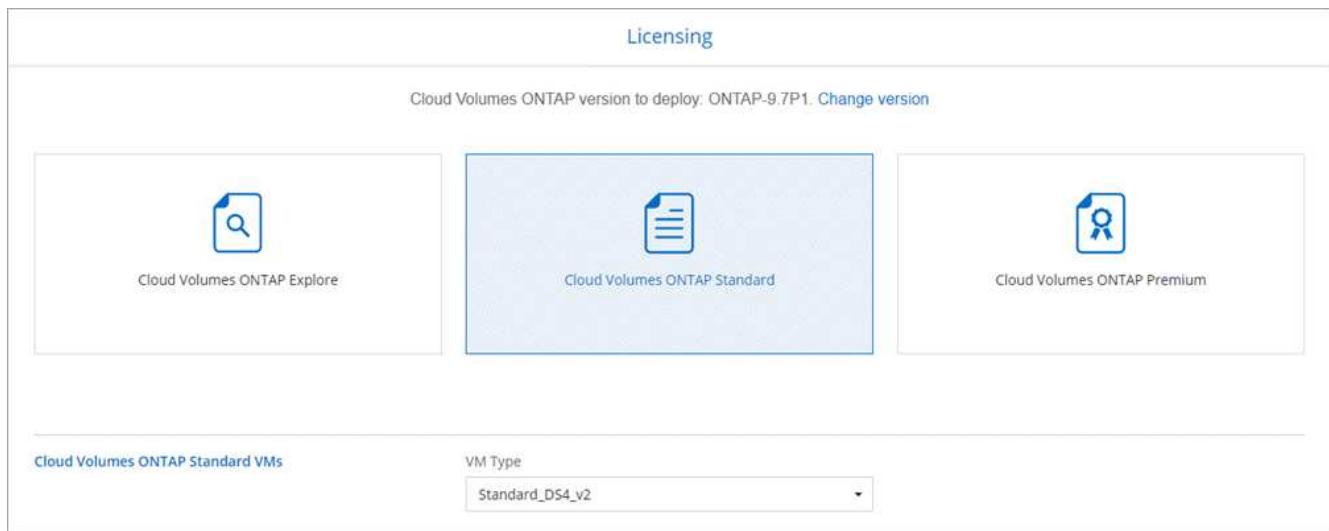
5. **Services:** Keep the services enabled or disable the individual services that you don't want to use with Cloud Volumes ONTAP.
 - [Learn more about Cloud Data Sense.](#)
 - [Learn more about Cloud Backup.](#)
 - [Learn more about the Monitoring service.](#)
6. **Location & Connectivity:** Select a location, a resource group, a security group, and then select the checkbox to confirm network connectivity between the Connector and the target location.

The following table describes fields for which you might need guidance:

Field	Description
Location	For single node systems, you can choose the Availability Zone in which you'd like to deploy Cloud Volumes ONTAP. If you don't select an AZ, Cloud Manager will select one for you.
Resource Group	<p>Create a new resource group for Cloud Volumes ONTAP or use an existing resource group. The best practice is to use a new, dedicated resource group for Cloud Volumes ONTAP. While it is possible to deploy Cloud Volumes ONTAP in an existing, shared resource group, it's not recommended due to the risk of data loss. See the warning above for more details.</p> <p>You must use a dedicated resource group for each Cloud Volumes ONTAP HA pair that you deploy in Azure. Only one HA pair is supported in a resource group. Cloud Manager experiences connection issues if you try to deploy a second Cloud Volumes ONTAP HA pair in an Azure resource group.</p> <p> If the Azure account that you're using has the required permissions, Cloud Manager removes Cloud Volumes ONTAP resources from a resource group, in case of deployment failure or deletion.</p>
Security group	If you choose an existing security group, then it must meet Cloud Volumes ONTAP requirements. View the default security group .

7. **Charging Methods and NSS Account:** Specify which charging option would you like to use with this system, and then specify a NetApp Support Site account.
 - [Learn about these charging methods.](#)
 - [Learn what's required in the wizard for the licensing method that you want to use.](#)
8. **Preconfigured Packages:** Select one of the packages to quickly deploy a Cloud Volumes ONTAP system, or click **Create my own configuration**.

If you choose one of the packages, you only need to specify a volume and then review and approve the configuration.
9. **Licensing:** Change the Cloud Volumes ONTAP version as needed, select a license, and select a virtual machine type.



If your needs change after you launch the system, you can modify the license or virtual machine type later.



If a newer Release Candidate, General Availability, or patch release is available for the selected version, then Cloud Manager updates the system to that version when creating the working environment. For example, the update occurs if you select Cloud Volumes ONTAP 9.6 RC1 and 9.6 GA is available. The update does not occur from one release to another—for example, from 9.6 to 9.7.

10. **Subscribe from the Azure Marketplace:** Follow the steps if Cloud Manager could not enable programmatic deployments of Cloud Volumes ONTAP.
11. **Underlying Storage Resources:** Choose settings for the initial aggregate: a disk type, a size for each disk, and whether data tiering to Blob storage should be enabled.

Note the following:

- The disk type is for the initial volume. You can choose a different disk type for subsequent volumes.
- The disk size is for all disks in the initial aggregate and for any additional aggregates that Cloud Manager creates when you use the simple provisioning option. You can create aggregates that use a different disk size by using the advanced allocation option.

For help choosing a disk type and size, see [Sizing your system in Azure](#).

- You can choose a specific volume tiering policy when you create or edit a volume.
- If you disable data tiering, you can enable it on subsequent aggregates.

[Learn more about data tiering](#).

12. Write Speed & WORM (single node systems only): Choose **Normal** or **High** write speed, and activate write once, read many (WORM) storage, if desired.

[Learn more about write speed](#).

WORM can't be enabled if Cloud Backup was enabled or if data tiering was enabled.

[Learn more about WORM storage](#).

13. Secure Communication to Storage & WORM (HA only): Choose whether to enable an HTTPS connection to Azure storage accounts, and activate write once, read many (WORM) storage, if desired.

The HTTPS connection is from a Cloud Volumes ONTAP 9.7 HA pair to Azure storage accounts. Note that enabling this option can impact write performance. You can't change the setting after you create the working environment.

[Learn more about WORM storage](#).

14. Create Volume: Enter details for the new volume or click **Skip**.

Some of the fields in this page are self-explanatory. The following table describes fields for which you might need guidance:

Field	Description
Size	The maximum size that you can enter largely depends on whether you enable thin provisioning, which enables you to create a volume that is bigger than the physical storage currently available to it.
Access control (for NFS only)	An export policy defines the clients in the subnet that can access the volume. By default, Cloud Manager enters a value that provides access to all instances in the subnet.
Permissions and Users / Groups (for CIFS only)	These fields enable you to control the level of access to a share for users and groups (also called access control lists or ACLs). You can specify local or domain Windows users or groups, or UNIX users or groups. If you specify a domain Windows user name, you must include the user's domain using the format domain\username.
Snapshot Policy	A Snapshot copy policy specifies the frequency and number of automatically created NetApp Snapshot copies. A NetApp Snapshot copy is a point-in-time file system image that has no performance impact and requires minimal storage. You can choose the default policy or none. You might choose none for transient data: for example, tempdb for Microsoft SQL Server.
Advanced options (for NFS only)	Select an NFS version for the volume: either NFSv3 or NFSv4.

Field	Description
Initiator group and IQN (for iSCSI only)	<p>iSCSI storage targets are called LUNs (logical units) and are presented to hosts as standard block devices.</p> <p>Initiator groups are tables of iSCSI host node names and control which initiators have access to which LUNs.</p> <p>iSCSI targets connect to the network through standard Ethernet network adapters (NICs), TCP offload engine (TOE) cards with software initiators, converged network adapters (CNAs) or dedicated host bus adapters (HBAs) and are identified by iSCSI qualified names (IQNs).</p> <p>When you create an iSCSI volume, Cloud Manager automatically creates a LUN for you. We've made it simple by creating just one LUN per volume, so there's no management involved. After you create the volume, use the IQN to connect to the LUN from your hosts.</p>

The following image shows the Volume page filled out for the CIFS protocol:

The screenshot shows the 'Volume Details, Protection & Protocol' page. On the left, under 'Details & Protection', there are fields for 'Volume Name' (vol) and 'Size (GB)' (250). Below these are 'Snapshot Policy' (default) and a note about 'Default Policy'. On the right, under 'Protocol', the 'CIFS' tab is selected, showing 'Share name' (vol_share), 'Permissions' (Full Control), and 'Users / Groups' (engineering). A note at the bottom states 'Valid users and groups separated by a semicolon'.

15. CIFS Setup: If you chose the CIFS protocol, set up a CIFS server.

Field	Description
DNS Primary and Secondary IP Address	The IP addresses of the DNS servers that provide name resolution for the CIFS server. The listed DNS servers must contain the service location records (SRV) needed to locate the Active Directory LDAP servers and domain controllers for the domain that the CIFS server will join.
Active Directory Domain to join	The FQDN of the Active Directory (AD) domain that you want the CIFS server to join.
Credentials authorized to join the domain	The name and password of a Windows account with sufficient privileges to add computers to the specified Organizational Unit (OU) within the AD domain.
CIFS server NetBIOS name	A CIFS server name that is unique in the AD domain.

Field	Description
Organizational Unit	<p>The organizational unit within the AD domain to associate with the CIFS server. The default is CN=Computers.</p> <p>To configure Azure AD Domain Services as the AD server for Cloud Volumes ONTAP, you should enter OU=AADDC Computers or OU=AADDC Users in this field.</p> <p>Azure Documentation: Create an Organizational Unit (OU) in an Azure AD Domain Services managed domain</p>
DNS Domain	The DNS domain for the Cloud Volumes ONTAP storage virtual machine (SVM). In most cases, the domain is the same as the AD domain.
NTP Server	Select Use Active Directory Domain to configure an NTP server using the Active Directory DNS. If you need to configure an NTP server using a different address, then you should use the API. See the Cloud Manager automation docs for details.

16. **Usage Profile, Disk Type, and Tiering Policy:** Choose whether you want to enable storage efficiency features and change the volume tiering policy, if needed.

For more information, see [Understanding volume usage profiles](#) and [Data tiering overview](#).

17. **Review & Approve:** Review and confirm your selections.

- Review details about the configuration.
- Click **More information** to review details about support and the Azure resources that Cloud Manager will purchase.
- Select the **I understand...** check boxes.
- Click **Go**.

Result

Cloud Manager deploys the Cloud Volumes ONTAP system. You can track the progress in the timeline.

If you experience any issues deploying the Cloud Volumes ONTAP system, review the failure message. You can also select the working environment and click **Re-create environment**.

For additional help, go to [NetApp Cloud Volumes ONTAP Support](#).

After you finish

- If you provisioned a CIFS share, give users or groups permissions to the files and folders and verify that those users can access the share and create a file.
- If you want to apply quotas to volumes, use System Manager or the CLI.

Quotas enable you to restrict or track the disk space and number of files used by a user, group, or qtree.

Get started in GCP

Getting started with Cloud Volumes ONTAP for Google Cloud

Get started with Cloud Volumes ONTAP for GCP in a few steps.

1

Create a Connector

If you don't have a [Connector](#) yet, an Account Admin needs to create one. [Learn how to create a Connector in GCP.](#)

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

2

Plan your configuration

Cloud Manager offers preconfigured packages that match your workload requirements, or you can create your own configuration. If you choose your own configuration, you should understand the options available to you.

[Learn more about planning your configuration.](#)

3

Set up your networking

- a. Ensure that your VPC and subnets will support connectivity between the Connector and Cloud Volumes ONTAP.
- b. If you plan to enable data tiering, [configure the Cloud Volumes ONTAP subnet for Private Google Access](#).
- c. If you're deploying an HA pair, ensure that you have four VPCs, each with their own subnet.
- d. If you're using a shared VPC, provide the *Compute Network User* role to the Connector service account.
- e. Enable outbound internet access from the target VPC so the Connector and Cloud Volumes ONTAP can contact several endpoints.

This step is important because the Connector can't manage Cloud Volumes ONTAP without outbound internet access. If you need to limit outbound connectivity, refer to the list of endpoints for [the Connector and Cloud Volumes ONTAP](#).

[Learn more about networking requirements.](#)

4

Set up a service account

Cloud Volumes ONTAP requires a Google Cloud service account for two purposes. The first is when you enable [data tiering](#) to tier cold data to low-cost object storage in Google Cloud. The second is when you enable the [Cloud Backup Service](#) to back up volumes to low-cost object storage.

You can set up one service account and use it for both purposes. The service account must have the **Storage Admin** role.

[Read step-by-step instructions.](#)

5

Enable Google Cloud APIs

[Enable the following Google Cloud APIs in your project.](#) These APIs are required to deploy the Connector and Cloud Volumes ONTAP.

- Cloud Deployment Manager V2 API

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

6

Launch Cloud Volumes ONTAP using Cloud Manager

Click **Add Working Environment**, select the type of system that you would like to deploy, and complete the steps in the wizard. [Read step-by-step instructions](#).

Related links

- [Creating a Connector from Cloud Manager](#)
- [Installing the Connector software on a Linux host](#)
- [What Cloud Manager does with GCP permissions](#)

Planning your Cloud Volumes ONTAP configuration in Google Cloud

When you deploy Cloud Volumes ONTAP in Google Cloud, you can choose a preconfigured system that matches your workload requirements, or you can create your own configuration. If you choose your own configuration, you should understand the options available to you.

Viewing supported regions

Cloud Volumes ONTAP is supported in most Google Cloud regions. [View the full list of supported regions](#).

Choosing a license

Several licensing options are available for Cloud Volumes ONTAP. Each option enables you to choose a consumption model that meets your needs. [Learn about licensing options for Cloud Volumes ONTAP](#).

Supported machine types

Cloud Volumes ONTAP supports several machine types, depending on the license type that you choose.

[Supported configurations for Cloud Volumes ONTAP in GCP](#)

Understanding storage limits

The raw capacity limit for a Cloud Volumes ONTAP system is tied to the license. Additional limits impact the size of aggregates and volumes. You should be aware of these limits as you plan your configuration.

[Storage limits for Cloud Volumes ONTAP in GCP](#)

Sizing your system in GCP

Sizing your Cloud Volumes ONTAP system can help you meet requirements for performance and capacity. You should be aware of a few key points when choosing a machine type, disk type, and disk size:

Machine type

Look at the supported machine types in the [Cloud Volumes ONTAP Release Notes](#) and then review details from Google about each supported machine type. Match your workload requirements to the number of vCPUs and memory for the machine type. Note that each CPU core increases networking performance.

Refer to the following for more details:

- [Google Cloud documentation: N1 standard machine types](#)
- [Google Cloud documentation: Performance](#)

GCP disk type

When you create volumes for Cloud Volumes ONTAP, you need to choose the underlying cloud storage that Cloud Volumes ONTAP uses for a disk. The disk type can be any of the following:

- *Zonal SSD persistent disks*: SSD persistent disks are best for workloads that require high rates of random IOPS.
- *Zonal Balanced persistent disks*: These SSDs balance performance and cost by providing lower IOPS per GB.
- *Zonal Standard persistent disks* : Standard persistent disks are economical and can handle sequential read/write operations.

For more details, see [Google Cloud documentation: Zonal Persistent disks \(Standard and SSD\)](#).

GCP disk size

You need to choose an initial disk size when you deploy a Cloud Volumes ONTAP system. After that you can let Cloud Manager manage a system's capacity for you, but if you want to build aggregates yourself, be aware of the following:

- All disks in an aggregate must be the same size.
- Determine the space that you need, while taking performance into consideration.
- The performance of persistent disks scales automatically with disk size and the number of vCPUs available to the system.

Refer to the following for more details:

- [Google Cloud documentation: Zonal Persistent disks \(Standard and SSD\)](#)
- [Google Cloud documentation: Optimizing Persistent Disk and Local SSD Performance](#)

Viewing default system disks

In addition to the storage for user data, Cloud Manager also purchases cloud storage for Cloud Volumes ONTAP system data (boot data, root data, core data, and NVRAM). For planning purposes, it might help for you to review these details before you deploy Cloud Volumes ONTAP.

- [View the default disks for Cloud Volumes ONTAP system data in Google Cloud](#).
- [Google Cloud docs: Resource quotas](#)

Google Cloud Compute Engine enforces quotas on resource usage so you should ensure that you haven't reached your limit before you deploy Cloud Volumes ONTAP.



The Connector also requires a system disk. [View details about the Connector's default configuration.](#)

GCP network information worksheet

When you deploy Cloud Volumes ONTAP in GCP, you need to specify details about your virtual network. You can use a worksheet to collect the information from your administrator.

Network information for a single-node system

GCP information	Your value
Region	
Zone	
VPC network	
Subnet	
Firewall policy (if using your own)	

Network information for an HA pair in multiple zones

GCP information	Your value
Region	
Zone for Node 1	
Zone for Node 2	
Zone for the mediator	
VPC-0 and subnet	
VPC-1 and subnet	
VPC-2 and subnet	
VPC-3 and subnet	
Firewall policy (if using your own)	

Network information for an HA pair in a single zone

GCP information	Your value
Region	
Zone	
VPC-0 and subnet	
VPC-1 and subnet	
VPC-2 and subnet	
VPC-3 and subnet	

GCP information	Your value
Firewall policy (if using your own)	

Choosing a write speed

Cloud Manager enables you to choose a write speed setting for Cloud Volumes ONTAP, except for high availability (HA) pairs in Google Cloud. Before you choose a write speed, you should understand the differences between the normal and high settings and risks and recommendations when using high write speed. [Learn more about write speed](#).

Choosing a volume usage profile

ONTAP includes several storage efficiency features that can reduce the total amount of storage that you need. When you create a volume in Cloud Manager, you can choose a profile that enables these features or a profile that disables them. You should learn more about these features to help you decide which profile to use.

NetApp storage efficiency features provide the following benefits:

Thin provisioning

Presents more logical storage to hosts or users than you actually have in your physical storage pool. Instead of preallocating storage space, storage space is allocated dynamically to each volume as data is written.

Deduplication

Improves efficiency by locating identical blocks of data and replacing them with references to a single shared block. This technique reduces storage capacity requirements by eliminating redundant blocks of data that reside in the same volume.

Compression

Reduces the physical capacity required to store data by compressing data within a volume on primary, secondary, and archive storage.

Networking requirements for Cloud Volumes ONTAP in GCP

Set up your Google Cloud Platform networking so Cloud Volumes ONTAP systems can operate properly. This includes networking for the Connector and Cloud Volumes ONTAP.

If you want to deploy an HA pair, you should [learn how HA pairs work in GCP](#).

Requirements for Cloud Volumes ONTAP

The following requirements must be met in GCP.

Internal load balancers

Cloud Manager automatically creates four Google Cloud internal load balancers (TCP/UDP) that manage incoming traffic to the Cloud Volumes ONTAP HA pair. No setup is required from your end. We've listed this as a requirement simply to inform you of the network traffic and to mitigate any security concerns.

One load balancer is for cluster management, one is for storage VM (SVM) management, one is for NAS traffic to node 1, and the last is for NAS traffic to node 2.

The setup for each load balancer is as follows:

- One shared private IP address
- One global health check

By default, the ports used by the health check are 63001, 63002, and 63003.

- One regional TCP backend service
- One regional UDP backend service
- One TCP forwarding rule
- One UDP forwarding rule
- Global access is disabled

Even though global access is disabled by default, enabling it post deployment is supported. We disabled it because cross region traffic will have significantly higher latencies. We wanted to ensure that you didn't have a negative experience due to accidental cross region mounts. Enabling this option is specific to your business needs.

One or multiple zones for HA pairs

You can ensure the high availability of your data by deploying an HA configuration across multiple or in a single zone. Cloud Manager will prompt you to choose multiple zones or a single zone when you create the HA pair.

- Multiple zones (recommended)

Deploying an HA configuration across three zones ensures continuous data availability if a failure occurs within a zone. Note that write performance is slightly lower compared to using a single zone, but it's minimal.

- Single zone

When deployed in a single zone, a Cloud Volumes ONTAP HA configuration uses a spread placement policy. This policy ensures that an HA configuration is protected from a single point of failure within the zone, without having to use separate zones to achieve fault isolation.

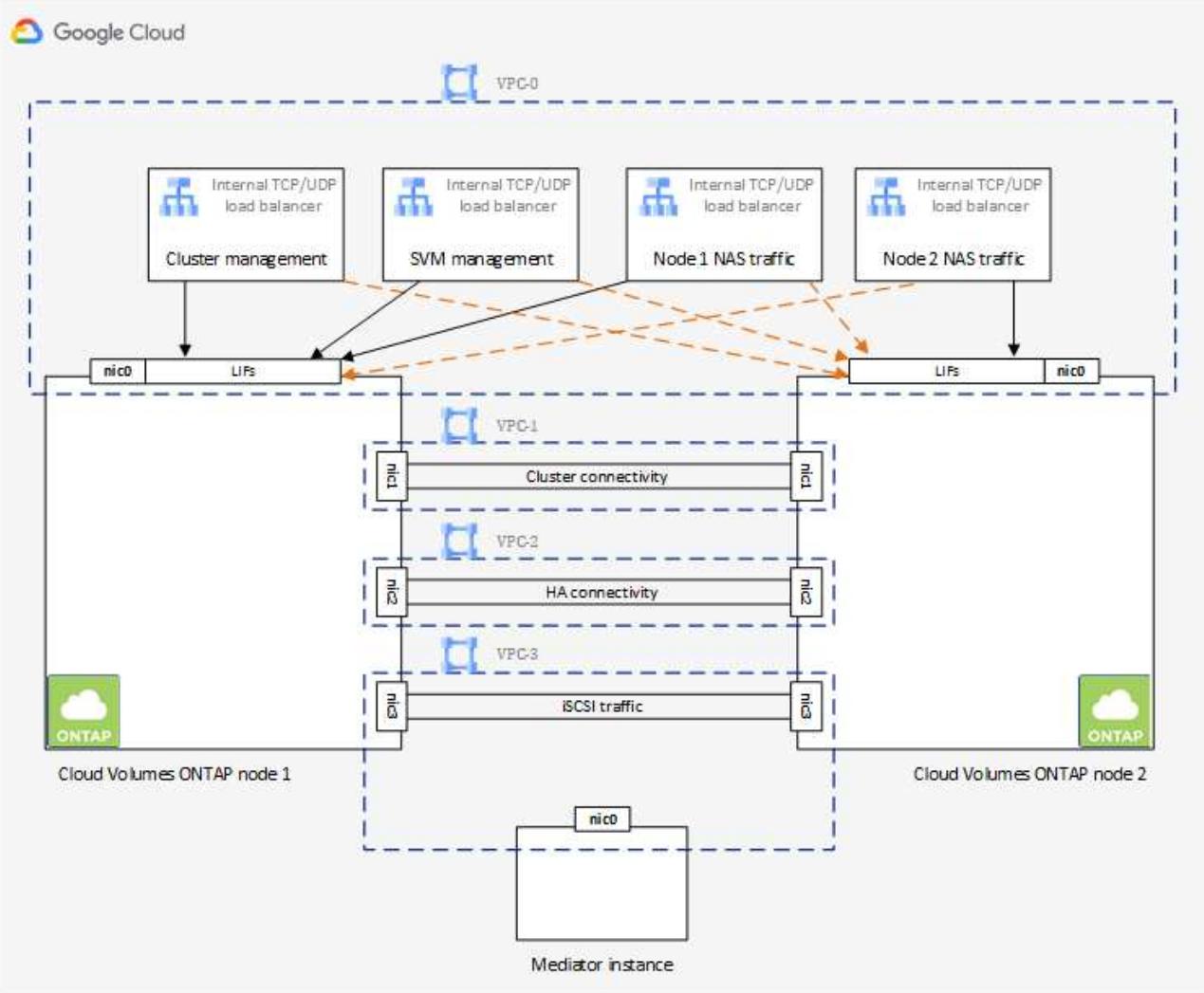
This deployment model does lower your costs because there are no data egress charges between zones.

Four Virtual Private Clouds for HA pairs

Four Virtual Private Clouds (VPCs) are required for an HA configuration. Four VPCs are required because GCP requires that each network interface resides in a separate VPC network.

Cloud Manager will prompt you to choose four VPCs when you create the HA pair:

- VPC-0 for inbound connections to the data and nodes
- VPC-1, VPC-2, and VPC-3 for internal communication between the nodes and the HA mediator



Subnets for HA pairs

A private subnet is required for each VPC.

If you place the Connector in VPC-0, then you will need to enable Private Google Access on the subnet to access the APIs and to enable data tiering.

The subnets in these VPCs must have distinct CIDR ranges. They can't have overlapping CIDR ranges.

One Virtual Private Cloud for single node systems

One VPC is required for a single node system.

Shared VPCs

Cloud Volumes ONTAP and the Connector are supported in a Google Cloud shared VPC and also in standalone VPCs.

For a single node system, the VPC can be either a shared VPC or a standalone VPC.

For an HA pair, four VPCs are required. Each of those VPCs can be either shared or standalone. For example, VPC-0 could be a shared VPC, while VPC-1, VPC-2, and VPC-3 could be standalone VPCs.

A shared VPC enables you to configure and centrally manage virtual networks across multiple projects. You can set up shared VPC networks in the *host project* and deploy the Connector and Cloud Volumes ONTAP

virtual machine instances in a *service project*. [Google Cloud documentation: Shared VPC overview](#).

The only requirement when using a shared VPC is to provide the [Compute Network User role](#) to the Connector service account. Cloud Manager needs these permissions to query the firewalls, VPC, and subnets in the host project.

Packet mirroring in VPCs

[Packet mirroring](#) must be disabled in the Google Cloud VPC in which you deploy Cloud Volumes ONTAP. Cloud Volumes ONTAP can't operate properly if packet mirroring is enabled.

Outbound internet access for Cloud Volumes ONTAP

Cloud Volumes ONTAP requires outbound internet access to send messages to NetApp AutoSupport, which proactively monitors the health of your storage.

Routing and firewall policies must allow HTTP/HTTPS traffic to the following endpoints so Cloud Volumes ONTAP can send AutoSupport messages:

- <https://support.netapp.com/aods/asupmessage>
- <https://support.netapp.com/asupprod/post/1.0/postAsup>

[Learn how to configure AutoSupport](#).



If you're using an HA pair, the HA mediator doesn't require outbound internet access.

Private IP addresses

Cloud Manager allocates the following number of private IP addresses to Cloud Volumes ONTAP in GCP:

- **Single node:** 3 or 4 private IP addresses

You can skip creation of the storage VM (SVM) management LIF if you deploy Cloud Volumes ONTAP using the API and specify the following flag:

```
skipSvmManagementLif: true
```

A LIF is an IP address associated with a physical port. A storage VM (SVM) management LIF is required for management tools like SnapCenter.

- **HA pair:** 15 or 16 private IP addresses
 - 7 or 8 private IP addresses for VPC-0

You can skip creation of the storage VM (SVM) management LIF if you deploy Cloud Volumes ONTAP using the API and specify the following flag:

```
skipSvmManagementLif: true
```

- Two private IP addresses for VPC-1
- Two private IP addresses for VPC-2
- Three private IP addresses for VPC-3

Firewall rules

You don't need to create firewall rules because Cloud Manager does that for you. If you need to use your own, refer to the firewall rules listed below.

Note that two sets of firewall rules are required for an HA configuration:

- One set of rules for HA components in VPC-0. These rules enable data access to Cloud Volumes ONTAP. [Learn more](#).
- Another set of rules for HA components in VPC-1, VPC-2, and VPC-3. These rules are open for inbound & outbound communication between the HA components. [Learn more](#).

Connection from Cloud Volumes ONTAP to Google Cloud Storage for data tiering

If you want to tier cold data to a Google Cloud Storage bucket, the subnet in which Cloud Volumes ONTAP resides must be configured for Private Google Access (if you're using an HA pair, this is the subnet in VPC-0). For instructions, refer to [Google Cloud documentation: Configuring Private Google Access](#).

For additional steps required to set up data tiering in Cloud Manager, see [Tiering cold data to low-cost object storage](#).

Connections to ONTAP systems in other networks

To replicate data between a Cloud Volumes ONTAP system in GCP and ONTAP systems in other networks, you must have a VPN connection between the VPC and the other network—for example, your corporate network.

For instructions, refer to [Google Cloud documentation: Cloud VPN overview](#).

Requirements for the Connector

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



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 VPCs in which you want to deploy Cloud Volumes ONTAP. If you're deploying an HA pair, then the Connector needs a connection to VPC-0 only.

Outbound internet access

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	To upgrade the Connector and its Docker components.
https://*.blob.core.windows.net	

Firewall rules for Cloud Volumes ONTAP

Cloud Manager creates GCP firewall rules that include the inbound and outbound rules that Cloud Volumes ONTAP needs to operate successfully. You might want to refer to the ports for testing purposes or if you prefer your own firewall rules.

The firewall rules for Cloud Volumes ONTAP require both inbound and outbound rules.

If you're deploying an HA configuration, these are the firewall rules for Cloud Volumes ONTAP in VPC-0.

Inbound rules

The source for inbound rules in the predefined firewall is 0.0.0.0/0.

To create your own firewall, ensure that you add all networks that need to communicate with Cloud Volumes ONTAP, but also ensure to add both address ranges to allow the internal Google Load Balancer to function correctly. These addresses are 130.211.0.0/22 and 35.191.0.0/16. For more information, refer to [Google Cloud documentation: Load Balancer Firewall Rules](#).

Protocol	Port	Purpose
All ICMP	All	Pinging the instance
HTTP	80	HTTP access to the System Manager web console using the IP address of the cluster management LIF
HTTPS	443	HTTPS access to the System Manager web console using the IP address of the cluster management LIF
SSH	22	SSH access to the IP address of the cluster management LIF or a node management LIF
TCP	111	Remote procedure call for NFS
TCP	139	NetBIOS service session for CIFS
TCP	161-162	Simple network management protocol
TCP	445	Microsoft SMB/CIFS over TCP with NetBIOS framing
TCP	635	NFS mount
TCP	749	Kerberos
TCP	2049	NFS server daemon
TCP	3260	iSCSI access through the iSCSI data LIF
TCP	4045	NFS lock daemon
TCP	4046	Network status monitor for NFS
TCP	10000	Backup using NDMP
TCP	11104	Management of intercluster communication sessions for SnapMirror
TCP	11105	SnapMirror data transfer using intercluster LIFs
TCP	63001-63050	Load balance probe ports to determine which node is healthy (required for HA pairs only)
UDP	111	Remote procedure call for NFS

Protocol	Port	Purpose
UDP	161-162	Simple network management protocol
UDP	635	NFS mount
UDP	2049	NFS server daemon
UDP	4045	NFS lock daemon
UDP	4046	Network status monitor for NFS
UDP	4049	NFS rquotad protocol

Outbound rules

The predefined security group for Cloud Volumes ONTAP 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 Cloud Volumes ONTAP includes the following outbound rules.

Protocol	Port	Purpose
All ICMP	All	All outbound traffic
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 Cloud Volumes ONTAP.



The source is the interface (IP address) on the Cloud Volumes ONTAP system.

Service	Protocol	Port	Source	Destination	Purpose
Active Directory	TCP	88	Node management LIF	Active Directory forest	Kerberos V authentication
	UDP	137	Node management LIF	Active Directory forest	NetBIOS name service
	UDP	138	Node management LIF	Active Directory forest	NetBIOS datagram service
	TCP	139	Node management LIF	Active Directory forest	NetBIOS service session
	TCP & UDP	389	Node management LIF	Active Directory forest	LDAP
	TCP	445	Node management LIF	Active Directory forest	Microsoft SMB/CIFS over TCP with NetBIOS framing
	TCP	464	Node management LIF	Active Directory forest	Kerberos V change & set password (SET_CHANGE)
	UDP	464	Node management LIF	Active Directory forest	Kerberos key administration
	TCP	749	Node management LIF	Active Directory forest	Kerberos V change & set Password (RPCSEC_GSS)
	TCP	88	Data LIF (NFS, CIFS, iSCSI)	Active Directory forest	Kerberos V authentication
	UDP	137	Data LIF (NFS, CIFS)	Active Directory forest	NetBIOS name service
	UDP	138	Data LIF (NFS, CIFS)	Active Directory forest	NetBIOS datagram service
	TCP	139	Data LIF (NFS, CIFS)	Active Directory forest	NetBIOS service session
	TCP & UDP	389	Data LIF (NFS, CIFS)	Active Directory forest	LDAP
	TCP	445	Data LIF (NFS, CIFS)	Active Directory forest	Microsoft SMB/CIFS over TCP with NetBIOS framing
	TCP	464	Data LIF (NFS, CIFS)	Active Directory forest	Kerberos V change & set password (SET_CHANGE)
	UDP	464	Data LIF (NFS, CIFS)	Active Directory forest	Kerberos key administration
	TCP	749	Data LIF (NFS, CIFS)	Active Directory forest	Kerberos V change & set password (RPCSEC_GSS)
AutoSupport	HTTPS	443	Node management LIF	support.netapp.com	AutoSupport (HTTPS is the default)
	HTTP	80	Node management LIF	support.netapp.com	AutoSupport (only if the transport protocol is changed from HTTPS to HTTP)

Service	Protocol	Port	Source	Destination	Purpose
Cluster	All traffic	All traffic	All LIFs on one node	All LIFs on the other node	Intercluster communications (Cloud Volumes ONTAP HA only)
UDP	68	Node management LIF	DHCP	DHCP client for first-time setup	DHCPS
UDP	67	Node management LIF	DHCP	DHCP server	DNS
UDP	53	Node management LIF and data LIF (NFS, CIFS)	DNS	DNS	NDMP
TCP	18600–18699	Node management LIF	Destination servers	NDMP copy	SMTP

Service	Protocol	Port	Source	Destination	Purpose
TCP	25	Node management LIF	Mail server	SMTP alerts, can be used for AutoSupport	SNMP
TCP	161	Node management LIF	Monitor server	Monitoring by SNMP traps	
UDP	161	Node management LIF	Monitor server	Monitoring by SNMP traps	
TCP	162	Node management LIF	Monitor server	Monitoring by SNMP traps	
UDP	162	Node management LIF	Monitor server	Monitoring by SNMP traps	SnapMirror
TCP	11104	Intercluster LIF	ONTAP intercluster LIFs	Management of intercluster communication sessions for SnapMirror	
TCP	11105	Intercluster LIF	ONTAP intercluster LIFs	SnapMirror data transfer	Syslog

Firewall rules for VPC-1, VPC-2, and VPC-3

In GCP, an HA configuration is deployed across four VPCs. The firewall rules needed for the HA configuration in VPC-0 are [listed above for Cloud Volumes ONTAP](#).

Meanwhile, the predefined firewall rules that Cloud Manager creates for instances in VPC-1, VPC-2, and VPC-3 enables ingress communication over *all* protocols and ports. These rules enable communication between HA nodes.

Communication from the HA nodes to the HA mediator takes place over port 3260 (iSCSI).

Using your own firewall rules with VPCs 1-3

When you create an HA pair, Cloud Manager gives you the option to use predefined firewall rules or to use existing rules for each VPC. If you use your own firewall rules for VPCs 1-3 and you're deploying the HA pair across multiple Google Cloud zones, then you must set up a *target tag* for the firewall rule. If you don't set up target tags, then you'll experience an error during deployment.

1. When you create the firewall rules in Google Cloud, go to the **Targets** field, select **Specified target tags**, and enter the tag.
The value can be any text string that you'd like.
2. When you create the HA pair in Cloud Manager, select the existing firewall rules on the **Connectivity** page.

After the firewall rules are attached to Cloud Volumes ONTAP, the target tag is automatically added to the Cloud Volumes ONTAP nodes as *network tags*.

Firewall rules for the Connector

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

Planning for VPC Service Controls in GCP

When choosing to lock down your Google Cloud environment with VPC Service Controls, you should understand how Cloud Manager and Cloud Volumes ONTAP interact with the Google Cloud APIs, as well as how to configure your service perimeter to deploy Cloud Manager and Cloud Volumes ONTAP.

VPC Service Controls enable you to control access to Google-managed services outside of a trusted perimeter, to block data access from untrusted locations, and to mitigate unauthorized data transfer risks. [Learn more about Google Cloud VPC Service Controls](#).

How NetApp services communicate with VPC Service Controls

NetApp services such as Cloud Central and Cloud Manager communicate directly with the Google Cloud APIs. This is either triggered from an external IP address outside of Google Cloud (for example, from api.services.cloud.netapp.com), or within Google Cloud from an internal address assigned to the Cloud Manager Connector.

Depending on the deployment style of the Connector, certain exceptions may have to be made for your service perimeter.

Images

Both Cloud Volumes ONTAP and Cloud Manager use images from a project within GCP that is managed by NetApp. This can affect the deployment of the Cloud Manager Connector and Cloud Volumes ONTAP, if your organization has a policy that blocks the use of images that are not hosted within the organization.

You can deploy a Connector manually using the manual installation method, but Cloud Volumes ONTAP will also need to pull images from the NetApp project. You must provide an allowed list in order to deploy a Connector and Cloud Volumes ONTAP.

Deploying a Connector

The user who deploys a Connector needs to be able to reference an image hosted in the projectId *netapp-cloudmanager* and the project number *14190056516*.

Deploying Cloud Volumes ONTAP

- The Cloud Manager service account needs to reference an image hosted in the projectId *netapp-cloudmanager* and the project number *14190056516* from the service project.
- The service account for the default Google APIs Service Agent needs to reference an image hosted in the projectId *netapp-cloudmanager* and the project number *14190056516* from the service project.

Examples of the rules needed for pulling these images with VPC Service Controls are defined below.

VPC Service Controls perimeter policies

Policies allow exceptions to the VPC Service Controls rule sets. For more information about policies, please visit the [GCP VPC Service Controls Policy Documentation](#).

To set the policies that Cloud Manager requires, navigate to your VPC Service Controls Perimeter within your organization and add the following policies. The fields should match the options given in the VPC Service Controls policy page. Also note that **all** rules are required and the **OR** parameters should be used in the rule set.

 Ingress rules 1 and 2 are for deploying the Cloud Manager Connector instance from Cloud Manager SaaS. These are not required for manual deployments. Ingress rule 3 and Egress rule 4 are used for all Cloud Volumes ONTAP deployment and maintenance operations and must be in place for full functionality.

Ingress rules

Rule 1

```
From:  
  Identities:  
    [User Email Address]  
  Source > All sources allowed  
To:  
  Projects =  
    [Service Project]  
  Services =  
    Service name: iam.googleapis.com  
      Service methods: All actions  
    Service name: compute.googleapis.com  
      Service methods: All actions
```

OR

Rule 2

```
From:  
  Identities:  
    [User Email Address]  
  Source > All sources allowed  
To:  
  Projects =  
    [Host Project]  
  Services =  
    Service name: compute.googleapis.com  
      Service methods: All actions
```

OR

Rule 3

```
From:  
  Identities:  
    [Service Project Number]@cloudservices.gserviceaccount.com  
  Source > All sources allowed  
To:  
  Projects =  
    [Service Project]  
    [Host Project]  
  Services =  
    Service name: compute.googleapis.com  
      Service methods: All actions
```

Egress rules

Rule 1:

```
From:  
  Identities:  
    [Service Project Number]@cloudservices.gserviceaccount.com  
    [Connector Service Account]@[Project ID].iam.gserviceaccount.com  
To:  
  Projects =  
    14190056516  
  Service =  
    Service name: compute.googleapis.com  
    Service methods: All actions
```



The project number outlined above is the project *netapp-cloudmanager* used by NetApp to store images for the Connector and for Cloud Volumes ONTAP.

Create a service account for data tiering and backups

Cloud Volumes ONTAP requires a Google Cloud service account for two purposes. The first is when you enable [data tiering](#) to tier cold data to low-cost object storage in Google Cloud. The second is when you enable the [Cloud Backup Service](#) to back up volumes to low-cost object storage.

Cloud Volumes ONTAP uses the service account to access and manage one bucket for tiered data and another bucket for backups.

You can set up one service account and use it for both purposes. The service account must have the **Storage Admin** role.

Steps

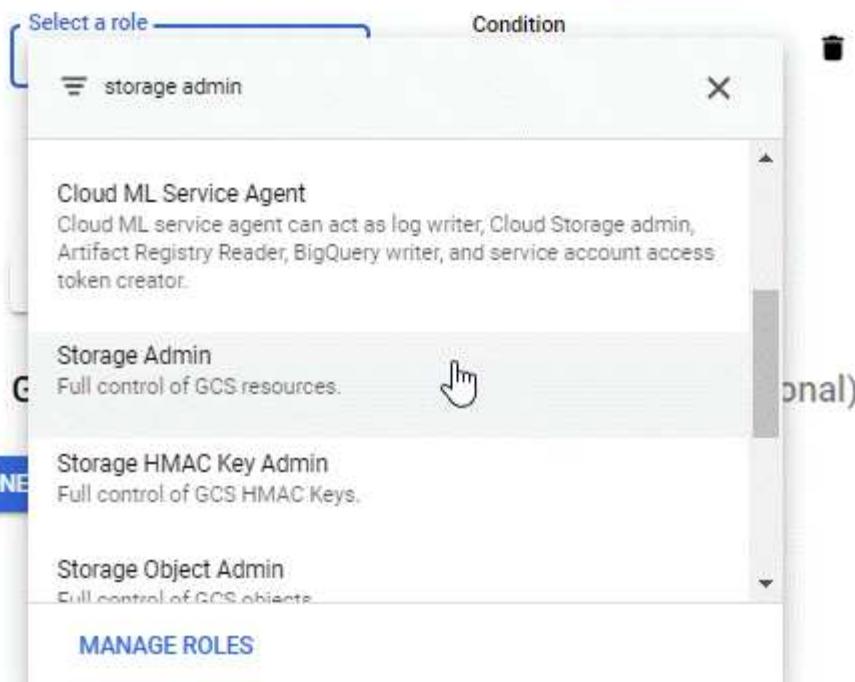
1. In the Google Cloud console, [go to the Service accounts page](#).
2. Select your project.
3. Click **Create service account** and provide the required information.
 - a. **Service account details:** Enter a name and description.
 - b. **Grant this service account access to project:** Select the **Storage Admin** role.

Create service account

Service account details

2 Grant this service account access to project (optional)

Grant this service account access to OCCM-Dev so that it has permission to complete specific actions on the resources in your project. [Learn more](#)



- c. **Grant users access to this service account:** Add the Connector service account as a *Service Account User* to this new service account.

This step is required for data tiering only. It's not required for the Cloud Backup Service.

Create service account

Service account details

Grant this service account access to project (optional)

3 Grant users access to this service account (optional)

Grant access to users or groups that need to perform actions as this service account. [Learn more](#)

Service account users role

netapp-cloud-manager@iam.gserviceaccount.com 



Grant users the permissions to deploy jobs and VMs with this service account

Service account admins role



Grant users the permission to administer this service account

DONE

CANCEL

What's next?

You'll need to select the service account later when you create a Cloud Volumes ONTAP working environment.

Details and Credentials

default-project Google Cloud Project	gcp-sub2 Marketplace Subscription	Edit Project
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>Details</p> <p>Working Environment Name (Cluster Name)</p> <input type="text" value="cloudvolumesontap"/> </div> <div style="width: 45%;"> <p>Credentials</p> <p>User Name</p> <input type="text" value="admin"/> </div> </div> <hr/> <div style="margin-top: 10px;"> <div style="display: flex; align-items: center;"> Service Account (i) <input checked="" type="checkbox"/> </div> <div style="border: 1px solid #ccc; padding: 5px; margin-top: 5px;"> Service Account Name <input type="text" value="account1"/> </div> <div style="display: flex; justify-content: space-between; width: 100%;"> + Add Labels Optional Field Up to four labels </div> </div>		

Using customer-managed encryption keys with Cloud Volumes ONTAP

While Google Cloud Storage always encrypts your data before it's written to disk, you can use the Cloud Manager API to create a Cloud Volumes ONTAP system that uses *customer-managed encryption keys*. These are keys that you generate and manage in GCP using the Cloud Key Management Service.

Steps

1. Ensure that the Cloud Manager Connector service account has the correct permissions at the project level, in the project where the key is stored.

The permissions are provided by the [Cloud Manager YAML file](#) by default, but may not be applied if you use an alternate project for the Cloud Key Management Service.

The permissions are as follows:

- ```

- cloudkms.cryptoKeyVersions.list
- cloudkms.cryptoKeys.get
- cloudkms.cryptoKeys.list
- cloudkms.keyRings.list

```

2. Ensure that the service account for the [Google Compute Engine Service Agent](#) has Cloud KMS Encrypter/Decrypter permissions on the key.

The name of the service account uses the following format: "service-[service\_project\_number]@compute-system.iam.gserviceaccount.com".

[Google Cloud Documentation: Using IAM with Cloud KMS - Granting roles on a resource](#)

3. Obtain the "id" of the key by invoking the get command for the /gcp/vsa/metadata/gcp-encryption-keys API call or by choosing "Copy Resource Name" on the key in the GCP console.
4. If using customer-managed encryption keys and tiering data to object storage, Cloud Manager attempts to utilize the same keys that are used to encrypt the persistent disks. But you'll first need to enable Google Cloud Storage buckets to use the keys:
  - a. Find the Google Cloud Storage service agent by following the [Google Cloud Documentation: Getting the Cloud Storage service agent](#).
  - b. Navigate to the encryption key and assign the Google Cloud Storage service agent with Cloud KMS Encrypter/Decrypter permissions.

For more information, refer to [Google Cloud Documentation: Using customer-managed encryption keys](#)

5. Use the "GcpEncryption" parameter with your API request when creating a working environment.

### Example

```
"gcpEncryptionParameters": {
 "key": "projects/project-1/locations/us-east4/keyRings/keyring-1/cryptoKeys/generatedkey1"
}
```

Refer to the [Cloud Manager automation docs](#) for more details about using the "GcpEncryption" parameter.

## Launching Cloud Volumes ONTAP in GCP

You can launch Cloud Volumes ONTAP in a single-node configuration or as an HA pair in Google Cloud Platform.

### Before you get started

You need the following to create a working environment.

- A Connector that's up and running.
  - You should have a [Connector that is associated with your workspace](#).
  - [You should be prepared to leave the Connector running at all times](#).
  - The service account associated with the Connector [should have the latest permissions](#).
- An understanding of the configuration that you want to use.

You should have prepared by choosing a configuration and by obtaining GCP networking information from your administrator. For details, see [Planning your Cloud Volumes ONTAP configuration](#).

- An understanding of what's required to choose a specific licensing option in the Add Working Environment wizard. [Learn more about Cloud Volumes ONTAP licensing](#).

| Licensing option                  | Requirement                                                                                                                                                                                                                                                                                                     | How to meet the requirement                                                                                                                                                                                                                                                                                                                                                                                                 |
|-----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Freemium                          | A Marketplace subscription or NetApp Support Site (NSS) account is required.                                                                                                                                                                                                                                    | You'll have the option to subscribe to your cloud provider's marketplace from the <b>Details &amp; Credentials</b> page.<br><br>You can enter your NSS account on the <b>Charging Methods and NSS Account</b> page.                                                                                                                                                                                                         |
| Professional or Essential package | A Marketplace subscription or capacity-based license (BYOL) is required.<br><br>A Marketplace subscription is recommended for capacity-based charging in the event that your account doesn't have a valid capacity-based license, or in the event that your provisioned capacity exceeds the licensed capacity. | You'll have the option to subscribe to your cloud provider's marketplace from the <b>Details &amp; Credentials</b> page.<br><br>If you want to use a capacity-based license (BYOL) that you purchased from NetApp, you must first add it to the <b>Digital Wallet</b> . <a href="#">Learn how to add capacity-based BYOL licenses</a> .                                                                                     |
| Keystone Flex Subscription        | Your account must be authorized and the subscription must be enabled for use with Cloud Volumes ONTAP.                                                                                                                                                                                                          | <ol style="list-style-type: none"> <li>1. <a href="#">Contact NetApp</a> to authorize your Cloud Manager user account with one or more Keystone Flex Subscriptions.</li> <li>2. After NetApp authorizes your account, <a href="#">link your subscriptions for use with Cloud Volumes ONTAP</a>.</li> <li>3. Select the Keystone Flex Subscription charging method when you create a Cloud Volumes ONTAP HA pair.</li> </ol> |
| Per node licensing                | A Marketplace subscription is required or you need to bring your own license (BYOL). This option is available for customers with existing subscriptions or existing licenses. It's not available for new customers.                                                                                             | If you want to use a node-based license (BYOL) that you purchased from NetApp, you must first add it to the <b>Digital Wallet</b> . <a href="#">Learn how to add node-based BYOL licenses</a> .<br><br>You can enter your NSS account on the <b>Charging Methods and NSS Account</b> page.                                                                                                                                  |

- Google Cloud APIs should be [enabled in your project](#):

- Cloud Deployment Manager V2 API
- Cloud Logging API
- Cloud Resource Manager API
- Compute Engine API
- Identity and Access Management (IAM) API

## Launching a single-node system in GCP

Create a working environment in Cloud Manager to launch Cloud Volumes ONTAP in GCP.

### Steps

1. On the Canvas page, click **Add Working Environment** and follow the prompts.
2. **Choose a Location:** Select **Google Cloud** and **Cloud Volumes ONTAP**.
3. If you're prompted, [create a Connector](#).
4. **Details & Credentials:** Select a project, specify a cluster name, optionally select a Service Account, optionally add labels, and then specify credentials.

The following table describes fields for which you might need guidance:

| Field                    | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Working Environment Name | Cloud Manager uses the working environment name to name both the Cloud Volumes ONTAP system and the GCP VM instance. It also uses the name as the prefix for the predefined security group, if you select that option.                                                                                                                                                                                                                                                                                                 |
| Service Account Name     | If you plan to use <a href="#">data tiering</a> or <a href="#">Cloud Backup</a> with Cloud Volumes ONTAP, then you need to enable <b>Service Account</b> and select a service account that has the predefined Storage Admin role. <a href="#">Learn how to create a service account</a> .                                                                                                                                                                                                                              |
| Add Labels               | <p>Labels are metadata for your GCP resources. Cloud Manager adds the labels to the Cloud Volumes ONTAP system and GCP resources associated with the system.</p> <p>You can add up to four labels from the user interface when creating a working environment, and then you can add more after its created. Note that the API does not limit you to four labels when creating a working environment.</p> <p>For information about labels, refer to <a href="#">Google Cloud Documentation: Labeling Resources</a>.</p> |
| User name and password   | These are the credentials for the Cloud Volumes ONTAP cluster administrator account. You can use these credentials to connect to Cloud Volumes ONTAP through System Manager or its CLI. Keep the default <i>admin</i> user name or change it to a custom user name.                                                                                                                                                                                                                                                    |

| Field        | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Edit Project | <p>Select the project where you want Cloud Volumes ONTAP to reside. The default project is the project where Cloud Manager resides.</p> <p>If you don't see any additional projects in the drop-down list, then you haven't yet associated the Cloud Manager service account with other projects. Go to the Google Cloud console, open the IAM service, and select the project. Add the service account with the Cloud Manager role to that project. You'll need to repeat this step for each project.</p> <p> This is the service account that you set up for Cloud Manager, <a href="#">as described on this page</a>.</p> <p>Click <b>Add Subscription</b> to associate the selected credentials with a subscription.</p> <p>To create a pay-as-you-go Cloud Volumes ONTAP system, you need to select a GCP project that's associated with a subscription to Cloud Volumes ONTAP from the GCP Marketplace.</p> |

The following video shows how to associate a pay-as-you-go Marketplace subscription to your GCP project. Alternatively, follow the steps to subscribe located in the [Associating a Marketplace subscription with GCP credentials](#) section.

► [https://docs.netapp.com/us-en/occm//media/video\\_subscribing\\_gcp.mp4](https://docs.netapp.com/us-en/occm//media/video_subscribing_gcp.mp4) (video)

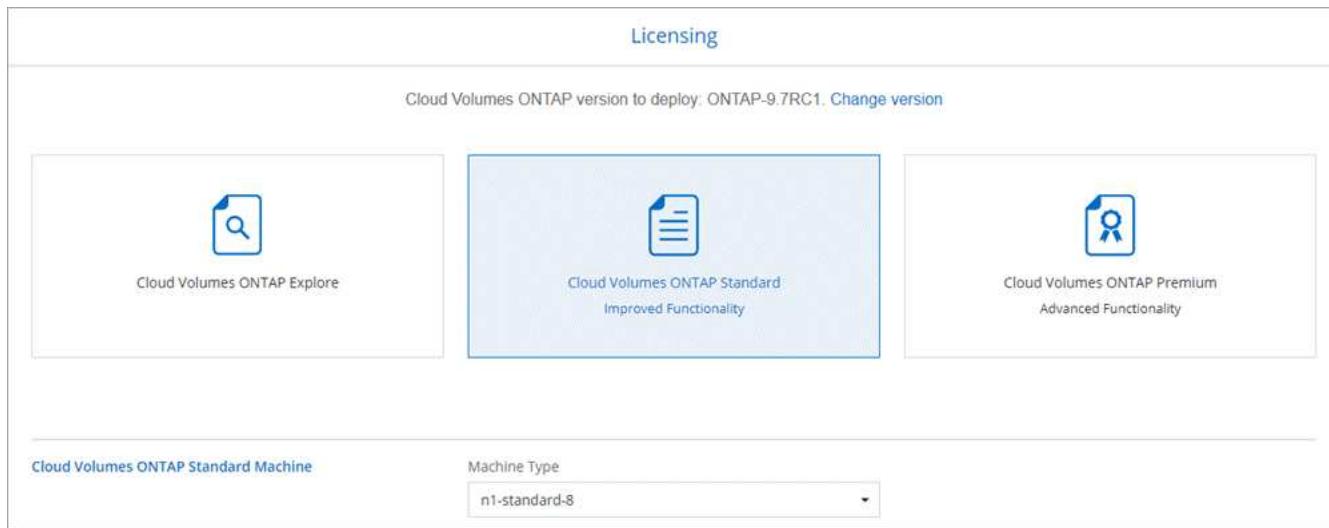
5. **Services:** Select the services that you want to use on this system. In order to select Cloud Backup, or to use Tiering, you must have specified the Service Account in step 3.
6. **Location & Connectivity:** Select a location, choose a firewall policy, and select the checkbox to confirm network connectivity to Google Cloud storage for data tiering.

If you want to tier cold data to a Google Cloud Storage bucket, the subnet in which Cloud Volumes ONTAP resides must be configured for Private Google Access. For instructions, refer to [Google Cloud Documentation: Configuring Private Google Access](#).

7. **Charging Methods and NSS Account:** Specify which charging option would you like to use with this system, and then specify a NetApp Support Site account.
  - [Learn about these charging methods](#).
  - [Learn what's required in the wizard for the licensing method that you want to use](#).
8. **Preconfigured Packages:** Select one of the packages to quickly deploy a Cloud Volumes ONTAP system, or click **Create my own configuration**.

If you choose one of the packages, you only need to specify a volume and then review and approve the configuration.

9. **Licensing:** Change the Cloud Volumes ONTAP version as needed, select a license, and select a virtual machine type.



If your needs change after you launch the system, you can modify the license or virtual machine type later.



If a newer Release Candidate, General Availability, or patch release is available for the selected version, then Cloud Manager updates the system to that version when creating the working environment. For example, the update occurs if you select Cloud Volumes ONTAP 9.6 RC1 and 9.6 GA is available. The update does not occur from one release to another—for example, from 9.6 to 9.7.

**10. Underlying Storage Resources:** Choose settings for the initial aggregate: a disk type and the size for each disk.

The disk type is for the initial volume. You can choose a different disk type for subsequent volumes.

The disk size is for all disks in the initial aggregate and for any additional aggregates that Cloud Manager creates when you use the simple provisioning option. You can create aggregates that use a different disk size by using the advanced allocation option.

For help choosing a disk type and size, see [Sizing your system in GCP](#).

**11. Write Speed & WORM:** Choose **Normal** or **High** write speed, and activate write once, read many (WORM) storage, if desired.

Choosing a write speed is supported with single node systems only.

[Learn more about write speed](#).

WORM can't be enabled if Cloud Backup was enabled or if data tiering was enabled.

[Learn more about WORM storage](#).

**12. Data Tiering in Google Cloud Platform:** Choose whether to enable data tiering on the initial aggregate, choose a storage class for the tiered data, and then either select a service account that has the predefined Storage Admin role (required for Cloud Volumes ONTAP 9.7 or later), or select a GCP account (required for Cloud Volumes ONTAP 9.6).

Note the following:

- Cloud Manager sets the service account on the Cloud Volumes ONTAP instance. This service account provides permissions for data tiering to a Google Cloud Storage bucket. Be sure to add the Connector

service account as a user of the tiering service account, otherwise, you can't select it from Cloud Manager.

- For help with adding a GCP account, see [Setting up and adding GCP accounts for data tiering with 9.6](#).
- You can choose a specific volume tiering policy when you create or edit a volume.
- If you disable data tiering, you can enable it on subsequent aggregates, but you'll need to turn off the system and add a service account from the GCP console.

[Learn more about data tiering](#).

**13. Create Volume:** Enter details for the new volume or click **Skip**.

Some of the fields in this page are self-explanatory. The following table describes fields for which you might need guidance:

| Field                                          | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Size                                           | The maximum size that you can enter largely depends on whether you enable thin provisioning, which enables you to create a volume that is bigger than the physical storage currently available to it.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Access control (for NFS only)                  | An export policy defines the clients in the subnet that can access the volume. By default, Cloud Manager enters a value that provides access to all instances in the subnet.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Permissions and Users / Groups (for CIFS only) | These fields enable you to control the level of access to a share for users and groups (also called access control lists or ACLs). You can specify local or domain Windows users or groups, or UNIX users or groups. If you specify a domain Windows user name, you must include the user's domain using the format domain\username.                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Snapshot Policy                                | A Snapshot copy policy specifies the frequency and number of automatically created NetApp Snapshot copies. A NetApp Snapshot copy is a point-in-time file system image that has no performance impact and requires minimal storage. You can choose the default policy or none. You might choose none for transient data: for example, tempdb for Microsoft SQL Server.                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Advanced options (for NFS only)                | Select an NFS version for the volume: either NFSv3 or NFSv4.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Initiator group and IQN (for iSCSI only)       | iSCSI storage targets are called LUNs (logical units) and are presented to hosts as standard block devices.<br><br>Initiator groups are tables of iSCSI host node names and control which initiators have access to which LUNs.<br><br>iSCSI targets connect to the network through standard Ethernet network adapters (NICs), TCP offload engine (TOE) cards with software initiators, converged network adapters (CNAs) or dedicated host bust adapters (HBAs) and are identified by iSCSI qualified names (IQNs).<br><br>When you create an iSCSI volume, Cloud Manager automatically creates a LUN for you. We've made it simple by creating just one LUN per volume, so there's no management involved. After you create the volume, <a href="#">use the IQN to connect to the LUN from your hosts</a> . |

The following image shows the Volume page filled out for the CIFS protocol:

The screenshot shows the 'Volume Details, Protection & Protocol' page. In the 'Protocol' section, 'CIFS' is selected. Under 'Details & Protection', the 'Volume Name' is 'vol' and the 'Size (GB)' is '250'. The 'Snapshot Policy' is set to 'default'. In the 'Protocol' section, the 'Share name' is 'vol\_share' and the 'Permissions' are 'Full Control'. The 'Users / Groups' field contains 'engineering'. A note at the bottom states 'Valid users and groups separated by a semicolon'.

14. **CIFS Setup:** If you chose the CIFS protocol, set up a CIFS server.

| Field                                     | Description                                                                                                                                                                                                                                                                              |
|-------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DNS Primary and Secondary IP Address      | The IP addresses of the DNS servers that provide name resolution for the CIFS server.<br>The listed DNS servers must contain the service location records (SRV) needed to locate the Active Directory LDAP servers and domain controllers for the domain that the CIFS server will join. |
| Active Directory Domain to join           | The FQDN of the Active Directory (AD) domain that you want the CIFS server to join.                                                                                                                                                                                                      |
| Credentials authorized to join the domain | The name and password of a Windows account with sufficient privileges to add computers to the specified Organizational Unit (OU) within the AD domain.                                                                                                                                   |
| CIFS server NetBIOS name                  | A CIFS server name that is unique in the AD domain.                                                                                                                                                                                                                                      |
| Organizational Unit                       | The organizational unit within the AD domain to associate with the CIFS server. The default is CN=Computers.                                                                                                                                                                             |
| DNS Domain                                | The DNS domain for the Cloud Volumes ONTAP storage virtual machine (SVM). In most cases, the domain is the same as the AD domain.                                                                                                                                                        |
| NTP Server                                | Select <b>Use Active Directory Domain</b> to configure an NTP server using the Active Directory DNS. If you need to configure an NTP server using a different address, then you should use the API. See the <a href="#">Cloud Manager automation docs</a> for details.                   |

15. **Usage Profile, Disk Type, and Tiering Policy:** Choose whether you want to enable storage efficiency features and change the volume tiering policy, if needed.

For more information, see [Understanding volume usage profiles](#) and [Data tiering overview](#).

16. **Review & Approve:** Review and confirm your selections.

- Review details about the configuration.

- b. Click **More information** to review details about support and the GCP resources that Cloud Manager will purchase.
- c. Select the **I understand...** check boxes.
- d. Click **Go**.

## Result

Cloud Manager deploys the Cloud Volumes ONTAP system. You can track the progress in the timeline.

If you experience any issues deploying the Cloud Volumes ONTAP system, review the failure message. You can also select the working environment and click **Re-create environment**.

For additional help, go to [NetApp Cloud Volumes ONTAP Support](#).

## After you finish

- If you provisioned a CIFS share, give users or groups permissions to the files and folders and verify that those users can access the share and create a file.
- If you want to apply quotas to volumes, use System Manager or the CLI.

Quotas enable you to restrict or track the disk space and number of files used by a user, group, or qtree.

## Launching an HA pair in GCP

Create a working environment in Cloud Manager to launch Cloud Volumes ONTAP in GCP.

### Steps

1. On the Canvas page, click **Add Working Environment** and follow the prompts.
2. **Choose a Location:** Select **Google Cloud** and **Cloud Volumes ONTAP HA**.
3. **Details & Credentials:** Select a project, specify a cluster name, optionally select a Service Account, optionally add labels, and then specify credentials.

The following table describes fields for which you might need guidance:

| Field                    | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Working Environment Name | Cloud Manager uses the working environment name to name both the Cloud Volumes ONTAP system and the GCP VM instance. It also uses the name as the prefix for the predefined security group, if you select that option.                                                                                                                                                                                                                                                                                                 |
| Service Account Name     | If you plan to use the <a href="#">Tiering</a> or <a href="#">Cloud Backup</a> services, you need to enable the <b>Service Account</b> switch and then select the Service Account that has the predefined Storage Admin role.                                                                                                                                                                                                                                                                                          |
| Add Labels               | <p>Labels are metadata for your GCP resources. Cloud Manager adds the labels to the Cloud Volumes ONTAP system and GCP resources associated with the system.</p> <p>You can add up to four labels from the user interface when creating a working environment, and then you can add more after its created. Note that the API does not limit you to four labels when creating a working environment.</p> <p>For information about labels, refer to <a href="#">Google Cloud Documentation: Labeling Resources</a>.</p> |

| Field                  | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| User name and password | <p>These are the credentials for the Cloud Volumes ONTAP cluster administrator account. You can use these credentials to connect to Cloud Volumes ONTAP through System Manager or its CLI. Keep the default <i>admin</i> user name or change it to a custom user name.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Edit Project           | <p>Select the project where you want Cloud Volumes ONTAP to reside. The default project is the project where Cloud Manager resides.</p> <p>If you don't see any additional projects in the drop-down list, then you haven't yet associated the Cloud Manager service account with other projects. Go to the Google Cloud console, open the IAM service, and select the project. Add the service account with the Cloud Manager role to that project. You'll need to repeat this step for each project.</p> <p> This is the service account that you set up for Cloud Manager, as described in step 4b on this page.</p> <p>Click <b>Add Subscription</b> to associate the selected credentials with a subscription.</p> <p>To create a pay-as-you-go Cloud Volumes ONTAP system, you need to select a GCP project that's associated with a subscription to Cloud Volumes ONTAP from the GCP Marketplace.</p> |

The following video shows how to associate a pay-as-you-go Marketplace subscription to your GCP project. Alternatively, follow the steps to subscribe located in the [Associating a Marketplace subscription with GCP credentials](#) section.

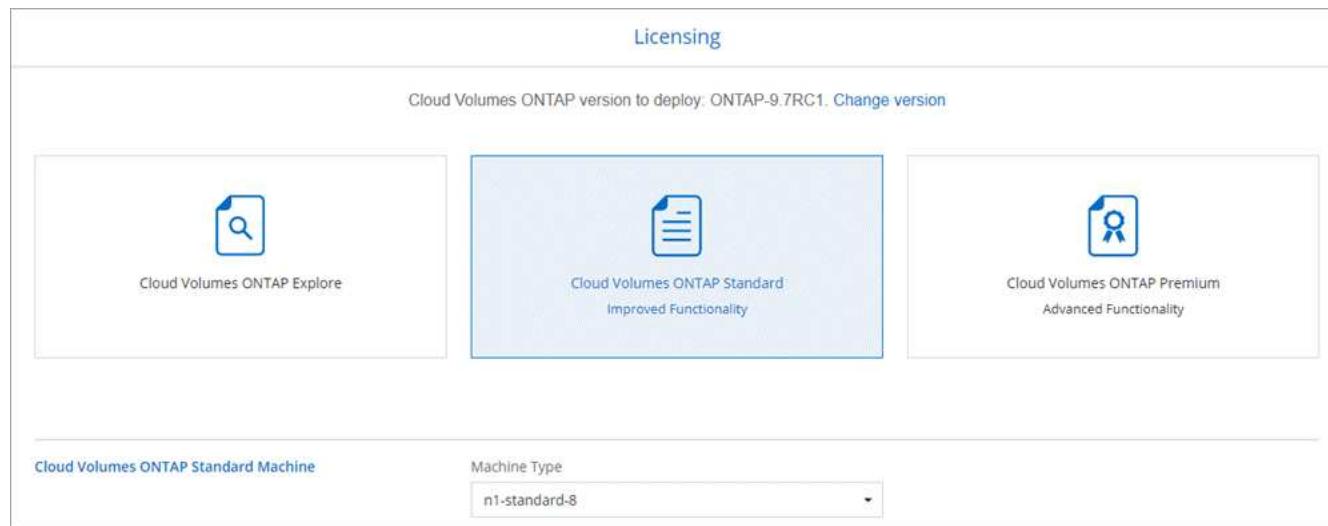
► [https://docs.netapp.com/us-en/occm//media/video\\_subscribing\\_gcp.mp4](https://docs.netapp.com/us-en/occm//media/video_subscribing_gcp.mp4) (video)

4. **Services:** Select the services that you want to use on this system. In order to select Cloud Backup, or to use Tiering, you must have specified the Service Account in step 3.
5. **HA Deployment Models:** Choose multiple zones (recommended) or a single zone for the HA configuration. Then select a region and zones.  
[Learn more about HA deployment models.](#)
6. **Connectivity:** Select four different VPCs for the HA configuration, a subnet in each VPC, and then choose a firewall policy.  
[Learn more about networking requirements.](#)
7. **Charging Methods and NSS Account:** Specify which charging option would you like to use with this system, and then specify a NetApp Support Site account.
  - [Learn about these charging methods.](#)
  - [Learn what's required in the wizard for the licensing method that you want to use.](#)
8. **Preconfigured Packages:** Select one of the packages to quickly deploy a Cloud Volumes ONTAP system, or click **Create my own configuration**.

If you choose one of the packages, you only need to specify a volume and then review and approve the

configuration.

9. **Licensing:** Change the Cloud Volumes ONTAP version as needed, select a license, and select a virtual machine type.



If your needs change after you launch the system, you can modify the license or virtual machine type later.



If a newer Release Candidate, General Availability, or patch release is available for the selected version, then Cloud Manager updates the system to that version when creating the working environment. For example, the update occurs if you select Cloud Volumes ONTAP 9.8 RC1 and 9.8 GA is available. The update does not occur from one release to another—for example, from 9.7 to 9.8.

10. **Underlying Storage Resources:** Choose settings for the initial aggregate: a disk type and the size for each disk.

The disk type is for the initial volume. You can choose a different disk type for subsequent volumes.

The disk size is for all disks in the initial aggregate and for any additional aggregates that Cloud Manager creates when you use the simple provisioning option. You can create aggregates that use a different disk size by using the advanced allocation option.

For help choosing a disk type and size, see [Sizing your system in GCP](#).

11. **WORM:** Activate write once, read many (WORM) storage, if desired.

WORM can't be enabled if data tiering was enabled. [Learn more about WORM storage](#).

12. **Data Tiering in Google Cloud Platform:** Choose whether to enable data tiering on the initial aggregate, choose a storage class for the tiered data, and then select a service account that has the predefined Storage Admin role.

Note the following:

- Cloud Manager sets the service account on the Cloud Volumes ONTAP instance. This service account provides permissions for data tiering to a Google Cloud Storage bucket. Be sure to add the Connector service account as a user of the tiering service account, otherwise, you can't select it from Cloud Manager.

- You can choose a specific volume tiering policy when you create or edit a volume.
- If you disable data tiering, you can enable it on subsequent aggregates, but you'll need to turn off the system and add a service account from the GCP console.

[Learn more about data tiering.](#)

### 13. **Create Volume:** Enter details for the new volume or click **Skip**.

Some of the fields in this page are self-explanatory. The following table describes fields for which you might need guidance:

| Field                                          | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Size                                           | The maximum size that you can enter largely depends on whether you enable thin provisioning, which enables you to create a volume that is bigger than the physical storage currently available to it.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Access control (for NFS only)                  | An export policy defines the clients in the subnet that can access the volume. By default, Cloud Manager enters a value that provides access to all instances in the subnet.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Permissions and Users / Groups (for CIFS only) | These fields enable you to control the level of access to a share for users and groups (also called access control lists or ACLs). You can specify local or domain Windows users or groups, or UNIX users or groups. If you specify a domain Windows user name, you must include the user's domain using the format domain\username.                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Snapshot Policy                                | A Snapshot copy policy specifies the frequency and number of automatically created NetApp Snapshot copies. A NetApp Snapshot copy is a point-in-time file system image that has no performance impact and requires minimal storage. You can choose the default policy or none. You might choose none for transient data: for example, tempdb for Microsoft SQL Server.                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Advanced options (for NFS only)                | Select an NFS version for the volume: either NFSv3 or NFSv4.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Initiator group and IQN (for iSCSI only)       | iSCSI storage targets are called LUNs (logical units) and are presented to hosts as standard block devices.<br><br>Initiator groups are tables of iSCSI host node names and control which initiators have access to which LUNs.<br><br>iSCSI targets connect to the network through standard Ethernet network adapters (NICs), TCP offload engine (TOE) cards with software initiators, converged network adapters (CNAs) or dedicated host bus adapters (HBAs) and are identified by iSCSI qualified names (IQNs).<br><br>When you create an iSCSI volume, Cloud Manager automatically creates a LUN for you. We've made it simple by creating just one LUN per volume, so there's no management involved. After you create the volume, <a href="#">use the IQN to connect to the LUN from your hosts</a> . |

The following image shows the Volume page filled out for the CIFS protocol:

**Volume Details, Protection & Protocol**

|                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Details &amp; Protection</b> <div style="margin-top: 10px;">         Volume Name: <input type="text" value="vol"/> Size (GB): <input type="text" value="250"/> </div> <div style="margin-top: 10px;">         Snapshot Policy: <input type="text" value="default"/> </div> <div style="margin-top: 5px;"> <span style="color: #ccc;">(i) Default Policy</span> </div> | <b>Protocol</b> <div style="margin-top: 10px;"> <span style="border-bottom: 3px solid blue; padding-bottom: 5px;">CIFS</span> NFS iSCSI       </div> <div style="margin-top: 10px;">         Share name: <input type="text" value="vol_share"/> Permissions: <input type="text" value="Full Control"/> </div> <div style="margin-top: 10px;">         Users / Groups: <input type="text" value="engineering"/> </div> <div style="font-size: small; margin-top: 5px;">Valid users and groups separated by a semicolon</div> |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

14. **CIFS Setup:** If you chose the CIFS protocol, set up a CIFS server.

| Field                                     | Description                                                                                                                                                                                                                                                                              |
|-------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DNS Primary and Secondary IP Address      | The IP addresses of the DNS servers that provide name resolution for the CIFS server.<br>The listed DNS servers must contain the service location records (SRV) needed to locate the Active Directory LDAP servers and domain controllers for the domain that the CIFS server will join. |
| Active Directory Domain to join           | The FQDN of the Active Directory (AD) domain that you want the CIFS server to join.                                                                                                                                                                                                      |
| Credentials authorized to join the domain | The name and password of a Windows account with sufficient privileges to add computers to the specified Organizational Unit (OU) within the AD domain.                                                                                                                                   |
| CIFS server NetBIOS name                  | A CIFS server name that is unique in the AD domain.                                                                                                                                                                                                                                      |
| Organizational Unit                       | The organizational unit within the AD domain to associate with the CIFS server. The default is CN=Computers.                                                                                                                                                                             |
| DNS Domain                                | The DNS domain for the Cloud Volumes ONTAP storage virtual machine (SVM). In most cases, the domain is the same as the AD domain.                                                                                                                                                        |
| NTP Server                                | Select <b>Use Active Directory Domain</b> to configure an NTP server using the Active Directory DNS. If you need to configure an NTP server using a different address, then you should use the API. See the <a href="#">Cloud Manager automation docs</a> for details.                   |

15. **Usage Profile, Disk Type, and Tiering Policy:** Choose whether you want to enable storage efficiency features and change the volume tiering policy, if needed.

For more information, see [Understanding volume usage profiles](#) and [Data tiering overview](#).

16. **Review & Approve:** Review and confirm your selections.

- a. Review details about the configuration.
- b. Click **More information** to review details about support and the GCP resources that Cloud Manager will purchase.

c. Select the **I understand...** check boxes.

d. Click **Go**.

## Result

Cloud Manager deploys the Cloud Volumes ONTAP system. You can track the progress in the timeline.

If you experience any issues deploying the Cloud Volumes ONTAP system, review the failure message. You can also select the working environment and click **Re-create environment**.

For additional help, go to [NetApp Cloud Volumes ONTAP Support](#).

## After you finish

- If you provisioned a CIFS share, give users or groups permissions to the files and folders and verify that those users can access the share and create a file.
- If you want to apply quotas to volumes, use System Manager or the CLI.

Quotas enable you to restrict or track the disk space and number of files used by a user, group, or qtree.

# Provision and manage storage

## Provision storage

You can provision additional storage for your Cloud Volumes ONTAP systems from Cloud Manager by managing volumes and aggregates.

All disks and aggregates must be created and deleted directly from Cloud Manager. You should not perform these actions from another management tool. Doing so can impact system stability, hamper the ability to add disks in the future, and potentially generate redundant cloud provider fees.

### Create FlexVol volumes

If you need more storage after you launch your initial Cloud Volumes ONTAP system, you can create new FlexVol volumes for NFS, CIFS, or iSCSI from Cloud Manager.

Cloud Manager provides several ways to create a new volume:

- Specify details for a new volume and let Cloud Manager handle the underlying data aggregates for you. [Learn more](#).
- Create a volume on a data aggregate of your choice. [Learn more](#).
- Create volume from a template to optimize the volume for the workload requirements for certain applications, such as databases or streaming services. [Learn more](#).
- Create a volume on the second node in an HA configuration. [Learn more](#).

### Before you get started

A few notes about volume provisioning:

- When you create an iSCSI volume, Cloud Manager automatically creates a LUN for you. We've made it simple by creating just one LUN per volume, so there's no management involved. After you create the

volume, [use the IQN to connect to the LUN from your hosts](#).

- You can create additional LUNs from System Manager or the CLI.
- If you want to use CIFS in AWS, you must have set up DNS and Active Directory. For details, see [Networking requirements for Cloud Volumes ONTAP for AWS](#).

## Create a volume

The most common way to create a volume is to specify the type of volume that you need and then Cloud Manager handles the disk allocation for you. But you also have the option to choose the specific aggregate on which you want to create the volume.

## Steps

1. On the Canvas page, double-click the name of the Cloud Volumes ONTAP system on which you want to provision a FlexVol volume.
2. Create a new volume by letting Cloud Manager handle the disk allocation for you, or choose a specific aggregate for the volume.

Choosing a specific aggregate is recommended only if you have a good understanding of the data aggregates on your Cloud Volumes ONTAP system.

### Any aggregate

In the Volumes tab, click **Add Volume > New volume**.

### Specific aggregate

- a. Click the menu icon, and then click **Advanced > Advanced allocation**.
- b. Click the menu for an aggregate.
- c. Click **Create volume**.

3. Follow the steps in the wizard to create the volume.

- a. **Details, Protection, and Tags:** Enter basic details about the volume and select a Snapshot policy.

Some of the fields on this page are self-explanatory. The following list describes fields for which you might need guidance:

| Field           | Description                                                                                                                                                                                                                                                                                                                                                            |
|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Volume Size     | The maximum size that you can enter largely depends on whether you enable thin provisioning, which enables you to create a volume that is bigger than the physical storage currently available to it.                                                                                                                                                                  |
| Tags            | Tags that you add to a volume are associated with the <a href="#">Application Templates service</a> , which can help you organize and simplify the management of your resources.                                                                                                                                                                                       |
| Snapshot Policy | A Snapshot copy policy specifies the frequency and number of automatically created NetApp Snapshot copies. A NetApp Snapshot copy is a point-in-time file system image that has no performance impact and requires minimal storage. You can choose the default policy or none. You might choose none for transient data: for example, tempdb for Microsoft SQL Server. |

- b. **Protocol:** Choose a protocol for the volume (NFS, CIFS, or iSCSI) and then provide the required information.

If you select CIFS and a server isn't set up, Cloud Manager prompts you to set up CIFS connectivity after you click **Next**.

The following sections describe fields for which you might need guidance. The descriptions are organized by protocol.

## NFS

### Access control

Choose a custom export policy to make the volume available to clients.

### Export policy

Defines the clients in the subnet that can access the volume. By default, Cloud Manager enters a value that provides access to all instances in the subnet.

## CIFS

### Permissions and users/groups

Enables you to control the level of access to an SMB share for users and groups (also called access control lists or ACLs). You can specify local or domain Windows users or groups, or UNIX users or groups. If you specify a domain Windows user name, you must include the user's domain using the format domain\username.

### DNS Primary and Secondary IP Address

The IP addresses of the DNS servers that provide name resolution for the CIFS server. The listed DNS servers must contain the service location records (SRV) needed to locate the Active Directory LDAP servers and domain controllers for the domain that the CIFS server will join.

### Active Directory Domain to join

The FQDN of the Active Directory (AD) domain that you want the CIFS server to join.

### Credentials authorized to join the domain

The name and password of a Windows account with sufficient privileges to add computers to the specified Organizational Unit (OU) within the AD domain.

### CIFS server NetBIOS name

A CIFS server name that is unique in the AD domain.

### Organizational Unit

The organizational unit within the AD domain to associate with the CIFS server. The default is CN=Computers.

- To configure AWS Managed Microsoft AD as the AD server for Cloud Volumes ONTAP, you should enter **OU=Computers,OU=corp** in this field.
- To configure Azure AD Domain Services as the AD server for Cloud Volumes ONTAP, you should enter **OU=AADDC Computers** or **OU=AADDC Users** in this field.  
[Azure Documentation: Create an Organizational Unit \(OU\) in an Azure AD Domain Services managed domain](#)

### DNS Domain

The DNS domain for the Cloud Volumes ONTAP storage virtual machine (SVM). In most cases, the domain is the same as the AD domain.

### NTP Server

Select **Use Active Directory Domain** to configure an NTP server using the Active Directory DNS. If you need to configure an NTP server using a different address, then you should use the API. See the [Cloud Manager automation docs](#) for details.

## iSCSI

### LUN

iSCSI storage targets are called LUNs (logical units) and are presented to hosts as standard block devices. When you create an iSCSI volume, Cloud Manager automatically creates a LUN for you. We've made it simple by creating just one LUN per volume, so there's no management involved. After you create the volume, [use the IQN to connect to the LUN from your hosts](#).

### Initiator group

Initiator groups (igroups) specify which hosts can access specified LUNs on the storage system

### Host initiator (IQN)

iSCSI targets connect to the network through standard Ethernet network adapters (NICs), TCP offload engine (TOE) cards with software initiators, converged network adapters (CNAs) or dedicated host bus adapters (HBAs) and are identified by iSCSI qualified names (IQNs).

- c. **Disk Type:** Choose an underlying disk type for the volume based on your performance needs and cost requirements.
  - [Sizing your system in AWS](#)
  - [Sizing your system in Azure](#)
  - [Sizing your system in GCP](#)
- d. **Usage Profile & Tiering Policy:** Choose whether to enable or disable storage efficiency features on the volume and then select a [volume tiering policy](#).

ONTAP includes several storage efficiency features that can reduce the total amount of storage that you need. NetApp storage efficiency features provide the following benefits:

### Thin provisioning

Presents more logical storage to hosts or users than you actually have in your physical storage pool. Instead of preallocating storage space, storage space is allocated dynamically to each volume as data is written.

### Deduplication

Improves efficiency by locating identical blocks of data and replacing them with references to a single shared block. This technique reduces storage capacity requirements by eliminating redundant blocks of data that reside in the same volume.

### Compression

Reduces the physical capacity required to store data by compressing data within a volume on primary, secondary, and archive storage.

- e. **Review:** Review details about the volume and then click **Add**.

### Result

Cloud Manager creates the volume on the Cloud Volumes ONTAP system.

### Create a volume from a template

If your organization has created Cloud Volumes ONTAP volume templates so you can deploy volumes that are optimized for the workload requirements for certain applications, follow the steps in this section.

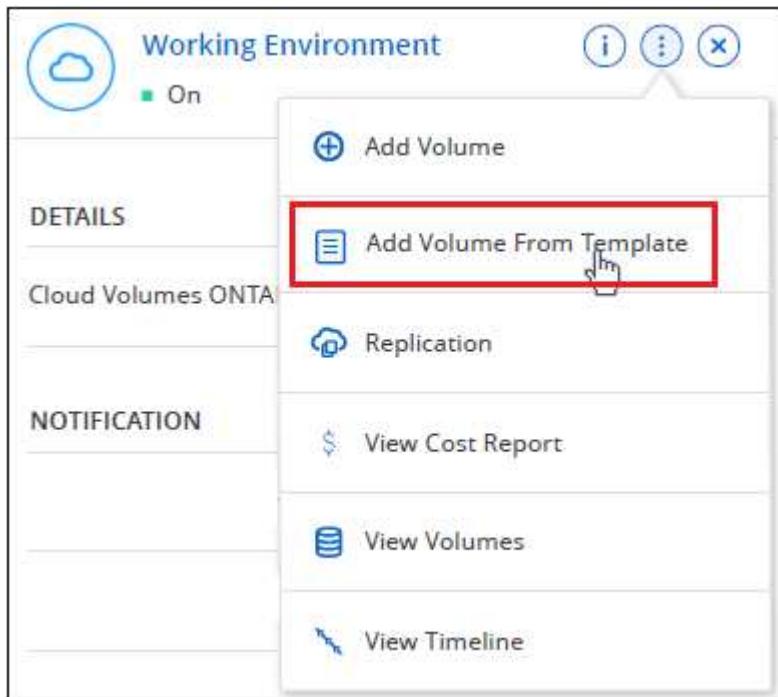
The template should make your job easier because certain volume parameters will already be defined in the template, such as disk type, size, protocol, snapshot policy, cloud provider, and more. When a parameter is already predefined, you can just skip to the next volume parameter.



You can only create NFS or CIFS volumes when using templates.

## Steps

1. On the Canvas page, click the name of the Cloud Volumes ONTAP system on which you want to provision a volume.
2. Click > Add Volume From Template.



3. In the *Select Template* page, select the template that you want to use to create the volume and click **Next**.

The screenshot shows the 'Select Template' page. At the top, there are two numbered steps: '1 Select Template' and '2 Define Parameters'. Below this is a table titled 'Select Template' with the heading '2 Templates'. The table has columns: 'Template Name', 'Template Description', 'Created by', 'Last Modified', and 'Parameters'. The first row, 'AWS CVO volume for production', has a checked checkbox in the 'Template Name' column and is highlighted with a red box. The second row, 'AWS CVO volume for staging', is also listed. At the bottom right of the table is a 'View' button.

| Template Name                 | Template Description               | Created by | Last Modified           | Parameters           |
|-------------------------------|------------------------------------|------------|-------------------------|----------------------|
| AWS CVO volume for production | High efficiency with daily backup  | Rabin      | Apr 05 2021, 1:39:30 pm | <a href="#">View</a> |
| AWS CVO volume for staging    | High efficiency with weekly backup | Rabin      | Apr 05 2021, 1:34:20 pm | <a href="#">View</a> |

The *Define Parameters* page is displayed.

**Define Parameters**

Enter your values for the actions. Parameters that are locked by the template are not editable.

**Actions**

```

graph TD
 A[Create Volume in Cloud Volumes
ONTAP (1)] --> B[Enable Cloud Backup (1)]
 style B fill:#e0f2fd

```

Show read-only parameters

**Details**

Volume Name  
Volume Name should start with "staging"

Volume Size (GB)  
Minimum value is 160, Maximum value is 185

**Protection**

Snapshot Policy  
Default

**Usage Profile**

Storage Efficiency    No Storage Efficiency

**Disk Type**

Disk Type  
GP2 - General Purpose SSD



You can click the checkbox **Show read-only parameters** to show all the fields that have been locked by the template if you want to see the values for those parameters. By default these predefined fields are hidden and only the fields you need to complete are shown.

4. In the *Context* area, the Working Environment is filled in with the name of the working environment you started with. You need to select the **Storage VM** where the volume will be created.
5. Add values for all of the parameters that are not hard-coded from the template. See [creating volumes](#) for details about all the parameters you need to complete to deploy a Cloud Volumes ONTAP volume.
6. If there are no other Actions that you need to define (for example, configuring Cloud Backup), click **Run Template**.

If there are other actions, click the action in the left pane to display the parameters you need to complete.

**Actions**

```

graph TD
 A[Create Volume in Cloud Volumes
ONTAP (1)] --> B[Enable Cloud Backup (1)]
 style B fill:#e0f2fd

```

For example, if the Enable Cloud Backup action requires that you select a backup policy, you can do that now.

7. Click **Run Template**.

## Result

Cloud Volumes ONTAP provisions the volume and displays a page so that you can see the progress.

The screenshot shows a progress bar at the top with the text "Creating your resources". Below the progress bar, a message says "This process can take a few minutes. Keep this page open to monitor progress, or you can close this page and check the Timeline later for details." Under the heading "Actions status", there are two entries: "Create Volume in Cloud Volumes ONTAP" (Status: Success) and "Enable Cloud Backup" (Status: Pending).

Additionally, if any secondary action is implemented in the template, for example, enabling Cloud Backup on the volume, that action is also performed.

### Create a volume on the second node in an HA configuration

By default, Cloud Manager creates volumes on the first node in an HA configuration. If you need an active-active configuration, in which both nodes serve data to clients, you must create aggregates and volumes on the second node.

#### Steps

1. On the Canvas page, double-click the name of the Cloud Volumes ONTAP working environment on which you want to manage aggregates.
2. Click the menu icon and then click **Advanced > Advanced allocation**.
3. Click **Add Aggregate** and then create the aggregate.
4. For Home Node, choose the second node in the HA pair.
5. After Cloud Manager creates the aggregate, select it and then click **Create volume**.
6. Enter details for the new volume, and then click **Create**.

## Result

Cloud Manager creates the volume on the second node in the HA pair.



For HA pairs deployed in multiple AWS Availability Zones, you must mount the volume to clients by using the floating IP address of the node on which the volume resides.

### After you create a volume

If you provisioned a CIFS share, give users or groups permissions to the files and folders and verify that those users can access the share and create a file.

If you want to apply quotas to volumes, you must use System Manager or the CLI. Quotas enable you to restrict or track the disk space and number of files used by a user, group, or qtree.

## Create an aggregate

You can create aggregates yourself or let Cloud Manager do it for you when it creates volumes. The benefit of creating aggregates yourself is that you can choose the underlying disk size, which enables you to size your aggregate for the capacity or the performance that you need.

### Steps

1. On the Canvas page, double-click the name of the Cloud Volumes ONTAP instance on which you want to manage aggregates.
2. Click the menu icon, and then click **Advanced > Advanced allocation**.
3. Click **Add Aggregate** and then specify details for the aggregate.

For help with disk type and disk size, see [Planning your configuration](#).

4. Click **Go**, and then click **Approve and Purchase**.

## Connect a LUN to a host

When you create an iSCSI volume, Cloud Manager automatically creates a LUN for you. We've made it simple by creating just one LUN per volume, so there's no management involved. After you create the volume, use the IQN to connect to the LUN from your hosts.

Note the following:

1. Cloud Manager's automatic capacity management doesn't apply to LUNs. When Cloud Manager creates a LUN, it disables the autogrow feature.
2. You can create additional LUNs from System Manager or the CLI.

### Steps

1. On the Canvas page, double-click the Cloud Volumes ONTAP working environment on which you want to manage volumes.
2. Select a volume, and then click **Target IQN**.
3. Click **Copy** to copy the IQN name.
4. Set up an iSCSI connection from the host to the LUN.
  - [ONTAP 9 iSCSI express configuration for Red Hat Enterprise Linux: Starting the iSCSI sessions with the target](#)
  - [ONTAP 9 iSCSI express configuration for Windows: Starting iSCSI sessions with the target](#)

## Use FlexCache volumes to accelerate data access

A FlexCache volume is a storage volume that caches NFS read data from an origin (or source) volume. Subsequent reads to the cached data result in faster access to that data.

You can use FlexCache volumes to speed up access to data or to offload traffic from heavily accessed volumes. FlexCache volumes help improve performance, especially when clients need to access the same data repeatedly, because the data can be served directly without having to access the origin volume. FlexCache volumes work well for system workloads that are read-intensive.

Cloud Manager does not provide management of FlexCache volumes at this time, but you can use the ONTAP CLI or ONTAP System Manager to create and manage FlexCache volumes:

- [FlexCache Volumes for Faster Data Access Power Guide](#)
- [Creating FlexCache volumes in System Manager](#)

Starting with the 3.7.2 release, Cloud Manager generates a FlexCache license for all new Cloud Volumes ONTAP systems. The license includes a 500 GiB usage limit.



## Managing existing storage

Cloud Manager enables you to manage volumes, aggregates, and CIFS servers. It also prompts you to move volumes to avoid capacity issues.

### Managing existing volumes

You can manage existing volumes as your storage needs change. You can view, edit, clone, restore, and delete volumes.

#### Steps

1. On the Canvas page, double-click the Cloud Volumes ONTAP working environment on which you want to manage volumes.
2. Manage your volumes:

| Task                            | Action                                        |
|---------------------------------|-----------------------------------------------|
| View information about a volume | Select a volume, and then click <b>Info</b> . |

| Task                                              | Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|---------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Edit a volume (read-write volumes only)           | <p>a. Select a volume, and then click <b>Edit</b>.</p> <p>b. Modify the volume's Snapshot policy, NFS protocol version, NFS access control list (export policy), or share permissions, and then click <b>Update</b>.</p> <p> If you need custom Snapshot policies, you can create them by using System Manager.</p>                                                                                                    |
| Clone a volume                                    | <p>a. Select a volume, and then click <b>Clone</b>.</p> <p>b. Modify the clone name as needed, and then click <b>Clone</b>.</p> <p>This process creates a FlexClone volume. A FlexClone volume is a writable, point-in-time copy that is space-efficient because it uses a small amount of space for metadata, and then only consumes additional space as data is changed or added.</p> <p>To learn more about FlexClone volumes, see the <a href="#">ONTAP 9 Logical Storage Management Guide</a>.</p> |
| Restore data from a Snapshot copy to a new volume | <p>a. Select a volume, and then click <b>Restore from Snapshot copy</b>.</p> <p>b. Select a Snapshot copy, enter a name for the new volume, and then click <b>Restore</b>.</p>                                                                                                                                                                                                                                                                                                                          |
| Create a Snapshot copy on demand                  | <p>a. Select a volume, and then click <b>Create a Snapshot copy</b>.</p> <p>b. Change the name, if needed, and then click <b>Create</b>.</p>                                                                                                                                                                                                                                                                                                                                                            |
| Get the NFS mount command                         | <p>a. Select a volume, and then click <b>Mount Command</b>.</p> <p>b. Click <b>Copy</b>.</p>                                                                                                                                                                                                                                                                                                                                                                                                            |
| View the target iQN for an iSCSI volume           | <p>a. Select a volume, and then click <b>Target iQN</b>.</p> <p>b. Click <b>Copy</b>.</p> <p>c. <a href="#">Use the IQN to connect to the LUN from your hosts</a>.</p>                                                                                                                                                                                                                                                                                                                                  |
| Change the underlying disk type                   | <p>a. Select a volume, and then click <b>Change Disk Type &amp; Tiering Policy</b>.</p> <p>b. Select the disk type, and then click <b>Change</b>.</p> <p> Cloud Manager moves the volume to an existing aggregate that uses the selected disk type or it creates a new aggregate for the volume.</p>                                                                                                                 |

| Task                      | Action                                                                                                                                                                                                                                                                                                                                                                                                                             |
|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Change the tiering policy | <p>a. Select a volume, and then click <b>Change Disk Type &amp; Tiering Policy</b>.<br/> b. Click <b>Edit Policy</b>.<br/> c. Select a different policy and click <b>Change</b>.</p> <p> Cloud Manager moves the volume to an existing aggregate that uses the selected disk type with tiering, or it creates a new aggregate for the volume.</p> |
| Delete a volume           | <p>a. Select a volume, and then click <b>Delete</b>.<br/> b. Click <b>Delete</b> again to confirm.</p>                                                                                                                                                                                                                                                                                                                             |

## Resizing a volume

By default, a volume automatically grows to a maximum size when it's out of space. The default value is 1,000, which means the volume can grow to 11 times its size. This value is configurable in a Connector's settings.

If you need to resize your volume, you can do it through [ONTAP System Manager](#). Be sure to take your system's capacity limits into consideration as you resize volumes. Go to the [Cloud Volumes ONTAP Release Notes](#) for more details.

## Managing existing aggregates

Manage aggregates yourself by adding disks, viewing information about the aggregates, and by deleting them.

### Before you begin

If you want to delete an aggregate, you must have first deleted the volumes in the aggregate.

### About this task

If an aggregate is running out of space, you can move volumes to another aggregate by using OnCommand System Manager.

### Steps

1. On the Canvas page, double-click the Cloud Volumes ONTAP working environment on which you want to manage aggregates.
2. Click the menu icon and then click **Advanced > Advanced allocation**.
3. Manage your aggregates:

| Task                                    | Action                                               |
|-----------------------------------------|------------------------------------------------------|
| View information about an aggregate     | Select an aggregate and click <b>Info</b> .          |
| Create a volume on a specific aggregate | Select an aggregate and click <b>Create volume</b> . |

| Task                      | Action                                                                                                                                                                                                                                                                                                     |
|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Add disks to an aggregate | <p>a. Select an aggregate and click <b>Add AWS disks</b> or <b>Add Azure disks</b>.</p> <p>b. Select the number of disks that you want to add and click <b>Add</b>.</p>  All disks in an aggregate must be the same size. |
| Delete an aggregate       | <p>a. Select an aggregate that does not contain any volumes and click <b>Delete</b>.</p> <p>b. Click <b>Delete</b> again to confirm.</p>                                                                                                                                                                   |

## Modifying the CIFS server

If you change your DNS servers or Active Directory domain, you need to modify the CIFS server in Cloud Volumes ONTAP so that it can continue to serve storage to clients.

### Steps

1. From the working environment, click the menu icon and then click **Advanced > CIFS setup**.
2. Specify settings for the CIFS server:

| Task                                      | Action                                                                                                                                                                                                                                                                                              |
|-------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DNS Primary and Secondary IP Address      | <p>The IP addresses of the DNS servers that provide name resolution for the CIFS server.</p> <p>The listed DNS servers must contain the service location records (SRV) needed to locate the Active Directory LDAP servers and domain controllers for the domain that the CIFS server will join.</p> |
| Active Directory Domain to join           | The FQDN of the Active Directory (AD) domain that you want the CIFS server to join.                                                                                                                                                                                                                 |
| Credentials authorized to join the domain | The name and password of a Windows account with sufficient privileges to add computers to the specified Organizational Unit (OU) within the AD domain.                                                                                                                                              |
| CIFS server NetBIOS name                  | A CIFS server name that is unique in the AD domain.                                                                                                                                                                                                                                                 |
| Organizational Unit                       | <p>The organizational unit within the AD domain to associate with the CIFS server. The default is CN=Computers.</p> <p>If you configure AWS Managed Microsoft AD as the AD server for Cloud Volumes ONTAP, you should enter <b>OU=Computers,OU=corp</b> in this field.</p>                          |
| DNS Domain                                | The DNS domain for the Cloud Volumes ONTAP storage virtual machine (SVM). In most cases, the domain is the same as the AD domain.                                                                                                                                                                   |
| NTP Server                                | Select <b>Use Active Directory Domain</b> to configure an NTP server using the Active Directory DNS. If you need to configure an NTP server using a different address, then you should use the API. See the <a href="#">Cloud Manager automation docs</a> for details.                              |

3. Click **Save**.

## Result

Cloud Volumes ONTAP updates the CIFS server with the changes.

## Moving a volume

Move volumes for capacity utilization, improved performance, and to satisfy service-level agreements.

You can move a volume in System Manager by selecting a volume and the destination aggregate, starting the volume move operation, and optionally monitoring the volume move job. When using System Manager, a volume move operation finishes automatically.

### Steps

1. Use System Manager or the CLI to move the volumes to the aggregate.

In most situations, you can use System Manager to move volumes.

For instructions, see the [ONTAP 9 Volume Move Express Guide](#).

## Moving a volume when Cloud Manager displays an Action Required message

Cloud Manager might display an Action Required message that says moving a volume is necessary to avoid capacity issues, but that you need to correct the issue yourself. If this happens, you need to identify how to correct the issue and then move one or more volumes.

 Cloud Manager displays these Action Required messages when an aggregate has reached 90% used capacity. If data tiering is enabled, the messages display when an aggregate has reached 80% used capacity. By default, 10% free space is reserved for data tiering. [Learn more about the free space ratio for data tiering](#).

### Steps

1. [Identify how to correct the issue](#).
2. Based on your analysis, move volumes to avoid capacity issues:
  - [Move volumes to another system](#).
  - [Move volumes to another aggregate on the same system](#).

## Identifying how to correct capacity issues

If Cloud Manager can't provide recommendations for moving a volume to avoid capacity issues, you must identify the volumes that you need to move and whether you should move them to another aggregate on the same system or to another system.

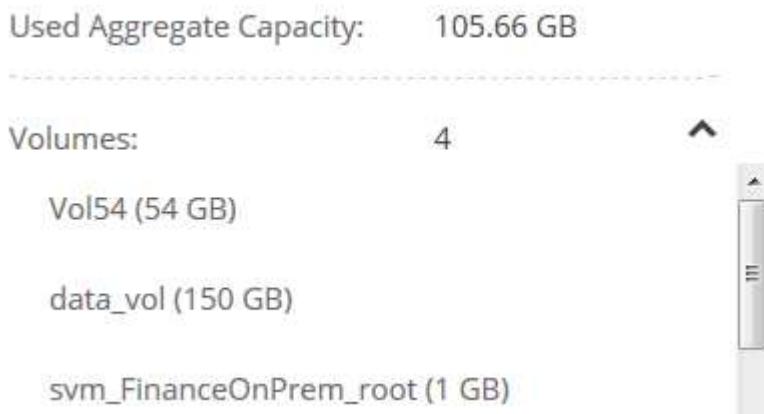
### Steps

1. View the advanced information in the Action Required message to identify the aggregate that has reached its capacity limit.

For example, the advanced information should say something similar to the following: Aggregate aggr1 has reached its capacity limit.

2. Identify one or more volumes to move out of the aggregate:

- a. In the working environment, click the menu icon, and then click **Advanced > Advanced allocation**.
- b. Select the aggregate, and then click **Info**.
- c. Expand the list of volumes.



- d. Review the size of each volume and choose one or more volumes to move out of the aggregate.

You should choose volumes that are large enough to free space in the aggregate so that you avoid additional capacity issues in the future.

3. If the system has not reached the disk limit, you should move the volumes to an existing aggregate or a new aggregate on the same system.

For details, see [Moving volumes to another aggregate to avoid capacity issues](#).

4. If the system has reached the disk limit, do any of the following:

- a. Delete any unused volumes.
- b. Rearrange volumes to free space on an aggregate.

For details, see [Moving volumes to another aggregate to avoid capacity issues](#).

- c. Move two or more volumes to another system that has space.

For details, see [Moving volumes to another system to avoid capacity issues](#).

#### **Moving volumes to another system to avoid capacity issues**

You can move one or more volumes to another Cloud Volumes ONTAP system to avoid capacity issues. You might need to do this if the system reached its disk limit.

#### **About this task**

You can follow the steps in this task to correct the following Action Required message:

Moving a volume is necessary to avoid capacity issues; however, Cloud Manager cannot perform this action for you because the system has reached the disk limit.

#### **Steps**

1. Identify a Cloud Volumes ONTAP system that has available capacity, or deploy a new system.
2. Drag and drop the source working environment on the target working environment to perform a one-time data replication of the volume.

For details, see [Replicating data between systems](#).

3. Go to the Replication Status page, and then break the SnapMirror relationship to convert the replicated volume from a data protection volume to a read/write volume.

For details, see [Managing data replication schedules and relationships](#).

4. Configure the volume for data access.

For information about configuring a destination volume for data access, see the [ONTAP 9 Volume Disaster Recovery Express Guide](#).

5. Delete the original volume.

For details, see [Managing existing volumes](#).

#### Moving volumes to another aggregate to avoid capacity issues

You can move one or more volumes to another aggregate to avoid capacity issues.

#### About this task

You can follow the steps in this task to correct the following Action Required message:

Moving two or more volumes is necessary to avoid capacity issues; however, Cloud Manager cannot perform this action for you.

#### Steps

1. Verify whether an existing aggregate has available capacity for the volumes that you need to move:
  - a. In the working environment, click the menu icon, and then click **Advanced > Advanced allocation**.
  - b. Select each aggregate, click **Info**, and then view the available capacity (aggregate capacity minus used aggregate capacity).

**aggr1**

Aggregate Capacity: 442.94 GB

Used Aggregate Capacity: 105.66 GB

2. If needed, add disks to an existing aggregate:
  - a. Select the aggregate, and then click **Add disks**.
  - b. Select the number of disks to add, and then click **Add**.

3. If no aggregates have available capacity, create a new aggregate.  
For details, see [Creating aggregates](#).
4. Use System Manager or the CLI to move the volumes to the aggregate.
5. In most situations, you can use System Manager to move volumes.

For instructions, see the [ONTAP 9 Volume Move Express Guide](#).

## Reasons why a volume move might perform slowly

Moving a volume might take longer than you expect if any of the following conditions are true for Cloud Volumes ONTAP:

- The volume is a clone.
- The volume is a parent of a clone.
- The source or destination aggregate has a single Throughput Optimized HDD (st1) disk.
- The Cloud Volumes ONTAP system is in AWS and one aggregate uses an older naming scheme for objects. Both aggregates have to use the same name format.

An older naming scheme is used if data tiering was enabled on an aggregate in the 9.4 release or earlier.

- The encryption settings don't match on the source and destination aggregates, or a rekey is in progress.
- The *-tiering-policy* option was specified on the volume move to change the tiering policy.
- The *-generate-destination-key* option was specified on the volume move.

## Tiering inactive data to low-cost object storage

You can reduce storage costs for Cloud Volumes ONTAP by combining an SSD or HDD performance tier for hot data with an object storage capacity tier for inactive data. Data tiering is powered by FabricPool technology. For a high-level overview, see [Data tiering overview](#).

To set up data tiering, you need to do the following:

1

### Choose a supported configuration

Most configurations are supported. If you have a Cloud Volumes ONTAP system running the most recent version, then you should be good to go. [Learn more](#).

2

### Ensure connectivity between Cloud Volumes ONTAP and object storage

- For AWS, you'll need a VPC Endpoint to S3. [Learn more](#).
- For Azure, you won't need to do anything as long as Cloud Manager has the required permissions. [Learn more](#).
- For GCP, you need to configure the subnet for Private Google Access and set up a service account. [Learn more](#).

**3**

### Ensure that you have an aggregate with tiering enabled

Data tiering must be enabled on an aggregate in order to enable data tiering on a volume. You should be aware of the requirements for new volumes and for existing volumes. [Learn more](#).

**4**

### Choose a tiering policy when creating, modifying, or replicating a volume

Cloud Manager prompts you to choose a tiering policy when you create, modify, or replicate a volume.

- [Tiering data on read-write volumes](#)
- [Tiering data on data protection volumes](#)

#### What's not required for data tiering?

- You don't need to install a feature license to enable data tiering.
- You don't need to create the capacity tier (an S3 bucket, Azure Blob container, or GCP bucket). Cloud Manager does that for you.
- You don't need to enable data tiering at the system level.

 Cloud Manager creates an object store for cold data when the system is created, [as long as there are no connectivity or permissions issues](#). After that, you just need to enable data tiering on volumes (and in some cases, [on aggregates](#)).

## Configurations that support data tiering

You can enable data tiering when using specific configurations and features:

- Data tiering is supported with Cloud Volumes ONTAP starting with the following versions:
  - Version 9.2 in AWS
  - Version 9.4 in Azure with single node systems
  - Version 9.6 in Azure with HA pairs
  - Version 9.6 in GCP
- In AWS, the performance tier can be General Purpose SSDs (gp3 or gp2) or Provisioned IOPS SSDs (io1).



Tiering data to object storage is not recommended when using Throughput Optimized HDDs (st1).

- In Azure, the performance tier can be Premium SSD managed disks, Standard SSD managed disks, or Standard HDD managed disks.
- In GCP, the performance tier can be either SSD persistent disks, balanced persistent disks, or standard persistent disks.
- Data tiering is supported with encryption technologies.
- Thin provisioning must be enabled on volumes.

## Requirements

Depending on your cloud provider, certain connections and permissions must be set up so that Cloud Volumes

ONTAP can tier cold data to object storage.

#### Requirements to tier cold data to AWS S3

Ensure that Cloud Volumes ONTAP has a connection to S3. The best way to provide that connection is by creating a VPC Endpoint to the S3 service. For instructions, see [AWS Documentation: Creating a Gateway Endpoint](#).

When you create the VPC Endpoint, be sure to select the region, VPC, and route table that corresponds to the Cloud Volumes ONTAP instance. You must also modify the security group to add an outbound HTTPS rule that enables traffic to the S3 endpoint. Otherwise, Cloud Volumes ONTAP cannot connect to the S3 service.

If you experience any issues, see [AWS Support Knowledge Center: Why can't I connect to an S3 bucket using a gateway VPC endpoint?](#)

#### Requirements to tier cold data to Azure Blob storage

You don't need to set up a connection between the performance tier and the capacity tier as long as Cloud Manager has the required permissions. Cloud Manager enables a VNet service endpoint for you if the Cloud Manager policy has these permissions:

```
"Microsoft.Network/virtualNetworks/subnets/write",
"Microsoft.Network/routeTables/join/action",
```

The permissions are included in the latest [Cloud Manager policy](#).

#### Requirements to tier cold data to a Google Cloud Storage bucket

- The subnet in which Cloud Volumes ONTAP resides must be configured for Private Google Access. For instructions, refer to [Google Cloud Documentation: Configuring Private Google Access](#).
- You need a service account that meets the following requirements:
  - It must have the predefined Storage Admin role.
  - The Connector service account must be a *Service Account User* of this tiering service account.

[Learn how to set up a service account](#).

- To encrypt the bucket with customer-managed encryption keys, enable the Google Cloud storage bucket to use the key.

[Learn how to use customer-managed encryption keys with Cloud Volumes ONTAP](#).

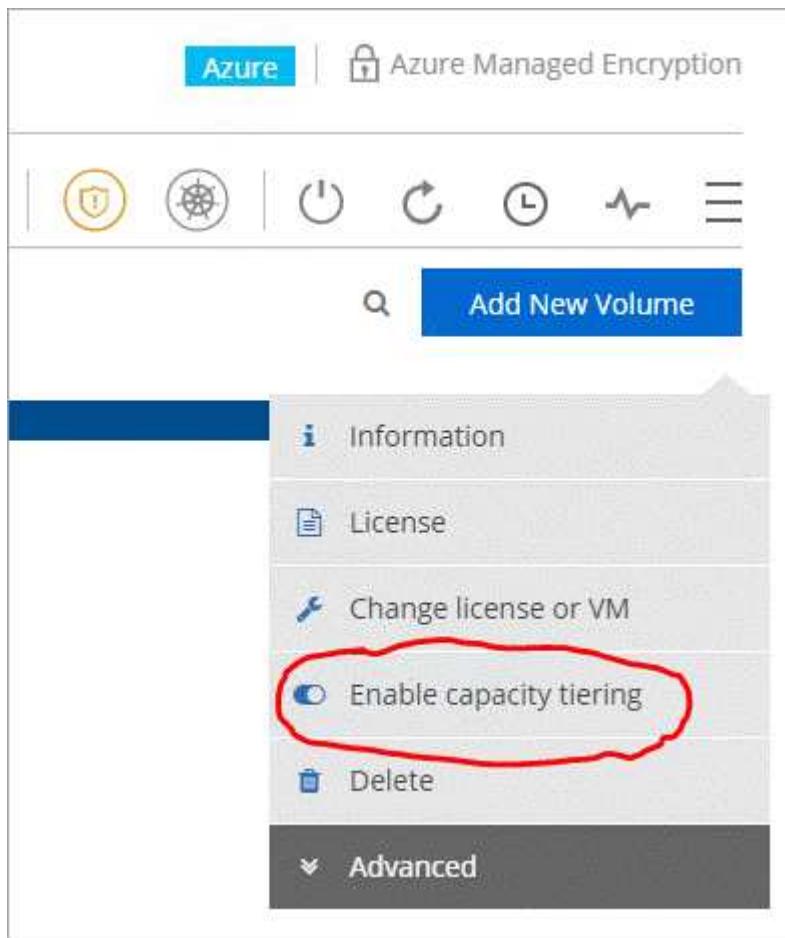
#### Enabling data tiering after implementing the requirements

Cloud Manager creates an object store for cold data when the system is created, as long as there are no connectivity or permissions issues. If you didn't implement the requirements listed above until after you created the system, then you'll need to manually enable tiering, which creates the object store.

#### Steps

1. [Ensure that you've met all requirements](#).
2. On the Canvas page, double-click the name of the Cloud Volumes ONTAP instance.

3. Click the menu icon and select **Enable capacity tiering**.



You'll only see this option if data tiering couldn't be enabled when Cloud Manager created the system.

4. Click **Enable** so Cloud Manager can create the object store that this Cloud Volumes ONTAP system will use for tiered data.

### Ensuring that tiering is enabled on aggregates

Data tiering must be enabled on an aggregate in order to enable data tiering on a volume. You should be aware of the requirements for new volumes and for existing volumes.

- **New volumes**

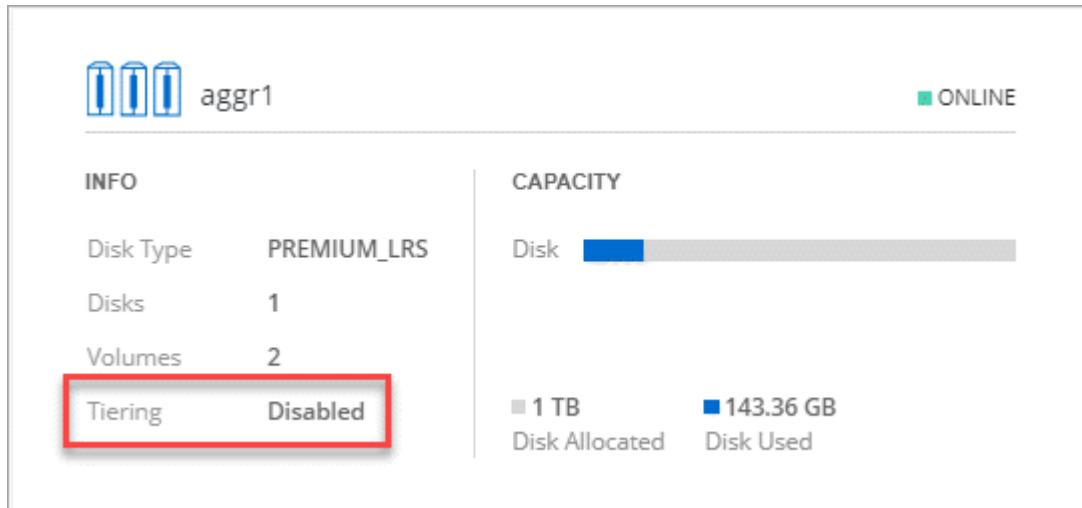
If you're enabling data tiering on a new volume, then you don't need to worry about enabling data tiering on an aggregate. Cloud Manager creates the volume on an existing aggregate that has tiering enabled, or it creates a new aggregate for the volume if a data tiering-enabled aggregate doesn't already exist.

- **Existing volumes**

If you want to enable data tiering on an existing volume, then you'll need to ensure that data tiering is enabled on the underlying aggregate. If data tiering isn't enabled on the existing aggregate, then you'll need to use System Manager to attach an existing aggregate to the object store.

### Steps to confirm whether tiering is enabled on an aggregate

1. Open the working environment in Cloud Manager.
2. Click the menu icon, click **Advanced**, and then click **Advanced allocation**.
3. Verify whether tiering is enabled or disabled on the aggregate.



#### Steps to enable tiering on an aggregate

1. In System Manager, click **Storage > Tiers**.
2. Click the action menu for the aggregate and select **Attach Cloud Tiers**.
3. Select the cloud tier to attach and click **Save**.

#### What's next?

You can now enable data tiering on new and existing volumes, as explained in the next section.

#### Tiering data from read-write volumes

Cloud Volumes ONTAP can tier inactive data on read-write volumes to cost-effective object storage, freeing up the performance tier for hot data.

#### Steps

1. In the working environment, create a new volume or change the tier of an existing volume:

| Task                      | Action                                                                     |
|---------------------------|----------------------------------------------------------------------------|
| Create a new volume       | Click <b>Add New Volume</b> .                                              |
| Modify an existing volume | Select the volume and click <b>Change Disk Type &amp; Tiering Policy</b> . |

2. Select a tiering policy.

For a description of these policies, see [Data tiering overview](#).

#### Example



## Tiering data to object storage

**i** Volume Tiering Policy

- All - Immediately tiers all data (not including metadata) to object storage.
- Auto - Tiers cold Snapshot copies and cold user data from the active file system to object storage.
- Snapshot Only - Tiers cold Snapshot copies to object storage
- None - Data tiering is disabled.

**i** Working Environment S3 Storage classes: Standard

Cloud Manager creates a new aggregate for the volume if a data tiering-enabled aggregate does not already exist.

### Tiering data from data protection volumes

Cloud Volumes ONTAP can tier data from a data protection volume to a capacity tier. If you activate the destination volume, the data gradually moves to the performance tier as it is read.

#### Steps

1. On the Canvas page, select the working environment that contains the source volume, and then drag it to the working environment to which you want to replicate the volume.
2. Follow the prompts until you reach the tiering page and enable data tiering to object storage.

#### Example



## S3 Tiering

**i** What are storage tiers?

Enabled     Disabled

**Note:** If you enable S3 tiering, thin provisioning must be enabled on volumes created in this aggregate.

For help with replicating data, see [Replicating data to and from the cloud](#).

### Changing the storage class for tiered data

After you deploy Cloud Volumes ONTAP, you can reduce your storage costs by changing the storage class for inactive data that hasn't been accessed for 30 days. The access costs are higher if you do access the data, so you must take that into consideration before you change the storage class.

The storage class for tiered data is system wide—it's not per volume.

For information about supported storage classes, see [Data tiering overview](#).

#### Steps

1. From the working environment, click the menu icon and then click **Storage Classes** or **Blob Storage Tiering**.
2. Choose a storage class and then click **Save**.

### Changing the free space ratio for data tiering

The free space ratio for data tiering defines how much free space is required on Cloud Volumes ONTAP SSDs/HDDs when tiering data to object storage. The default setting is 10% free space, but you can tweak the setting based on your requirements.

For example, you might choose less than 10% free space to ensure that you are utilizing the purchased capacity. Cloud Manager can then purchase additional disks for you when additional capacity is required (up until you reach the disk limit for the aggregate).

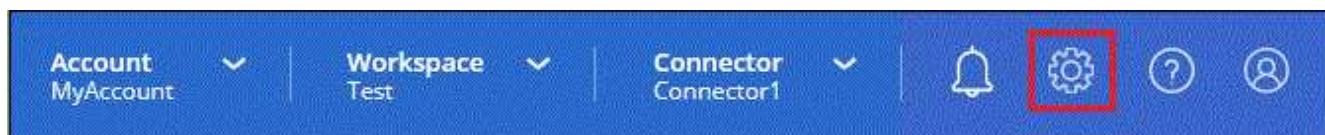


If there isn't sufficient space, then Cloud Volumes ONTAP can't move the data and you might experience performance degradation. Any change should be done with caution. If you're unsure, reach out to NetApp support for guidance.

The ratio is important for disaster recovery scenarios because as data is read from the object store, Cloud Volumes ONTAP moves the data to SSDs/HDDs to provide better performance. If there isn't sufficient space, then Cloud Volumes ONTAP can't move the data. Take this into consideration when changing the ratio so that you can meet your business requirements.

#### Steps

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



2. Under **Capacity**, click **Aggregate Capacity Thresholds - Free Space Ratio for Data Tiering**.
3. Change the free space ratio based on your requirements and click **Save**.

### Changing the cooling period for the auto tiering policy

If you enabled data tiering on a Cloud Volumes ONTAP volume using the *auto* tiering policy, you can adjust the default cooling period based on your business needs. This action is supported using the API only.

The cooling period is the number of days that user data in a volume must remain inactive before it is considered "cold" and moved to object storage.

The default cooling period for the auto tiering policy is 31 days. You can change the cooling period as follows:

- 9.8 or later: 2 days to 183 days
- 9.7 or earlier: 2 days to 63 days

#### Step

1. Use the *minimumCoolingDays* parameter with your API request when creating a volume or modifying an existing volume.

## Using Cloud Volumes ONTAP as persistent storage for Kubernetes

Cloud Manager can automate the deployment of NetApp Trident on Kubernetes clusters so you can use Cloud Volumes ONTAP as persistent storage for containers.



This feature has been deprecated and will be removed in a future release. It has been replaced with the ability to add managed-Kubernetes clusters to the Canvas as a working environment for advanced data management. [Learn more](#).

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

### Quick start

Get started quickly by following these steps or scroll down to the remaining sections for full details.

1

#### Review prerequisites

Ensure that your environment can meet the prerequisites, which includes connectivity between Kubernetes clusters and Cloud Volumes ONTAP, connectivity between Kubernetes clusters and a Connector, a minimum Kubernetes version of 1.14, at least one worker node in a cluster, and more. [See the complete list](#).

2

#### Add your Kubernetes clusters to Cloud Manager

In Cloud Manager, click **K8s** and discover clusters directly from your cloud provider's managed service or import a cluster by providing a kubeconfig file.

3

#### Connect your clusters to Cloud Volumes ONTAP

After you add a Kubernetes cluster, click **Connect to Working Environment** to connect the cluster to one or more Cloud Volumes ONTAP systems.

4

#### Start provisioning Persistent Volumes

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

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

### Reviewing prerequisites

Before you get started, ensure that your Kubernetes clusters and Connector meet specific requirements.

#### Kubernetes cluster requirements

- Network connectivity is required between a Kubernetes cluster and the Connector and between a Kubernetes cluster and Cloud Volumes ONTAP.

Both the Connector and Cloud Volumes ONTAP need a connection to the Kubernetes API endpoint:

- For managed clusters, set up a route between a cluster’s VPC and the VPC where the Connector and Cloud Volumes ONTAP reside.
- For other clusters, the IP address of the primary node or load balancer (as listed in the kubeconfig file) must be reachable by the Connector and Cloud Volumes ONTAP, and it must present a valid TLS certificate.
- A Kubernetes cluster can be in any location that has the network connectivity listed above.
- A Kubernetes cluster must be running version 1.14 at a minimum.

The maximum supported version is defined by Trident. [Click here to see the maximum supported Kubernetes version.](#)

- A Kubernetes cluster must have at least one worker node.
- For clusters running in Amazon Elastic Kubernetes Service (Amazon EKS), each cluster needs an IAM role added in order to resolve a permissions error. After you add the cluster, Cloud Manager will prompt you with the exact eksctl command that resolves the error.

[Learn about IAM permissions boundaries.](#)

- For clusters running in Azure Kubernetes Service (AKS), those clusters must be assigned the *Azure Kubernetes Service RBAC Cluster Admin* role. This is required so Cloud Manager can install Trident and configure storage classes on the cluster.

#### Connector requirements

Ensure that the following permissions are in place for the Connector.

#### Required permissions to discover and manage EKS clusters

The Connector needs Admin permissions to discover and manage Kubernetes clusters running in Amazon Elastic Kubernetes Service (EKS):

```
{
 "Version": "2012-10-17",
 "Statement": [
 {
 "Sid": "VisualEditor0",
 "Effect": "Allow",
 "Action": "eks:*",
 "Resource": "*"
 }
]
}
```

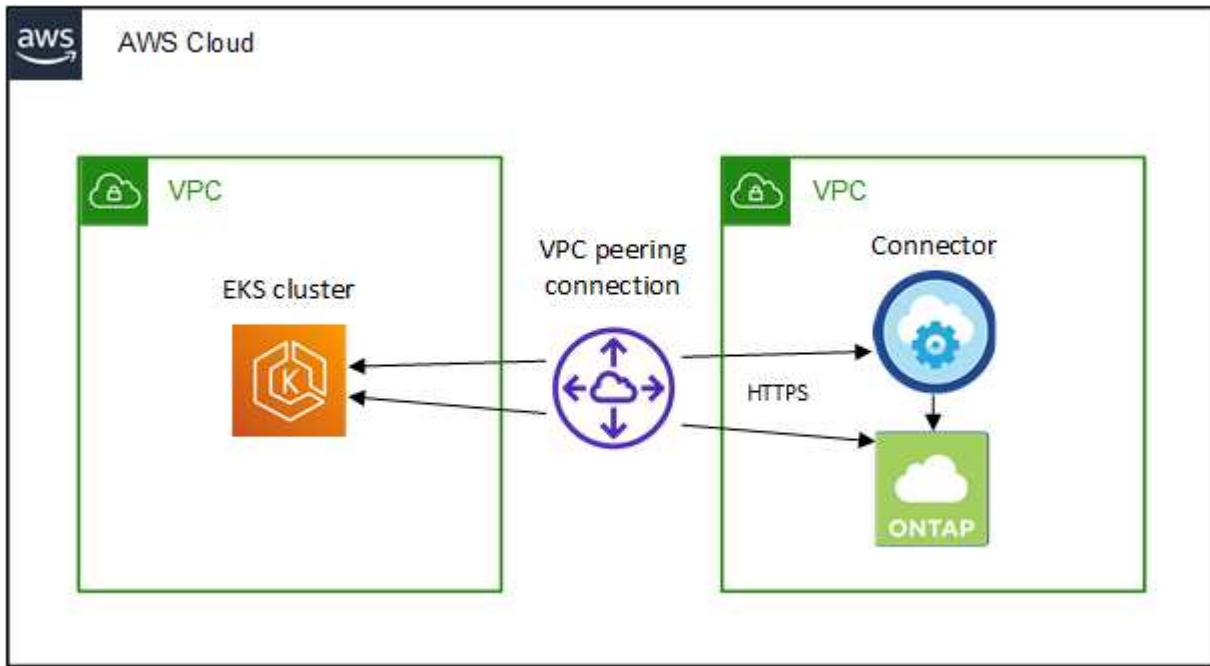
#### Required permissions to discover and manage GKE clusters

The Connector needs the following permissions to discover and manage Kubernetes clusters running in Google Kubernetes Engine (GKE):

container.\*

## Example setup

The following image shows an example of a Kubernetes cluster running in Amazon Elastic Kubernetes Service (Amazon EKS) and its connections to the Connector and Cloud Volumes ONTAP. In this example, VPC peering provides a connection between the VPC for the EKS cluster and the VPC for the Connector and Cloud Volumes ONTAP.



## Adding Kubernetes clusters

Add Kubernetes clusters to Cloud Manager by discovering the clusters running in your cloud provider's managed Kubernetes service or by importing a cluster's kubeconfig file.

### Steps

1. At the top of Cloud Manager, click **K8s**.
2. Click **Add Cluster**.
3. Choose one of the available options:
  - Click **Discover Clusters** to discover the managed clusters that Cloud Manager has access to based on permissions that you provided to the Connector.

For example, if your Connector is running in Google Cloud, Cloud Manager uses the permissions from the Connector's service account to discover clusters running in Google Kubernetes Engine (GKE).

- Click **Import Cluster** to import a cluster using a kubeconfig file.

After you upload the file, Cloud Manager verifies connectivity to the cluster and saves an encrypted copy of the kubeconfig file.

## Result

Cloud Manager adds the Kubernetes cluster. You can now connect the cluster to Cloud Volumes ONTAP.

## Connecting a cluster to Cloud Volumes ONTAP

Connect a Kubernetes cluster to Cloud Volumes ONTAP so you can use Cloud Volumes ONTAP as persistent storage for containers.

### Steps

1. At the top of Cloud Manager, click **K8s**.
2. Click **Connect to Working Environment** for the cluster that you just added.

The screenshot shows the 'Cluster List' page in Cloud Manager. At the top, there's a 'Kubernetes' icon and a 'Add Cluster' button. Below that is a 'Cluster List' navigation bar with a magnifying glass icon. The main area shows a table with one cluster entry:

| Status | Cluster Name | Added By | Version | Working Environments                           | Date Added      |
|--------|--------------|----------|---------|------------------------------------------------|-----------------|
|        | kubernetes   | Import   | v1.18.0 | <a href="#">Connect to Working Environment</a> | August 30, 2020 |

At the bottom right of the table, there's a small circular icon with a hand cursor over it. The bottom right corner of the page has the text '1-1 of 1'.

3. Select a working environment and click **Continue**.
  4. Choose the NetApp storage class to use as the default storage class for the Kubernetes cluster and click **Continue**.
- When a user creates a persistent volume, the Kubernetes cluster can use this storage class as the backend storage by default.
5. Choose whether to use default auto export policies or whether to add a custom CIDR block.

The screenshot shows a modal dialog titled 'Select Storage Class Type'. At the top, there are three tabs: 'Select' (which is active), 'Configure', and 'Confirm'. To the right of the tabs is a close button (X). The main content area has two sections: 'Working Environment Information' on the left and 'Export Policy Information' on the right.

**Working Environment Information:**

|                    |                                                                                                         |
|--------------------|---------------------------------------------------------------------------------------------------------|
| Name               | ishai0ntap4k8                                                                                           |
| Connected Clusters | None                                                                                                    |
| Region             | asia-east1                                                                                              |
| Zones              | asia-east1-a                                                                                            |
| High Availability  | Not Supported                                                                                           |
| Storage Classes    | NFS Single Node <span style="border: 1px solid blue; padding: 2px;">Default</span><br>iSCSI Single Node |

**Export Policy Information:**

If you plan to use NFS volumes you will need to set an export policy to allow connectivity between your clusters and your volumes.

Use the default auto-export policies. (Suitable for most cases.)

OR

General Network CIDR ⓘ

6. Click **Add Working Environment**.

### Result

Cloud Manager connects the working environment to the cluster, which can take up to 15 minutes.

## Managing your clusters

Cloud Manager enables you to manage your Kubernetes clusters by changing the default storage class, upgrading Trident, and more.

### Changing the default storage class

Make sure that you've set a Cloud Volumes ONTAP storage class as the default storage class so clusters use Cloud Volumes ONTAP as the backend storage.

#### Steps

1. At the top of Cloud Manager, click **K8s**.
2. Click the name of the Kubernetes cluster.
3. In the **Storage Classes** table, click the actions menu on the far right for the storage class that you'd like to set as the default.

| Storage Class ID        | Provisioner | Volumes | Labels |
|-------------------------|-------------|---------|--------|
| Gp2                     | aws         | 0       | ...    |
| NFS Single Node         | NetApp      | 0       | ...    |
| NFS High Availability   | Default     | 0       | ...    |
| iSCSI High Availability | NetApp      | 0       | ...    |
| iSCSI Single Node       | NetApp      | 0       | ...    |

4. Click **Set as Default**.

### Upgrading Trident

You can upgrade Trident from Cloud Manager when a new version is available.

#### Steps

1. At the top of Cloud Manager, click **K8s**.
2. Click the name of the Kubernetes cluster.
3. If a new version is available, click **Upgrade** next to the Trident version.

| Cluster List > Cluster Details > |         | kubernetes-baldwin |      | Connect to Working Environment |           | Remove Cluster |
|----------------------------------|---------|--------------------|------|--------------------------------|-----------|----------------|
| Status                           | Running | Cluster Version    | 1.15 | Added by                       | Discovery | Volumes        |
|                                  |         |                    |      |                                |           | 2              |

### Updating the kubeconfig file

If you added your cluster to Cloud Manager by importing the kubeconfig file, you can upload the latest kubeconfig file to Cloud Manager at any time. You might do this if you've updated the credentials, if you've changed users or roles, or if something changed that affects the cluster, user, namespaces, or authentication.

## Steps

1. At the top of Cloud Manager, click **K8s**.
2. Click the name of the Kubernetes cluster.
3. Click **Update Kubeconfig**.
4. When prompted through your web browser, select the updated kubeconfig file and click **Open**.

## Result

Cloud Manager updates information about the Kubernetes cluster based on the latest kubeconfig file.

### Disconnecting a cluster

When you disconnect a cluster from Cloud Volumes ONTAP, you can no longer use that Cloud Volumes ONTAP system as persistent storage for containers. Existing Persistent Volumes are not deleted.

## Steps

1. At the top of Cloud Manager, click **K8s**.
2. Click the name of the Kubernetes cluster.
3. In the **Working Environments** table, click the actions menu on the far right for the working environment that you want to disconnect.

The screenshot shows the 'Cluster Details' page for a Kubernetes cluster named 'kubernetes'. The 'Working Environments' table lists one entry: 'ishai0ntap4k8' (Provider: Google Cloud, Region: asia-east1, Zone: asia-east1-a, Subnet: 10.140.0.0/20, Capacity: 0.00 used of 10 TB available). A context menu is open over this row, with the 'Disconnect' option highlighted.

| Name          | Provider     | Region     | Zone         | Subnet        | Capacity                     | Actions                                       |
|---------------|--------------|------------|--------------|---------------|------------------------------|-----------------------------------------------|
| ishai0ntap4k8 | Google Cloud | asia-east1 | asia-east1-a | 10.140.0.0/20 | 0.00 used of 10 TB available | <a href="#">Disconnect</a> <a href="#">f1</a> |

4. Click **Disconnect**.

## Result

Cloud Manager disconnects the cluster from the Cloud Volumes ONTAP system.

### Removing a cluster

Remove decommissioned clusters from Cloud Manager after you disconnect all working environments from the cluster.

## Steps

1. At the top of Cloud Manager, click **K8s**.
2. Click the name of the Kubernetes cluster.

### 3. Click Remove Cluster.

The screenshot shows the Cloud Manager interface under the 'Kubernetes' tab. In the center, there's a cluster detail card for 'k8sdemo'. At the top right of this card is a blue 'Remove Cluster' button, which is highlighted with a red arrow. Below the card, there are two buttons: 'Update Kubeconfig' and 'Connect to Working Environment'.

## Encrypting volumes with NetApp encryption solutions

Cloud Volumes ONTAP supports NetApp Volume Encryption (NVE) and NetApp Aggregate Encryption (NAE). NVE and NAE are software-based solutions that enable (FIPS) 140-2-compliant data-at-rest encryption of volumes. [Learn more about these encryption solutions.](#)

Both NVE and NAE are supported with an external key manager. If you use NVE, you have the option to use Azure Key Vault (AKV) or the Google Cloud Key Management Service to protect ONTAP encryption keys.

New aggregates will have NAE enabled by default after you set up an external key manager. New volumes that aren't part of an NAE aggregate will have NVE enabled by default (for example, if you have existing aggregates that were created before setting up an external key manager).

Cloud Volumes ONTAP doesn't support onboard key management.

### What you'll need

Your Cloud Volumes ONTAP system should be registered with NetApp support. A NetApp Volume Encryption license is automatically installed on each Cloud Volumes ONTAP system that is registered with NetApp Support.

- [Adding NetApp Support Site accounts to Cloud Manager](#)
- [Registering pay-as-you-go systems](#)



Cloud Manager doesn't install the NVE license on systems that reside in the China region.

### Steps

1. Review the list of supported key managers in the [NetApp Interoperability Matrix Tool](#).



Search for the **Key Managers** solution.

2. [Connect to the Cloud Volumes ONTAP CLI](#).
3. Configure external key management.

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

# Manage storage VMs

## Manage storage VMs in Cloud Manager

A storage VM is a virtual machine running within ONTAP that provides storage and data services to your clients. You might know this as an *SVM* or a *vserver*. Cloud Volumes ONTAP is configured with one storage VM by default, but some configurations support additional storage VMs.

### Supported number of storage VMs

Multiple storage VMs are supported with Cloud Volumes ONTAP in AWS and in Azure with certain configurations. Go to the [Cloud Volumes ONTAP Release Notes](#) to verify the supported number of storage VMs for your version of Cloud Volumes ONTAP.

### Work with multiple storage VMs

Cloud Manager supports any additional storage VMs that you create from System Manager or the CLI.

For example, the following image shows how you can choose a storage VM when you create a volume.

The screenshot shows the 'Details & Protection' configuration screen for creating a new volume. It includes fields for 'Storage VM Name' (set to 'svm\_name1'), 'Volume Name' (empty), 'Size (GiB)' (empty, with a note 'Volume size'), and 'Snapshot Policy' (set to 'default'). A link 'Default Policy' is also visible.

And the following image shows how you can choose a storage VM when replicating a volume to another system.

The screenshot shows a configuration dialog with three main fields:

- Destination Volume Name:** A text input field containing "volume\_copy".
- Destination Storage VM Name:** A dropdown menu currently set to "svm\_name1".
- Destination Aggregate:** A dropdown menu currently set to "Automatically select the best aggregate".

### Modify the name of the default storage VM

Cloud Manager automatically names the single storage VM that it creates for Cloud Volumes ONTAP. You can modify the name of the storage VM if you have strict naming standards. For example, you might want the name to match how you name the storage VMs for your ONTAP clusters.

If you created any additional storage VMs for Cloud Volumes ONTAP, then you can't rename the storage VMs from Cloud Manager. You'll need to do so directly from Cloud Volumes ONTAP by using System Manager or the CLI.

#### Steps

1. From the working environment, click the menu icon, and then click **Information**.
2. Click the edit icon to the right of the storage VM name.

## Working Environment Information

### ONTAP

Serial Number:



System ID:

system-id-capacitytest

Cluster Name:

capacitytest

ONTAP Version:

9.7RC1

Date Created:

Jul 6, 2020 07:42:02 am

Storage VM Name:

svm\_capacitytest 

3. In the Modify SVM Name dialog box, change the name, and then click **Save**.

### Manage storage VMs for disaster recovery

Cloud Manager doesn't provide any setup or orchestration support for storage VM disaster recovery. You must use System Manager or the CLI.

- [SVM Disaster Recovery Preparation Express Guide](#)
- [SVM Disaster Recovery Express Guide](#)

### Create data-serving storage VMs for Cloud Volumes ONTAP in AWS

A storage VM is a virtual machine running within ONTAP that provides storage and data services to your clients. You might know this as an *SVM* or a *vserver*. Cloud Volumes ONTAP is configured with one storage VM by default, but some configurations support additional storage VMs.

To create additional data-serving storage VMs, you need to allocate IP addresses in AWS and then run ONTAP commands based on your Cloud Volumes ONTAP configuration.

### Supported number of storage VMs

Multiple storage VMs are supported with Cloud Volumes ONTAP BYOL in AWS with an add-on license, starting with the 9.7 release. Go to the [Cloud Volumes ONTAP Release Notes](#) to verify the supported number of storage VMs for your version of Cloud Volumes ONTAP.

All other Cloud Volumes ONTAP configurations support one data-serving storage VM and one destination storage VM used for disaster recovery. You can activate the destination storage VM for data access if there's

an outage on the source storage VM.

## Verify limits for your configuration

Each EC2 instance supports a maximum number of private IPv4 addresses per network interface. You need to verify the limit before you allocate IP addresses in AWS for the new storage VM.

### Steps

1. Go the [Storage limits section in the Cloud Volumes ONTAP Release Notes](#).
2. Identify the maximum number of IP addresses per interface for your instance type.
3. Make note of this number because you'll need it in the next section when you allocate IP addresses in AWS.

## Allocate IP addresses in AWS

Private IPv4 addresses must be assigned to port e0a in AWS before you create LIFs for the new storage VM.

Note that an optional management LIF for a storage VM requires a private IP address on a single node system and on an HA pair in a single AZ. This management LIF provides a connection to management tools like SnapCenter.

### Steps

1. Log in to AWS and open the EC2 service.
2. Select the Cloud Volumes ONTAP instance and click **Networking**.
- If you're creating a storage VM on an HA pair, select node 1.
3. Scroll down to **Network interfaces** and click the **Interface ID** for port e0a.

| Name               | Insta...        | Instance state | Instance type     | Status check |
|--------------------|-----------------|----------------|-------------------|--------------|
| danielleAws        | i-07...         | Running        | m5.2xlarge        | 2/2 check    |
| occmTiering0702    | i-0a7...        | Stopped        | m5.2xlarge        | -            |
| <b>cvoTiering1</b> | <b>i-02a...</b> | <b>Stopped</b> | <b>m5.2xlarge</b> | <b>-</b>     |

| Interface ID                  | Description                                                                          |
|-------------------------------|--------------------------------------------------------------------------------------|
| <a href="#">eni-07c301...</a> | Interface for Node & Cluster Management, Inter-Cluster Communication, and Data - e0a |

4. Select the network interface and click **Actions > Manage IP addresses**.
5. Expand the list of IP addresses for e0a.
6. Verify the IP addresses:
  - a. Count the number of allocated IP addresses to confirm that the port has room for additional IPs.

You should have identified the maximum number of supported IP addresses per interface in the

previous section of this page.

- b. Optional: Go to the CLI for Cloud Volumes ONTAP and run **network interface show** to confirm that each of these IP addresses are in use.

If an IP address isn't in use, then you can use it with the new storage VM.

7. Back in the AWS Console, click **Assign new IP address** to assign additional IP addresses based on the amount that you need for the new storage VM.

- Single node system: One unused secondary private IP is required.

An optional secondary private IP is required if you want to create a management LIF on the storage VM.

- HA pair in a single AZ: One unused secondary private IP is required on node 1.

An optional secondary private IP is required if you want to create a management LIF on the storage VM.

- HA pair in multiple AZs: One unused secondary private IP is required on each node.

8. If you're allocating the IP address on an HA pair in a single AZ, enable **Allow secondary private IPv4 addresses to be reassigned**.

9. Click **Save**.

10. If you have an HA pair in multiple AZs, then you'll need to repeat these steps for node 2.

### Create a storage VM on a single node system

These steps create a new storage VM on a single node system. One private IP address is required to create a NAS LIF and another optional private IP address is needed if you want to create a management LIF.

#### Steps

1. Create the storage VM and a route to the storage VM.

```
vserver create -rootvolume-security-style unix -rootvolume root_svm_2
-snapshot-policy default -vserver svm_2 -aggregate aggr1
```

```
network route create -destination 0.0.0.0/0 -vserver svm_2 -gateway
subnet_gateway
```

2. Create a NAS LIF.

```
network interface create -auto-revert true -vserver svm_2 -service
-policy default-data-files -home-port e0a -address private_ip_x -netmask
node1Mask -lif ip_nas_2 -home-node cvo-node
```

Where *private\_ip\_x* is an unused secondary private IP on e0a.

3. Optional: Create a storage VM management LIF.

```
network interface create -auto-revert true -vserver svm_2 -service
-policy default-management -home-port e0a -address private_ip_y -netmask
node1Mask -lif ip_svm_mgmt_2 -home-node cvo-node
```

Where *private\_ip\_y* is another unused secondary private IP on e0a.

### Create a storage VM on an HA pair in a single AZ

These steps create a new storage VM on an HA pair in a single AZ. One private IP address is required to create a NAS LIF and another optional private IP address is needed if you want to create a management LIF.

Both of these LIFs get allocated on node 1. The private IP addresses can move between nodes if failures occur.

#### Steps

1. Create the storage VM and a route to the storage VM.

```
vserver create -rootvolume-security-style unix -rootvolume root_svm_2
-snapshot-policy default -vserver svm_2 -aggregate aggr1
```

```
network route create -destination 0.0.0.0/0 -vserver svm_2 -gateway
subnet_gateway
```

2. Create a NAS LIF on node 1.

```
network interface create -auto-revert true -vserver svm_2 -service
-policy default-data-files -home-port e0a -address private_ip_x -netmask
node1Mask -lif ip_nas_2 -home-node cvo-node1
```

Where *private\_ip\_x* is an unused secondary private IP on e0a of cvo-node1. This IP address can be relocated to the e0a of cvo-node2 in case of takeover because the service policy default-data-files indicates that IPs can migrate to the partner node.

3. Optional: Create a storage VM management LIF on node 1.

```
network interface create -auto-revert true -vserver svm_2 -service
-policy default-management -home-port e0a -address private_ip_y -netmask
node1Mask -lif ip_svm_mgmt_2 -home-node cvo-node1
```

Where *private\_ip\_y* is another unused secondary private IP on e0a.

## Create a storage VM on an HA pair in multiple AZs

These steps create a new storage VM on an HA pair in multiple AZs.

A *floating* IP address is required for a NAS LIF and is optional for a management LIF. These floating IP addresses don't require you to allocate private IPs in AWS. Instead, the floating IPs are automatically configured in the AWS route table to point to a specific node's ENI in the same VPC.

In order for floating IPs to work with ONTAP, a private IP address must be configured on every storage VM on each node. This is reflected in the steps below where an iSCSI LIF is created on node 1 and on node 2.

### Steps

1. Create the storage VM and a route to the storage VM.

```
vserver create -rootvolume-security-style unix -rootvolume root_svm_2
-snapshot-policy default -vserver svm_2 -aggregate aggr1
```

```
network route create -destination 0.0.0.0/0 -vserver svm_2 -gateway
subnet_gateway
```

2. Create a NAS LIF on node 1.

```
network interface create -auto-revert true -vserver svm_2 -service
-policy default-data-files -home-port e0a -address floating_ip -netmask
node1Mask -lif ip_nas_floating_2 -home-node cvo-node1
```

- The floating IP address must be outside of the CIDR blocks for all VPCs in the AWS region in which you deploy the HA configuration. 192.168.209.27 is an example floating IP address. [Learn more about choosing a floating IP address](#).
- `-service-policy default-data-files` indicates that IPs can migrate to the partner node.

3. Optional: Create a storage VM management LIF on node 1.

```
network interface create -auto-revert true -vserver svm_2 -service
-policy default-management -home-port e0a -address floating_ip -netmask
node1Mask -lif ip_svm_mgmt_2 -home-node cvo-node1
```

4. Create an iSCSI LIF on node 1.

```
network interface create -vserver svm_2 -service-policy default-data-
blocks -home-port e0a -address private_ip -netmask node1Mask -lif
ip_node1_iscsi_2 -home-node cvo-node1
```

- This iSCSI LIF is required to support LIF migration of the floating IPs in the storage VM. It doesn't have

to be an iSCSI LIF, but it can't be configured to migrate between nodes.

- `-service-policy default-data-block` indicates that an IP address does not migrate between nodes.
- `private_ip` is an unused secondary private IP address on eth0 (e0a) of cvo\_node1.

## 5. Create an iSCSI LIF on node 2.

```
network interface create -vserver svm_2 -service-policy default-data-blocks -home-port e0a -address private_ip -netmaskNode2Mask -lif ip_node2_iscsi_2 -home-node cvo-node2
```

- This iSCSI LIF is required to support LIF migration of the floating IPs in the storage VM. It doesn't have to be an iSCSI LIF, but it can't be configured to migrate between nodes.
- `-service-policy default-data-block` indicates that an IP address does not migrate between nodes.
- `private_ip` is an unused secondary private IP address on eth0 (e0a) of cvo\_node2.

## Create data-serving storage VMs for Cloud Volumes ONTAP in Azure

A storage VM is a virtual machine running within ONTAP that provides storage and data services to your clients. You might know this as an *SVM* or a *vserver*. Cloud Volumes ONTAP is configured with one storage VM by default, but additional storage VMs are supported when running Cloud Volumes ONTAP in Azure.

To create additional data-serving storage VMs, you need to allocate IP addresses in Azure and then run ONTAP commands to create the storage VM and data LIFs.

### Supported number of storage VMs

Multiple storage VMs are supported with Cloud Volumes ONTAP BYOL in Azure with an add-on license starting with the 9.9.0 release. Go to the [Cloud Volumes ONTAP Release Notes](#) to verify the supported number of storage VMs for your version of Cloud Volumes ONTAP.

All other Cloud Volumes ONTAP configurations support one data-serving storage VM and one destination storage VM used for disaster recovery. You can activate the destination storage VM for data access if there's an outage on the source storage VM.

### Allocate IP addresses in Azure

Follow the steps below for your configuration: either a single node system, an HA pair using iSCSI, or an HA pair using NFS/SMB.

#### Single node

IP addresses must be assigned to nic0 in Azure before you create a storage VM and allocate LIFs.

You'll need to create an IP address for data LIF access and another optional IP address for a storage VM (SVM) management LIF. This management LIF provides a connection to management tools like SnapCenter.

#### Steps

1. Log in to the Azure portal and open the **Virtual machine** service.
2. Click the name of the Cloud Volumes ONTAP VM.
3. Click **Networking**.
4. Click the name of the network interface for nic0.
5. Under **Settings**, click **IP configurations**.
6. Click **Add**.
7. Enter a name for the IP configuration, select **Dynamic**, and then click **OK**.
8. Click the name of the IP configuration that you just created, change the **Assignment** to **Static**, and click **Save**.

It's best to use a static IP address because a static IP ensures that the IP address won't change, which can help to prevent unnecessary outages to your application.

9. If you want to create an SVM management LIF, repeat these steps on node 1.

#### After you finish

Copy the private IP addresses that you just created. You'll need to specify those IP addresses when you create LIFs for the new storage VM.

#### HA pair using iSCSI

iSCSI IP addresses must be assigned to nic0 in Azure before you create a storage VM and allocate LIFs. IPs for iSCSI are assigned to nic0 and not the load balancer because iSCSI uses ALUA for failover.

You'll need to create an IP address for data LIF access from node 1, another IP address for data LIF access from node 2, and another optional IP address for a storage VM (SVM) management LIF. This management LIF provides a connection to management tools like SnapCenter.

#### Steps

1. Log in to the Azure portal and open the **Virtual machine** service.
2. Click the name of the Cloud Volumes ONTAP VM for node 1.
3. Click **Networking**.
4. Click the name of the network interface for nic0.
5. Under **Settings**, click **IP configurations**.
6. Click **Add**.
7. Enter a name for the IP configuration, select **Dynamic**, and then click **OK**.
8. Click the name of the IP configuration that you just created, change the **Assignment** to **Static**, and click **Save**.

It's best to use a static IP address because a static IP ensures that the IP address won't change, which can help to prevent unnecessary outages to your application.

9. Repeat these steps on node 2.
10. If you want to create an SVM management LIF, repeat these steps on node 1.

#### After you finish

Copy the private IP addresses that you just created. You'll need to specify those IP addresses when you create

LIFs for the new storage VM.

#### HA pair using NFS/SMB

IP addresses that you use for NFS and SMB data are allocated in the load balancer so that the IP addresses can migrate to the other node in case failover events occur.

#### Steps

1. In the Azure portal, open the **Load balancers** service.
2. Click the name of the load balancer for the HA pair.
3. Create one frontend IP configuration for data LIF access from node 1, another for data LIF access from node 2 (HA pairs only), and another optional frontend IP for a storage VM (SVM) management LIF.
  - a. Under **Settings**, click **Frontend IP configuration**.
  - b. Click **Add**.
  - c. Enter a name for the frontend IP, select the subnet for the Cloud Volumes ONTAP HA pair, and leave **Dynamic** selected.

The screenshot shows the 'Add frontend IP address' page in the Azure portal. The URL in the address bar is 'Home > Load balancers > azureha1011s3-rg-lb > Add frontend IP address'. The page title is 'Add frontend IP address' with a '...' button. Below the title, it says 'azureha1011s3-rg-lb'. The form fields are: 'Name \*' with value 'ip-for-svm2' (highlighted with a purple border and a green checkmark icon); 'Virtual network' with value 'Default-Networking-vnet'; 'Subnet' with value 'default (172.19.2.0/24)' (highlighted with a purple border and a dropdown arrow icon); and 'Assignment' with two radio buttons: 'Dynamic' (selected, highlighted with a blue circle) and 'Static' (unselected, highlighted with a white circle). The entire form is enclosed in a light gray box.

- d. Click the name of the frontend IP configuration that you just created, change the **Assignment** to **Static**, and click **Save**.

It's best to use a static IP address because a static IP ensures that the IP address won't change, which can help to prevent unnecessary outages to your application.

4. Add a health probe for each frontend IP that you just created.
  - a. Under the load balancer's **Settings**, click **Health probes**.
  - b. Click **Add**.
  - c. Enter a name for the health probe and enter a port number that's between 63005 and 65000. Keep the default values for the other fields.

It's important that the port number is between 63005 and 65000. For example, if you are creating three health probes, you could enter probes that use the port numbers 63005, 63006, and 63007.

Microsoft Azure

Search resources, services, and

Home > Load balancers > azureha1011s3-rg-lb >

## Add health probe

azureha1011s3-rg-lb

|                       |                    |                      |
|-----------------------|--------------------|----------------------|
| Name *                | svm2-health-probe1 | ✓                    |
| Protocol *            | TCP                | ▼                    |
| Port *                | 63005              | ✓                    |
| Interval *            | 5                  | seconds              |
| Unhealthy threshold * | 2                  | consecutive failures |
| Used by               | Not used           |                      |

5. Create new load balancing rules for each frontend IP.

- Under the load balancer's **Settings**, click **Load balancing rules**.
- Click **Add** and enter the required information:
  - Name:** Enter a name for the rule.
  - IP Version:** Select **IPv4**.
  - Frontend IP address:** Select one of the frontend IP addresses that you just created.
  - HA Ports:** Enable this option.
  - Backend pool:** Keep the default Backend pool that was already selected.
  - Health probe:** Select the health probe that you created for the selected frontend IP.
  - Session persistence:** Select **None**.
  - Floating IP:** Select **Enabled**.

## Add load balancing rule

chandanaTcPRst3-rg-lb

A load balancing rule distributes incoming traffic that is sent to a selected IP address and port combination across a group of backend pool instances. Only backend instances that the health probe considers healthy receive new traffic.

Name \*

jimmy\_new\_rule

IP Version \*

IPv4  IPv6

Frontend IP address \*

10.1.0.156 (dataAFIP)

HA Ports

Backend pool

backendPool (2 virtual machines)

Health probe

dataAProbe (TCP:63002)

Session persistence

None

Floating IP

Disabled  Enabled

### After you finish

Ensure that the network security group rules for Cloud Volumes ONTAP allows the load balancer to send TCP probes for the health probes that were created in step 4 above. Note that this is allowed by default.

### Create a storage VM and LIFs

These steps create a new storage VM on a single node system or on an HA pair. One IP address is required for data LIF access from node 1, another IP address for data LIF access from node 2 (HA pairs only), and another optional IP address for a storage VM (SVM) management LIF. This management LIF provides a connection to management tools like SnapCenter.

Use the commands below that match the data access protocol for the storage VM, which is either NAS or iSCSI.

#### Steps

1. Create the storage VM and a route to the storage VM.

```
vserver create -vserver <svm-name> -subtype default -rootvolume <root-volume-name> -rootvolume-security-style unix
```

```
network route create -destination 0.0.0.0/0 -vserver <svm-name> -gateway <ip-of-gateway-server>
```

2. Create data LIFs:

- Use the following command to create a NAS LIF on node 1.

```
network interface create -vserver <svm-name> -lif <lif-name> -role data -data-protocol cifs,nfs -address <nfs-ip-address> -netmask <length> -length <length> -home-node <name-of-node1> -status-admin up -failover-policy system-defined -firewall-policy data -home-port e0a -auto-revert true -failover-group Default -probe-port <port-number-for-azure-health-probe1>
```

If this is a single node system, then you should change the value of the `-failover-policy` parameter to *disabled*.

- Use the following command to create a NAS LIF on node 2 (for HA pairs only).

```
network interface create -vserver <svm-name> -lif <lif-name> -role data -data-protocol cifs,nfs -address <nfs-cifs-ip-address> -netmask <length> -length <length> -home-node <name-of-node2> -status-admin up -failover-policy system-defined -firewall-policy data -home-port e0a -auto-revert true -failover-group Default -probe-port <port-number-for-azure-health-probe2>
```

- Use the following command to create an iSCSI LIF on node 1.

```
network interface create -vserver <svm-name> -home-port e0a -address <iscsi-ip-address> -lif <lif-name> -home-node <name-of-node1> -data-protocol iscsi
```

- Use the following command to create an iSCSI LIF on node 2 (for HA pairs only).

```
network interface create -vserver <svm-name> -home-port e0a -address <iscsi-ip-address> -lif <lif-name> -home-node <name-of-node2> -data-protocol iscsi
```

3. Optional: Create a storage VM management LIF on node 1.

```
network interface create -vserver <svm-name> -lif <lif-name> -role data
-data-protocol none -address <svm-mgmt-ip-address> -netmask-length
<length> -home-node node1 -status-admin up -failover-policy system-
defined -firewall-policy mgmt -home-port e0a -auto-revert false
-failover-group Default -probe-port <port-number-for-azure-health-
probe3>
```

## What's next?

After you create a storage VM on an HA pair, it's best to wait 12 hours before you provision storage on that SVM. Starting with the Cloud Volumes ONTAP 9.10.1 release, Cloud Manager scans the settings for an HA pair's load balancer at a 12-hour interval. If there are new SVMs, Cloud Manager will enable a setting that provides shorter unplanned failover.

# Monitor performance

## Learn about the Monitoring service

The Monitoring service gives you insights into the health and performance of your Cloud Volumes ONTAP instances and helps you troubleshoot and optimize the performance of your cloud storage environment.

### Features

- Automatically monitor all volumes
- View volume performance data in terms of IOPS, throughput, and latency
- Identify performance issues to minimize impact on your users and apps

### Supported cloud providers

The Monitoring service is supported with Cloud Volumes ONTAP for AWS and Cloud Volumes ONTAP for Azure.

### Cost

NetApp doesn't charge you for using the Monitoring service, but Cloud Manager launches a virtual machine in your VPC to facilitate monitoring. This VM results in charges from your cloud provider.

### How the Monitoring service works

Cloud Manager leverages [NetApp's Cloud Insights service](#) to provide monitoring.

At a high-level, Cloud Insights integration with Cloud Manager works like this:

1. You enable the Monitoring service on Cloud Volumes ONTAP.
2. Cloud Manager configures your environment. It does the following:
  - a. Creates a Cloud Insights tenant (also called *environment*) and associates all users in your NetApp account to the tenant.

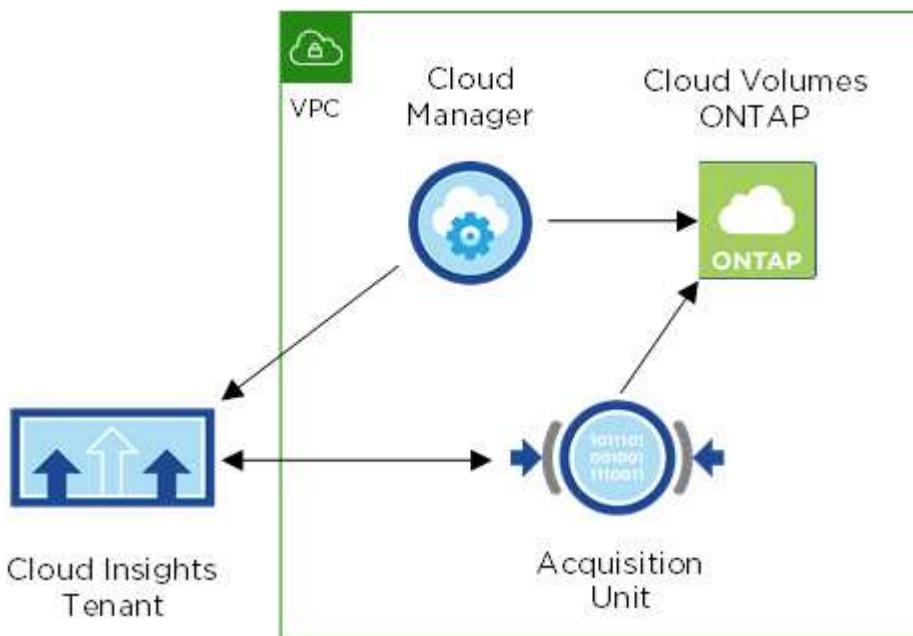
If you already have a tenant, then Cloud Manager uses that existing tenant.

- b. Enables a free trial of Cloud Insights.

On the 29th day, your plan automatically transitions from the Trial Version to the [Basic Edition](#).

- c. Deploys a virtual machine in your VPC/VNet called an Acquisition Unit. The Acquisition Unit facilitates monitoring of volumes (this is the VM mentioned in the Cost section above).
  - d. Connects the Acquisition Unit to Cloud Volumes ONTAP and to the Cloud Insights tenant.
3. In Cloud Manager, you click Monitoring and use the performance data to troubleshoot and optimize performance.

The following image shows the relationship between these components in an AWS VPC:



#### The Acquisition Unit

When you enable Monitoring, Cloud Manager deploys an Acquisition Unit in the same subnet as the Connector.

An *Acquisition Unit* collects performance data from Cloud Volumes ONTAP and sends it to the Cloud Insights tenant. Cloud Manager then queries that data and presents it to you.

Note the following about the Acquisition Unit instance:

- In AWS, the Acquisition Unit runs on a t3.xlarge instance with a 100 GiB GP2 volume.
- In Azure, the Acquisition Unit runs on a D4\_v3 virtual machine with a 30 GiB Standard SSD.
- The instance is named *CloudInsights-AU* with a generated hash (UUID) concatenated to it. For example: *CloudInsights-AU-FAN7FqeH*
- Only one Acquisition Unit is deployed per Connector.
- The instance must be running to access performance information in the Monitoring tab.

## Cloud Insights tenant

If you don't already have a *tenant*, Cloud Manager sets one up for you when you enable Monitoring. A Cloud Insights tenant enables you to access the performance data that the Acquisition Unit collects. The tenant is a secure data partition within the NetApp Cloud Insights service.

## Cloud Insights web interface

The Monitoring tab in Cloud Manager provides basic performance data for your volumes. You can go to the Cloud Insights web interface from your browser to perform more in-depth monitoring and to configure alerts for your Cloud Volumes ONTAP systems.

## Free trial and subscription

Cloud Manager enables a free trial of Cloud Insights to provide performance data within Cloud Manager and for you to explore the features that Cloud Insights Standard Edition has to offer.

On the 29th day, your plan automatically transitions from the Trial Version to the [Basic Edition](#).

You have the option to subscribe to the Standard or Premium editions to gain access to additional features from the Cloud Insights web interface.

[Learn how to subscribe to Cloud Insights.](#)

## Monitoring Cloud Volumes ONTAP

Complete a few steps to start monitoring Cloud Volumes ONTAP performance.

### Quick start

Get started quickly by following these steps or scroll down to the remaining sections for full details.

1

#### Verify support for your configuration

- You need a Cloud Volumes ONTAP system running in AWS or Azure.
- For AWS, you need a Connector running version 3.8.4 or later.
- For Azure, you need a Connector running version 3.9.3 or later.

2

#### Enable Monitoring on your new or existing system

- New working environments: Be sure to keep Monitoring enabled when you create the working environment (it's enabled by default).
- Existing working environments: Select a working environment and click **Start Monitoring**.

3

#### View performance data

Click **Monitoring** and view performance data for your volumes.

## Requirements

Read the following requirements to make sure that you have a supported configuration.

### Supported Cloud Volumes ONTAP versions

Any version of Cloud Volumes ONTAP in AWS or in Azure.

### Supported Connector

- For AWS, you need a Connector running version 3.8.4 or later.
- For Azure, you need a Connector running version 3.9.3 or later.



You can view a Connector's version by clicking the icon and then **Support > Connector**.

### Email address for Cloud Central

The email address for your Cloud Central user account should be your business email address. Free email domains like gmail and hotmail aren't supported when creating a Cloud Insights tenant.

### Networking for the Acquisition Unit

The Acquisition Unit uses 2-way/mutual authentication to connect to the Cloud Insights server. The client certificate must be passed to the Cloud Insights server to be authenticated. To accomplish this, the proxy must be set up to forward the http request to the Cloud Insights server without decrypting the data.

The Acquisition Unit uses the following two endpoints to communicate with Cloud Insights. If you have a firewall between the Acquisition Unit server and Cloud Insights, you need these endpoints when configuring firewall rules:

```
https://aulogin.<Cloud Insights Domain>
https://<your-tenant-ID>.<Cloud Insights Domain>
```

For example:

```
https://aulogin.c01.cloudinsights.netapp.com
https://cg0c586a-ee05-45rb-a5ac-
333b5ae7718d7.c01.cloudinsights.netapp.com
```

Contact us through the in-product chat if you need help identifying your Cloud Insights domain and tenant ID.

### Networking for the Connector

Similar to the Acquisition Unit, the Connector must have outbound connectivity to the Cloud Insights tenant. But the endpoint that the Connector contacts is slightly different. It contacts the tenant host URL using the shortened tenant ID:

```
https://<your-short-tenant-ID>.<Cloud Insights Domain>
```

For example:

<https://abcd12345.c01.cloudinsights.netapp.com>

Again, you can contact us through the in-product chat if you need help identifying the tenant host URL.

## Enabling monitoring on a new system

The Monitoring service is enabled by default in the working environment wizard. Be sure to keep the option enabled.

### Steps

1. Click **Create Cloud Volumes ONTAP**.
2. Select Amazon Web Services or Microsoft Azure as the cloud provider and then choose a single node or HA system.
3. Fill out the Details & Credentials page.
4. On the Services page, leave the Monitoring service enabled and click **Continue**.

The screenshot shows a configuration page for the NetApp Monitoring service. At the top, there's a header with a monitoring icon and the word "Monitoring". To the right is a toggle switch that is turned on (blue). Below the header, there's a brief description of what NetApp Monitoring does: "NetApp Monitoring is an infrastructure monitoring tool that gives you visibility into your complete infrastructure. With Monitoring, you can monitor, troubleshoot and optimize all your resources including your public clouds and your private data centers." Underneath this text, there are two sections: "ADVANTAGES" and "CLARIFICATIONS", each containing a bulleted list of points.

| ADVANTAGES                                                                                                                                                                                 | CLARIFICATIONS                                                                                                                                                                                                            |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"><li>➤ Automatically monitor all volumes - no configuration is required</li><li>➤ Prevent performance issues from impacting your users and apps</li></ul> | <ul style="list-style-type: none"><li>➤ Activation is free, but requires deploying a small-size cloud instance which will incur charges by your cloud provider</li><li>➤ Monitoring can be disabled at any time</li></ul> |

## Enabling monitoring on an existing system

Enable monitoring at any time from the working environment.

### Steps

1. At the top of Cloud Manager, click **Canvas**.
2. Select a working environment.
3. In the pane on the right, click **Start Monitoring**.

The screenshot shows the Cloud Manager dashboard for environment CVO2, which is currently set to 'On | AWS'. The dashboard lists four services:

- Cloud Compliance**: Status is Off. There is a blue 'Enable Compliance' button.
- Backup to Cloud**: Status is On. It indicates 1 Volume Backed Up. There is a grey 'More' button.
- Kubernetes**: Status is Off. There is a blue 'Activate Kubernetes' button.
- Monitoring**: Status is Off. There is a blue 'Start Monitoring' button with a hand cursor icon.

## Monitoring your volumes

Monitor performance by viewing IOPS, throughput, and latency for each of your volumes.

### Steps

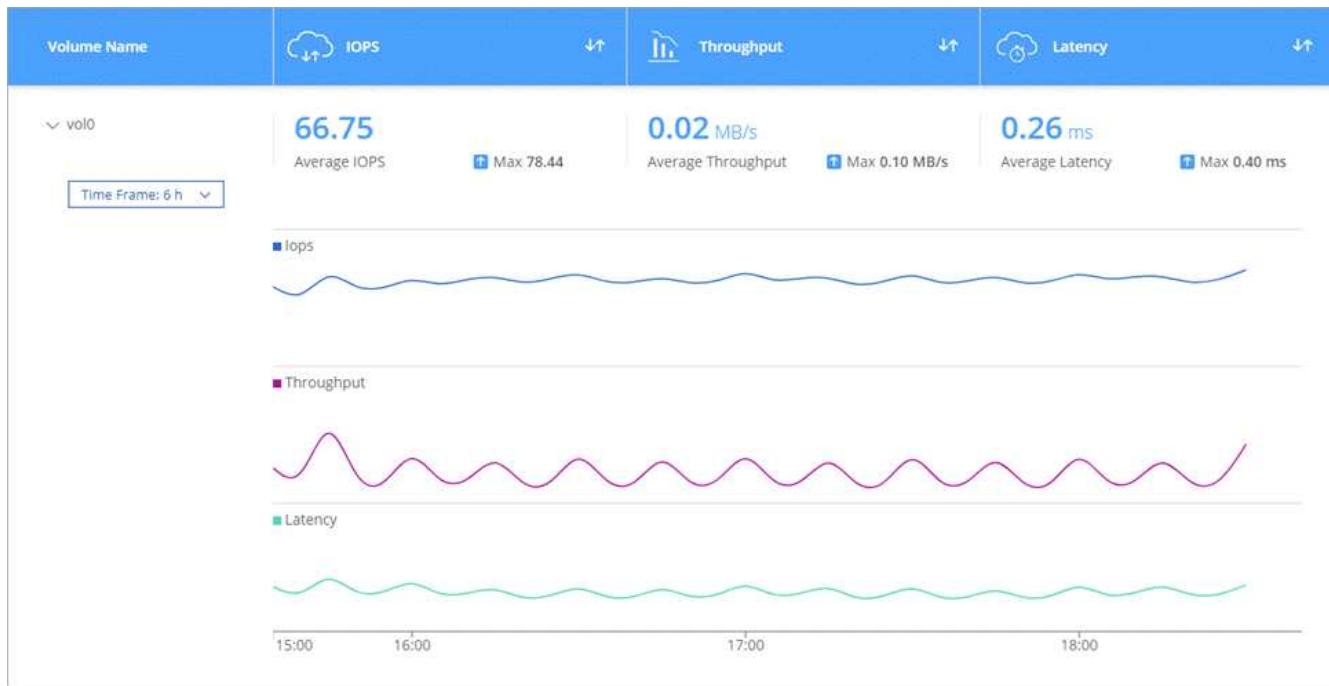
1. At the top of Cloud Manager, click **Monitoring**.
2. Filter the contents of the dashboard to get the information that you need.
  - Select a specific working environment.
  - Select a different timeframe.
  - Select a specific SVM.
  - Search for a specific volume.

The following image highlights each of these options:

The screenshot shows the Cloud Manager interface with the 'Monitoring' tab selected. At the top, there are dropdown menus for 'testaws2' and 'SVM: All'. Below this, two summary cards provide average network throughput (0.02 MB/s) and average CPU utilization (5.55 %). A search bar and a time frame selector (6 hours) are also present. The main content area displays a table of volume performance metrics:

| Volume Name | IOPS                         | Throughput                              | Latency                           |
|-------------|------------------------------|-----------------------------------------|-----------------------------------|
| > vol0      | <b>66.75</b><br>Average IOPS | <b>0.02</b> MB/s<br>Average Throughput  | <b>0.26</b> ms<br>Average Latency |
| > volaws2   | <b>50.02</b><br>Average IOPS | <b>12.60</b> MB/s<br>Average Throughput | <b>0.19</b> ms<br>Average Latency |

- Click a volume in the table to expand the row and view a timeline for IOPS, throughput, and latency.



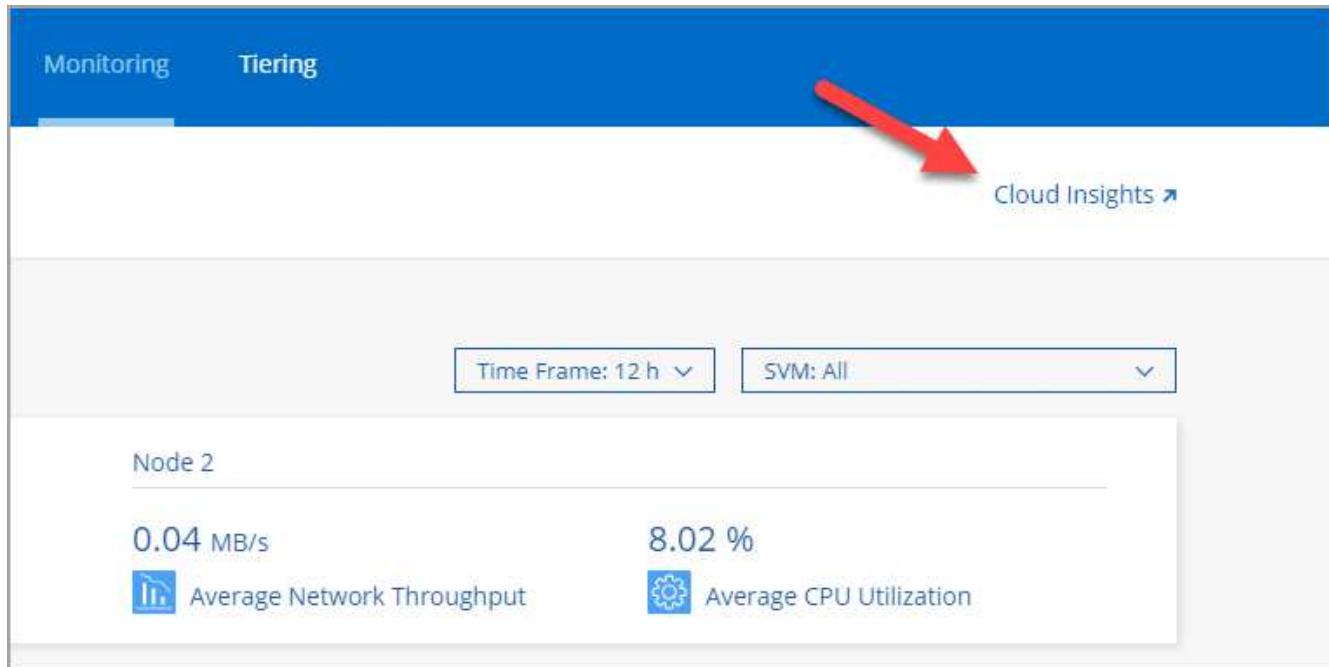
- Use the data to identify performance issues to minimize impact on your users and apps.

## Getting more information from Cloud Insights

The Monitoring tab in Cloud Manager provides basic performance data for your volumes. You can go to the Cloud Insights web interface from your browser to perform more in-depth monitoring and to configure alerts for your Cloud Volumes ONTAP systems.

### Steps

- At the top of Cloud Manager, click **Monitoring**.
- Click the **Cloud Insights** link.



## Result

Cloud Insights open in a new browser tab. If you need help, refer to the [Cloud Insights documentation](#).

## Disabling monitoring

If you no longer want to monitor Cloud Volumes ONTAP, you can disable the service at any time.



If you disable monitoring from each of your working environments, you'll need to delete the virtual machine instance yourself. The instance is named *AcquisitionUnit* with a generated hash (UUID) concatenated to it. For example: *AcquisitionUnit-FAN7FqeH*

## Steps

1. At the top of Cloud Manager, click **Canvas**.
2. Select a working environment.
3. In the pane on the right, click the icon and select **Deactivate Scan**.

## Optimize your Cloud Volumes ONTAP systems using Active IQ Digital Advisor

[Active IQ Digital Advisor](#) is integrated into the Cloud Manager UI so that you can optimize the operations, security, and performance of your Cloud Volumes ONTAP systems in a single pane of glass.

## Features

You can view the overall status of your storage system, high-level information about the wellness of the system, inventory, planning, and valuable insights at a watchlist level using Active IQ Digital Advisor.

- Analyze and optimize the health of your storage systems
- Gain insights regarding all the risks to your storage systems and the actions to mitigate the risks
- Analyze the performance of your storage devices by viewing the graphical format of performance data
- Get details about systems that have exceeded 90% capacity or are nearing 90% capacity

## Supported ONTAP systems

Active IQ Digital Advisor provides information for all the on-premises ONTAP systems and Cloud Volumes ONTAP systems within your NSS account.

## Cost

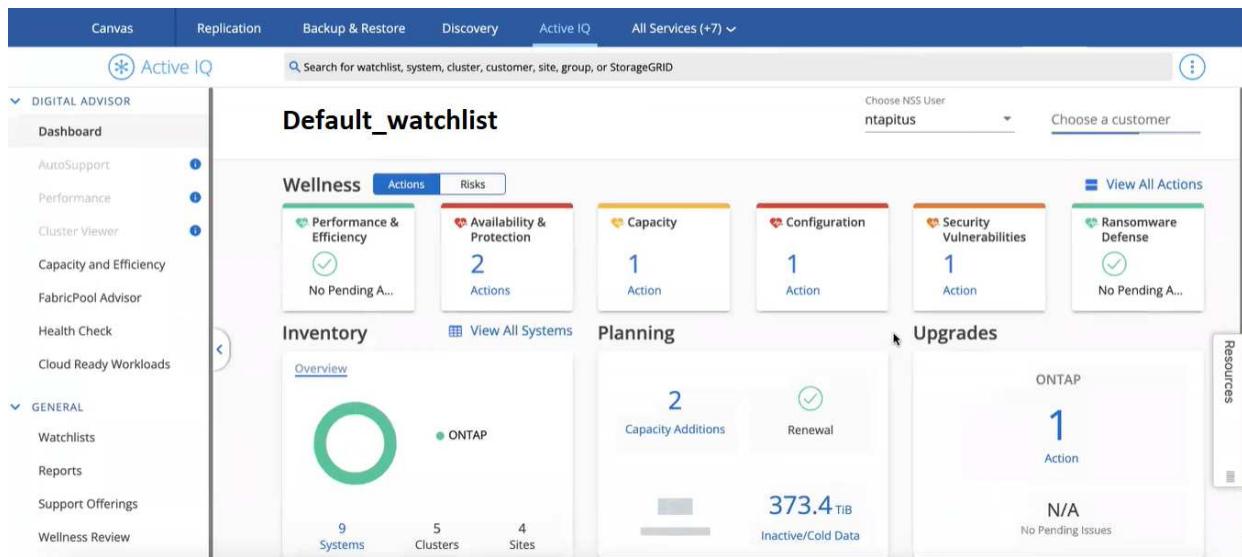
There's no cost to use this service through Cloud Manager.

## How Active IQ Digital Advisor works with Cloud Manager

The Active IQ Digital Advisor user interface is completely integrated in Cloud Manager.

In Cloud Manager, click the **Active IQ** service.

- If you have already registered an existing NSS account in Cloud Manager, the Active IQ Digital Advisor UI appears just like you would see it in a standalone implementation at <https://activeiq.netapp.com/>.



- If you haven't registered an NSS account in Cloud Manager, [register an NSS account now](#) and then the Active IQ Digital Advisor UI appears.

i As of December 3, 2021, NetApp has switched to a new methodology of registering credentials for NSS accounts. [See this FAQ for details](#). If your NSS account uses the old set of credentials you will need to update the account to the new credentials.

## What's next

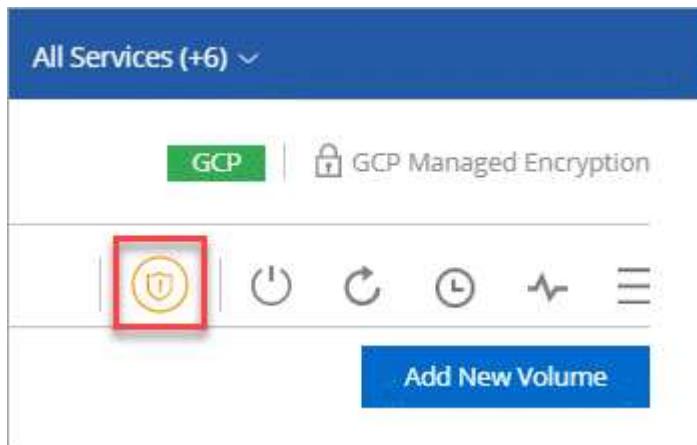
See the [Active IQ Digital Advisor documentation](#) for details.

## Improving protection against ransomware

Ransomware attacks can cost a business time, resources, and reputation. Cloud Manager enables you to implement the NetApp solution for ransomware, which provides effective tools for visibility, detection, and remediation.

### Steps

1. From the working environment, click the **Ransomware** icon.



2. Implement the NetApp solution for ransomware:

- a. Click **Activate Snapshot Policy**, if you have volumes that do not have a Snapshot policy enabled.

NetApp Snapshot technology provides the industry's best solution for ransomware remediation. The key to a successful recovery is restoring from uninfected backups. Snapshot copies are read-only, which prevents ransomware corruption. They can also provide the granularity to create images of a single file copy or a complete disaster recovery solution.

- b. Click **Activate FPolicy** to enable ONTAP's FPolicy solution, which can block file operations based on a file's extension.

This preventative solution improves protection from ransomware attacks by blocking common ransomware file types.

The default FPolicy scope blocks files that have the following extensions:

micro, encrypted, locked, crypto, crypt, crinf, r5a, XRNT, XTBL, R16M01D05, pzdc, good, LOL!, OMG!, RDM, RRK, encryptedRS, crjoker, EnCiPhErEd, LeChiffre



Cloud Manager creates this scope when you activate FPolicy on Cloud Volumes ONTAP. The list is based on common ransomware file types. You can customize the blocked file extensions by using the `vserver fpolicy policy scope` commands from the Cloud Volumes ONTAP CLI.

## Ransomware Protection

Ransomware attacks can cost a business time, resources, and reputation. The NetApp solution for ransomware provides effective tools for visibility, detection, and remediation. [Learn More](#)

### 1 Enable Snapshot Copy Protection



1 Volumes without a Snapshot Policy

To protect your data, activate the default Snapshot policy for these volumes [\(1\)](#)

[Activate Snapshot Policy](#)

### 2 Block Ransomware File Extensions



ONTAP's native FPolicy configuration monitors and blocks file operations based on a file's extension.

[View Denied File Names](#) [\(1\)](#)

[Activate FPolicy](#)

# Administer

## Manage licenses for Cloud Volumes ONTAP

The Digital Wallet page enables you to manage licenses for Cloud Volumes ONTAP from a single location. You can add new licenses and update existing licenses.

You can manage the following types of licenses for Cloud Volumes ONTAP:

- *Capacity-based licenses*, which enable you to pay for Cloud Volumes ONTAP per TiB of capacity.  
[Contact NetApp Sales](#) to purchase a capacity-based license.
- *Keystone Flex Subscriptions*, which is a pay-as-you-grow storage service offered by NetApp.
- *Node-based licenses*, which are the previous generation licensing model:
  - BYOL licenses purchased from NetApp.
  - Hourly pay-as-you-go (PAYGO) subscriptions from your cloud provider's marketplace.

[Learn more about Cloud Volumes ONTAP licenses.](#)

### Manage capacity-based licenses

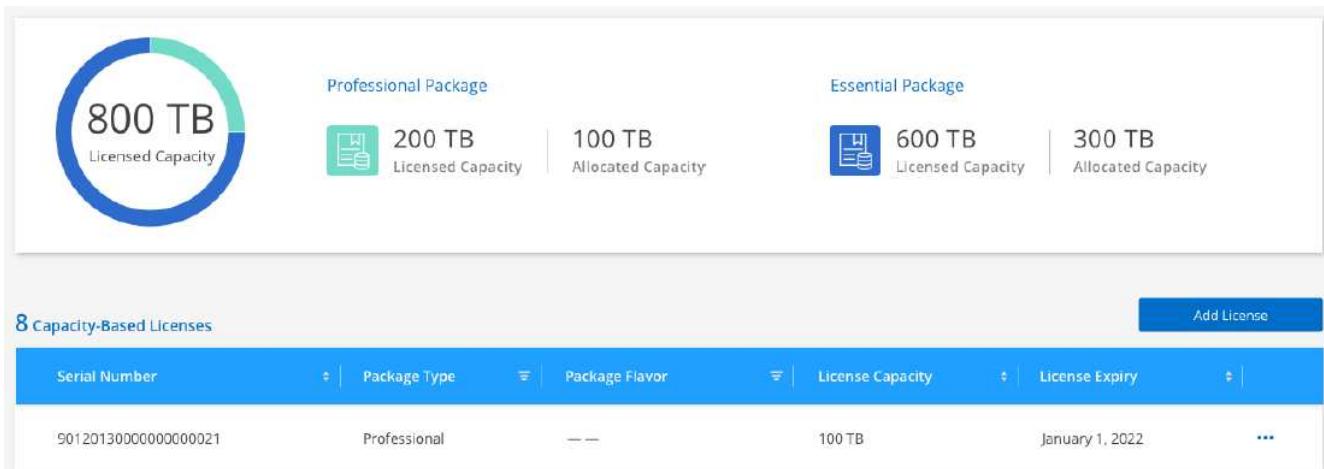
Manage your capacity-based licenses to ensure that your NetApp account has enough capacity for your Cloud Volumes ONTAP systems.

#### View your account's capacity

View the licensed capacity and provisioned capacity by package to ensure that you have enough room for your data volumes.

#### Steps

1. Click **All Services > Digital Wallet > Cloud Volumes ONTAP**.
2. With **Capacity Based Licenses** selected, view the licensed capacity and provisioned capacity for each package.



3. If needed, purchase additional licensed capacity and then add the license to your account.

#### Add purchased licenses to your account

After you purchase licenses for your NetApp account, you need to add the licenses to Cloud Manager so that the capacity is available for Cloud Volumes ONTAP.

#### What you'll need

- You need to provide Cloud Manager the serial number of the license or the license file.
- If you want to enter the serial number, you first need to [add your NetApp Support Site account to Cloud Manager](#). This is the NetApp Support Site account that's authorized to access the serial number.

#### Steps

1. Click **All Services > Digital Wallet > Cloud Volumes ONTAP**.
2. Click **Add License**.
3. Enter the serial number for your capacity-based license or upload the license file.

If you entered a serial number, you also need to select the NetApp Support Site account that's authorized to access the serial number.

4. Click **Add License**.

#### Update a capacity-based license

If you purchased additional capacity or extended the term of your license, Cloud Manager automatically updates the license in the Digital Wallet. There's nothing that you need to do.

However, if you deployed Cloud Manager in a location that doesn't have internet access, then you'll need to manually update the license in Cloud Manager.

#### What you'll need

The license file (or *files* if you have an HA pair).

#### Steps

1. Click **All Services > Digital Wallet > Cloud Volumes ONTAP**.
2. Click the action menu next to the license and select **Update License**.
3. Upload the license file.

#### 4. Click **Upload License**.

##### Remove a capacity-based license

If a capacity-based license expired and is no longer in use, then you can remove it at any time.

##### Steps

1. Click **All Services > Digital Wallet > Cloud Volumes ONTAP**.
2. Click the action menu next to the license and select **Remove License**.
3. Click **Remove** to confirm.

##### Manage Keystone Flex Subscriptions

Manage your Keystone Flex Subscriptions from the Digital Wallet by enabling subscriptions for use with Cloud Volumes ONTAP. You can also request changes to the committed capacity and you can unlink subscriptions.

##### Authorize your account

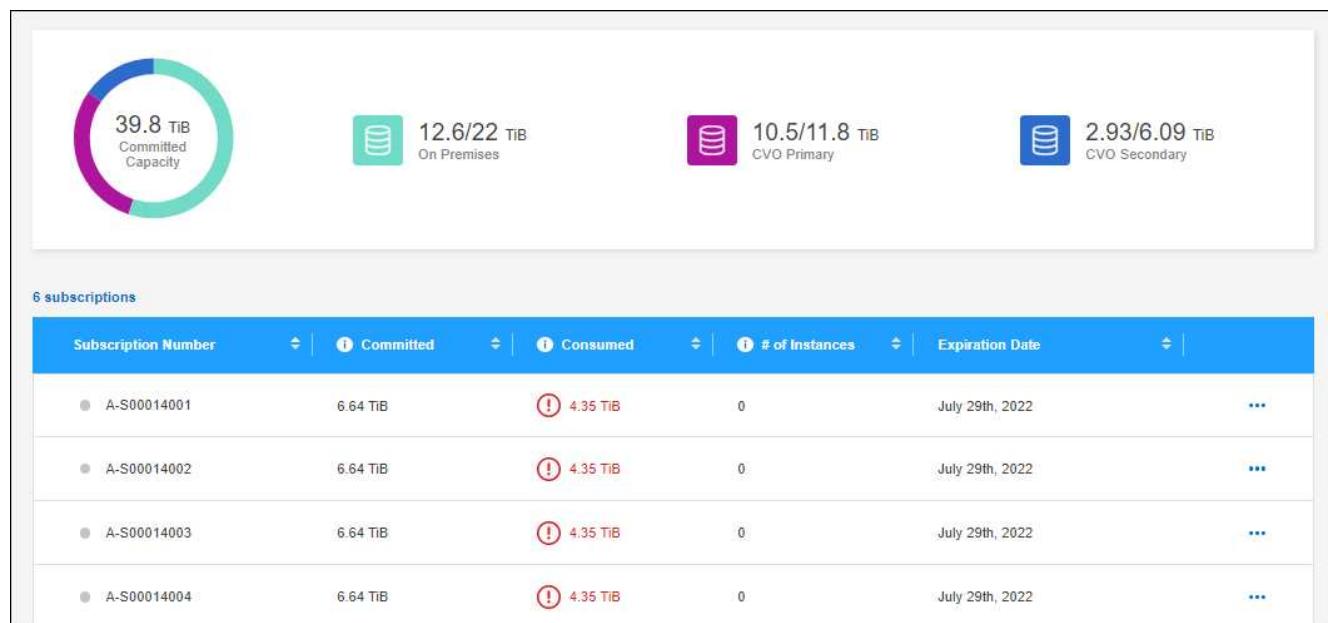
Before you can use and manage Keystone Flex Subscriptions in Cloud Manager, you need to contact NetApp to authorize your Cloud Manager user account with your Keystone Flex Subscriptions.

##### Steps

1. Click **All Services > Digital Wallet**.
2. Click **Keystone Flex Subscription**.
3. If you see the **Welcome to NetApp Keystone** page, send an email to the address listed on the page.

A NetApp representative will process your request by authorizing your user account to access the subscriptions.

4. Come back to the **Keystone Flex Subscription** to view your subscriptions.



##### What's next?

Link the subscriptions that you want to use with Cloud Volumes ONTAP.

## Link a subscription

After NetApp authorizes your account, you need to link Keystone Flex Subscriptions for use with Cloud Volumes ONTAP. This action enables users to select the subscription as the charging method for new Cloud Volumes ONTAP systems.

### Steps

1. Click **All Services > Digital Wallet**.
2. Click **Keystone Flex Subscription**.
3. For the subscription that you want to link, click **...** and select **Link**.

| Subscription Number | Committed | Consumed   | # of Instances | Expiration Date |  |
|---------------------|-----------|------------|----------------|-----------------|--|
| A-S00014001         | 6.64 TiB  | ! 4.35 TiB | 0              | July 29th, 2022 |  |
| A-S00014002         | 6.64 TiB  | ! 4.35 TiB | 0              | July 29th, 2022 |  |
| A-S00014003         | 6.64 TiB  | ! 4.35 TiB | 0              | July 29th, 2022 |  |

## Result

The subscription is now linked to your Cloud Manager account and available to select when creating a Cloud Volumes ONTAP working environment.

### Request more or less committed capacity

If you need to adjust the committed capacity for a subscription, you can send a request right from the Cloud Manager interface.

### Steps

1. Click **All Services > Digital Wallet**.
2. Click **Keystone Flex Subscription**.
3. For the subscription that you want adjust the capacity, click **...** and select **View detail and edit**.
4. Enter the requested committed capacity for one or more subscriptions.

**Subscription Modification for A-S00014001**

| Service Level | Current Committed Capacity | Current Consumed Capacity                       | Requested Committed Capacity                       |
|---------------|----------------------------|-------------------------------------------------|----------------------------------------------------|
| Extreme       | 0.977 TiB                  | 0.293 TiB                                       | <input type="text"/> Enter amount <span>TiB</span> |
| Premium       | 0.977 TiB                  | 0.488 TiB                                       | <input type="text"/> Enter amount <span>TiB</span> |
| Performance   | 0 TiB                      | 0 TiB                                           | <input type="text"/> Enter amount <span>TiB</span> |
| Standard      | 0.732 TiB                  | 0.439 TiB                                       | <input type="text"/> Enter amount <span>TiB</span> |
| Value         | 0.977 TiB                  | 0.879 TiB <span style="color: orange;">!</span> | <input type="text"/> Enter amount <span>TiB</span> |
| Data Tiering  | 0 TiB                      | 0 TiB                                           | <input type="text"/> Enter amount <span>TiB</span> |
| CVO Primary   | 1.96 TiB                   | 1.76 TiB <span style="color: orange;">!</span>  | <input type="text"/> 3 <span>TiB</span>            |
| CVO Secondary | 1.02 TiB                   | 0.488 TiB                                       | <input type="text"/> Enter amount <span>TiB</span> |

**Additional Information**

Is there anything else we should know about your request?  
Please be as descriptive as possible.

Enter your notes here

**Submit** **Cancel**

5. Scroll down, enter any additional details for the request, and then click **Submit**.

## Result

Your request creates a ticket in NetApp's system for processing.

### Unlink a subscription

If you no longer want to use a Keystone Flex Subscription with new Cloud Volumes ONTAP systems, you can unlink the subscription. Note that you can only unlink a subscription that isn't attached to an existing Cloud Volumes ONTAP subscription.

### Steps

1. Click **All Services > Digital Wallet**.
2. Click **Keystone Flex Subscription**.
3. For the subscription that you want to unlink, click **...** and select **Unlink**.

## Result

The subscription is unlinked from your Cloud Manager account and no longer available to select when creating a Cloud Volumes ONTAP working environment.

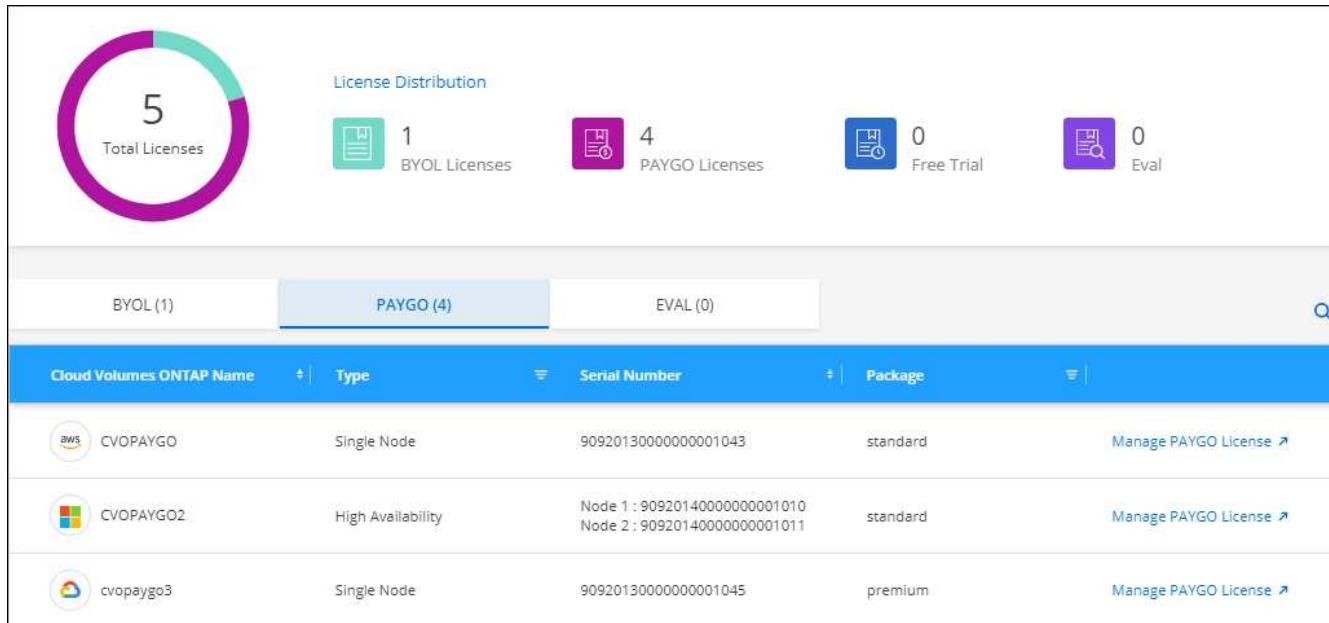
### Manage node-based PAYGO licenses

The Digital Wallet page enables you to view details about each of your PAYGO Cloud Volumes ONTAP

systems, including the serial number and PAYGO license type.

## Steps

1. Click **All Services > Digital Wallet > Cloud Volumes ONTAP**.
2. Select **Node Based Licenses** from the drop-down.
3. Click **PAYGO**.
4. View details in the table about each of your PAYGO licenses.



5. If needed, click **Manage PAYGO License** to change the PAYGO license or to change the instance type.

## Manage node-based BYOL licenses

Manage your node-based licenses to ensure that each Cloud Volumes ONTAP system has a valid license with the required capacity.

### Add unassigned licenses

Add a node-based license to the Digital Wallet so that you can select the license when you create a new Cloud Volumes ONTAP system. The Digital Wallet identifies these licenses as *unassigned*.

## Steps

1. Click **All Services > Digital Wallet > Cloud Volumes ONTAP**.
2. Select **Node Based Licenses** from the drop-down.
3. Click **Unassigned**.
4. Click **Add Unassigned Licenses**.
5. Enter the serial number of the license or upload the license file.

If you don't have the license file yet, refer to the section below.

6. Click **Add License**.

## Result

Cloud Manager adds the license to the Digital Wallet. The license will be identified as unassigned until you associate it with a new Cloud Volumes ONTAP system. After that happens, the license moves to the **BYOL** tab in the Digital Wallet.

#### Exchange unassigned node-based licenses

If you have an unassigned node-based license for Cloud Volumes ONTAP that you haven't used, you can exchange the license by converting it to a Cloud Backup license, a Cloud Data Sense license, or a Cloud Tiering license.

Exchanging the license revokes the Cloud Volumes ONTAP license and creates a dollar-equivalent license for the service:

- Licensing for a Cloud Volumes ONTAP HA pair is converted to a 51 TiB data service license
- Licensing for a Cloud Volumes ONTAP single node is converted to a 32 TiB data service license

The converted license has the same expiry date as the Cloud Volumes ONTAP license.

#### Steps

1. Click **All Services > Digital Wallet > Cloud Volumes ONTAP**.
2. Select **Node Based Licenses** from the drop-down.
3. Click **Unassigned**.
4. Click **Exchange License**.

| BYOL (14)             |             | Eval (2)       |                 | Unassigned (3)                               |                                  | PAYGO (6) |  | Q | Add Unassigned Licenses |
|-----------------------|-------------|----------------|-----------------|----------------------------------------------|----------------------------------|-----------|--|---|-------------------------|
| Serial Number         | Type        | Cloud Provider | License Expiry  | Status                                       |                                  |           |  |   |                         |
| 012345678901234567890 | Single Node | All Providers  | April 20, 2022  | Unassigned                                   | <a href="#">Exchange License</a> | ...       |  |   |                         |
| 012345678901234567891 | Single Node | Azure          | April 20, 2022  | Unassigned                                   | <a href="#">Exchange License</a> | ...       |  |   |                         |
| 012345678901234567892 | Single Node | AWS            | January 1, 2022 | Exchanged to Cloud Tiering on August 1, 2021 |                                  |           |  |   |                         |

5. Select the service that you'd like to exchange the license with.
6. If you're prompted, select an additional license for the HA pair.
7. Read the legal consent and click **Agree**.

#### Result

Cloud Manager converts the unassigned license to the service that you selected. You can view the new license in the **Data Services Licenses** tab.

#### Obtain a system license file

In most cases, Cloud Manager can automatically obtain your license file using your NetApp Support Site account. But if it can't, then you'll need to manually upload the license file. If you don't have the license file, you can obtain it from [netapp.com](http://netapp.com).

#### Steps

1. Go to the [NetApp License File Generator](#) and log in using your NetApp Support Site credentials.

2. Enter your password, choose your product, enter the serial number, confirm that you have read and accepted the privacy policy, and then click **Submit**.

### Example

3. Choose whether you want to receive the serialnumber.NLF JSON file through email or direct download.

#### Update a system license

When you renew a BYOL subscription by contacting a NetApp representative, Cloud Manager automatically obtains the new license from NetApp and installs it on the Cloud Volumes ONTAP system.

If Cloud Manager can't access the license file over the secure internet connection, you can obtain the file yourself and then manually upload the file to Cloud Manager.

#### Steps

1. Click **All Services > Digital Wallet > Cloud Volumes ONTAP**.
2. Select **Node Based Licenses** from the drop-down.
3. In the **BYOL** tab, expand the details for a Cloud Volumes ONTAP system.
4. Click the action menu next to the system license and select **Update License**.
5. Upload the license file (or files if you have an HA pair).
6. Click **Update License**.

#### Result

Cloud Manager updates the license on the Cloud Volumes ONTAP system.

#### Manage extra capacity licenses

You can purchase extra capacity licenses for a Cloud Volumes ONTAP BYOL system to allocate more than the 368 TiB of capacity that's provided with a BYOL system license. For example, you might purchase one extra license capacity to allocate up to 736 TiB of capacity to Cloud Volumes ONTAP. Or you could purchase three extra capacity licenses to get up to 1.4 PiB.

The number of licenses that you can purchase for a single node system or HA pair is unlimited.

#### Add capacity licenses

Purchase an extra capacity license by contacting us through the chat icon in the lower-right of Cloud Manager. After you purchase the license, you can apply it to a Cloud Volumes ONTAP system.

#### Steps

1. Click **All Services > Digital Wallet > Cloud Volumes ONTAP**.
2. Select **Node Based Licenses** from the drop-down.
3. In the **BYOL** tab, expand the details for a Cloud Volumes ONTAP system.
4. Click **Add Capacity License**.
5. Enter the serial number or upload the license file (or files if you have an HA pair).
6. Click **Add Capacity License**.

## Update capacity licenses

If you extended the term of an extra capacity license, you'll need to update the license in Cloud Manager.

### Steps

1. Click **All Services > Digital Wallet > Cloud Volumes ONTAP**.
2. Select **Node Based Licenses** from the drop-down.
3. In the **BYOL** tab, expand the details for a Cloud Volumes ONTAP system.
4. Click the action menu next to the capacity license and select **Update License**.
5. Upload the license file (or files if you have an HA pair).
6. Click **Update License**.

## Remove capacity licenses

If an extra capacity license expired and is no longer in use, then you can remove it at any time.

### Steps

1. Click **All Services > Digital Wallet > Cloud Volumes ONTAP**.
2. Select **Node Based Licenses** from the drop-down.
3. In the **BYOL** tab, expand the details for a Cloud Volumes ONTAP system.
4. Click the action menu next to the capacity license and select **Remove License**.
5. Click **Remove**.

## Convert an Eval license to a BYOL

An evaluation license is good for 30 days. You can apply a new BYOL license on top of the evaluation license for an in-place upgrade.

When you convert an Eval license to a BYOL, Cloud Manager restarts the Cloud Volumes ONTAP system.

- For a single-node system, the restart results in I/O interruption during the reboot process.
- For an HA pair, the restart initiates takeover and giveback to continue serving I/O to clients.

### Steps

1. Click **All Services > Digital Wallet > Cloud Volumes ONTAP**.
2. Select **Node Based Licenses** from the drop-down.
3. Click **Eval**.
4. In the table, click **Convert to BYOL License** for a Cloud Volumes ONTAP system.
5. Enter the serial number or upload the license file.
6. Click **Convert License**.

## Result

Cloud Manager starts the conversion process. Cloud Volumes ONTAP automatically restarts as part of this process. When it's back up, the licensing information will reflect the new license.

## Registering pay-as-you-go systems

Support from NetApp is included with Cloud Volumes ONTAP PAYGO systems, but you must first activate support by registering the systems with NetApp.

Registering a PAYGO system with NetApp is required to upgrade ONTAP software using any of the methods [described on this page](#).



A system that isn't registered for support will still receive the software update notifications that appear in Cloud Manager when a new version is available. But you will need to register the system before you can upgrade the software.

### Steps

1. If you have not yet added your NetApp Support Site account to Cloud Manager, go to **Account Settings** and add it now.  
[Learn how to add NetApp Support Site accounts.](#)
2. On the Canvas page, double-click the name of the system that you want to register.
3. Click the menu icon and then click **Support registration**:



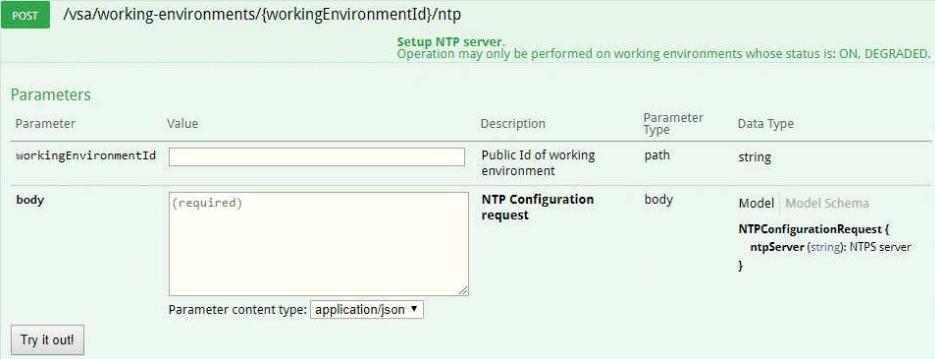
4. Select a NetApp Support Site account and click **Register**.

### Result

Cloud Manager registers the system with NetApp.

## Setting up Cloud Volumes ONTAP

After you deploy Cloud Volumes ONTAP, you can set it up by synchronizing the system time using NTP and by performing a few optional tasks from either System Manager or the CLI.

| Task                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Description |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| <p>Synchronize the system time using NTP</p> <p>Specifying an NTP server synchronizes the time between the systems in your network, which can help prevent issues due to time differences.</p> <p>Specify an NTP server using the Cloud Manager API or from the user interface when you set up a CIFS server.</p> <ul style="list-style-type: none"> <li>• <a href="#">Modifying the CIFS server</a></li> <li>• <a href="#">Cloud Manager automation docs</a></li> </ul> <p>For example, here's the API for a single-node system in AWS:</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |             |
| <p>Set up AutoSupport</p> <p>AutoSupport proactively monitors the health of your system and sends messages to NetApp technical support. By default, AutoSupport is enabled on each node to send messages to technical support using the HTTPS transport protocol.</p> <p>If the Cloud Manager Account Admin added a proxy server to Cloud Manager before you launched your instance, Cloud Volumes ONTAP is configured to use that proxy server for AutoSupport messages.</p> <p>The only required configuration step is to ensure that Cloud Volumes ONTAP has outbound internet connectivity through a NAT instance or your environment's proxy services. For details, refer to the networking requirements for your cloud provider.</p> <ul style="list-style-type: none"> <li>• <a href="#">AWS networking requirements</a></li> <li>• <a href="#">Azure networking requirement</a></li> <li>• <a href="#">Google Cloud networking requirements</a></li> </ul> <p>After you've verified that outbound internet access is available, you can test AutoSupport to ensure that it can send messages. For instructions, go to <a href="#">ONTAP docs: Set up AutoSupport</a>.</p> |             |

| Task                                                        | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Optional: Configure EMS                                     | <p>The Event Management System (EMS) collects and displays information about events that occur on Cloud Volumes ONTAP systems. To receive event notifications, you can set event destinations (email addresses, SNMP trap hosts, or syslog servers) and event routes for a particular event severity.</p> <p>You can configure EMS using the CLI. For instructions, see the <a href="#">ONTAP 9 EMS Configuration Express Guide</a>.</p>                                                                                                                                                                                              |
| Optional: Change the backup location of configuration files | <p>Cloud Volumes ONTAP automatically creates configuration backup files that contain information about the configurable options that it needs to operate properly.</p> <p>By default, Cloud Volumes ONTAP backs up the files to the Connector host every eight hours. If you want to send the backups to an alternate location, you can change the location to an FTP or HTTP server in your data center or in AWS. For example, you might already have a backup location for your FAS storage systems.</p> <p>You can change the backup location using the CLI. See the <a href="#">ONTAP 9 System Administration Reference</a>.</p> |

## Upgrading Cloud Volumes ONTAP software

Cloud Manager includes several options that you can use to upgrade to the current Cloud Volumes ONTAP release. You should prepare Cloud Volumes ONTAP systems before you upgrade the software.

### Requirements

You should be aware of the following requirements before you start the Cloud Volumes ONTAP upgrade process.

#### Software upgrades must be completed by Cloud Manager

Upgrades of Cloud Volumes ONTAP must be completed from Cloud Manager. You should not upgrade Cloud Volumes ONTAP by using System Manager or the CLI. Doing so can impact system stability.

#### Cloud Volumes ONTAP must be registered with NetApp Support

Cloud Volumes ONTAP must be registered with NetApp support in order to upgrade the software using any of the methods described on this page. This applies to both PAYGO and BYOL. You'll need to [manually register PAYGO systems](#), while BYOL systems are registered by default.

 A system that isn't registered for support will still receive the software update notifications that appear in Cloud Manager when a new version is available. But you will need to register the system before you can upgrade the software.

### A note about downgrades

Cloud Manager doesn't support downgrading Cloud Volumes ONTAP to a previous version. Contact NetApp technical support for help with downgrades.

## Preparing to upgrade Cloud Volumes ONTAP software

Before performing an upgrade, you must verify that your systems are ready and make any required configuration changes.

- [Understanding supported upgrade paths](#)
- [Planning for downtime](#)
- [Verifying that automatic giveback is still enabled](#)
- [Suspending SnapMirror transfers](#)
- [Verifying that aggregates are online](#)

### Understanding supported upgrade paths

Refer to the "Upgrade notes" page in the Cloud Volumes ONTAP Release Notes for the target version.

### Planning for downtime

When you upgrade a single-node system, the upgrade process takes the system offline for up to 25 minutes, during which I/O is interrupted.

Upgrading an HA pair is nondisruptive and I/O is uninterrupted. During this nondisruptive upgrade process, each node is upgraded in tandem to continue serving I/O to clients.

### Verifying that automatic giveback is still enabled

Automatic giveback must be enabled on a Cloud Volumes ONTAP HA pair (this is the default setting). If it isn't, then the operation will fail.

[ONTAP 9 Documentation: Commands for configuring automatic giveback](#)

### Suspending SnapMirror transfers

If a Cloud Volumes ONTAP system has active SnapMirror relationships, it is best to suspend transfers before you update the Cloud Volumes ONTAP software. Suspending the transfers prevents SnapMirror failures. You must suspend the transfers from the destination system.



Even though Cloud Backup uses an implementation of SnapMirror to create backup files (called SnapMirror Cloud), backups do not need to be suspended when a system is upgraded.

### About this task

These steps describe how to use System Manager for version 9.3 and later.

#### Steps

1. [Log in to System Manager](#) from the destination system.
2. Click **Protection > Relationships**.
3. Select the relationship and click **Operations > Quiesce**.

### Verifying that aggregates are online

Aggregates for Cloud Volumes ONTAP must be online before you update the software. Aggregates should be online in most configurations, but if they are not, then you should bring them online.

## About this task

These steps describe how to use System Manager for version 9.3 and later.

## Steps

1. In the working environment, click the menu icon, and then click **Advanced > Advanced allocation**.
2. Select an aggregate, click **Info**, and then verify that the state is online.

The screenshot shows the 'Info' page for an aggregate named 'aggr1'. The page displays the following information:

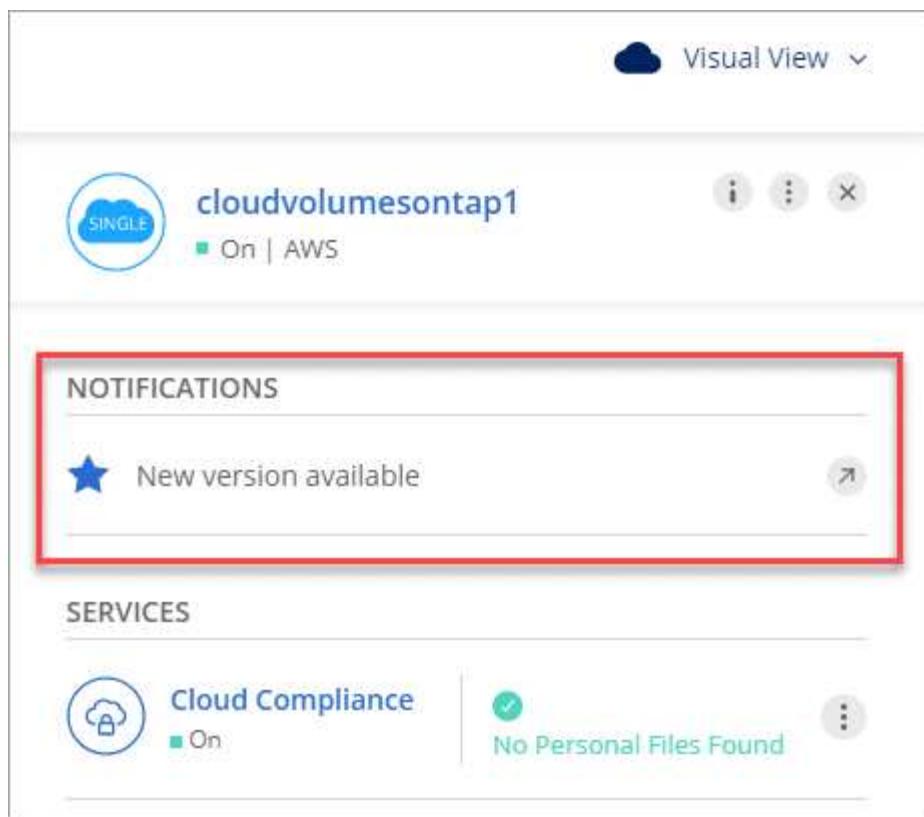
- Aggregate Capacity: 88.57 GB
- Used Aggregate Capacity: 1.07 GB
- Volumes: 2
- AWS Disks: 1
- State: online

The 'State' field is highlighted with a red rectangular border.

3. If the aggregate is offline, use System Manager to bring the aggregate online:
  - a. [Log in to System Manager](#).
  - b. Click **Storage > Aggregates & Disks > Aggregates**.
  - c. Select the aggregate, and then click **More Actions > Status > Online**.

## Upgrading Cloud Volumes ONTAP

Cloud Manager displays a notification in Cloud Volumes ONTAP working environments when a new version of Cloud Volumes ONTAP is available:



You can start the upgrade process from this notification, which automates the process by obtaining the software image from an S3 bucket, installing the image, and then restarting the system. For details, see [Upgrading from Cloud Manager notifications](#).



For HA systems in AWS or Google Cloud, Cloud Manager might upgrade the HA mediator as part of the upgrade process.

Cloud Manager also provides the following advanced options for upgrading Cloud Volumes ONTAP software with both PAYGO and BYOL:

- Software upgrades using an image on an external URL

This option is helpful if Cloud Manager can't access the S3 bucket to upgrade the software or if you were provided with a patch.

For details, see [Upgrading by using an HTTP or FTP server](#).

- Software upgrades using the alternate image on the system

You can use this option to upgrade by making the alternate software image the default image. This option is not available for HA pairs.

For details, see [Upgrading by using a local image](#).

#### **Upgrading from Cloud Manager notifications**

Cloud Manager notifies you when a new version of Cloud Volumes ONTAP is available. Click the notification to start the upgrade process.

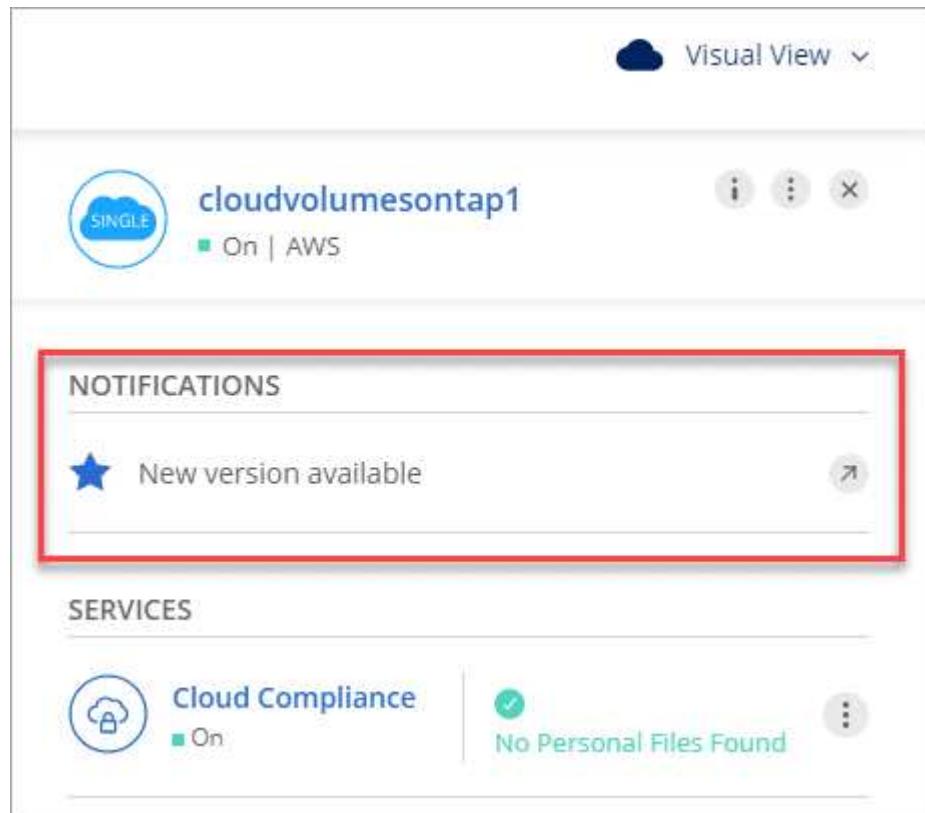
#### **Before you begin**

Cloud Manager operations such as volume or aggregate creation must not be in progress for the Cloud Volumes ONTAP system.

## Steps

1. Click **Canvas**.
2. Select a working environment.

A notification appears in the right pane if a new version is available:



3. If a new version is available, click **Upgrade**.
4. In the Release Information page, click the link to read the Release Notes for the specified version, and then select the **I have read...** check box.
5. In the End User License Agreement (EULA) page, read the EULA, and then select **I read and approve the EULA**.
6. In the Review and Approve page, read the important notes, select **I understand...**, and then click **Go**.

## Result

Cloud Manager starts the software upgrade. You can perform actions on the working environment once the software update is complete.

## After you finish

If you suspended SnapMirror transfers, use System Manager to resume the transfers.

### Upgrading by using an HTTP or FTP server

You can place the Cloud Volumes ONTAP software image on an HTTP or FTP server and then initiate the software upgrade from Cloud Manager. You might use this option if Cloud Manager can't access the S3 bucket

to upgrade the software.

## Steps

1. Set up an HTTP server or FTP server that can host the Cloud Volumes ONTAP software image.
2. If you have a VPN connection to the virtual network, you can place the Cloud Volumes ONTAP software image on an HTTP server or FTP server in your own network. Otherwise, you must place the file on an HTTP server or FTP server in the cloud.
3. If you use your own security group for Cloud Volumes ONTAP, ensure that the outbound rules allow HTTP or FTP connections so Cloud Volumes ONTAP can access the software image.



The predefined Cloud Volumes ONTAP security group allows outbound HTTP and FTP connections by default.

4. Obtain the software image from [the NetApp Support Site](#).
5. Copy the software image to the directory on the HTTP or FTP server from which the file will be served.
6. From the working environment in Cloud Manager, click the menu icon, and then click **Advanced > Update Cloud Volumes ONTAP**.
7. On the update software page, choose **Select an image available from a URL**, enter the URL, and then click **Change Image**.
8. Click **Proceed** to confirm.

## Result

Cloud Manager starts the software update. You can perform actions on the working environment once the software update is complete.

## After you finish

If you suspended SnapMirror transfers, use System Manager to resume the transfers.

### Upgrading by using a local image

Each Cloud Volumes ONTAP system can hold two software images: the current image that is running, and an alternate image that you can boot. Cloud Manager can change the alternate image to be the default image.

## Steps

1. From the working environment, click the menu icon, and then click **Advanced > Update Cloud Volumes ONTAP**.
2. On the update software page, select the alternate image, and then click **Change Image**.
3. Click **Proceed** to confirm.

## Result

Cloud Manager starts the software update. You can perform actions on the working environment once the software update is complete.

## After you finish

If you suspended SnapMirror transfers, use System Manager to resume the transfers.

### Fixing download failures when using a Google Cloud NAT gateway

The Connector automatically downloads software updates for Cloud Volumes ONTAP. The download can fail if

your configuration uses a Google Cloud NAT gateway. You can correct this issue by limiting the number of parts that the software image is divided into. This step must be completed by using the Cloud Manager API.

## Step

1. Submit a PUT request to /occm/config with the following JSON as body:

```
{
 "maxDownloadSessions": 32
}
```

The value for *maxDownloadSessions* can be 1 or any integer greater than 1. If the value is 1, then the downloaded image will not be divided.

Note that 32 is an example value. The value that you should use depends on your NAT configuration and the number of sessions that you can have simultaneously.

[Learn more about the /occm/config API call.](#)

## Modifying Cloud Volumes ONTAP systems

You might need to change the configuration of Cloud Volumes ONTAP systems as your storage needs change. For example, you can change between pay-as-you-go configurations, change the instance or VM type, and more.

### Changing the instance or machine type for Cloud Volumes ONTAP

You can choose from several instance or machine types when you launch Cloud Volumes ONTAP in AWS, Azure, or GCP. You can change the instance or machine type at any time if you determine that it is undersized or oversized for your needs.

#### About this task

- Automatic giveback must be enabled on a Cloud Volumes ONTAP HA pair (this is the default setting). If it isn't, then the operation will fail.

[ONTAP 9 Documentation: Commands for configuring automatic giveback](#)

- Changing the instance or machine type affects cloud provider service charges.
- The operation restarts Cloud Volumes ONTAP.

For single node systems, I/O is interrupted.

For HA pairs, the change is nondisruptive. HA pairs continue to serve data.



Cloud Manager gracefully changes one node at a time by initiating takeover and waiting for give back. NetApp's QA team tested both writing and reading files during this process and didn't see any issues on the client side. As connections changed, we did see retries on the I/O level, but the application layer overcame these short "re-wire" of NFS/CIFS connections.

## Steps

1. From the working environment, click the menu icon, and then click **Change license or instance** for AWS,

**Change license or VM** for Azure, or **Change license or machine** for GCP.

2. If you are using a pay-as-you-go configuration, you can optionally choose a different license.
3. Select an instance or machine type, select the check box to confirm that you understand the implications of the change, and then click **OK**.

## Result

Cloud Volumes ONTAP reboots with the new configuration.

## Changing between hourly (pay-as-you-go) configurations

After you launch a by-node, pay-as-you-go Cloud Volumes ONTAP system, you can change between the Explore, Standard, and Premium configurations at any time by modifying the license. Changing the license increases or decreases the raw capacity limit and enables you to choose from different instance or VM types.

### About this task

Note the following about changing between pay-as-you-go licenses:

- The operation restarts Cloud Volumes ONTAP.
  - For single node systems, I/O is interrupted.
  - For HA pairs, the change is nondisruptive. HA pairs continue to serve data.
- Changing the instance or machine type affects cloud provider service charges.

## Steps

1. From the working environment, click the menu icon, and then click **Change license or instance** for AWS, **Change license or VM** for Azure, or **Change license or machine** for GCP.
2. Select a license type and an instance type or machine type, select the check box to confirm that you understand the implications of the change, and then click **OK**.

## Result

Cloud Volumes ONTAP reboots with the new license, instance type or machine type, or both.

## Moving to an alternate Cloud Volumes ONTAP configuration

If you want to switch between a pay-by-the-hour (PAYGO) subscription, an annual contract (AWS only), or a BYOL subscription, then you need to create a new Cloud Volumes ONTAP working environment and then replicate data from the existing working environment to the new working environment. The same is true if you want to switch between a single Cloud Volumes ONTAP system and an HA pair.

## Steps

1. Create a new Cloud Volumes ONTAP working environment.

[Launching Cloud Volumes ONTAP in AWS](#)  
[Launching Cloud Volumes ONTAP in Azure](#)  
[Launching Cloud Volumes ONTAP in GCP](#)

2. [Set up one-time data replication](#) between the systems for each volume that you must replicate.
3. Terminate the Cloud Volumes ONTAP system that you no longer need by [deleting the original working environment](#).

## Changing write speed to normal or high

Cloud Manager enables you to choose a normal or high write speed for Cloud Volumes ONTAP. The default write speed is normal. You can change to high write speed if fast write performance is required for your workload.

High write speed is supported with all types of single node systems. It's also supported with HA pairs in AWS and Azure when using a specific instance or VM type. High write speed is not supported with HA pairs in GCP. [Go to the Cloud Volumes ONTAP Release Notes for more details.](#)

Before you change the write speed, you should [understand the differences between the normal and high settings.](#)

### About this task

- Ensure that operations such as volume or aggregate creation are not in progress.
- Be aware that this change restarts the Cloud Volumes ONTAP system. This is disruptive process that requires downtime for the entire system.

### Steps

1. From the working environment, click the menu icon, and then click **Advanced > Writing Speed**.
2. Select **Normal** or **High**.

If you choose High, then you'll need to read the "I understand..." statement and confirm by checking the box.

3. Click **Save**, review the confirmation message, and then click **Proceed**.

## Modifying the storage VM name

Cloud Manager automatically names the single storage VM (SVM) that it creates for Cloud Volumes ONTAP. You can modify the name of the SVM if you have strict naming standards. For example, you might want the name to match how you name the SVMs for your ONTAP clusters.

But if you created any additional SVMs for Cloud Volumes ONTAP, then you can't rename the SVMs from Cloud Manager. You'll need to do so directly from Cloud Volumes ONTAP by using System Manager or the CLI.

### Steps

1. From the working environment, click the menu icon, and then click **Information**.
2. Click the edit icon to the right of the storage VM name.

## Working Environment Information

### ONTAP

Serial Number:



System ID:

system-id-capacitytest

Cluster Name:

capacitytest

ONTAP Version:

9.7RC1

Date Created:

Jul 6, 2020 07:42:02 am

Storage VM Name:

svm\_capacitytest 

3. In the Modify SVM Name dialog box, change the name, and then click **Save**.

### Changing the password for Cloud Volumes ONTAP

Cloud Volumes ONTAP includes a cluster admin account. You can change the password for this account from Cloud Manager, if needed.



You should not change the password for the admin account through System Manager or the CLI. The password will not be reflected in Cloud Manager. As a result, Cloud Manager cannot monitor the instance properly.

#### Steps

1. From the working environment, click the menu icon, and then click **Advanced > Set password**.
2. Enter the new password twice and then click **Save**.

The new password must be different than one of the last six passwords that you used.

### Changing route tables associated with HA pairs in multiple AWS AZs

You can modify the AWS route tables that include routes to the floating IP addresses for an HA pair. You might do this if new NFS or CIFS clients need to access an HA pair in AWS.

#### Steps

1. From the working environment, click the menu icon and then click **Information**.
2. Click **Route Tables**.
3. Modify the list of selected route tables and then click **Save**.

## Result

Cloud Manager sends an AWS request to modify the route tables.

## Managing the state of Cloud Volumes ONTAP

You can stop and start Cloud Volumes ONTAP from Cloud Manager to manage your cloud compute costs.

### Scheduling automatic shutdowns of Cloud Volumes ONTAP

You might want to shut down Cloud Volumes ONTAP during specific time intervals to lower your compute costs. Rather than do this manually, you can configure Cloud Manager to automatically shut down and then restart systems at specific times.

#### About this task

- When you schedule an automatic shutdown of your Cloud Volumes ONTAP system, Cloud Manager postpones the shutdown if an active data transfer is in progress.

Cloud Manager shuts down the system after the transfer is complete.

- This task schedules automatic shutdowns of both nodes in an HA pair.
- Snapshots of boot and root disks are not created when turning off Cloud Volumes ONTAP through scheduled shutdowns.

Snapshots are automatically created only when performing a manual shutdown, as described in the next section.

#### Steps

- From the working environment, click the clock icon:



- Specify the shutdown schedule:

- Choose whether you want to shut down the system every day, every weekday, every weekend, or any combination of the three options.
- Specify when you want to turn off the system and for how long you want it turned off.

#### Example

The following image shows a schedule that instructs Cloud Manager to shut down the system every Saturday at 12:00 a.m. for 48 hours. Cloud Manager restarts the system every Monday at 12:00 a.m.

|                                                            |             |    |   |    |    |     |    |              |
|------------------------------------------------------------|-------------|----|---|----|----|-----|----|--------------|
| <input type="checkbox"/> Turn off every weekday            | turn off at | 08 | : | 00 | PM | for | 12 | Hours (1-24) |
| Mon, Tue, Wed, Thu, Fri                                    |             | ▼  |   | ▼  |    |     |    |              |
| <input checked="" type="checkbox"/> Turn off every weekend | turn off at | 12 | : | 00 | AM | for | 48 | Hours (1-48) |
| Sat                                                        |             | ▼  |   | ▼  |    |     |    |              |

3. Click **Save**.

## Result

Cloud Manager saves the schedule. The clock icon changes to indicate that a schedule is set:



## Stopping Cloud Volumes ONTAP

Stopping Cloud Volumes ONTAP saves you from accruing compute costs and creates snapshots of the root and boot disks, which can be helpful for troubleshooting.



To reduce costs, Cloud Manager periodically deletes older snapshots of root and boot disks. Only the two most recent snapshots are retained for both the root and boot disks.

### About this task

When you stop an HA pair, Cloud Manager shuts down both nodes.

### Steps

1. From the working environment, click the **Turn off** icon.



2. Keep the option to create snapshots enabled because the snapshots can enable system recovery.

3. Click **Turn Off**.

It can take up to a few minutes to stop the system. You can restart systems at a later time from the working environment page.

## Monitoring AWS resource costs

Cloud Manager enables you to view the resource costs associated with running Cloud Volumes ONTAP in AWS. You can also see how much money you saved by using NetApp features that can reduce storage costs.

### About this task

Cloud Manager updates the costs when you refresh the page. You should refer to AWS for final cost details.

### Step

1. Verify that Cloud Manager can obtain cost information from AWS:
  - a. Ensure that the IAM policy that provides Cloud Manager with permissions includes the following actions:

```
"ce:GetReservationUtilization",
"ce:GetDimensionValues",
"ce:GetCostAndUsage",
"ce:GetTags"
```

These actions are included in the latest [Cloud Manager policy](#). New systems deployed from NetApp Cloud Central automatically include these permissions.

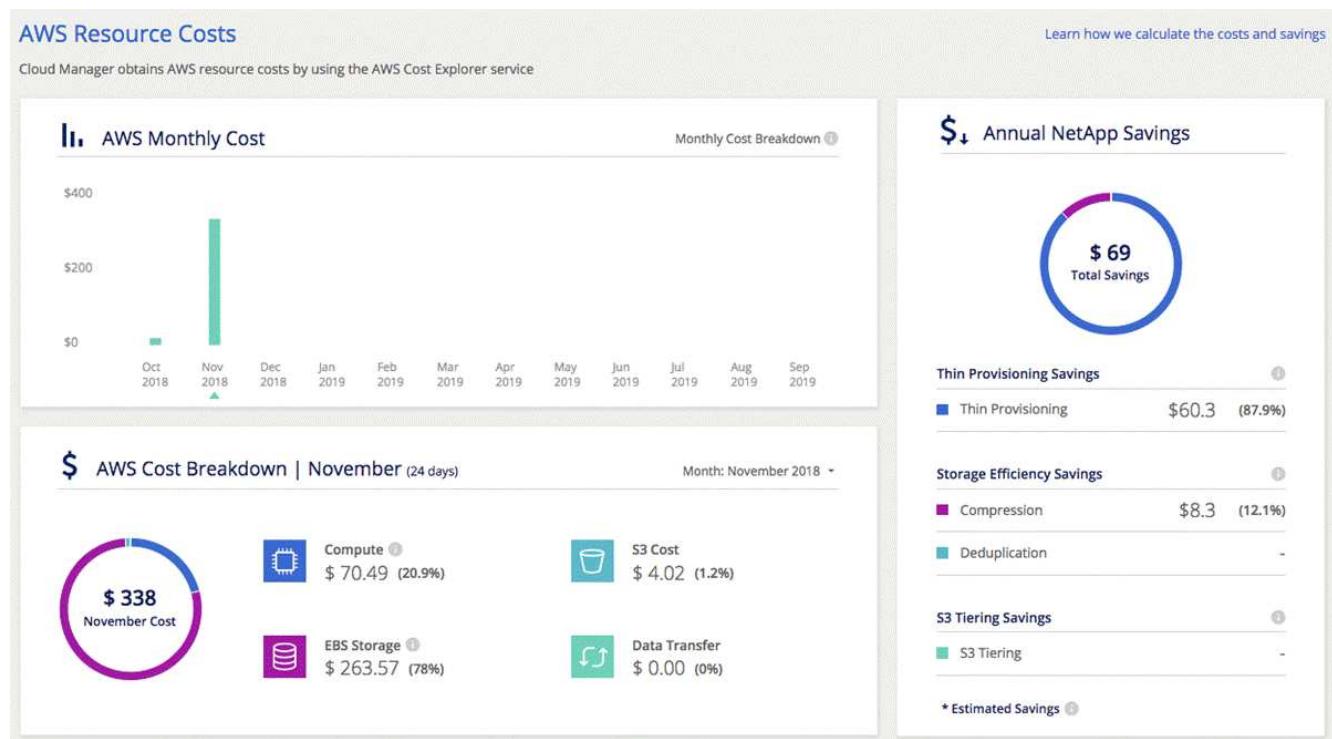
b. [Activate the WorkingEnvironmentId tag](#).

To track your AWS costs, Cloud Manager assigns a cost allocation tag to Cloud Volumes ONTAP instances. After you create your first working environment, activate the **WorkingEnvironmentId** tag. User-defined tags don't appear on AWS billing reports until you activate them in the Billing and Cost Management console.

2. On the Canvas page, select a Cloud Volumes ONTAP working environment and then click **Cost**.

The Cost page displays costs for the current and previous months and shows your annual NetApp savings, if you enabled NetApp's cost-saving features on volumes.

The following image shows a sample Cost page:



## Connecting to Cloud Volumes ONTAP

If you need to perform advanced management of Cloud Volumes ONTAP, you can do so using ONTAP System Manager or the command line interface.

### Connecting to System Manager

You might need to perform some Cloud Volumes ONTAP tasks from System Manager, which is a browser-based management tool that runs on the Cloud Volumes ONTAP system. For example, you need to use System Manager if you want to create LUNs.

#### Before you begin

The computer from which you are accessing Cloud Manager must have a network connection to Cloud Volumes ONTAP. For example, you might need to log in to Cloud Manager from a jump host that's in your

cloud provider network.



When deployed in multiple AWS Availability Zones, Cloud Volumes ONTAP HA configurations use a floating IP address for the cluster management interface, which means external routing is not available. You must connect from a host that is part of the same routing domain.

## Steps

1. From the Canvas page, double-click the Cloud Volumes ONTAP system that you want to manage with System Manager.
2. Click the menu icon, and then click **Advanced > System Manager**.
3. Click **Launch**.

System Manager loads in a new browser tab.

4. At the login screen, enter **admin** in the User Name field, enter the password that you specified when you created the working environment, and then click **Sign In**.

## Result

The System Manager console loads. You can now use it to manage Cloud Volumes ONTAP.

## Connecting to the Cloud Volumes ONTAP CLI

The Cloud Volumes ONTAP CLI enables you to run all administrative commands and is a good choice for advanced tasks or if you are more comfortable using the CLI. You can connect to the CLI using Secure Shell (SSH).

### Before you begin

The host from which you use SSH to connect to Cloud Volumes ONTAP must have a network connection to Cloud Volumes ONTAP. For example, you might need to use SSH from a jump host in AWS or Azure.



When deployed in multiple AZs, Cloud Volumes ONTAP HA configurations use a floating IP address for the cluster management interface, which means external routing is not available. You must connect from a host that is part of the same routing domain.

## Steps

1. In Cloud Manager, identify the IP address of the cluster management interface:
  - a. On the Canvas page, select the Cloud Volumes ONTAP system.
  - b. Copy the cluster management IP address that appears in the right pane.
2. Use SSH to connect to the cluster management interface IP address using the admin account.

### Example

The following image shows an example using PuTTY:

Specify the destination you want to connect to

|                                  |      |
|----------------------------------|------|
| Host <u>Name</u> (or IP address) | Port |
| admin@192.168.111.5              | 22   |

Connection type:

Raw    Telnet    Rlogin    SSH    Serial

- At the login prompt, enter the password for the admin account.

#### Example

```
Password: *****
```

```
COT2::>
```

## Adding existing Cloud Volumes ONTAP systems to Cloud Manager

You can discover and add existing Cloud Volumes ONTAP systems to Cloud Manager. You might do this if you deployed a new Cloud Manager system.

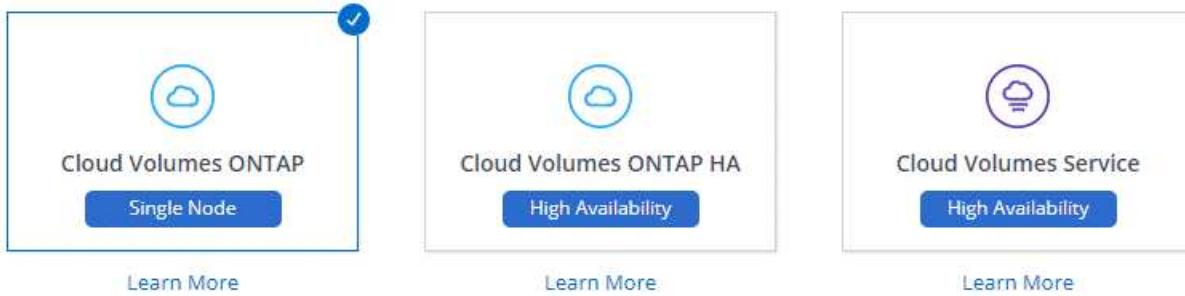
#### Before you begin

You must know the password for the Cloud Volumes ONTAP admin user account.

#### Steps

- On the Canvas page, click **Add Working Environment**.
- Select the cloud provider in which the system resides.
- Choose the type of Cloud Volumes ONTAP system.
- Click the link to discover an existing system.

## Define Your Working Environment



You're about to create a new **Cloud Volumes ONTAP** system in AWS.



If you want to discover an existing Cloud Volumes ONTAP in AWS, click here.

5. On the Region page, choose the region where the instances are running, and then select the instances.
6. On the Credentials page, enter the password for the Cloud Volumes ONTAP admin user, and then click **Go**.

### Result

Cloud Manager adds the Cloud Volumes ONTAP instances to the workspace.

## Overriding CIFS locks for Cloud Volumes ONTAP HA in Azure

The Account Admin can enable a setting in Cloud Manager that prevents issues with Cloud Volumes ONTAP storage giveback during Azure maintenance events. When you enable this setting, Cloud Volumes ONTAP vetoes CIFS locks and resets active CIFS sessions.

### About this task

Microsoft Azure schedules periodic maintenance events on its virtual machines. When a maintenance event occurs on a Cloud Volumes ONTAP HA pair, the HA pair initiates storage takeover. If there are active CIFS sessions during this maintenance event, the locks on CIFS files can prevent storage giveback.

If you enable this setting, Cloud Volumes ONTAP will veto the locks and reset the active CIFS sessions. As a result, the HA pair can complete storage giveback during these maintenance events.



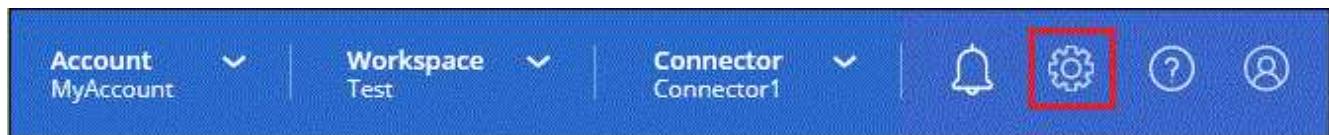
This process might be disruptive to CIFS clients. Data that is not committed from CIFS clients could be lost.

### What you'll need

You need to create a Connector before you can change Cloud Manager settings. [Learn how](#).

### Steps

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



2. Under **Azure**, click **Azure CIFS locks for Azure HA working environments**.

3. Click the checkbox to enable the feature and then click **Save**.

## Using an Azure Private Link with Cloud Volumes ONTAP

By default, Cloud Manager enables an Azure Private Link connection between Cloud Volumes ONTAP and its associated storage accounts. A Private Link secures connections between endpoints in Azure and provides performance benefits. [Learn more](#).

In most cases, there's nothing that you need to do—Cloud Manager manages the Azure Private Link for you. But if you use Azure Private DNS, then you'll need to edit a configuration file. You can also disable the Private Link connection, if desired.

### Connector location in Azure

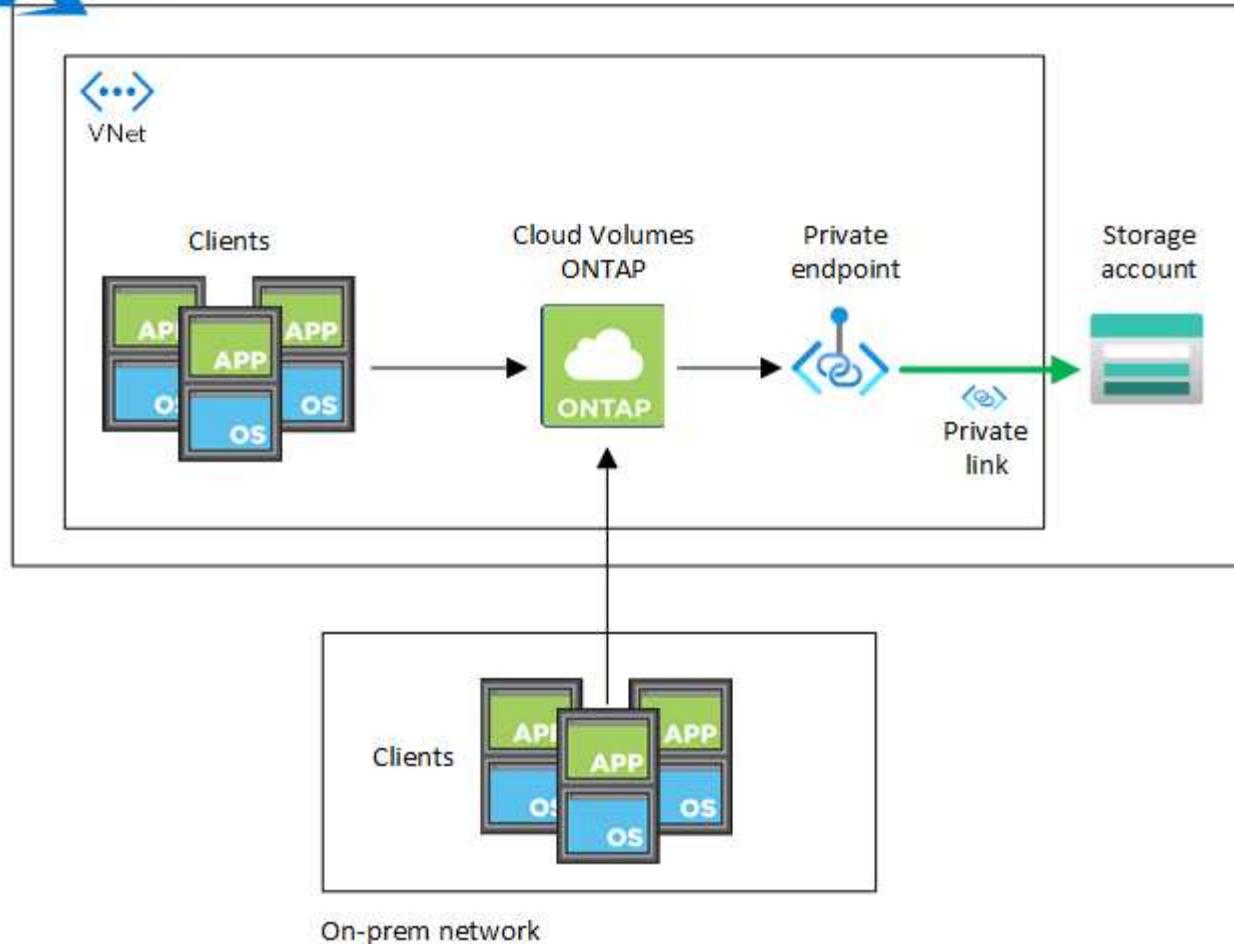
The Connector should be deployed in the same Azure region as the Cloud Volumes ONTAP systems that it manages, or in the [Azure region pair](#) for the Cloud Volumes ONTAP systems. This requirement ensures that an Azure Private Link connection is used between Cloud Volumes ONTAP and its associated storage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

### How Private Link connections work with Cloud Volumes ONTAP

When Cloud Manager deploys Cloud Volumes ONTAP in Azure, it creates a private endpoint in the resource group. The private endpoint is associated with the storage account for Cloud Volumes ONTAP. As a result, access to Cloud Volumes ONTAP storage travels through the Microsoft backbone network.

Client access goes through the private link when clients are within the same VNet as Cloud Volumes ONTAP, within peered VNets, or in your on-premises network when using a private VPN or ExpressRoute connection to the VNet.

Here's an example that shows client access over a private link from within the same VNet and from an on-prem network that has either a private VPN or ExpressRoute connection.



## Providing Cloud Manager with details about your Azure Private DNS

If you use [Azure Private DNS](#), then you need to modify a configuration file on each Connector. Otherwise, Cloud Manager can't enable the Azure Private Link connection between Cloud Volumes ONTAP and its associated storage accounts.

Note that the DNS name must match Azure DNS naming requirements as shown in [Azure documentation](#).

### Steps

1. SSH to the Connector host and log in.
2. Navigate to the following directory: /opt/application/netapp/cloudmanager/docker\_occm/data
3. Edit app.conf by modifying the following parameters as shown:

```
"user-private-dns-zone-settings": {
 "use-existing": true,
 "resource-group": "<resource group name of the DNS zone>",
 "subscription": "<subscription ID>"
}
```

The subscription parameter is required only if the Private DNS Zone exists in a different subscription than

the Connector.

4. Save the file and log off the Connector.

A reboot isn't required.

## Disabling Azure Private Link connections

If required for your Azure configuration, you can disable the Azure Private Link connection between Cloud Volumes ONTAP and storage accounts.

### Steps

1. In the upper right of the Cloud Manager console, click the Settings icon, and select **Connector Settings**.
2. Under **Azure**, click **Use Azure Private Link**.
3. Deselect **Private Link connection between Cloud Volumes ONTAP and storage accounts**.
4. Click **Save**.

## Deleting a Cloud Volumes ONTAP working environment

You should always delete Cloud Volumes ONTAP systems from Cloud Manager, rather than from your cloud provider's console. For example, if you terminate a licensed Cloud Volumes ONTAP instance from your cloud provider, then you can't use the license key for another instance. You must delete the working environment from Cloud Manager to release the license.

When you delete a working environment, Cloud Manager terminates Cloud Volumes ONTAP instances and deletes disks and snapshots.

Resources managed by other services like backups for Cloud Backup and instances for Cloud Data Sense and Monitoring are not deleted when you delete a working environment. You'll need to manually delete them yourself. If you don't, then you'll continue to receive charges for these resources.



When Cloud Manager deploys Cloud Volumes ONTAP in your cloud provider, it enables termination protection on the instances. This option helps prevent accidental termination.

### Steps

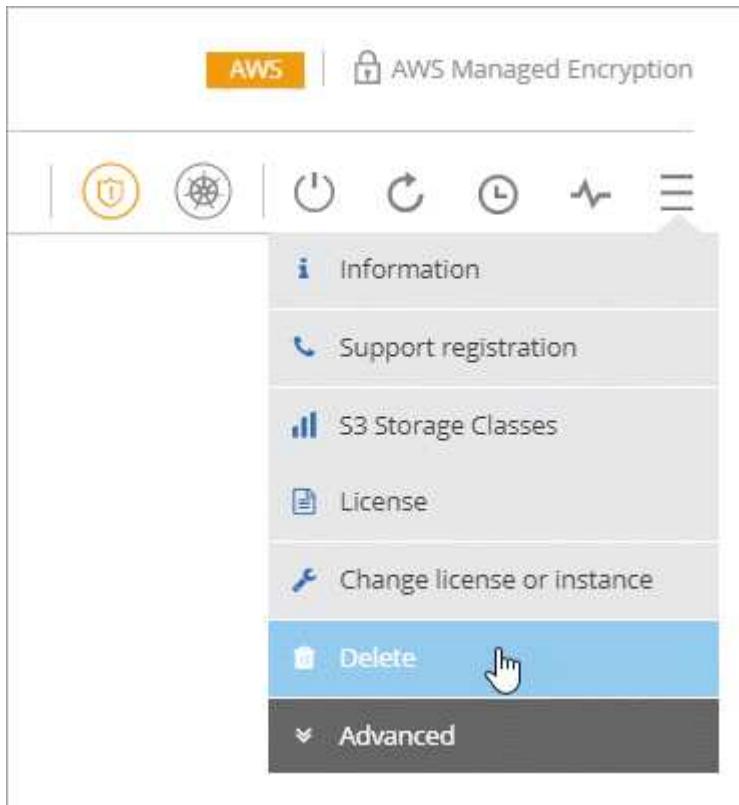
1. If you enabled Cloud Backup on the working environment, determine whether the backed up data is still required and then [delete the backups, if necessary](#).

Cloud Backup is independent from Cloud Volumes ONTAP by design. Cloud Backup doesn't automatically delete backups when you delete a Cloud Volumes ONTAP system, and there is no current support in the UI to delete the backups after the system has been deleted.

2. If you enabled Cloud Data Sense or Monitoring on this working environment and no other working environments use those services, then you'll need to delete the instances for those services.
  - [Learn more about the Cloud Data Sense instance](#).
  - [Learn more about the Monitoring Acquisition Unit](#).
3. Delete the Cloud Volumes ONTAP working environment.
  - a. On the Canvas page, double-click the name of the Cloud Volumes ONTAP working environment that

you want to delete.

- b. Click menu icon and then click **Delete**.



- c. Type the name of the working environment and then click **Delete**.

It can take up to 5 minutes to delete the working environment.

# Provision volumes using a file service

## Azure NetApp Files

### Learn about Azure NetApp Files

Azure NetApp Files enables enterprises to migrate and run their performance-intensive and latency-sensitive core, business-critical applications in Azure with no need to refactor for the cloud.

#### Features

- Support for multiple protocols enables "lift & shift" of both Linux & Windows applications to run seamlessly in Azure.
- Multiple performance tiers allow for close alignment with workload performance requirements.
- Leading certifications including SAP HANA, GDPR, and HIPAA enables migration of the most demanding workloads to Azure.

#### Additional features in Cloud Manager

- Migrate NFS or SMB data to Azure NetApp Files directly from Cloud Manager. Data migrations are powered by NetApp's Cloud Sync service. [Learn more](#).
- Using Artificial Intelligence (AI) driven technology, Cloud Data Sense can help you understand data context and identify sensitive data that resides in your Azure NetApp Files accounts. [Learn more](#).

#### Cost

[View Azure NetApp Files pricing](#).

Note that your subscription and charging are maintained by the Azure NetApp Files service and not by Cloud Manager.

#### Supported regions

[View supported Azure regions](#).

#### Getting help

For technical support issues associated with Azure NetApp Files, use the Azure portal to log a support request to Microsoft. Select your associated Microsoft subscription and select the **Azure NetApp Files** service name under **Storage**. Provide the remaining information required to create your Microsoft support request.

For issues related to Cloud Sync and Azure NetApp Files, you can start with NetApp using your Cloud Sync serial number directly from the Cloud Sync service. You will need to access the Cloud Sync service through the link in Cloud Manager. [View the process to enable Cloud Sync support](#).

#### Related links

- [NetApp Cloud Central: Azure NetApp Files](#)
- [Azure NetApp Files documentation](#)

- [Cloud Sync documentation](#)

## Setting up and discovering Azure NetApp Files

Create an Azure NetApp Files working environment in Cloud Manager to create and manage NetApp accounts, capacity pools, volumes, and snapshots.

If you haven't set up Azure NetApp Files yet, you'll need to complete all of the steps on this page.

If you already set up Azure NetApp Files from outside of Cloud Manager, then you simply need to set up an Azure AD application and then create the Azure NetApp Files working environment.

### Quick start

Get started quickly by following these steps or scroll down to the remaining sections for full details.

1

#### **Set up an Azure AD application**

From Azure, grant permissions to an Azure AD application and copy the application (client) ID, the directory (tenant) ID, and the value of a client secret.

2

#### **Create an Azure NetApp Files working environment**

In Cloud Manager, click **Add Working Environment > Microsoft Azure > Azure NetApp Files** and then provide details about the AD application.

### Setting up an Azure AD application

Cloud Manager needs permissions to set up and manage Azure NetApp Files. You can grant the required permissions to an Azure account by creating and setting up an Azure AD application and by obtaining the Azure credentials that Cloud Manager needs.

#### Creating the AD application

Create an Azure Active Directory (AD) application and service principal that Cloud Manager can use for role-based access control.

#### 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.

The screenshot shows the Microsoft Azure portal interface. At the top, there's a search bar with the text "active directory". Below the search bar, the "Services" section is visible, featuring four items: "Azure AD Privileged Identity Management", "Azure Active Directory" (with a hand cursor icon indicating it's selected), "Activity log", and "Security". On the left side, there's a sidebar titled "Azure services" with a "Create a resource" button.

2. In the menu, click **App registrations**.

3. Create the application:

a. Click **New registration**.

b. 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 blank.

c. Click **Register**.

4. Copy the **Application (client) ID** and the **Directory (tenant) ID**.

The screenshot shows the "App registrations" page in the Azure portal. The application "azure-netapp-files" is selected. On the left, there's a navigation menu with "Overview" (selected), "Quickstart", and "Integration assistant (preview)". On the right, there's a "Display name" field set to "azure-netapp-files". Below it, the "Application (client) ID" and "Directory (tenant) ID" fields are highlighted with a red box. The "Object ID" field is also visible. At the top right, there are "Delete" and "Endpoints" buttons.

|                         |   |                                      |
|-------------------------|---|--------------------------------------|
| Display name            | : | azure-netapp-files                   |
| Application (client) ID | : | e461f4ca-9d9a-4aec-8f39-fc842b684c97 |
| Directory (tenant) ID   | : | 8e21f23a-10b9-46fb-9d50-720ef604be98 |
| Object ID               | : | a910846e-a497-4838-a3bc-9c2c01625056 |

When you create the Azure NetApp Files working environment in 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.

5. Create a client secret for the application so Cloud Manager can use it to authenticate with Azure AD:

- a. Click **Certificates & secrets > New client secret**.
- b. Provide a description of the secret and a duration.
- c. Click **Add**.
- d. Copy the value of the client secret.

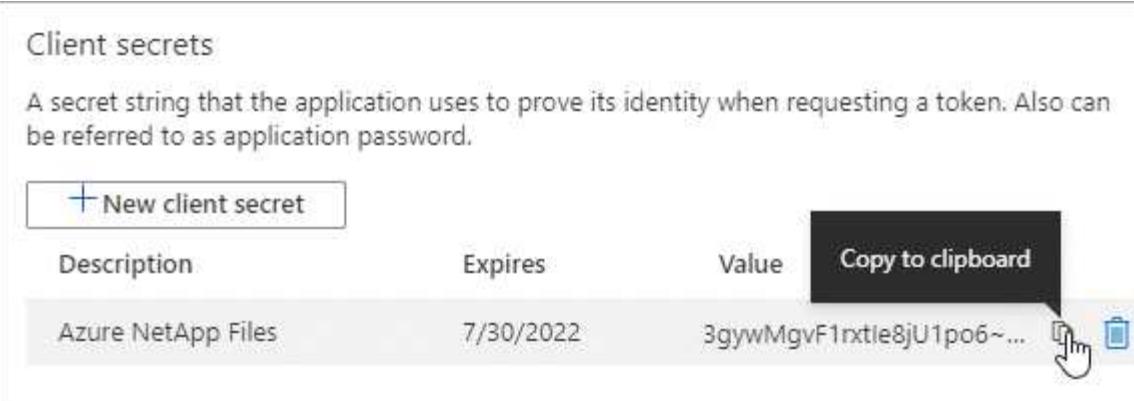
**Client secrets**

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

| Description        | Expires   | Value                     |
|--------------------|-----------|---------------------------|
| Azure NetApp Files | 7/30/2022 | 3gywMgvF1rxtle8jU1po6~... |

**New client secret**

**Copy to clipboard**



## Result

Your AD application 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 add an Azure NetApp Files working environment.

## Assigning the app to a role

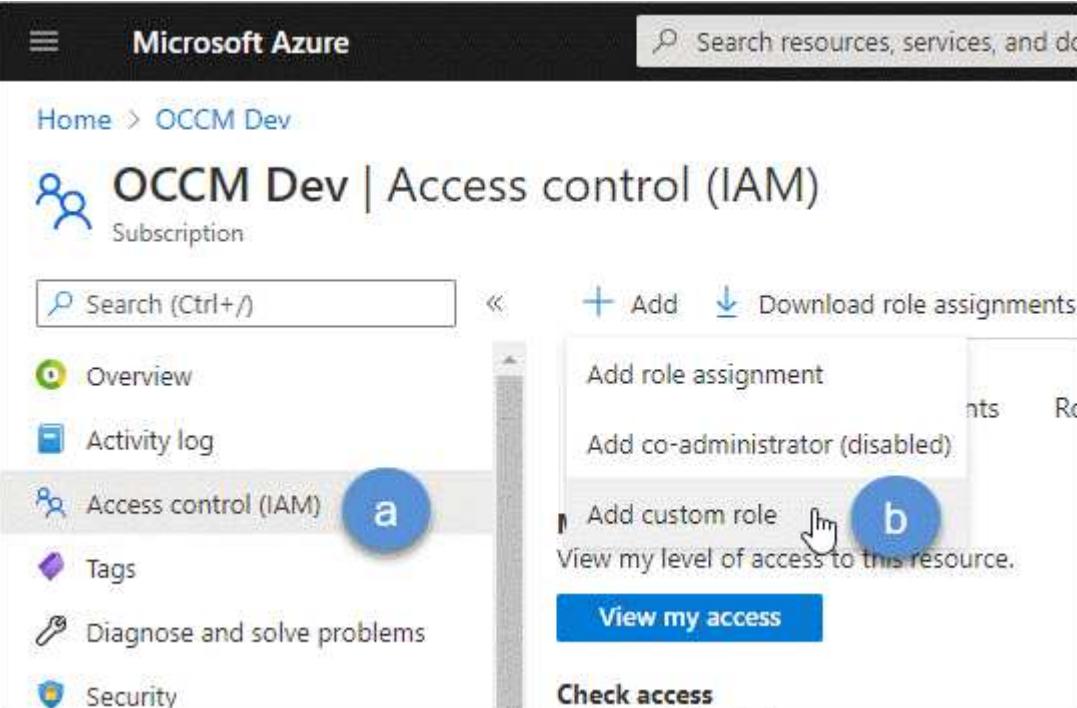
You must bind the service principal to your Azure subscription and assign it a custom role that has the required permissions.

## Steps

1. Create a custom role in Azure.

The following steps describe how to create the role from the Azure portal.

- a. Open the subscription and click **Access control (IAM)**.
- b. Click **Add > Add custom role**.



**Microsoft Azure**

Search resources, services, and documents

Home > OCCM Dev

**OCCM Dev | Access control (IAM)**

Subscription

Search (Ctrl+ /)

+ Add    Download role assignments

**Add role assignment**

Add co-administrator (disabled)

**Add custom role** (highlighted with a blue circle and a mouse cursor)

View my level of access to this resource.

**View my access**

**Check access**

Overview

Activity log

Access control (IAM) (highlighted with a blue circle)

Tags

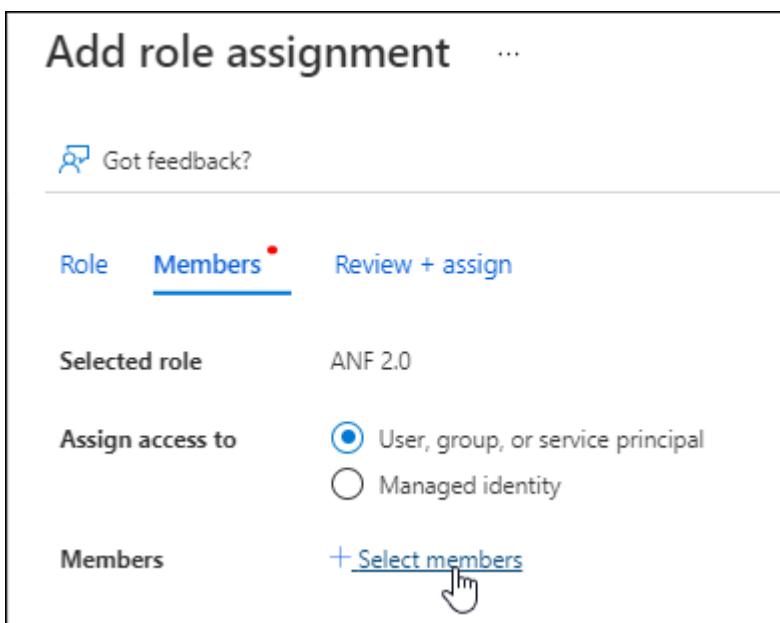
Diagnose and solve problems

Security

- c. In the **Basics** tab, enter a name and description for the role.
- d. Click **JSON** and click **Edit** which appears at the top right of the JSON format.
- e. Add the following permission under **actions**:

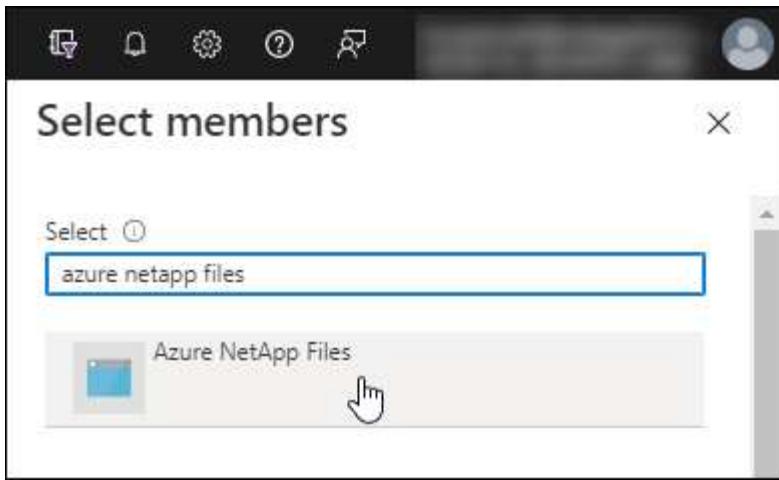
```
"actions": [
 "Microsoft.NetApp/*",
],
```

- f. Click **Save**, click **Next**, and then click **Create**.
2. Now assign the application to the role that you just created:
- 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 custom role that you created and click **Next**.
  - e. In the **Members** tab, complete the following steps:
    - Keep **User, group, or service principal** selected.
    - Click **Select members**.



- Search for the name of the application.

Here's an example:



- Select the application and click **Select**.
  - Click **Next**.
- f. Click **Review + assign**.

The service principal for Cloud Manager now has the required Azure permissions for that subscription.

### Creating an Azure NetApp Files working environment

Set up an Azure NetApp Files working environment in Cloud Manager so you can start creating volumes.

1. From the Canvas page, click **Add Working Environment**.
2. Select **Microsoft Azure** and then **Azure NetApp Files**.
3. Provide details about the AD application that you previously set up.

## Azure NetApp Files Credentials

Working Environment Name

ANF

Application (client) ID

e461f4ca-9d9a-4aec-8f39-fc842b684c97

Client Secret

.....

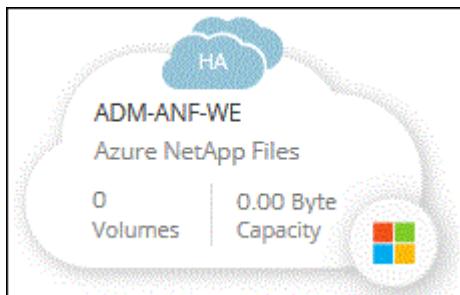
Directory (tenant) ID

8e21f23a-10b9-46fb-9d50-720ef604be98

4. Click **Add**.

### Result

You should now have an Azure NetApp Files working environment.



### What's next?

[Start creating and managing volumes.](#)

## Creating and managing volumes for Azure NetApp Files

After you set up your working environment, you can create and manage Azure NetApp Files accounts, capacity pools, volumes, and snapshots.

## Creating volumes

You can create NFS or SMB volumes in a new or existing Azure NetApp Files account.

A Cloud Manager feature called "templates" enables you to create volumes that are optimized for the workload requirements for certain applications; such as databases or streaming services. If your organization has created volume templates that you should use, follow [these steps](#).

### Before you begin

- If you want to use SMB, you must have set up DNS and Active Directory.
- When planning to create an SMB volume, you must have a Windows Active Directory server available to which you can connect. You will enter this information when creating the volume.

### Steps

1. Open the Azure NetApp Files working environment.

2. Click **Add New Volume**.

3. Provide the required information on each page:

- **Azure NetApp Files Account:** Choose an existing Azure NetApp Files account or create a new account. When creating a new account you can also choose the Resource Group that you want to use.

- **Capacity Pool:** Select an existing capacity pool or create a new capacity pool.

If you create a new capacity pool, you need to specify a size and select a [service level](#).

The minimum size for the capacity pool is 4 TB. You can specify a size in multiples of 4 TB.

- **Details & Tags:** Enter a volume name and size, the VNet and subnet where the volume should reside, and optionally specify tags for the volume.

- **Protocol:** Choose the NFS or SMB protocol and enter the required information.

Here's an example of details for NFS.

Protocol

Select the volume's protocol:  **NFS Protocol**  SMB Protocol

| Protocol                                                                                          | Export Policy                                                                                                                           |
|---------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| Volume Path<br>vol1                                                                               | Allowed Client & Access<br>192.168.1.22/24 <input checked="" type="radio"/> Read & Write <input type="radio"/> Read Only <span>X</span> |
| Select NFS Version:<br><input checked="" type="checkbox"/> NFSv3 <input type="checkbox"/> NFSv4.1 | 192.168.1.22/24 <input checked="" type="radio"/> Read & Write <input type="radio"/> Read Only <span>X</span>                            |
| <span>+ Add Export Policy Rule (Up to 5)</span>                                                   |                                                                                                                                         |

Here's an example of details for SMB. You'll need to provide Active Directory information on the next page when you set up your first SMB volume.

The screenshot shows a 'Protocol' configuration dialog. At the top, there are two radio button options: 'NFS Protocol' and 'SMB Protocol'. The 'SMB Protocol' option is selected, indicated by a blue circle with a dot. Below the radio buttons is a 'Share Name' field containing the value 'vol1'.

4. If you want this volume to be created based on a snapshot of an existing volume, select the snapshot from the Snapshot Name drop-down list.
5. Click **Add Volume**.

## Result

The new volume is added to the working environment.

Continue with [mounting the cloud volume](#).

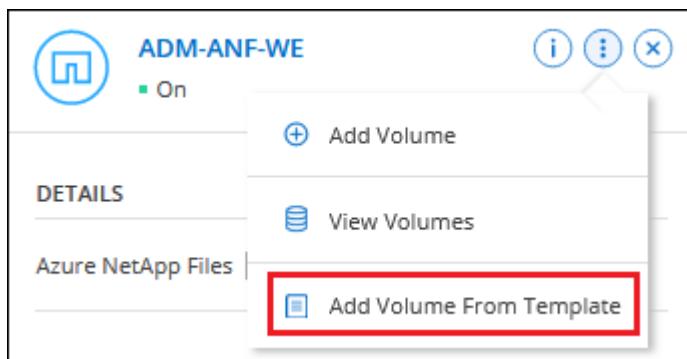
## Creating volumes from templates

If your organization has created ANF volume templates so you can deploy volumes that are optimized for the workload requirements for certain applications, follow the steps in this section.

The template should make your job easier because certain volume parameters will already be defined in the template, such as capacity pool, size, protocol, VNet and subnet where the volume should reside, and more. When a parameter is already predefined, you can just skip to the next volume parameter.

## Steps

1. On the Canvas page, click the Azure NetApp Files working environment on which you want to provision a volume.
2. Click > **Add Volume From Template**.



3. In the *Select Template* page, select the template that you want to use to create the volume and click **Next**.

The screenshot shows a search interface for selecting a template. At the top, there are two numbered steps: '1 Select Template' and '2 Define Parameters'. Below the steps is a search bar labeled 'Select Template' with a magnifying glass icon. Underneath the search bar is a table header with columns: 'Template Name', 'Template Description', 'Created by', 'Last Modified', and 'Parameters'. A single row is visible in the table, representing a template named 'Azure ANF volume for staging'.

The *Define Parameters* page is displayed.

The screenshot shows the 'Define Parameters' page. At the top, it says 'Enter your values for the actions. Parameters that are locked by the template are not editable.' On the left, under 'Actions', there is a button labeled 'Create Volume in Azure NetApp Files (1)'. On the right, there are several configuration sections: 'Volume Details' (Volume Name: 'Volume Name should start with "staging"', Volume Size (GB): 'Minimum value is 160, Maximum value is 165'), 'Tags' (Add Tags), 'Protocol' (radio buttons for NFSv3, NFSv4.1, SMB, with NFSv3 selected), 'Volume Path' ('volPatsdscwwwq'), and 'Export Policy Rules (up to 5)'.

**Note:** You can click the checkbox **Show read-only parameters** to show all the fields that have been locked by the template if you want to see the values for those parameters. By default these predefined fields are hidden and only the fields you need to complete are shown.

4. Add values for all of the parameters that are not hard-coded from the template. See [creating volumes](#) for details about all the parameters you need to complete to deploy an ANF volume.
5. Click **Run Template** after you have defined all the parameters needed for this volume.

## Result

Cloud Manager provisions the volume and displays a page so that you can see the progress.

This process can take a few minutes.  
Keep this page open to monitor progress, or you can close this page  
and check the [Timeline](#) later for details.

**Actions status**

|                                     |         |
|-------------------------------------|---------|
| Create Volume in Azure NetApp Files | Pending |
|-------------------------------------|---------|

Then the new volume is added to the working environment.

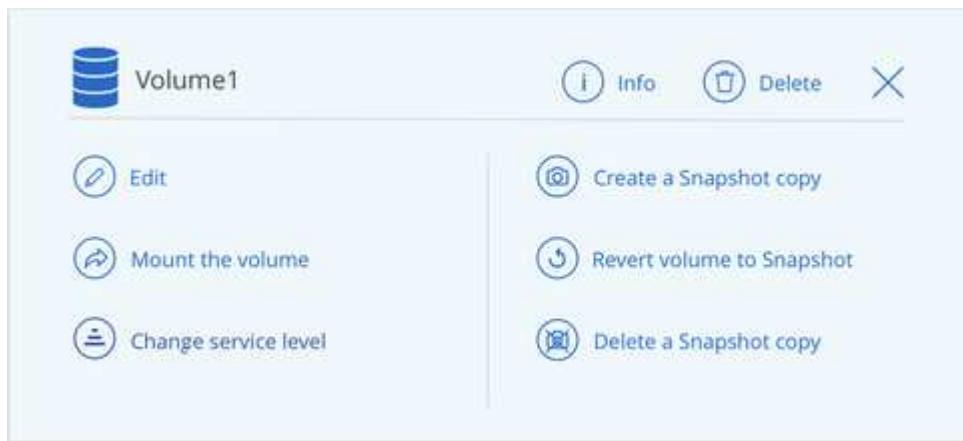
Continue with mounting the cloud volume.

## Mounting volumes

Access mounting instructions from within Cloud Manager so you can mount the volume to a host.

### Steps

1. Open the working environment.
2. Hover over the volume and select **Mount the volume**.



3. Follow the instructions to mount the volume.

## Editing a volume's size and tags

After you create a volume, you can modify its size and tags at any time.

### Steps

1. Open the working environment.
2. Hover over the volume and select **Edit**.
3. Modify the size and tags as needed.
4. Click **Apply**.

## Changing the volume's service level

After you create a volume, you can change the service level at any time as long as the destination capacity pool already exists.

### Steps

1. Open the working environment.
2. Hover over the volume and select **Change service level**.
3. Select the capacity pool that provides the service level that you want.
4. Click **Change**.

### Result

The volume is moved to the other capacity pool with no impact to the volume.

## Managing Snapshot copies

Snapshot copies provide a point-in-time copy of your volume. Create Snapshot copies, restore the data to a new volume, and delete Snapshot copies.

### Steps

1. Open the working environment.
2. Hover over the volume and choose one of the available options to manage Snapshot copies:
  - **Create a Snapshot copy**
  - **Revert volume to Snapshot**
  - **Delete a Snapshot copy**
3. Follow the prompts to complete the selected action.

## Deleting volumes

Delete the volumes that you no longer need.

### Steps

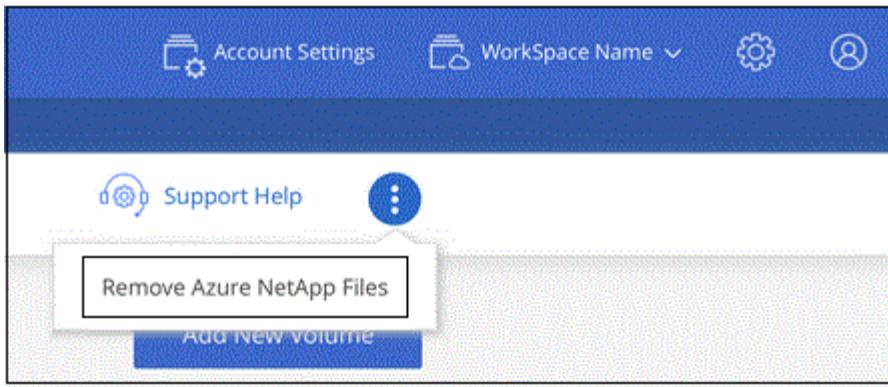
1. Open the working environment.
2. Hover over the volume and click **Delete**.
3. Confirm that you want to delete the volume.

## Removing Azure NetApp Files

This action removes Azure NetApp Files from Cloud Manager. It doesn't delete your Azure NetApp Files account or volumes. You can add Azure NetApp Files back to Cloud Manager at any time.

### Steps

1. Open the Azure NetApp Files working environment.
2. At the top right of the page, select the actions menu and click **Remove Azure NetApp Files**.



3. Click **Remove** to confirm.

## Amazon FSx for ONTAP

### Learn about Amazon FSx for ONTAP

Amazon FSx for ONTAP is a fully managed service allowing customers to launch and run file systems powered by NetApp's ONTAP storage operating system. FSx for ONTAP provides the same features, performance, and administrative capabilities NetApp customers use on premises, with the simplicity, agility, security, and scalability of a native AWS service.

### Features

- No need to configure or manage storage devices, software, or backups.
- Support for CIFS, NFSv3, NFSv4.x, and SMB v2.0 - v3.1.1 protocols.
- Low cost, virtually unlimited data storage capacity using available Infrequently Accessed (IA) storage tier.
- Certified to run on latency-sensitive applications including Oracle RAC.
- Choice of bundled and pay-as-you-go pricing.

### Additional features in Cloud Manager

- Using a Connector in AWS and Cloud Manager, you can create and manage volumes, replicate data, and integrate FSx for ONTAP with NetApp cloud services, such as Data Sense and Cloud Sync.
- Using Artificial Intelligence (AI) driven technology, Cloud Data Sense can help you understand data context and identify sensitive data that resides in your FSx for ONTAP accounts. [Learn more](#).
- Using NetApp Cloud Sync, you can automate data migration to any target in the cloud or on premises. [Learn more](#)

### Cost

Your FSx for ONTAP account is maintained by AWS and not by Cloud Manager. [Amazon FSx for ONTAP getting started guide](#)

There is an additional cost associated with using the Connector in AWS and the optional data services such as Cloud Sync and Data Sense.

## Supported regions

[View supported Amazon regions.](#)

## Getting help

Amazon FSx for ONTAP is an AWS first-party solution. For questions or technical support issues associated with your AWS FSx file system, infrastructure or any AWS solution using this service, use the Support Center in your AWS console to open a support case to AWS. Select the “FSx for ONTAP” service and appropriate category. Provide the remaining information required to create your AWS support case.

For general questions specific to Cloud Manager or Cloud Manager micro-services, you can start with the in-line Cloud Manager chat.

For technical support issues specific to Cloud Manager or micro-services within, you can open a NetApp support ticket using your Cloud Manager account level serial number. You will need to register your Cloud Manager serial number to activate support.

## Limitations

- Cloud Manager can replicate data only from on-premises or Cloud Volumes ONTAP to FSx for ONTAP.
- At this time iSCSI volumes can be created using the ONTAP CLI, ONTAP API, or Cloud Manager API.

## Get started with Amazon FSx for ONTAP

Get started with Amazon FSx for ONTAP in a few steps.

You can get started with FSx for ONTAP in just a few steps.

1

### Create an FSx for ONTAP working environment

You must create an Amazon FSx for ONTAP working environment before adding volumes. You will need to [set up an IAM role that enables the Cloud Manager SaaS to assume the role](#).

2

### Create a Connector

You must have a [Connector for AWS](#) to open the FSx for ONTAP working environment, create volumes, or perform other actions. When a Connector is required, Cloud Manager will prompt you if one is not already added.

3

### Add volumes

You can create FSx for ONTAP volumes using Cloud Manager.

4

### Manage your volumes

Use Cloud Manager to manage your volumes and configure additional services such as replication, Cloud Sync, and Data Sense.

## Related links

- [Creating a Connector from Cloud Manager](#)
- [Launching a Connector from the AWS Marketplace](#)
- [Installing the Connector software on a Linux host](#)

## Set up permissions for FSx for ONTAP

To create or manage an Amazon FSx for ONTAP working environment, you need to add AWS credentials to Cloud Manager by providing the ARN of an IAM role that gives Cloud Manager the permissions needed to create an FSx for ONTAP working environment.

### Set up the IAM role

Set up an IAM role that enables the Cloud Manager SaaS to assume the role.

#### Steps

1. Go to the IAM console in the target account.
2. Under Access Management, click **Roles > Create Role** and follow the steps to create the role.

Be sure to do the following:

- Under **Trusted entity type**, select **AWS account**.
- Select **Another AWS account** and enter the ID of the Cloud Manager SaaS: 733004784675
- Create a policy that includes the following permissions:

```
{
 "Version": "2012-10-17",
 "Statement": [
 {
 "Sid": "VisualEditor0",
 "Effect": "Allow",
 "Action": [
 "fsx:*",
 "ec2:Describe*",
 "ec2:CreateTags",
 "kms:Describe*",
 "kms>List*",
 "iam>CreateServiceLinkedRole"
],
 "Resource": "*"
 }
]
}
```

3. Copy the Role ARN of the IAM role so that you can paste it in Cloud Manager in the next step.

### Result

The IAM role now has the required permissions.

## Add the credentials

After you provide the IAM role with the required permissions, add the role ARN to Cloud Manager.

### Before you get started

If you just created the IAM role, it might take a few minutes until they are available for use. Wait a few minutes before you add the credentials to Cloud Manager.

### Steps

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



2. Click **Add Credentials** and follow the steps in the wizard.

- Credentials Location:** Select **Amazon Web Services > Cloud Manager**.
- Define Credentials:** Provide the ARN (Amazon Resource Name) of the IAM role.
- Review:** Confirm the details about the new credentials and click **Add**.

### Result

You can now use the credentials when creating an FSx for ONTAP working environment.

### Related links

- [AWS credentials and permissions](#)
- [Managing AWS credentials for Cloud Manager](#)

## Security group rules for FSx for ONTAP

Cloud Manager creates AWS security groups that include the inbound and outbound rules that Cloud Manager and FSx for ONTAP need to operate successfully. You might want to refer to the ports for testing purposes or if you need to use your own.

### Rules for FSx for ONTAP

The security group for FSx for ONTAP requires both inbound and outbound rules.

#### Inbound rules

The source for inbound rules in the predefined security group is 0.0.0.0/0.

| Protocol | Port | Purpose                                                                                          |
|----------|------|--------------------------------------------------------------------------------------------------|
| All ICMP | All  | Pinging the instance                                                                             |
| HTTP     | 80   | HTTP access to the System Manager web console using the IP address of the cluster management LIF |

| Protocol | Port    | Purpose                                                                                           |
|----------|---------|---------------------------------------------------------------------------------------------------|
| HTTPS    | 443     | HTTPS access to the System Manager web console using the IP address of the cluster management LIF |
| SSH      | 22      | SSH access to the IP address of the cluster management LIF or a node management LIF               |
| TCP      | 111     | Remote procedure call for NFS                                                                     |
| TCP      | 139     | NetBIOS service session for CIFS                                                                  |
| TCP      | 161-162 | Simple network management protocol                                                                |
| TCP      | 445     | Microsoft SMB/CIFS over TCP with NetBIOS framing                                                  |
| TCP      | 635     | NFS mount                                                                                         |
| TCP      | 749     | Kerberos                                                                                          |
| TCP      | 2049    | NFS server daemon                                                                                 |
| TCP      | 3260    | iSCSI access through the iSCSI data LIF                                                           |
| TCP      | 4045    | NFS lock daemon                                                                                   |
| TCP      | 4046    | Network status monitor for NFS                                                                    |
| TCP      | 10000   | Backup using NDMP                                                                                 |
| TCP      | 11104   | Management of intercluster communication sessions for SnapMirror                                  |
| TCP      | 11105   | SnapMirror data transfer using intercluster LIFs                                                  |
| UDP      | 111     | Remote procedure call for NFS                                                                     |
| UDP      | 161-162 | Simple network management protocol                                                                |
| UDP      | 635     | NFS mount                                                                                         |
| UDP      | 2049    | NFS server daemon                                                                                 |
| UDP      | 4045    | NFS lock daemon                                                                                   |
| UDP      | 4046    | Network status monitor for NFS                                                                    |
| UDP      | 4049    | NFS rquotad protocol                                                                              |

### Outbound rules

The predefined security group for FSx for ONTAP 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 FSx for ONTAP includes the following outbound rules.

| Protocol | Port | Purpose              |
|----------|------|----------------------|
| All ICMP | All  | All outbound traffic |
| 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 FSx for ONTAP.



The source is the interface (IP address) on the FSx for ONTAP system.

| Service          | Protocol  | Port | Source                      | Destination                         | Purpose                                                     |
|------------------|-----------|------|-----------------------------|-------------------------------------|-------------------------------------------------------------|
| Active Directory | TCP       | 88   | Node management LIF         | Active Directory forest             | Kerberos V authentication                                   |
|                  | UDP       | 137  | Node management LIF         | Active Directory forest             | NetBIOS name service                                        |
|                  | UDP       | 138  | Node management LIF         | Active Directory forest             | NetBIOS datagram service                                    |
|                  | TCP       | 139  | Node management LIF         | Active Directory forest             | NetBIOS service session                                     |
|                  | TCP & UDP | 389  | Node management LIF         | Active Directory forest             | LDAP                                                        |
|                  | TCP       | 445  | Node management LIF         | Active Directory forest             | Microsoft SMB/CIFS over TCP with NetBIOS framing            |
|                  | TCP       | 464  | Node management LIF         | Active Directory forest             | Kerberos V change & set password (SET_CHANGE)               |
|                  | UDP       | 464  | Node management LIF         | Active Directory forest             | Kerberos key administration                                 |
|                  | TCP       | 749  | Node management LIF         | Active Directory forest             | Kerberos V change & set Password (RPCSEC_GSS)               |
|                  | TCP       | 88   | Data LIF (NFS, CIFS, iSCSI) | Active Directory forest             | Kerberos V authentication                                   |
|                  | UDP       | 137  | Data LIF (NFS, CIFS)        | Active Directory forest             | NetBIOS name service                                        |
|                  | UDP       | 138  | Data LIF (NFS, CIFS)        | Active Directory forest             | NetBIOS datagram service                                    |
|                  | TCP       | 139  | Data LIF (NFS, CIFS)        | Active Directory forest             | NetBIOS service session                                     |
|                  | TCP & UDP | 389  | Data LIF (NFS, CIFS)        | Active Directory forest             | LDAP                                                        |
|                  | TCP       | 445  | Data LIF (NFS, CIFS)        | Active Directory forest             | Microsoft SMB/CIFS over TCP with NetBIOS framing            |
|                  | TCP       | 464  | Data LIF (NFS, CIFS)        | Active Directory forest             | Kerberos V change & set password (SET_CHANGE)               |
|                  | UDP       | 464  | Data LIF (NFS, CIFS)        | Active Directory forest             | Kerberos key administration                                 |
|                  | TCP       | 749  | Data LIF (NFS, CIFS)        | Active Directory forest             | Kerberos V change & set password (RPCSEC_GSS)               |
| Backup to S3     | TCP       | 5010 | Intercluster LIF            | Backup endpoint or restore endpoint | Back up and restore operations for the Backup to S3 feature |

| Service        | Protocol    | Port                | Source                                       | Destination                | Purpose                                                          |
|----------------|-------------|---------------------|----------------------------------------------|----------------------------|------------------------------------------------------------------|
| Cluster        | All traffic | All traffic         | All LIFs on one node                         | All LIFs on the other node | Intercluster communications (Cloud Volumes ONTAP HA only)        |
|                | TCP         | 3000                | Node management LIF                          | HA mediator                | ZAPI calls (Cloud Volumes ONTAP HA only)                         |
|                | ICMP        | 1                   | Node management LIF                          | HA mediator                | Keep alive (Cloud Volumes ONTAP HA only)                         |
| DHCP           | UDP         | 68                  | Node management LIF                          | DHCP                       | DHCP client for first-time setup                                 |
| DHCPS          | UDP         | 67                  | Node management LIF                          | DHCP                       | DHCP server                                                      |
| DNS            | UDP         | 53                  | Node management LIF and data LIF (NFS, CIFS) | DNS                        | DNS                                                              |
| NDMP           | TCP         | 1860<br>0–18<br>699 | Node management LIF                          | Destination servers        | NDMP copy                                                        |
| SMTP           | TCP         | 25                  | Node management LIF                          | Mail server                | SMTP alerts, can be used for AutoSupport                         |
| SNMP           | TCP         | 161                 | Node management LIF                          | Monitor server             | Monitoring by SNMP traps                                         |
|                | UDP         | 161                 | Node management LIF                          | Monitor server             | Monitoring by SNMP traps                                         |
|                | TCP         | 162                 | Node management LIF                          | Monitor server             | Monitoring by SNMP traps                                         |
|                | UDP         | 162                 | Node management LIF                          | Monitor server             | Monitoring by SNMP traps                                         |
| SnapMirr<br>or | TCP         | 1110<br>4           | Intercluster LIF                             | ONTAP intercluster LIFs    | Management of intercluster communication sessions for SnapMirror |
|                | TCP         | 1110<br>5           | Intercluster LIF                             | ONTAP intercluster LIFs    | SnapMirror data transfer                                         |
| Syslog         | UDP         | 514                 | Node management LIF                          | Syslog server              | Syslog forward messages                                          |

## Rules for the Connector

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 |

| Protocol | Port | Purpose                                                                                                         |
|----------|------|-----------------------------------------------------------------------------------------------------------------|
| HTTP     | 80   | Provides HTTP access from client web browsers to the local user interface and connections from Cloud Data Sense |
| HTTPS    | 443  | Provides HTTPS access from client web browsers to the local user interface                                      |
| TCP      | 3128 | Provides the Cloud Data Sense instance with internet access, if your AWS network doesn't use a NAT or proxy     |

#### 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 | HTTP     | 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 |

## Create and manage an Amazon FSx for ONTAP working environment

Using Cloud Manager you can create and manage FSx for ONTAP working environments to add and manage volumes and additional data services.

### Create an Amazon FSx for ONTAP working environment

The first step is to create an FSx for ONTAP working environment. If you already created an FSx for ONTAP file system in the AWS Management Console, you can [discover it using Cloud Manager](#).

#### Before you begin

Before creating your FSx for ONTAP working environment in Cloud Manager, you will need:

- The ARN of an IAM role that gives Cloud Manager the permissions needed to create an FSx for ONTAP working environment. See [adding AWS credentials to Cloud Manager](#) for details.
- The region and VPN information for where you will create the FSx for ONTAP instance.

#### Steps

1. In Cloud Manager, add a new Working Environment, select the location **Amazon Web Services**, and click **Next**.
2. Select **Amazon FSx for ONTAP** and click **Next**.

Add Working Environment

Choose a Location



Microsoft Azure



Amazon Web Services



Google Cloud Platform



On-Premises

Choose Type



Cloud Volumes ONTAP

Single Node



Cloud Volumes ONTAP HA

High Availability



Amazon FSx for ONTAP

High Availability



Kubernetes Cluster

Managed

🔍 If you want to discover an existing Amazon FSx for ONTAP in AWS, [Click Here](#)

Next

### 3. Authenticate FSx for ONTAP in Cloud Manager.

- If there is an existing IAM role in your account with the correct AWS permissions for FSx for ONTAP, select it from the dropdown.

#### FSx for ONTAP Authentication

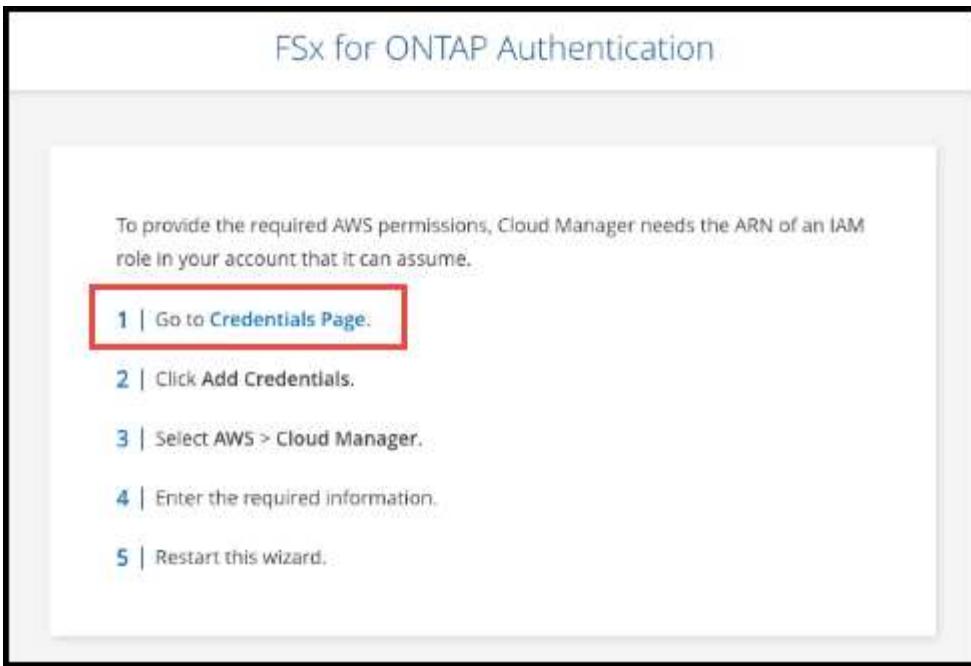
Select the credentials that provides Cloud Manager with the permissions that it needs to manage FSx for ONTAP.

Credentials Name

mjulia

To add a new set of credential, go to the [Credentials Page](#).

- If there is no IAM role in your account, click **Credentials Page** and follow the steps in the wizard to add an ARN for an AWS IAM role with FSx for ONTAP credentials. See [adding AWS credentials to Cloud Manager](#) for details.



4. Provide information about your FSx for ONTAP instance:

- a. Enter the working environment name you want to use.
- b. Optionally, you can create tags by clicking the plus sign and entering a tag name and value.
- c. Enter and confirm the ONTAP Cluster password you want to use.
- d. Select the option to use the same password for your SVM user or set a different password.
- e. Click **Next**.

| Add FSx for ONTAP                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Details and Credentials |                                                                                  |  |             |  |                                                  |  |           |  |                                               |  |                                       |  |      |                         |                        |  |                            |  |                                        |  |  |  |                                                                          |  |  |  |                                                                                  |  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|----------------------------------------------------------------------------------|--|-------------|--|--------------------------------------------------|--|-----------|--|-----------------------------------------------|--|---------------------------------------|--|------|-------------------------|------------------------|--|----------------------------|--|----------------------------------------|--|--|--|--------------------------------------------------------------------------|--|--|--|----------------------------------------------------------------------------------|--|
| <table border="1"><thead><tr><th colspan="2">Details</th><th colspan="2">Credentials</th></tr></thead><tbody><tr><td colspan="2">Working Environment Name <small>Optional</small></td><td colspan="2">User Name</td></tr><tr><td colspan="2"><input type="text" value="myfsxenvironment"/></td><td colspan="2"><input type="text" value="fsxadmin"/></td></tr><tr><td>Tags</td><td><small>Optional</small></td><td colspan="2">ONTAP Cluster Password</td></tr><tr><td colspan="2"><a href="#">+ Add Tags</a></td><td colspan="2"><input type="password" value="*****"/></td></tr><tr><td colspan="2"></td><td colspan="2">Confirm ONTAP Cluster Password<br/><input type="password" value="*****"/></td></tr><tr><td colspan="2"></td><td colspan="2"><input checked="" type="checkbox"/> Use the same password for SVM user (vsadmin)</td></tr></tbody></table> |                         | Details                                                                          |  | Credentials |  | Working Environment Name <small>Optional</small> |  | User Name |  | <input type="text" value="myfsxenvironment"/> |  | <input type="text" value="fsxadmin"/> |  | Tags | <small>Optional</small> | ONTAP Cluster Password |  | <a href="#">+ Add Tags</a> |  | <input type="password" value="*****"/> |  |  |  | Confirm ONTAP Cluster Password<br><input type="password" value="*****"/> |  |  |  | <input checked="" type="checkbox"/> Use the same password for SVM user (vsadmin) |  |
| Details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                         | Credentials                                                                      |  |             |  |                                                  |  |           |  |                                               |  |                                       |  |      |                         |                        |  |                            |  |                                        |  |  |  |                                                                          |  |  |  |                                                                                  |  |
| Working Environment Name <small>Optional</small>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                         | User Name                                                                        |  |             |  |                                                  |  |           |  |                                               |  |                                       |  |      |                         |                        |  |                            |  |                                        |  |  |  |                                                                          |  |  |  |                                                                                  |  |
| <input type="text" value="myfsxenvironment"/>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                         | <input type="text" value="fsxadmin"/>                                            |  |             |  |                                                  |  |           |  |                                               |  |                                       |  |      |                         |                        |  |                            |  |                                        |  |  |  |                                                                          |  |  |  |                                                                                  |  |
| Tags                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <small>Optional</small> | ONTAP Cluster Password                                                           |  |             |  |                                                  |  |           |  |                                               |  |                                       |  |      |                         |                        |  |                            |  |                                        |  |  |  |                                                                          |  |  |  |                                                                                  |  |
| <a href="#">+ Add Tags</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                         | <input type="password" value="*****"/>                                           |  |             |  |                                                  |  |           |  |                                               |  |                                       |  |      |                         |                        |  |                            |  |                                        |  |  |  |                                                                          |  |  |  |                                                                                  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                         | Confirm ONTAP Cluster Password<br><input type="password" value="*****"/>         |  |             |  |                                                  |  |           |  |                                               |  |                                       |  |      |                         |                        |  |                            |  |                                        |  |  |  |                                                                          |  |  |  |                                                                                  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                         | <input checked="" type="checkbox"/> Use the same password for SVM user (vsadmin) |  |             |  |                                                  |  |           |  |                                               |  |                                       |  |      |                         |                        |  |                            |  |                                        |  |  |  |                                                                          |  |  |  |                                                                                  |  |
| <a href="#">Previous</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <a href="#">Next</a>    |                                                                                  |  |             |  |                                                  |  |           |  |                                               |  |                                       |  |      |                         |                        |  |                            |  |                                        |  |  |  |                                                                          |  |  |  |                                                                                  |  |

5. Provide region and VPC information:

- a. Select a region and VPC with subnets in at least two Availability Zones so each node is in a dedicated Availability Zone.
- b. Accept the default security group or select a different one. [AWS security groups](#) control inbound and outbound traffic. These are configured by your AWS admin and are associated with your [AWS elastic](#)

network interface (ENI).

- c. Select an Availability Zone and subnet for each node.
- d. Click **Next**.

Add FSx for ONTAP

Region and VPC

|                            |                      |                        |
|----------------------------|----------------------|------------------------|
| Region                     | VPC                  | Security Group         |
| us-east-2   US East (Ohio) | VPC4QA - 10.0.0.0/16 | Default security group |

Node 1

Availability Zone: us-east-2b  
Subnet: 10.0.4.0/24

Node 2

Availability Zone: us-east-2c  
Subnet: 10.0.3.0/24

Previous Next

6. Leave *CIDR Range* empty and click **Next** to automatically set an available range. Optionally, you can use [AWS Transit Gateway](#) to manually configure a range.

Add FSx for ONTAP

Floating IP

Floating IP addresses are required for cluster and SVM access and for NFS and CIFS data access.

Floating IPs can migrate between HA nodes if failures occur. To access the data from outside the VPC, you can set up an [AWS transit gateway](#).

CIDR Range Optional  
Example: 10.10.10.10/24

Notice: You must specify a CIDR block that is outside of the CIDR blocks for all VPCs in the selected AWS region.

Previous Next

7. Select route tables that include routes to the floating IP addresses. If you have just one route table for the subnets in your VPC (the main route table), Cloud Manager automatically adds the floating IP addresses to that route table. Click **Next** to continue.

Add FSx for ONTAP

Route Tables

Select the route tables that should include routes to the floating IP addresses. This enables client access to volumes. Clients associated with unselected route tables won't have access to volumes.

[Learn More](#)

2 Route table

| <input type="checkbox"/>            | Name        | Main | ID                        | Associate with Subnets | Tags |   |
|-------------------------------------|-------------|------|---------------------------|------------------------|------|---|
| <input checked="" type="checkbox"/> | VPC4QA      | Yes  | rtb-0880ec9d<br>aeb55d630 | 2 Subnets              | 2    | ▼ |
| <input type="checkbox"/>            | No tag name | No   | rtb-0e0c7d9e<br>a4cf05d66 | 1 Subnet               | 1    | ▼ |

**Notice:** The main route table is the default for the VPC

[Previous](#) [Next](#)

- Accept the default AWS master key or click **Change Key** to select a different AWS Customer Master Key (CMK). For more information on CMK, see [Setting up the AWS KMS](#). Click **Next** to continue.

Add FSx for ONTAP

Data Encryption

AWS Managed Encryption

AWS is responsible for data encryption and decryption operations. Key management is handled by AWS key management services.

Default Master Key: aws/fsx [Change Key](#)

[Previous](#) [Next](#)

- Configure your storage:
  - Select the throughput, capacity, and unit.
  - You can optionally specify an IOPS value. If you don't specify an IOPS value, Cloud Manager will set a default value based on 3 IOPS per GiB of the total capacity entered. For example, if you enter 2000 GiB for the total capacity and no value for the IOPS, the effective IOPS value will be set to 6000.

If you specify an IOPS value that does not meet the minimum requirements, you'll receive an error when adding the working environment.



Failed to create FSx for ONTAP systems [Show Less](#)



Invalid SSD IOPS provided: 400 IOPS. Amazon FSx does not support provisioning fewer than 3 IOPS per GB of SSD storage capacity on a ONTAP file system.

c. Click **Next**.

Add FSx for ONTAP Storage Configuration

SSD Disk Properties

|                                    |                                                                                                                                                                     |      |
|------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| Throughput                         | Capacity                                                                                                                                                            | Unit |
| 512 MBps                           | 3                                                                                                                                                                   | TiB  |
| IOPS Value <small>Optional</small> | <small>Notice:</small> The current version of FSx does not allow changing the capacity after creation. Also, note that the capacity drives the cost of the service. |      |
| 400                                |                                                                                                                                                                     |      |

[Previous](#) [Next](#)

10. Review your configuration:

- a. Click the tabs to review your ONTAP properties, provider properties, and networking configuration.
- b. Click **Previous** to make changes to any settings.
- c. Click **Add** to accept the settings and create your Working Environment.

Review

 myfsxenvironment  
FSx for ONTAP | HA | Multiple AZs

**Overview**

| ONTAP Properties    |                            | Provider Properties | Networking |
|---------------------|----------------------------|---------------------|------------|
| HA Deployment Model | Multiple Availability Zone |                     |            |
| Capacity            | 3 TiB                      |                     |            |
| Throughput          | 512 MBps                   |                     |            |

[Previous](#) [Add](#)

## Result

Cloud Manager displays your FSx for ONTAP configuration on the Canvas page.



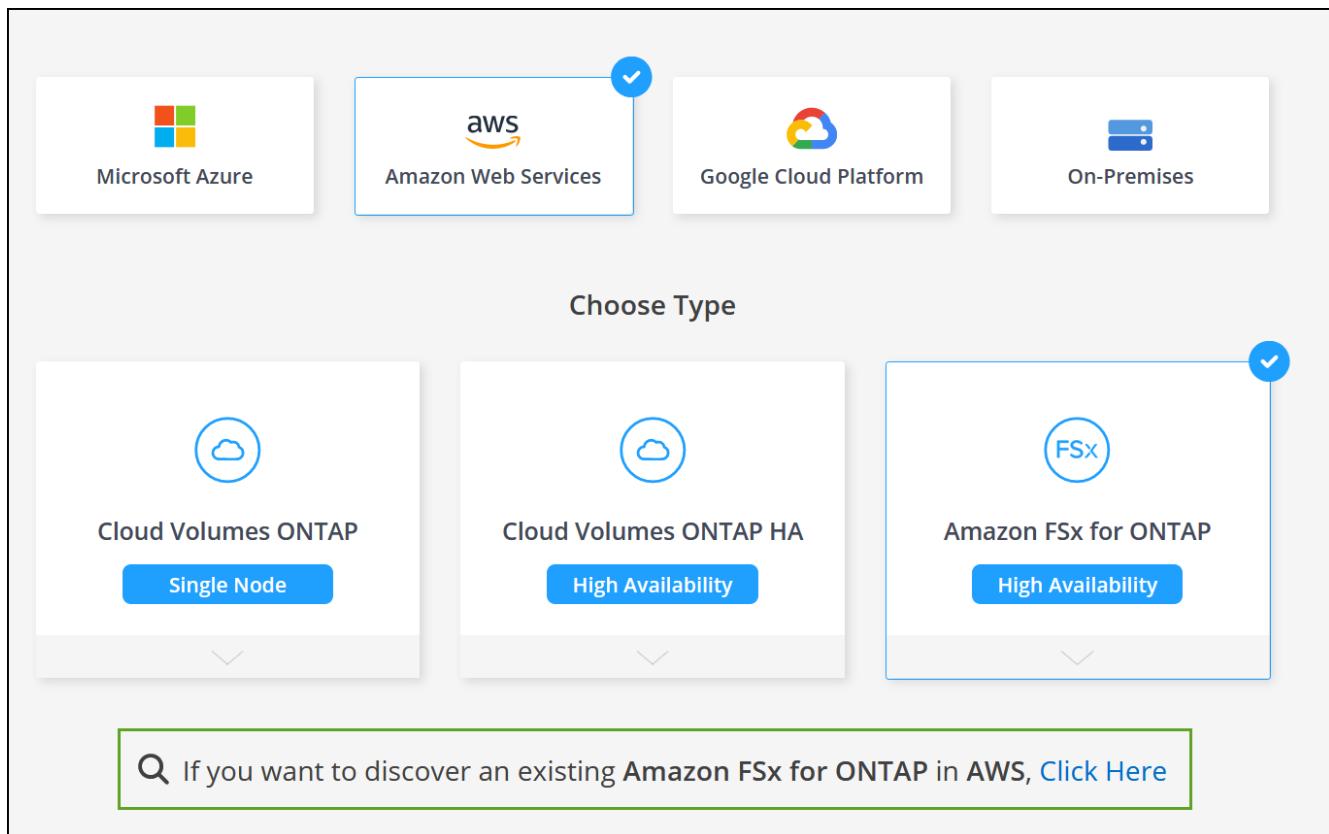
You can now add volumes to your FSx for ONTAP working environment using Cloud Manager.

### Discover an existing FSx for ONTAP file system

If you created an FSx for ONTAP file system using the AWS Management Console or if you want to restore a working environment you previously removed, you can discover it using Cloud Manager.

#### Steps

1. In Cloud Manager, click **Add Working Environment**, select **Amazon Web Services**.
2. Select **Amazon FSx for ONTAP** and click **Click Here**.



3. Select existing credentials or create new credentials. Click **Next**.
4. Select the AWS region and the working environment you want to add.



5. Click **Add**.

## Result

Cloud Manager displays your discovered FSx for ONTAP file system.

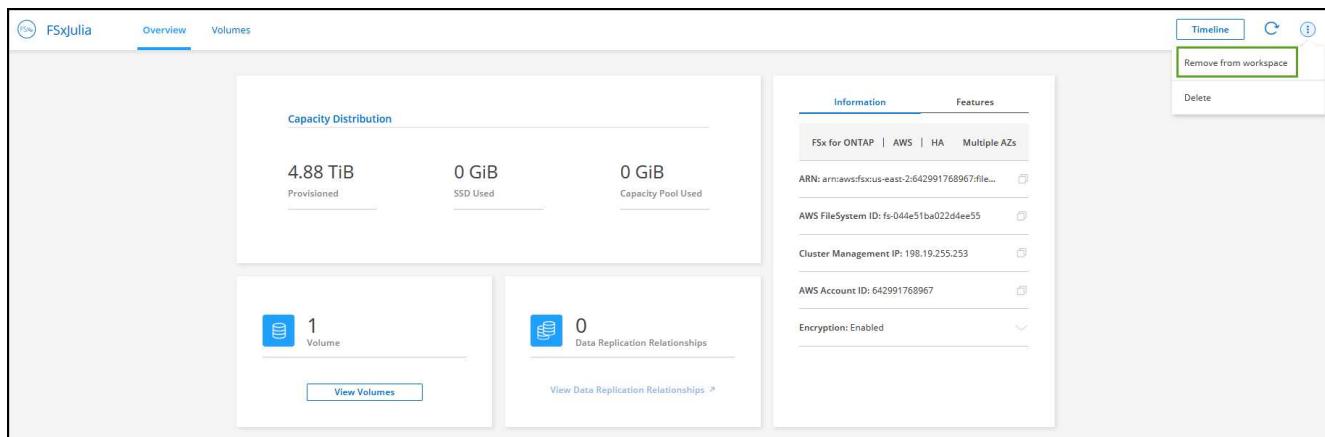
## Remove FSx for ONTAP from the workspace

You can remove FSx for ONTAP from Cloud Manager without deleting your FSx for ONTAP account or volumes. You can add the FSx for ONTAP working environment back to Cloud Manager at any time.

## Steps

1. Open the working environment. If you don't have a Connector in AWS, you will see the prompt screen. You can ignore this and proceed with removing the working environment.

- At the top right of the page, select the actions menu and click **Remove from workspace**.



- Click **Remove** to remove FSx for ONTAP from Cloud Manager.

### Delete the FSx for ONTAP working environment

You can delete the FSx for ONTAP from Cloud Manager.

#### Before you begin

- You must [delete all volumes](#) associated with the file system.



You will need an active Connector in AWS to remove or delete volumes.

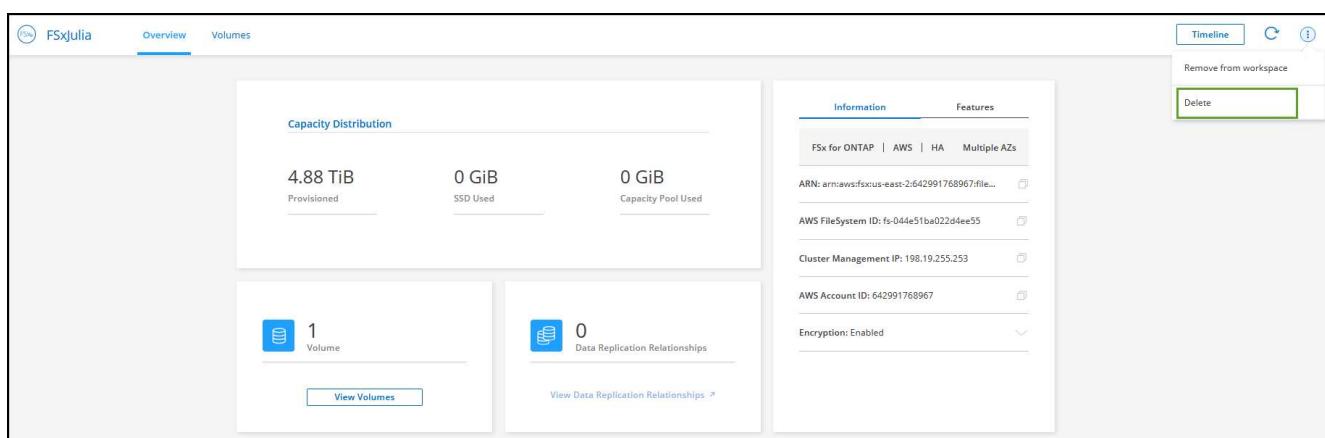
- You cannot delete a working environment that contains failed volumes. Failed volumes must be deleted using the AWS Management Console or CLI prior to deleting FSx for ONTAP files system.



This action will delete all resources associated with the working environment. This action cannot be undone.

#### Steps

- Open the working environment. If you don't have a Connector in AWS, you will see the prompt screen. You can ignore this and proceed to deleting the working environment.
- At the top right of the page, select the actions menu and click **Delete**.



- Enter the name of the working environment and click **Delete**.

## Create and manage volumes for Amazon FSx for ONTAP

After you set up your working environment, you can create and manage FSx for ONTAP volumes, clones, and snapshots, and change tiering policies for FSx for ONTAP.

### Create volumes

You can create and manage NFS and CIFS volumes from your FSx for ONTAP working environment in Cloud Manager. NFS and CIFS volumes created using ONTAP CLI will also be visible in your FSx for ONTAP working environment.

You can create iSCSI volumes using ONTAP CLI, ONTAP API, or Cloud Manager API and manage them using Cloud Manager in your FSx for ONTAP working environment.

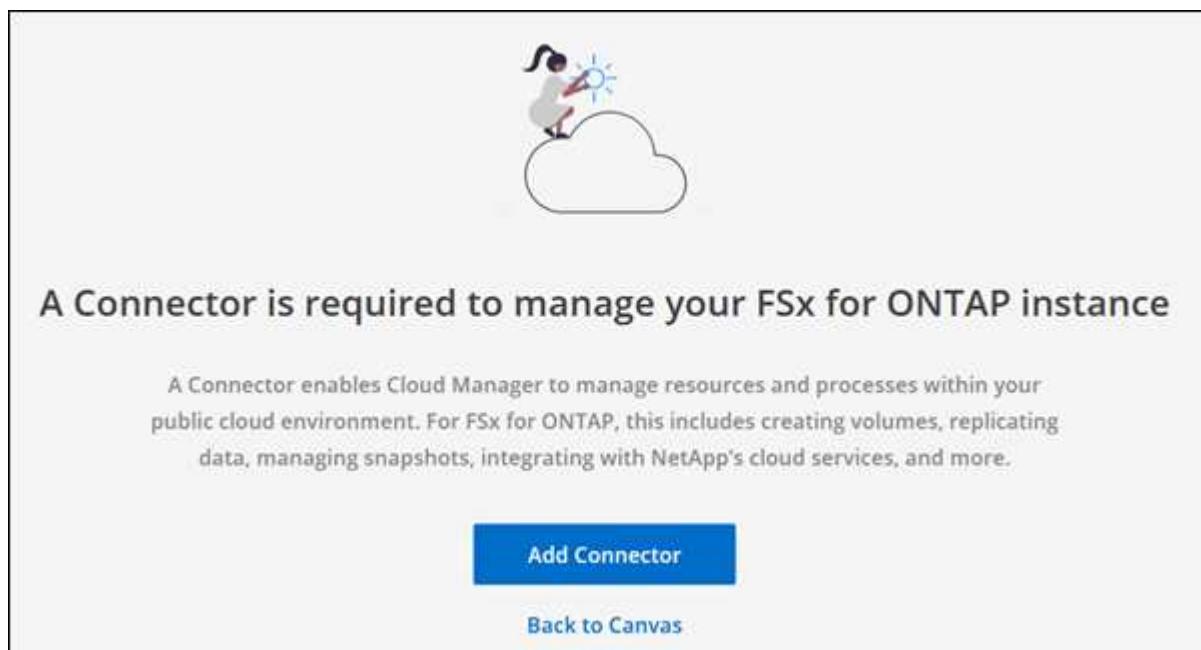
### Before you begin

You need:

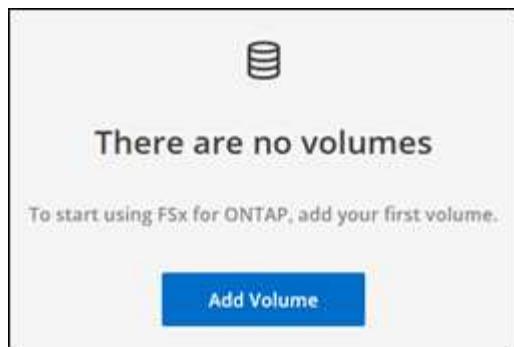
- An active [Connector in AWS](#).
- If you want to use SMB, you must have set up DNS and Active Directory. For more information on DNS and Active Directory network configuration, see [AWS: Prerequisites for using a self-managed Microsoft AD](#).

### Steps

1. Open the FSx for ONTAP working environment.
2. If you don't have a Connector enabled, you'll be prompted to add one.



3. Click the **Volumes** tab
4. Click **Add Volume**.



## 5. Volume Details and Protection:

- a. Enter a name for your new volume.
- b. The Storage VM (SVM) fields auto-populates the SVM based on the name of your working environment.
- c. Enter the volume size and select a unit (GiB or TiB). Note that the volume size will grow with usage.
- d. Select a snapshot policy. By default, a snapshot is taken every hour (keeping the last six copies), every day (keeping the last two copies), and every week (keeping the last two copies).
- e. Click **Next**.

Volume Details & Protection

|             |                  |                 |
|-------------|------------------|-----------------|
| Volume Name | Storage VM (SVM) |                 |
| 1-100000    | svm_FSxJulia     |                 |
| Volume Size | Unit             | Snapshot Policy |
| 1-100000    | GiB              | default         |
|             | TiB              | default policy  |
|             | GiB              |                 |

## 6. Protocol: Select the an NFS or CIFS volume protocol.

- a. For NFS:
  - Select an Access Control policy.
  - Select the NFS versions.
  - Select a Custom Export Policy. Click the information icon for valid value criteria.

**Volume Protocol**

Select the volume's protocol:  NFS Protocol  CIFS Protocol

Access Control: Custom\_export\_policy

Select NFS Version:  NFSv3  NFSv4

Custom Export Policy: 10.20.0.0/16

b. For CIFS:

- Enter a Share Name.
- Enter users or groups separated by a semicolon.
- Select the permission level for the volume.

**Volume Protocol**

Select the volume's protocol:  NFS Protocol  CIFS Protocol

Share Name: <Volume name>\_share

Users/Groups: Everyone;

Permissions: Full Control



If this is the first CIFS volume for this working environment, you will be prompted to configure CIFS connectivity using an *Active Directory* or *Workgroup* setup.

- If you select an Active Directory setup, you'll need to provide the following configuration information.

| Field                                     | Description                                                                                                                                                                                                                                                                         |
|-------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DNS Primary IP Address                    | The IP addresses of the DNS servers that provides name resolution for the CIFS server.<br>The listed DNS server must contain the service location records (SRV) needed to locate the Active Directory LDAP servers and domain controllers for the domain the CIFS server will join. |
| Active Directory Domain to join           | The FQDN of the Active Directory (AD) domain you want the CIFS server to join.                                                                                                                                                                                                      |
| Credentials authorized to join the domain | The name and password of a Windows account with sufficient privileges to add computers to the specified Organizational Unit (OU) within the AD domain.                                                                                                                              |
| CIFS server NetBIOS name                  | A CIFS server name that is unique in the AD domain.                                                                                                                                                                                                                                 |
| Organizational Unit                       | The organizational unit within the AD domain to associate with the CIFS server. The default is CN=Computers.                                                                                                                                                                        |
| DNS Domain                                | The DNS domain for the storage virtual machine (SVM). In most cases, the domain is the same as the AD domain.                                                                                                                                                                       |
| NTP Server                                | Select <b>Enable NTP Server Configuration</b> to configure an NTP server using the Active Directory DNS. If you need to configure an NTP server using a different address, then you should use the API. See the <a href="#">Cloud Manager automation docs</a> for details.          |

- If you select a Workgroup setup, enter the server and workgroup name for a workgroup configured for CIFS.

c. Click **Next**.

#### 7. Usage Profile and Tiering:

- By default, **Storage Efficiency** is disabled. You can change this setting to enable deduplication and compression.
- By default, **Tiering Policy** is set to **Snapshot Only**. You can select a different tiering policy based on your needs.
- Click **Next**.

**Usage Profile & Tiering Policy**

**Usage Profile**

① Storage Efficiency

Enabled - Deduplication, compression and compaction  
 Disabled - No Efficiency

**Tiering data to object storage**

① Tiering policy

Auto - Tiers cold Snapshot copies and cold user data from the active file system to object storage.  
 Snapshot Only - Tiers cold Snapshot copies to object storage.  
 None - Data tiering is disabled.  
 All - Immediately tiers all data (not including metadata) to object storage.

8. **Review:** Review your volume configuration. Click **Previous** to change settings or click **Add** to create the volume.

## Result

The new volume is added to the working environment.

## Mount volumes

Access mounting instructions from within Cloud Manager so you can mount the volume to a host.

### Steps

1. Open the working environment.
2. Open the volume menu and select **Mount the volume**.



3. Follow the instructions to mount the volume.

## Edit volumes

After you create a volume, you can modify it at any time.

### Steps

1. Open the working environment.
2. Open the volume menu and select **Edit**.
  - a. For NFS, you can modify the size and tags.
  - b. For CIFS, you can modify the share name, users, permissions, and Snapshot policy as needed.
3. Click **Apply**.

## Clone volumes

After you create a volume, you can create a new read-write volume from a new Snapshot.

### Steps

1. Open the working environment.
2. Open the volume menu and select **Clone**.
3. Enter a name for the cloned volume.
4. Click **Clone**.

## Manage Snapshot copies

Snapshot copies provide a point-in-time copy of your volume. Create Snapshot copies and restore the data to a new volume.

### Steps

1. Open the working environment.
2. Open the volume menu and choose one of the available options to manage Snapshot copies:
  - **Create a Snapshot copy**
  - **Restore from a Snapshot copy**
3. Follow the prompts to complete the selected action.

## Change the tiering policy

Change the tiering policy for the volume.

### Steps

1. Open the working environment.
2. Open the volume menu and select **Change Tiering policy**.
3. Select a new volume tiering policy and click **Change**.

## Replicate and sync data

You can replicate data between storage environments using Cloud Manager. To configure FSx for ONTAP replication, see [replicating data between systems](#).

You can create sync relationships using Cloud Sync in Cloud Manager. To configure sync relationships, see

create sync relationships.

## Delete volumes

Delete the volumes that you no longer need.

### Before you begin

You cannot delete a volume that was previously part of a SnapMirror relationship using Cloud Manager. SnapMirror volumes must be deleted using the AWS Management Console or CLI.

### Steps

1. Open the working environment.
2. Open the volume menu and select **Delete**.
3. Enter the working environment name and confirm that you want to delete the volume. It can take up to an hour before the volume is completely removed from Cloud Manager.



If you try to delete a cloned volume, you will receive an error.

## Cloud Volumes Service for AWS

### Learn about Cloud Volumes Service for AWS

NetApp Cloud Volumes Service for AWS is a cloud native file service that provides NAS volumes over NFS and SMB with all-flash performance. This service enables any workload, including legacy applications, to run in the AWS cloud.



With the launch of [Amazon FSx for ONTAP](#), you can no longer create new CVS for AWS working environments in Cloud Manager. However, if you had previously added CVS for AWS working environments to Cloud Manager, you can continue to create and manage volumes.

### Benefits of using Cloud Volumes Service for AWS

Cloud Volumes Service for AWS provides the following benefits:

- Fully managed service, therefore no need to configure or manage storage devices
- Support for NFSv3 and NFSv4.1, and SMB 3.0 and 3.1.1 NAS protocols
- Secure access to Linux and Windows Elastic Container Service (ECS) instances, with support including the following:
  - Amazon Linux 2, Red Hat Enterprise Linux 7.5, SLES 12 SP3, and Ubuntu 16.04 LTS
  - Windows Server 2008 R2, Windows Server 2012 R2, and Windows Server 2016
- Choice of bundled and pay-as-you-go pricing

### Cost

Volumes created by the Cloud Volumes Service for AWS are charged based on your subscription to the service, not through Cloud Manager.

There are no charges to discover a Cloud Volumes Service for AWS region or volume from Cloud Manager.

## Quick start

Get started quickly by following these steps, or go to the next sections for full details.

1

### Verify support for your configuration

You must have set up AWS for Cloud Volumes Service and subscribed to one of the [NetApp Cloud Volumes Service offerings on the AWS Marketplace](#) and have an existing CVS for AWS working environment configured in Cloud Manager to create and manage volumes.

2

### Create, mount, and manage cloud volumes

Using an existing CVS for AWS working environment, you can create, mount, and manage cloud volumes for existing CVS for AWS subscriptions using Cloud Manager.

## Getting help

Use the Cloud Manager chat for general service questions.

For technical support issues associated with your cloud volumes, use your 20 digit "930" serial number located in the "Support" tab of the Cloud Volumes Service user interface. Use this support ID when opening a web ticket or calling for support. Be sure to activate your Cloud Volumes Service serial number for support from the Cloud Volumes Service user interface. [Those steps are explained here.](#)

## Limitations

- Cloud Manager doesn't support data replication between working environments when using Cloud Volumes Service volumes.
- Removing your Cloud Volumes Service for AWS subscription from Cloud Manager isn't supported. You can do this only through the Cloud Volumes Service for AWS interface.

## Related links

- [NetApp Cloud Central: Cloud Volumes Service for AWS](#)
- [NetApp Cloud Volumes Service for AWS documentation](#)

## Managing Cloud Volumes Service for AWS

Cloud Manager enables you to create cloud volumes based on your [Cloud Volumes Service for AWS](#) subscription. You can also discover cloud volumes that you have already created from the Cloud Volumes Service interface and add them to a working environment.

 With the launch of [Amazon FSx for ONTAP](#), you can no longer create new CVS for AWS working environments in Cloud Manager. However, if you had previously added CVS for AWS working environments to Cloud Manager, you can continue to create and manage volumes.

## Create cloud volumes

For configurations where volumes already exist in the Cloud Volumes Service working environment you can

use these steps to add new volumes.

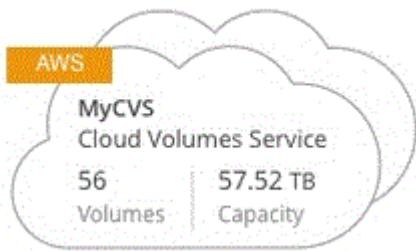
For configurations where no volumes exist, you can create your first volume directly from Cloud Manager after you have set up your Cloud Volumes Service for AWS subscription. In the past, the first volume had to be created directly in the Cloud Volumes Service user interface.

### Before you begin

- If you want to use SMB in AWS, you must have set up DNS and Active Directory.
- When planning to create an SMB volume, you must have a Windows Active Directory server available to which you can connect. You will enter this information when creating the volume. Also, make sure that the Admin user is able to create a machine account in the Organizational unit (OU) path specified.
- You will need this information when creating the first volume in a new region/working environment:
  - AWS account ID: A 12-digit Amazon account identifier with no dashes. To find your account ID, refer to this [AWS topic](#).
  - Classless Inter-Domain Routing (CIDR) Block: An unused IPv4 CIDR block. The network prefix must range between /16 and /28, and it must also fall within the ranges reserved for private networks (RFC 1918). Do not choose a network that overlaps your VPC CIDR allocations.

### Steps

1. Select a CVS for AWS working environment and click **Add New Volume**.



2. If you are adding the first volume to the working environment in the region, you have to add AWS networking information.

- a. Enter the IPv4 range (CIDR) for the region.
- b. Enter the 12-digit AWS account ID (with no dashes) to connect your Cloud Volumes account to your AWS account.
- c. Click **Continue**.

### Network Setup

Your Cloud Volumes Service account isn't connected to your AWS account yet. Enter information about your AWS networking to connect the accounts. For details, see the [Cloud Volumes Service for AWS Account Setup document](#).

|                |                 |
|----------------|-----------------|
| CIDR (IPv4)    | AWS Account ID  |
| 192.168.0.0/28 | 123456789012345 |

3. The Accepting Virtual Interfaces page describes some steps you will need to perform after you add the volume so that you are prepared to complete that step. Just click **Continue** again.
4. In the Details & Tags page, enter details about the volume:
  - a. Enter a name for the volume.
  - b. Specify a size within the range of 100 GiB to 90,000 GiB (equivalent to 88 TiBs).

[Learn more about allocated capacity.](#)
  - c. Specify a service level: Standard, Premium, or Extreme.

[Learn more about service levels.](#)
  - d. Enter one or more tag names to categorize the volume if you want.
  - e. Click **Continue**.
5. In the Protocol page, select NFS, SMB, or Dual Protocol and then define the details. Required entries for NFS and SMB are shown in separate sections below.
6. In the Volume Path field, specify the name of the volume export you will see when you mount the volume.
7. If you select Dual-protocol you can select the security style by selecting NTFS or UNIX. Security styles affect the file permission type used and how permissions can be modified.
  - UNIX uses NFSv3 mode bits, and only NFS clients can modify permissions.
  - NTFS uses NTFS ACLs, and only SMB clients can modify permissions.
8. For NFS:
  - a. In the NFS Version field, select NFSv3, NFSv4.1, or both depending on your requirements.
  - b. Optionally, you can create an export policy to identify the clients that can access the volume. Specify the:
    - Allowed clients by using an IP address or Classless Inter-Domain Routing (CIDR).
    - Access rights as Read & Write or Read Only.
    - Access protocol (or protocols if the volume allows both NFSv3 and NFSv4.1 access) used for users.
    - Click **+ Add Export Policy Rule** if you want to define additional export policy rules.

The following image shows the Volume page filled out for the NFS protocol:

Protocol

Select the volume's protocol:  NFS Protocol  SMB Protocol  Dual Protocol

Export Policy

|                                                                                                              |                                                                                                                                                         |
|--------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| Volume Path<br><input type="text" value="vol1"/>                                                             | Allowed Client & Access<br><input type="text" value="192.168.1.2/24"/><br><input checked="" type="radio"/> Read & Write <input type="radio"/> Read Only |
| Select NFS Version:<br><input checked="" type="checkbox"/> NFSv3 <input checked="" type="checkbox"/> NFSv4.1 | Select NFS Version:<br><input checked="" type="checkbox"/> NFSv3 <input type="checkbox"/> NFSv4.1                                                       |
|                                                                                                              | <input type="text" value="192.168.1.22/24"/><br><input checked="" type="radio"/> Read & Write <input type="radio"/> Read Only                           |
|                                                                                                              | Select NFS Version:<br><input type="checkbox"/> NFSv3 <input checked="" type="checkbox"/> NFSv4.1                                                       |

9. For SMB:

- You can enable SMB session encryption by checking the box for SMB Protocol Encryption.
- You can integrate the volume with an existing Windows Active Directory server by completing the fields in the Active directory section:

| Field                                     | Description                                                                                                                                                                                                                                                                                                                      |
|-------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DNS Primary IP Address                    | The IP addresses of the DNS servers that provide name resolution for the SMB server. Use a comma to separate the IP addresses when referencing multiple servers, for example, 172.31.25.223, 172.31.2.74..                                                                                                                       |
| Active Directory Domain to join           | The FQDN of the Active Directory (AD) domain that you want the SMB server to join.<br>When using AWS Managed Microsoft AD, use the value from the "Directory DNS name" field.                                                                                                                                                    |
| SMB Server NetBIOS name                   | A NetBIOS name for the SMB server that will be created.                                                                                                                                                                                                                                                                          |
| Credentials authorized to join the domain | The name and password of a Windows account with sufficient privileges to add computers to the specified Organizational Unit (OU) within the AD domain.                                                                                                                                                                           |
| Organizational Unit                       | The organizational unit within the AD domain to associate with the SMB server. The default is CN=Computers for connections to your own Windows Active Directory server.<br>If you configure AWS Managed Microsoft AD as the AD server for the Cloud Volumes Service, you should enter <b>OU=Computers,OU=corp</b> in this field. |

The following image shows the Volume page filled out for the SMB protocol:

| SMB Connectivity Setup                                           |                                            |
|------------------------------------------------------------------|--------------------------------------------|
| DNS Primary IP Address                                           | User Name                                  |
| <input type="text" value="127.0.0.1"/>                           | <input type="text" value="administrator"/> |
| Active Directory Domain to Join                                  | Password                                   |
| <input type="text" value="yourdomain.com up to 107 characters"/> | <input type="password"/>                   |
| SMB Server NetBIOS Name                                          | Organizational Unit                        |
| <input type="text" value="WENName"/>                             | <input type="text" value="CN=Computers"/>  |



You should follow the guidance on AWS security group settings to enable cloud volumes to integrate with Windows Active Directory servers correctly. See [AWS security group settings for Windows AD servers](#) for more information.

10. In the Volume from Snapshot page, if you want this volume to be created based on a snapshot of an existing volume, select the snapshot from the Snapshot Name drop-down list.
11. In the Snapshot Policy page, you can enable Cloud Volumes Service to create snapshot copies of your volumes based on a schedule. You can do this now or edit the volume later to define the snapshot policy.

See [Creating a snapshot policy](#) for more information about snapshot functionality.

## 12. Click **Add Volume**.

The new volume is added to the working environment.

### After you finish

If this is the first volume created in this AWS subscription, you need to launch the AWS Management Console to accept the two virtual interface that will be used in this AWS region to connect all your cloud volumes. See the [NetApp Cloud Volumes Service for AWS Account Setup Guide](#) for details.

You must accept the interfaces within 10 minutes after clicking the **Add Volume** button or the system may time out. If this happens, email [cvs-support@netapp.com](mailto:cvs-support@netapp.com) with your AWS Customer ID and NetApp Serial Number. Support will fix the issue and you can restart the onboarding process.

Then continue with [Mounting the cloud volume](#).

### Mount the cloud volume

You can mount a cloud volume to your AWS instance. Cloud volumes currently support NFSv3 and NFSv4.1 for Linux and UNIX clients, and SMB 3.0 and 3.1.1 for Windows clients.

**Note:** Please use the highlighted protocol/dialect supported by your client.

### Steps

1. Open the working environment.
2. Hover over the volume and click **Mount the volume**.

NFS and SMB volumes display mount instructions for that protocol. Dual-protocol volumes provide both sets of instructions.

3. Hover over the commands and copy them to your clipboard to make this process easier. Just add the destination directory/mount point at the end of the command.

#### **NFS example:**

**Mount the volume - testk**

---

**Setting up your instance**

1. Open an SSH client and connect to your instance.
2. Install the nfs client on your instance.  
On Red Hat Enterprise Linux or SuSE Linux instance:  

```
$ sudo yum install -y nfs-utils
```
- On an Ubuntu or Debian instance:  

```
$ sudo apt-get install nfs-common
```

**Mounting your volume**

1. Create a new directory on your instance:  

```
$ sudo mkdir /dir
```
2. Mount your NFSv3 volume using the command below:  

```
sudo mount -t nfs -o rw,hard,rsize=65536,wsize=65536,vers=3,tc...
```
3. Mount your NFSv4.1 volume using the command below:  

```
sudo mount -t nfs -o rw,hard,rsize=65536,wsize=65536,vers=4.1,t...
```

The maximum I/O size defined by the `rsize` and `wsize` options is 1048576, however 65536 is the recommended default for most use cases.

Note that Linux clients will default to NFSv4.1 unless the version is specified with the `vers=<nfs_version>` option.

#### **SMB example:**

## Mount the volume - <Volume Name>

### Mapping your network drive

1. Click the Start button and then click on Computer.
2. Click Map Network Drive.
3. In the Drive list, click any available drive letter.
4. In the Folder box, type this:

```
\test.cv-pm.local\silly-condescending-mcnulty
```

To connect every time you log on to your computer, check the **Reconnect at logon** option.

5. Click Finish.

4. Connect to your Amazon Elastic Compute Cloud (EC2) instance by using an SSH or RDP client, and then follow the mount instructions for your instance.

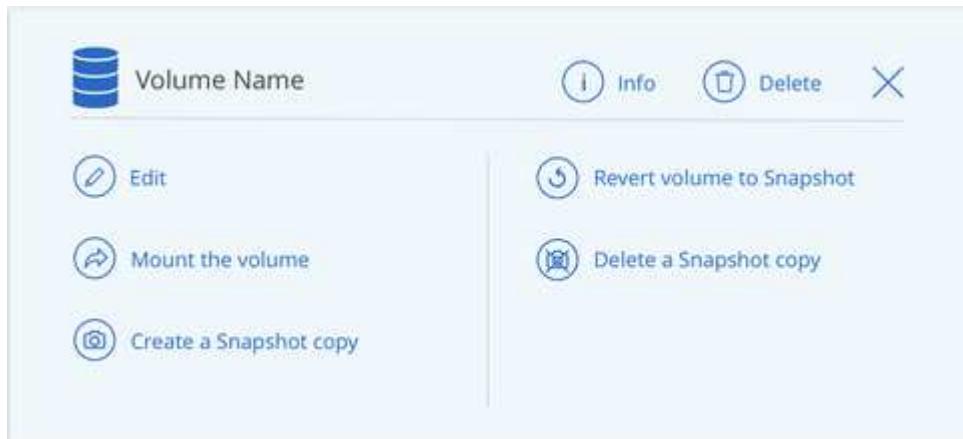
After completing the steps in the mount instructions, you have successfully mounted the cloud volume to your AWS instance.

## Managing existing volumes

You can manage existing volumes as your storage needs change. You can view, edit, restore, and delete volumes.

### Steps

1. Open the working environment.
2. Hover over the volume.



3. Manage your volumes:

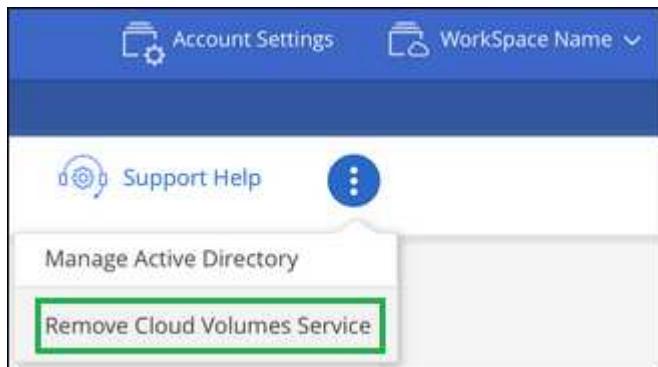
| Task                                                    | Action                                                                                                                                                                                                                                                                 |
|---------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| View information about a volume                         | Select a volume, and then click <b>Info</b> .                                                                                                                                                                                                                          |
| Edit a volume (including snapshot policy)               | a. Select a volume, and then click <b>Edit</b> .<br>b. Modify the volume's properties and then click <b>Update</b> .                                                                                                                                                   |
| Get the NFS or SMB mount command                        | a. Select a volume, and then click <b>Mount the volume</b> .<br>b. Click <b>Copy</b> to copy the command(s).                                                                                                                                                           |
| Create a Snapshot copy on demand                        | a. Select a volume, and then click <b>Create a Snapshot copy</b> .<br>b. Change the snapshot name, if needed, and then click <b>Create</b> .                                                                                                                           |
| Replace the volume with the contents of a Snapshot copy | a. Select a volume, and then click <b>Revert volume to Snapshot</b> .<br>b. Select a Snapshot copy and click <b>Revert</b> .                                                                                                                                           |
| Delete a Snapshot copy                                  | a. Select a volume, and then click <b>Delete a Snapshot copy</b> .<br>b. Select the Snapshot copy you want to delete and click <b>Delete</b> .<br>c. Click <b>Delete</b> again to confirm.                                                                             |
| Delete a volume                                         | a. Unmount the volume from all clients:<br>◦ On Linux clients, use the <code>umount</code> command.<br>◦ On Windows clients, click <b>Disconnect network drive</b> .<br>b. Select a volume, and then click <b>Delete</b> .<br>c. Click <b>Delete</b> again to confirm. |

## Remove Cloud Volumes Service from Cloud Manager

You can remove a Cloud Volumes Service for AWS subscription and all existing volumes from Cloud Manager. The volumes are not deleted, they are just removed from the Cloud Manager interface.

### Steps

1. Open the working environment.



2. Click the  button at the top of the page and click **Remove Cloud Volumes Service**.
3. In the confirmation dialog box, click **Remove**.

## Manage Active Directory configuration

If you change your DNS servers or Active Directory domain, you need to modify the SMB server in Cloud Volumes Services so that it can continue to serve storage to clients.

You can also delete the link to an Active Directory if you no longer need it.

### Steps

1. Open the working environment.
2. Click the  button at the top of the page and click **Manage Active Directory**.
3. If no Active Directory is configured, you can add one now. If one is configured, you can modify the settings or delete it using the  button.
4. Specify the settings for the Active Directory that you want to join:

| Field                                     | Description                                                                                                                                                                                                                                                                                                                      |
|-------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DNS Primary IP Address                    | The IP addresses of the DNS servers that provide name resolution for the SMB server. Use a comma to separate the IP addresses when referencing multiple servers, for example, 172.31.25.223, 172.31.2.74.                                                                                                                        |
| Active Directory Domain to join           | The FQDN of the Active Directory (AD) domain that you want the SMB server to join.<br>When using AWS Managed Microsoft AD, use the value from the "Directory DNS name" field.                                                                                                                                                    |
| SMB Server NetBIOS name                   | A NetBIOS name for the SMB server that will be created.                                                                                                                                                                                                                                                                          |
| Credentials authorized to join the domain | The name and password of a Windows account with sufficient privileges to add computers to the specified Organizational Unit (OU) within the AD domain.                                                                                                                                                                           |
| Organizational Unit                       | The organizational unit within the AD domain to associate with the SMB server. The default is CN=Computers for connections to your own Windows Active Directory server.<br>If you configure AWS Managed Microsoft AD as the AD server for the Cloud Volumes Service, you should enter <b>OU=Computers,OU=corp</b> in this field. |

5. Click **Save** to save your settings.

## Manage cloud volumes snapshots

You can create a snapshot policy for each volume so that you can recover or restore the entire contents of a volume from an earlier time. You can also create an on-demand snapshot of a cloud volume when needed.

### Create an on-demand snapshot

You can create an on-demand snapshot of a cloud volume if you want to create a snapshot with the current

volume state.

## Steps

1. Open the working environment.
2. Hover over the volume and click **Create a snapshot copy**.
3. Enter a name for the snapshot, or use the automatically generated name, and click **Create**.

**Create a Snapshot Copy - <Volume Name>**

A NetApp Snapshot copy is a read-only, point-in-time image of a volume. The image protects your data with no performance impact and requires minimal storage.

Snapshot Copy Name

manually.2020-05-04\_1722

**Create**

## Create or modify a snapshot policy

You can create or modify a snapshot policy as necessary for a cloud volume. You define the snapshot policy from the *Snapshot Policy* tab either when creating a volume or when editing a volume.

## Steps

1. Open the working environment.
2. Hover over the volume and click **Edit**.
3. From the *Snapshot Policy* tab, move the enable snapshots slider to the right.
4. Define the schedule for snapshots:
  - a. Select the frequency: **Hourly**, **Daily**, **Weekly**, or **Monthly**
  - b. Select the number of snapshots you want to keep.
  - c. Select the day, hour, and minute when the snapshot should be taken.

Schedule Snapshot Policies:

|                                            |                                 |                                                                                                        |                                                               |
|--------------------------------------------|---------------------------------|--------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|
| <input checked="" type="checkbox"/> Hourly | Number of Snapshot to Keep      | Minute                                                                                                 |                                                               |
|                                            | <input type="text" value="12"/> | <input type="text" value="30"/>                                                                        |                                                               |
| <input type="checkbox"/> Daily             | Number of Snapshot to Keep      | Hour      Minute                                                                                       |                                                               |
|                                            | <input type="text" value="0"/>  | <input type="text" value="0"/> <input type="text" value="0"/>                                          |                                                               |
| <input checked="" type="checkbox"/> Weekly | Number of Snapshot to Keep      | Days                                                                                                   | Hour      Minute                                              |
|                                            | <input type="text" value="3"/>  | <input type="button" value="Sunday X"/>                                                                | <input type="text" value="0"/> <input type="text" value="0"/> |
| <input type="checkbox"/> Monthly           | Number of Snapshot to Keep      | Days                                                                                                   | Hour      Minute                                              |
|                                            | <input type="text" value="0"/>  | <input type="checkbox"/> Sunday<br><input type="checkbox"/> Monday<br><input type="checkbox"/> Tuesday | <input type="text" value="0"/> <input type="text" value="0"/> |

- Click **Add volume** or **Update volume** to save your policy settings.

### Disable a snapshot policy

You can disable a snapshot policy to stop snapshots from being created for a short period of time while retaining your snapshot policy settings.

#### Steps

- Open the working environment.
- Hover over the volume and click **Edit**.
- From the *Snapshot Policy* tab, move the enable snapshots slider to the left.

**Enable automatic Snapshot copies**

When disabled, Cloud Volumes Service does not create Snapshot copies of your volumes.

- Click **Update volume**.

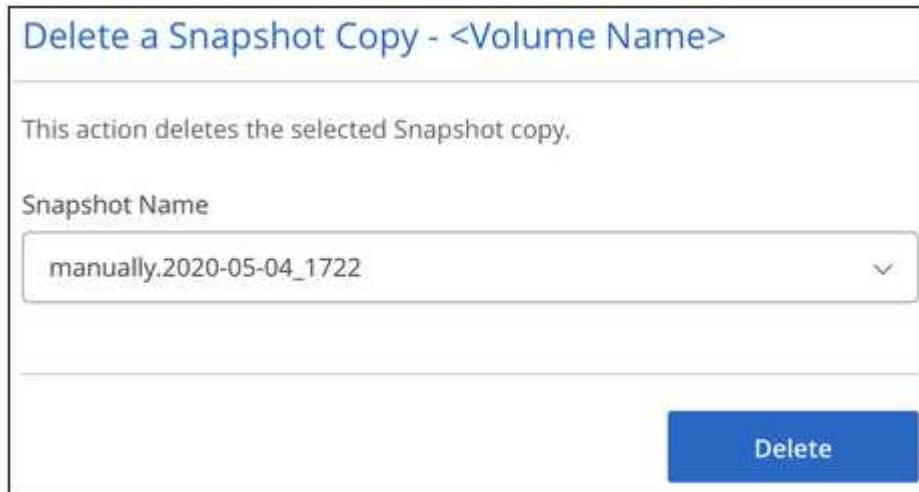
When you want to re-enable the snapshot policy, move the enable snapshots slider to the right and click **Update volume**.

### Delete a snapshot

You can delete a snapshot from the Volumes page.

## Steps

1. Open the working environment.
2. Hover over the volume and click **Delete a Snapshot copy**.
3. Select the snapshot from the drop-down list and click **Delete**.



4. In the confirmation dialog box, click **Delete**.

## Revert a volume from a snapshot

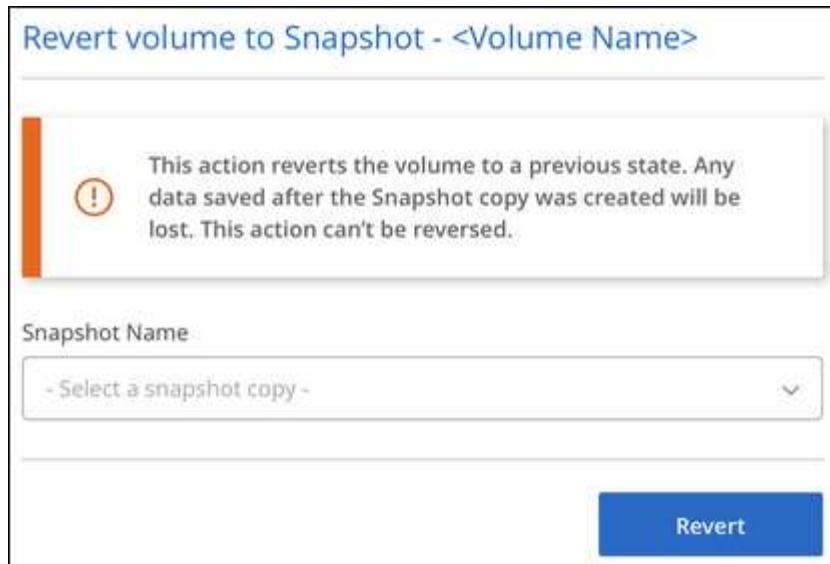
You can revert a volume to an earlier point in time from an existing snapshot.

When you revert a volume, the content of the snapshot overwrites the existing volume configuration. Any changes that were made to the data in the volume after the snapshot was created are lost.

Note that clients do not need to remount the volume after the revert operation.

## Steps

1. Open the working environment.
2. Hover over the volume and click **Revert volume to Snapshot**.
3. Select the snapshot that you want to use to restore the existing volume from the drop-down list and click **Revert**.



## Reference

### Service levels and allocated capacity

The cost for Cloud Volumes Service for AWS is based on the *service level* and the *allocated capacity* that you select. Selecting the appropriate service level and capacity helps you meet your storage needs at the lowest cost.

### Considerations

Storage needs include two fundamental aspects:

- The storage *capacity* for holding data
- The storage *bandwidth* for interacting with data

If you consume more storage space than the capacity you selected for the volume, the following considerations apply:

- You will be billed for the additional storage capacity that you consume at the price defined by your service level.
- The amount of storage bandwidth available to the volume does not increase until you increase the allocated capacity size or change the service level.

### Service levels

Cloud Volumes Service for AWS supports three service levels. You specify your service level when you create or modify the volume.

The service levels are catered to different storage capacity and storage bandwidth needs:

- **Standard** (capacity)

If you want capacity at the lowest cost, and your bandwidth needs are limited, then the Standard service level might be most appropriate for you. An example is using the volume as a backup target.

- Bandwidth: 16 KB of bandwidth per GB provisioned capacity
- **Premium** (a balance of capacity and performance)

If your application has a balanced need for storage capacity and bandwidth, then the Premium service level might be most appropriate for you. This level is less expensive per MB/s than the Standard service level, and it is also less expensive per GB of storage capacity than the Extreme service level.

- Bandwidth: 64 KB of bandwidth per GB provisioned capacity
- **Extreme** (performance)

The Extreme service level is least expensive in terms of storage bandwidth. If your application demands storage bandwidth without the associated demand for lots of storage capacity, then the Extreme service level might be most appropriate for you.

- Bandwidth: 128 KB of bandwidth per GB provisioned capacity

#### **Allocated capacity**

You specify your allocated capacity for the volume when you create or modify the volume.

While you would select your service level based on your general, high-level business needs, you should select your allocated capacity size based on the specific needs of applications, for example:

- How much storage space the applications need
- How much storage bandwidth per second the applications or the users require

Allocated capacity is specified in GBs. A volume's allocated capacity can be set within the range of 100 GB to 100,000 GB (equivalent to 100 TBs).

#### **Number of inodes**

Volumes less than or equal to 1 TB can use up to 20 million inodes. The number of inodes increase by 20 million for each TB you allocate, up to a maximum of 100 million inodes.

- <= 1TB = 20 million inodes
- >1 TB to 2 TB = 40 million inodes
- >2 TB to 3 TB = 60 million inodes
- >3 TB to 4 TB = 80 million inodes
- >4 TB to 100 TB = 100 million inodes

#### **Bandwidth**

The combination of both the service level and the allocated capacity you select determines the maximum bandwidth for the volume.

If your applications or users need more bandwidth than your selections, you can change the service level or increase the allocated capacity. The changes do not disrupt data access.

#### **Selecting the service level and the allocated capacity**

To select the most appropriate service level and allocated capacity for your needs, you need to know how much capacity and bandwidth you require at the peak or the edge.

## List of service levels and allocated capacity

The leftmost column indicates the capacity, and the other columns define the MB/s available at each capacity point based on service level.

See [Contract subscription pricing](#) and [Metered subscription pricing](#) for complete details on pricing.

| Capacity (TB) | Standard (MB/s) | Premium (MB/s) | Extreme (MB/s) |
|---------------|-----------------|----------------|----------------|
| 0.1 (100 GB)  | 1.6             | 6.4            | 12.8           |
| 1             | 16              | 64             | 128            |
| 2             | 32              | 128            | 256            |
| 3             | 48              | 192            | 384            |
| 4             | 64              | 256            | 512            |
| 5             | 80              | 320            | 640            |
| 6             | 96              | 384            | 768            |
| 7             | 112             | 448            | 896            |
| 8             | 128             | 512            | 1,024          |
| 9             | 144             | 576            | 1,152          |
| 10            | 160             | 640            | 1,280          |
| 11            | 176             | 704            | 1,408          |
| 12            | 192             | 768            | 1,536          |
| 13            | 208             | 832            | 1,664          |
| 14            | 224             | 896            | 1,792          |
| 15            | 240             | 960            | 1,920          |
| 16            | 256             | 1,024          | 2,048          |
| 17            | 272             | 1,088          | 2,176          |
| 18            | 288             | 1,152          | 2,304          |
| 19            | 304             | 1,216          | 2,432          |
| 20            | 320             | 1,280          | 2,560          |
| 21            | 336             | 1,344          | 2,688          |
| 22            | 352             | 1,408          | 2,816          |
| 23            | 368             | 1,472          | 2,944          |
| 24            | 384             | 1,536          | 3,072          |
| 25            | 400             | 1,600          | 3,200          |
| 26            | 416             | 1,664          | 3,328          |
| 27            | 432             | 1,728          | 3,456          |
| 28            | 448             | 1,792          | 3,584          |

| Capacity (TB) | Standard (MB/s) | Premium (MB/s) | Extreme (MB/s) |
|---------------|-----------------|----------------|----------------|
| 29            | 464             | 1,856          | 3,712          |
| 30            | 480             | 1,920          | 3,840          |
| 31            | 496             | 1,984          | 3,968          |
| 32            | 512             | 2,048          | 4,096          |
| 33            | 528             | 2,112          | 4,224          |
| 34            | 544             | 2,176          | 4,352          |
| 35            | 560             | 2,240          | 4,480          |
| 36            | 576             | 2,304          | 4,500          |
| 37            | 592             | 2,368          | 4,500          |
| 38            | 608             | 2,432          | 4,500          |
| 39            | 624             | 2,496          | 4,500          |
| 40            | 640             | 2,560          | 4,500          |
| 41            | 656             | 2,624          | 4,500          |
| 42            | 672             | 2,688          | 4,500          |
| 43            | 688             | 2,752          | 4,500          |
| 44            | 704             | 2,816          | 4,500          |
| 45            | 720             | 2,880          | 4,500          |
| 46            | 736             | 2,944          | 4,500          |
| 47            | 752             | 3,008          | 4,500          |
| 48            | 768             | 3,072          | 4,500          |
| 49            | 784             | 3,136          | 4,500          |
| 50            | 800             | 3,200          | 4,500          |
| 51            | 816             | 3,264          | 4,500          |
| 52            | 832             | 3,328          | 4,500          |
| 53            | 848             | 3,392          | 4,500          |
| 54            | 864             | 3,456          | 4,500          |
| 55            | 880             | 3,520          | 4,500          |
| 56            | 896             | 3,584          | 4,500          |
| 57            | 912             | 3,648          | 4,500          |
| 58            | 928             | 3,712          | 4,500          |
| 59            | 944             | 3,776          | 4,500          |
| 60            | 960             | 3,840          | 4,500          |
| 61            | 976             | 3,904          | 4,500          |

| Capacity (TB) | Standard (MB/s) | Premium (MB/s) | Extreme (MB/s) |
|---------------|-----------------|----------------|----------------|
| 62            | 992             | 3,968          | 4,500          |
| 63            | 1,008           | 4,032          | 4,500          |
| 64            | 1,024           | 4,096          | 4,500          |
| 65            | 1,040           | 4,160          | 4,500          |
| 66            | 1,056           | 4,224          | 4,500          |
| 67            | 1,072           | 4,288          | 4,500          |
| 68            | 1,088           | 4,352          | 4,500          |
| 69            | 1,104           | 4,416          | 4,500          |
| 70            | 1,120           | 4,480          | 4,500          |
| 71            | 1,136           | 4,500          | 4,500          |
| 72            | 1,152           | 4,500          | 4,500          |
| 73            | 1,168           | 4,500          | 4,500          |
| 74            | 1,184           | 4,500          | 4,500          |
| 75            | 1,200           | 4,500          | 4,500          |
| 76            | 1,216           | 4,500          | 4,500          |
| 77            | 1,232           | 4,500          | 4,500          |
| 78            | 1,248           | 4,500          | 4,500          |
| 79            | 1,264           | 4,500          | 4,500          |
| 80            | 1,280           | 4,500          | 4,500          |
| 81            | 1,296           | 4,500          | 4,500          |
| 82            | 1,312           | 4,500          | 4,500          |
| 83            | 1,328           | 4,500          | 4,500          |
| 84            | 1,344           | 4,500          | 4,500          |
| 85            | 1,360           | 4,500          | 4,500          |
| 86            | 1,376           | 4,500          | 4,500          |
| 87            | 1,392           | 4,500          | 4,500          |
| 88            | 1,408           | 4,500          | 4,500          |
| 89            | 1,424           | 4,500          | 4,500          |
| 90            | 1,440           | 4,500          | 4,500          |
| 91            | 1,456           | 4,500          | 4,500          |
| 92            | 1,472           | 4,500          | 4,500          |
| 93            | 1,488           | 4,500          | 4,500          |
| 94            | 1,504           | 4,500          | 4,500          |

| Capacity (TB) | Standard (MB/s) | Premium (MB/s) | Extreme (MB/s) |
|---------------|-----------------|----------------|----------------|
| 95            | 1,520           | 4,500          | 4,500          |
| 96            | 1,536           | 4,500          | 4,500          |
| 97            | 1,552           | 4,500          | 4,500          |
| 98            | 1,568           | 4,500          | 4,500          |
| 99            | 1,584           | 4,500          | 4,500          |
| 100           | 1,600           | 4,500          | 4,500          |

### Example 1

For example, your application requires 25 TB of capacity and 100 MB/s of bandwidth. At 25 TB of capacity, the Standard service level would provide 400 MB/s of bandwidth at a cost of \$2,500 (estimate: see current pricing), making Standard the most suitable service level in this case.

### Example 2

For example, your application requires 12 TB of capacity and 800 MB/s of peak bandwidth. Although the Extreme service level can meet the demands of the application at the 12 TB mark, it is more cost-effective (estimate: see current pricing) to select 13 TB at the Premium service level.

### AWS security group settings for Windows AD servers

If you use Windows Active Directory (AD) servers with cloud volumes, you should familiarize yourself with the guidance on AWS security group settings. The settings enable cloud volumes to integrate with AD correctly.

By default, the AWS security group applied to an EC2 Windows instance does not contain inbound rules for any protocol except RDP. You must add rules to the security groups that are attached to each Windows AD instance to enable inbound communication from Cloud Volumes Service. The required ports are as follows:

| Service         | Port | Protocol   |
|-----------------|------|------------|
| AD Web Services | 9389 | TCP        |
| DNS             | 53   | TCP        |
| DNS             | 53   | UDP        |
| ICMPv4          | N/A  | Echo Reply |
| Kerberos        | 464  | TCP        |
| Kerberos        | 464  | UDP        |
| Kerberos        | 88   | TCP        |
| Kerberos        | 88   | UDP        |
| LDAP            | 389  | TCP        |

| Service      | Port | Protocol |
|--------------|------|----------|
| LDAP         | 389  | UDP      |
| LDAP         | 3268 | TCP      |
| NetBIOS name | 138  | UDP      |
| SAM/LSA      | 445  | TCP      |
| SAM/LSA      | 445  | UDP      |
| Secure LDAP  | 636  | TCP      |
| Secure LDAP  | 3269 | TCP      |
| w32time      | 123  | UDP      |

If you are deploying and managing your AD installation domain controllers and member servers on an AWS EC2 instance, you will require several security group rules to allow traffic for the Cloud Volumes Service. Below is an example of how to implement these rules for AD applications as part of the AWS CloudFormation template.

```
{
 "AWSTemplateFormatVersion" : "2010-09-09",
 "Description" : "Security Group for AD",
 "Parameters" :
 {
 "VPC" :
 {
 "Type" : "AWS::EC2::VPC::Id",
 "Description" : "VPC where the Security Group will belong:"
 },
 "Name" :
 {
 "Type" : "String",
 "Description" : "Name Tag of the Security Group:"
 },
 "Description" :
 {
 "Type" : "String",
 "Description" : "Description Tag of the Security Group:",
 "Default" : "Security Group for Active Directory for CVS"
 },
 "CIDRrangeforTCPandUDP" :
 {
 "Type" : "String",
 "Description" : "CIDR Range for the UDP ports
445,138,464,389,53,123 and for the TCP ports
464,339,3389,3268,88,636,9389,445 and 0-65535: *CIDR range format:
10.0.0.0/24"
 }
 }
}
```

```

 }
 },
 "Resources" :
 {
 "ADSGWest" :
 {
 "Type" : "AWS::EC2::SecurityGroup",
 "Properties" :
 {
 "GroupDescription" : { "Ref" : "Description" },
 "VpcId" : { "Ref" : "VPC" },
 "SecurityGroupIngress" : [
 {
 "IpProtocol" : "udp",
 "CidrIp" : { "Ref" : "CIDRrangeforTCPandUDP" },
 "FromPort" : "445",
 "ToPort" : "445"
 },
 {
 "IpProtocol" : "udp",
 "CidrIp" : { "Ref" : "CIDRrangeforTCPandUDP" },
 "FromPort" : "138",
 "ToPort" : "138"
 },
 {
 "IpProtocol" : "udp",
 "CidrIp" : { "Ref" : "CIDRrangeforTCPandUDP" },
 "FromPort" : "464",
 "ToPort" : "464"
 },
 {
 "IpProtocol" : "tcp",
 "CidrIp" : { "Ref" : "CIDRrangeforTCPandUDP" },
 "FromPort" : "464",
 "ToPort" : "464"
 },
 {
 "IpProtocol" : "udp",
 "CidrIp" : { "Ref" : "CIDRrangeforTCPandUDP" },
 "FromPort" : "389",
 "ToPort" : "389"
 },
 {
 "IpProtocol" : "udp",
 "CidrIp" : { "Ref" : "CIDRrangeforTCPandUDP" },
 "FromPort" : "53",
 "ToPort" : "53"
 }
]
 }
 }
 }
}

```

```

 "ToPort" : "53"
 },
{
 "IpProtocol" : "tcp",
 "CidrIp" : {"Ref" : "CIDRrangeforTCPandUDP"},
 "FromPort" : "339",
 "ToPort" : "339"
},
{
 "IpProtocol" : "udp",
 "CidrIp" : {"Ref" : "CIDRrangeforTCPandUDP"},
 "FromPort" : "123",
 "ToPort" : "123"
},
{
 "IpProtocol" : "tcp",
 "CidrIp" : {"Ref" : "CIDRrangeforTCPandUDP"},
 "FromPort" : "3389",
 "ToPort" : "3389"
},
{
 "IpProtocol" : "tcp",
 "CidrIp" : {"Ref" : "CIDRrangeforTCPandUDP"},
 "FromPort" : "3268",
 "ToPort" : "3268"
},
{
 "IpProtocol" : "tcp",
 "CidrIp" : {"Ref" : "CIDRrangeforTCPandUDP"},
 "FromPort" : "88",
 "ToPort" : "88"
},
{
 "IpProtocol" : "tcp",
 "CidrIp" : {"Ref" : "CIDRrangeforTCPandUDP"},
 "FromPort" : "636",
 "ToPort" : "636"
},
{
 "IpProtocol" : "tcp",
 "CidrIp" : {"Ref" : "CIDRrangeforTCPandUDP"},
 "FromPort" : "3269",
 "ToPort" : "3269"
},
{
 "IpProtocol" : "tcp",

```

```

 "CidrIp" : {"Ref" : "CIDRrangeforTCPandUDP"},

 "FromPort" : "53",

 "ToPort" : "53"

 },

 {

 "IpProtocol" : "tcp",

 "CidrIp" : {"Ref" : "CIDRrangeforTCPandUDP"},

 "FromPort" : "0",

 "ToPort" : "65535"

 },

 {

 "IpProtocol" : "tcp",

 "CidrIp" : {"Ref" : "CIDRrangeforTCPandUDP"},

 "FromPort" : "9389",

 "ToPort" : "9389"

 },

 {

 "IpProtocol" : "tcp",

 "CidrIp" : {"Ref" : "CIDRrangeforTCPandUDP"},

 "FromPort" : "445",

 "ToPort" : "445"

 }

}

]

}

}

},

"Outputs" :

{

 "SecurityGroupID" :

 {

 "Description" : "Security Group ID",

 "Value" : { "Ref" : "ADSGWest" }

 }

}
}

```

## Cloud Volumes Service for GCP

### Learn about Cloud Volumes Service for Google Cloud

NetApp Cloud Volumes Service for Google Cloud enables you to quickly add multi-protocol workloads as well as build and deploy both Windows-based and UNIX-based apps.

## **Key features:**

- Migrate data between on-premises and Google Cloud.
- Provision volumes from 1 to 100 TiB in seconds.
- Multiprotocol support (you can create an NFS or SMB volume).
- Protect data with automated, efficient snapshots.
- Accelerate app development with rapid cloning.

## **Cost**

Volumes created by the Cloud Volumes Service for Google Cloud are charged to your subscription to the service, not through Cloud Manager.

[View pricing](#)

There are no charges to discover a Cloud Volumes Service for Google Cloud region or volume from Cloud Manager.

## **Supported regions**

[View supported Google Cloud regions.](#)

## **Before you get started**

Cloud Manager can discover existing Cloud Volumes Service for GCP subscriptions and volumes. See the [NetApp Cloud Volumes Service for Google Cloud documentation](#) if you haven't set up your subscription yet.

## **Getting help**

Use the Cloud Manager chat for general questions about Cloud Volumes Service operation in Cloud Manager.

For general questions about Cloud Volumes Service for Google Cloud, email NetApp's Google Cloud Team at [gcinfo@netapp.com](mailto:gcinfo@netapp.com).

For technical issues associated with your cloud volumes, you can create a technical support case from the Google Cloud Console. See [obtaining support](#) for details.

## **Limitations**

- Cloud Manager doesn't support data replication between working environments when using Cloud Volumes Service volumes.
- Deleting your Cloud Volumes Service for Google Cloud subscription from Cloud Manager isn't supported. You can do this only through the Google Cloud Console.

## **Related links**

- [NetApp Cloud Central: Cloud Volumes Service for Google Cloud](#)
- [NetApp Cloud Volumes Service for Google Cloud documentation](#)

## Set up Cloud Volumes Service for Google Cloud

Create a Cloud Volumes Service for Google Cloud working environment in Cloud Manager to create and manage volumes and snapshots.

### Quick start

Get started quickly by following these steps, or go to the next section for full details.

1

#### Enable the Cloud Volumes Service API

From Google, enable the Cloud Volumes Service for GCP API so that Cloud Manager can manage the subscription and cloud volumes.

2

#### Create a GCP service account and download credentials

From Google, create a GCP service account and role so that Cloud Manager can access your Cloud Volumes Service for GCP account.

3

#### Create a Cloud Volumes Service for GCP working environment

In Cloud Manager, click **Add Working Environment > Google Cloud > Cloud Volumes Service** and then provide details about the service account and Google Cloud project.

### Enable the Cloud Volumes Service API

In Google Cloud Shell, run the following command to enable the Cloud Volumes Service API:

```
gcloud --project=<my-cvs-project> services enable cloudvolumesgcp-api.netapp.com
```

### Give Cloud Manager access to the Cloud Volumes Service for GCP account

You must complete the following tasks so that Cloud Manager can access your Google Cloud project:

- Create a new service account
- Add the new service account member to your project and assign it specific roles (permissions)
- Create and download a key pair for the service account that is used to authenticate to Google

### Steps

1. In the Google Cloud console, [go to the Service accounts page](#).
2. Click **Select a project**, choose your project, and click **Open**.
3. Click **Create service account**.
4. Enter the service account name (friendly display name) and description.

The Cloud Console generates a service account ID based on this name. Edit the ID if necessary - you cannot change the ID later.

5. To set access controls now, click **Create** and then **DONE** from the bottom of the page, and continue to the next step.

6. From the *IAM page* click **Add** and fill out the fields in the *Add Members* page:
  - a. In the New Members field, enter the full service account ID, for example, [user1-service-account-cvs@project1.iam.gserviceaccount.com](mailto:user1-service-account-cvs@project1.iam.gserviceaccount.com).
  - b. Add these roles:
    - *NetApp Cloud Volumes Admin*
    - *Compute Network Viewer*
  - c. Click **Save**.
7. Click the Service Account name, and then from the *Service account details* page, click **Add key > Create new key**.
8. Select **JSON** as the key type and click **Create**.

By clicking **Create** your new public/private key pair is generated and downloaded to your system. It serves as the only copy of the private key. Store this file securely because it can be used to authenticate as your service account.

For detailed steps, see the Google Cloud topics [Creating and managing service accounts](#), [Granting, changing, and revoking access to resources](#), and [Creating and managing service account keys](#).

### Create a Cloud Volumes Service for GCP working environment

Set up a Cloud Volumes Service for GCP working environment in Cloud Manager so you can start creating volumes.

Regardless of whether you have already created volumes from the Google Cloud Console, or if you just signed up for Cloud Volumes Service for GCP and have no volumes yet, the first step is to create a working environment for the volumes based on your GCP subscription.

If cloud volumes already exist for this subscription, then the volumes will appear in the new working environment. If you haven't added any cloud volumes yet for the GCP subscription, then you do that after you create the new working environment.



If you have subscriptions and volumes in multiple GCP projects, you need to perform this task for each project.

#### Before you begin

You must have the following information available when adding a subscription for each project:

- Service account credentials (JSON private key you downloaded)
- Project name

#### Steps

1. In Cloud Manager, add a new Working Environment, select the location **Google Cloud**, and click **Continue**.
2. Select **Cloud Volumes Service** and click **Continue**.

Add Working Environment Wizard      Define Your Working Environment

↑ Previous Step

You're about to set up Cloud Volumes Service for GCP.

**Continue**

3. Provide information about your Cloud Volumes Service subscription:
  - a. Enter the Working Environment Name you want to use.
  - b. Copy/paste the JSON private key you downloaded in the previous steps.
  - c. Select the name of your Google Cloud project.
  - d. Click **Continue**.

Cloud Volumes Service Credentials

Working Environment Name

Service Account Credentials

Paste the contents of the JSON file here.

Project

Select project < ▾

## Result

Cloud Manager displays your Cloud Volumes Service for Google Cloud working environment.



If cloud volumes already exist for this subscription, then the volumes appear in the new working environment. You can add additional cloud volumes from Cloud Manager.

If no cloud volumes exist for this subscription, create them now.

#### What's next?

[Start creating and managing volumes](#).

## Create and manage volumes for Cloud Volumes Service for Google Cloud

Cloud Manager enables you to create cloud volumes based on your [Cloud Volumes Service for Google Cloud](#) subscription. You can also edit certain attributes of a volume, get the relevant mount commands, create snapshot copies, and delete cloud volumes.

### Create cloud volumes

You can create NFS or SMB volumes in a new or existing Cloud Volumes Service for Google Cloud account. Cloud volumes currently support NFSv3 and NFSv4.1 for Linux and UNIX clients, and SMB 3.x for Windows clients.

#### Before you begin

- If you want to use SMB in GCP, you must have set up DNS and Active Directory.
- When planning to create an SMB volume, you must have a Windows Active Directory server available to which you can connect. You will enter this information when creating the volume. Also, make sure that the Admin user is able to create a machine account in the Organizational unit (OU) path specified.

#### Steps

1. Select the working environment and click **Add New Volume**.
2. In the Details & Location page, enter details about the volume:
  - a. Enter a name for the volume.
  - b. Specify a size within the range of 1 TiB (1024 GiB) to 100 TiB.  
[Learn more about allocated capacity](#).
  - c. Specify a service level: Standard, Premium, or Extreme.  
[Learn more about service levels](#).
  - d. Select the Google Cloud region.
  - e. Select the VPC Network from which the volume will be accessible. Note that the VPC cannot be changed or edited after the volume is created.
  - f. Click **Continue**.
3. In the Protocol page, select NFS or SMB and then define the details. Required entries for NFS and SMB are shown in separate sections below.
4. For NFS:
  - a. In the Volume Path field, specify the name of the volume export you will see when you mount the volume.

- b. Select NFSv3, NFSv4.1, or both depending on your requirements.
- c. Optionally, you can create an export policy to identify the clients that can access the volume. Specify the:
  - Allowed clients by using an IP address or Classless Inter-Domain Routing (CIDR).
  - Access rights as Read & Write or Read Only.
  - Access protocol (or protocols if the volume allows both NFSv3 and NFSv4.1 access) used for users.
  - Click **+ Add Export Policy Rule** if you want to define additional export policy rules.

The following image shows the Volume page filled out for the NFS protocol:

Protocol

Select the volume's protocol:  NFS Protocol  SMB Protocol

|                                                                                                   |                                                                                                                     |
|---------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|
| Protocol                                                                                          | Export Policy                                                                                                       |
| Volume Path<br>vol1                                                                               | Allowed Client & Access<br>0.0.0.0/24 <input checked="" type="radio"/> Read & Write <input type="radio"/> Read Only |
| Select NFS Version:<br><input checked="" type="checkbox"/> NFSv3 <input type="checkbox"/> NFSv4.1 | Select NFS Version: <input checked="" type="checkbox"/> NFSv3 <input type="checkbox"/> NFSv4.1                      |

**+ Add Export Policy Rule (Up to 5)**

##### 5. For SMB:

- a. In the Volume Path field, specify the name of the volume export you will see when you mount the volume and click **Continue**.
- b. If Active Directory has been set up, you see the configuration. If it is the first volume being set up and no Active Directory has been set up, you can enable SMB session encryption in the SMB Connectivity Setup page:

| Field                                     | Description                                                                                                                                                                                                |
|-------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DNS Primary IP Address                    | The IP addresses of the DNS servers that provide name resolution for the SMB server. Use a comma to separate the IP addresses when referencing multiple servers, for example, 172.31.25.223, 172.31.2.74.. |
| Active Directory Domain to join           | The FQDN of the Active Directory (AD) domain that you want the SMB server to join.                                                                                                                         |
| SMB Server NetBIOS name                   | A NetBIOS name for the SMB server that will be created.                                                                                                                                                    |
| Credentials authorized to join the domain | The name and password of a Windows account with sufficient privileges to add computers to the specified Organizational Unit (OU) within the AD domain.                                                     |

| Field               | Description                                                                                                                                                             |
|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Organizational Unit | The organizational unit within the AD domain to associate with the SMB server. The default is CN=Computers for connections to your own Windows Active Directory server. |

The following image shows the Volume page filled out for the SMB protocol:

The screenshot shows the 'SMB Connectivity Setup' page. It includes the following fields:

- DNS Primary IP Address: 127.0.0.1
- User Name: administrator
- Active Directory Domain to Join: yourdomain.com up to 107 characters
- Password: (empty field)
- SMB Server NetBIOS Name: WEName
- Organizational Unit: CN=Computers

6. Click **Continue**.
7. If you want to create the volume based on a snapshot of an existing volume, select the snapshot from the Snapshot Name drop-down list. Otherwise just click **Continue**.
8. In the Snapshot Policy page, you can enable Cloud Volumes Service to create snapshot copies of your volumes based on a schedule. You can do this now by moving the selector to the right, or you can edit the volume later to define the snapshot policy.

See [Creating a snapshot policy](#) for more information about snapshot functionality.

9. Click **Add Volume**.

The new volume is added to the working environment.

Continue with [Mounting the cloud volume](#).

## Mount cloud volumes

Access mounting instructions from within Cloud Manager so you can mount the volume to a host.

**Note:** Please use the highlighted protocol/dialect supported by your client.

### Steps

1. Open the working environment.
2. Hover over the volume and click **Mount the volume**.

NFS and SMB volumes display mount instructions for that protocol.

3. Hover over the commands and copy them to your clipboard to make this process easier. Just add the destination directory/mount point at the end of the command.

## NFS example:

**Mount the volume - testk**

**Setting up your instance**

1. Open an SSH client and connect to your instance.
2. Install the nfs client on your instance.  
On Red Hat Enterprise Linux or SuSE Linux instance:  

```
$ sudo yum install -y nfs-utils
```
- On an Ubuntu or Debian instance:  

```
$ sudo apt-get install nfs-common
```

**Mounting your volume**

1. Create a new directory on your instance:  

```
$ sudo mkdir /dir
```
2. Mount your NFSv3 volume using the command below:  

```
sudo mount -t nfs -o rw,hard,rsize=65536,wsize=65536,vers=3,tc...
```
3. Mount your NFSv4.1 volume using the command below:  

```
sudo mount -t nfs -o rw,hard,rsize=65536,wsize=65536,vers=4.1,t...
```

The maximum I/O size defined by the `rsize` and `wsize` options is 1048576, however 65536 is the recommended default for most use cases.

Note that Linux clients will default to NFSv4.1 unless the version is specified with the `vers=<nfs_version>` option.

## SMB example:

## Mount the volume - <Volume Name>

### Mapping your network drive

1. Click the Start button and then click on Computer.
2. Click Map Network Drive.
3. In the Drive list, click any available drive letter.
4. In the Folder box, type this:

```
\test.cv-pm.local\silly-condescending-mcnulty
```

To connect every time you log on to your computer, check the **Reconnect at logon** option.

5. Click Finish.

4. Map your network drive by following the mount instructions for your instance.

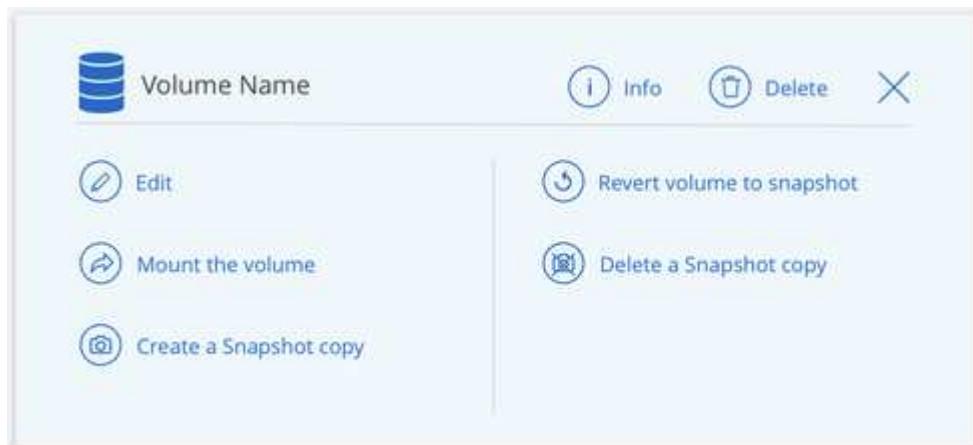
After completing the steps in the mount instructions, you have successfully mounted the cloud volume to your GCP instance.

### Manage existing volumes

You can manage existing volumes as your storage needs change. You can view, edit, restore, and delete volumes.

#### Steps

1. Open the working environment.
2. Hover over the volume.



3. Manage your volumes:

| Task                                                    | Action                                                                                                                                                                                                                                                                 |
|---------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| View information about a volume                         | Click <b>Info</b> .                                                                                                                                                                                                                                                    |
| Edit a volume (including snapshot policy)               | a. Click <b>Edit</b> .<br>b. Modify the volume's properties and then click <b>Update</b> .                                                                                                                                                                             |
| Get the NFS or SMB mount command                        | a. Click <b>Mount the volume</b> .<br>b. Click <b>Copy</b> to copy the command(s).                                                                                                                                                                                     |
| Create a Snapshot copy on demand                        | a. Click <b>Create a Snapshot copy</b> .<br>b. Change the name, if needed, and then click <b>Create</b> .                                                                                                                                                              |
| Replace the volume with the contents of a Snapshot copy | a. Click <b>Revert volume to snapshot</b> .<br>b. Select a Snapshot copy and click <b>Restore</b> .                                                                                                                                                                    |
| Delete a Snapshot copy                                  | a. Click <b>Delete a Snapshot copy</b> .<br>b. Select the snapshot and click <b>Delete</b> .<br>c. Click <b>Delete</b> again when prompted to confirm.                                                                                                                 |
| Delete a volume                                         | a. Unmount the volume from all clients:<br>◦ On Linux clients, use the <code>umount</code> command.<br>◦ On Windows clients, click <b>Disconnect network drive</b> .<br>b. Select a volume, and then click <b>Delete</b> .<br>c. Click <b>Delete</b> again to confirm. |

## Remove Cloud Volumes Service from Cloud Manager

You can remove a Cloud Volumes Service for Google Cloud subscription and all existing volumes from Cloud Manager. The volumes are not deleted, they are just removed from the Cloud Manager interface.

### Steps

1. Open the working environment.
2. Click the  button at the top of the page and click **Remove Cloud Volumes Service**.
3. In the confirmation dialog box, click **Remove**.

## Manage Active Directory configuration

If you change your DNS servers or Active Directory domain, you need to modify the SMB server in Cloud Volumes Services so that it can continue to serve storage to clients.

### Steps

1. Open the working environment.

2. Click the  button at the top of the page and click **Manage Active Directory**. If no Active Directory is configured, you can add one now. If one is configured, you can modify or delete the settings using the  button.
3. Specify the settings for the SMB server:

| Field                                     | Description                                                                                                                                                                                               |
|-------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DNS Primary IP Address                    | The IP addresses of the DNS servers that provide name resolution for the SMB server. Use a comma to separate the IP addresses when referencing multiple servers, for example, 172.31.25.223, 172.31.2.74. |
| Active Directory Domain to join           | The FQDN of the Active Directory (AD) domain that you want the SMB server to join.                                                                                                                        |
| SMB Server NetBIOS name                   | A NetBIOS name for the SMB server that will be created.                                                                                                                                                   |
| Credentials authorized to join the domain | The name and password of a Windows account with sufficient privileges to add computers to the specified Organizational Unit (OU) within the AD domain.                                                    |
| Organizational Unit                       | The organizational unit within the AD domain to associate with the SMB server. The default is CN=Computers for connections to your own Windows Active Directory server.                                   |

4. Click **Save** to save your settings.

## Manage cloud volumes snapshots

You can create a snapshot policy for each volume so that you can recover or restore the entire contents of a volume from an earlier time. You can also create an on-demand snapshot of a cloud volume when needed.

### Create an on-demand snapshot

You can create an on-demand snapshot of a cloud volume if you want to create a snapshot with the current volume state.

#### Steps

1. Open the working environment.
2. Hover over the volume and click **Create a snapshot copy**.
3. Enter a name for the snapshot, or use the automatically generated name, and click **Create**.

## Create a Snapshot Copy - <Volume Name>

A NetApp Snapshot copy is a read-only, point-in-time image of a volume. The image protects your data with no performance impact and requires minimal storage.

Snapshot Copy Name

manually.2020-05-04\_1722

Create

The snapshot is created.

## Create or modify a snapshot policy

You can create or modify a snapshot policy as necessary for a cloud volume. You define the snapshot policy from the *Snapshot Policy* tab either when creating a volume or when editing a volume.

### Steps

1. Open the working environment.
2. Hover over the volume and click **Edit**.
3. From the *Snapshot Policy* tab, move the enable snapshots slider to the right.
4. Define the schedule for snapshots:
  - a. Select the frequency: **Hourly**, **Daily**, **Weekly**, or **Monthly**
  - b. Select the number of snapshots you want to keep.
  - c. Select the day, hour, and minute when the snapshot should be taken.

Schedule Snapshot Policies:

|                                            |                                 |                                                                                                                                                                                                            |                                |                                |
|--------------------------------------------|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|--------------------------------|
| <input checked="" type="checkbox"/> Hourly | Number of Snapshot to Keep      | Minute                                                                                                                                                                                                     |                                |                                |
|                                            | <input type="text" value="12"/> | <input type="text" value="30"/>                                                                                                                                                                            |                                |                                |
| <input type="checkbox"/> Daily             | Number of Snapshot to Keep      | Hour                                                                                                                                                                                                       | Minute                         |                                |
|                                            | <input type="text" value="0"/>  | <input type="text" value="0"/>                                                                                                                                                                             | <input type="text" value="0"/> |                                |
| <input checked="" type="checkbox"/> Weekly | Number of Snapshot to Keep      | Days                                                                                                                                                                                                       | Hour                           | Minute                         |
|                                            | <input type="text" value="3"/>  | <input style="background-color: #0070C0; color: white; border: none; padding: 5px; width: 150px; height: 30px; font-size: 14px; border-radius: 5px; margin-bottom: 10px;" type="button" value="Sunday X"/> | <input type="text" value="0"/> | <input type="text" value="0"/> |
| <input type="checkbox"/> Monthly           | Number of Snapshot to Keep      | Days                                                                                                                                                                                                       | Hour                           | Minute                         |
|                                            | <input type="text" value="0"/>  | <input type="checkbox"/> Sunday<br><input type="checkbox"/> Monday<br><input type="checkbox"/> Tuesday                                                                                                     | <input type="text" value="0"/> | <input type="text" value="0"/> |

5. Click **Add volume** or **Update volume** to save your policy settings.

## Disable a snapshot policy

You can disable a snapshot policy to stop snapshots from being created for a short period of time while retaining your snapshot policy settings.

## Steps

1. Open the working environment.
  2. Hover over the volume and click **Edit**.
  3. From the *Snapshot Policy* tab, move the enable snapshots slider to the left.



- #### 4. Click **Update volume**.

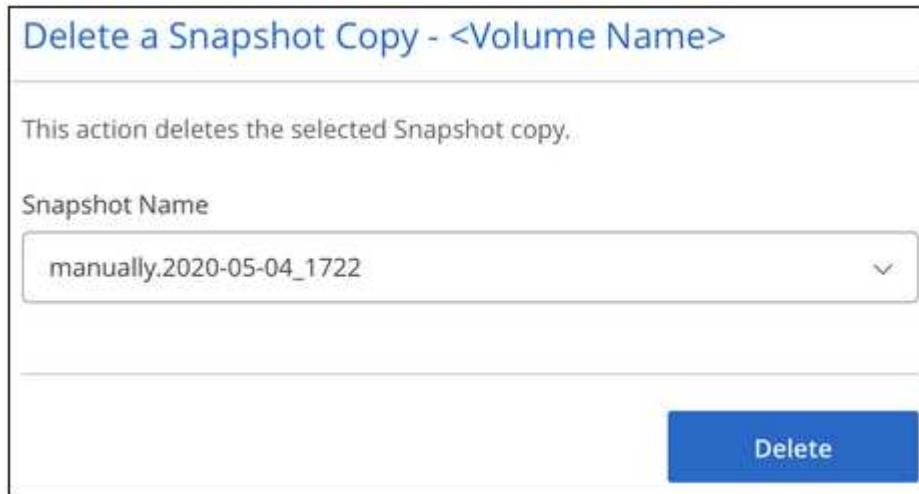
When you want to re-enable the snapshot policy, move the enable snapshots slider to the right and click **Update volume**.

## Delete a snapshot

You can delete a snapshot if it is no longer needed.

## Steps

1. Open the working environment.
2. Hover over the volume and click **Delete a Snapshot copy**.
3. Select the snapshot from the drop-down list and click **Delete**.



4. In the confirmation dialog box, click **Delete**.

## Restore a snapshot to a new volume

You can restore a snapshot to a new volume as necessary.

## Steps

1. Open the working environment.
2. Hover over the volume and click **Restore to a new volume**.
3. Select the snapshot that you want to use to create the new volume from the drop-down list.
4. Enter a name for the new volume and click **Restore**.

## Restore to a new volume - <Volume Name>

This operation restores data from a Snapshot copy to a new volume.

Snapshot Name

manually.2020-05-04\_1722



Restored Volume Name:

vol\_restore

**Restore**

The volume is created in the working environment.

5. If you need to change any of the volume attributes, such as volume path or service level:
  - a. Hover over the volume and click **Edit**.
  - b. Make your changes and click **Update volume**.

### After you finish

Continue with [Mounting the cloud volume](#).

# Manage on-prem ONTAP clusters

## Discovering on-premises ONTAP clusters

Cloud Manager can discover the ONTAP clusters in your on-premises environment, in a NetApp Private Storage configuration, and in the IBM Cloud. Adding on-prem clusters to the Cloud Manager Canvas enables you to manage these clusters using the same tools as your Cloud Volumes ONTAP and other cloud storage solutions.

In addition to being able to provision storage on those systems, adding these systems to Cloud Manager also makes it easy to view hardware and software contract status information in the Digital Wallet, and configure critical cloud-based services for those clusters. This includes replicating data to the cloud, backing up data to the cloud, tiering cold data to the cloud, and running compliance scans on that data.

### Requirements

- A Connector installed in a cloud provider or on your premises.

If you want to tier cold data to the cloud, then you should review requirements for the Connector based on where you plan to tier cold data.

- [Learn about Connectors](#)
- [Switching between Connectors](#)
- [Learn about Cloud Tiering](#)

- The cluster management IP address and the password for the admin user account to add the cluster to Cloud Manager.

Cloud Manager discovers ONTAP clusters using HTTPS. If you use custom firewall policies, they must meet the following requirements:

- The Connector host must allow outbound HTTPS access through port 443.

If the Connector is in the cloud, all outbound communication is allowed by the predefined security group.

- The ONTAP cluster must allow inbound HTTPS access through port 443.

The default "mgmt" firewall policy allows inbound HTTPS access from all IP addresses. If you modified this default policy, or if you created your own firewall policy, you must associate the HTTPS protocol with that policy and enable access from the Connector host.

- A valid set of NetApp Support Site credentials. See how to [add NetApp Support Site accounts to Cloud Manager](#).

### Viewing discovered and undiscovered on-prem clusters

You can use the *Digital Wallet* or the *Discovery* service in Cloud Manager to view, discover, and manage your on-prem ONTAP clusters that are under a support contract.

To view on-prem clusters and license details from the *Digital Wallet*:

#### Steps

1. From Cloud Manager, select the **Digital Wallet** service.

2. Click the **On-Premises ONTAP** tab.

The screenshot shows the 'On-Premises' section of the 'On-Premises ONTAP' tab. It displays the following statistics:

- Total: 12
- Discovered By Cloud Manager: 6
- Undiscovered: 6
- Contract Notification Status:
  - About to Expire Contracts: 4
  - Expired Contracts: 8

A table below lists the discovered hosts:

| Host name            | Status       | Capacity                           | Software Contract | HW Contract     |
|----------------------|--------------|------------------------------------|-------------------|-----------------|
| OnPremisesHostName#1 | Discovered   | 10.25 TB Used   50.25 TB Allocated | January 1, 2025   | January 1, 2025 |
| OnPremisesHostName#2 | Discovered   | 10.25 TB Used   50.25 TB Allocated | January 1, 2022   | January 1, 2025 |
| OnPremisesHostName#4 | Discovered   | 10.25 TB Used   50.25 TB Allocated | Expired           | January 1, 2025 |
| OnPremisesHostName#8 | Undiscovered | 10.25 TB Used   50.25 TB Allocated | January 1, 2022   | January 1, 2025 |

Your ONTAP clusters are displayed with a status of whether they have been discovered in Cloud Manager.

If you are prompted to enter your NetApp Support Site (NSS) account credentials first, enter them in the Support Dashboard. After you have added the account, the clusters that are included in that account are displayed.

To view on-prem clusters and license details from the *Discovery* service:

## Steps

1. From Cloud Manager, select the **Discovery** service.
2. Select the Active IQ login associated with your NSS account, if necessary.

Your ONTAP clusters that have a valid support contract are displayed with a status of whether they have been discovered in Cloud Manager.

**i** If your support contract expires, the systems are removed from the Discovery page. However, you can continue to manage these systems in their working environment. See how to [renew your support contract from Active IQ Digital Advisor](#).

## Viewing cluster information and contract details

You can use the *Digital Wallet* to view cluster details and hardware and software contract status.

### Steps

1. In the **Digital Wallet**, click the **On-Premises ONTAP** tab.

The Software Contract and Hardware Contract expiration dates appear on the line for each cluster.

2. If the contract is close to the expiration date, or has expired, you can click the chat icon in the lower-right of Cloud Manager to request an extension to the contract.
3. For clusters that you want to know additional details, click **▼** to expand the cluster information.

## Discovering on-prem clusters from Cloud Manager

You can discover on-prem ONTAP clusters in Cloud Manager from the *Digital Wallet*, the *Discovery* service, or from the *Canvas*. Once discovered, they are available as a working environment in Cloud Manager so that you can manage the cluster.

### Discovering clusters from the Digital Wallet

You can discover your ONTAP clusters from the Digital Wallet and add them as a working environment.

#### Steps

1. From the **Digital Wallet**, click the **On-Premises ONTAP** tab.

| 12 On-Premises       |              |                                    |                   |                 |                             |
|----------------------|--------------|------------------------------------|-------------------|-----------------|-----------------------------|
| Host name            | Status       | Capacity                           | Software Contract | HW Contract     |                             |
| OnPremisesHostName#1 | Discovered   | 10.25 TB Used   50.25 TB Allocated | January 1, 2025   | January 1, 2025 | ▼                           |
| OnPremisesHostName#2 | Discovered   | 10.25 TB Used   50.25 TB Allocated | ! January 1, 2022 | January 1, 2025 | ▼                           |
| OnPremisesHostName#4 | Discovered   | 10.25 TB Used   50.25 TB Allocated | ! Expired         | January 1, 2025 | ▼                           |
| OnPremisesHostName#8 | Undiscovered | 10.25 TB Used   50.25 TB Allocated | ! January 1, 2022 | January 1, 2025 | <button>Discover</button> ▼ |

2. Click **Discover** for the cluster that you want to manage through Cloud Manager.
3. On the *Discover ONTAP Cluster* page, enter the password for the admin user account and click **Discover**.

Note that the cluster management IP address is populated based on information from the Digital Wallet.

The status for the cluster turns to **Discovered** in the *On-Premises ONTAP* page.

#### Result

Cloud Manager discovers the cluster and adds it to a working environment in the Canvas using the cluster name as the working environment name.



You can enable services for this cluster in the right panel to replicate data to and from the cluster, set up data tiering to the cloud, back up volumes to the cloud, or run compliance scans on the volumes. You can also create new volumes or launch System Manager to perform advanced tasks.

### Discovering clusters from the Discovery page

You can discover your ONTAP clusters from the Discovery page and add them as a working environment.

## Steps

1. From the **Discovery** page, click the **Cluster Inventory** tab.

| Cluster Inventory (42) |                | Licenses (30) | Firmware Updates (7) | Cloud Ready Workloads (1375) |
|------------------------|----------------|---------------|----------------------|------------------------------|
| Cluster Name           | Cluster Status | OS Version    | IP Address           |                              |
| durlabdu01             | ● Discovered   | 9.8RC1        | 10. [REDACTED]       |                              |
| durbku99               | ● Undiscovered | 9.8           | 10. [REDACTED]       | <b>Discover</b>              |
| blrclu02               | ● Undiscovered | 9.7P7         | 10. [REDACTED]       | <b>Discover</b>              |

2. Click **Discover** for the cluster that you want to manage through Cloud Manager.
3. On the *Choose a Location* page **On-Premises ONTAP** is pre-selected, so just click **Continue**.
4. On the *ONTAP Cluster Details* page, enter the password for the admin user account and click **Add**.

Note that the cluster management IP address is populated based on information from Active IQ.

5. On the *Details & Credentials* page the cluster name is added as the Working Environment Name, so just click **Go**.

## Result

Cloud Manager discovers the cluster and adds it to a working environment in the Canvas using the cluster name as the working environment name.

You can enable services for this cluster in the right panel to replicate data to and from the cluster, set up data tiering to the cloud, back up volumes to the cloud, or run compliance scans on the volumes. You can also create new volumes or launch System Manager to perform advanced tasks.

## Discovering clusters from the Canvas page

You can discover your ONTAP clusters and add them as a working environment from the Canvas page. These steps can be used in cases where the cluster is not listed in the Digital Wallet or Discovery page because it currently has no support contract.

## Steps

1. On the Canvas page, click **Add Working Environment** and select **On-Premises ONTAP**.
2. If you're prompted, create a Connector.

Refer to the links above for more details.

3. On the *ONTAP Cluster Details* page, enter the cluster management IP address, the password for the admin user account, and click **Add**.
4. On the *Details & Credentials* page, enter a name and description for the working environment, and then click **Go**.

## Result

Cloud Manager discovers the cluster and adds it to a working environment in the Canvas.

You can enable services for this cluster in the right panel to replicate data to and from the cluster, set up data tiering to the cloud, back up volumes to the cloud, or run compliance scans on the volumes. You can also create new volumes or launch System Manager to perform advanced tasks.

# Managing storage for on-prem ONTAP clusters

After you discover your on-prem ONTAP cluster from Cloud Manager, you can open the working environment to provision and manage storage.

## Creating volumes

Cloud Manager enables you to create NFS or CIFS volumes on existing aggregates. You can't create new aggregates on an on-prem ONTAP cluster from Cloud Manager.

A Cloud Manager feature called "templates" enables you to create volumes that are optimized for the workload requirements for certain applications; such as databases or streaming services. If your organization has created volume templates that you should use, follow [these steps](#).

### Steps

1. On the Canvas page, double-click the name of the on-prem ONTAP cluster on which you want to provision volumes.
2. Click **Add New Volume**.
3. Follow the steps in the wizard to create the volume.
  - a. **Details & Protection:** Enter basic details about the volume and then select a Snapshot policy.

Some of the fields on this page are self-explanatory. The following list describes fields for which you might need guidance:

| Field           | Description                                                                                                                                                                                                                                                                                                                                                            |
|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Size            | The maximum size that you can enter largely depends on whether you enable thin provisioning, which enables you to create a volume that is bigger than the physical storage currently available to it.                                                                                                                                                                  |
| Snapshot Policy | A Snapshot copy policy specifies the frequency and number of automatically created NetApp Snapshot copies. A NetApp Snapshot copy is a point-in-time file system image that has no performance impact and requires minimal storage. You can choose the default policy or none. You might choose none for transient data: for example, tempdb for Microsoft SQL Server. |

- b. **Protocol:** Choose the protocol for the volume (NFS or CIFS) and then set the access control or permissions for the volume.

If you choose CIFS and a server isn't set up yet, then Cloud Manager prompts you to set up a CIFS server using either Active Directory or a workgroup.

The following list describes fields for which you might need guidance:

| Field                        | Description                                                                                                                                                                                                                                                                                                                               |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Access Control               | An NFS export policy defines the clients in the subnet that can access the volume. By default, Cloud Manager enters a value that provides access to all instances in the subnet.                                                                                                                                                          |
| Permissions and Users/Groups | These fields enable you to control the level of access to an SMB share for users and groups (also called access control lists or ACLs). You can specify local or domain Windows users or groups, or UNIX users or groups. If you specify a domain Windows user name, you must include the user's domain using the format domain\username. |

c. **Usage Profile:** Choose whether to enable or disable storage efficiency features on the volume.

ONTAP includes several storage efficiency features that can reduce the total amount of storage that you need. NetApp storage efficiency features provide the following benefits:

#### Thin provisioning

Presents more logical storage to hosts or users than you actually have in your physical storage pool. Instead of preallocating storage space, storage space is allocated dynamically to each volume as data is written.

#### Deduplication

Improves efficiency by locating identical blocks of data and replacing them with references to a single shared block. This technique reduces storage capacity requirements by eliminating redundant blocks of data that reside in the same volume.

#### Compression

Reduces the physical capacity required to store data by compressing data within a volume on primary, secondary, and archive storage.

d. **Review:** Review details about the volume and then click **Add**.

## Creating volumes from templates

If your organization has created on-premises ONTAP volume templates so you can deploy volumes that are optimized for the workload requirements for certain applications, follow the steps in this section.

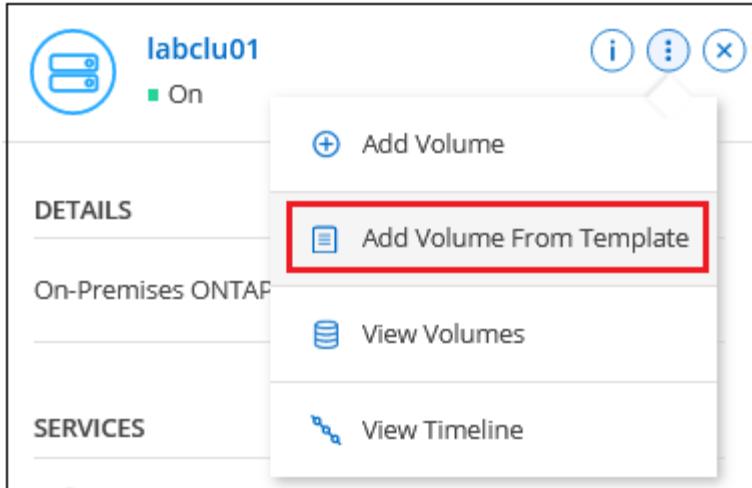
The template should make your job easier because certain volume parameters will already be defined in the template, such as disk type, size, protocol, snapshot policy, and more. When a parameter is already predefined, you can just skip to the next volume parameter.



You can only create NFS or CIFS volumes when using templates.

### Steps

1. On the Canvas page, click the name of the on-premises ONTAP system on which you want to provision a volume.
2. Click > **Add Volume From Template**.



3. In the *Select Template* page, select the template that you want to use to create the volume and click **Next**.

| Template Name       | Template Description            | Created by | Last Modified           | Parameters           |
|---------------------|---------------------------------|------------|-------------------------|----------------------|
| Onprem ONTAP volume | Volumes for application testing | Tacki      | Jun 04 2021, 2:39:51 pm | <a href="#">View</a> |

The *Define Parameters* page is displayed.

**Actions**

Reset Zoom

[Create Volume in On-Premises ONTAP \(#43e\)](#)

**Parameters**

Show read-only parameters

**Context**

Working Environment

labclu01 X ▾

**Storage VM**

Select Storage VM

**Aggregate Name**

Select Aggregate name

**Details** ⓘ

Volume Name

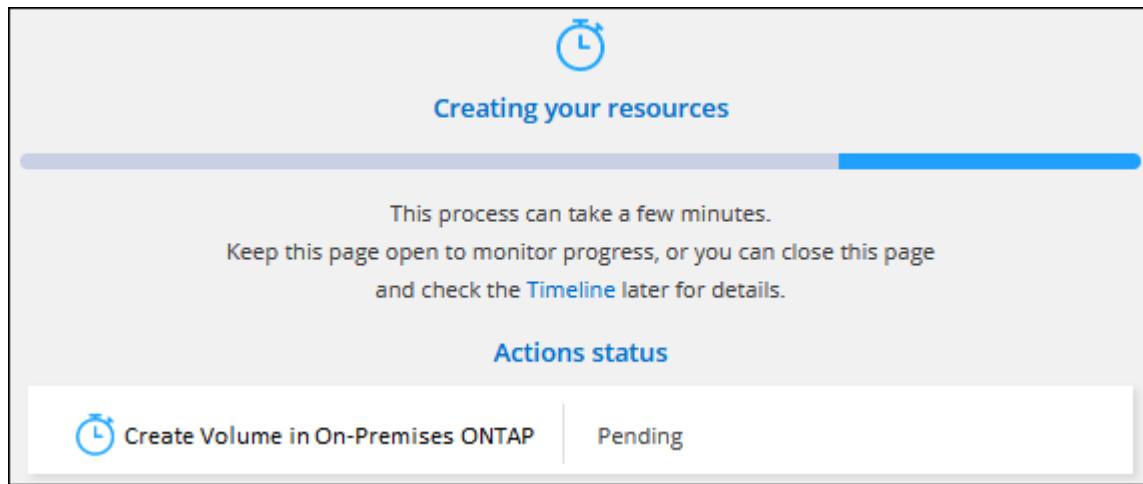
Volume Name should start with "vol\_"

**Note:** You can click the checkbox **Show read-only parameters** to show all the fields that have been locked by the template if you want to see the values for those parameters. By default these predefined fields are hidden and only the fields you need to complete are shown.

4. In the *Context* area, the Working Environment is filled in with the name of the working environment you started with. You need to select the **Storage VM** and **Aggregate** where the volume will be created.
5. Add values for all of the parameters that are not hard-coded from the template. See [creating volumes](#) for details about all the parameters you need to complete to deploy an on-prem ONTAP volume.
6. Click **Run Template** after you have defined all the parameters needed for this volume.

## Result

Cloud Manager provisions the volume and displays a page so that you can see the progress.



Then the new volume is added to the working environment.

Additionally, if any secondary action is implemented in the template, for example, enabling Cloud Backup on the volume, that action is also performed.

## After you finish

If you provisioned a CIFS share, give users or groups permissions to the files and folders and verify that those users can access the share and create a file.

## Replicating data

You can replicate data between Cloud Volumes ONTAP systems and ONTAP clusters by choosing a one-time data replication, which can help you move data to and from the cloud, or a recurring schedule, which can help with disaster recovery or long-term retention.

[Click here for more details.](#)

## Backing up data

You can back up data from your on-premises ONTAP system to low-cost object storage in the cloud by using Cloud Backup. This service provides backup and restore capabilities for protection and long-term archive of your on-prem and cloud data.

[Click here for more details.](#)

## Scan, map, and classify your data

Cloud Data Sense can scan your corporate on-premises clusters to map and classify data, and to identify

private information. This can help reduce your security and compliance risk, decrease storage costs, and assist with your data migration projects.

[Click here for more details.](#)

## Tiering data to the cloud

Extend your data center to the cloud by automatically tiering inactive data from ONTAP clusters to object storage using Cloud Tiering.

[Click here for more details.](#)

# Optimize your clusters using Active IQ Digital Advisor

[Active IQ Digital Advisor](#) is integrated into the Cloud Manager UI so that you can optimize the operations, security, and performance of your ONTAP clusters in a single pane of glass.

## Features

You can view the overall status of your storage system, high-level information about the wellness of the system, inventory, planning, upgrades, and valuable insights at a watchlist level using Active IQ Digital Advisor.

- Analyze and optimize the health of your storage systems
- Gain insights regarding all the risks to your storage systems and the actions to mitigate the risks
- Analyze the performance of your storage devices by viewing the graphical format of performance data
- Get details about systems that have exceeded 90% capacity or are nearing 90% capacity
- Get information about the hardware and software that have expired or are near-expiration within the next 6 months
- Upgrade your storage system software, and update your ONTAP firmware using Ansible

## Supported ONTAP systems

Active IQ Digital Advisor provides information for all the on-premises ONTAP systems and Cloud Volumes ONTAP systems within your NSS account.

## Cost

There's no cost to use this service through Cloud Manager.

## How Active IQ Digital Advisor works with Cloud Manager

The Active IQ Digital Advisor user interface is completely integrated in Cloud Manager.

In Cloud Manager, click the **Active IQ** service.

- If you have already registered an existing NSS account in Cloud Manager, the Active IQ Digital Advisor UI appears just like you would see it in a standalone implementation at <https://activeiq.netapp.com/>.

The screenshot shows the Active IQ Digital Advisor interface. The top navigation bar includes tabs for Canvas, Replication, Backup & Restore, Discovery, Active IQ, and All Services (+7). The Active IQ tab is selected. On the left, a sidebar under the Digital Advisor section lists various advisor categories like AutoSupport, Performance, Cluster Viewer, etc. The main content area is titled "Default\_watchlist". It features several cards: "Wellness" (Performance & Efficiency: 2 Actions, Availability & Protection: 1 Action, Capacity: 1 Action, Configuration: 1 Action, Security Vulnerabilities: 1 Action, Ransomware Defense: 1 Action); "Inventory" (Overview: ONTAP, 9 Systems, 5 Clusters, 4 Sites); "Planning" (2 Capacity Additions, 373.4 TiB Inactive/Cold Data); and "Upgrades" (ONTAP: 1 Action, N/A). A "View All Actions" button is located at the top right of the dashboard.

- If you haven't registered an NSS account in Cloud Manager, [register an NSS account now](#) and then the Active IQ Digital Advisor UI appears.



As of December 3, 2021, NetApp has switched to a new methodology of registering credentials for NSS accounts. [See this FAQ for details](#). If your NSS account uses the old set of credentials you will need to update the account to the new credentials.

## What's next

See the [Active IQ Digital Advisor documentation](#) for details.

## Using Active IQ data to manage ONTAP clusters

The Discovery page in Cloud Manager shows you any undiscovered ONTAP clusters in your on-premises environments, whether any clusters require updated disk or shelf firmware, and if you are using all the Cloud Volumes ONTAP licenses that you were granted when you purchased the on-prem systems. This information is provided to Cloud Manager from [Active IQ Digital Advisor](#).

### Viewing unused Cloud Volumes ONTAP node-based licenses

Many on-premises ONTAP storage system packages that you purchased included a free Cloud Volumes ONTAP node-based license so you can try the NetApp cloud storage offerings in Cloud Manager. You can use the license to create a new Cloud Volumes ONTAP instance, or you can apply the license to an existing Cloud Volumes ONTAP instance to expand the capacity by 368 TiB.

You can see whether you have any unused Cloud Volumes ONTAP licenses based on your NetApp Support Site credentials.



The term for a node-based license starts on the first day of the next month after the license was issued. For example, if you obtain a node-based BYOL license on Dec 15, 2021, the license term starts on Jan 1, 2022 (the first day of the next month).

## Steps

1. In Cloud Manager, click the **Discovery** tab.
2. Click the **Licenses** tab in the lower portion of the page.

| Cluster Inventory (42) |              | Licenses (30) |            | Firmware Updates (7) |             | Cloud Ready Workloads (1375) |                   |
|------------------------|--------------|---------------|------------|----------------------|-------------|------------------------------|-------------------|
| Serial Number          | License Type | Hyperscaler   | Model Type | Expires              | AutoSupport |                              |                   |
| 903201300000000001514  | BYOL         | AWS           | Single     | December 31, 2022    | No          | <a href="#">Use License</a>  | <a href="#">▼</a> |
| 908201300000000001141  | BYOL         | AWS           | Single     | N/A                  | Yes         |                              |                   |
| 908201300000000001142  | BYOL         | AWS           | Single     | December 31, 2022    | Yes         | <a href="#">Use License</a>  | <a href="#">▼</a> |
| 908201300000000001143  | BYOL         | AWS           | HA         | December 31, 2022    | Yes         | <a href="#">Use License</a>  | <a href="#">▼</a> |

A **Use License** button appears for each unused license.

3. If you want to activate and start using the license, click **Use License**.



See the tasks below to learn about the options for using the available licenses.

## Using unused Cloud Volumes ONTAP licenses

You can use unused licenses to create a new Cloud Volumes ONTAP instance or to extend the capacity of the license on an existing Cloud Volumes ONTAP instance. The capacity of the license is 368 TiB.

The *Expires* column indicates the last day the license is active. When creating a new Cloud Volumes ONTAP system this is the date the license expires. When updating an existing Cloud Volumes ONTAP system this indicates the length of time the existing license is extended.

The *License Type*, *Hyperscaler*, and *Model Type* columns describe the type of Cloud Volumes ONTAP license it is. For example, **BYOL | Single | Azure** means the license is a "bring-your-own" license for a "single node" Cloud Volumes ONTAP system deployed in "Microsoft Azure". The values that can appear in this column are shown in the table.

| Column       | Values                               |
|--------------|--------------------------------------|
| License Type | PAYGO<br>BYOL                        |
| Hyperscaler  | Azure<br>AWS<br>GCP<br>All Providers |

| Column     | Values       |
|------------|--------------|
| Model Type | Single<br>HA |

When creating a *new* Cloud Volumes ONTAP system, this is the type of system you are deploying. For example, using the sample license (**BYOL | Single | Azure**), you can create a single-node Cloud Volumes ONTAP system in Azure with entitlement for up to 368 TiB. This license can't be used to create an HA system or to deploy an instance in AWS.

When updating an *existing* Cloud Volumes ONTAP system, this indicates the type of system that can have the capacity for its existing license extended. Using the sample license again, you can extend the license for any single-node Cloud Volumes ONTAP system in Azure. This license can't be used to extend the license for an HA system or for an instance deployed in AWS.

### Creating a new Cloud Volumes ONTAP system with the unused license

Follow these steps to create a new Cloud Volumes ONTAP instance with the unused license.

#### Steps

1. Click **Use License** and select **Use License for a new Cloud Volumes ONTAP**.
2. In the "Use License..." page, verify the license information and click **Use License**.

In most cases you will be directed to the **Details & Credentials** page for creating the working environment for the Cloud Volumes ONTAP system because both the cloud provider and number of nodes are defined by the license.

If you are using a license defined as "All Providers", then you are directed to the **Choose a Location** page so you can pick the cloud provider first, before completing the **Details & Credentials** page.

3. Follow the steps to create the working environment and your first volume.

See the following sections depending on the cloud provider on which you are deploying the Cloud Volumes ONTAP system.

- [Launching Cloud Volumes ONTAP in Azure](#)
- [Launching Cloud Volumes ONTAP in AWS](#)
- [Launching Cloud Volumes ONTAP in GCP](#)

### Extending the license capacity for an existing Cloud Volumes ONTAP system

If you have a currently deployed Cloud Volumes ONTAP system that matches the license requirements of one of the free licenses (meaning the same cloud provider, number of nodes, etc.), you can follow these steps to extend the capacity of the license by 368 TiB.

#### Steps

1. Click **Use License** and select **Add License to existing Cloud Volumes ONTAP**.

Add License to Existing Cloud Volumes ONTAP

| License Information                                                                                    |                      |                                      |                               |
|--------------------------------------------------------------------------------------------------------|----------------------|--------------------------------------|-------------------------------|
| 90419737477578510576<br>Serial Number                                                                  | BYOL<br>License Type | AWS<br>Provider                      | Single<br>Cloud Volumes ONTAP |
| Select Cloud Volumes ONTAP                                                                             |                      |                                      |                               |
| <input type="text" value="Cloud_Volumes_ONTAP_001   AWS   Single"/>                                    |                      |                                      |                               |
| <small>Note: Only Cloud Volumes ONTAP systems that match the license parameters are displayed.</small> |                      |                                      |                               |
| <input type="button" value="Add License"/>                                                             |                      | <input type="button" value="Close"/> |                               |

- In the "Add License..." page, select the Cloud Volumes ONTAP system where you want to extend the license and click **Add License**.

A confirmation dialog is displayed.

Add License to Existing Cloud Volumes ONTAP



**License added Successfully**

License: 90419737477578510576 (BYOL | AWS | Single)  
added successfully to Cloud Volumes ONTAP "Cloud\_Volumes\_ONTAP\_Name"

[Go to "Cloud\\_Volumes\\_ONTAP\\_Name" License Page ➔](#)

- You can click **Close** to close the window and return to the Discovery page, or you can click the link to go to the Cloud Volumes ONTAP Licensing page to view more details about licensing for that system.

## Downloading new disk and shelf firmware

You can see whether any of your discovered ONTAP clusters need to have their shelf or disk firmware updated. And you can download the Ansible playbook to upgrade the firmware.

**Note:** The ability to view and download new firmware is available only when you have subscribed to certain support plans.

### Steps

- From the Discovery page, click the **Firmware Updates** tab.

| Cluster Inventory (42) | Licenses (30)  | Firmware Updates (7) | Cloud Ready Workloads (1375) | <a href="#">Download All</a> |
|------------------------|----------------|----------------------|------------------------------|------------------------------|
| Cluster Name           | Cluster Status | Disk Firmware        | Shelf Firmware               |                              |
| durbkpclu99            | ● Undiscovered | ✗ Update Available   | No Updates Available         |                              |
| durdevnasclu01         | ● Undiscovered | ✗ Update Available   | No Updates Available         |                              |
| durlabdevclu01         | ● Discovered   | No Updates Available | No Updates Available         |                              |
| blrprdclu02            | ● Undiscovered | No Updates Available | No Updates Available         |                              |

If any cluster require new firmware, a **Download All** button appears.

- Click **Download All** and save the zip file.
- Unzip the zip file and see the following instructions to [update your storage system firmware](#).

## Result

Your firmware is updated. The next time your ONTAP system sends an AutoSupport message to Active IQ, the status in the *Firmware Updates* page will be updated to show that updates are no longer needed.

## Viewing on-prem workloads that are candidates for the cloud

Certain workloads or volumes are ideal to move to a Cloud Volumes ONTAP system from your on-prem ONTAP clusters. Some of the advantages include reduced costs and improved performance and resiliency. The *Cloud Ready Workloads* tab provides a list of these workloads from your discovered ONTAP clusters.

| Cluster Inventory (42) | Licenses (30)  | Firmware Updates (7) | Cloud Ready Workloads (1375) |               |
|------------------------|----------------|----------------------|------------------------------|---------------|
| Cluster Name           | Cluster Status | SVM Name             | Volume Name                  | Workload Type |
| hioprclu02             | ● Undiscovered | vsvhiopax01prd       | volpaxprd_hanabackup01       | SAP HANA      |
| hioprclu02             | ● Undiscovered | svmhiocdb02prd       | volcdbprd_sqluserdata01      | MSSQL         |
| durdevclu02            | ● Discovered   | vsvdurmox01spd       | volpaxdev_hana_data          | SAP HANA      |
| durdevclu02            | ● Discovered   | vsvdurmox01spd       | volpaxstg_hana_backup        | SAP HANA      |
| durdevclu02            | ● Discovered   | vsvdurmox01spd       | xdperpspd_oradata02          | ORACLE        |

The supported workloads that are called out on this page include: SAP, SAP HANA, Oracle, File share, and SharePoint.

*Lift and shift* is an approach for migrating your apps to the cloud. It means moving an application and its associated data to a cloud platform without redesigning the app. See more information about [lift and shift](#).

# Connecting to on-premises ONTAP systems

If you need to perform advanced management of on-premises ONTAP systems, you can do so using ONTAP System Manager or the command line interface.

## Connect to System Manager

You might need to perform some on-premises ONTAP tasks from System Manager, which is a browser-based management tool that runs on the cluster.

### Before you begin

The computer from which you are accessing Cloud Manager must have a network connection to the on-prem ONTAP system. For example, you might need to log in to Cloud Manager from a jump host that's in your on-premises network.

### Steps

1. From the Canvas page, double-click the on-prem ONTAP system that you want to manage with System Manager.
2. Click the menu icon, and then click **System Manager**.
3. Click **Launch**.

System Manager loads in a new browser tab.

4. At the login screen, enter the user name and password for the admin user that you specified when you created the cluster, and then click **Sign In**.

### Result

The System Manager console loads. You can now use it to manage the on-prem ONTAP system.

## Connect to the ONTAP CLI

The ONTAP CLI enables you to run all administrative commands and is a good choice for advanced tasks or if you're more comfortable using the CLI. You can connect to the CLI using Secure Shell (SSH).

### Before you begin

The host from which you use SSH to connect to the on-prem ONTAP system must have a network connection to the on-prem ONTAP system. For example, you might need to use SSH from a jump host in your on-premises network.

### Steps

1. In Cloud Manager, identify the IP address of the cluster management interface:
  - a. On the Canvas page, select the on-premises ONTAP system.
  - b. Click  in the right pane and copy the cluster management IP address.
2. Use SSH to connect to the cluster management interface IP address using the admin account.

### Example

The following image shows an example using PuTTY:

Specify the destination you want to connect to

|                                  |      |
|----------------------------------|------|
| Host <u>Name</u> (or IP address) | Port |
| admin@192.168.111.5              | 22   |

Connection type:

Raw    Telnet    Rlogin    SSH    Serial

- At the login prompt, enter the password for the admin account.

#### Example

```
Password: *****
```

```
ONTAP2:>
```

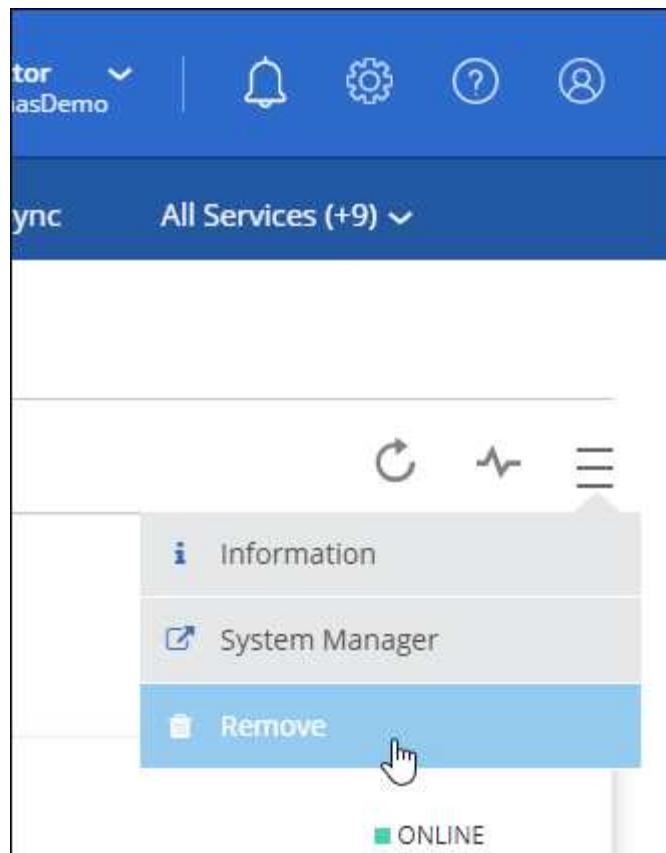
## Remove an on-prem ONTAP working environment

Remove an on-premises ONTAP working environment if you no longer want to manage it from Cloud Manager.

Removing the working environment doesn't affect the ONTAP cluster. You can rediscover it from Cloud Manager at any time.

#### Steps

- On the Canvas page, double-click the name of the on-premises ONTAP working environment.
- Click the menu icon and select **Remove**.



3. Click **Remove** to confirm.

# Manage data for Kubernetes clusters

## Kubernetes overview

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

### Features

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

The screenshot shows the Cloud Manager interface with the 'Kubernetes' tab selected. At the top, there's a dropdown menu showing '1 Selected Kubernetes Clusters'. To the right is a 'Backup Settings' button. Below this, there are three summary metrics: '1 Kubernetes Clusters', '5 Protected PVs', and '97.66 KB Total Backups Size'. To the right of these metrics is a 'Protected Persistent Volumes Status' section showing '5 Healthy Backup' and '0 Failed Backup'. Below these sections is a table titled '5 Backup jobs' with the following data:

| Source K8s Cluster | Source Persistent Volume                             | Source Namespace | Last Backup          | Backup Copies | Backup Status | Actions |
|--------------------|------------------------------------------------------|------------------|----------------------|---------------|---------------|---------|
| eks1<br>■ On       | pvc-1704aa1f-af1d-49e9-87fd-6edd86125855<br>■ Online | default          | Nov 25 2021, 14:56:3 | 2             | Enabled       | ...     |
| eks1<br>■ On       | pvc-d1f839c1-d932-4f49-b620-33321dbe939e<br>■ Online | trident          | Nov 25 2021, 14:56:3 | 2             | Enabled       | ...     |
| eks1<br>■ On       | pvc-f615f0a8-2d5d-44d0-b4e4-f365cc3fb4a6<br>■ Online | default          | Nov 25 2021, 14:56:3 | 2             | Enabled       | ...     |
| eks1<br>■ On       | pvc-1615f0a8-2d5d-44d0-b4e4-f365cc3fb4a6<br>■ Online | default          | Nov 25 2021, 14:56:3 | 2             | Enabled       | ...     |
| eks1<br>■ On       | pvc-05881c70-t5f-4edc-8537-a0a5ce36f9a1<br>■ Online  | default          | Nov 25 2021, 14:56:3 | 2             | Enabled       | ...     |

### Supported Kubernetes deployments

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

### Supported backend storage

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

### Cost

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

# Get started with Kubernetes clusters in AWS

## Requirements for Kubernetes clusters in AWS

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

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

### Requirements

#### Astra Trident

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

#### Cloud Volumes ONTAP

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

#### Cloud Manager Connector

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

#### Network connectivity

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

#### RBAC authorization

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

### Prepare a Connector

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

#### Create a new Connector

Follow the steps in one of the links below.

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

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

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

### Steps

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

aws Services Search for services, features, blogs, docs, and more [Alt+S]

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Instances

Instances New  
Instance Types  
Launch Templates  
Spot Requests  
Savings Plans  
Reserved Instances New  
Dedicated Hosts  
Scheduled Instances  
Capacity Reservations

Instances (1/40) Info

| Name                    | Instan... | Instance state |
|-------------------------|-----------|----------------|
| occmAnatoly             | i-0984... | Running        |
| Cloud-Manager-Connector | i-03ad... | Running        |
| tomerCM2311S2prod       | i-07cd... | Running        |
| tomerCvo                | i-0a05... | Running        |

Instance: i-03adf85b99abdfbfa (Cloud-Manager-Connector)

| Details                                                                   | Security | Networking | Storage | Status checks |
|---------------------------------------------------------------------------|----------|------------|---------|---------------|
| ▼ Security details                                                        |          |            |         |               |
| IAM Role                                                                  |          |            |         |               |
| <input type="checkbox"/> <a href="#">Cloud-Manager-Operator-P5mGGXw</a> ↗ |          |            |         |               |
| Security groups                                                           |          |            |         |               |

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

Permissions

Trust relationships

Tags

Access Advisor

▼ Permissions policies (1 policy applied)

**Attach policies**

Policy name ▾

▼ Cloud-Manager-ConnectorCloudManagerPolicy

Policy summary

{ } JSON

Edit policy

1 {  
2 "Statement": [  
3 {  
4 "Action": [  
5 "iam>ListInstanceProfiles"

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

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

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

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

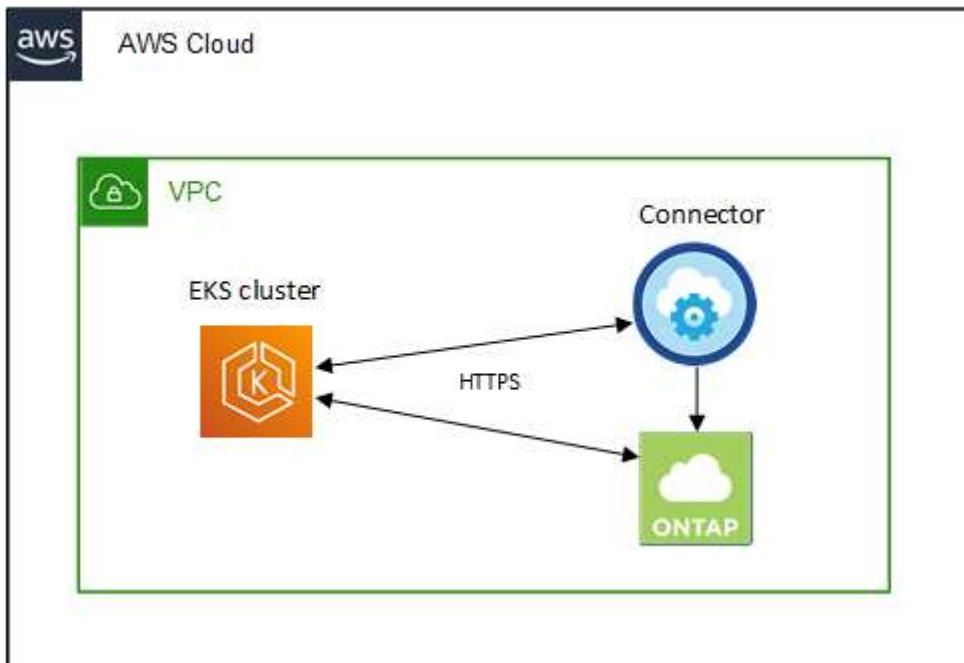
### Review networking requirements

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

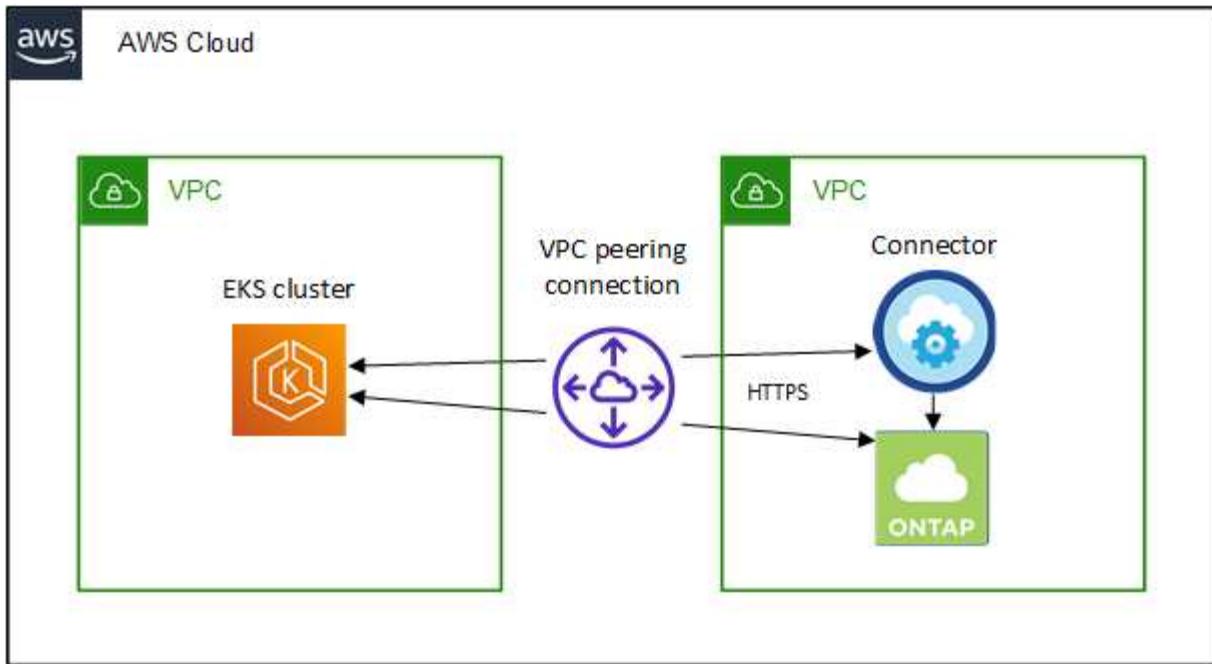
- Each Kubernetes cluster must have an inbound connection from the Connector
- The Connector must have an outbound connection to each Kubernetes cluster over port 443

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

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



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



## Set up RBAC authorization

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

### Steps

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

```

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

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

```

- b. Apply the configuration to a cluster.

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

2. Create an identity mapping to the permissions group.

#### Use eksctl

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

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

An example is provided below.

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

#### Edit aws-auth

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

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

An example is provided below.

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

## Add an Amazon Kubernetes cluster to Cloud Manager

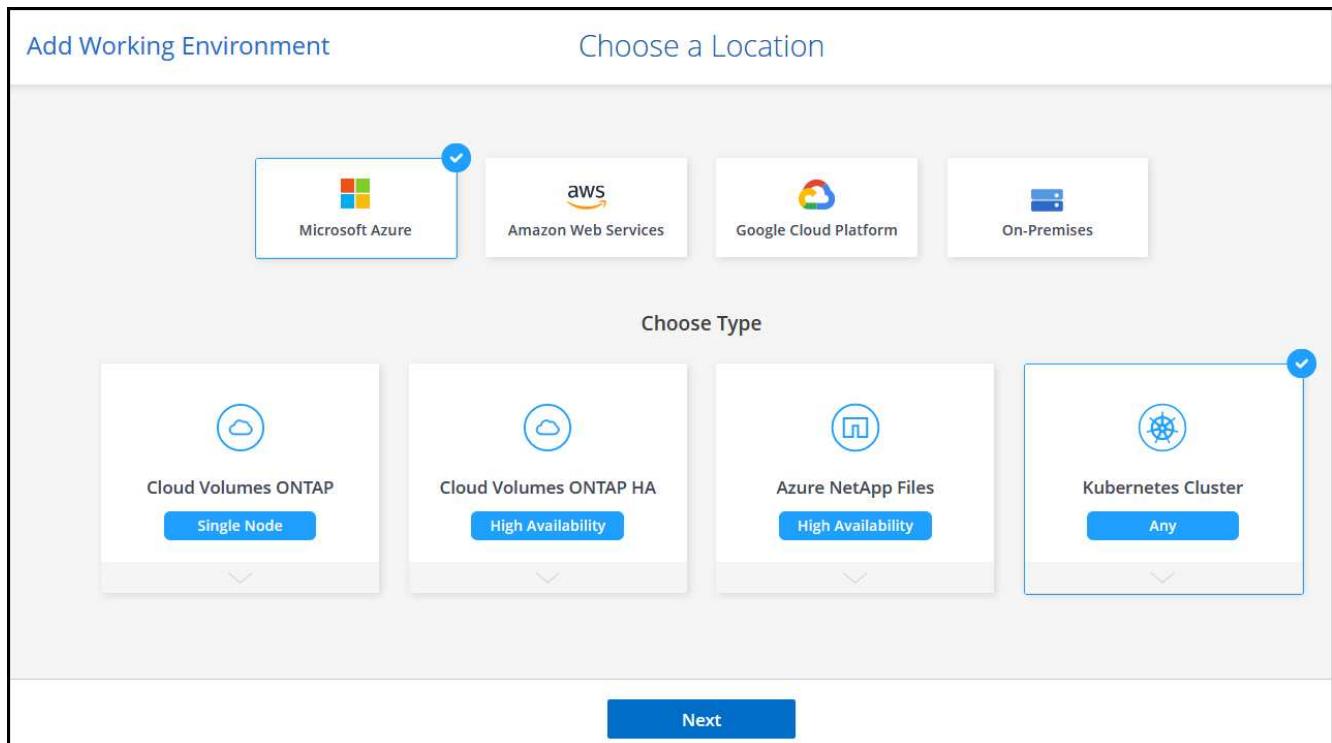
You can discover or import Kubernetes clusters to Cloud Manager so you can back up persistent volumes to Amazon S3.

### Discover a cluster

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

### Steps

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



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

Add Existing Kubernetes Cluster      Discover a Kubernetes Cluster      X

Instance Profile      Account Details      642991768967      Account ID      Switch Account

Choose an AWS region and then select a Kubernetes cluster.

AWS Region      US West (N. California)

1 Cluster     

| Kubernetes Cluster Name | Status | Kubernetes Version | VPC          |
|-------------------------|--------|--------------------|--------------|
| eksTest                 | active | 1.21               | vpc-5825393a |

Previous      Next

## Result

Cloud Manager adds the Kubernetes cluster to the Canvas.

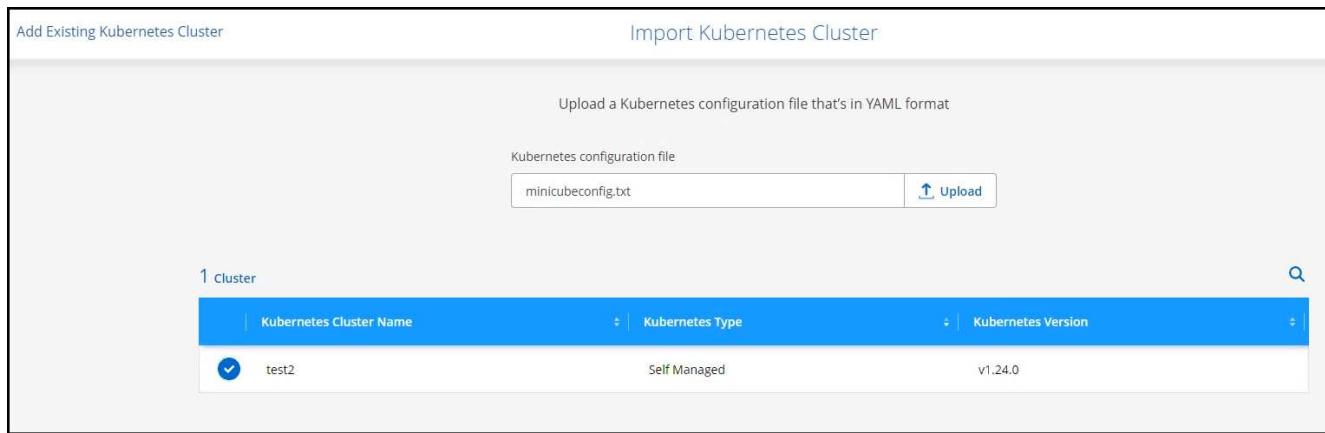


## Import a Cluster

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

### Steps

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



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

## Result

Cloud Manager adds the Kubernetes cluster to the Canvas.

# Get started with Kubernetes clusters in Azure

## Requirements for Kubernetes clusters in Azure

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

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

## Requirements

### Astra Trident

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

### Cloud Volumes ONTAP

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

### Cloud Manager Connector

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

### Network connectivity

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

### RBAC authorization

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

## Prepare a Connector

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

### Create a new Connector

Follow the steps in one of the links below.

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

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

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

### Steps

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

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

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

### Review networking requirements

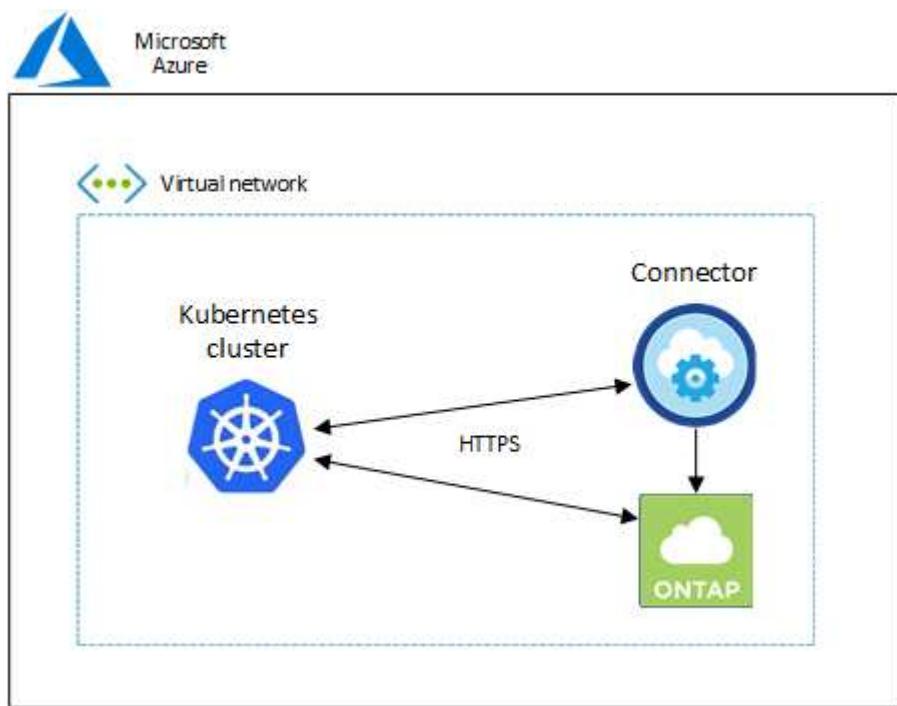
You need to provide network connectivity between the Kubernetes cluster and the Connector and between the Kubernetes cluster and the Cloud Volumes ONTAP system that provides backend storage to the cluster.

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

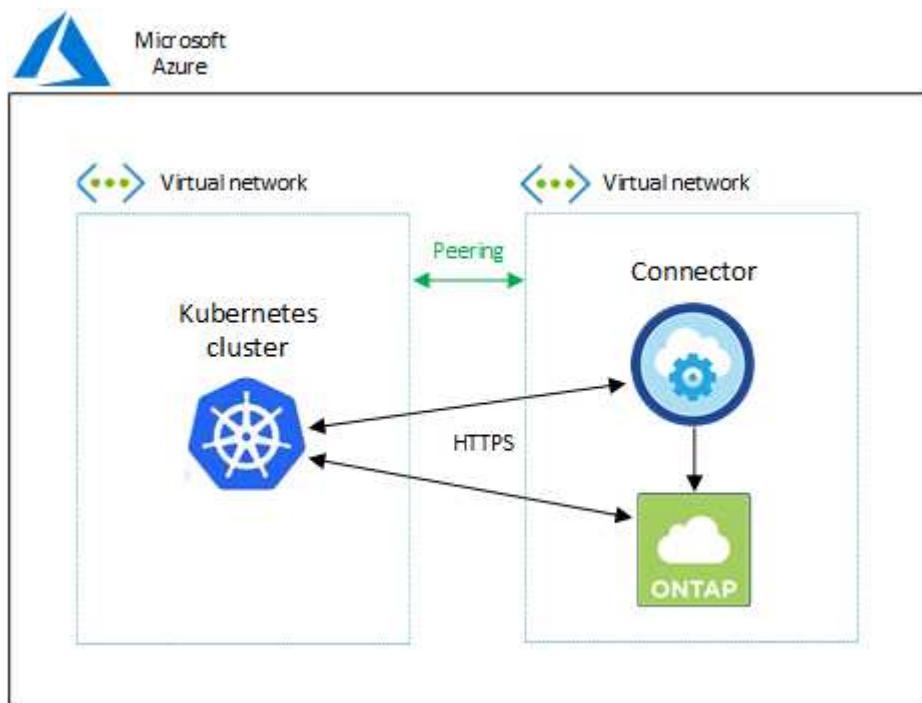
The simplest way to provide this connectivity is to deploy the Connector and Cloud Volumes ONTAP in the same VNet as the Kubernetes cluster. Otherwise, you need to set up a peering connection between the

different VNets.

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



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



### Set up RBAC authorization

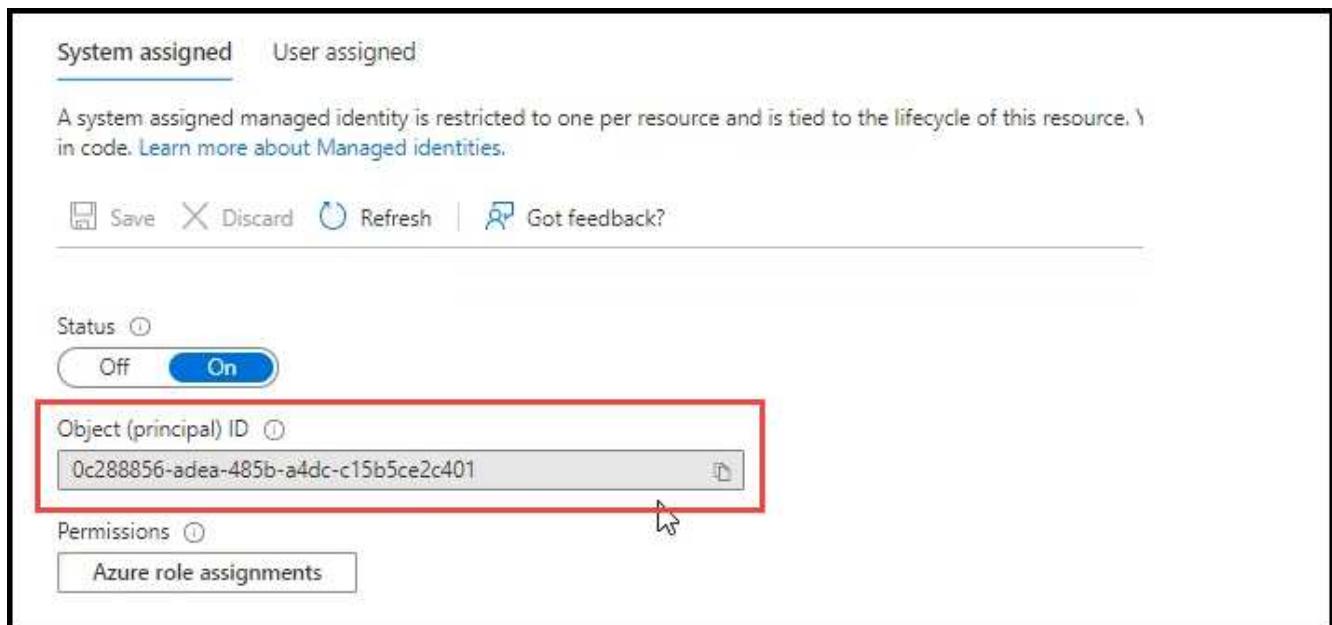
RBAC validation occurs only on Kubernetes clusters with Active Directory (AD) enabled. Kubernetes clusters without AD will pass validation automatically.

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

## Before you begin

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

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



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

## Steps

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

```

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

apiVersion: rbac.authorization.k8s.io/v1
kind: ClusterRoleBinding
metadata:
 name: k8s-access-binding
subjects:
 - kind: User
 name: Object (principal) ID (for AKS) or username (for self-managed)
 apiGroup: rbac.authorization.k8s.io
roleRef:
 kind: ClusterRole
 name: cloudmanager-access-clusterrole
 apiGroup: rbac.authorization.k8s.io

```

- b. Apply the configuration to a cluster.

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

## Add an Azure Kubernetes cluster to Cloud Manager

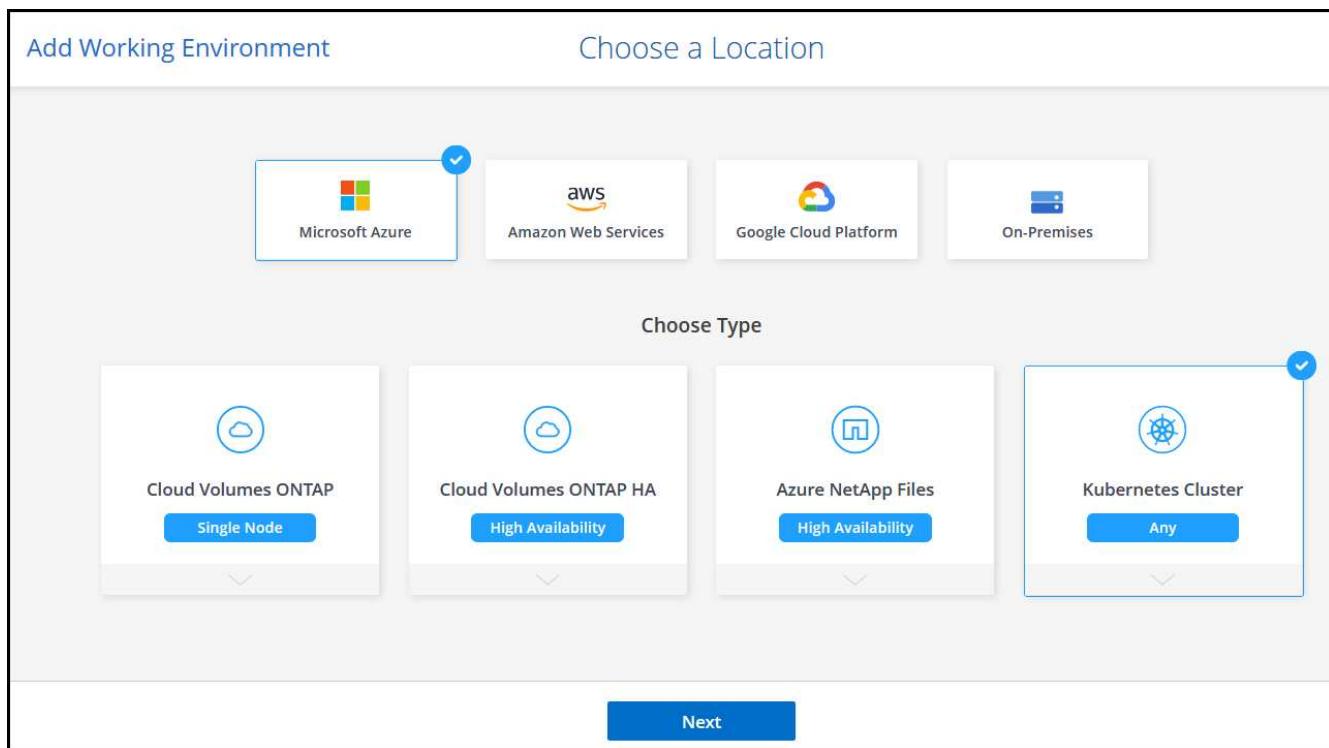
You can discover or import Kubernetes clusters to Cloud Manager so that you can back up persistent volumes to Azure.

### Discover a cluster

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

### Steps

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

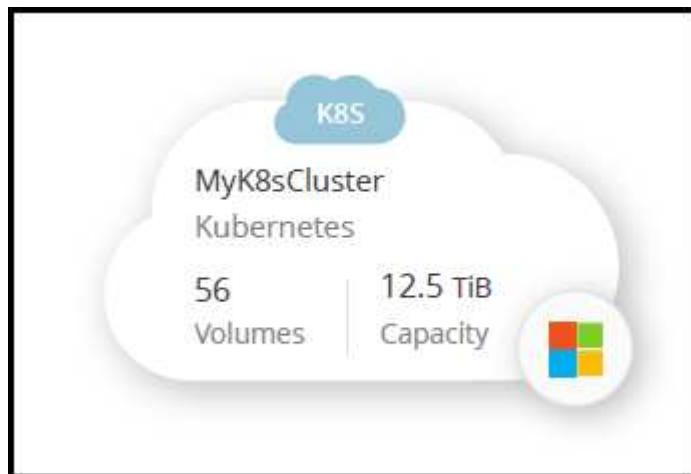


3. Select **Discover Cluster** and click **Next**.
4. Select a Kubernetes cluster and click **Next**.

| Kubernetes Cluster Name | Status | Kubernetes Version | Resource Group | Location  |
|-------------------------|--------|--------------------|----------------|-----------|
| Cluster_1               | Active | 10.2.23.36         | Cell text      | Cell text |
| Cluster_2               | Active | 10.2.23.36         | Cell text      | Cell text |
| Cluster_3               | Active | 10.2.23.36         | Cell text      | Cell text |

## Result

Cloud Manager adds the Kubernetes cluster to the Canvas.



## Import a Cluster

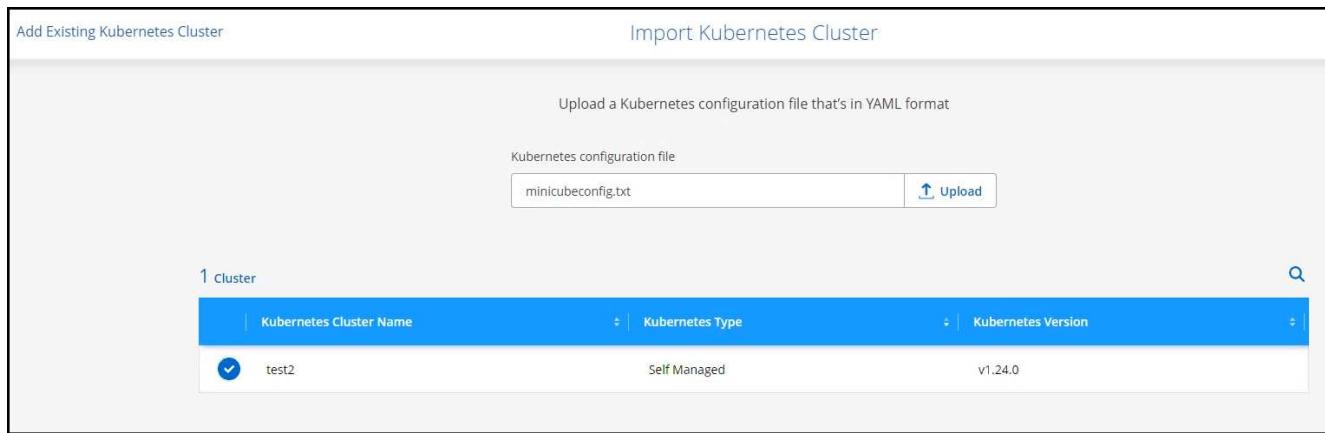
You can import a self-managed Kubernetes cluster using a Kubernetes configuration file.

### Before you get started

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

### Steps

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



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

## Result

Cloud Manager adds the Kubernetes cluster to the Canvas.

# Get started with Kubernetes clusters in Google Cloud

## Requirements for Kubernetes clusters in Google Cloud

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

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

### Requirements

#### Astra Trident

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

#### Cloud Volumes ONTAP

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

#### Cloud Manager Connector

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

#### Network connectivity

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

#### RBAC authorization

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

## Prepare a Connector

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

### Create a new Connector

Follow the steps in one of the links below.

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

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

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

### Steps

1. In [Cloud Console](#), go to the **Roles** page.
2. Using the drop-down list at the top of the page, select the project or organization that contains the role that you want to edit.
3. Click a custom role.
4. Click **Edit Role** to update the role's permissions.
5. Click **Add Permissions** to add the following new permissions to the role.

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

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

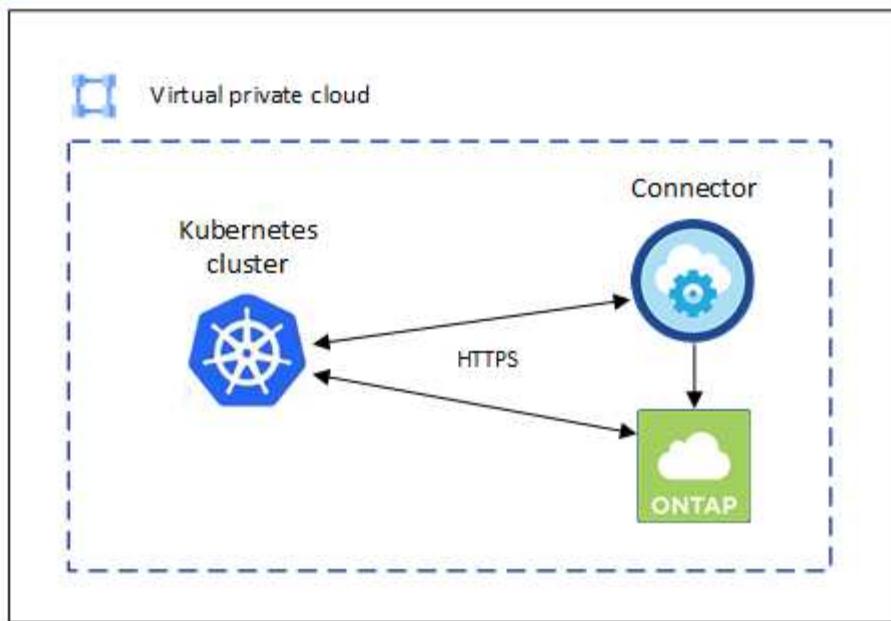
### Review networking requirements

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

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

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

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



## Set up RBAC authorization

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

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

### Before you begin

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

You can find the unique ID one of two ways:

- Using the command:

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

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

The screenshot shows the 'Cloud Manager Service Account' details page. At the top, there's a blue header bar with the CloudSync-Dev logo and a back arrow. Below the header, the title 'Cloud Manager Service Account' is displayed. A navigation bar with tabs for 'DETAILS', 'PERMISSIONS', 'KEYS', 'METRICS', and 'LOGS' is visible. The 'DETAILS' tab is selected. The main content area is titled 'Service account details'. It contains fields for 'Name' (set to 'Cloud Manager Service Account') and 'Description', both with 'SAVE' buttons. Below these, the 'Email' field shows 'cloudmanager-service-account@cloudsync-dev-214020.iam.gserviceaccount.com'. The 'Unique ID' field shows '102217358851946603445', which is highlighted with a yellow background.

## Steps

1. Create a cluster role and role binding.
  - a. Create a YAML file that includes the following text. Replace the `subjects: kind: variable` with your username and `subjects: user:` with the unique ID for the authorized service account.

```

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

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

```

- b. Apply the configuration to a cluster.

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

## Add a Google Cloud Kubernetes cluster to Cloud Manager

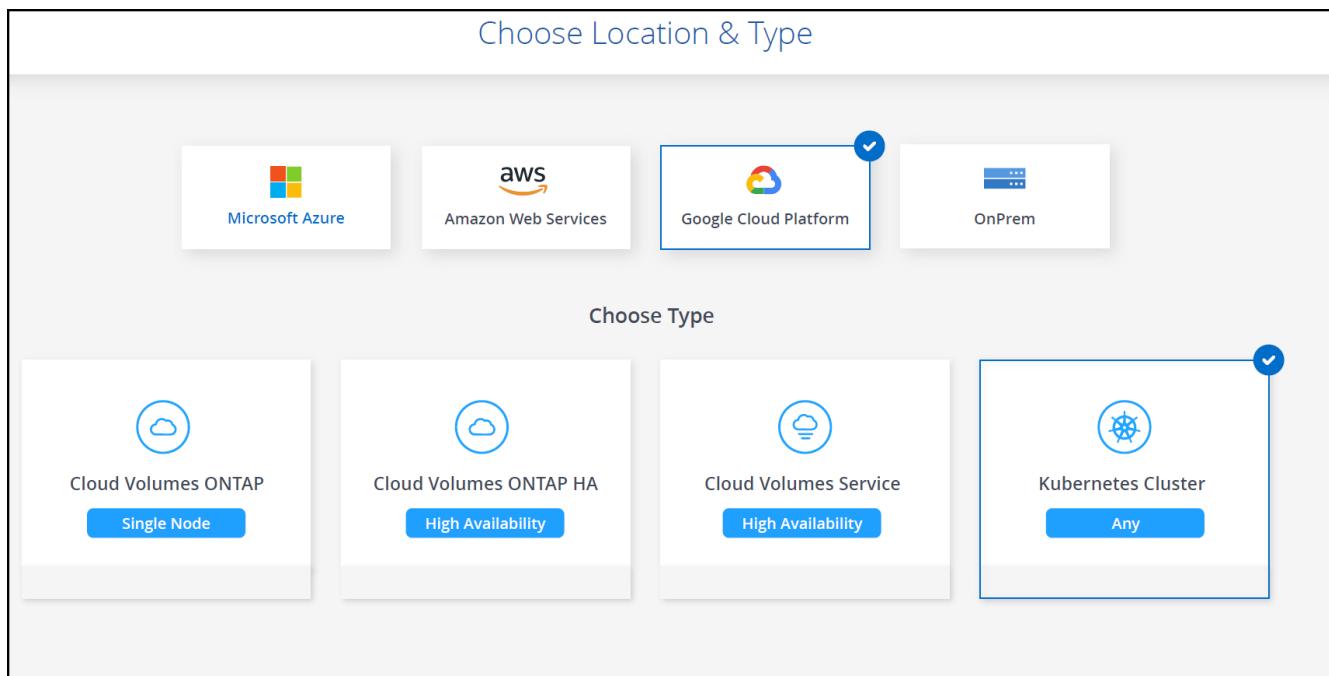
You can discover or import Kubernetes clusters to Cloud Manager so that you can back up persistent volumes to Google Cloud.

### Discover a cluster

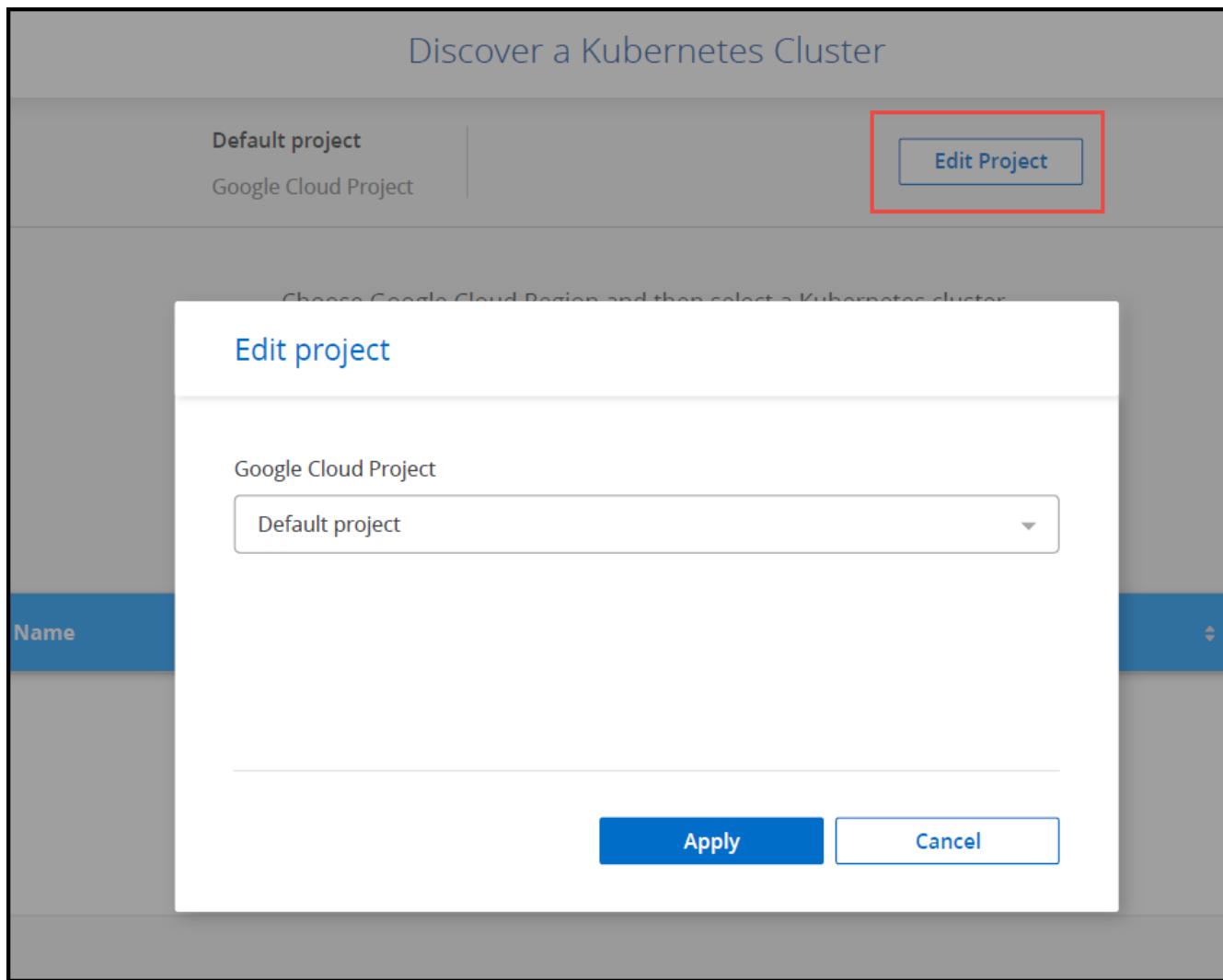
You can discover a fully-managed or self-managed Kubernetes cluster. Managed clusters must be discovered; they cannot be imported.

### Steps

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



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

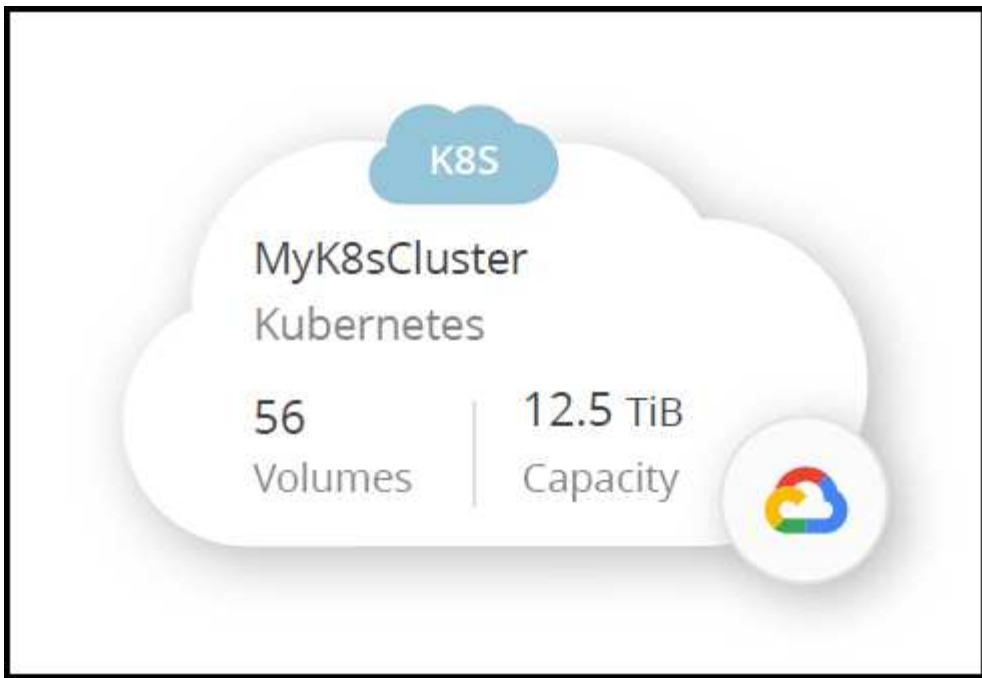


5. Select a Kubernetes cluster and click **Next**.

| Discover a Kubernetes Cluster |                      |                    |         |               |  |  |  |  |  |
|-------------------------------|----------------------|--------------------|---------|---------------|--|--|--|--|--|
| CloudSync-Dev                 | Google Cloud Project | Edit Project       |         |               |  |  |  |  |  |
| Select a Kubernetes cluster.  |                      |                    |         |               |  |  |  |  |  |
| 3 clusters                    |                      |                    |         |               |  |  |  |  |  |
| Kubernetes Cluster Name       | Status               | Kubernetes Version | VPC     | Location      |  |  |  |  |  |
| cluster-1                     | Running              | 1.21.6-gke.1500    | default | us-central1-c |  |  |  |  |  |
| test-cluster-1                | Running              | 1.20.10-gke.1600   | default | us-central1   |  |  |  |  |  |
| kerengke1702                  | Running              | 1.21.6-gke.1500    | default | europe-west3  |  |  |  |  |  |

## Result

Cloud Manager adds the Kubernetes cluster to the Canvas.



## Import a Cluster

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

### Before you get started

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

### Steps

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

| Kubernetes Cluster Name | Kubernetes Type | Kubernetes Version |
|-------------------------|-----------------|--------------------|
| Cluster_1               | ???             | 10.2.23.36         |
| Cluster_2               | ???             | 10.2.23.36         |
| Cluster_3               | ???             | 10.2.23.36         |

## Result

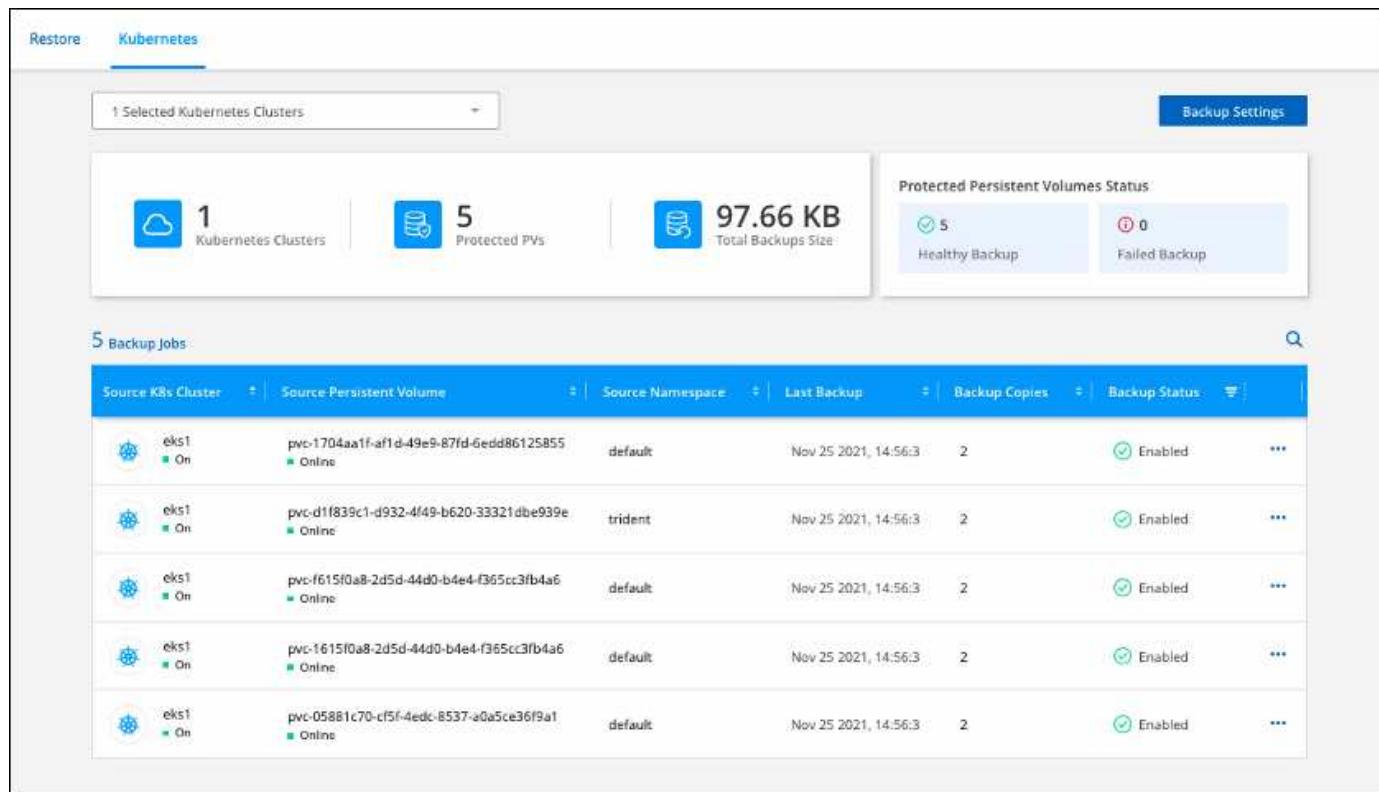
Cloud Manager adds the Kubernetes cluster to the Canvas.

# Use NetApp's cloud data services with Kubernetes clusters

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

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

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



The screenshot shows the Cloud Manager interface with the 'Kubernetes' tab selected. At the top, it displays '1 Selected Kubernetes Clusters'. Below this, there are summary statistics: '1 Kubernetes Clusters', '5 Protected PVs', and '97.66 KB Total Backups Size'. To the right, a 'Protected Persistent Volumes Status' section shows '5 Healthy Backup' and '0 Failed Backup'. The main area is titled '5 Backup Jobs' and contains a table with the following data:

| Source K8s Cluster | Source Persistent Volume                           | Source Namespace | Last Backup          | Backup Copies | Backup Status | Actions |
|--------------------|----------------------------------------------------|------------------|----------------------|---------------|---------------|---------|
| eks1<br>On         | pvc-1704aa1f-a1d-49e9-87fd-6edd86125855<br>Online  | default          | Nov 25 2021, 14:56:3 | 2             | Enabled       | ...     |
| eks1<br>On         | pvc-d1f839c1-d932-4f49-b620-33321dbe939e<br>Online | trident          | Nov 25 2021, 14:56:3 | 2             | Enabled       | ...     |
| eks1<br>On         | pvc-f615f0a8-2d5d-44d0-b4e4-f365cc3fb4a6<br>Online | default          | Nov 25 2021, 14:56:3 | 2             | Enabled       | ...     |
| eks1<br>On         | pvc-1615f0a8-2d5d-44d0-b4e4-f365cc3fb4a6<br>Online | default          | Nov 25 2021, 14:56:3 | 2             | Enabled       | ...     |
| eks1<br>On         | pvc-05881c70-cf5f-4edc-8537-a0a5ce36f9a1<br>Online | default          | Nov 25 2021, 14:56:3 | 2             | Enabled       | ...     |

# Replicate ONTAP data

## Learn about the Replication service

NetApp SnapMirror replicates data at high speeds over LAN or WAN, so you get high data availability and fast data replication in both virtual and traditional environments. When you replicate data to NetApp storage systems and continually update the secondary data, your data is kept current and remains available whenever you need it. No external replication servers are required.

### Features

- Replicate data between ONTAP storage systems to support backup and disaster recovery to the cloud or between clouds.
- Ensure the reliability of your DR environment with high availability.
- Efficient block-level replication between ONTAP storage is fast and efficient, with granular recovery points for both DR and backup.

### Cost

NetApp doesn't charge you for using the Replication service, but you'll need to check your cloud provider for applicable data ingress and egress charges.

### Supported working environments

Cloud Manager enables data replication between the following types of working environments.

| Source working environment | Supported target working environments                                                                                                |
|----------------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| Cloud Volumes ONTAP        | <ul style="list-style-type: none"><li>• Amazon FSx for ONTAP</li><li>• Cloud Volumes ONTAP</li><li>• On-prem ONTAP cluster</li></ul> |
| On-prem ONTAP cluster      | <ul style="list-style-type: none"><li>• Amazon FSx for ONTAP</li><li>• Cloud Volumes ONTAP</li><li>• On-prem ONTAP cluster</li></ul> |

### How data replication works

Cloud Manager simplifies data replication between volumes on separate ONTAP systems using SnapMirror and SnapVault technologies. You simply need to identify the source volume and the destination volume, and then choose a replication policy and schedule.

For Cloud Volumes ONTAP, Cloud Manager purchases the required disks, configures relationships, applies the replication policy, and then initiates the baseline transfer between volumes.



The baseline transfer includes a full copy of the source data. Subsequent transfers contain differential copies of the source data.

## Supported data protection configurations

Cloud Manager supports simple, fanout, and cascade data protection configurations:

- In a simple configuration, replication occurs from volume A to volume B.
- In a fanout configuration, replication occurs from volume A to multiple destinations.
- In a cascade configuration, replication occurs from volume A to volume B and from volume B to volume C.

## Replicating data between systems

You can replicate data between ONTAP working environments by choosing a one-time data replication for data transfer, or a recurring schedule for disaster recovery or long-term retention. For example, you can set up data replication from an on-prem ONTAP system to Cloud Volumes ONTAP for disaster recovery.

### Data replication requirements

Before you can replicate data, you should confirm that specific requirements are met for Cloud Volumes ONTAP, on-prem ONTAP clusters, or Amazon FSx for ONTAP.

#### Working environments

If you haven't done so already, you need to create the working environments for the source and target in the data replication relationship.

- [Create an Amazon FSx for ONTAP working environment](#)
- [Launch Cloud Volumes ONTAP in AWS](#)
- [Launch Cloud Volumes ONTAP in Azure](#)
- [Launch Cloud Volumes ONTAP in GCP](#)
- [Add existing Cloud Volumes ONTAP systems](#)
- [Discover ONTAP clusters](#)

#### Version requirements

You should verify that the source and destination volumes are running compatible ONTAP versions before replicating data. For details, see the [Data Protection Power Guide](#).

#### Requirements specific to Cloud Volumes ONTAP

- The instance's security group must include the required inbound and outbound rules: specifically, rules for ICMP and ports 11104 and 11105.

These rules are included in the predefined security group.

- To replicate data between two Cloud Volumes ONTAP systems in different subnets, the subnets must be routed together (this is the default setting).
- To replicate data between two Cloud Volumes ONTAP systems in different cloud providers, you must have a VPN connection between the virtual networks.

## Requirements specific to ONTAP clusters

- An active SnapMirror license must be installed.
- If the cluster is on your premises, you should have a connection from your corporate network to your virtual network in AWS, Azure, or GCP. This is typically a VPN connection.
- ONTAP clusters must meet additional subnet, port, firewall, and cluster requirements.

For details, see the [Cluster and SVM Peering Express Guide](#).

## Requirements specific to Amazon FSx for ONTAP

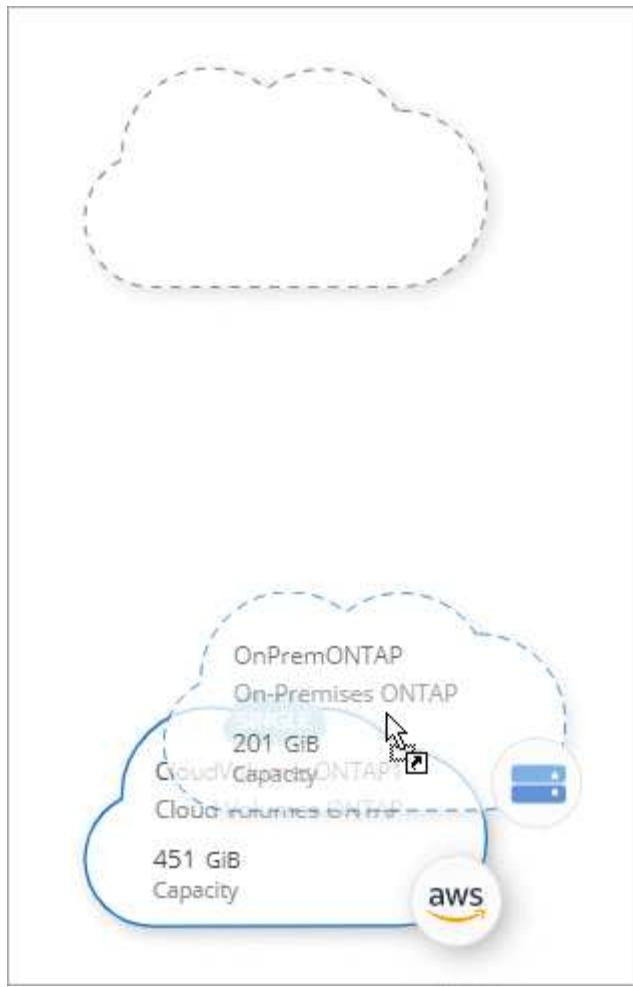
- An Amazon FSx for ONTAP working environment must be the target in the data replication relationship.  
The source can be Cloud Volumes ONTAP or an on-prem ONTAP cluster.
- If Cloud Volumes ONTAP is the source, ensure connectivity between VPCs by enabling VPC peering or by using a Transit Gateway.
- If an on-prem ONTAP cluster is the source, ensure connectivity between your on-premises network and the AWS VPC by using a Direct Connect or VPN connection.

## Setting up data replication between systems

You can replicate data by choosing a one-time data replication, which can help you move data to and from the cloud, or a recurring schedule, which can help with disaster recovery or long-term retention.

### Steps

1. On the Canvas page, select the working environment that contains the source volume, and then drag it to the working environment to which you want to replicate the volume.



2. **Source and Destination Peering Setup:** If this page appears, select all of the intercluster LIFs for the cluster peer relationship.

The intercluster network should be configured so that cluster peers have *pair-wise full-mesh connectivity*, which means that each pair of clusters in a cluster peer relationship has connectivity among all of their intercluster LIFs.

These pages appear if an ONTAP cluster that has multiple LIFs is the source or destination.

3. **Source Volume Selection:** Select the volume that you want to replicate.
4. **Destination Disk Type and Tiering:** If the target is a Cloud Volumes ONTAP system, select the destination disk type and choose whether you want to enable data tiering.
5. **Destination Volume Name:** Specify the destination volume name and choose the destination aggregate.

If the destination is an ONTAP cluster, you must also specify the destination storage VM.

6. **Max Transfer Rate:** Specify the maximum rate (in megabytes per second) at which data can be transferred.

You should limit the transfer rate. An unlimited rate might negatively impact the performance of other applications and it might impact your internet performance.

7. **Replication Policy:** Choose a default policy or click **Additional Policies**, and then select one of the advanced policies.

For help, [learn about replication policies](#).

If you choose a custom backup (SnapVault) policy, the labels associated with the policy must match the labels of the Snapshot copies on the source volume. For more information, [learn how backup policies work](#).

8. **Schedule:** Choose a one-time copy or a recurring schedule.

Several default schedules are available. If you want a different schedule, you must create a new schedule on the *destination* cluster using System Manager.

9. **Review:** Review your selections and click **Go**.

## Result

Cloud Manager starts the data replication process. You can view details about the volume relationship in the Replication service.

# Managing data replication schedules and relationships

After you set up data replication between two systems, you can manage the data replication schedule and relationship from Cloud Manager.

## Steps

1. Click **Replication**.
2. Review the status of the data replication relationships to verify that they are healthy.



If the Status of a relationship is idle and the Mirror State is uninitialized, you must initialize the relationship from the destination system for the data replication to occur according to the defined schedule. You can initialize the relationship by using System Manager or the command-line interface (CLI). These states can appear when the destination system fails and then comes back online.

3. Click the action menu for a volume relationship and choose one of the available actions.

The screenshot shows a table titled "1 Volume Relationship". The columns are: Health Status, Source Volume, Target Volume, Transfer Time, Status, Mirror State, and Last Successful Transfer. The first row contains the following data:  
Health Status: checked (green)  
Source Volume: vol1  
OnPremONTAP  
Target Volume: vol1\_copy  
CloudVolumesONTAP1  
Transfer Time: 1 second  
Status: idle  
Mirror State: snapmirrored  
Last Successful Transfer: Apr 26, 2021, 1:53:54 PM  
0 B  
The "Actions" column for this row displays a context menu with the following options:

- Information
- Break
- Reverse Resync
- Edit Schedule
- Edit Max Transfer Rate
- Update
- Delete

The following table describes the available actions:

| Action                 | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Information            | Shows you details about the volume relationship: transfer information, last transfer information, details about the volume, and information about the protection policy assigned to the relationship.                                                                                                                                                                                                                                                                                                                                            |
| Break                  | <p>Breaks the relationship between the source and destination volumes, and activates the destination volume for data access.</p> <p>This option is typically used when the source volume cannot serve data due to events such as data corruption, accidental deletion, or an offline state.</p> <p>For information about configuring a destination volume for data access and reactivating a source volume, see the <a href="#">ONTAP 9 Volume Disaster Recovery Express Guide</a>.</p>                                                          |
| Resync                 | <p>Reestablishes a broken relationship between volumes and resumes data replication according to the defined schedule.</p> <p> When you resynchronize the volumes, the contents on the destination volume are overwritten by the contents on the source volume.</p> <p>To perform a reverse resync, which resynchronizes the data from the destination volume to the source volume, see the <a href="#">ONTAP 9 Volume Disaster Recovery Express Guide</a>.</p> |
| Reverse Resync         | <p>Reverses the roles of the source and destination volumes. Contents from the original source volume are overwritten by contents of the destination volume. This is helpful when you want to reactivate a source volume that went offline.</p> <p>Any data written to the original source volume between the last data replication and the time that the source volume was disabled is not preserved.</p>                                                                                                                                       |
| Edit Schedule          | Enables you to choose a different schedule for data replication.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Edit Max Transfer Rate | Enables you to edit the maximum rate (in kilobytes per second) at which data can be transferred.                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Update                 | Starts an incremental transfer to update the destination volume.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Delete                 | Deletes the data protection relationship between the source and destination volumes, which means that data replication no longer occurs between the volumes. This action does not activate the destination volume for data access. This action also deletes the cluster peer relationship and the storage VM (SVM) peer relationship, if there are no other data protection relationships between the systems.                                                                                                                                   |

## Result

After you select an action, Cloud Manager updates the relationship or schedule.

## Learn about replication policies

You might need help choosing a replication policy when you set up data replication in Cloud Manager. A replication policy defines how the storage system replicates data from a source volume to a destination volume.

## What replication policies do

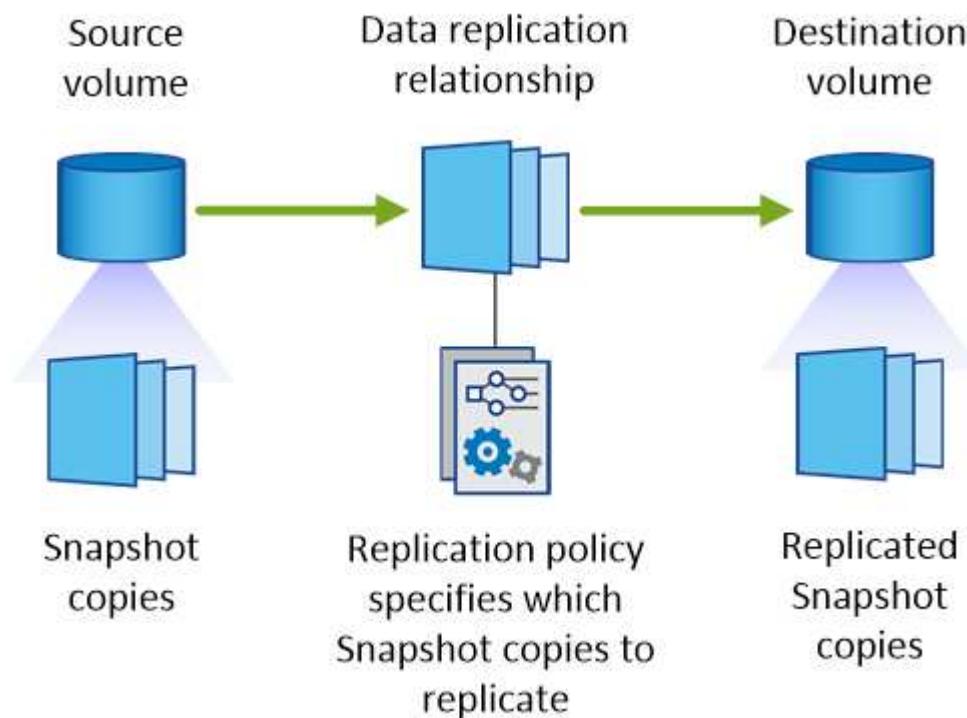
The ONTAP operating system automatically creates backups called Snapshot copies. A Snapshot copy is a read-only image of a volume that captures the state of the file system at a point in time.

When you replicate data between systems, you replicate Snapshot copies from a source volume to a destination volume. A replication policy specifies which Snapshot copies to replicate from the source volume to the destination volume.



Replication policies are also referred to as *protection* policies because they are powered by SnapMirror and SnapVault technologies, which provide disaster recovery protection and disk-to-disk backup and recovery.

The following image shows the relationship between Snapshot copies and replication policies:



## Types of replication policies

There are three types of replication policies:

- A *Mirror* policy replicates newly created Snapshot copies to a destination volume.

You can use these Snapshot copies to protect the source volume in preparation for disaster recovery or for one-time data replication. You can activate the destination volume for data access at any time.

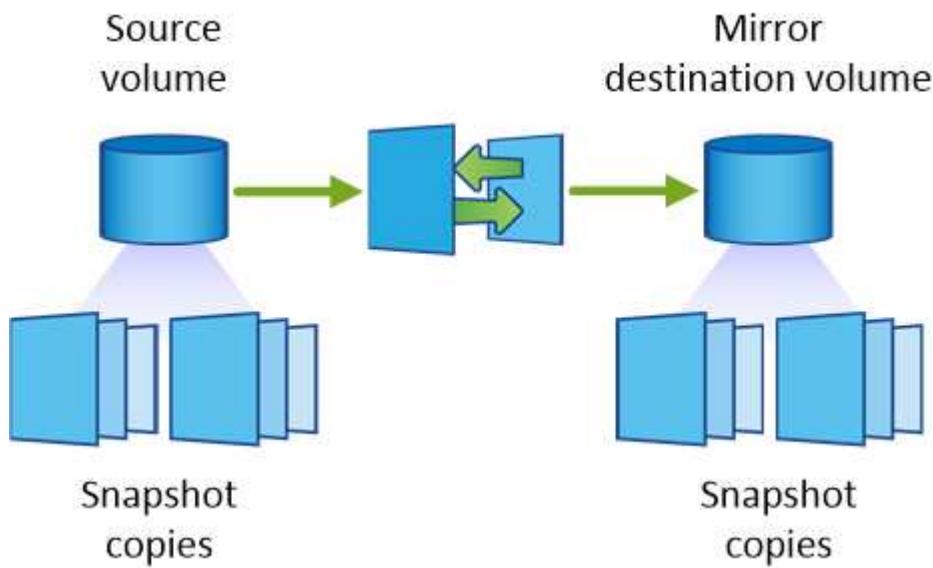
- A *Backup* policy replicates specific Snapshot copies to a destination volume and typically retains them for a longer period of time than you would on the source volume.

You can restore data from these Snapshot copies when data is corrupted or lost, and retain them for standards compliance and other governance-related purposes.

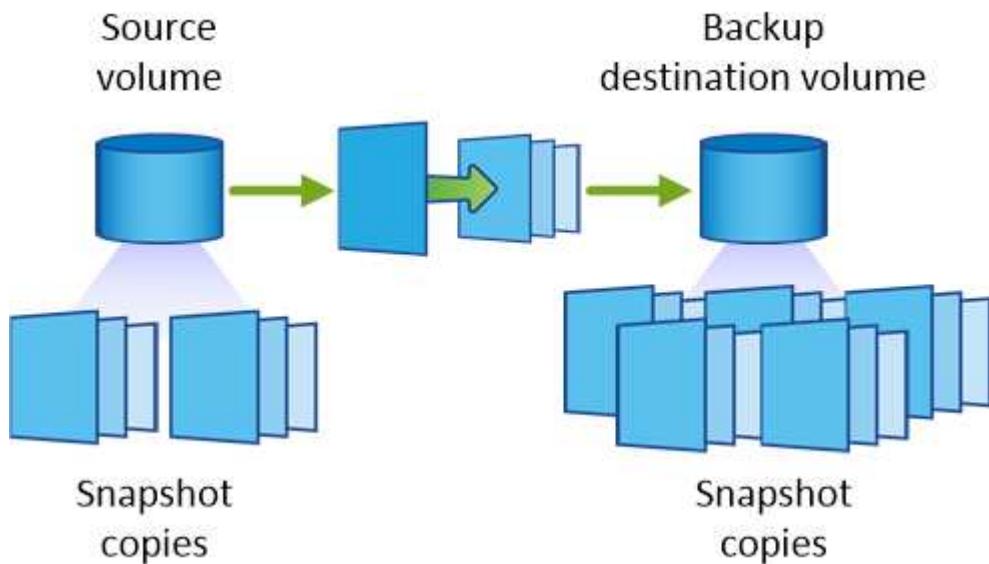
- A *Mirror and Backup* policy provides both disaster recovery and long-term retention.

Each system includes a default Mirror and Backup policy, which works well for many situations. If you find that you need custom policies, you can create your own using System Manager.

The following images show the difference between the Mirror and Backup policies. A Mirror policy mirrors the Snapshot copies available on the source volume.



A Backup policy typically retains Snapshot copies longer than they are retained on the source volume:



## How Backup policies work

Unlike Mirror policies, Backup (SnapVault) policies replicate specific Snapshot copies to a destination volume. It is important to understand how Backup policies work if you want to use your own policies instead of the default policies.

### Understanding the relationship between Snapshot copy labels and Backup policies

A Snapshot policy defines how the system creates Snapshot copies of volumes. The policy specifies when to create the Snapshot copies, how many copies to retain, and how to label them. For example, a system might

create one Snapshot copy every day at 12:10 a.m., retain the two most recent copies, and label them "daily".

A Backup policy includes rules that specify which labeled Snapshot copies to replicate to a destination volume and how many copies to retain. The labels defined in a Backup policy must match one or more labels defined in a Snapshot policy. Otherwise, the system cannot replicate any Snapshot copies.

For example, a Backup policy that includes the labels "daily" and "weekly" results in replication of Snapshot copies that include only those labels. No other Snapshot copies are replicated, as shown in the following image:

## **Default policies and custom policies**

The default Snapshot policy creates hourly, daily, and weekly Snapshot copies, retaining six hourly, two daily, and two weekly Snapshot copies.

You can easily use a default Backup policy with the default Snapshot policy. The default Backup policies replicate daily and weekly Snapshot copies, retaining seven daily and 52 weekly Snapshot copies.

If you create custom policies, the labels defined by those policies must match. You can create custom policies using System Manager.

# Use templates to standardize resource creation

## Learn about Application Templates

The Application Template service enables you to standardize resource creation in your working environments. For example, you can hard-code required parameters in a "volume template" that are later applied when a storage admin creates a volume using the template. This can include required disk type, size, protocol, snapshot policy, cloud provider, and more. You can also turn on certain services, like Cloud Backup, for every created volume.

Templates make it easy for your storage admins to create volumes that are optimized for the workload requirements for each deployed application; such as databases, email, or streaming services. And it makes life easier for your storage architects knowing that each volume is created optimally for each application.

## Features

Application Templates offer the following features and benefits:

- Automates and improves the design and development of your infrastructure
- Provides a single location to activate different NetApp Cloud services; like Cloud Backup and Cloud Data Sense
- Identifies resources that have been changed and are no longer compliant with the template (using the "drift" feature)

### What is "drift"?

"Drift" allows Cloud Manager to monitor the parameter values used when a resource is created with the template. At this time, "drift" can identify when a resource has been changed so you can manually make adjustments to bring it back into compliance with the template. In the future we'll be able to send you notifications when a resource is out of compliance, or even reverse a user's change so that all resources created from a template are brought back into compliance automatically.

[Learn more about drift.](#)

## Available template actions

A template is a chain of "actions" that have some pre-defined values. You can build templates that include the following actions:

### Resource actions:

- Create a Cloud Volumes ONTAP volume (on AWS, Azure, or GCP)
- Create an Azure NetApp Files volume
- Create an on-premises ONTAP volume
- Create a Cloud Volumes ONTAP working environment (single node or HA system on AWS)
- Find existing resources that meet certain criteria (so you can apply a "services" action on exiting resources)

### Services actions:

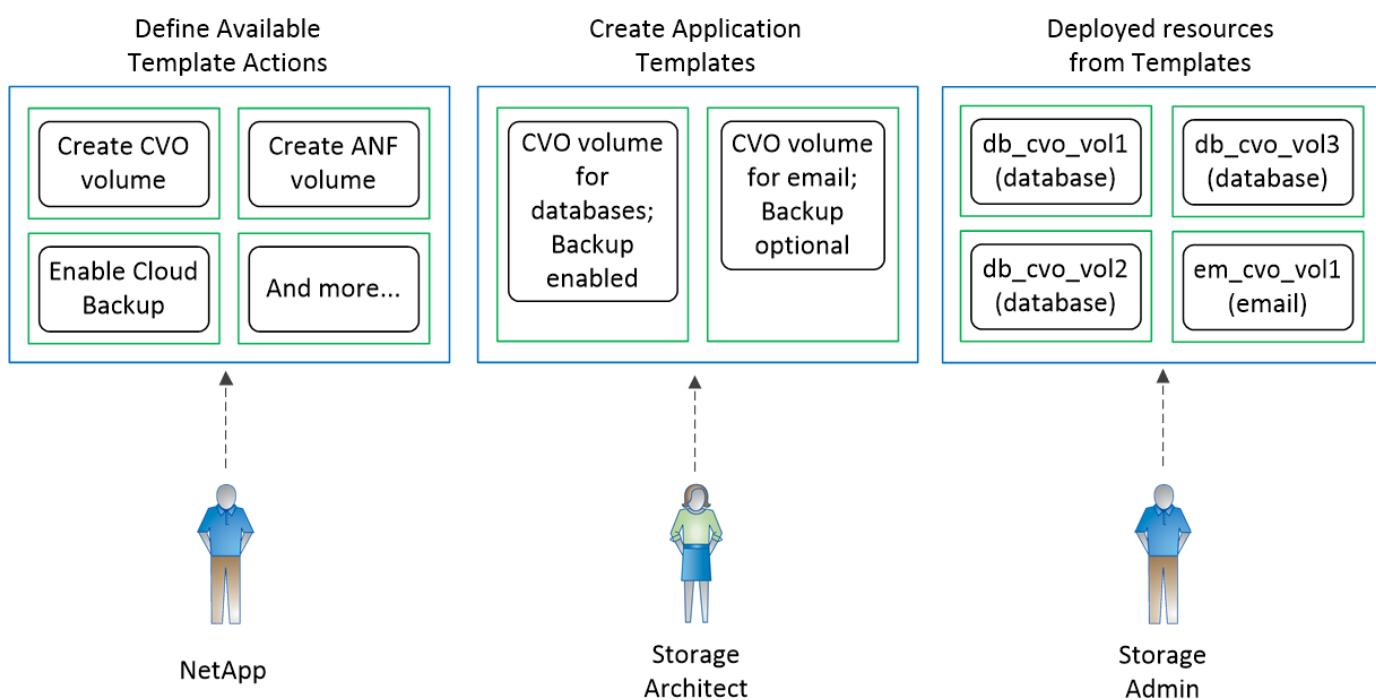
- Activate [Cloud Backup](#) on volumes (not applicable for Azure NetApp Files)
- Activate [Cloud Data Sense](#) on volumes
- Activate [Replication](#) on volumes (not applicable for Azure NetApp Files)

For example, you can create a template that creates a Cloud Volumes ONTAP volume. Or that that creates a Cloud Volumes ONTAP volume and then enables Cloud Backup on that volume. Or that that creates a Cloud Volumes ONTAP volume, and then enables Cloud Backup *and* Cloud Data Sense on that volume.

More actions will be added over time by NetApp.

## How Application Templates work

The Application Templates service is made up of 3 parts. The available template "actions", the customized application template, and the deployed resource as a result of running the template. The following image shows the relationship between each component:



At a high level, Templates work like this:

1. NetApp defines the available template "actions".

For example, an "action" to create a Cloud Volumes ONTAP volume or an Azure NetApp Files volume.

2. Your storage architect selects the "actions" they want to use to create an Application Template, and then they hard-code certain values for the listed parameters.

For example, they select high speed disks and a large amount of RAM for Cloud Volumes ONTAP volumes that will be used to carry the workloads for Oracle databases. And they require that backups are made for each volume.

3. Your storage admins use the templates to create resources that are optimized for the applications they will be used for.

For example, they create a volume that will be used for an Oracle database by using the volume template created for databases.

4. The service tracks certain resource settings defined in the template using the "drift" feature as determined by your storage architect.

## Pricing and licenses

The Application Templates feature requires no licensing and is free to use by all Cloud Manager users.



Templates enable you to apply a cloud service onto a created resources, for example, enable Cloud Backup on every volume. In this case there is a cost for using the Backup service and for the object storage space used by the backup files.

## Limitations

- The Application Templates service is not supported in any of the Gov Cloud regions or in sites without internet access.
- You can't use a template to create a Cloud Volumes ONTAP volume on an existing aggregate. New volumes are created in a new aggregate.

## Template building blocks

There are certain features you can use when building a template that enable you pass values between actions (like a volume name), conditionally branch to connect actions together (enable backups on a new volume), and that help your users customize resources when using the template.

### Special template controls

Before you start creating your template, you should understand some special options that you can set when pre-populating a value for a parameter in a template.

|                                                     |                                             |                                |
|-----------------------------------------------------|---------------------------------------------|--------------------------------|
| Enable Storage Efficiency                           | <input type="checkbox"/> Editable           | <input type="checkbox"/> Drift |
| <input checked="" type="radio"/> Storage Efficiency | <input type="radio"/> No Storage Efficiency |                                |

#### Editable checkbox

Check this box to let the storage admin override the pre-populated value you have entered in the template. This gives the storage admin a suggestion for what the value should be, but it allows them to customize the value when creating the resource.

When unchecked, the user can't change the value and the hard-coded value in the template is always used when the admin deploys a resource.

#### Drift checkbox

Check this box so that Cloud Manager monitors the hard-coded value you entered for a parameter when a resource is created with the template. Later, you can run a Drift Report to see which fields configured with Drift

are no longer compliant with the template settings.

When unchecked, the user can change the value to any value after the resource has been created.



For the drift feature to work, after you have defined drift for some parameters in the template, you must enable the drift feature for the template. This is the last step when creating a template. Drift doesn't work if it is enabled for a parameter but hasn't been enabled on the template.

## Using a regular expression (regex) in fields

There are a few fields within templates that allow you to enter a regex to define the value that your admin can enter in the field; for example "Volume Name" and "Share Name".

The screenshot shows a user interface element for a 'Volume Name'. It consists of a text input field with the placeholder 'Volume Name' and a 'Regex' input field below it. The 'Regex' field contains the pattern '^a-zA-Z][0-9a-zA-Z]{0,149}\$'. A red rectangular box highlights this regex pattern.

As an example, if you enter "`^a-zA-Z][0-9a-zA-Z]{0,149}$`" as the regex for the volume name, it means that *"the name should start with an alphabetic character, it can contain only numbers, letters, or the underscore, and it should be 150 or fewer characters in length"*.

## Pass values between template actions

Templates have the ability to use information from a previous action to populate a field in a future action. For example, when defining the name of the volume that will have Cloud Backup functionality enabled, you can instruct the Backup action to use the value the storage admin entered as the name of the volume from the Create Cloud Volumes ONTAP action.

There are three types of information that the AppTemplate service can use:

- Input value - This is the actual value the storage admin entered into a field in a previous template action.
- Output value - This is the value Cloud Manager generates after creating a resource from a previous template action.
- Enter your own value - This is a value that you enter; it is not accessed from a previous action in the template.

For example, to enable compliance scanning on a volume, the Cloud Data Sense service needs both the "volume name" that the storage admin enters (the Input value), and the "volume uuid" that Cloud Manager generates when it creates the volume (the Output value).

The following illustration shows how to enter this information in the Cloud Data Sense action section of the template.

## Activate Cloud Data Sense on Volume

Action Definition

**Details**

|                                                                                                                                                                                                        |                                                                  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|
| Volume Name                                                                                                           | <input type="checkbox"/> Editable <input type="checkbox"/> Drift |
| Get output value from action         |                                                                  |
| Create Volume in On-Premises ONTAP   |                                                                  |
| Volume Name                          |                                                                  |
| Volume UUID                                                                                                           | <input type="checkbox"/> Editable <input type="checkbox"/> Drift |
| Get output value from action         |                                                                  |
| Create Volume in On-Premises ONTAP   |                                                                  |
| uuid                                                                                                                                                                                                   |                                                                  |

Get the volume name:

From the value the storage admin entered...

In the earlier action used to create the volume...

in the "Volume Name" field.

Get the volume UUID:

From the value Cloud Manager generates...

In the earlier action used to create the volume...

in the "uuid" field.

## Use conditions to perform different actions based on logic statements

Conditions tell the template to execute different actions depending on whether the condition is true or false when the storage admin runs the template. You add a condition by selecting the **Logical If** action:

### Add New Action



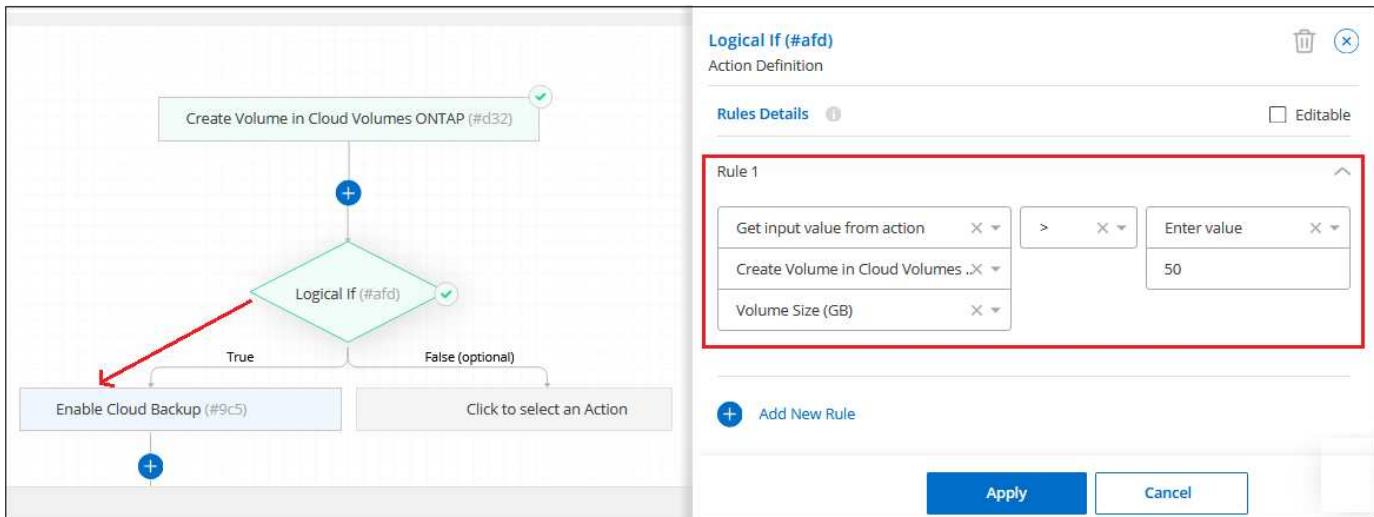
**ACTIONS - SERVICES**

- Activate Cloud Data Sense on Volume
- Enable Cloud Backup
- Enable Volume Replication to Cloud Volumes ONTAP
- Enable Volume Replication to On-Premises ONTAP

**FLOW CONTROLS**

- Logical If** 

For example, you may have a guideline that if a volume has a capacity larger than 50 GB then Cloud Backup is required to be enabled on that volume. If the volume has a smaller capacity, then Cloud Backup is not enabled. You can implement this in your template as shown below.



Conditions consist of two parts:

- Rules - The item you are checking for being either true or false.
- And/Or statement - Allows you to use multiple rules to further refine whether additional actions are added.

A Rule is made up of three parts:

**Source field** - The location from which you will get the value to compare.

- Get input value from action - The actual value the storage admin entered into a field in a previous template action.
- Get output value from action - The value Cloud Manager generated after creating a resource from a previous template action.
- Enter value - This is a value that you enter; it is not accessed from a previous action in the template. This can be a value from a resource that already exists; for example an existing volume.

**Operator** - The operator used for the comparison. The options are **Equal, Not Equal, Greater Than, Less Than, Greater Than or Equal, Less Than or Equal**.

**Field value** - The actual value you are comparing. The options are the same as those for the *Source field*.

An And/Or statement enables you to conditionally add more actions for users when they run the template based on whether multiple rules are evaluated as True or False. **And** requires all rules to be true or false, and **Or** requires just one of the rules needs to be true or false.

When using both an And and Or statement with your rules, the evaluation process follows standard mathematical order where “AND” precedes “OR”. For example:

- <Rule1> OR <Rule2> AND <Rule3>

This statement is evaluated in the following order:  
<Rule1> OR (<Rule2> AND <Rule3>)

## Build application templates for your organization

Select one or more of the NetApp-provided "actions" and quickly build an application

template that your organization can use to start optimizing the creation of resources.

## Quick start

Get started quickly by following these steps, or scroll down to the remaining sections for full details.

1

### Verify required prerequisites

- Before users can create a volume for a Cloud Volumes ONTAP, on-premises ONTAP, or Azure NetApp Files system using a template, make sure they have access to an appropriate working environment where the volume will be deployed.
- If you plan to add a Cloud service "action" to your template, such as [Cloud Backup](#) or [Cloud Data Sense](#), ensure that the service is active and licensed in your environment.

2

### Launch the Application Templates service

Select the **AppTemplate** service, click the **Editor** tab, and select the actions you'll use in your template.

3

### Build the template by selecting "actions" and defining parameters

Follow the creation steps and define the actions that will be performed by the template.

## Requirements

Read the following requirements to make sure that you have a supported configuration.

- If you don't already have a Connector, [see how to create Connectors](#) for AWS, Azure, and GCP.
- When creating a Cloud Volumes ONTAP volume template, make sure you have a Cloud Volumes ONTAP working environment available for your users. See how to launch a Cloud Volumes ONTAP system in [AWS](#), [Azure](#), or in [GCP](#).
- When creating an on-premises ONTAP volume template, make sure you have an on-premises ONTAP working environment available for your users. See how to [discover an on-premises ONTAP system](#) in Cloud Manager.
- When creating an Azure NetApp Files volume template, make sure you have an Azure NetApp Files working environment available for your users. See how to [create an Azure NetApp Files working environment](#) in Cloud Manager.
- If you plan to use Cloud Backup to backup up a volume in the template, ensure that your environment has activated Cloud Backup.
- If you plan to use Cloud Data Sense to scan volumes in the template, ensure that your environment has activated Cloud Data Sense.
- If you plan to enable Replication in the template, and the template is for an on-premises ONTAP volume, the ONTAP cluster must have an active SnapMirror license.

## Examples of creating resources using templates

Resource templates enable you to create new volumes or a new Cloud Volumes ONTAP working environment.

## Create a template for a Cloud Volumes ONTAP volume

See [how to provision Cloud Volumes ONTAP volumes](#) for details about all the parameters you need to complete in the Cloud Volumes ONTAP volume template.

For this example we'll create a template named "CVO volume for databases" and include the following 2 actions:

- Create Cloud Volumes ONTAP Volume

Make the volume for the AWS environment, configure it with 100 GB of storage, set the Snapshot Policy to "default", and enable Storage Efficiency.

- Enable Cloud Backup

Create 30 daily, 13 weekly, and 3 monthly backups (using the *3 Months Retention* policy).

### Steps

1. Select the **AppTemplate** service, click the **Templates** tab, and click **Add New Template**.

The *Select\_a\_Template* page is displayed.

### Select a Template to Get Started

Choose a template for the type of resource you want to create and then customize the parameters for what's required in your environment.

For even greater flexibility, choose the "blank" template to mix and match configurations and to apply additional Cloud Manager services.

Start with a template of:

**Blank template**    **Volume for Cloud Volumes ONTAP**    **Volume for Cloud Volumes ONTAP + Backup**    **Volume for Azure NetApp files**

**Get Started**    **Cancel**

The screenshot shows the 'Select a Template to Get Started' page. The central text area contains instructions for choosing a template. Below this is a diagram showing two stylized figures interacting with a large blue cloud icon containing a wrench and a checkmark. A callout bubble points to the 'Volume for Cloud Volumes ONTAP + Backup' option, which is highlighted with a blue border and a checkmark. The other three options ('Blank template', 'Volume for Cloud Volumes ONTAP', and 'Volume for Azure NetApp files') are shown without borders or checkmarks. At the bottom are 'Get Started' and 'Cancel' buttons.

2. Select **Volume for Cloud Volumes ONTAP + Backup** as the type of resource you want to create, and click **Get Started**.

The *Create Volume in Cloud Volumes ONTAP Action Definition* page is displayed.

The screenshot shows a template editor interface. On the left, a workflow diagram is displayed with two main steps: "Create Volume in Cloud Volumes ONTAP (#1da)" and "Enable Cloud Backup On Volume (#a09)". Arrows indicate a sequential flow from the first step to the second. On the right, the "Create Volume in Cloud Volumes ONTAP (#1da)" configuration panel is open. It includes sections for "Action Definition", "Details", "Protection", and "Usage Profile". Under "Details", there are fields for "Volume Name" (with checkboxes for "Editable" and "Drift"), "Volume Size (GB)" (with "Minimum" and "Maximum" fields), and "Tags" (with an "Add Tags" button). Under "Protection", there is a "Snapshot Policy" field. At the bottom are "Apply" and "Cancel" buttons.

3. **Action Name:** Optionally, enter a customized action name instead of the default value.
4. **Context:** Enter the Cloud Volumes ONTAP working environment context; if required.

When users launch the template from an existing working environment, this information gets filled in automatically.

When users launch the template from the Templates Dashboard (not in a working environment context), then they need to select the working environment and the SVM where the volume will be created. That's why these fields are marked as "Editable".

5. **Details:** Enter the volume name and size.

| Field       | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Volume Name | <p>Click in the field and select one of the 5 options. You can let the admin enter any name by selecting <b>Free Text</b>, or you can specify that the volume name must have a certain prefix or suffix, that it <i>contains</i> certain characters, or that it follows rules from a regular expression (regex) you enter.</p> <p>For example, you could specify that "db" be a required prefix, suffix, or contains; requiring the user to add volume names like "db_vol1", "vol1_db", or "vol_db_1".</p> |
| Volume Size | You can specify a range of allowable values, or you can specify a fixed size. This value is in GB. For our example we can add a fixed value <b>100</b> .                                                                                                                                                                                                                                                                                                                                                   |
| Tags        | Enter a name and value pair for a tag that you want to associate with this volume. For example, you could add "Cost Center" as the tag name and the cost center code "6655829" as the value. You can associate more than one tag with a volume by adding more tag name and value pairs.                                                                                                                                                                                                                    |

6. **Protection:** Choose whether this volume will have Snapshot copies created by selecting "Default" or some other policy, or choose "None" if you do not want to create Snapshot copies.

7. **Usage Profile:** Choose whether or not NetApp storage efficiency features are applied to the volume. This includes Thin Provisioning, Deduplication, and Compression. For our example, keep storage efficiency enabled.
8. **Disk Type:** Choose the cloud storage provider and the type of disk. For some disk selections you can also select a minimum and maximum IOPS or Throughput (MB/s) value; basically defining a certain Quality of Service (QoS).
9. **Protocol Options:** Select **NFS** or **SMB** to set the protocol of the volume. And then provide the protocol details.

| NFS Fields     | Description                                                                                          |
|----------------|------------------------------------------------------------------------------------------------------|
| Access Control | Choose whether access controls are needed to access the volume.                                      |
| Export Policy  | Create an export policy to define the clients in the subnet that can access the volume.              |
| NFS Version    | Select the NFS version for the volume: either <i>NFSv3</i> or <i>NFSv4</i> , or you can select both. |

| SMB Fields     | Description                                                                                                                                                                                                                                                                                         |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Share Name     | Click in the field and select one of the 5 options. You can let the admin enter any name (Free Text) or you can specify that the share name must have a certain prefix or suffix, that it <i>contains</i> certain characters, or that it follows rules from a regular expression (regex) you enter. |
| Permissions    | Select the level of access to a share for users and groups (also called access control lists, or ACLs).                                                                                                                                                                                             |
| Users / Groups | Specify local or domain Windows users or groups, or UNIX users or groups. If you specify a domain Windows user name, you must include the user's domain using the format domain\username.                                                                                                           |

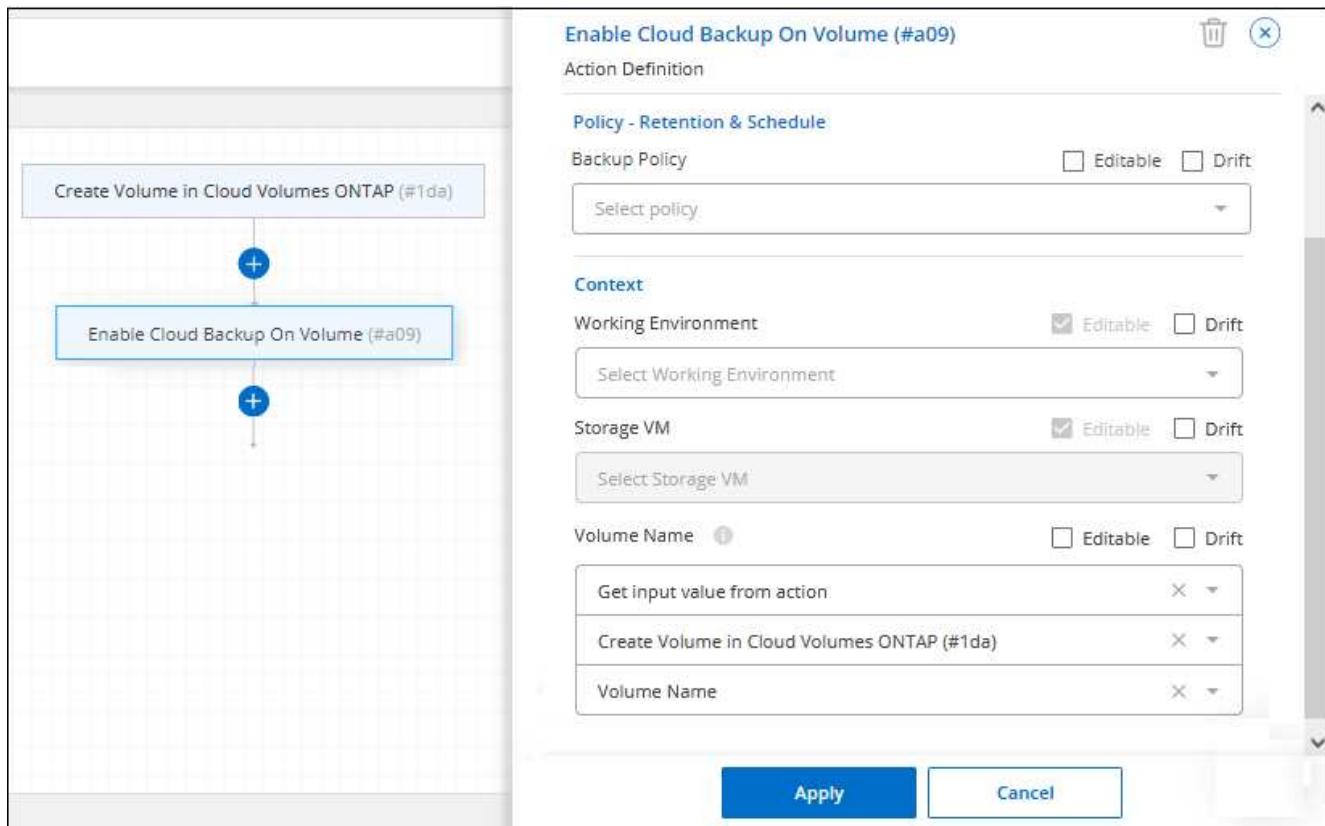
10. **Tiering:** Choose the tiering policy that you would like applied to the volume, or set this to "None" if you do not want to tier cold data from this volume to object storage.

See [volume tiering policies](#) for an overview, and see [Tiering inactive data to object storage](#) to make sure your environment is set up for tiering.

11. Click **Apply** after you have defined the parameters needed for this action.

If the template values are correctly completed, a green checkmark is added to the "Create Volume in Cloud Volumes ONTAP" box.

12. Click the **Enable Cloud Backup on Volume** box and the *Enable Cloud Backup on Volume Action Definition* dialog is displayed so you can fill in the Cloud Backup details.



13. Select the **3 Months Retention** backup policy to create 30 daily, 13 weekly, and 3 monthly backups.
14. Below the Working Environment and Volume Name fields there are three selections you use to indicate which volume will have backup enabled. See [how to complete these fields](#).
15. Click **Apply** and the Cloud Backup dialog is saved.
16. Enter the template name **CVO volume for databases** (for this example) in the top left.
17. Click **Settings & Drift** to provide a more detailed description so that this template can be distinguished from other similar templates, and so you can enable Drift for the overall template, and then click **Apply**.  
  
Drift allows Cloud Manager to monitor the hard-coded values you entered for parameters when creating this template.
18. Click **Save Template**.

## Result

The template is created and you are returned to the Templates Dashboard where your new template appears.

See [what you should tell your users about templates](#).

## Create a template for an Azure NetApp Files volume

Creating a template for an Azure NetApp Files volume is done in the same manner as creating a template for a Cloud Volumes ONTAP volume.

See [how to provision Azure NetApp Files volumes](#) for details about all the parameters you need to complete in the ANF volume template.

## Steps

1. Select the **AppTemplate** service, click the **Templates** tab, and click **Add New Template**.

The *Select\_a\_Template* page is displayed.

**Select a Template to Get Started**

Choose a template for the type of resource you want to create and then customize the parameters for what's required in your environment.

For even greater flexibility, choose the "blank" template to mix and match configurations and to apply additional Cloud Manager services.



Start with a template of:

**Blank template**

Volume for Cloud Volumes ONTAP + Backup

Volume for Cloud Volumes ONTAP + Backup + Data Sense

Volume for Azure NetApp files + Data Sense

**Get Started**      **Cancel**

2. Select **Blank template** and click **Get Started**.

3. Select **Create Volume in Azure NetApp Files** as the type of resource you want to create, and click **Apply**.

The *Create Volume in Azure NetApp Files Action Definition* page is displayed.

Enter a name for this template

**Create Volume in Azure NetApp Files (#23c)**

Action Definition

**Create Volume in Azure NetApp Files (#23c)**

Volume Details

Volume Name   Editable  Drift

Volume Size (GB)  
Minimum   Editable  Drift  
Maximum   Editable  Drift

Fixed value   
Enter volume size in GB   Editable  Drift

Tags  Editable  Drift

Protocol

NFSv3  NFSv4.1  SMB  Editable  Drift

Volume Path   Editable  Drift

**Apply** **Cancel**

4. **Action Name:** Optionally, enter a customized action name instead of the default value.
5. **Volume Details:** Enter a volume name and size, and optionally specify tags for the volume.

| Field       | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Volume Name | <p>Click in the field and select one of the 5 options. You can let the admin enter any name by selecting <b>Free Text</b>, or you can specify that the volume name must have a certain prefix or suffix, that it <i>contains</i> certain characters, or that it follows rules from a regular expression (regex) you enter.</p> <p>For example, you could specify that "db" be a required prefix, suffix, or contains; requiring the user to add volume names like "db_vol1", "vol1_db", or "vol_db_1".</p> |
| Volume Size | You can specify a range of allowable values, or you can specify a fixed size. This value is in GB.                                                                                                                                                                                                                                                                                                                                                                                                         |
| Tags        | Enter a name and value pair for a tag that you want to associate with this volume. For example, you could add "Cost Center" as the tag name and the cost center code "6655829" as the value. You can associate more than one tag with a volume by adding more tag name and value pairs.                                                                                                                                                                                                                    |

6. **Protocol:** Select **NFSv3**, **NFSv4.1**, or **SMB** to set the protocol of the volume. And then provide the protocol details.

| NFS Fields          | Description                                                                                                                                                                                                                                                                                     |
|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Volume Path         | Select one of the 5 options. You can let the admin enter any path by selecting <b>Free Text</b> , or you can specify that the path name must have a certain prefix or suffix, that it <i>contains</i> certain characters, or that it follows rules from a regular expression (regex) you enter. |
| Export Policy Rules | Create an export policy to define the clients in the subnet that can access the volume.                                                                                                                                                                                                         |

| SMB Fields  | Description                                                                                                                                                                                                                                                                                     |
|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Volume Path | Select one of the 5 options. You can let the admin enter any path by selecting <b>Free Text</b> , or you can specify that the path name must have a certain prefix or suffix, that it <i>contains</i> certain characters, or that it follows rules from a regular expression (regex) you enter. |

7. **Context:** Enter the Azure NetApp Files working environment, details for a new or an existing Azure NetApp Files account, and other details.

| Field               | Description                                                                                                                                                                                                                                                                                                                            |
|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Working Environment | <p>When storage admin users launch the template from an existing working environment, this information gets filled in automatically.</p> <p>When users launch the template from the Templates Dashboard (not in a working environment context), then they need to select the working environment where the volume will be created.</p> |
| NetApp Account Name | Enter the name you want to use for the account.                                                                                                                                                                                                                                                                                        |

| Field                 | Description                                                                                                                                                                                                                           |
|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Azure Subscription ID | Enter the Azure Subscription ID. This is the full ID in a format similar to "2b04f26-7de6-42eb-9234-e2903d7s327".                                                                                                                     |
| Region                | Enter the region using the <a href="#">internal region name</a> .                                                                                                                                                                     |
| Resource Group Name   | Enter the name of the Resource Group you want to use.                                                                                                                                                                                 |
| Capacity Pool Name    | Enter the name of an existing capacity pool.                                                                                                                                                                                          |
| Subnet                | Enter the VNet and subnet. This value includes the full path, in a format similar to "/subscriptions/<subscription_id>/resourceGroups/<resource_group>/providers/Microsoft.Network/virtualNetworks/<vpc_name>/subnets/<subnet_name>". |

8. **Snapshot Copy:** Enter the Snapshot ID for an existing volume Snapshot if you want this new volume to be created using characteristics from an existing volume.
9. Click **Apply** after you have defined the parameters needed for this action.
10. Enter the name you want to use for the template in the top left.
11. Click **Settings & Drift** to provide a more detailed description so that this template can be distinguished from other similar templates, and so you can enable Drift for the overall template, and then click **Apply**.  
Drift allows Cloud Manager to monitor the hard-coded values you entered for parameters when creating this template.
12. Click **Save Template**.

## Result

The template is created and you are returned to the Templates Dashboard where your new template appears.

See [what you should tell your users about templates](#).

## Create a template for an on-premises ONTAP volume

See [how to provision on-premises ONTAP volumes](#) for details about all the parameters you need to complete in the on-premises ONTAP volume template.

## Steps

1. Select the **AppTemplate** service, click the **Templates** tab, and click **Add New Template**.

The *Select\_a\_Template* page is displayed.

## Select a Template to Get Started

Choose a template for the type of resource you want to create and then customize the parameters for what's required in your environment.

For even greater flexibility, choose the "blank" template to mix and match configurations and to apply additional Cloud Manager services.



Start with a template of:

Blank template

Volume for Cloud Volumes ONTAP + Backup

Volume for Cloud Volumes ONTAP + Backup + Data Sense

Volume for Azure NetApp files + Data Sense

Get Started

Cancel

2. Select **Blank template** and click **Get Started**.

The *Add New Action* page is displayed.

### Add New Action

Search for actions

**ACTIONS - RESOURCES**

Create Volume in Azure NetApp Files

Create Volume in Cloud Volumes ONTAP

Create Volume in On-Premises ONTAP

Create Working Environment in AWS (single node)

**ACTIONS - SERVICES**

Activate Cloud Data Sense on Volume

Apply Cancel

3. Select **Create Volume in On-Premises ONTAP** as the type of resource you want to create, and click **Apply**.

The *Create Volume in On-Premises ONTAP Action Definition* page is displayed.

**Create Volume in On-Premises ONTAP (#7b6)**

**Action Definition**

**Details**

Volume Name   Editable  Drift  
Select...

Volume Size (GB)  
Minimum   Editable  Drift  
Maximum   Editable  Drift  
Enter minimum  Enter maximum  Fixed value

Tags  Editable  Drift  
Add Tags

**Protection**

Snapshot Policy   Editable  Drift  
Select snapshot policy

**Usage Profile**

**Buttons:** Apply, Cancel

4. **Action Name:** Optionally, enter a customized action name instead of the default value.

5. **Context:** Enter the on-premises ONTAP working environment context; if required.

When users launch the template from an existing working environment, this information gets filled in automatically.

When users launch the template from the Templates Dashboard (not in a working environment context), then they need to select the working environment, the SVM, and the aggregate where the volume will be created.

6. **Details:** Enter the volume name and size.

| Field       | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Volume Name | Click in the field and select one of the 5 options. You can let the admin enter any name by selecting <b>Free Text</b> , or you can specify that the volume name must have a certain prefix or suffix, that it <i>contains</i> certain characters, or that it follows rules from a regular expression (regex) you enter.<br><br>For example, you could specify that "db" be a required prefix, suffix, or contains; requiring the user to add volume names like "db_vol1", "vol1_db", or "vol_db_1". |
| Volume Size | You can specify a range of allowable values, or you can specify a fixed size. This value is in GB. For our example we can add a fixed value <b>100</b> .                                                                                                                                                                                                                                                                                                                                             |

| Field | Description                                                                                                                                                                                                                                                                             |
|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Tags  | Enter a name and value pair for a tag that you want to associate with this volume. For example, you could add "Cost Center" as the tag name and the cost center code "6655829" as the value. You can associate more than one tag with a volume by adding more tag name and value pairs. |

7. **Protection:** Choose whether this volume will have Snapshot copies created by selecting "Default" or some other policy, or choose "None" if you do not want to create Snapshot copies.
8. **Usage Profile:** Choose whether or not NetApp storage efficiency features are applied to the volume. This includes Thin Provisioning, Deduplication, and Compression.
9. **Protocol Options:** Select **NFS** or **SMB** to set the protocol of the volume. And then provide the protocol details.

| NFS Fields     | Description                                                                                          |
|----------------|------------------------------------------------------------------------------------------------------|
| Access Control | Choose whether access controls are needed to access the volume.                                      |
| Export Policy  | Create an export policy to define the clients in the subnet that can access the volume.              |
| NFS Version    | Select the NFS version for the volume: either <i>NFSv3</i> or <i>NFSv4</i> , or you can select both. |

| SMB Fields     | Description                                                                                                                                                                                                                                                                                         |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Share Name     | Click in the field and select one of the 5 options. You can let the admin enter any name (Free Text) or you can specify that the share name must have a certain prefix or suffix, that it <i>contains</i> certain characters, or that it follows rules from a regular expression (regex) you enter. |
| Permissions    | Select the level of access to a share for users and groups (also called access control lists, or ACLs).                                                                                                                                                                                             |
| Users / Groups | Specify local or domain Windows users or groups, or UNIX users or groups. If you specify a domain Windows user name, you must include the user's domain using the format domain\username.                                                                                                           |

10. Click **Apply** after you have defined the parameters needed for this action.

If the template values are correctly completed, a green checkmark is added to the "Create Volume in On-Premises ONTAP" box.

11. Enter the template name in the top left.
12. Click **Settings & Drift** to provide a more detailed description so that this template can be distinguished from other similar templates, and so you can enable Drift for the overall template, and then click **Apply**.

Drift allows Cloud Manager to monitor the hard-coded values you entered for parameters when creating this template.

13. Click **Save Template**.

## Result

The template is created and you are returned to the Template Dashboard where your new template appears.

See [what you should tell your users about templates](#).

## Create a template for a Cloud Volumes ONTAP working environment

You can create a single-node or high-availability Cloud Volumes ONTAP working environment using templates.

- This support is provided only for AWS environments at this time.
- This template doesn't create the first volume in the working environment. You must add a "Create Volume in Cloud Volumes ONTAP" action in the template to create the volume.

See [how to launch a single-node Cloud Volumes ONTAP system in AWS](#) or a [Cloud Volumes ONTAP HA pair in AWS](#) for the prerequisites that must be in place, and for details about all the parameters you'll need to define in this template.

### Steps

1. Select the **AppTemplate** service, click the **Templates** tab, and click **Add New Template**.

The *Select\_a\_Template* page is displayed.

### Select a Template to Get Started

Choose a template for the type of resource you want to create and then customize the parameters for what's required in your environment.

For even greater flexibility, choose the "blank" template to mix and match configurations and to apply additional Cloud Manager services.

Start with a template of:



- Blank template**
- Volume for Cloud Volumes ONTAP + Backup
- Volume for Cloud Volumes ONTAP + Backup + Data Sense
- Volume for Azure NetApp files + Data Sense

**Get Started** **Cancel**

2. Select **Blank template** and click **Get Started**.

The *Add New Action* page is displayed.

## Add New Action



Create Volume in Azure NetApp Files

Create Volume in Cloud Volumes ONTAP

Create Volume in On-Premises ONTAP

Create Working Environment in AWS (high availability)

Create Working Environment in AWS (single node)



Find Existing Resources

3. Select **Create Working Environment in AWS (single node)** or **Create Working Environment in AWS (high availability)** as the type of resource you want to create, and click **Apply**.

For this example, the *Create Working Environment in AWS (single node)* page is displayed.

**Create Working Environment in AWS (single node) (#a22)**

Action Definition

Action Name i

Create Working Environment in AWS (single node) (#a22)

**Details and Credentials**

Credentials  Editable  Drift

Working Environment Name i  Editable  Drift

Select...

Tags  Editable  Drift

+ Add Tags

4. **Action Name:** Optionally, enter a customized action name instead of the default value.
5. **Details and Credentials:** Select the AWS credentials to use, enter a working environment name, and add tags, if needed.

Some of the fields in this page are self-explanatory. The following table describes fields for which you might need guidance:

| Field                    | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Credentials              | These are the credentials for the Cloud Volumes ONTAP cluster admin account. You can use these credentials to connect to Cloud Volumes ONTAP through ONTAP System Manager or its CLI.                                                                                                                                                                                                                                                                                                                                                                                   |
| Working Environment Name | Cloud Manager uses the working environment name to name both the Cloud Volumes ONTAP system and the Amazon EC2 instance. It also uses the name as the prefix for the predefined security group, if you select that option.<br><br>Click in the field and select one of the 5 options. You can let the admin enter any name by selecting <b>Free Text</b> , or you can specify that the working environment name must have a certain prefix or suffix, that it <i>contains</i> certain characters, or that it follows rules from a regular expression (regex) you enter. |
| Tags                     | AWS tags are metadata for your AWS resources. Cloud Manager adds the tags to the Cloud Volumes ONTAP instance and each AWS resource associated with the instance.<br><br>For information about tags, refer to <a href="#">AWS Documentation: Tagging your Amazon EC2 Resources</a> .                                                                                                                                                                                                                                                                                    |

6. **Location & Connectivity:** Enter the network information that you recorded in the [AWS worksheet](#). This includes the AWS Region, VPC, Subnet, and Security Group.

If you have an AWS Outpost, you can deploy a single node Cloud Volumes ONTAP system in that Outpost by selecting the Outpost VPC. The experience is the same as any other VPC that resides in AWS.

7. **Authentication Method:** Select the SSH authentication method you want to use; either a password or a key pair.
8. **Data Encryption:** Choose no data encryption or AWS-managed encryption.

For AWS-managed encryption, you can choose a different Customer Master Key (CMK) from your account or another AWS account.

[Learn how to set up the AWS KMS for Cloud Volumes ONTAP.](#)

9. **Charging Method:** Specify which charging option would you like to use with this system.

[Learn about these charging methods.](#)

10. **NetApp Support Site Account:** Select a NetApp Support Site account.
11. **Preconfigured Packages:** Select one of the four preconfigured packages that will determine several factors for volumes created in the working environment.
12. **SMB Configuration:** If you plan to deploy volumes using SMB on this working environment, you can set up a CIFS server and related configuration elements.
13. Click **Apply** after you have defined the parameters needed for this action.

If the template values are correctly completed, a green checkmark is added to the "Create Working Environment in AWS (single node)" box.

14. You may want to add another action in this template to create a volume for this working environment. If so, click  and add that action. See how to [Create a template for a Cloud Volumes ONTAP volume](#) for details.
15. Enter the template name in the top left.
16. Click **Settings & Drift** to provide a more detailed description so that this template can be distinguished from other similar templates, and so you can enable Drift for the overall template, and then click **Apply**.  
Drift allows Cloud Manager to monitor the hard-coded values you entered for parameters when creating this template.
17. Click **Save Template**.

## Result

The template is created and you are returned to the Template Dashboard where your new template appears.

See [what you should tell your users about templates](#).

## Examples of finding existing resources and enabling services using templates

Using the *Find Existing Resources* action you can find specific working environments or find existing volumes and enable a cloud service on those volumes. This action provides a variety of filters so you can narrow your search to just the resources you are interested in.



At this time you can find volumes within Cloud Volumes ONTAP, on-premises ONTAP, and Azure NetApp Files systems only. And you can enable only Cloud Backup on Cloud Volumes ONTAP and on-premises ONTAP volumes. Additional resources and services will be available at a later time.

## Find existing volumes and activate Cloud Backup

The current *Find Existing Resources* action functionality enables you to find volumes on Cloud Volumes ONTAP and on-premises ONTAP working environments that do not currently have Cloud Backup enabled. When you enable Cloud Backup on specific volumes, this action also sets the backup policy you configure as the default policy for that working environment. So all future volumes on those working environments can use the same backup policy.

### Steps

1. Select the **AppTemplate** service, click the **Templates** tab, and click **Add New Template**.

The *Select\_a\_Template* page is displayed.

### Select a Template to Get Started

Choose a template for the type of resource you want to create and then customize the parameters for what's required in your environment.

For even greater flexibility, choose the "blank" template to mix and match configurations and to apply additional Cloud Manager services.

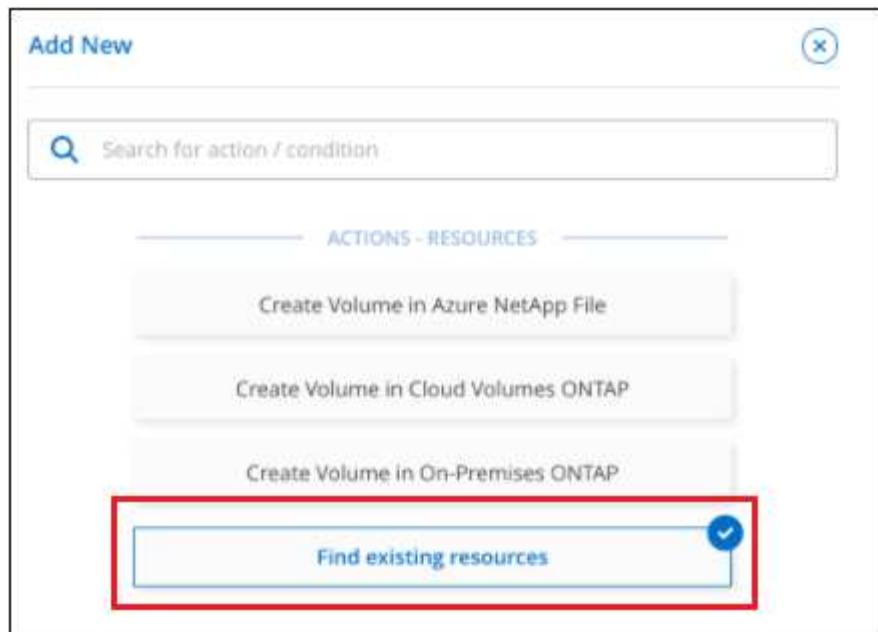
Start with a template of:

|                       |                                         |                                                      |                                            |
|-----------------------|-----------------------------------------|------------------------------------------------------|--------------------------------------------|
| <b>Blank template</b> | Volume for Cloud Volumes ONTAP + Backup | Volume for Cloud Volumes ONTAP + Backup + Data Sense | Volume for Azure NetApp files + Data Sense |
|-----------------------|-----------------------------------------|------------------------------------------------------|--------------------------------------------|

**Get Started** **Cancel**

2. Select **Blank template** and click **Get Started**.

The *Add New Action* page is displayed.



3. Select **Find Existing Resources** as the type of action you want to define, and click **Apply**.

The *Find Existing Resources Action Definition* page is displayed.

The screenshot shows the 'Find Existing Resources (#1ef)' action definition page. At the top left is the title 'Find Existing Resources (#1ef)'. To the right are a trash can icon and a close button. Below the title is the heading 'Action Definition'. Under 'Action Name' is a text input field containing 'Find Existing Resources (#1ef)'. Below 'Resource Type' is a dropdown menu with the placeholder 'Select resource type'. A list of resource types is visible in the dropdown: 'Volumes in Cloud Volumes ONTAP', 'Volumes in On-Premises ONTAP', and 'Volumes in Azure NetApp Files'. The 'Volumes in Cloud Volumes ONTAP' option is currently selected.

4. **Action Name:** Enter a customized action name instead of the default value. For example, "Find large volumes on cluster ABC and enable Backup".
5. **Resource Type:** Select the type of resource you want to find. In this case you might select **Volumes in Cloud Volumes ONTAP**.

This is the only required entry for this action. You could click **Continue** now and you'll receive a list of all volumes on all Cloud Volumes ONTAP systems in your environment.

Instead, it is recommended that you fill out a few filters to reduce the number of results (in this case,

volumes) on which you'll apply the Cloud Backup action.

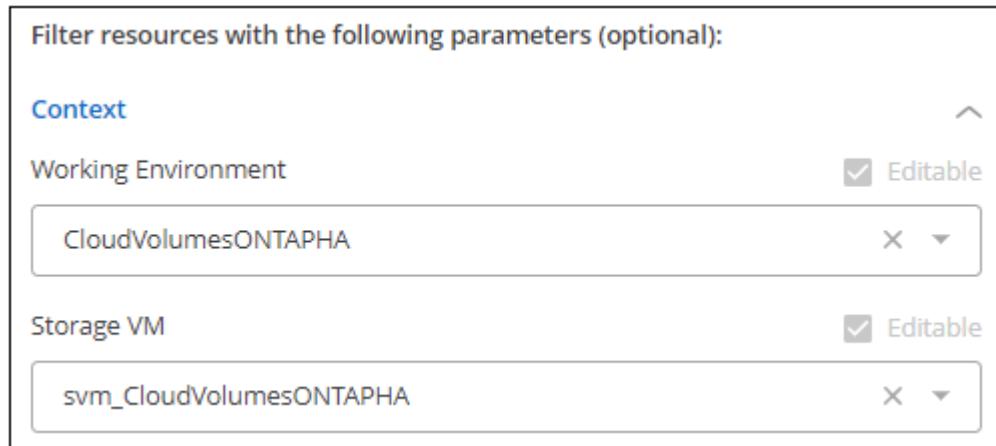
6. In the *Context* area you can select a specific working environment and some other details about that working environment.

Filter resources with the following parameters (optional):

**Context**

Working Environment  Editable  
CloudVolumesONTAPHA

Storage VM  Editable  
svm\_CloudVolumesONTAPHA



7. In the *Details* area you can select a volume name and the volume size.

For the volume name, click in the field and select one of the 5 options. You can let the admin enter any name by selecting **Free Text**, or you can specify that the volume name must have a certain prefix or suffix, that it *contains* certain characters, or that it follows rules from a regular expression (regex) you enter.

For volume size you can specify a range; for example, all volumes between 100 GiB and 500 GiB.

**Details**

Volume Name  Editable  
Select...

Volume Size (GB)

Minimum  Maximum



8. Click **Continue** and the page updates to show the Search Criteria that you've defined in the template.

**Search Criteria** 

Resource Type: Volumes in Cloud Volumes ONTAP

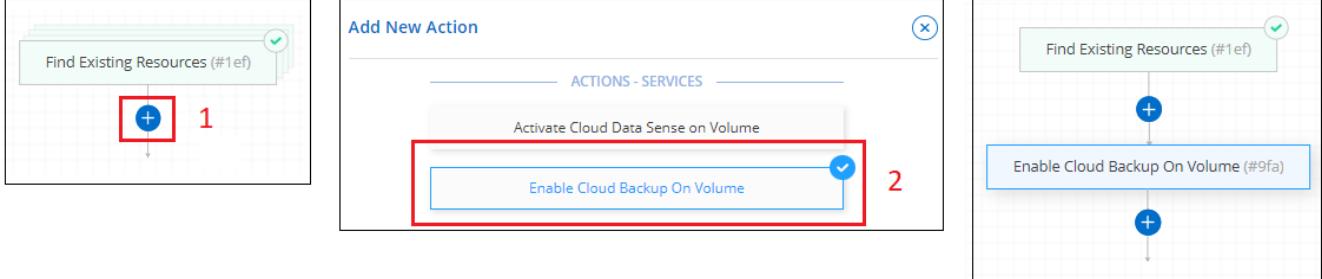
Working Environment: CloudVolumesONTAPHA

Storage VM: svm\_CloudVolumesONTAPHA

Volume Size (GB): 100 - 500

[Test your search criteria now →](#)

9. Click **Test your search criteria now** to see the current results.
    - If the results are not what you expected, click  next to *Search Criteria* and refine your search further.
    - When the results are good, click **Done**.

Your completed *Find Existing Resources* action appears in the editor window.
  10. Click the Plus sign to add another action, select **Enable Cloud Backup On Volume**, and click **Apply**.
- The *Enable Cloud Backup On Volume* action is added to the window.
- 
- ```

graph TD
    A[Find Existing Resources (#1ef)] --> B[Enable Cloud Backup On Volume (#9fa)]
  
```

11. Now you can define the Backup criteria as described in [Adding Backup functionality to a volume](#) so that the template applies the correct backup policy to the volumes you select from the *Find Existing Resources* action.
12. Click **Apply** to save the customization you made to the Backup action, and then click **Save Template** when you are done.

Result

The template is created and you are returned to the Template Dashboard where your new template appears.

See [what you should tell your users about templates](#).

Find existing working environments

Using the *Find Existing Resources* action you can find the working environment, and then use other template actions, such as creating a volume, to easily perform actions on the existing working environment.

Steps

1. Select the **AppTemplate** service, click the **Templates** tab, and click **Add New Template**.

The *Select_a_Template* page is displayed.

Select a Template to Get Started

Choose a template for the type of resource you want to create and then customize the parameters for what's required in your environment.

For even greater flexibility, choose the "blank" template to mix and match configurations and to apply additional Cloud Manager services.

Start with a template of:



<input checked="" type="radio"/> Blank template	Volume for Cloud Volumes ONTAP + Backup	Volume for Cloud Volumes ONTAP + Backup + Data Sense	Volume for Azure NetApp files + Data Sense
---	---	--	--

Get Started **Cancel**

2. Select **Blank template** and click **Get Started**.

The *Add New Action* page is displayed.

Add New

Search for action / condition

ACTIONS - RESOURCES

Create Volume in Azure NetApp File

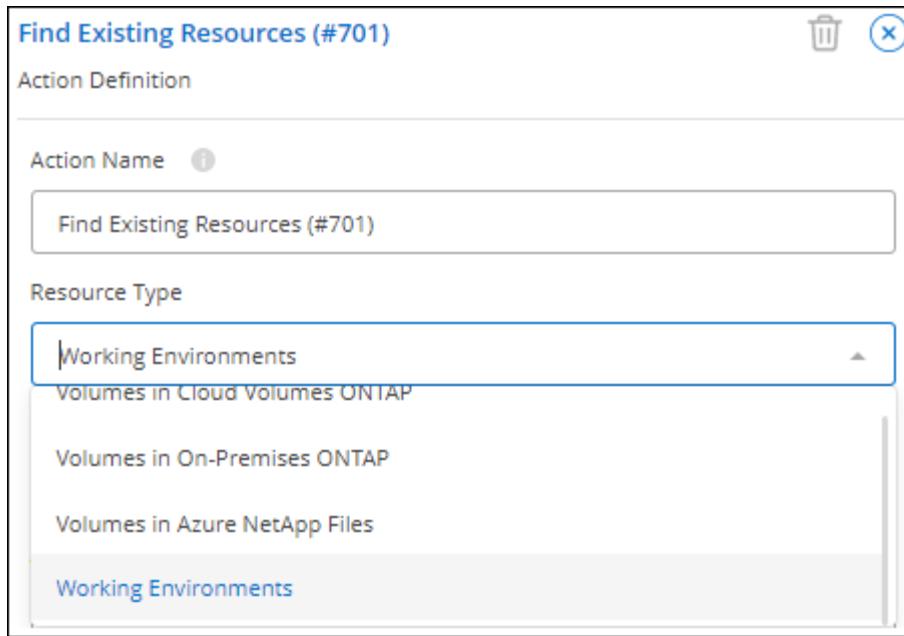
Create Volume in Cloud Volumes ONTAP

Create Volume in On-Premises ONTAP

Find existing resources

3. Select **Find Existing Resources** as the type of action you want to define, and click **Apply**.

The *Find Existing Resources Action Definition* page is displayed.



4. **Action Name:** Enter a customized action name instead of the default value. For example, "Find work environments that include Dallas".
5. **Resource Type:** Select the type of resource you want to find. In this case you would select **Working Environments**.

This is the only required entry for this action. You could click **Continue** now and you'll receive a list of all working environments in your environment.

Instead, it is recommended that you fill out a few filters to reduce the number of results (in this case, working environments).

6. After defining a few filters in the *Details* area, you can select a specific working environment.
7. Click **Continue** to save your settings, and then click **Done**.
8. Enter the template name in the top left, and then click **Save Template**

Result

The template is created and you are returned to the Template Dashboard where your new template appears.

See [what you should tell your users about templates](#).

Examples of enabling services using templates

Service templates enable you to activate Cloud Backup, Cloud Data Sense, or Replication (SnapMirror) services on a newly created volume.

Add Backup functionality to a volume

When creating a volume template, you can add in the template that you want to create backups of the volume periodically using the [Cloud Backup](#) service.



This action is not applicable for Azure NetApp Files volumes.

Enable Cloud Backup (#a09)

Action Definition

Action Name (i)

Enable Cloud Backup (#a09)

Policy - Retention & Schedule

Backup Policy Editable Drift

Select policy ▼

Context

Working Environment (i) Editable Drift

Get input value from action X ▼
 Create Volume in Cloud Volumes ONTAP (#1da) X ▼
 Working Environment X ▼

Storage VM (i) Editable Drift

Get input value from action X ▼
 Create Volume in Cloud Volumes ONTAP (#1da) X ▼
 Storage VM X ▼

Volume Name (i) Editable Drift

Get input value from action X ▼
 Create Volume in Cloud Volumes ONTAP (#1da) X ▼
 Volume Name X ▼

- 1. Policy:** Select the backup policy that you want to use.
- 2. Context:** By default, the variables are filled out for the working environment, storage VM, and volume to indicate that you will be creating backups for the volume created previously in this same template. So if that's what you want to do, you're all set.

If you want to create backups for a different volume, you can enter those details manually. See how to [complete the Context fields](#) to indicate a different volume.

3. Click **Apply** to save your changes.

Add Data Sense functionality to a volume

When creating a volume template, you can add in the template that you want to scan the volume for compliance and classification using the [Cloud Data Sense](#) service.

Activate Cloud Data Sense on Volume (#87e)

Action Definition

Action Name i

Activate Cloud Data Sense on Volume (#87e)

Context

Working Environment i

Editable Drift

Get input value from action X ▾

Create Volume in Azure NetApp Files (#a0f) X ▾

Working Environment X ▾

Volume Name i

Editable Drift

Get input value from action X ▾

Create Volume in Azure NetApp Files (#a0f) X ▾

Volume Name X ▾

Volume UUID i

Editable Drift

Get output value from action X ▾

Create Volume in Azure NetApp Files (#a0f) X ▾

uuid

Volume Path i

Editable Drift

Get input value from action X ▾

Create Volume in Azure NetApp Files (#a0f) X ▾

Volume Path X ▾

Protocol i

Editable Drift

Get output value from action X ▾

Create Volume in Azure NetApp Files (#a0f) X ▾

protocolTypes

- Context:** By default, the variables are filled out for the working environment, volume name, volume UUID, volume path, and protocol to indicate that you will be scanning data for the volume created previously in this same template. So if that's what you want to do, you're all set.

If you want to scan data for a different volume, you can enter those details manually. See how to [complete the Context fields](#) to indicate a different volume.

2. Click **Apply** to save your changes.

Add Replication functionality to a volume

When creating a volume template, you can add in the template that you want to replicate the data in the volume to another volume using the [Replication](#) service. You can replicate data to a Cloud Volumes ONTAP cluster or to an on-prem ONTAP cluster.



This action is not applicable for Azure NetApp Files volumes.

Replication functionality consists of three parts: selecting the source volume, selecting the destination volume, and defining the replication settings. Each section is described below.

1. **Source Details:** Enter the details about the source volume you want to replicate:

The screenshot shows a configuration interface for 'Source Details' across four sections: Source Working Environment, Source Storage VM, Source Volume Name, and Source intercluster LIF IPs.

- Source Working Environment:** Contains fields for 'Get input value from action', 'Create Volume in Cloud Volumes ONTAP (#b2e)', and 'Working Environment'. Both 'Editable' and 'Drift' checkboxes are present.
- Source Storage VM:** Contains fields for 'Get input value from action', 'Create Volume in Cloud Volumes ONTAP (#b2e)', and 'Storage VM'. Both 'Editable' and 'Drift' checkboxes are present.
- Source Volume Name:** Contains fields for 'Get input value from action', 'Create Volume in Cloud Volumes ONTAP (#b2e)', and 'Volume Name'. Both 'Editable' and 'Drift' checkboxes are present.
- Source intercluster LIF IPs:** Contains a field for 'Intercluster LIF IP (1)' with an 'x' button to clear it. A checked 'Editable' checkbox is present, while the 'Drift' checkbox is unchecked. A blue '+' button labeled 'Add Source intercluster LIF IPs' is located at the bottom.

- a. By default, the first three variables are filled out for the working environment, storage VM, and volume to indicate that you will be replicating the volume created previously in this same template. So if that's what you want to do, you're all set.

If you want to replicate a different volume, you can enter those details manually. See how to [complete](#)

the Context fields to indicate a different volume.

- b. Replication requires that the source and destination working environments are connected through their intercluster LIFs. Enter the intercluster LIF IP address for the source working environment.

To get this information: double-click the working environment, click the menu icon, and click Information.

2. **Destination Details:** Enter the details about the destination volume that will be created by the replication operation:

Destination Details ⓘ

Destination Working Environment	<input type="checkbox"/> Editable <input type="checkbox"/> Drift
Select destination Working Environment	
Destination Storage VM	<input type="checkbox"/> Editable <input type="checkbox"/> Drift
Select destination Storage VM	
Destination Provider	<input type="checkbox"/> Editable <input type="checkbox"/> Drift
GCP	X ⏮
<input checked="" type="checkbox"/> Enable Destination Volume Tiering	<input type="checkbox"/> Editable <input type="checkbox"/> Drift
Destination Volume name ⓘ	<input type="checkbox"/> Editable <input type="checkbox"/> Drift
Select...	
Destination intercluster LIF IPs ⓘ	<input checked="" type="checkbox"/> Editable <input type="checkbox"/> Drift
Intercluster LIF IP (1)	
Add Destination intercluster LIF IPs	
Select destination aggregate ⓘ	<input type="checkbox"/> Editable <input type="checkbox"/> Drift
Automatically manage destination aggregate (recommended)	X ⏮
Destination Disk Type	<input type="checkbox"/> Editable <input type="checkbox"/> Drift
Select destination disk type	

- a. Select the working environment where the volume will be created.
- b. Select the storage VM on which the volume will reside.
- c. When replicating a volume to a Cloud Volumes ONTAP cluster (not to an on-prem ONTAP cluster), you need to specify the Destination Provider (AWS, Azure, or GCP).
- d. When replicating a volume to a Cloud Volumes ONTAP cluster, you can specify whether volume tiering is enabled on the destination volume.

- e. For the destination volume name, click in the field and select one of the 5 options. You can let the admin enter any name by selecting **Free Text**, or you can specify that the volume name must have a certain prefix or suffix, that it *contains* certain characters, or that it follows rules from a regular expression (regex) you enter.
- f. Replication requires that the source and destination working environments are connected through their intercluster LIFs. Enter the intercluster LIF IP address for the destination working environment.
- g. Select the aggregate on which the volume will reside.
- h. When replicating a volume to a Cloud Volumes ONTAP cluster (not to an on-prem ONTAP cluster), you need to specify the type of disk that will be used for the new volume.

3. Replication Details: Enter the details about the type and frequency of the replication operation:

The screenshot shows a configuration interface for 'Replication Details'. At the top, there's a section for 'Replication Policy' with a dropdown menu labeled 'Select replication policy' and two checkboxes: 'Editable' and 'Drift'. Below that is a 'Schedule' section with a dropdown menu labeled 'Select schedule' and two checkboxes: 'Editable' and 'Drift'. Under 'Transfer Rate Limit (KB/s)', there are two radio buttons: 'Limit transfer rate' (selected) and 'Unlimited (recommended for DR only machines)'. There are also two input fields: 'Enter minimum' and 'Enter maximum', each with a 'Editable' and 'Drift' checkbox. At the bottom, there's a 'Fixed value' section with a radio button 'Enter a value for transfer rate limit' and an input field.

- a. Select the **replication policy** that you want to use.
 - b. Choose a one-time copy or a recurring replication schedule.
 - c. Enable replication health status monitoring if you want the drift report to include the replication health of the SnapMirror relationship along with the lag time, status, and last transfer time. [See what this looks like in the drift report.](#)
 - d. Select whether you want to set a transfer rate limit, and then enter the maximum rate (in kilobytes per second) at which data can be transferred. You can enter a fixed value, or you can provide a minimum and maximum and let the storage admin select a value in that range.
4. Click **Apply** to save your changes.

What to do after you have created the template

After you have created a template, you should inform your storage administrators to use the template when creating new working environments and volumes.

You can point them to [Creating resources using templates](#) for details.

Edit or delete a template

You can modify a template if you need to change any of the parameters. After you save your changes, all future resources created from the template will use the new parameter values.

You can also delete a template if you no longer need it. Deleting a template does not affect any of the resources that were created with the template. However, no Drift compliance checking can be done after the template is deleted.

The screenshot shows a table of templates. One row is selected, and a context menu is displayed to its right. The menu items are: Run Drift, Run Template, Edit Template (highlighted with a red box), Duplicate Template, and Delete Template (highlighted with a red box). The table columns include Template Name, Template Description, Created by, Last Modified, View, and Resources created.

Template Name	Template Description	Created by	Last Modified	View	Resources created	Actions
CVO volume for databases	Volume for Oracle databases requiring large and fast disks.	Onacki	Apr 05 2021, 3:32:14 pm	View	4	More Run Drift Run Template Edit Template (highlighted) Duplicate Template Delete Template (highlighted)

Make a copy of a template

You can create a copy of an existing template. This can save a lot of time in case you want to create a new template that is very similar to an existing template. Just make the duplicate with a new name, and then you can edit the template to change the couple items that make the template unique.

The screenshot shows a table of templates. A context menu is displayed over a specific template row, with 'Duplicate Template' highlighted with a red box. The table columns include Template Name, Template Description, Created by, Last Modified, View, Resources created, and Actions.

Template Name	Template Description	Created by	Last Modified	View	Resources created	Actions
Create AWS CVO (single)		Rabinovich	Aug 16 2021, 5:20:58 am	View	3	More
Create CVO volume		Rabinovich	Aug 04 2021, 9:01:01 am	View	19	Run Drift
Replication to OnPREM		Rabinovich	Aug 04 2021, 10:35:35 am	View	2	Run Template Edit Template Duplicate Template (highlighted) Delete Template

Check resources for template compliance

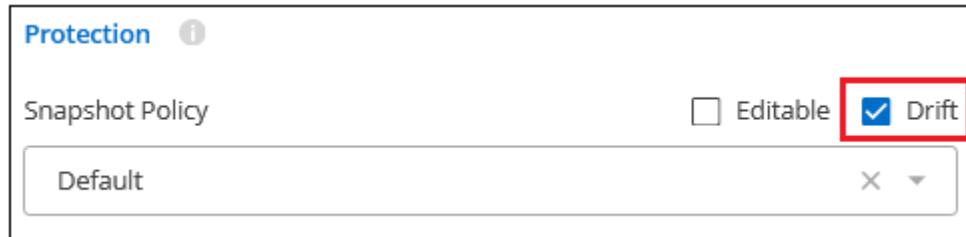
Cloud Manager can monitor the parameter values used when a resource was created with a template using the "drift" feature. Drift identifies resources that have been changed and that are no longer compliant with the template settings.

At this time, drift identifies the changed parameters in a resource — you must manually make adjustments to the resource to bring it back into compliance with the template.

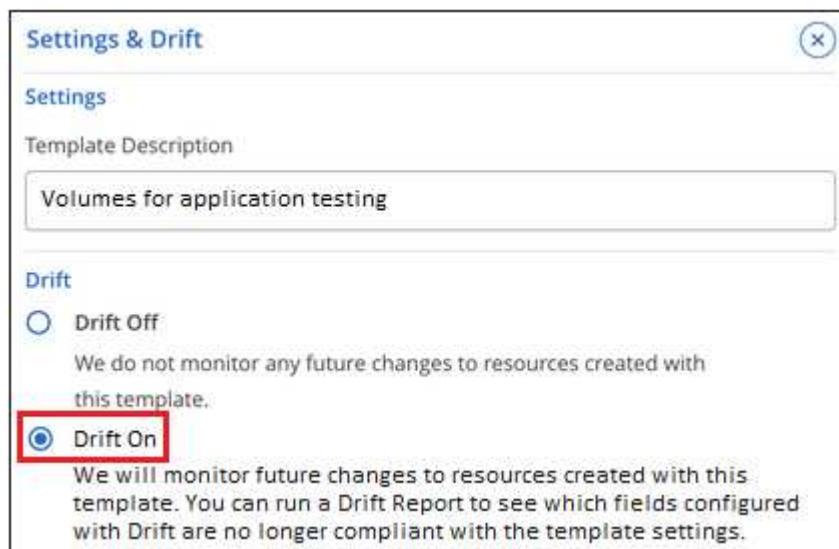
How does drift work

Drift identifies non-compliant parameters like this:

1. When creating a template, you turn drift on for certain parameters that you do not want users to change.
For example, you may require that Snapshot copies are created using the "Default" policy for all volumes created from a template.



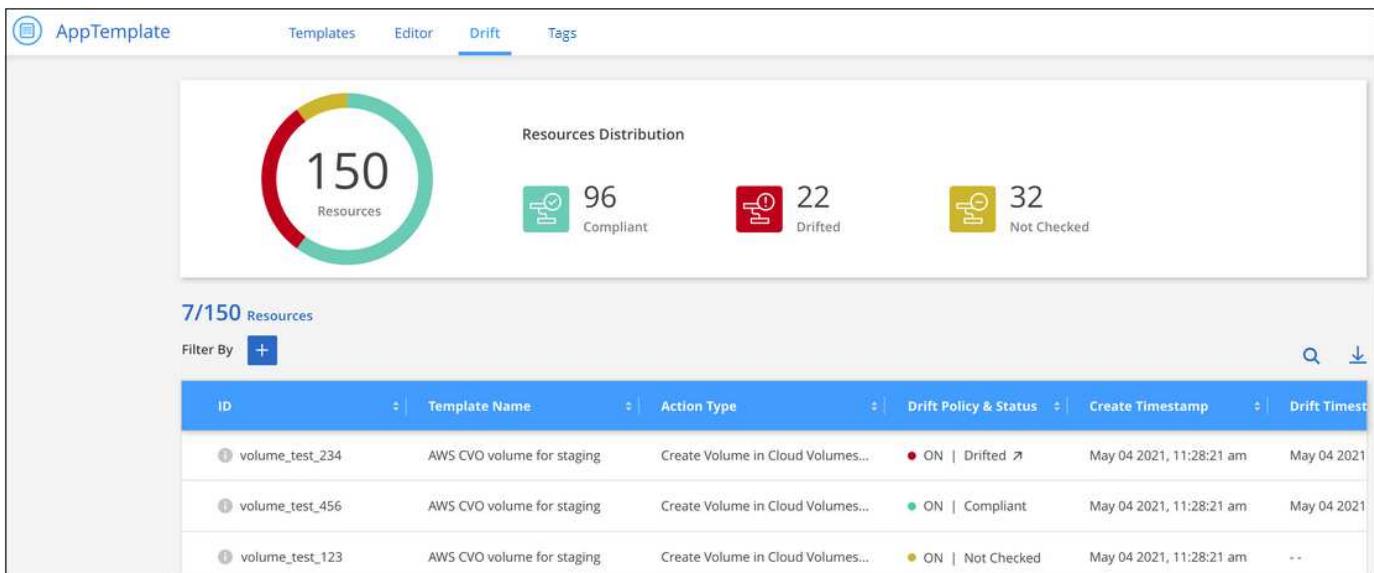
2. You turn drift on for the template, and then save the template.



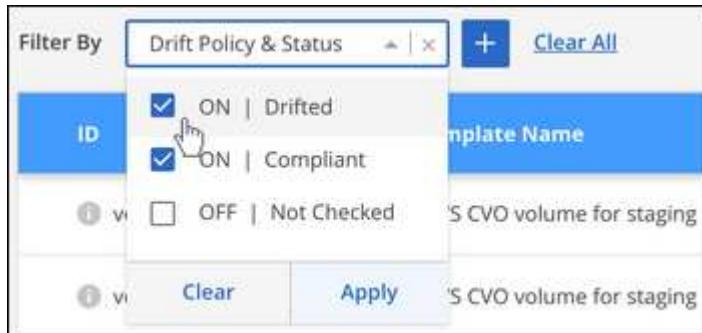
3. Storage admins run the template to create volumes.
4. Later, a storage admin edits a volume and disables Snapshot copies.
5. You run drift checking on all templates, and the AppTemplates service compares the Snapshot copies template setting to the current setting in the volume. Any non-compliant values are flagged so you can fix the incorrect setting.

The Drift Dashboard

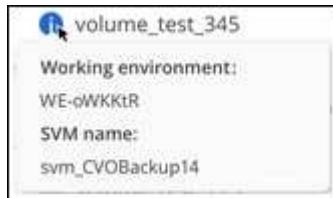
The Drift Dashboard shows the total number of resources (for example, volumes) that have been created using your templates, the number that are still compliant with the template, the number that are not compliant (drifted), and the number that were created with Drift disabled.



- The controls at the top of each column allow you to sort the results in numerical or alphabetical order.
- The **+** enables you to filter the results by Template Name, Drift Policy & Status, and Action Type. For example:



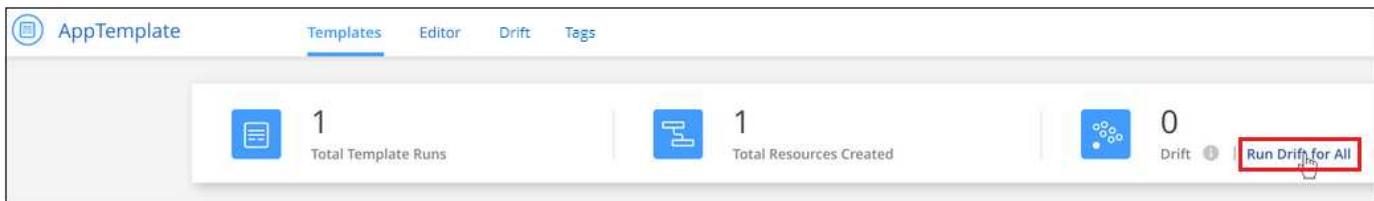
- The search bar enables you to search for a specific volume name or template name.
- To find out more details about the actual resource (or volume), such as the working environment and storage VM, you can click the **i**.



Populate the Drift Dashboard

You must run drift checking on a template before it populates the values in the Drift Dashboard.

You can run drift checking for all templates from the Templates Dashboard:



You can run drift checking on a single template from the Templates Dashboard:

The screenshot shows the 'Templates' tab selected. It displays a list of 5 templates, each with columns for Template name, Resource type, Created by, Last Modified, Parameters, and Resources created. A red box highlights the 'Run Drift' button for the second template in the list.

Template name	Resource type	Created by	Last Modified	Parameters	Resources created	Actions	
Cloud Volume ONTAP	Cloud Volume ONTAP Volume	Jhon Doe	Dec 16, 2020 02:13:59 pm UTC	10	View	0	
Cloud Volume ONTAP	Cloud Volume ONTAP Volume	Jhon Doe	Dec 16, 2020 02:13:59 pm UTC	10	View	0	Run Drift
Cloud Volume ONTAP	Cloud Volume ONTAP Volume	Jhon Doe	Dec 16, 2020 02:13:59 pm UTC	10	View	0	Run Template
Cloud Volume ONTAP	Cloud Volume ONTAP Volume	Jhon Doe	Dec 16, 2020 02:13:59 pm UTC	10	View	0	Edit Template
Cloud Volume ONTAP	Cloud Volume ONTAP Volume	Jhon Doe	Dec 16, 2020 02:13:59 pm UTC	10	View	0	Delete Template

Create a drift report for non-compliant resources

You can view a drift report for a single resource, or run a report to download a report for all resources. Using this report you can assign actions to system admins to make changes that bring the resources back into compliance with the template.

You can click the Drift icon for a resource in the Drift Dashboard to view a list of the parameters in each resource that is non-compliant.

7/150 Resources

Filter By +  

ID	Template Name	Action Type	Drift Policy & Status	Create Timestamp	Drift Times
volume_test_234	AWS CVO volume for staging	Create Volume in Cloud Volumes...	ON Drifted ↗	May 04 2021, 11:28:21 am	May 04 2021
volume_test_234	AWS CVO volume for staging	Create Volume in Cloud Volumes...	ON Drifted ↗	May 04 2021, 11:28:21 am	May 04 2021
volume_test_345	AWS CVO volum				2021

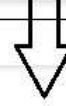
Drift Details

Resource: volume_test_234

Resource Differences

Property	Change	Expected Value	Current Value
Disk Type	Not Equal	Premium_LRS	gp2
Tiering Policy	Not Equal	all	none

Close



To view a drift report for resources that have been created from your templates, click  to download a .CSV file. The drift report reflects what is currently filtered on the page - it does not show all resources unless you haven't applied any filters on the page.

Replication health details in the drift report

When [enabling Replication on a volume using templates](#), you can choose to show more detailed replication information in the drift report by enabling drift in the "Enable replication health monitoring" field. When enabled, the drift report shows whether the health of the Replication relationship is healthy or unhealthy (drifted), along with the SnapMirror lag time, status, and last transfer time.

This screenshot shows the replication details for a SnapMirror relationship that is unhealthy in the drift report.

Drift Details

Throughput		575
Health	 Not Equal	True
Monitor		
Property	Value	
Lagtime	5 Days	
Status	Idle	
Last transfer end time	May 04 2021, 11:28:21 am	

Note: As replication is initially being applied to the volume the health will be returned as "False", meaning it is

unhealthy. After a few minutes the real replication status will be displayed.

Create or modify resources using templates

Select one of the application templates that your organization has built to create working environments or volumes that are optimized for specific workloads and applications.

Templates also enable you to activate [Cloud Backup](#), [Cloud Data Sense](#), and [Replication \(SnapMirror\)](#) on the created volumes, or on existing volumes.

Templates enable you to create volumes for Cloud Volumes ONTAP, Azure NetApp Files, and on-premises ONTAP systems.

Quick start

Get started quickly by following these steps, or scroll down to the remaining sections for full details.

1

Verify required prerequisites

- Before you can create a volume for a Cloud Volumes ONTAP, on-premises ONTAP, or Azure NetApp Files system using a template, make sure you have access to an appropriate working environment where the volume will be deployed.
- If the template activates a cloud service on the volume, such as [Cloud Backup](#) or [Cloud Data Sense](#), ensure that the service is active and licensed in your environment.

2

Launch the Application Templates service

Select the **AppTemplate** service and click the **Templates** tab.

3

Build the resource by running the template and defining parameters

Select the template, click **Run Template**, and enter values in the editable fields to create the resource.

Requirements

Read the following requirements to make sure that you have a supported configuration.

- If you don't already have a Connector, [see how to create Connectors](#) for AWS, Azure, and GCP.
- When creating a Cloud Volumes ONTAP volume, make sure you have a Cloud Volumes ONTAP working environment available.
- When creating an on-premises ONTAP volume, make sure you have an on-premises ONTAP working environment available.
- When creating an Azure NetApp Files volume, make sure you have an Azure NetApp Files working environment available.
- If the template activates a cloud service on the volume, such as [Cloud Backup](#), [Cloud Data Sense](#), or [Replication \(SnapMirror\)](#), ensure that the service is active and licensed in your environment.

Select and run a volume template

There are multiple ways to select and run a template to create new volumes:

- Run the volume template from the working environment
- Run the volume template from the Templates dashboard

Regardless of the method you choose, the details about the required volume parameters that you must define are available in these sections:

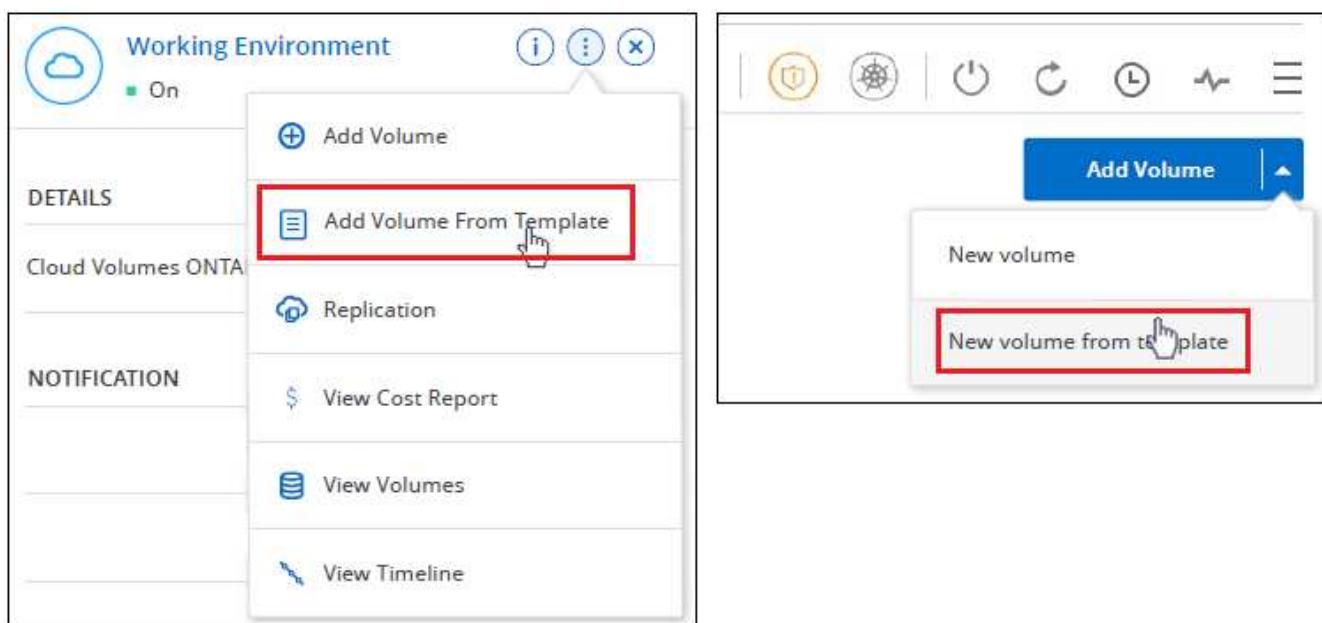
- [How to provision Cloud Volumes ONTAP volumes](#)
- [How to provision Azure NetApp Files volumes](#)
- [How to provision on-premises ONTAP volumes](#)

Run a volume template from the working environment

You can add a volume to an existing working environment from the *Working Environment* page and from the *Volume Details* page.

Steps

1. From the *Working Environment* page or from the *Volume Details* page, click **Add Volume From Template**.



The *Templates Dashboard* is displayed and it lists only those templates that are applicable to the selected working environment—for example, it only shows Cloud Volumes ONTAP templates.

2. Click **...** and **Run Template**.

The screenshot shows the AppTemplate service's Templates dashboard. At the top, there are summary metrics: 2 Total Template Runs, 147 Total Resources Created, and 0 Drift. Below this, a table lists three templates. The third template, 'CVO small volume', has a context menu open, with 'Run Template' highlighted by a red box.

Template name	Resource type	Created by	Last Modified	View	Resources created
Cloud Volume ONTAP	Cloud Volume ONTAP Volume	Jhon Doe	Dec 16, 2020 02:13:59 pm UTC	10 View	0
CVO with daily backups	Cloud Volume ONTAP Volume	Jhon Doe	Dec 16, 2020 02:13:59 pm UTC	10 View	0
CVO small volume	Cloud Volume ONTAP Volume	Jhon Doe	Dec 16, 2020 02:13:59 pm UTC	10 View	0

The *Add Volume from Template* page appears.

- Enter values in the editable fields to create the volume and click **Run Template**.

The screenshot shows the 'Add Volume From Template' page at the 'Review Template' step. It displays a list of actions and their details. One action, 'Create Volume in Cloud Volumes ONTAP (#453)', is highlighted with a green box. On the right, there is a 'Define Parameters' section for 'Volume Name' with a 'Show all Parameters' checkbox checked. The 'Volume Name' field contains 'Free text: Volume Name1'.

Run a volume template from the Templates Dashboard

You can add a volume to an existing working environment from the *Templates Dashboard*.

Steps

- Select the **AppTemplate** service and click the **Templates** tab.

The *Templates Dashboard* is displayed.

- For the template that you want to use, click **...** and **Run Template**.

The screenshot shows the AppTemplate service's Templates dashboard. At the top, there are summary statistics: 99 Total Template Runs, 76 Total Resources Created, and 0 Drift items. Below this is a table with columns: Template Name, Template Description, Created by, Last Modified, View, and Resources created. A single row is visible: 'Onprem ONTAP volume' with 'Volumes for application testing' description, created by 'Tacki' on 'Jun 03 2021, 9:41:26 am', and 0 resources created. To the right of this row is a context menu with options: Run Drift, Run Template (which is highlighted with a red box), Edit Template, and Delete Template.

The *Run Template* page appears.

3. Enter values in editable fields to create the volume and click **Run Template**.

The screenshot shows the 'Run Template' page for the 'Create Volume in On-Premises ONTAP (#43e)' action. The left side has an 'Actions' section with a 'Create Volume in On-Premises ONTAP (#43e)' button. The right side has a 'Parameters' section with a 'Context' subsection for 'Working Environment'. A checkbox 'Show read-only parameters' is present. A note at the top says: 'Enter your values for the actions. Parameters that are locked by the template are not editable.'

Note that when you run the template from the dashboard that you need to select the working environment and other variables (for example, the storage VM and/or aggregate). When you run the template from the working environment, the working environment gets filled in automatically.

Select and run a working environment template

You can create a new working environment from the *Templates Dashboard* if your company has created a template for this functionality.

If you have any questions about the details required to create the working environment, see [Launching Cloud Volumes ONTAP in AWS](#).

Steps

1. Select the **AppTemplate** service and click the **Templates** tab.

The *Templates Dashboard* is displayed.

2. For the template that you want to use, click **...** and **Run Template**.

The screenshot shows the AppTemplate service's Templates dashboard. At the top, there are summary statistics: 99 Total Template Runs, 76 Total Resources Created, and 0 Drift items. Below this is a table with columns: Template Name, Template Description, Created by, Last Modified, View, and Resources created. One row is visible, representing a template named 'CVO AWS working environment'. To the right of this row is a context menu with options: Run Drift, Run Template (which is highlighted with a red box), Edit Template, and Delete Template.

The *Run Template* page appears.

3. Enter values in editable fields to create the working environment and the first volume and click **Run Template**.

The screenshot shows the 'Run Template' page for the 'Create CVO AWS Working Environment' action. On the left, under 'Actions', there is a button labeled 'Create CVO AWS Working Environment'. On the right, under 'Parameters', there are two fields: 'Working Environment Name' (with a note: 'Working Environment Name should start with "Tom"') and 'Password' (with a note: 'Enter password'). There is also a checkbox for 'Show read-only parameters' which is unchecked.

Select and run a template that finds existing resources

You can run a template that finds certain resources (for example, volumes), and then enables a cloud service on those resources (for example, Cloud Backup), if your company has created a template using this functionality. When running the template, you can make some minor adjustments so that you apply the cloud service only to the appropriate resources.

Steps

1. Select the **AppTemplate** service and click the **Templates** tab.

The *Templates Dashboard* is displayed.

2. For the template that you want to use, click **...** and **Run Template**.

2 Templates							<input type="text"/>	Add new template
Template Name	Template Description	Created by	Created At	Last Modified	View	Resources created		
Enable FIPS 140-2	Configure SSL communication	NetApp		0	...			
Enable Backup on Existing Volumes	Find large volumes and enable Backup	Tom Onacki	Feb 03 2022, 1:37 pm	Feb 04 2022, 11:12 am	0	...	<input type="button" value="Run Template"/>	

The *Run Template* page appears and immediately runs the search that was defined in the template to find the volumes that match the criteria.

- View the list of returned volumes in the *Volume Results* area.

Run Template

Enter your values for the actions. Parameters that are locked by the template are not editable.

Actions

- + Reset Zoom

Find Existing Resources (#1ef)

Enable Cloud Backup On Volume (#fe4)

Show read-only parameters

Parameters

Search Criteria

Resource Type: Volumes in Cloud Volumes ONTAP
Working Environment: CloudVolumesONTAPHA
Storage VM: svm_CloudVolumesONTAPHA
Volume Size (GB): 100 - 500

17 Volumes Found

- VolumeName_long_string_188bbfh7
125 GB | May 11, 2021 | key_a : value_a
- VolumeName_long_string_abc
257 GB | May 17, 2021 | key_bbb : value_b1b1
- Volume_string_ffjk78s
304 GB | May 21, 2021 | key_c : value_c1

- If the results are what you expected, select the checkbox for each volume that you want to have Cloud Backup enabled using the criteria from the *Enable Cloud Backup on Volume* part of the template and click **Run Template**.

If the results are not what you expected, click next to *Search Criteria* and refine the search further.

Results

The template will run and it will enable Cloud Backup on each volume that you checked from the search criteria.

Any error will be called out in the *Running your Template* page, and you can resolve the issues if needed.

Back up data to the cloud

Learn about Cloud Backup

Cloud Backup is a service for Cloud Manager working environments that provides backup and restore capabilities for protection and long-term archive of your data. Backups are automatically generated and stored in an object store in your public or private cloud account, independent of volume Snapshot copies used for near-term recovery or cloning.

When necessary, you can restore an entire *volume*, or one or more *files*, from a backup to the same or different working environment.

[Learn more about Cloud Backup.](#)

Features

Backup features:

- Back up independent copies of your data volumes to low-cost object storage.
- Apply a single backup policy to all volumes in a cluster, or assign different backup policies to volumes that have unique recovery point objectives.
- Tier older backup files to archival storage to save costs (supported with AWS and Azure when using ONTAP 9.10.1+)
- Back up from cloud to cloud, and from on-premises systems to public or private cloud.
- For Cloud Volumes ONTAP systems, your backups can reside on a different subscription/account or different region.
- Backup data is secured with AES-256 bit encryption at-rest and TLS 1.2 HTTPS connections in-flight.
- Use your own customer-managed keys for data encryption instead of using the default encryption keys from your cloud provider.
- Support for up to 4,000 backups of a single volume.

Restore features:

- Restore data from a specific point in time.
- Restore a volume, or individual files, to the source system or to a different system.
- Restore data to a working environment using a different subscription/account or that is in a different region.
- Restores data on a block level, placing the data directly in the location you specify, all while preserving the original ACLs.
- Browsable file catalog for selecting individual files for single file restore.

Supported working environments and object storage providers

Cloud Backup enables you to back up volumes from the following working environments to object storage in the following public and private cloud providers:

Source Working Environment	Backup File Destination
Cloud Volumes ONTAP in AWS	Amazon S3
Cloud Volumes ONTAP in Azure	Azure Blob
Cloud Volumes ONTAP in Google	Google Cloud Storage
On-premises ONTAP system	Amazon S3 Azure Blob Google Cloud Storage NetApp StorageGRID
Kubernetes cluster in AWS	Amazon S3
Kubernetes cluster in Azure	Azure Blob
Kubernetes cluster in Google	Google Cloud Storage

You can restore a volume, or individual files, from a backup file to the following working environments:

Backup File		Destination Working Environment	
Location	Type	Volume Restore	File Restore
Amazon S3	ONTAP	Cloud Volumes ONTAP in AWS On-premises ONTAP system	Cloud Volumes ONTAP in AWS On-premises ONTAP system
Amazon S3	Kubernetes	Kubernetes cluster in AWS	
Azure Blob	ONTAP	Cloud Volumes ONTAP in Azure On-premises ONTAP system	Cloud Volumes ONTAP in Azure On-premises ONTAP system
Azure Blob	Kubernetes	Kubernetes cluster in Azure	
Google Cloud Storage	ONTAP	Cloud Volumes ONTAP in Google On-premises ONTAP system	
Google Cloud Storage	Kubernetes	Kubernetes cluster in Google	
NetApp StorageGRID	ONTAP	On-premises ONTAP system	

Cost

There are two types of costs associated with using Cloud Backup: resource charges and service charges.

Resource charges

Resource charges are paid to the cloud provider for object storage capacity and for running a virtual machine/instance in the cloud.

- For Backup, you pay your cloud provider for object storage costs.

Since Cloud Backup preserves the storage efficiencies of the source volume, you pay the cloud provider object storage costs for the data *after* ONTAP efficiencies (for the smaller amount of data after

deduplication and compression have been applied).

- For File Restore, you pay your cloud provider for compute costs only when the Restore instance is running.

The instance resides in the same subnet as the Connector, and it runs only when browsing a backup file to locate the individual files you want to restore. The instance is turned off when not in use to save costs.

- In AWS, the Restore instance runs on an [m5n.xlarge instance](#) with 4 CPUs, 16 GiB memory, and EBS Only instance storage. The operating system image is Amazon Linux 2.

In regions where m5n.xlarge instance isn't available, Restore runs on an m5.xlarge instance instead.

- In Azure, the Restore virtual machine runs on a [Standard_D4s_v3 VM](#) with 4 CPUs, 16 GiB memory, and a 32 GiB disk. The operating system image is CentOS 7.5).

The instance is named *Cloud-Restore-Instance* with your Account ID concatenated to it. For example: *Cloud-Restore-Instance-MyAccount*.

- For Volume Restore there is no cost because no separate instance or virtual machine is required.
- If you need to restore volume data from a backup file that has been moved to archival storage (supported with AWS and Azure when using ONTAP 9.10.1+), then there is an additional per-GB retrieval fee and per-request fee from the cloud provider.

Service charges

Service charges are paid to NetApp and cover both the cost to *create* backups and to *restore* volumes, or files, from those backups. You pay only for the data that you protect, calculated by the source logical used capacity (*before* ONTAP efficiencies) of ONTAP volumes which are backed up to object storage. This capacity is also known as Front-End Terabytes (FETB).

There are three ways to pay for the Backup service. The first option is to subscribe from your cloud provider, which enables you to pay per month. The second option is to get an annual contract - this is only available through AWS. The third option is to purchase licenses directly from NetApp. Read the [Licensing](#) section for details.

Licensing

Cloud Backup is available in three licensing options: Pay As You Go (PAYGO), an annual contract from the AWS Marketplace, and Bring Your Own License (BYOL). A 30-day free trial is available if you don't have a license.

Free trial

When using the 30-day free trial, you are notified about the number of free trial days that remain. At the end of your free trial, backups stop being created. You must subscribe to the service or purchase a license to continue using the service.

Backup files are not deleted when the service is disabled. You'll continue to be charged by your cloud provider for object storage costs for the capacity that your backups use unless you delete the backups.

Pay-as-you-go subscription

Cloud Backup offers consumption-based licensing in a pay-as-you-go model. After subscribing through your cloud provider's marketplace, you pay per GB for data that's backed up—there's no up-front payment. You are billed by your cloud provider through your monthly bill.

You should subscribe even if you have a free trial or if you bring your own license (BYOL):

- Subscribing ensures that there's no disruption of service after your free trial ends.

When the trial ends, you'll be charged hourly according to the amount of data that you back up.

- If you back up more data than allowed by your BYOL license, then data backup continues through your pay-as-you-go subscription.

For example, if you have a 10 TB BYOL license, all capacity beyond the 10 TB is charged through the PAYGO subscription.

You won't be charged from your pay-as-you-go subscription during your free trial or if you haven't exceeded your BYOL license.

[Learn how to set up a pay-as-you-go subscription.](#)

Annual contract (AWS only)

Two annual contracts are available from the AWS Marketplace:

- An annual contract that enables you to back up Cloud Volumes ONTAP data and on-premises ONTAP data.

You'll also need to pay for your Cloud Volumes ONTAP systems using this annual contract subscription since you can assign only one active subscription to your AWS credentials in Cloud Manager.

- A Professional Package that enables you to bundle Cloud Volumes ONTAP and Cloud Backup by using an annual contract for 12, 24, or 36 months. This option doesn't enable you to back up on-prem data.

You can set up the annual contract when you create a Cloud Volumes ONTAP working environment and Cloud Manager will prompt you to subscribe to the AWS Marketplace.

[Learn how to set up yearly AWS contracts.](#)

Bring your own license

BYOL is term-based (12, 24, or 36 months) *and* capacity-based in 1 TB increments. You pay NetApp to use the service for a period of time, say 1 year, and for a maximum amount capacity, say 10 TB.

You'll receive a serial number that you enter in the Cloud Manager Digital Wallet page to enable the service. When either limit is reached, you'll need to renew the license. The Backup BYOL license applies to all Cloud Volumes ONTAP and on-premises ONTAP systems associated with your [Cloud Manager account](#).

[Learn how to manage your BYOL licenses.](#)

BYOL license considerations

When using a Cloud Backup BYOL license, Cloud Manager displays a warning in the user interface when the size of all volumes you are backing up is nearing the capacity limit or nearing the license expiration date. You receive these warnings:

- When backups have reached 80% of licensed capacity, and again when you have reached the limit
- 30 days before a license is due to expire, and again when the license expires

Use the chat icon in the lower right of the Cloud Manager interface to renew your license when you see these warnings.

Two things can happen when your license expires:

- If the account you are using for your ONTAP systems has a marketplace account, the backup service continues to run, but you are shifted over to a PAYGO licensing model. You are charged for the capacity that your backups are using.
- If the account you are using for your ONTAP systems does not have a marketplace account, the backup service continues to run, but you will continue to see the warnings.

Once you renew your BYOL subscription, Cloud Manager automatically updates the license. If Cloud Manager can't access the license file over the secure internet connection (for example, when installed in a dark site), you can obtain the file yourself and manually upload it to Cloud Manager. For instructions, see [how to update a Cloud Backup license](#).

Systems that were shifted over to a PAYGO license are returned to the BYOL license automatically. And systems that were running without a license will stop seeing the warnings and will be charged for backup activity that occurred while the license was expired.

How Cloud Backup works

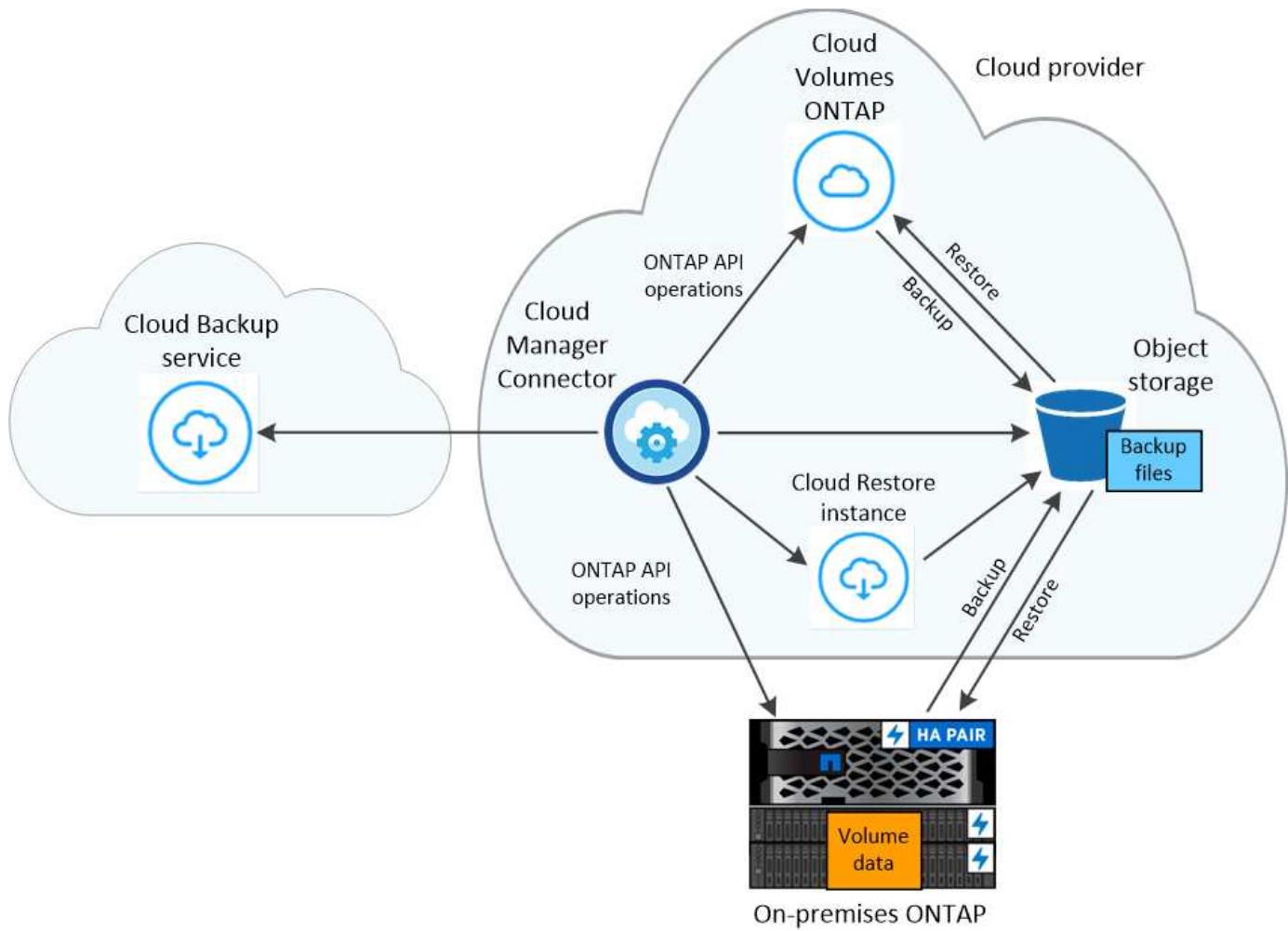
When you enable Cloud Backup on a Cloud Volumes ONTAP or on-premises ONTAP system, the service performs a full backup of your data. Volume snapshots are not included in the backup image. After the initial backup, all additional backups are incremental, which means that only changed blocks and new blocks are backed up. This keeps network traffic to a minimum.

In most cases you'll use the Cloud Manager UI for all backup operations. However, starting with ONTAP 9.9.1 you can initiate volume backup operations of your on-premises ONTAP clusters using ONTAP System Manager. See [how to use System Manager to back up your volumes to the cloud using Cloud Backup](#).



Any actions taken directly from your cloud provider environment to manage or change backup files may corrupt the files and will result in an unsupported configuration.

The following image shows the relationship between each component:



Where backups reside

Backup copies are stored in an object store that Cloud Manager creates in your cloud account. There's one object store per cluster/working environment, and Cloud Manager names the object store as follows: "netapp-backup-clusteruuid". Be sure not to delete this object store.

- In AWS, Cloud Manager enables the [Amazon S3 Block Public Access feature](#) on the S3 bucket.
- In Azure, Cloud Manager uses a new or existing resource group with a storage account for the Blob container. Cloud Manager [blocks public access to your blob data](#) by default.
- In GCP, Cloud Manager uses a new or existing project with a storage account for the Google Cloud Storage bucket.
- In StorageGRID, Cloud Manager uses an existing storage account for the object store bucket.

If you want to change the destination object store for a cluster in the future, you'll need to [unregister Cloud Backup for the working environment](#), and then enable Cloud Backup using the new cloud provider information.

Supported storage classes or access tiers

- In AWS, backups start in the *Standard* storage class and transition to the *Standard-Infrequent Access* storage class after 30 days.

If your cluster is using ONTAP 9.10.1 or greater, you can choose to tier older backups to either *S3 Glacier* or *S3 Glacier Deep Archive* storage after a certain number of days for further cost optimization. [Learn more](#)

about AWS archival storage.

- In Azure, backups are associated with the *Cool* access tier.

If your cluster is using ONTAP 9.10.1 or greater, you can choose to tier older backups to *Azure Archive* storage after a certain number of days for further cost optimization. [Learn more about Azure archival storage](#).

- In GCP, backups are associated with the *Standard* storage class by default.

You can also use the lower cost *Nearline* storage class, or the *Coldline* or *Archive* storage classes. See the Google topic [Storage classes](#) for information about changing the storage class.

- In StorageGRID, backups are associated with the *Standard* storage class.

Customizable backup schedule and retention settings per cluster

When you enable Cloud Backup for a working environment, all the volumes you initially select are backed up using the default backup policy that you define. If you want to assign different backup policies to certain volumes that have different recovery point objectives (RPO), you can create additional policies for that cluster and assign those policies to other volumes.

You can choose a combination of hourly, daily, weekly, and monthly backups of all volumes. You can also select one of the system-defined policies that provide backups and retention for 3 months, 1 year, and 7 years. These policies are:

Backup Policy Name	Backups per interval...			Max. Backups
	Daily	Weekly	Monthly	
Netapp3MonthsRetention	30	13	3	46
Netapp1YearRetention	30	13	12	55
Netapp7YearsRetention	30	53	84	167

Backup protection policies that you have created on the cluster using ONTAP System Manager or the ONTAP CLI will also appear as selections.

Once you have reached the maximum number of backups for a category, or interval, older backups are removed so you always have the most current backups.

Note that you can [create an on-demand backup of a volume](#) from the Backup Dashboard at any time, in addition to those backup files created from the scheduled backups.



The retention period for backups of data protection volumes is the same as defined in the source SnapMirror relationship. You can change this if you want by using the API.

Backups are taken at midnight

- Hourly backups start 5 minutes past the hour, every hour.
- Daily backups start just after midnight each day.
- Weekly backups start just after midnight on Sunday mornings.
- Monthly backups start just after midnight on the first day of each month.

The start time is based on the time zone set on each source ONTAP system. You can't schedule backup operations at a user-specified time from the UI. For more information, contact your System Engineer.

Backup copies are associated with your NetApp account

Backup copies are associated with the [NetApp account](#) in which the Connector resides.

If you have multiple Connectors in the same NetApp account, each Connector will display the same list of backups. That includes the backups associated with Cloud Volumes ONTAP and on-premises ONTAP instances from other Connectors.

FabricPool tiering policy considerations

There are certain things you need to be aware of when the volume you are backing up resides on a FabricPool aggregate and it has an assigned policy other than `none`:

- The first backup of a FabricPool-tiered volume requires reading all local and all tiered data (from the object store). A backup operation does not "reheat" the cold data tiered in object storage.

This operation could cause a one-time increase in cost to read the data from your cloud provider.

- Subsequent backups are incremental and do not have this effect.
- If the tiering policy is assigned to the volume when it is initially created you will not see this issue.

- Consider the impact of backups before assigning the `all` tiering policy to volumes. Because data is tiered immediately, Cloud Backup will read data from the cloud tier rather than from the local tier. Because concurrent backup operations share the network link to the cloud object store, performance degradation might occur if network resources become saturated. In this case, you may want to proactively configure multiple network interfaces (LIFs) to decrease this type of network saturation.

Supported volumes

Cloud Backup supports FlexVol read-write volumes and SnapMirror data protection (DP) destination volumes.

FlexGroup volumes and SnapLock volumes aren't currently supported.

Limitations

- The ability to tier older backup files to archival storage requires that the cluster is running ONTAP 9.10.1 or greater (supported currently with AWS and Azure). Restoring volumes from backup files that reside in archival storage also requires that the destination cluster is running ONTAP 9.10.1+.
- When creating or editing a backup policy when no volumes are assigned to the policy, the number of retained backups can be a maximum of 1018. As a workaround you can reduce the number of backups to create the policy. Then you can edit the policy to create up to 4000 backups after you assign volumes to the policy.
- When backing up data protection (DP) volumes, relationships with the following SnapMirror labels won't be backed up to cloud:
 - `app_consistent`
 - `all_source_snapshot`
- SVM-DR volume backup is supported with the following restrictions:
 - Backups are supported from the ONTAP secondary only.

- The Snapshot policy applied to the volume must be one of the policies recognized by Cloud Backup, including daily, weekly, monthly, etc. The default "sm_created" policy (used for **Mirror All Snapshots**) is not recognized and the DP volume will not be shown in the list of volumes that can be backed up.
- Ad-hoc volume backups using the **Backup Now** button aren't supported on data protection volumes.
- SM-BC configurations are not supported.
- MetroCluster (MCC) backup is supported from ONTAP secondary only: MCC > SnapMirror > ONTAP > Cloud Backup > object storage.
- ONTAP doesn't support fan-out of SnapMirror relationships from a single volume to multiple object stores; therefore, this configuration is not supported by Cloud Backup.
- WORM/Compliance mode on an object store is not supported.

Single File Restore limitations

- Single file restore can restore up to 100 individual files at a time. There is currently no support for restoring folders/directories.
- The file being restored must be using the same language as the language on the destination volume. You will receive an error message if the languages are not the same.
- File level restore is not supported when using the same account with different Cloud Managers in different subnets.

Back up Cloud Volumes ONTAP data

Backing up Cloud Volumes ONTAP data to Amazon S3

Complete a few steps to get started backing up data from Cloud Volumes ONTAP to Amazon S3.

Quick start

Get started quickly by following these steps or scroll down to the remaining sections for full details.

1

Verify support for your configuration

- You're running Cloud Volumes ONTAP 9.6 or later in AWS.
- You have a valid cloud provider subscription for the storage space where your backups will be located.
- You have subscribed to the [Cloud Manager Marketplace Backup offering](#), an [AWS annual contract](#), or you have purchased [and activated](#) a Cloud Backup BYOL license from NetApp.
- The IAM role that provides the Cloud Manager Connector with permissions includes S3 permissions from the latest [Cloud Manager policy](#).

2

Enable Cloud Backup on your new or existing system

- New systems: Cloud Backup is enabled by default in the working environment wizard. Be sure to keep the option enabled.
- Existing systems: Select the working environment and click **Enable** next to the Backup & Restore service in the right-panel, and then follow the setup wizard.



3

Enter the provider details

Select the AWS Account and the region where you want to create the backups. You can also choose your own customer-managed key for data encryption instead of using the default Amazon S3 encryption key.

The screenshot shows the 'Provider Settings' page. On the left, under 'Provider Information', there is a dropdown for 'AWS Account' containing 'AWS_Account_1'. Below it are fields for 'AWS Access Key' (with placeholder 'Enter AWS Access Key') and 'AWS Secret Key' (with placeholder 'Enter AWS Secret Key'). On the right, under 'Location & Connectivity', there is a dropdown for 'Region' set to 'us-east-2'. Below it is an 'Encryption' section showing 'Encryption Key Type: AWS SSE-S3' and a 'Change Key' link.

4

Define the default backup policy

The default policy backs up volumes every day and retains the most recent 30 backup copies of each volume. Change to hourly, daily, weekly, or monthly backups, or select one of the system-defined policies that provide more options. You can also change the number of backup copies you want to retain.

Backups are stored in S3 Standard storage by default. If your cluster is using ONTAP 9.10.1 or greater, you can choose to tier backups to either S3 Glacier or S3 Glacier Deep Archive storage after a certain number of days for further cost optimization.

Define Policy

This policy is applied to the volumes you select in the next step. You can apply different policies to volumes after activating backup.

Policy - Retention & Schedule Create a New Policy Select an Existing Policy

<input type="checkbox"/> Hourly	Number of backups to retain	24
<input checked="" type="checkbox"/> Daily	Number of backups to retain	30
<input type="checkbox"/> Weekly	Number of backups to retain	52
<input type="checkbox"/> Monthly	Number of backups to retain	12

Archival Policy

Backups reside in S3 Standard storage for frequently accessed data. Optionally, you can tier backups to either S3 Glacier or S3 Glacier Deep Archive storage for further cost optimization.

Tier Backups to Archival

Archive after (Days)	Storage Class
30	S3 Glacier
	S3 Glacier
	S3 Glacier Deep Archive

S3 Bucket

Cloud Manager will create the S3 bucket for you during the wizard

5

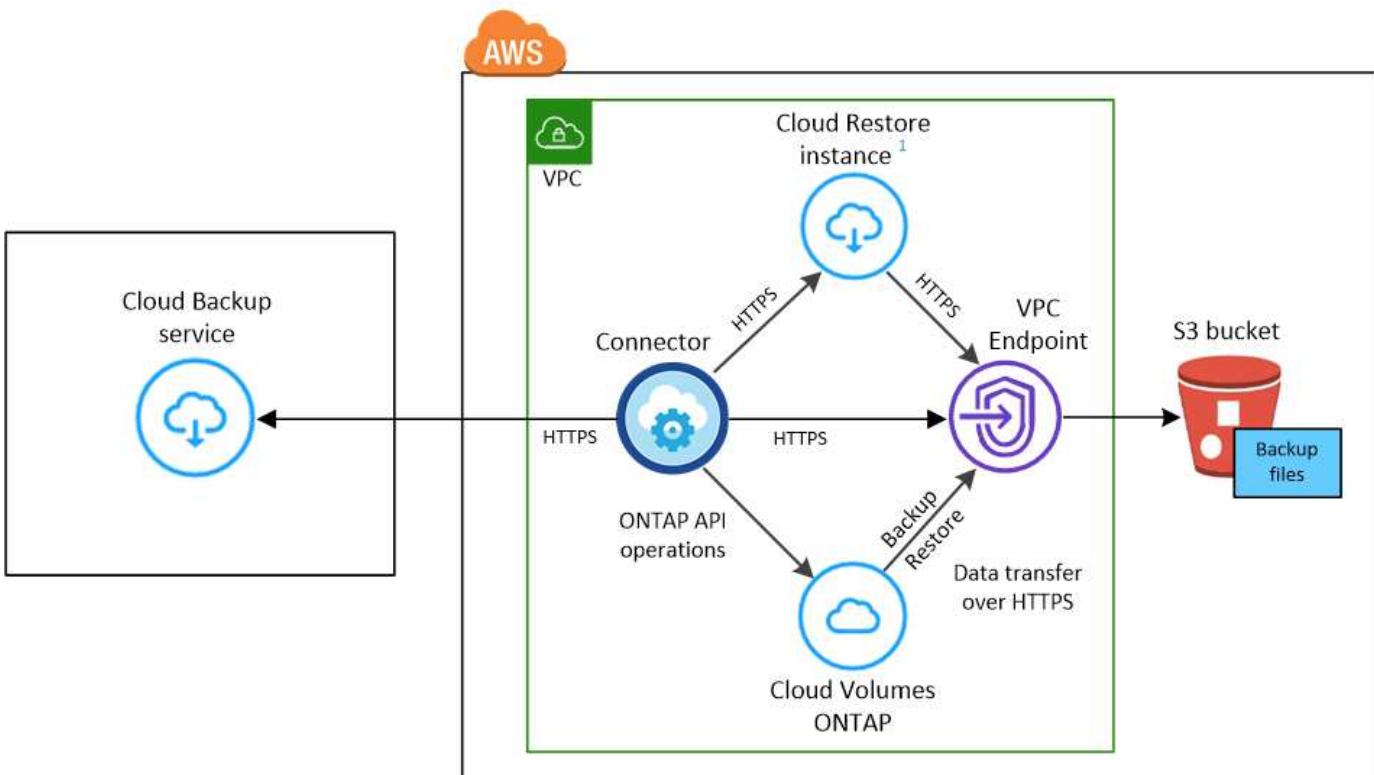
Select the volumes that you want to back up

Identify which volumes you want to back up using the default backup policy in the Select Volumes page. If you want to assign different backup policies to certain volumes, you can create additional policies and apply them to volumes later.

Requirements

Read the following requirements to make sure that you have a supported configuration before you start backing up volumes to S3.

The following image shows each component and the connections that you need to prepare between them:



¹ Cloud Restore instance is active only during single-file restore operations.

When the Cloud Restore instance is deployed in the cloud, it is located in the same subnet as the Connector.

Supported ONTAP versions

Cloud Volumes ONTAP 9.6 and later.

License requirements

For Cloud Backup PAYGO licensing, a Cloud Manager subscription is available in the AWS Marketplace that enables deployments of Cloud Volumes ONTAP and Cloud Backup. You need to [subscribe to this Cloud Manager subscription](#) before you enable Cloud Backup. Billing for Cloud Backup is done through this subscription.

For an annual contract that enables you to back up both Cloud Volumes ONTAP data and on-premises ONTAP data, you need to subscribe from the [AWS Marketplace page](#) and then [associate the subscription with your AWS credentials](#).

For an annual contract that enables you to bundle Cloud Volumes ONTAP and Cloud Backup, you must set up the annual contract when you create a Cloud Volumes ONTAP working environment. This option doesn't enable you to back up on-prem data.

For Cloud Backup BYOL licensing, you need the serial number from NetApp that enables you to use the service for the duration and capacity of the license. [Learn how to manage your BYOL licenses](#).

And you need to have an AWS account for the storage space where your backups will be located.

Supported AWS regions

Cloud Backup is supported in all AWS regions [where Cloud Volumes ONTAP is supported](#); including AWS GovCloud regions.

Required setup for creating backups in a different AWS account

By default, backups are created using the same account as the one used for your Cloud Volumes ONTAP system. If you want to use a different AWS account for your backups, you must [log in to the AWS portal and link the two accounts](#).

Required information for using customer-managed keys for data encryption

You can choose your own customer-managed keys for data encryption in the activation wizard instead of using the default Amazon S3 encryption keys. In this case you'll need to have the encryption managed keys already set up. [See how to use your own keys](#).

AWS Backup permissions required

The IAM role that provides Cloud Manager with permissions must include S3 permissions from the latest [Cloud Manager policy](#).

Here are the specific permissions from the policy:

```
{  
    "Sid": "backupPolicy",  
    "Effect": "Allow",  
    "Action": [  
        "s3:DeleteBucket",  
        "s3:GetLifecycleConfiguration",  
        "s3:PutLifecycleConfiguration",  
        "s3:PutBucketTagging",  
        "s3>ListBucketVersions",  
        "s3:GetObject",  
        "s3>DeleteObject",  
        "s3>ListBucket",  
        "s3>ListAllMyBuckets",  
        "s3:GetBucketTagging",  
        "s3:GetBucketLocation",  
        "s3:GetBucketPolicyStatus",  
        "s3:GetBucketPublicAccessBlock",  
        "s3:GetBucketAcl",  
        "s3:GetBucketPolicy",  
        "s3:PutBucketPublicAccessBlock"  
    ],  
    "Resource": [  
        "arn:aws:s3:::netapp-backup-*"  
    ]  
},
```

AWS Restore permissions required

The following EC2 permissions are needed for the IAM role that provides Cloud Manager with permissions so that it can start, stop, and terminate the Cloud Restore instance:

```

    "Action": [
        "ec2:DescribeInstanceTypeOfferings",
        "ec2:StartInstances",
        "ec2:StopInstances",
        "ec2:TerminateInstances"
    ],

```

Required outbound internet access for AWS deployments

The Cloud Restore instance requires outbound internet access. If your virtual or physical network uses a proxy server for internet access, ensure that the instance has outbound internet access to contact the following endpoints.

Endpoints	Purpose
http://amazonlinux.us-east-1.amazonaws.com/2/extras/docker/stable/x86_64/4bf88ee77c395ffe1e0c3ca68530dfb3a683ec65a4a1ce9c0ff394be50e922b2/	CentOS package for the Cloud Restore Instance AMI.
http://cloudmanagerinfraprod.azurecr.io https://cloudmanagerinfraprod.azurecr.io	Cloud Restore Instance image repository.

Enabling Cloud Backup on a new system

Cloud Backup is enabled by default in the working environment wizard. Be sure to keep the option enabled.

See [Launching Cloud Volumes ONTAP in AWS](#) for requirements and details for creating your Cloud Volumes ONTAP system.

Steps

1. Click **Create Cloud Volumes ONTAP**.
2. Select Amazon Web Services as the cloud provider and then choose a single node or HA system.
3. Fill out the Details & Credentials page.
4. On the Services page, leave the service enabled and click **Continue**.



5. Complete the pages in the wizard to deploy the system.

Result

Cloud Backup is enabled on the system and backs up volumes every day and retains the most recent 30 backup copies.

What's next?

You can [start and stop backups for volumes or change the backup schedule](#).

You can also [restore entire volumes or individual files from a backup file to a Cloud Volumes ONTAP system in AWS, or to an on-premises ONTAP system](#).

Enabling Cloud Backup on an existing system

Enable Cloud Backup at any time directly from the working environment.

Steps

1. Select the working environment and click **Enable** next to the Backup & Restore service in the right-panel.



2. Select the provider details and click **Next**.

- a. The AWS Account used to store the backups. This can be a different account than where the Cloud Volumes ONTAP system resides.

If you want to use a different AWS account for your backups, you must [log in to the AWS portal and link the two accounts](#).

- b. The region where the backups will be stored. This can be a different region than where the Cloud Volumes ONTAP system resides.
- c. Whether you'll use the default Amazon S3 encryption keys or choose your own customer-managed keys from your AWS account to manage encryption of your data. ([See how to use your own encryption keys](#)).

A screenshot of a 'Provider Settings' configuration page. It is divided into two main sections: 'Provider Information' on the left and 'Location & Connectivity' on the right. In the 'Provider Information' section, there are three input fields: 'AWS Account' (containing 'AWS_Account_1'), 'AWS Access Key' (with placeholder text 'Enter AWS Access Key'), and 'AWS Secret Key' (with placeholder text 'Enter AWS Secret Key'). In the 'Location & Connectivity' section, there are two input fields: 'Region' (containing 'us-east-2') and 'Encryption' (with a small info icon). Below the 'Encryption' field, it says 'Encryption Key Type: AWS SSE-S3' and has a 'Change Key' button with a pencil icon.

3. Enter the default backup policy details and click **Next**.

- a. Define the backup schedule and choose the number of backups to retain. [See the list of existing policies you can choose](#).
- b. When using ONTAP 9.10.1 and greater, you can choose to tier backups to either S3 Glacier or S3 Glacier Deep Archive storage after a certain number of days for further cost optimization. [Learn more about using archival tiers](#).

Define Policy

This policy is applied to the volumes you select in the next step. You can apply different policies to volumes after activating backup.

Policy - Retention & Schedule

Create a New Policy Select an Existing Policy

<input type="checkbox"/> Hourly	Number of backups to retain	24	<input type="button" value="▼"/>
<input checked="" type="checkbox"/> Daily	Number of backups to retain	30	<input type="button" value="▼"/>
<input type="checkbox"/> Weekly	Number of backups to retain	52	<input type="button" value="▼"/>
<input type="checkbox"/> Monthly	Number of backups to retain	12	<input type="button" value="▼"/>

Archival Policy

Backups reside in S3 Standard storage for frequently accessed data. Optionally, you can tier backups to either S3 Glacier or S3 Glacier Deep Archive storage for further cost optimization.

Tier Backups to Archival

Archive after (Days)	Storage Class
30	S3 Glacier
	S3 Glacier
	S3 Glacier Deep Archive

S3 Bucket

Cloud Manager will create the S3 bucket for you. [Create Wizard](#)

- Select the volumes that you want to back up using the default backup policy in the Select Volumes page. If you want to assign different backup policies to certain volumes, you can create additional policies and apply them to those volumes later.

Select Volumes

57 Volumes 🔍

<input checked="" type="checkbox"/>	Volume Name	Volume Type	SVM Name	Used Capacity	Allocated Capacity	Backup Status
<input checked="" type="checkbox"/>	Volume_Name_1 ■ On	RW	SVM_Name_1	0.25 TB	10 TB	<input type="radio"/> Not Active
<input checked="" type="checkbox"/>	Volume_Name_2 ■ On	RW	SVM_Name_1	0.25 TB	10 TB	<input type="radio"/> Not Active
<input checked="" type="checkbox"/>	Volume_Name_3 ■ On	RW	SVM_Name_1	0.25 TB	10 TB	<input type="radio"/> Not Active
<input checked="" type="checkbox"/>	Volume_Name_4 ■ On	DP	SVM_Name_2	0.25 TB	10 TB	<input type="radio"/> Not Active
<input checked="" type="checkbox"/>	Volume_Name_5 ■ On	RW	SVM_Name_1	0.25 TB	10 TB	<input type="radio"/> Not Active
<input checked="" type="checkbox"/>	Automatically back up future volumes on all storage VMs with the selected backup policy ⓘ					

- To back up all volumes, check the box in the title row (**Volume Name**).
 - To back up individual volumes, check the box for each volume (Volume_1).
- If you want all volumes added in the future to have backup enabled, just leave the checkbox for "Automatically back up future volumes..." checked. If you disable this setting, you'll need to manually enable backups for future volumes.
 - Click **Activate Backup** and Cloud Backup starts taking the initial backups of each selected volume.

Result

Cloud Backup starts taking the initial backups of each selected volume and the Volume Backup Dashboard is displayed so you can monitor the state of the backups.

What's next?

You can [start and stop backups for volumes or change the backup schedule](#).

You can also [restore entire volumes or individual files from a backup file to a Cloud Volumes ONTAP system in AWS, or to an on-premises ONTAP system](#).

Backing up Cloud Volumes ONTAP data to Azure Blob storage

Complete a few steps to get started backing up data from Cloud Volumes ONTAP to Azure Blob storage.

Quick start

Get started quickly by following these steps or scroll down to the remaining sections for full details.

1

Verify support for your configuration

- You're running Cloud Volumes ONTAP 9.7P5 or later in Azure.
- You have a valid cloud provider subscription for the storage space where your backups will be located.
- You have subscribed to the [Cloud Manager Marketplace Backup offering](#), or you have purchased [and activated](#) a Cloud Backup BYOL license from NetApp.

2

Enable Cloud Backup on your new or existing system

- New systems: Cloud Backup is enabled by default in the working environment wizard. Be sure to keep the option enabled.
- Existing systems: Select the working environment and click **Enable** next to the Backup & Restore service in the right-panel, and then follow the setup wizard.



3

Enter the provider details

Select the provider subscription and region, and choose whether you want to create a new resource group or use an already existing resource group. You can also choose your own customer-managed keys for data encryption instead of using the default Microsoft-managed encryption key.

Provider Settings

Azure Subscription	Region
Azure_Subscription_1	Default_CM_Region
Resource Group	Encryption Managed Keys
<input checked="" type="radio"/> Create a new <input type="radio"/> Use an existing	<input checked="" type="radio"/> Microsoft-managed <input type="radio"/> Customer-managed
Resource Group Name	

4

Define the default backup policy

The default policy backs up volumes every day and retains the most recent 30 backup copies of each volume. Change to hourly, daily, weekly, or monthly backups, or select one of the system-defined policies that provide more options. You can also change the number of backup copies you want to retain.

By default, backups are stored in the Cool access tier. If your cluster is using ONTAP 9.10.1 or greater, you can choose to tier backups to Azure Archive storage after a certain number of days for further cost optimization.

Define Policy

This policy is applied to the volumes you select in the next step. You can apply different policies to volumes after activating backup.

Policy - Retention & Schedule	<input checked="" type="radio"/> Create a New Policy <input type="radio"/> Select an Existing Policy	
<input type="checkbox"/> Hourly	Number of backups to retain	24
<input checked="" type="checkbox"/> Daily	Number of backups to retain	30
<input type="checkbox"/> Weekly	Number of backups to retain	52
<input type="checkbox"/> Monthly	Number of backups to retain	12
Archival Policy		
Backups reside in Cool Azure Blob storage for frequently accessed data.		
Optionally, you can tier backups to Azure Archive storage for further cost optimization.		
<input checked="" type="checkbox"/> Tier Backups to Archival		
Archive after (Days)	Access Tier	
30	Azure Archive	
Storage Account	Cloud Manager will create the storage account after you complete the wizard	

5

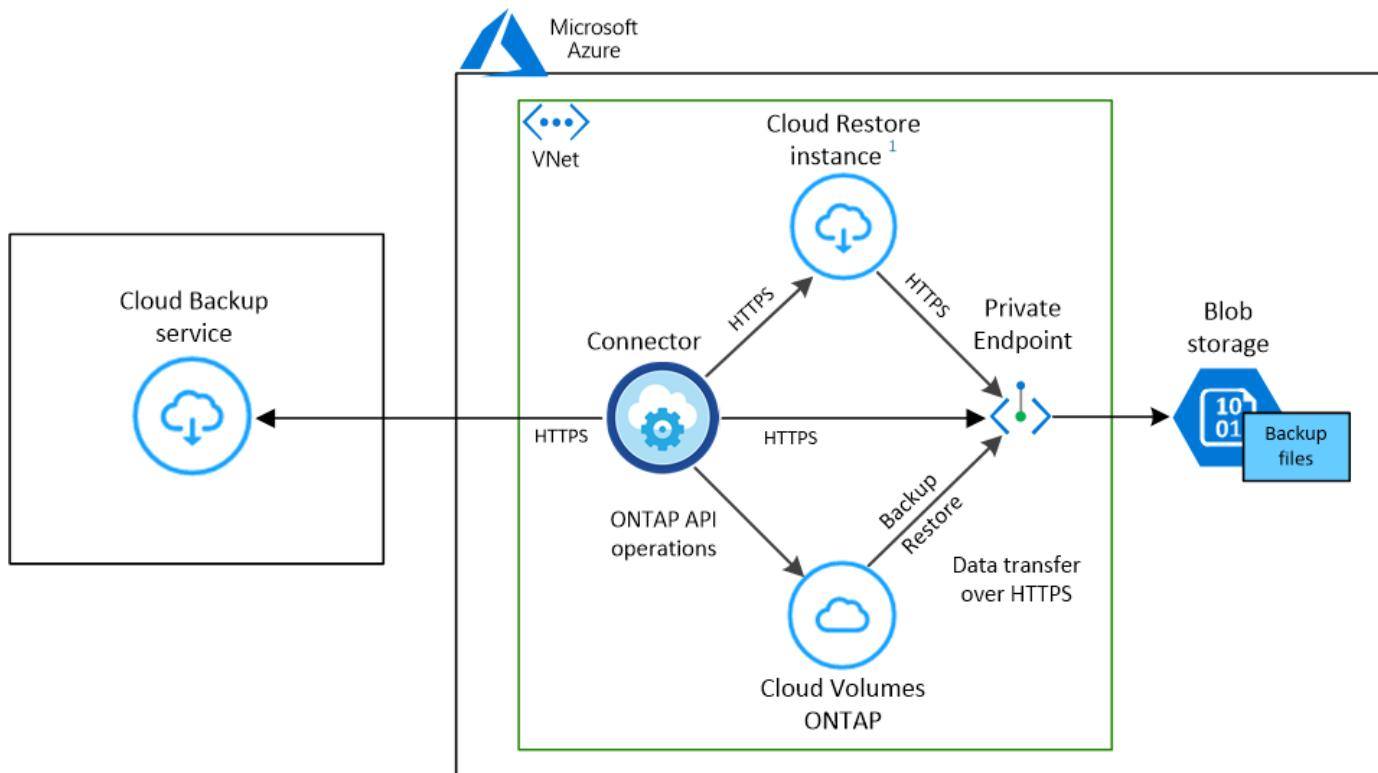
Select the volumes that you want to back up

Identify which volumes you want to back up using the default backup policy in the Select Volumes page. If you want to assign different backup policies to certain volumes, you can create additional policies and apply them to volumes later.

Requirements

Read the following requirements to make sure that you have a supported configuration before you start backing up volumes to Azure Blob storage.

The following image shows each component and the connections that you need to prepare between them:



When the Cloud Restore virtual machine is deployed in the cloud, it is located in the same subnet as the Connector.

Supported ONTAP versions

Cloud Volumes ONTAP 9.7P5 and later.

License requirements

For Cloud Backup PAYGO licensing, a subscription through the Azure Marketplace is required before you enable Cloud Backup. Billing for Cloud Backup is done through this subscription. [You can subscribe from the Details & Credentials page of the working environment wizard.](#)

For Cloud Backup BYOL licensing, you need the serial number from NetApp that enables you to use the service for the duration and capacity of the license. [Learn how to manage your BYOL licenses.](#)

And you need to have a Microsoft Azure subscription for the storage space where your backups will be located.

Supported Azure regions

Cloud Backup is supported in all Azure regions [where Cloud Volumes ONTAP is supported](#); including Azure Government regions.

Required setup for creating backups in a different Azure subscription

By default, backups are created using the same subscription as the one used for your Cloud Volumes ONTAP system. If you want to use a different Azure subscription for your backups, you must [log in to the Azure portal and link the two subscriptions](#).

Required information for using customer-managed keys for data encryption

You can use your own customer-managed keys for data encryption in the activation wizard instead of using the default Microsoft-managed encryption keys. In this case you will need to have the Azure Subscription, Key Vault name, and the Key. [See how to use your own keys](#).

Required outbound internet access for Azure deployments

The Cloud Restore virtual machine requires outbound internet access. If your virtual or physical network uses a proxy server for internet access, ensure that the instance has outbound internet access to contact the following endpoints.

Endpoints	Purpose
http://olcentgbl.trafficmanager.net https://olcentgbl.trafficmanager.net	Provides CentOS packages for the Cloud Restore virtual machine.
http://cloudmanagerinfraprod.azurecr.io https://cloudmanagerinfraprod.azurecr.io	Cloud Restore virtual machine image repository.

Enabling Cloud Backup on a new system

Cloud Backup is enabled by default in the working environment wizard. Be sure to keep the option enabled.

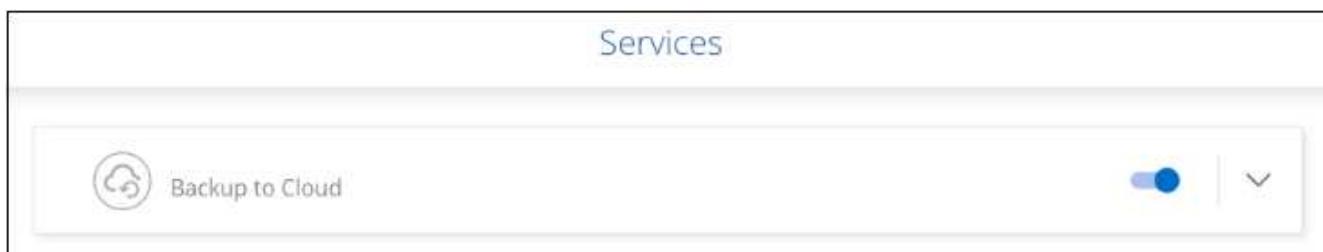
See [Launching Cloud Volumes ONTAP in Azure](#) for requirements and details for creating your Cloud Volumes ONTAP system.



If you want to pick the name of the resource group, **disable** Cloud Backup when deploying Cloud Volumes ONTAP. Follow the steps for [enabling Cloud Backup on an existing system](#) to enable Cloud Backup and choose the resource group.

Steps

1. Click **Create Cloud Volumes ONTAP**.
2. Select Microsoft Azure as the cloud provider and then choose a single node or HA system.
3. In the Define Azure Credentials page, enter the credentials name, client ID, client secret, and directory ID, and click **Continue**.
4. Fill out the Details & Credentials page and be sure that an Azure Marketplace subscription is in place, and click **Continue**.
5. On the Services page, leave the service enabled and click **Continue**.



6. Complete the pages in the wizard to deploy the system.

Result

Cloud Backup is enabled on the system and backs up volumes every day and retains the most recent 30 backup copies.

What's next?

You can [start and stop backups for volumes or change the backup schedule](#).

You can also [restore entire volumes or individual files from a backup file to a Cloud Volumes ONTAP system in Azure, or to an on-premises ONTAP system](#).

Enabling Cloud Backup on an existing system

Enable Cloud Backup at any time directly from the working environment.

Steps

1. Select the working environment and click **Enable** next to the Backup & Restore service in the right-panel.



2. Select the provider details and click **Next**.

- a. The Azure subscription used to store the backups. This can be a different subscription than where the Cloud Volumes ONTAP system resides.

If you want to use a different Azure subscription for your backups, you must [log in to the Azure portal and link the two subscriptions](#).

- b. The region where the backups will be stored. This can be a different region than where the Cloud Volumes ONTAP system resides.
- c. The resource group that manages the Blob container - you can create a new resource group or select an existing resource group.
- d. Whether you'll use the default Microsoft-managed encryption key or choose your own customer-managed keys to manage encryption of your data. ([See how to use your own keys](#)).

A screenshot of the 'Provider Settings' dialog box. It contains several configuration fields:

- Azure Subscription:** A dropdown menu set to "Azure_Subscription_1".
- Region:** A dropdown menu set to "Default_CM_Region".
- Resource Group:** A text input field with a placeholder "Resource Group Name".
- Encryption Managed Keys:** A radio button group where "Microsoft-managed" is selected, while "Customer-managed" is unselected.

3. Enter the default backup policy details and click **Next**.

- Define the backup schedule and choose the number of backups to retain. [See the list of existing policies you can choose](#).
- When using ONTAP 9.10.1 and greater, you can choose to tier backups to Azure Archive storage after a certain number of days for further cost optimization. [Learn more about using archival tiers](#).

Define Policy

This policy is applied to the volumes you select in the next step. You can apply different policies to volumes after activating backup.

Policy - Retention & Schedule Create a New Policy Select an Existing Policy

<input type="checkbox"/> Hourly	Number of backups to retain	24
<input checked="" type="checkbox"/> Daily	Number of backups to retain	30
<input type="checkbox"/> Weekly	Number of backups to retain	52
<input type="checkbox"/> Monthly	Number of backups to retain	12

Archival Policy

Backups reside in Cool Azure Blob storage for frequently accessed data.
Optionally, you can tier backups to Azure Archive storage for further cost optimization.

Tier Backups to Archival

Archive after (Days)	Access Tier
30	Azure Archive

Storage Account

Cloud Manager will create the storage account after you complete the wizard

- Select the volumes that you want to back up using the default backup policy in the Select Volumes page. If you want to assign different backup policies to certain volumes, you can create additional policies and apply them to those volumes later.

Select Volumes

57 Volumes Q

<input checked="" type="checkbox"/>	Volume Name	Volume Type	SVM Name	Used Capacity	Allocated Capacity	Backup Status
<input checked="" type="checkbox"/>	Volume_Name_1 On	RW	SVM_Name_1	0.25 TB	10 TB	<input type="radio"/> Not Active
<input checked="" type="checkbox"/>	Volume_Name_2 On	RW	SVM_Name_1	0.25 TB	10 TB	<input type="radio"/> Not Active
<input checked="" type="checkbox"/>	Volume_Name_3 On	RW	SVM_Name_1	0.25 TB	10 TB	<input type="radio"/> Not Active
<input checked="" type="checkbox"/>	Volume_Name_4 On	DP	SVM_Name_2	0.25 TB	10 TB	<input type="radio"/> Not Active
<input checked="" type="checkbox"/>	Volume_Name_5 On	RW	SVM_Name_1	0.25 TB	10 TB	<input type="radio"/> Not Active
<input checked="" type="checkbox"/>	Automatically back up future volumes on all storage VMs with the selected backup policy <input type="radio"/>					

- To back up all volumes, check the box in the title row (Volume Name).
 - To back up individual volumes, check the box for each volume (Volume_1).
- If you want all volumes added in the future to have backup enabled, just leave the checkbox for "Automatically back up future volumes..." checked. If you disable this setting, you'll need to manually

enable backups for future volumes.

6. Click **Activate Backup** and Cloud Backup starts taking the initial backups of each selected volume.

Result

Cloud Backup starts taking the initial backups of each selected volume and the Volume Backup Dashboard is displayed so you can monitor the state of the backups.

What's next?

You can [start and stop backups for volumes or change the backup schedule](#).

You can also [restore entire volumes or individual files from a backup file](#) to a Cloud Volumes ONTAP system in Azure, or to an on-premises ONTAP system.

Backing up Cloud Volumes ONTAP data to Google Cloud Storage

Complete a few steps to get started backing up data from Cloud Volumes ONTAP to Google Cloud Storage.

Quick start

Get started quickly by following these steps or scroll down to the remaining sections for full details.

1

Verify support for your configuration

- You're running Cloud Volumes ONTAP 9.7P5 or later in GCP.
- You have a valid GCP subscription for the storage space where your backups will be located.
- You have a service account in your Google Cloud Project that has the predefined Storage Admin role.
- You have subscribed to the [Cloud Manager Marketplace Backup offering](#), or you have purchased [and activated](#) a Cloud Backup BYOL license from NetApp.

2

Enable Cloud Backup on your new or existing system

- New systems: Cloud Backup can be enabled when you complete the new working environment wizard.
- Existing systems: Select the working environment and click **Enable** next to the Backup & Restore service in the right-panel, and then follow the setup wizard.



3

Enter the provider details

Select the Google Cloud Project where you want the Google Cloud Storage bucket to be created for backups.

Provider Settings

Google Cloud Project

Default Project

Region

us-east-2

4

Define the default backup policy

The default policy backs up volumes every day and retains the most recent 30 backup copies of each volume. Change to hourly, daily, weekly, or monthly backups, or select one of the system-defined policies that provide more options. You can also change the number of backup copies you want to retain.

Define Policy

This policy is applied to the volumes you select in the next step. You can apply different policies to volumes after activating backup.

Policy - Retention & Schedule Create a New Policy Select an Existing Policy

<input type="checkbox"/> Hourly	Number of backups to retain	24
<input checked="" type="checkbox"/> Daily	Number of backups to retain	30
<input type="checkbox"/> Weekly	Number of backups to retain	52
<input type="checkbox"/> Monthly	Number of backups to retain	12

DP Volumes Data protection volume backups use the same retention period as defined in the source SnapMirror relationship by default. Use the API if you want to change this value

Google Cloud Storage Bucket Cloud Manager will create the Google Cloud Storage Bucket after you complete the wizard

5

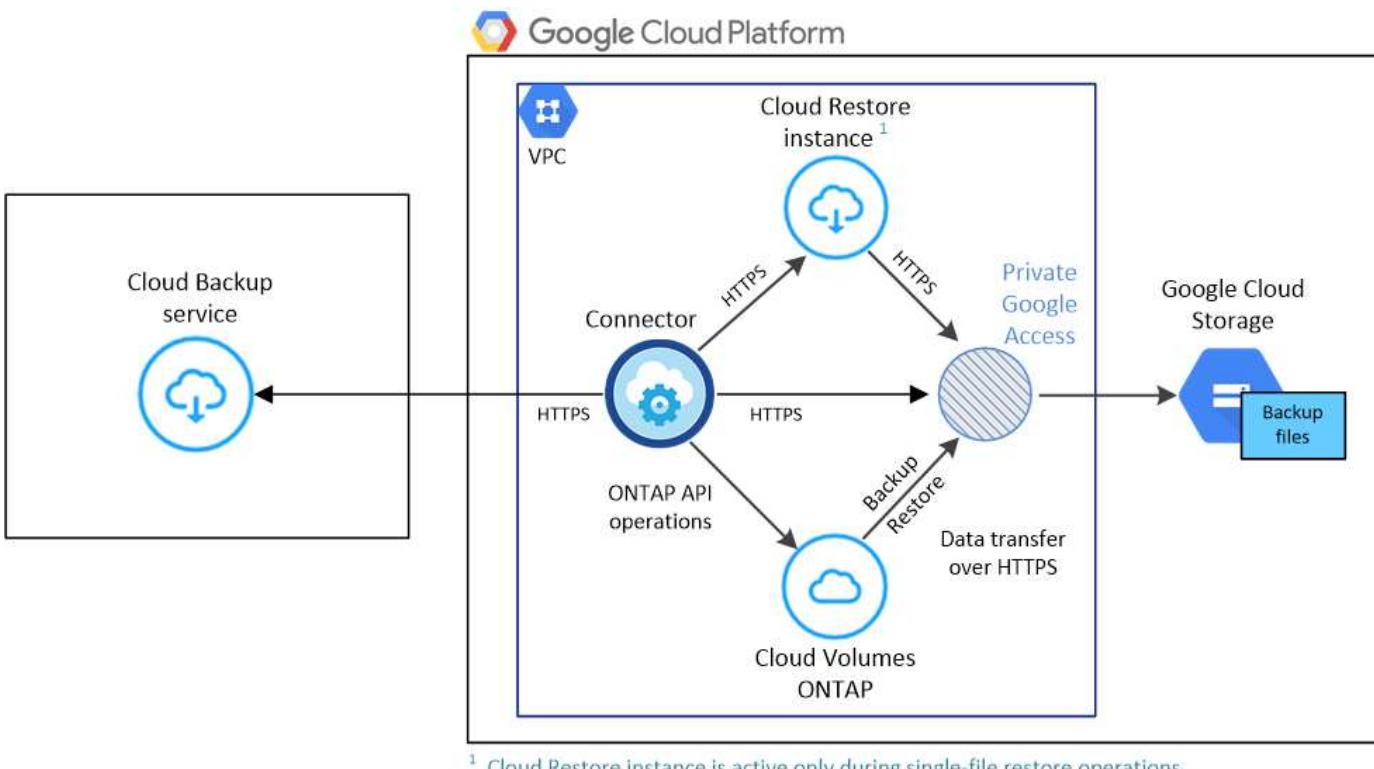
Select the volumes that you want to back up

Identify which volumes you want to back up using the default backup policy in the Select Volumes page. If you want to assign different backup policies to certain volumes, you can create additional policies and apply them to volumes later.

Requirements

Read the following requirements to make sure that you have a supported configuration before you start backing up volumes to Google Cloud storage.

The following image shows each component and the connections that you need to prepare between them:



¹ Cloud Restore instance is active only during single-file restore operations.

Supported ONTAP versions

Cloud Volumes ONTAP 9.7P5 and later.

Supported GCP regions

Cloud Backup is supported in all GCP regions [where Cloud Volumes ONTAP is supported](#).

License requirements

For Cloud Backup PAYGO licensing, a subscription through the [GCP Marketplace](#) is required before you enable Cloud Backup. Billing for Cloud Backup is done through this subscription. [You can subscribe from the Details & Credentials page of the working environment wizard](#).

For Cloud Backup BYOL licensing, you need the serial number from NetApp that enables you to use the service for the duration and capacity of the license. [Learn how to manage your BYOL licenses](#).

And you need to have a Google subscription for the storage space where your backups will be located.

GCP Service Account

You need to have a service account in your Google Cloud Project that has the predefined Storage Admin role. [Learn how to create a service account](#).

Enabling Cloud Backup on a new system

Cloud Backup can be enabled when you complete the working environment wizard to create a new Cloud Volumes ONTAP system.

You must have a Service Account already configured. If you don't select a service account when you create the Cloud Volumes ONTAP system, then you'll need to turn off the system and add the service account to Cloud Volumes ONTAP from the GCP console.

See [Launching Cloud Volumes ONTAP in GCP](#) for requirements and details for creating your Cloud Volumes

ONTAP system.

Steps

1. On the Working Environments page, click **Add Working Environment** and follow the prompts.
2. **Choose a Location:** Select **Google Cloud Platform**.
3. **Choose Type:** Select **Cloud Volumes ONTAP** (either single-node or high-availability).
4. **Details & Credentials:** Enter the following information:
 - a. Click **Edit Project** and select a new project if the one you want to use is different than the default Project (where Cloud Manager resides).
 - b. Specify the cluster name.
 - c. Enable the **Service Account** switch and select the Service Account that has the predefined Storage Admin role. This is required to enable backups and tiering.
 - d. Specify the credentials.

Make sure that a GCP Marketplace subscription is in place.

Details & Credentilas

Project1 Google Cloud Project	MPAWSSubscription1222 Marketplace Subscription	Edit Project
Details		Credentials
Working Environment Name (Cluster Name) <input type="text" value="TamiVSA"/>		User Name <input type="text" value="admin"/>
Service Account <input checked="" type="checkbox"/>		Password <input type="password" value="*****"/>
Service Account Name <input type="text" value="ServiceAccount1"/>		Confirm Password <input type="password" value="*****"/>
+ Add Labels Optional Field Up to four labels		

5. **Services:** Leave the Cloud Backup service enabled and click **Continue**.

Services

 Backup to Cloud	<input checked="" type="checkbox"/>	
---	-------------------------------------	---

6. Complete the pages in the wizard to deploy the system as described in [Launching Cloud Volumes ONTAP in GCP](#).

Result

Cloud Backup is enabled on the system and backs up the volume you created every day and retains the most recent 30 backup copies.

You can [start and stop backups for volumes or change the backup schedule](#).

You can also [restore entire volumes from a backup file](#) to a Cloud Volumes ONTAP system in Google, or to an on-premises ONTAP system.

Enabling Cloud Backup on an existing system

You can enable Cloud Backup at any time directly from the working environment.

Steps

1. Select the working environment and click **Enable** next to the Backup & Restore service in the right-panel.



2. Select the Google Cloud Project and region where you want the Google Cloud Storage bucket to be created for backups, and click **Next**.



Note that the Project must have a Service Account that has the predefined Storage Admin role.

3. In the *Define Policy* page, select the default backup schedule and retention value and click **Next**.

Define Policy

This policy is applied to the volumes you select in the next step. You can apply different policies to volumes after activating backup.

Policy - Retention & Schedule

Create a New Policy Select an Existing Policy

<input type="checkbox"/> Hourly	Number of backups to retain	24
<input checked="" type="checkbox"/> Daily	Number of backups to retain	30
<input type="checkbox"/> Weekly	Number of backups to retain	52
<input type="checkbox"/> Monthly	Number of backups to retain	12

DP Volumes Data protection volume backups use the same retention period as defined in the source SnapMirror relationship by default. Use the API if you want to change this value

Google Cloud Storage Bucket Cloud Manager will create the Google Cloud Storage Bucket after you complete the wizard

[See the list of existing policies.](#)

4. Select the volumes that you want to back up using the default backup policy in the Select Volumes page. If you want to assign different backup policies to certain volumes, you can create additional policies and apply them to those volumes later.

Select Volumes

57 Volumes 🔍

<input checked="" type="checkbox"/>	Volume Name	Volume Type	SVM Name	Used Capacity	Allocated Capacity	Backup Status
<input checked="" type="checkbox"/>	Volume_Name_1 └─ On	RW	SVM_Name_1	0.25 TB	10 TB	ⓘ Not Active
<input checked="" type="checkbox"/>	Volume_Name_2 └─ On	RW	SVM_Name_1	0.25 TB	10 TB	ⓘ Not Active
<input checked="" type="checkbox"/>	Volume_Name_3 └─ On	RW	SVM_Name_1	0.25 TB	10 TB	ⓘ Not Active
<input checked="" type="checkbox"/>	Volume_Name_4 └─ On	DP	SVM_Name_2	0.25 TB	10 TB	ⓘ Not Active
<input checked="" type="checkbox"/>	Volume_Name_5 └─ On	RW	SVM_Name_1	0.25 TB	10 TB	ⓘ Not Active
<input checked="" type="checkbox"/>	Automatically back up future volumes on all storage VMs with the selected backup policy ⓘ					

- To back up all volumes, check the box in the title row (**Volume Name**).
 - To back up individual volumes, check the box for each volume (**Volume_1**).
5. If you want all volumes added in the future to have backup enabled, just leave the checkbox for "Automatically back up future volumes..." checked. If you disable this setting, you'll need to manually enable backups for future volumes.
 6. Click **Activate Backup** and Cloud Backup starts taking the initial backups of each selected volume.

Result

Cloud Backup starts taking the initial backups of each selected volume and the Volume Backup Dashboard is displayed so you can monitor the state of the backups.

What's next?

You can [start and stop backups for volumes or change the backup schedule](#).

You can also [restore entire volumes from a backup file](#) to a Cloud Volumes ONTAP system in Google, or to an on-premises ONTAP system.

Back up on-premises ONTAP data

Backing up on-premises ONTAP data to Amazon S3

Complete a few steps to get started backing up data from your on-premises ONTAP systems to Amazon S3 storage.



In most cases you'll use Cloud Manager for all backup and restore operations. However, starting with ONTAP 9.9.1 you can initiate volume backup operations of your on-premises ONTAP clusters using ONTAP System Manager. [See how to use System Manager to back up your volumes to the cloud using Cloud Backup](#).

Quick start

Get started quickly by following these steps, or scroll down to the remaining sections for full details.

1

Verify support for your configuration

- You have discovered the on-premises cluster and added it to a working environment in Cloud Manager. See [Discovering ONTAP clusters](#) for details.
 - The cluster is running ONTAP 9.7P5 or later.
 - The cluster has a SnapMirror license — it is included as part of the Premium Bundle or Data Protection Bundle.
 - The cluster must have the required network connections to S3 storage and to the Connector.
- The Connector must have the required network connections to S3 storage and to the cluster, and the required permissions.
- You have a valid AWS subscription for the object storage space where your backups will be located.
- You have an AWS Account with an access key and secret key, and the [required permissions](#) so the ONTAP cluster can back up and restore data.

2

Enable Cloud Backup on the system

Select the working environment and click **Enable** next to the Backup & Restore service in the right-panel, and then follow the setup wizard.



3

Select the cloud provider and enter the provider details

Select Amazon Web Services as your provider and then enter the provider details. You'll need to select the AWS Account and the region where you want to create the backups. You can also choose your own customer-managed key for data encryption instead of using the default Amazon S3 encryption key.

Provider Settings

Provider Information		Location & Connectivity	
AWS Account	AWS_Account_1	Region	us-east-2
AWS Access Key	Enter AWS Access Key	Encryption	Encryption Key Type: AWS SSE-S3 Change Key
AWS Secret Key	Enter AWS Secret Key		

4

Select the cluster IPspace and optionally select an AWS PrivateLink connection

Select the IPspace in the ONTAP cluster where the volumes reside. You can also choose to use an existing AWS PrivateLink configuration for a more secure connection to the VPC from your on-prem data center.

Networking

IPspace		
IP_Space_1		
<input checked="" type="checkbox"/> Private Link Configuration		
Select Private Link		
Name	VPC	Endpoint ID
Private_Link_Name_001	vpce0-012345678901234567890 (Default)	vpce0-012345678901234567890
Private_Link_Name_002	vpce0-012345678901234567890 (k8s)	vpce0-012345678901234567890

5

Define the default backup policy

The default policy backs up volumes every day and retains the most recent 30 backup copies of each volume. Change to hourly, daily, weekly, or monthly backups, or select one of the system-defined policies that provide more options. You can also change the number of backup copies you want to retain.

By default, backups are stored in S3 Standard storage. If your cluster is using ONTAP 9.10.1 or greater, you can choose to tier backups to either S3 Glacier or S3 Glacier Deep Archive storage after a certain number of days for further cost optimization.

Define Policy

This policy is applied to the volumes you select in the next step. You can apply different policies to volumes after activating backup.

Policy - Retention & Schedule Create a New Policy Select an Existing Policy

<input type="checkbox"/> Hourly	Number of backups to retain	24
<input checked="" type="checkbox"/> Daily	Number of backups to retain	30
<input type="checkbox"/> Weekly	Number of backups to retain	52
<input type="checkbox"/> Monthly	Number of backups to retain	12

Archival Policy

Backups reside in S3 Standard storage for frequently accessed data. Optionally, you can tier backups to either S3 Glacier or S3 Glacier Deep Archive storage for further cost optimization.

Tier Backups to Archival

Archive after (Days)	Storage Class
30	S3 Glacier
	S3 Glacier
	S3 Glacier Deep Archive

S3 Bucket

Cloud Manager will create the S3 bucket for you during the wizard

6

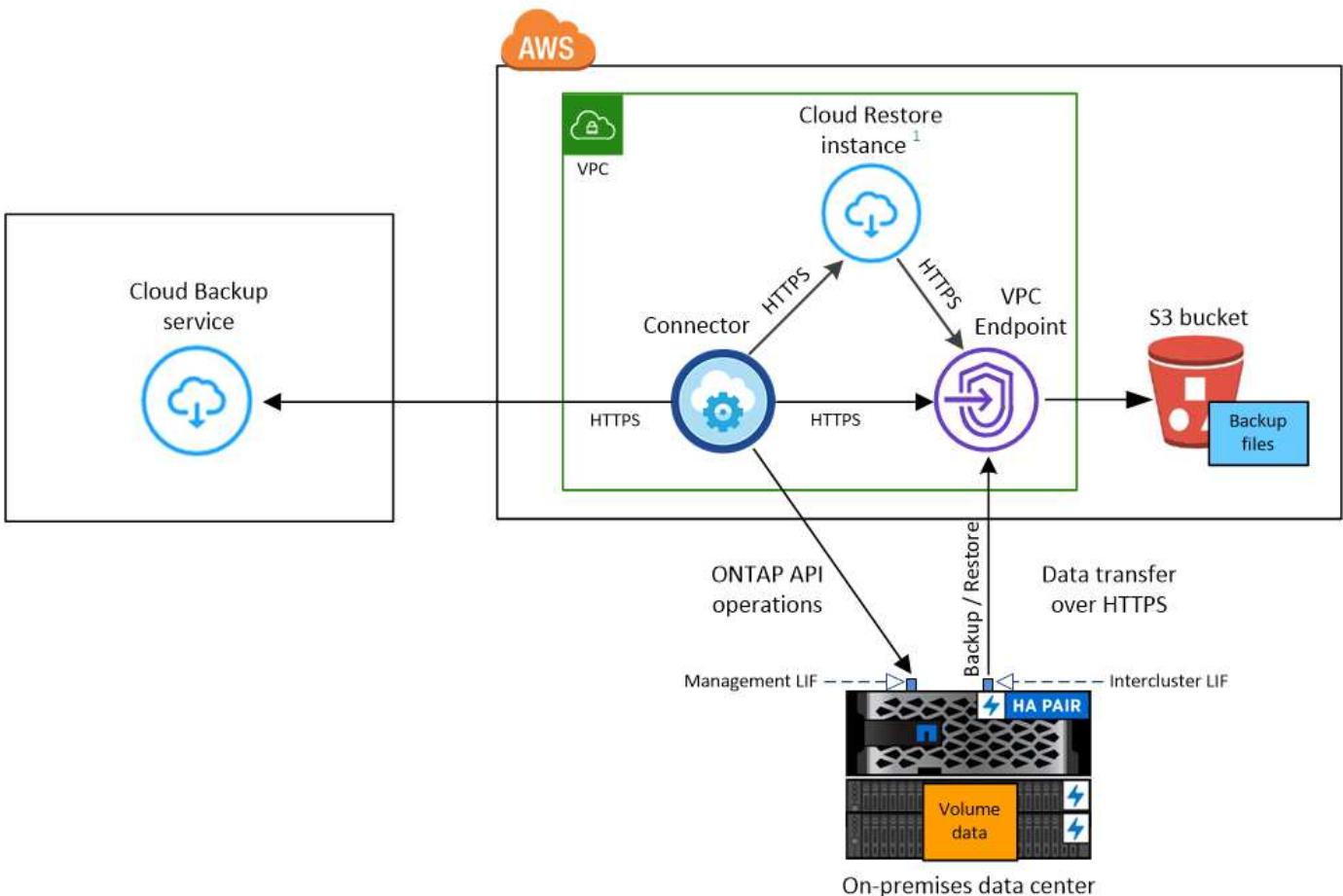
Select the volumes that you want to back up

Identify which volumes you want to back up using the default backup policy in the Select Volumes page. If you want to assign different backup policies to certain volumes, you can create additional policies and apply them to volumes later.

Requirements

Read the following requirements to make sure you have a supported configuration before you start backing up on-premises volumes to S3 storage.

The following image shows each component and the connections that you need to prepare between them:



¹ Cloud Restore instance is active only during single-file restore operations.

Note that when the Cloud Restore instance is deployed in the cloud, it is located in the same subnet as the Connector.

Preparing your ONTAP clusters

You need to discover your on-premises ONTAP clusters in Cloud Manager before you can start backing up volume data.

[Learn how to discover a cluster.](#)

ONTAP requirements

- ONTAP 9.7P5 and later.
- A SnapMirror license (included as part of the Premium Bundle or Data Protection Bundle).

Note: The "Hybrid Cloud Bundle" is not required when using Cloud Backup.

See how to [manage your cluster licenses](#).

- Time and time zone are set correctly.

See how to [configure your cluster time](#).

Cluster networking requirements

- The ONTAP cluster initiates an HTTPS connection over port 443 from the intercluster LIF to Amazon S3 storage for backup and restore operations.
- ONTAP reads and writes data to and from object storage. The object storage never initiates, it just responds.
- ONTAP requires an inbound connection from the Connector to the cluster management LIF. The Connector can reside in an AWS VPC.
- An intercluster LIF is required on each ONTAP node that hosts the volumes you want to back up. The LIF must be associated with the *IPspace* that ONTAP should use to connect to object storage. [Learn more about IPspaces](#).

When you set up Cloud Backup, you are prompted for the IPspace to use. You should choose the IPspace that each LIF is associated with. That might be the "Default" IPspace or a custom IPspace that you created.

- The nodes' intercluster LIFs are able to access the object store.
- DNS servers have been configured for the storage VM where the volumes are located. See how to [configure DNS services for the SVM](#).
- Note that if you use are using a different IPspace than the Default, then you might need to create a static route to get access to the object storage.
- Update firewall rules, if necessary, to allow Cloud Backup service connections from ONTAP to object storage through port 443 and name resolution traffic from the storage VM to the DNS server over port 53 (TCP/UDP).

Creating or switching Connectors

A Connector is required to back up data to the cloud, and the Connector must be in an AWS VPC when backing up data to AWS S3 storage. You can't use a Connector that's deployed on-premises. You'll either need to create a new Connector or make sure that the currently selected Connector resides in the correct provider.

- [Learn about Connectors](#)
- [Creating a Connector in AWS](#)
- [Switching between Connectors](#)

Preparing networking for the Connector

Ensure that the Connector has the required networking connections.

Steps

1. Ensure that the network where the Connector is installed enables the following connections:
 - An outbound internet connection to the Cloud Backup service over port 443 (HTTPS)
 - An HTTPS connection over port 443 to your S3 object storage
 - An HTTPS connection over port 443 to your ONTAP clusters
2. Enable a VPC Endpoint to S3. This is needed if you have a Direct Connect or VPN connection from your ONTAP cluster to the VPC and you want communication between the Connector and S3 to stay in your AWS internal network.

Supported regions

You can create backups from on-premises systems to Amazon S3 in all regions [where Cloud Volumes ONTAP is supported](#); including AWS GovCloud regions. You specify the region where the backups will be stored when you set up the service.

License requirements

Before your 30-day free trial of Cloud Backup expires, you need to subscribe to a pay-as-you-go (PAYGO) Cloud Manager Marketplace offering from AWS, or purchase and activate a Cloud Backup BYOL license from NetApp. These licenses are for the account and can be used across multiple systems.

- For Cloud Backup PAYGO licensing, you'll need a subscription to the [AWS Cloud Manager Marketplace](#) offering to continue using Cloud Backup. Billing for Cloud Backup is done through this subscription.
- For Cloud Backup BYOL licensing, you don't need a subscription. You need the serial number from NetApp that enables you to use the service for the duration and capacity of the license. [Learn how to manage your BYOL licenses](#).

You need to have an AWS subscription for the object storage space where your backups will be located.

A SnapMirror license is required on the cluster. Note that the "Hybrid Cloud Bundle" is not required when using Cloud Backup.

Preparing Amazon S3 for backups

When you are using Amazon S3, you must configure permissions for the Connector to create and manage the S3 bucket, and you must configure permissions so the on-premises ONTAP cluster can read and write to the S3 bucket.

Steps

1. Confirm that the following S3 permissions (from the latest [Cloud Manager policy](#)) are part of the IAM role that provides the Connector with permissions:

```
{
    "Sid": "backupPolicy",
    "Effect": "Allow",
    "Action": [
        "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"
    ],
    "Resource": [
        "arn:aws:s3:::netapp-backup-*"
    ]
},
}
```

2. Add the following EC2 permissions to the IAM role that provides the Connector with permissions so that it can start, stop, and terminate the Cloud Restore instance:

```
"Action": [
    "ec2:DescribeInstanceTypeOfferings",
    "ec2:StartInstances",
    "ec2:StopInstances",
    "ec2:TerminateInstances"
],
```

3. During the Backup wizard you will be prompted to enter an access key and secret key. For that, you will need to create an IAM user with the following permissions. Cloud Backup passes these credentials on to the ONTAP cluster so that ONTAP can backup and restore data to the S3 bucket.

```

"s3>ListAllMyBuckets",
"s3>ListBucket",
"s3:GetBucketLocation",
"s3GetObject",
"s3PutObject",
"s3PutBucketEncryption",
"s3DeleteObject"

```

See the [AWS Documentation: Creating a Role to Delegate Permissions to an IAM User](#) for details.

4. If your virtual or physical network uses a proxy server for internet access, ensure that the Cloud Restore instance has outbound internet access to contact the following endpoints.

Endpoints	Purpose
http://amazonlinux.us-east-1.amazonaws.com/2/extras/docker/stable/x86_64/4bf88ee77c395ffe1e0c3ca68530dfb3a683ec65a4a1ce9c0ff394be50e922b2/	CentOS package for the Cloud Restore Instance AMI.
http://cloudmanagerinfraprod.azurecr.io https://cloudmanagerinfraprod.azurecr.io	Cloud Restore Instance image repository.

5. You can choose your own custom-managed keys for data encryption in the activation wizard instead of using the default Amazon S3 encryption keys. In this case you'll need to have the encryption managed keys already set up. [See how to use your own keys](#).
6. If you want to have a more secure connection over the public internet from your on-prem data center to the VPC, there is an option to select an AWS PrivateLink connection in the activation wizard. It is required if you are connecting your on-premises system via VPN/DirectConnect. In this case you'll need to have created an Interface endpoint configuration using the Amazon VPC console or the command line. [See details about using AWS PrivateLink for Amazon S3](#).

Note that you'll also need to modify the security group configuration that is associated with the Cloud Manager Connector. You must change the policy to "Custom" (from "Full Access"), and you must add the permissions from the backup policy as shown earlier (above).

Policy*

- Full Access - Allow access by any user or service within the VPC using credentials from any AWS accounts to any resources in this AWS service. All policies — IAM user policies, VPC endpoint policies, and AWS service-specific policies (e.g. Amazon S3 bucket policies, any S3 ACL policies) — must grant the necessary permissions for access to succeed.
- Custom

Use the [policy creation tool](#) to generate a policy, then paste the generated policy below.

```
{
  "Sid": "backupPolicy",
  "Effect": "Allow",
  "Action": [
    "s3:DeleteBucket",
    "s3:GetLifecycleConfiguration",
    "s3:PutLifecycleConfiguration",
    "s3:PutBucketTagging",
    "s3>ListBucketVersions",
    "s3:GetObject",
    "s3>DeleteObject",
    "s3>ListBucket",
    "s3>ListAllMyBuckets",
    "s3:GetBucketTagging",
    "s3:GetBucketLocation",
    "s3:PutObjectAcl"
  ],
  "Resource": "*"
}
```

Enabling Cloud Backup

Enable Cloud Backup at any time directly from the on-premises working environment.

Steps

- From the Canvas, select the working environment and click **Enable** next to the Backup & Restore service in the right-panel.



- Select Amazon Web Services as your provider and click **Next**.

- Enter the provider details and click **Next**.

- The AWS Account, the AWS Access Key, and the Secret Key used to store the backups.

The access key and secret key are for the user you created to give the ONTAP cluster access to the S3 bucket.

- The AWS region where the backups will be stored.

- Whether you'll use the default Amazon S3 encryption keys or choose your own customer-managed keys from your AWS account to manage encryption of your data. ([See how to use your own keys](#)).

Provider Settings

Provider Information	Location & Connectivity
AWS Account <input type="text" value="AWS_Account_1"/>	Region <input type="text" value="us-east-2"/>
AWS Access Key <input type="text" value="Enter AWS Access Key"/>	Encryption <input type="text" value="Encryption Key Type: AWS SSE-S3"/> Change Key
AWS Secret Key <input type="text" value="Enter AWS Secret Key"/>	

4. Enter the networking details and click **Next**.

- The IPspace in the ONTAP cluster where the volumes you want to back up reside. The intercluster LIFs for this IPspace must have outbound internet access.
- Optional, choose whether you'll use an AWS PrivateLink that you have previously configured. [See details about using AWS PrivateLink for Amazon S3.](#)

Networking

IPspace <input type="text" value="IP_Space_1"/>									
Private Link Configuration									
Select Private Link									
<table border="1"> <thead> <tr> <th>Name</th> <th>VPC</th> <th>Endpoint ID</th> </tr> </thead> <tbody> <tr> <td>Private_Link_Name_001</td> <td>vpce0-012345678901234567890 (Default)</td> <td>vpce0-012345678901234567890</td> </tr> <tr> <td>Private_Link_Name_002</td> <td>vpce0-012345678901234567890 (k8s)</td> <td>vpce0-012345678901234567890</td> </tr> </tbody> </table>	Name	VPC	Endpoint ID	Private_Link_Name_001	vpce0-012345678901234567890 (Default)	vpce0-012345678901234567890	Private_Link_Name_002	vpce0-012345678901234567890 (k8s)	vpce0-012345678901234567890
Name	VPC	Endpoint ID							
Private_Link_Name_001	vpce0-012345678901234567890 (Default)	vpce0-012345678901234567890							
Private_Link_Name_002	vpce0-012345678901234567890 (k8s)	vpce0-012345678901234567890							

5. Enter the default backup policy details and click **Next**.

- Define the backup schedule and choose the number of backups to retain. [See the list of existing policies you can choose.](#)
- When using ONTAP 9.10.1 and greater, you can choose to tier backups to either S3 Glacier or S3 Glacier Deep Archive storage after a certain number of days for further cost optimization. [Learn more about using archival tiers.](#)

Define Policy

This policy is applied to the volumes you select in the next step. You can apply different policies to volumes after activating backup.

Policy - Retention & Schedule

Create a New Policy Select an Existing Policy

<input type="checkbox"/> Hourly	Number of backups to retain	24
<input checked="" type="checkbox"/> Daily	Number of backups to retain	30
<input type="checkbox"/> Weekly	Number of backups to retain	52
<input type="checkbox"/> Monthly	Number of backups to retain	12

Archival Policy

Backups reside in S3 Standard storage for frequently accessed data. Optionally, you can tier backups to either S3 Glacier or S3 Glacier Deep Archive storage for further cost optimization.

Tier Backups to Archival

Archive after (Days)	Storage Class
30	S3 Glacier
	S3 Glacier
	S3 Glacier Deep Archive

S3 Bucket

Cloud Manager will create the S3 bucket for you. [Create S3 Bucket Wizard](#)

- Select the volumes that you want to back up using the default backup policy in the Select Volumes page. If you want to assign different backup policies to certain volumes, you can create additional policies and apply them to those volumes later.
 - To back up all volumes, check the box in the title row (**Volume Name**).
 - To back up individual volumes, check the box for each volume (**Volume_1**).

Select Volumes

57 Volumes

<input checked="" type="checkbox"/>	Volume Name	Volume Type	SVM Name	Used Capacity	Allocated Capacity	Backup Status
<input checked="" type="checkbox"/>	Volume_Name_1	RW	SVM_Name_1	0.25 TB	10 TB	<input type="radio"/> Not Active
<input checked="" type="checkbox"/>	Volume_Name_2	RW	SVM_Name_1	0.25 TB	10 TB	<input type="radio"/> Not Active
<input checked="" type="checkbox"/>	Volume_Name_3	RW	SVM_Name_1	0.25 TB	10 TB	<input type="radio"/> Not Active
<input checked="" type="checkbox"/>	Volume_Name_4	DP	SVM_Name_2	0.25 TB	10 TB	<input type="radio"/> Not Active
<input checked="" type="checkbox"/>	Volume_Name_5	RW	SVM_Name_1	0.25 TB	10 TB	<input type="radio"/> Not Active
<input checked="" type="checkbox"/>	Automatically back up future volumes on all storage VMs with the selected backup policy					<input type="radio"/>

If you want all volumes added in the future to have backup enabled, just leave the checkbox for "Automatically back up future volumes..." checked. If you disable this setting, you'll need to manually enable backups for future volumes.

- Click **Activate Backup** and Cloud Backup starts taking the initial backups of your volumes.

Result

Cloud Backup starts taking the initial backups of each selected volume and the Volume Backup Dashboard is displayed so you can monitor the state of the backups.

What's next?

You can [start and stop backups for volumes or change the backup schedule](#).

You can also [restore entire volumes or individual files from a backup file to a Cloud Volumes ONTAP system in AWS, or to an on-premises ONTAP system](#).

Backing up on-premises ONTAP data to Azure Blob storage

Complete a few steps to get started backing up data from your on-premises ONTAP systems to Azure Blob storage.



In most cases you'll use Cloud Manager for all backup and restore operations. However, starting with ONTAP 9.9.1 you can initiate volume backup operations of your on-premises ONTAP clusters using ONTAP System Manager. [See how to use System Manager to back up your volumes to the cloud using Cloud Backup](#).

Quick start

Get started quickly by following these steps, or scroll down to the remaining sections for full details.

1

Verify support for your configuration

- You have discovered the on-premises cluster and added it to a working environment in Cloud Manager. See [Discovering ONTAP clusters](#) for details.
 - The cluster is running ONTAP 9.7P5 or later.
 - The cluster has a SnapMirror license — it is included as part of the Premium Bundle or Data Protection Bundle.
 - The cluster must have the required network connections to Blob storage and to the Connector.
- The Connector must have the required network connections to Blob storage and to the cluster, and the required permissions.
- You have a valid Azure subscription for the object storage space where your backups will be located.

2

Enable Cloud Backup on the system

Select the working environment and click **Enable** next to the Backup & Restore service in the right-panel, and then follow the setup wizard.



3

Select the cloud provider and enter the provider details

Select Microsoft Azure as your provider and then enter the provider details. You'll need to select the Azure

Subscription and the region where you want to create the backups. You can also choose your own customer-managed key for data encryption instead of using the default Microsoft-managed encryption key.

Provider Settings

Azure Subscription	Region
Azure_Subscription_1	Default_CM_Region
Resource Group	Encryption
<input type="radio"/> Create a new <input checked="" type="radio"/> Use an existing	<input checked="" type="radio"/> Microsoft-managed <input type="radio"/> Customer-managed
Select an Existing Resource Group	
Resource_Group_1	

4

Select the cluster IPspace and optional use of a private VNet endpoint

Select the IPspace in the ONTAP cluster where the volumes reside. You can also choose to use an existing Azure Private Endpoint for a more secure connection to the VNet from your on-prem data center.

Networking

IPspace
IP_Space_1
<input checked="" type="checkbox"/> Private Endpoint Configuration
VNet
Select VNet
Subnet
Select Subnet

5

Define the default backup policy

The default policy backs up volumes every day and retains the most recent 30 backup copies of each volume. Change to hourly, daily, weekly, or monthly backups, or select one of the system-defined policies that provide more options. You can also change the number of backup copies you want to retain.

By default, backups are stored in the Cool access tier. If your cluster is using ONTAP 9.10.1 or greater, you can choose to tier backups to Azure Archive storage after a certain number of days for further cost optimization.

Define Policy

This policy is applied to the volumes you select in the next step. You can apply different policies to volumes after activating backup.

Policy - Retention & Schedule Create a New Policy Select an Existing Policy

<input type="checkbox"/> Hourly	Number of backups to retain	24
<input checked="" type="checkbox"/> Daily	Number of backups to retain	30
<input type="checkbox"/> Weekly	Number of backups to retain	52
<input type="checkbox"/> Monthly	Number of backups to retain	12

Archival Policy Backups reside in Cool Azure Blob storage for frequently accessed data. Optionally, you can tier backups to Azure Archive storage for further cost optimization. Tier Backups to Archival

Archive after (Days)	Access Tier
30	Azure Archive

Storage Account Cloud Manager will create the storage account after you complete the wizard

6

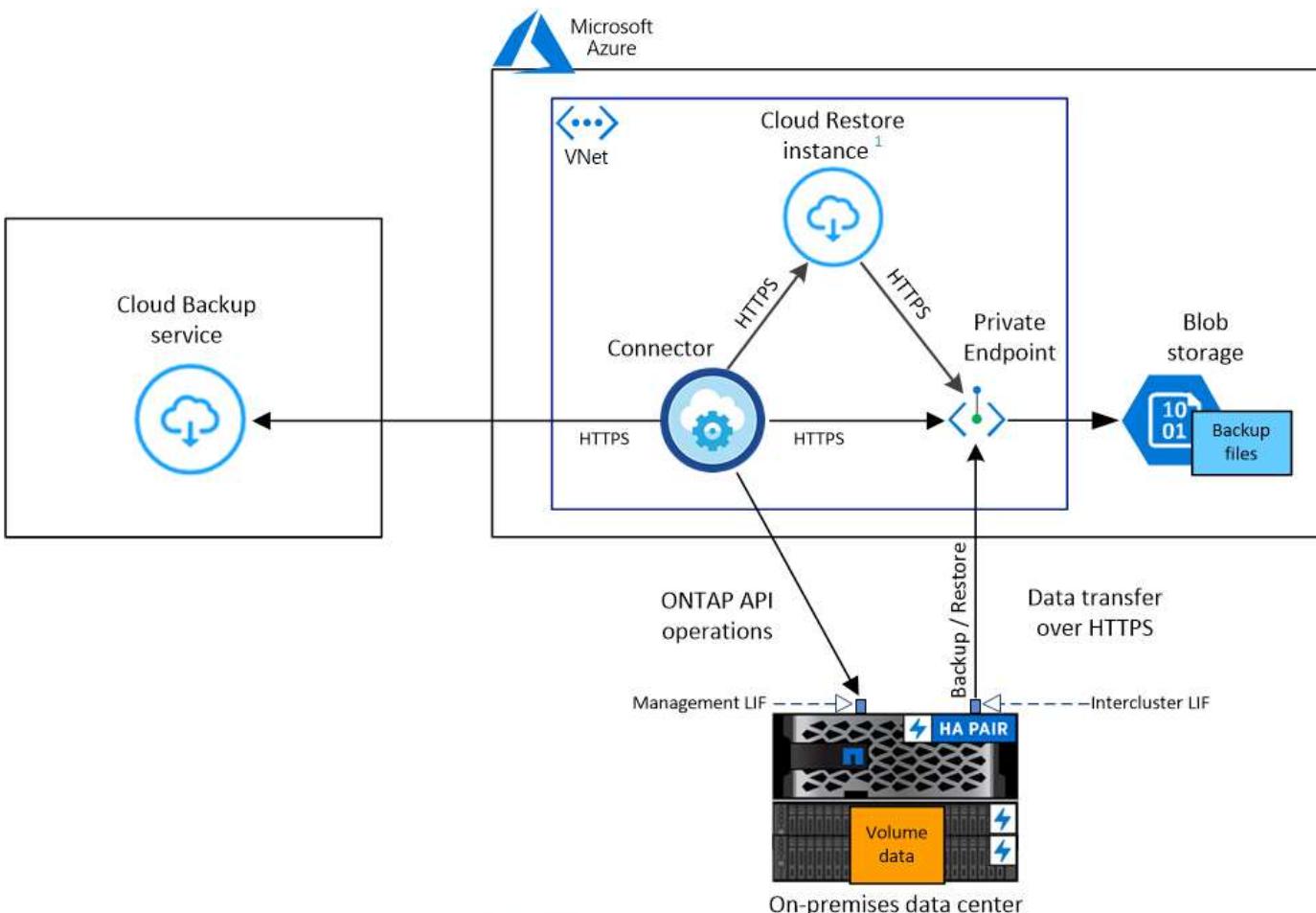
Select the volumes that you want to back up

Identify which volumes you want to back up using the default backup policy in the Select Volumes page. If you want to assign different backup policies to certain volumes, you can create additional policies and apply them to volumes later.

Requirements

Read the following requirements to make sure you have a supported configuration before you start backing up on-premises volumes to Azure Blob storage.

The following image shows each component and the connections that you need to prepare between them:



¹ Cloud Restore instance is active only during single-file restore operations.

Note that when the Cloud Restore instance is deployed in the cloud, it is located in the same subnet as the Connector.

Preparing your ONTAP clusters

You need to discover your on-premises ONTAP clusters in Cloud Manager before you can start backing up volume data.

[Learn how to discover a cluster.](#)

ONTAP requirements

- ONTAP 9.7P5 and later.
- A SnapMirror license (included as part of the Premium Bundle or Data Protection Bundle).

Note: The "Hybrid Cloud Bundle" is not required when using Cloud Backup.

See how to [manage your cluster licenses](#).

- Time and time zone are set correctly.

See how to [configure your cluster time](#).

Cluster networking requirements

- The ONTAP cluster initiates an HTTPS connection over port 443 from the intercluster LIF to Azure Blob storage for backup and restore operations.
- ONTAP reads and writes data to and from object storage. The object storage never initiates, it just responds.
- ONTAP requires an inbound connection from the Connector to the cluster management LIF. The Connector can reside in an Azure VNet.
- An intercluster LIF is required on each ONTAP node that hosts the volumes you want to back up. The LIF must be associated with the *IPspace* that ONTAP should use to connect to object storage. [Learn more about IPspaces](#).

When you set up Cloud Backup, you are prompted for the IPspace to use. You should choose the IPspace that each LIF is associated with. That might be the "Default" IPspace or a custom IPspace that you created.

- The nodes' and intercluster LIFs are able to access the object store.
- DNS servers have been configured for the storage VM where the volumes are located. See how to [configure DNS services for the SVM](#).
- Note that if you use are using a different IPspace than the Default, then you might need to create a static route to get access to the object storage.
- Update firewall rules, if necessary, to allow Cloud Backup service connections from ONTAP to object storage through port 443 and name resolution traffic from the storage VM to the DNS server over port 53 (TCP/UDP).

Creating or switching Connectors

A Connector is required to back up data to the cloud, and the Connector must be in an Azure VNet when backing up data to Azure Blob storage. You can't use a Connector that's deployed on-premises. You'll either need to create a new Connector or make sure that the currently selected Connector resides in the correct provider.

- [Learn about Connectors](#)
- [Creating a Connector in Azure](#)
- [Switching between Connectors](#)

Preparing networking for the Connector

Ensure that the Connector has the required networking connections.

Steps

1. Ensure that the network where the Connector is installed enables the following connections:
 - An outbound internet connection to the Cloud Backup service over port 443 (HTTPS)
 - An HTTPS connection over port 443 to your Blob object storage
 - An HTTPS connection over port 443 to your ONTAP clusters
2. Enable a VNet Private Endpoint to Azure storage. This is needed if you have an ExpressRoute or VPN connection from your ONTAP cluster to the VNet and you want communication between the Connector and Blob storage to stay in your virtual private network.

Supported regions

You can create backups from on-premises systems to Azure Blob in all regions [where Cloud Volumes ONTAP is supported](#); including Azure Government regions. You specify the region where the backups will be stored when you set up the service.

License requirements

Before your 30-day free trial of Cloud Backup expires, you need to subscribe to a pay-as-you-go (PAYGO) Cloud Manager Marketplace offering from Azure, or purchase and activate a Cloud Backup BYOL license from NetApp. These licenses are for the account and can be used across multiple systems.

- For Cloud Backup PAYGO licensing, you'll need a subscription to the [Azure Cloud Manager Marketplace](#) offering to continue using Cloud Backup. Billing for Cloud Backup is done through this subscription.
- For Cloud Backup BYOL licensing, you don't need a subscription. You need the serial number from NetApp that enables you to use the service for the duration and capacity of the license. [Learn how to manage your BYOL licenses](#).

You need to have an Azure subscription for the object storage space where your backups will be located.

A SnapMirror license is required on the cluster. Note that the "Hybrid Cloud Bundle" is not required when using Cloud Backup.

Preparing Azure Blob storage for backups

1. If your virtual or physical network uses a proxy server for internet access, ensure that the Cloud Restore virtual machine has outbound internet access to contact the following endpoints.

Endpoints	Purpose
http://olcentgbl.trafficmanager.net https://olcentgbl.trafficmanager.net	Provides CentOS packages for the Cloud Restore virtual machine.
http://cloudmanagerinfraprod.azurecr.io https://cloudmanagerinfraprod.azurecr.io	Cloud Restore virtual machine image repository.

2. You can choose your own custom-managed keys for data encryption in the activation wizard instead of using the default Microsoft-managed encryption keys. In this case you will need to have the Azure Subscription, Key Vault name, and the Key. [See how to use your own keys](#).
3. If you want to have a more secure connection over the public internet from your on-prem data center to the VNet, there is an option to configure an Azure Private Endpoint in the activation wizard. In this case you will need to know the VNet and Subnet for this connection. [See details about using a Private Endpoint](#).

Enabling Cloud Backup

Enable Cloud Backup at any time directly from the on-premises working environment.

Steps

1. From the Canvas, select the working environment and click **Enable** next to the Backup & Restore service in the right-panel.



2. Select Microsoft Azure as your provider and click **Next**.
3. Enter the provider details and click **Next**.
 - a. The Azure subscription used for backups and the Azure region where the backups will be stored.
 - b. The resource group that manages the Blob container - you can create a new resource group or select an existing resource group.
 - c. Whether you will use the default Microsoft-managed encryption key or choose your own customer-managed keys to manage encryption of your data. ([See how to use your own keys](#)).

Provider Settings

Azure Subscription: Azure_Subscription_1

Region: Default_CM_Region

Resource Group:

- Create a new
- Use an existing

Select an Existing Resource Group: Resource_Group_1

Encryption:

- Microsoft-managed
- Customer-managed

4. Enter the networking details and click **Next**.
 - a. The IPspace in the ONTAP cluster where the volumes you want to back up reside. The intercluster LIFs for this IPspace must have outbound internet access.
 - b. Optionally, choose whether you will configure an Azure Private Endpoint. [See details about using a Private Endpoint](#).

Networking

IPspace: IP_Space_1

Private Endpoint Configuration:

VNet:

Select VNet: Select_VNet

Subnet:

Select Subnet: Select_Subnet

5. Enter the default backup policy details and click **Next**.
 - a. Define the backup schedule and choose the number of backups to retain. [See the list of existing policies you can choose](#).
 - b. When using ONTAP 9.10.1 and greater, you can choose to tier backups to Azure Archive storage after a certain number of days for further cost optimization. [Learn more about using archival tiers](#).

Define Policy

This policy is applied to the volumes you select in the next step. You can apply different policies to volumes after activating backup.

Policy - Retention & Schedule

Create a New Policy Select an Existing Policy

<input type="checkbox"/> Hourly	Number of backups to retain	24
<input checked="" type="checkbox"/> Daily	Number of backups to retain	30
<input type="checkbox"/> Weekly	Number of backups to retain	52
<input type="checkbox"/> Monthly	Number of backups to retain	12

Archival Policy

Backups reside in Cool Azure Blob storage for frequently accessed data. Optionally, you can tier backups to Azure Archive storage for further cost optimization.

Tier Backups to Archival

Archive after (Days) Access Tier

Storage Account

Cloud Manager will create the storage account after you complete the wizard

6. Select the volumes that you want to back up using the default backup policy in the Select Volumes page. If you want to assign different backup policies to certain volumes, you can create additional policies and apply them to those volumes later.

- To back up all volumes, check the box in the title row (**Volume Name**).
- To back up individual volumes, check the box for each volume (**Volume_1**).

Select Volumes

57 Volumes

<input checked="" type="checkbox"/>	Volume Name	Volume Type	SVM Name	Used Capacity	Allocated Capacity	Backup Status
<input checked="" type="checkbox"/>	Volume_Name_1 On	RW	SVM_Name_1	0.25 TB	10 TB	<input type="radio"/> Not Active
<input checked="" type="checkbox"/>	Volume_Name_2 On	RW	SVM_Name_1	0.25 TB	10 TB	<input type="radio"/> Not Active
<input checked="" type="checkbox"/>	Volume_Name_3 On	RW	SVM_Name_1	0.25 TB	10 TB	<input type="radio"/> Not Active
<input checked="" type="checkbox"/>	Volume_Name_4 On	DP	SVM_Name_2	0.25 TB	10 TB	<input type="radio"/> Not Active
<input checked="" type="checkbox"/>	Volume_Name_5 On	RW	SVM_Name_1	0.25 TB	10 TB	<input type="radio"/> Not Active
<input checked="" type="checkbox"/>	Automatically back up future volumes on all storage VMs with the selected backup policy <input type="radio"/>					

If you want all volumes added in the future to have backup enabled, just leave the checkbox for "Automatically back up future volumes..." checked. If you disable this setting, you'll need to manually enable backups for future volumes.

7. Click **Activate Backup** and Cloud Backup starts taking the initial backups of your volumes.

Result

Cloud Backup starts taking the initial backups of each selected volume and the Volume Backup Dashboard is

displayed so you can monitor the state of the backups.

What's next?

You can [start and stop backups for volumes or change the backup schedule](#).

You can also [restore entire volumes or individual files from a backup file](#) to a Cloud Volumes ONTAP system in Azure, or to an on-premises ONTAP system.

Backing up on-premises ONTAP data to Google Cloud Storage

Complete a few steps to get started backing up data from your on-premises ONTAP systems to Google Cloud Storage.



In most cases you'll use Cloud Manager for all backup and restore operations. However, starting with ONTAP 9.9.1 you can initiate volume backup operations of your on-premises ONTAP clusters using ONTAP System Manager. [See how to use System Manager to back up your volumes to the cloud using Cloud Backup](#).

Quick start

Get started quickly by following these steps, or scroll down to the remaining sections for full details.

1

Verify support for your configuration

- You have discovered the on-premises cluster and added it to a working environment in Cloud Manager. See [Discovering ONTAP clusters](#) for details.
 - The cluster is running ONTAP 9.7P5 or later.
 - The cluster has a SnapMirror license — it is included as part of the Premium Bundle or Data Protection Bundle.
 - The cluster must have the required network connections to Google storage and to the Connector.
- The Connector must have the required network connections to Google storage and to the cluster.
- You have a valid Google subscription for the object storage space where your backups will be located.
- You have a Google account with an access key and secret key so the ONTAP cluster can back up and restore data.

2

Enable Cloud Backup on the system

Select the working environment and click **Enable** next to the Backup & Restore service in the right-panel, and then follow the setup wizard.



3

Select the cloud provider and enter the provider details

Select Google Cloud as your provider and then enter the provider details. You also need to specify the IPspace in the ONTAP cluster where the volumes reside.

4

Define the default backup policy

The default policy backs up volumes every day and retains the most recent 30 backup copies of each volume. Change to hourly, daily, weekly, or monthly backups, or select one of the system-defined policies that provide more options. You can also change the number of backup copies you want to retain.

Define Policy

This policy is applied to the volumes you select in the next step. You can apply different policies to volumes after activating backup.

Policy - Retention & Schedule

Create a New Policy Select an Existing Policy

<input type="checkbox"/> Hourly	Number of backups to retain	24
<input checked="" type="checkbox"/> Daily	Number of backups to retain	30
<input type="checkbox"/> Weekly	Number of backups to retain	52
<input type="checkbox"/> Monthly	Number of backups to retain	12

DP Volumes Data protection volume backups use the same retention period as defined in the source SnapMirror relationship by default. Use the API if you want to change this value

Google Cloud Storage Bucket Cloud Manager will create the Google Cloud Storage Bucket after you complete the wizard

5

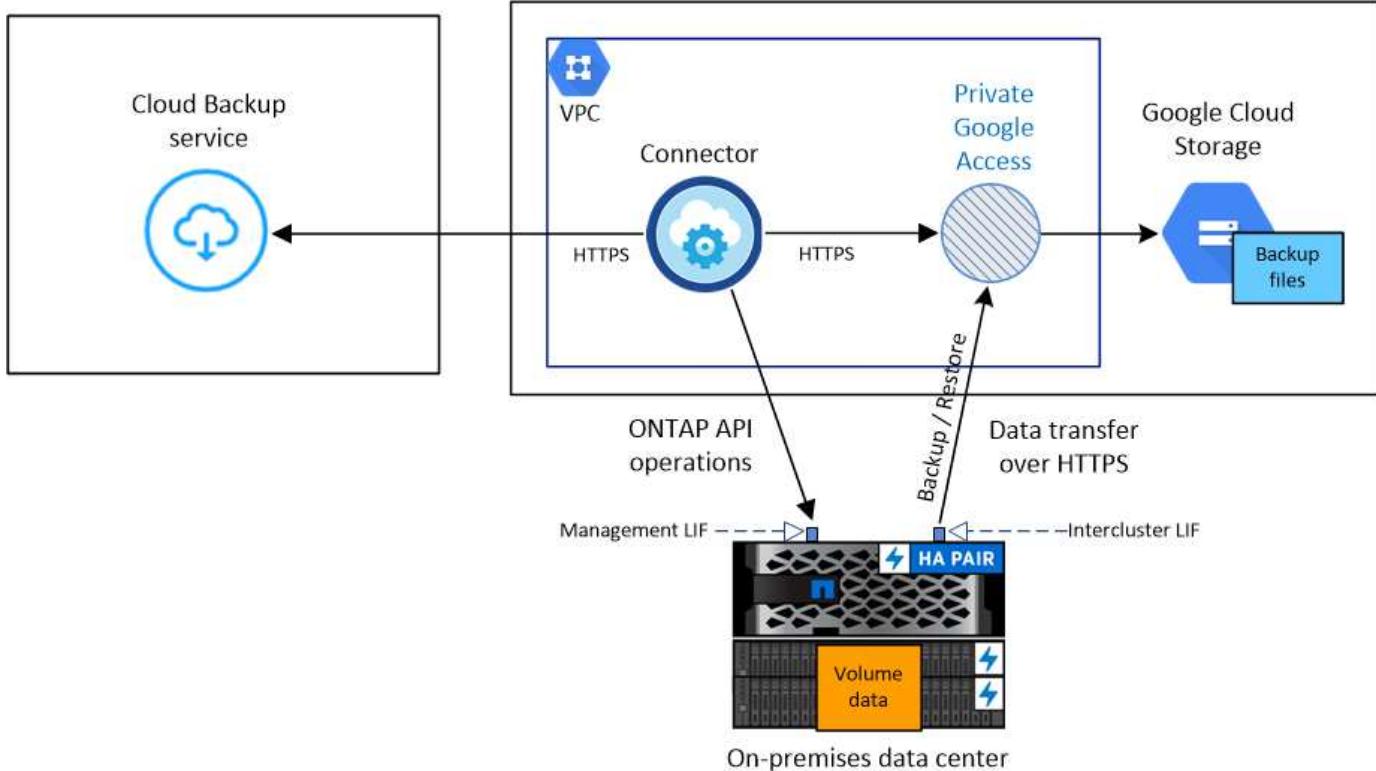
Select the volumes that you want to back up

Identify which volumes you want to back up using the default backup policy in the Select Volumes page. If you want to assign different backup policies to certain volumes, you can create additional policies and apply them to volumes later.

Requirements

Read the following requirements to make sure you have a supported configuration before you start backing up on-premises volumes to Google Cloud storage.

The following image shows each component and the connections that you need to prepare between them:



Note that the Cloud Restore instance is not shown in this diagram because single-file restore is not currently supported in GCP.

Preparing your ONTAP clusters

You need to discover your on-premises ONTAP clusters in Cloud Manager before you can start backing up volume data.

[Learn how to discover a cluster.](#)

ONTAP requirements

- ONTAP 9.7P5 and later.
- A SnapMirror license (included as part of the Premium Bundle or Data Protection Bundle).

Note: The "Hybrid Cloud Bundle" is not required when using Cloud Backup.

See how to [manage your cluster licenses](#).

- Time and time zone are set correctly.

See how to [configure your cluster time](#).

Cluster networking requirements

- The ONTAP cluster initiates an HTTPS connection over port 443 from the intercluster LIF to Google Cloud storage for backup and restore operations.

ONTAP reads and writes data to and from object storage. The object storage never initiates, it just responds.

- ONTAP requires an inbound connection from the Connector to the cluster management LIF. The Connector can reside in a Google Cloud Platform VPC.
- An intercluster LIF is required on each ONTAP node that hosts the volumes you want to back up. The LIF must be associated with the IPspace that ONTAP should use to connect to object storage. [Learn more about IPspaces](#).

When you set up Cloud Backup, you are prompted for the IPspace to use. You should choose the IPspace that each LIF is associated with. That might be the "Default" IPspace or a custom IPspace that you created.

- The nodes' intercluster LIFs are able to access the object store.
- DNS servers have been configured for the storage VM where the volumes are located. See how to [configure DNS services for the SVM](#).
- Note that if you use are using a different IPspace than the Default, then you might need to create a static route to get access to the object storage.
- Update firewall rules, if necessary, to allow Cloud Backup service connections from ONTAP to object storage through port 443 and name resolution traffic from the storage VM to the DNS server over port 53 (TCP/UDP).

Creating or switching Connectors

A Connector is required to back up data to the cloud, and the Connector must be in a Google Cloud Platform VPC when backing up data to Google Cloud storage. You can't use a Connector that's deployed on-premises. You'll either need to create a new Connector or make sure that the currently selected Connector resides in the correct provider.

- [Learn about Connectors](#)
- [Creating a Connector in GCP](#)
- [Switching between Connectors](#)

Preparing networking for the Connector

Ensure that the Connector has the required networking connections.

Steps

1. Ensure that the network where the Connector is installed enables the following connections:
 - An outbound internet connection to the Cloud Backup service over port 443 (HTTPS)
 - An HTTPS connection over port 443 to your Google Cloud storage
 - An HTTPS connection over port 443 to your ONTAP clusters
2. Enable Private Google Access on the subnet where you plan to deploy the Connector. [Private Google Access](#) is needed if you have a direct connection from your ONTAP cluster to the VPC and you want communication between the Connector and Google Cloud Storage to stay in your virtual private network.

Note that Private Google Access works with VM instances that have only internal (private) IP addresses (no external IP addresses).

Supported regions

You can create backups from on-premises systems to Google Cloud storage in all regions [where Cloud Volumes ONTAP is supported](#). You specify the region where the backups will be stored when you set up the

service.

License requirements

Before your 30-day free trial of Cloud Backup expires, you need to subscribe to a pay-as-you-go (PAYGO) Cloud Manager Marketplace offering from Google, or purchase and activate a Cloud Backup BYOL license from NetApp. These licenses are for the account and can be used across multiple systems.

- For Cloud Backup PAYGO licensing, you'll need a subscription to the [Google Cloud Manager Marketplace](#) offering to continue using Cloud Backup. Billing for Cloud Backup is done through this subscription.
- For Cloud Backup BYOL licensing, you don't need a subscription. You need the serial number from NetApp that enables you to use the service for the duration and capacity of the license. [Learn how to manage your BYOL licenses.](#)

You need to have a Google subscription for the object storage space where your backups will be located.

A SnapMirror license is required on the cluster. Note that the "Hybrid Cloud Bundle" is not required when using Cloud Backup.

Preparing Google Cloud Storage for backups

When you set up backup, you need to provide storage access keys for a service account that has Storage Admin permissions. A service account enables Cloud Backup to authenticate and access Cloud Storage buckets used to store backups. The keys are required so that Google Cloud Storage knows who is making the request.

Steps

1. [Create a service account that has the predefined Storage Admin role.](#)
2. Go to [GCP Storage Settings](#) and create access keys for the service account:
 - a. Select a project, and click **Interoperability**. If you haven't already done so, click **Enable interoperability access**.
 - b. Under **Access keys for service accounts**, click **Create a key for a service account**, select the service account that you just created, and click **Create Key**.

You'll need to enter the keys in Cloud Backup later when you configure the backup service.

Enabling Cloud Backup

Enable Cloud Backup at any time directly from the on-premises working environment.

Steps

1. From the Canvas, select the working environment and click **Enable** next to the Backup & Restore service in the right-panel.



2. Select Google Cloud as your provider and click **Next**.
3. Enter the provider details and click **Next**.

- The Google Cloud Project where you want the Google Cloud Storage bucket to be created for backups. (The Project must have a Service Account that has the predefined Storage Admin role.)
- The Google Access Key and Secret Key used to store the backups.
- The Google region where the backups will be stored.
- The IPspace in the ONTAP cluster where the volumes you want to back up reside. The intercluster LIFs for this IPspace must have outbound internet access.

Provider Settings

Provider Information	Location & Connectivity
Google Cloud Project Cloud Manager Default Project	Region Cloud Manager Default Region
Google Cloud Access Key Enter Google Cloud Access Key	IPspace IP_Space_1
Google Cloud Secret Key Enter Google Cloud Secret Key	

- In the *Define Policy* page, select an existing backup schedule and retention value, or define a new default backup policy, and click **Next**.

Define Policy

This policy is applied to the volumes you select in the next step. You can apply different policies to volumes after activating backup.

Policy - Retention & Schedule	<input checked="" type="radio"/> Create a New Policy <input type="radio"/> Select an Existing Policy
	<input type="checkbox"/> Hourly Number of backups to retain 24 <input checked="" type="checkbox"/> Daily Number of backups to retain 30 <input type="checkbox"/> Weekly Number of backups to retain 52 <input type="checkbox"/> Monthly Number of backups to retain 12
DP Volumes	Data protection volume backups use the same retention period as defined in the source SnapMirror relationship by default. Use the API if you want to change this value
Google Cloud Storage Bucket	Cloud Manager will create the Google Cloud Storage Bucket after you complete the wizard

See [the list of existing policies](#).

- Select the volumes that you want to back up using the default backup policy in the *Select Volumes* page. If you want to assign different backup policies to certain volumes, you can create additional policies and apply them to those volumes later.
 - To back up all volumes, check the box in the title row (**Volume Name**).

- To back up individual volumes, check the box for each volume (Volume_1).

Select Volumes						
57 Volumes	Volume Name	Volume Type	SVM Name	Used Capacity	Allocated Capacity	Backup Status
<input checked="" type="checkbox"/>	Volume_Name_1 On	RW	SVM_Name_1	0.25 TB	10 TB	Not Active
<input checked="" type="checkbox"/>	Volume_Name_2 On	RW	SVM_Name_1	0.25 TB	10 TB	Not Active
<input checked="" type="checkbox"/>	Volume_Name_3 On	RW	SVM_Name_1	0.25 TB	10 TB	Not Active
<input checked="" type="checkbox"/>	Volume_Name_4 On	DP	SVM_Name_2	0.25 TB	10 TB	Not Active
<input checked="" type="checkbox"/>	Volume_Name_5 On	RW	SVM_Name_1	0.25 TB	10 TB	Not Active
<input checked="" type="checkbox"/>	Automatically back up future volumes on all storage VMs with the selected backup policy ⓘ					

If you want all volumes added in the future to have backup enabled, just leave the checkbox for "Automatically back up future volumes..." checked. If you disable this setting, you'll need to manually enable backups for future volumes.

- Click **Activate Backup** and Cloud Backup starts taking the initial backups of your volumes.

Result

Cloud Backup starts taking the initial backups of each selected volume and the Volume Backup Dashboard is displayed so you can monitor the state of the backups.

What's next?

You can [start and stop backups for volumes or change the backup schedule](#).

You can also [restore entire volumes from a backup file](#) to a Cloud Volumes ONTAP system in Google, or to an on-premises ONTAP system.

Backing up on-premises ONTAP data to StorageGRID

Complete a few steps to get started backing up data from your on-premises ONTAP systems to object storage in your NetApp StorageGRID systems.

Quick start

Get started quickly by following these steps, or scroll down to the remaining sections for full details.

1

Verify support for your configuration

- You have discovered the on-premises cluster and added it to a working environment in Cloud Manager. See [Discovering ONTAP clusters](#) for details.
 - The cluster is running ONTAP 9.7P5 or later.
 - The cluster has a SnapMirror license — it is included as part of the Premium Bundle or Data Protection Bundle.
 - The cluster must have the required network connections to StorageGRID and to the Connector.

- You have a Connector installed on your premises.
 - Networking for the Connector enables an outbound HTTPS connection to the ONTAP cluster and to StorageGRID.
- You have purchased [and activated](#) a Cloud Backup BYOL license from NetApp.
- Your StorageGRID has version 10.3 or later with access keys that have S3 permissions.

2

Enable Cloud Backup on the system

Select the working environment and click **Enable** next to the Backup & Restore service in the right-panel, and then follow the setup wizard.



3

Enter the StorageGRID details

Select StorageGRID as the provider, and then enter the StorageGRID server and service account details. You also need to specify the IPspace in the ONTAP cluster where the volumes reside.

Provider Settings	
Provider Information	
Storage Server	Connectivity
Enter Storage Server	IPspace IP_Space_1
Access Key	
Access Key	
Secret Key	
Secret Key	

4

Define the default backup policy

The default policy backs up volumes every day and retains the most recent 30 backup copies of each volume. Change to hourly, daily, weekly, or monthly backups, or select one of the system-defined policies that provide more options. You can also change the number of backup copies you want to retain.

Define Policy

This policy is applied to the volumes you select in the next step. You can apply different policies to volumes after activating backup.

Policy - Retention & Schedule	<input type="radio"/> Create a New Policy	<input checked="" type="radio"/> Select an Existing Policy
Select Policy		
<input type="button" value="Default Policy (30 Daily)"/>		
DP Volumes	Data protection volume backups use the same retention period as defined in the source SnapMirror relationship by default. Use the API if you want to change this value	

5

Select the volumes that you want to back up

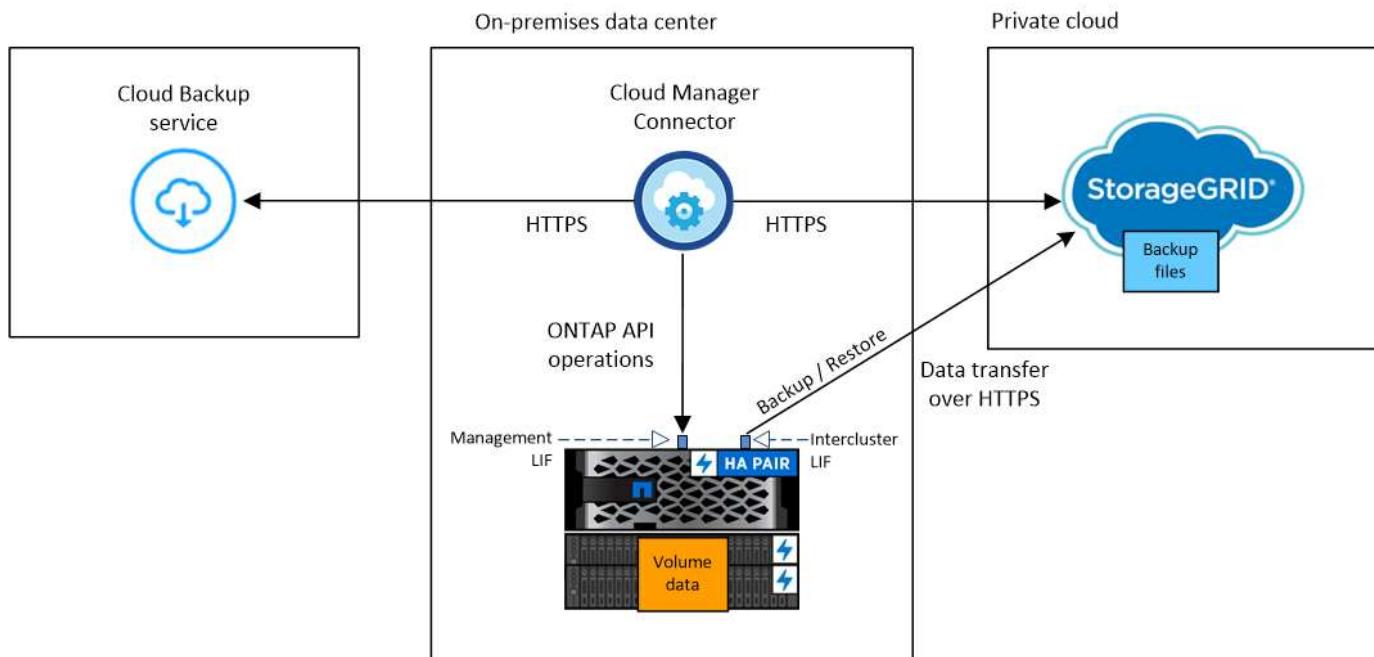
Identify which volumes you want to back up using the default backup policy in the Select Volumes page. If you want to assign different backup policies to certain volumes, you can create additional policies and apply them to volumes later.

An S3 bucket is created automatically in the service account indicated by the S3 access key and secret key you entered, and the backup files are stored there.

Requirements

Read the following requirements to make sure you have a supported configuration before you start backing up on-premises volumes to StorageGRID.

The following image shows each component when backing up an on-prem ONTAP system to StorageGRID and the connections that you need to prepare between them:



Note that the Cloud Restore instance is not shown in this diagram because single-file restore is not currently supported when using StorageGRID.

Preparing your ONTAP clusters

You need to discover your on-premises ONTAP clusters in Cloud Manager before you can start backing up volume data.

[Learn how to discover a cluster.](#)

ONTAP requirements

- ONTAP 9.7P5 and later.
- A SnapMirror license (included as part of the Premium Bundle or Data Protection Bundle).

Note: The "Hybrid Cloud Bundle" is not required when using Cloud Backup.

See how to [manage your cluster licenses](#).

- Time and time zone are set correctly.

See how to [configure your cluster time](#).

Cluster networking requirements

- The ONTAP cluster initiates an HTTPS connection over a user-specified port from the intercluster LIF to StorageGRID for backup and restore operations. The port is configurable during backup setup.

ONTAP reads and writes data to and from object storage. The object storage never initiates, it just responds.

- ONTAP requires an inbound connection from the Connector to the cluster management LIF. The Connector must reside on your premises.
- An intercluster LIF is required on each ONTAP node that hosts the volumes you want to back up. The LIF must be associated with the *IPspace* that ONTAP should use to connect to object storage. [Learn more about IPspaces](#).

When you set up Cloud Backup, you are prompted for the *IPspace* to use. You should choose the *IPspace* that each LIF is associated with. That might be the "Default" *IPspace* or a custom *IPspace* that you created.

- The nodes' intercluster LIFs are able to access the object store.
- DNS servers have been configured for the storage VM where the volumes are located. See how to [configure DNS services for the SVM](#).
- Note that if you use are using a different *IPspace* than the Default, then you might need to create a static route to get access to the object storage.
- Update firewall rules, if necessary, to allow Cloud Backup service connections from ONTAP to object storage through the port you specified (typically port 443) and name resolution traffic from the storage VM to the DNS server over port 53 (TCP/UDP).

Preparing StorageGRID

StorageGRID must meet the following requirements. See the [StorageGRID documentation](#) for more information.

Supported StorageGRID versions

StorageGRID 10.3 and later is supported.

S3 credentials

When you set up backup to StorageGRID, the backup wizard prompts you for an S3 access key and secret key for a service account. A service account enables Cloud Backup to authenticate and access the StorageGRID buckets used to store backups. The keys are required so that StorageGRID knows who is making the request.

These access keys must be associated with a user who has the following permissions:

```
"s3>ListAllMyBuckets",
"s3>ListBucket",
"s3GetObject",
"s3PutObject",
"s3DeleteObject",
"s3CreateBucket"
```

Object versioning

You must not enable StorageGRID object versioning on the object store bucket.

Creating or switching Connectors

When backing up data to StorageGRID, a Connector must be available on your premises. You'll either need to install a new Connector or make sure that the currently selected Connector resides on-prem.

- [Learn about Connectors](#)
- [Installing the Connector on a Linux host with internet access](#)
- [Switching between Connectors](#)

Preparing networking for the Connector

Ensure that the Connector has the required networking connections.

Steps

1. Ensure that the network where the Connector is installed enables the following connections:
 - An HTTPS connection over port 443 to StorageGRID
 - An HTTPS connection over port 443 to your ONTAP clusters
 - An outbound internet connection over port 443 to Cloud Backup

License requirements

Before your 30-day free trial of Cloud Backup expires, you need to purchase and activate a Cloud Backup BYOL license from NetApp. This license is for the account and can be used across multiple systems.

You'll need the serial number from NetApp that enables you to use the service for the duration and capacity of the license. [Learn how to manage your BYOL licenses](#).



PAYGO licensing is not supported when backing up files to StorageGRID.

A SnapMirror license is required on the cluster. Note that the "Hybrid Cloud Bundle" is not required when using Cloud Backup.

Enabling Cloud Backup to StorageGRID

Enable Cloud Backup at any time directly from the on-premises working environment.

Steps

1. From the Canvas, select the on-premises working environment and click **Enable** next to the Backup & Restore service in the right-panel.



2. Select **StorageGRID** as the provider, click **Next**, and then enter the provider details:
 - a. The FQDN of the StorageGRID server and the port that ONTAP should use for HTTPS communication with StorageGRID; for example: s3.eng.company.com:8082
 - b. The Access Key and the Secret Key used to access the bucket to store backups.
 - c. The IPspace in the ONTAP cluster where the volumes you want to back up reside. The intercluster LIFs for this IPspace must have outbound internet access.

Selecting the correct IPspace ensures that Cloud Backup can set up a connection from ONTAP to your StorageGRID object storage.

Provider Settings	
Provider Information	
Storage Server	Connectivity
<input type="text" value="Enter Storage Server"/>	IPspace IP_Space_1
Access Key	
<input type="text" value="Access Key"/>	
Secret Key	
<input type="text" value="Secret Key"/>	

Note that you cannot change this information after the service has started.

3. In the *Define Policy* page, select the default backup schedule and retention value and click **Next**.

Define Policy

This policy is applied to the volumes you select in the next step. You can apply different policies to volumes after activating backup.

Policy - Retention & Schedule
 Create a New Policy
 Select an Existing Policy

Select Policy

Default Policy (30 Daily)

DP Volumes

Data protection volume backups use the same retention period as defined in the source SnapMirror relationship by default. Use the API if you want to change this value

[See the list of existing policies.](#)

4. Select the volumes that you want to back up using the default backup policy in the Select Volumes page. If you want to assign different backup policies to certain volumes, you can create additional policies and apply them to those volumes later.

- To back up all volumes, check the box in the title row (**Volume Name**).
- To back up individual volumes, check the box for each volume (**Volume_1**).

Select Volumes

57 Volumes

<input checked="" type="checkbox"/>	Volume Name	Volume Type	SVM Name	Used Capacity	Allocated Capacity	Backup Status
<input checked="" type="checkbox"/>	Volume_Name_1 On	RW	SVM_Name_1	0.25 TB	10 TB	Not Active
<input checked="" type="checkbox"/>	Volume_Name_2 On	RW	SVM_Name_1	0.25 TB	10 TB	Not Active
<input checked="" type="checkbox"/>	Volume_Name_3 On	RW	SVM_Name_1	0.25 TB	10 TB	Not Active
<input checked="" type="checkbox"/>	Volume_Name_4 On	DP	SVM_Name_2	0.25 TB	10 TB	Not Active
<input checked="" type="checkbox"/>	Volume_Name_5 On	RW	SVM_Name_1	0.25 TB	10 TB	Not Active
<input checked="" type="checkbox"/>	Automatically back up future volumes on all storage VMs with the selected backup policy (i)					

If you want all volumes added in the future to this cluster to have backup enabled, just leave the checkbox for "Automatically back up future volumes..." checked. If you disable this setting, you'll need to manually enable backups for future volumes.

5. Click **Activate Backup** and Cloud Backup starts taking the initial backups of each selected volume.

Result

An S3 bucket is created automatically in the service account indicated by the S3 access key and secret key you entered, and the backup files are stored there. The Volume Backup Dashboard is displayed so you can monitor the state of the backups.

What's next?

You can [start and stop backups for volumes or change the backup schedule](#).

You can also [restore entire volumes from a backup file](#) to a new volume on an on-premises ONTAP system.

Back up Kubernetes cluster data

Backing up Kubernetes persistent volume data to Amazon S3

Complete a few steps to get started backing up data from your persistent volumes on EKS Kubernetes clusters to Amazon S3 storage.

Quick start

Get started quickly by following these steps or scroll down to the remaining sections for full details.

1

Review prerequisites

- You have discovered the Kubernetes cluster as a Cloud Manager working environment.
 - Trident must be installed on the cluster, and the Trident version must be 21.1 or greater.
 - All PVCs that will be used to create persistent volumes that you want to back up must have "snapshotPolicy" set to "default".
 - The cluster must be using Cloud Volumes ONTAP on AWS for its' backend storage.
 - The Cloud Volumes ONTAP system must be running ONTAP 9.7P5 or later.
- You have a valid cloud provider subscription for the storage space where your backups will be located.
- You have subscribed to the [Cloud Manager Marketplace Backup offering](#), an [AWS annual contract](#), or you have purchased [and activated](#) a Cloud Backup BYOL license from NetApp.
- The IAM role that provides the Cloud Manager Connector with permissions includes S3 permissions from the latest [Cloud Manager policy](#).

2

Enable Cloud Backup on your existing Kubernetes cluster

Select the working environment and click **Enable** next to the Backup & Restore service in the right-panel, and then follow the setup wizard.



3

Define the backup policy

The default policy backs up volumes every day and retains the most recent 30 backup copies of each volume. Change to hourly, daily, weekly, or monthly backups, or select one of the system-defined policies that provide more options. You can also change the number of backup copies you want to retain.

Define Policy

Policy - Retention & Schedule

<input type="checkbox"/> Hourly	Number of backups to retain	24	▲ ▼
<input checked="" type="checkbox"/> Daily	Number of backups to retain	30	▲ ▼
<input type="checkbox"/> Weekly	Number of backups to retain	52	▲ ▼
<input type="checkbox"/> Monthly	Number of backups to retain	12	▲ ▼

S3 Bucket Cloud Manager will create the S3 bucket after you complete the wizard

4

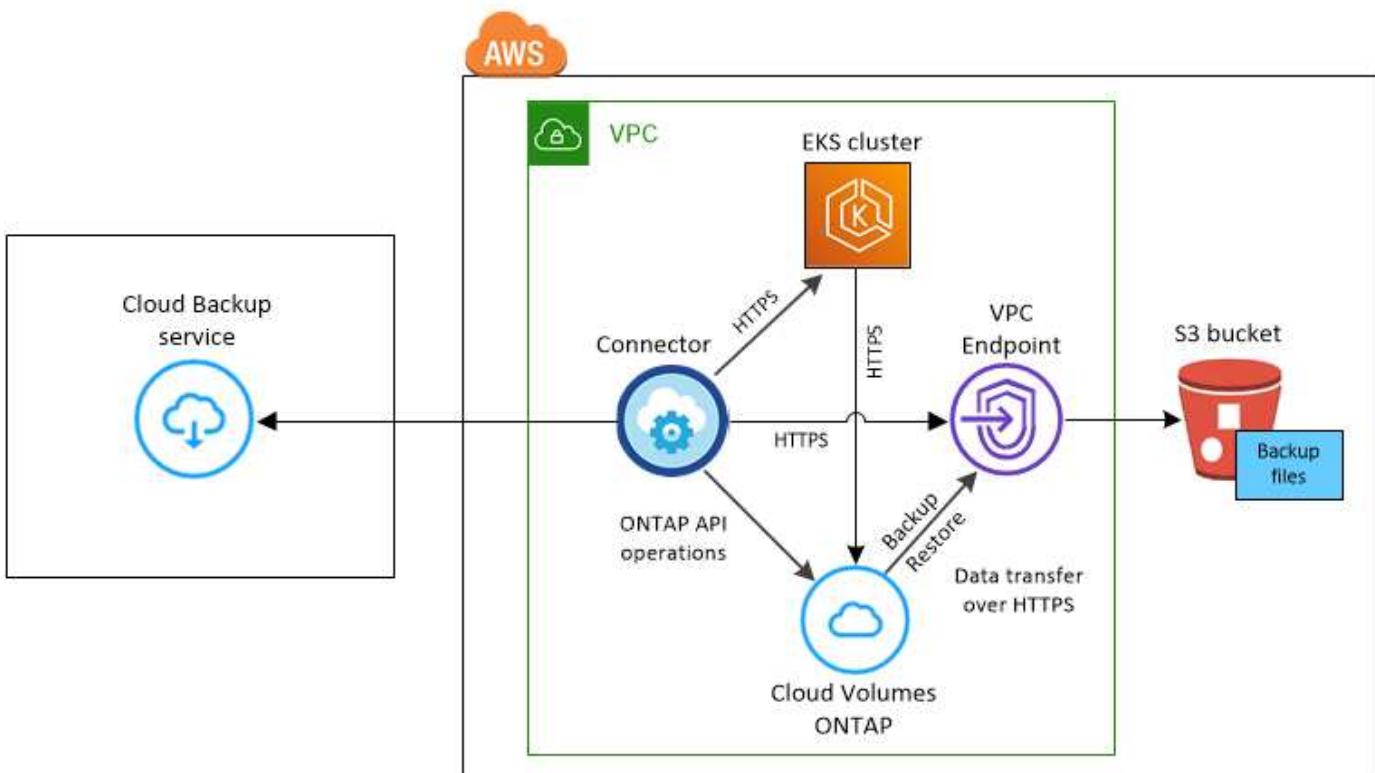
Select the volumes that you want to back up

Identify which volumes you want to back up in the Select Volumes page. An S3 bucket is created automatically in the same AWS account and Region as the Cloud Volumes ONTAP system, and the backup files are stored there.

Requirements

Read the following requirements to make sure that you have a supported configuration before you start backing up Kubernetes persistent volumes to S3.

The following image shows each component and the connections that you need to prepare between them:



Note that the VPC Endpoint is optional.

Kubernetes cluster requirements

- You have discovered the Kubernetes cluster as a Cloud Manager working environment. [See how to discover the Kubernetes cluster](#).
- Trident must be installed on the cluster, and the Trident version must be a minimum of 21.1. See [how to install Trident](#) or [how to upgrade the Trident version](#).
- The cluster must be using Cloud Volumes ONTAP on AWS for its' backend storage.
- The Cloud Volumes ONTAP system must be in the same AWS region as the Kubernetes cluster, and it must be running ONTAP 9.7P5 or later.

Note that Kubernetes clusters in on-premises locations are not supported. Only Kubernetes clusters in cloud deployments that are using Cloud Volumes ONTAP systems are supported.

- All Persistent Volume Claim objects that will be used to create the persistent volumes that you want to back up must have "snapshotPolicy" set to "default".

You can do this for individual PVCs by adding `snapshotPolicy` under annotations:

```
kind: PersistentVolumeClaim
apiVersion: v1
metadata:
  name: full
  annotations:
    trident.netapp.io/snapshotPolicy: "default"
spec:
  accessModes:
    - ReadWriteMany
  resources:
    requests:
      storage: 1000Mi
  storageClassName: silver
```

You can do this for all PVCs associated with a particular backend storage by adding the `snapshotPolicy` field under `defaults` in the `backend.json` file:

```

apiVersion: trident.netapp.io/v1
kind: TridentBackendConfig
metadata:
  name: backend-tbc-ontap-nas-advanced
spec:
  version: 1
  storageDriverName: ontap-nas
  managementLIF: 10.0.0.1
  dataLIF: 10.0.0.2
  backendName: tbc-ontap-nas-advanced
  svm: trident_svm
  credentials:
    name: backend-tbc-ontap-nas-advanced-secret
  limitAggregateUsage: 80%
  limitVolumeSize: 50Gi
  nfsMountOptions: nfsvers=4
  defaults:
    spaceReserve: volume
    exportPolicy: myk8scluster
    snapshotPolicy: default
    snapshotReserve: '10'
    deletionPolicy: retain

```

License requirements

For Cloud Backup PAYGO licensing, a Cloud Manager subscription is available in the AWS Marketplace that enables deployments of Cloud Volumes ONTAP and Cloud Backup. You need to [subscribe to this Cloud Manager subscription](#) before you enable Cloud Backup. Billing for Cloud Backup is done through this subscription.

For an annual contract that enables you to back up both Cloud Volumes ONTAP data and on-premises ONTAP data, you need to subscribe from the [AWS Marketplace page](#) and then [associate the subscription with your AWS credentials](#).

For an annual contract that enables you to bundle Cloud Volumes ONTAP and Cloud Backup, you must set up the annual contract when you create a Cloud Volumes ONTAP working environment. This option doesn't enable you to back up on-prem data.

For Cloud Backup BYOL licensing, you need the serial number from NetApp that enables you to use the service for the duration and capacity of the license. [Learn how to manage your BYOL licenses](#).

And you need to have an AWS account for the storage space where your backups will be located.

Supported AWS regions

Cloud Backup is supported in all AWS regions [where Cloud Volumes ONTAP is supported](#).

AWS Backup permissions required

The IAM role that provides Cloud Manager with permissions must include S3 permissions from the latest [Cloud Manager policy](#).

Here are the specific S3 permissions from the policy:

```
{  
    "Sid": "backupPolicy",  
    "Effect": "Allow",  
    "Action": [  
        "s3:DeleteBucket",  
        "s3:GetLifecycleConfiguration",  
        "s3:PutLifecycleConfiguration",  
        "s3:PutBucketTagging",  
        "s3>ListBucketVersions",  
        "s3:GetObject",  
        "s3>DeleteObject",  
        "s3>ListBucket",  
        "s3>ListAllMyBuckets",  
        "s3:GetBucketTagging",  
        "s3:GetBucketLocation",  
        "s3:GetBucketPolicyStatus",  
        "s3:GetBucketPublicAccessBlock",  
        "s3:GetBucketAcl",  
        "s3:GetBucketPolicy",  
        "s3:PutBucketPublicAccessBlock"  
    ],  
    "Resource": [  
        "arn:aws:s3:::netapp-backup-*"  
    ]  
},
```

Enabling Cloud Backup on an existing system

Enable Cloud Backup at any time directly from the working environment.

Steps

1. Select the working environment and click **Enable** next to the Backup & Restore service in the right-panel.



2. Enter the backup policy details and click **Next**.

You can define the backup schedule and choose the number of backups to retain.

Define Policy

Policy - Retention & Schedule

<input type="checkbox"/> Hourly	Number of backups to retain	24	<input type="button" value="▼"/>
<input checked="" type="checkbox"/> Daily	Number of backups to retain	30	<input type="button" value="▼"/>
<input type="checkbox"/> Weekly	Number of backups to retain	52	<input type="button" value="▼"/>
<input type="checkbox"/> Monthly	Number of backups to retain	12	<input type="button" value="▼"/>

S3 Bucket

Cloud Manager will create the S3 bucket after you complete the wizard

3. Select the persistent volumes that you want to back up.

- To back up all volumes, check the box in the title row (**Volume Name**).
- To back up individual volumes, check the box for each volume (**Volume_1**).

Select Volumes					
57 Volumes					
<input checked="" type="checkbox"/>	Persistent Volume Name	Namespace	Allocated Capacity	Backup Status	
<input checked="" type="checkbox"/>	Persistent Volume 1	Namespace 1	10 TB	■ On	
<input checked="" type="checkbox"/>	Persistent Volume 2	Namespace 1	10 TB	■ On	
<input checked="" type="checkbox"/>	Persistent Volume 3	Namespace 1	10 TB	■ On	
<input checked="" type="checkbox"/>	PV 1	Namespace 2	10 TB	■ On	
<input checked="" type="checkbox"/>	PV 2	Namespace 2	10 TB	■ On	

4. Click **Activate Backup** and Cloud Backup starts taking the initial backups of each selected volume.

Result

An S3 bucket is created automatically in the same AWS account and Region as the Cloud Volumes ONTAP system, and the backup files are stored there.

The Kubernetes Dashboard is displayed so you can monitor the state of the backups.

What's next?

You can [start and stop backups for volumes or change the backup schedule](#).

You can also [restore entire volumes from a backup file](#) as a new volume on the same or different Kubernetes cluster in AWS (in the same region).

Backing up Kubernetes persistent volume data to Azure Blob storage

Complete a few steps to get started backing up data from your persistent volumes on AKS Kubernetes clusters to Azure Blob storage.

Quick start

Get started quickly by following these steps or scroll down to the remaining sections for full details.

1

Review prerequisites

- You have discovered the Kubernetes cluster as a Cloud Manager working environment.
 - Trident must be installed on the cluster, and the Trident version must be 21.1 or greater.
 - All PVCs that will be used to create persistent volumes that you want to back up must have "snapshotPolicy" set to "default".
 - The cluster must be using Cloud Volumes ONTAP on Azure for its' backend storage.
 - The Cloud Volumes ONTAP system must be running ONTAP 9.7P5 or later.
- You have a valid cloud provider subscription for the storage space where your backups will be located.
- You have subscribed to the [Cloud Manager Marketplace Backup offering](#), or you have purchased **and activated** a Cloud Backup BYOL license from NetApp.

2

Enable Cloud Backup on your existing Kubernetes cluster

Select the working environment and click **Enable** next to the Backup & Restore service in the right-panel, and then follow the setup wizard.



3

Define the backup policy

The default policy backs up volumes every day and retains the most recent 30 backup copies of each volume. Change to hourly, daily, weekly, or monthly backups, or select one of the system-defined policies that provide more options. You can also change the number of backup copies you want to retain.

Define Policy

Policy - Retention & Schedule

<input type="checkbox"/> Hourly	Number of backups to retain	24
<input checked="" type="checkbox"/> Daily	Number of backups to retain	30
<input type="checkbox"/> Weekly	Number of backups to retain	52
<input type="checkbox"/> Monthly	Number of backups to retain	12

Storage Account Cloud Manager will create the storage account after you complete the wizard

4

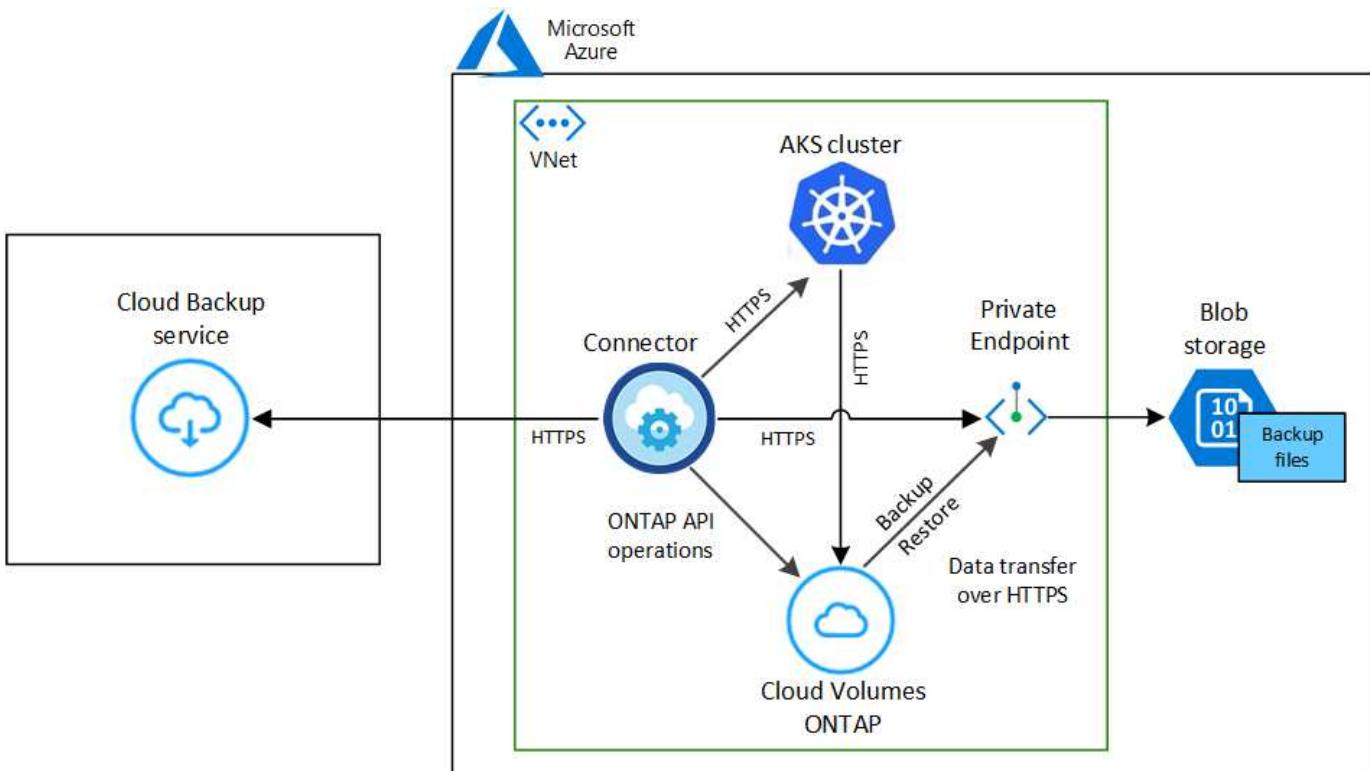
Select the volumes that you want to back up

Identify which volumes you want to back up in the Select Volumes page. The backup files are stored in a Blob container using the same Azure subscription and Region as the Cloud Volumes ONTAP system.

Requirements

Read the following requirements to make sure that you have a supported configuration before you start backing up Kubernetes persistent volumes to Blob storage.

The following image shows each component and the connections that you need to prepare between them:



Note that the Private Endpoint is optional.

Kubernetes cluster requirements

- You have discovered the Kubernetes cluster as a Cloud Manager working environment. [See how to discover the Kubernetes cluster](#).
- Trident must be installed on the cluster, and the Trident version must be a minimum of 21.1. See [how to install Trident](#) or [how to upgrade the Trident version](#).
- The cluster must be using Cloud Volumes ONTAP on Azure for its' backend storage.
- The Cloud Volumes ONTAP system must be in the same Azure region as the Kubernetes cluster, and it must be running ONTAP 9.7P5 or later.

Note that Kubernetes clusters in on-premises locations are not supported. Only Kubernetes clusters in cloud deployments that are using Cloud Volumes ONTAP systems are supported.

- All Persistent Volume Claim objects that will be used to create the persistent volumes that you want to back up must have "snapshotPolicy" set to "default".

You can do this for individual PVCs by adding `snapshotPolicy` under annotations:

```
kind: PersistentVolumeClaim
apiVersion: v1
metadata:
  name: full
  annotations:
    trident.netapp.io/snapshotPolicy: "default"
spec:
  accessModes:
    - ReadWriteMany
  resources:
    requests:
      storage: 1000Mi
  storageClassName: silver
```

You can do this for all PVCs associated with a particular backend storage by adding the `snapshotPolicy` field under `defaults` in the `backend.json` file:

```

apiVersion: trident.netapp.io/v1
kind: TridentBackendConfig
metadata:
  name: backend-tbc-ontap-nas-advanced
spec:
  version: 1
  storageDriverName: ontap-nas
  managementLIF: 10.0.0.1
  dataLIF: 10.0.0.2
  backendName: tbc-ontap-nas-advanced
  svm: trident_svm
  credentials:
    name: backend-tbc-ontap-nas-advanced-secret
  limitAggregateUsage: 80%
  limitVolumeSize: 50Gi
  nfsMountOptions: nfsvers=4
  defaults:
    spaceReserve: volume
    exportPolicy: myk8scluster
    snapshotPolicy: default
    snapshotReserve: '10'
    deletionPolicy: retain

```

License requirements

For Cloud Backup PAYGO licensing, a subscription through the Azure Marketplace is required before you enable Cloud Backup. Billing for Cloud Backup is done through this subscription. [You can subscribe from the Details & Credentials page of the working environment wizard.](#)

For Cloud Backup BYOL licensing, you need the serial number from NetApp that enables you to use the service for the duration and capacity of the license. [Learn how to manage your BYOL licenses.](#)

And you need to have a Microsoft Azure subscription for the storage space where your backups will be located.

Supported Azure regions

Cloud Backup is supported in all Azure regions [where Cloud Volumes ONTAP is supported](#).

Enabling Cloud Backup on an existing system

Enable Cloud Backup at any time directly from the working environment.

Steps

1. Select the working environment and click **Enable** next to the Backup & Restore service in the right-panel.



2. Enter the backup policy details and click **Next**.

You can define the backup schedule and choose the number of backups to retain.

Define Policy

Policy - Retention & Schedule

<input type="checkbox"/> Hourly	Number of backups to retain	24
<input checked="" type="checkbox"/> Daily	Number of backups to retain	30
<input type="checkbox"/> Weekly	Number of backups to retain	52
<input type="checkbox"/> Monthly	Number of backups to retain	12

Storage Account Cloud Manager will create the storage account after you complete the wizard

3. Select the persistent volumes that you want to back up.

- To back up all volumes, check the box in the title row (**Volume Name**).
- To back up individual volumes, check the box for each volume (**Volume_1**).

Select Volumes

57 Volumes

<input checked="" type="checkbox"/>	Persistent Volume Name	Namespace	Allocated Capacity	Backup Status
<input checked="" type="checkbox"/>	Persistent Volume 1	Namespace 1	10 TB	On
<input checked="" type="checkbox"/>	Persistent Volume 2	Namespace 1	10 TB	On
<input checked="" type="checkbox"/>	Persistent Volume 3	Namespace 1	10 TB	On
<input checked="" type="checkbox"/>	PV 1	Namespace 2	10 TB	On
<input checked="" type="checkbox"/>	PV 2	Namespace 2	10 TB	On

4. Click **Activate Backup** and Cloud Backup starts taking the initial backups of each selected volume.

Result

The backup files are stored in a Blob container using the same Azure subscription and Region as the Cloud Volumes ONTAP system.

The Kubernetes Dashboard is displayed so you can monitor the state of the backups.

What's next?

You can [start and stop backups for volumes or change the backup schedule](#).

You can also [restore entire volumes from a backup file](#) as a new volume on the same or different Kubernetes cluster in Azure (in the same region).

Backing up Kubernetes persistent volume data to Google Cloud storage

Complete a few steps to get started backing up data from your persistent volumes on GKE Kubernetes clusters to Google Cloud storage.

Quick start

Get started quickly by following these steps or scroll down to the remaining sections for full details.

1

Review prerequisites

- You have discovered the Kubernetes cluster as a Cloud Manager working environment.
 - Trident must be installed on the cluster, and the Trident version must be 21.1 or greater.
 - All PVCs that will be used to create persistent volumes that you want to back up must have "snapshotPolicy" set to "default".
 - The cluster must be using Cloud Volumes ONTAP on GCP for its' backend storage.
 - The Cloud Volumes ONTAP system must be running ONTAP 9.7P5 or later.
- You have a valid GCP subscription for the storage space where your backups will be located.
- You have a service account in your Google Cloud Project that has the predefined Storage Admin role.
- You have subscribed to the [Cloud Manager Marketplace Backup offering](#), or you have purchased [and activated](#) a Cloud Backup BYOL license from NetApp.

2

Enable Cloud Backup on your existing Kubernetes cluster

Select the working environment and click **Enable** next to the Backup & Restore service in the right-panel, and then follow the setup wizard.



3

Define the backup policy

The default policy backs up volumes every day and retains the most recent 30 backup copies of each volume. Change to hourly, daily, weekly, or monthly backups, or select one of the system-defined policies that provide more options. You can also change the number of backup copies you want to retain.

Define Policy

Policy - Retention & Schedule

<input type="checkbox"/> Hourly	Number of backups to retain	24
<input checked="" type="checkbox"/> Daily	Number of backups to retain	30
<input type="checkbox"/> Weekly	Number of backups to retain	52
<input type="checkbox"/> Monthly	Number of backups to retain	12

Storage Account Cloud Manager will create the storage account after you complete the wizard

4

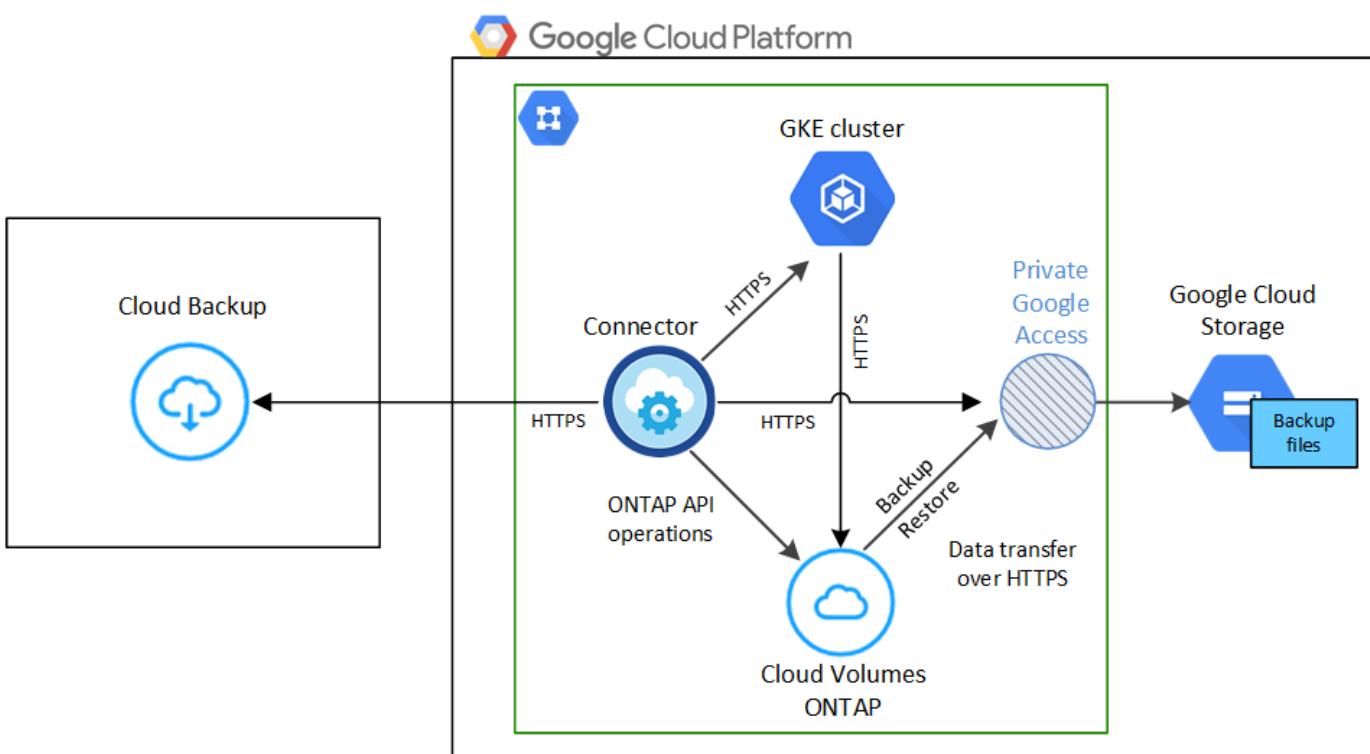
Select the volumes that you want to back up

Identify which volumes you want to back up in the Select Volumes page. The backup files are stored in a Google Cloud Storage bucket using the same GCP subscription and Region as the Cloud Volumes ONTAP system.

Requirements

Read the following requirements to make sure that you have a supported configuration before you start backing up Kubernetes persistent volumes to Google Cloud storage.

The following image shows each component and the connections that you need to prepare between them:



Note that the Private Endpoint is optional.

Kubernetes cluster requirements

- You have discovered the Kubernetes cluster as a Cloud Manager working environment. [See how to discover the Kubernetes cluster](#).
- Trident must be installed on the cluster, and the Trident version must be a minimum of 21.1. See [how to install Trident](#) or [how to upgrade the Trident version](#).
- The cluster must be using Cloud Volumes ONTAP on GCP for its' backend storage.
- The Cloud Volumes ONTAP system must be in the same GCP region as the Kubernetes cluster, and it must be running ONTAP 9.7P5 or later.

Note that Kubernetes clusters in on-premises locations are not supported. Only Kubernetes clusters in cloud deployments that are using Cloud Volumes ONTAP systems are supported.

- All Persistent Volume Claim objects that will be used to create the persistent volumes that you want to back up must have "snapshotPolicy" set to "default".

You can do this for individual PVCs by adding `snapshotPolicy` under annotations:

```
kind: PersistentVolumeClaim
apiVersion: v1
metadata:
  name: full
  annotations:
    trident.netapp.io/snapshotPolicy: "default"
spec:
  accessModes:
    - ReadWriteMany
  resources:
    requests:
      storage: 1000Mi
  storageClassName: silver
```

You can do this for all PVCs associated with a particular backend storage by adding the `snapshotPolicy` field under `defaults` in the `backend.json` file:

```

apiVersion: trident.netapp.io/v1
kind: TridentBackendConfig
metadata:
  name: backend-tbc-ontap-nas-advanced
spec:
  version: 1
  storageDriverName: ontap-nas
  managementLIF: 10.0.0.1
  dataLIF: 10.0.0.2
  backendName: tbc-ontap-nas-advanced
  svm: trident_svm
  credentials:
    name: backend-tbc-ontap-nas-advanced-secret
  limitAggregateUsage: 80%
  limitVolumeSize: 50Gi
  nfsMountOptions: nfsvers=4
  defaults:
    spaceReserve: volume
    exportPolicy: myk8scluster
    snapshotPolicy: default
    snapshotReserve: '10'
    deletionPolicy: retain

```

Supported GCP regions

Cloud Backup is supported in all GCP regions [where Cloud Volumes ONTAP is supported](#).

License requirements

For Cloud Backup PAYGO licensing, a subscription through the [GCP Marketplace](#) is required before you enable Cloud Backup. Billing for Cloud Backup is done through this subscription. [You can subscribe from the Details & Credentials page of the working environment wizard](#).

For Cloud Backup BYOL licensing, you need the serial number from NetApp that enables you to use the service for the duration and capacity of the license. [Learn how to manage your BYOL licenses](#).

And you need to have a Google subscription for the storage space where your backups will be located.

GCP Service Account

You need to have a service account in your Google Cloud Project that has the predefined Storage Admin role. [Learn how to create a service account](#).

Enabling Cloud Backup on an existing system

Enable Cloud Backup at any time directly from the working environment.

Steps

1. Select the working environment and click **Enable** next to the Backup & Restore service in the right-panel.



2. Enter the backup policy details and click **Next**.

You can define the backup schedule and choose the number of backups to retain.

Define Policy

Policy - Retention & Schedule

<input type="checkbox"/> Hourly	Number of backups to retain	24
<input checked="" type="checkbox"/> Daily	Number of backups to retain	30
<input type="checkbox"/> Weekly	Number of backups to retain	52
<input type="checkbox"/> Monthly	Number of backups to retain	12

Storage Account: Cloud Manager will create the storage account after you complete the wizard

3. Select the persistent volumes that you want to back up.

- To back up all volumes, check the box in the title row (**Volume Name**).
- To back up individual volumes, check the box for each volume (**Volume_1**).

Select Volumes

57 Volumes

<input checked="" type="checkbox"/>	Persistent Volume Name	Namespace	Allocated Capacity	Backup Status
<input checked="" type="checkbox"/>	Persistent Volume 1	Namespace 1	10 TB	On
<input checked="" type="checkbox"/>	Persistent Volume 2	Namespace 1	10 TB	On
<input checked="" type="checkbox"/>	Persistent Volume 3	Namespace 1	10 TB	On
<input checked="" type="checkbox"/>	PV 1	Namespace 2	10 TB	On
<input checked="" type="checkbox"/>	PV 2	Namespace 2	10 TB	On

4. Click **Activate Backup** and Cloud Backup starts taking the initial backups of each selected volume.

Result

The backup files are stored in a Google Cloud Storage bucket using the same GCP subscription and Region as the Cloud Volumes ONTAP system.

The Kubernetes Dashboard is displayed so you can monitor the state of the backups.

What's next?

You can start and stop backups for volumes or change the backup schedule.

You can also restore entire volumes from a backup file as a new volume on the same or different Kubernetes cluster in GCP (in the same region).

Set up licensing for Cloud Backup

A 30-day free trial of Cloud Backup starts when you enable the Cloud Backup service. When the free trial ends, you'll need to pay for Cloud Backup using a pay-as-you-go (PAYGO) subscription through your cloud provider, an annual contract through AWS, or a bring-your-own license (BYOL) from NetApp.

A few notes before you read any further:

- If you've already subscribed to the Cloud Manager pay-as-you-go (PAYGO) subscription in your cloud provider's marketplace, then you're automatically subscribed to Cloud Backup as well. You won't need to subscribe again.
- The Cloud Backup bring-your-own-license (BYOL) is a floating license that you can use across all Cloud Volumes ONTAP and on-premises ONTAP systems associated with your Cloud Manager account.
- Backup to StorageGRID requires a BYOL license, but there's no cost for cloud provider storage space in this case.

[Learn more about the licensing and costs related to Cloud Backup.](#)

Use a Cloud Backup PAYGO subscription

For pay-as-you-go you'll pay your cloud provider for object storage costs and for NetApp backup licensing costs. Use these links to subscribe to Cloud Backup from your cloud provider marketplace:

- AWS: [Go to the Cloud Manager Marketplace offering for pricing details.](#)
- Azure: [Go to the Cloud Manager Marketplace offering for pricing details.](#)
- GCP: [Go to the Cloud Manager Marketplace offering for pricing details.](#)

Subscribe to yearly contracts through AWS

There are two annual contracts available from the AWS Marketplace:

- An annual contract that enables you to back up Cloud Volumes ONTAP data and on-premises ONTAP data.

Go to the [AWS Marketplace page](#) to view pricing details.

If you want to use this option, set up your subscription from the Marketplace page and then [associate the subscription with your AWS credentials](#). Note that you'll also need to pay for your Cloud Volumes ONTAP systems using this annual contract subscription since you can assign only one active subscription to your AWS credentials in Cloud Manager.

- A Professional Package that enables you to bundle Cloud Volumes ONTAP and Cloud Backup by using an annual contract for 1, 2, or 3 years. Payment is per TiB. This option doesn't enable you to back up on-premises ONTAP data.

Go to the [AWS Marketplace page](#) to view pricing details and go to the [Cloud Volumes ONTAP Release](#)

[Notes](#) to learn more about this licensing option.

If you want to use this option, you can set up the annual contract when you create a Cloud Volumes ONTAP working environment and Cloud Manager prompts you to subscribe to the AWS Marketplace.

Use a Cloud Backup BYOL license

Bring-your-own licenses from NetApp provide 1-, 2-, or 3-year terms. You pay only for the data that you protect, calculated by the logical used capacity (*before* ONTAP efficiencies) of the source ONTAP volumes which are being backed up. This capacity is also known as Front-End Terabytes (FETB).

The BYOL Cloud Backup license is a floating license where the total capacity is shared across all Cloud Volumes ONTAP and on-premises ONTAP systems associated with your Cloud Manager account. You can get a rough estimate of the capacity you'll need by running the ONTAP command `volume show-space -logical-used` for the volumes you plan to back up.

If you don't have a Cloud Backup BYOL license, click the chat icon in the lower-right of Cloud Manager to purchase one.

Optionally, if you have an unassigned node-based license for Cloud Volumes ONTAP that you won't be using, you can convert it to a Cloud Backup license with the same dollar-equivalence and the same expiration date. [Go here for details.](#)

You use the Digital Wallet page in Cloud Manager to manage BYOL licenses for Cloud Backup. You can add new licenses and update existing licenses.

Obtain your Cloud Backup license file

After you've purchased your Cloud Backup license, you activate the license in Cloud Manager by entering the Cloud Backup serial number and NSS account, or by uploading the NLF license file. The steps below show how to get the NLF license file if you plan to use that method.

Steps

1. Sign in to the [NetApp Support Site](#) and click **Systems > Software Licenses**.
2. Enter your Cloud Backup license serial number.

Serial #	Cluster SN	License Name	License Key	Host ID	Value	End Date
4810	CLOUD_BKP_SERVICE		Get NetApp License File		100	12/31/9998

3. In the **License Key** column, click **Get NetApp License File**.
4. Enter your Cloud Manager Account ID (this is called a Tenant ID on the support site) and click **Submit** to download the license file.

Get License

SERIAL NUMBER:	4810 [REDACTED]
LICENSE:	CLOUD_BKP_SERVICE
SALES ORDER:	3005 [REDACTED]
TENANT ID:	<input type="text" value="Enter Tenant ID"/>

Example: account-xxxxxxxx

[Cancel](#) Submit

You can find your Cloud Manager Account ID by selecting the **Account** drop-down from the top of Cloud Manager, and then clicking **Manage Account** next to your account. Your Account ID is in the Overview tab.

Add Cloud Backup BYOL licenses to your account

After you purchase a Cloud Backup license for your NetApp account, you need to add the license to Cloud Manager.

Steps

1. Click **All Services > Digital Wallet > Data Services Licenses**.
2. Click **Add License**.
3. In the *Add License* dialog, enter the license information and click **Add License**:
 - If you have the backup license serial number and know your NSS account, select the **Enter Serial Number** option and enter that information.

If your NetApp Support Site account isn't available from the drop-down list, [add the NSS account to Cloud Manager](#).

- If you have the backup license file, select the **Upload License File** option and follow the prompts to attach the file.

Add Cloud Backup License

A Backup License must be installed with an active subscription. A Backup license enables you to use Cloud Backup for a certain period of time and for a maximum amount of backup space.

<input checked="" type="radio"/> Enter Serial Number	<input type="radio"/> Upload License File
Serial Number	<input type="text" value="Enter Serial Number"/>
NetApp Support Site Account	<input type="text" value="Select Support Site Account"/>
Add Backup License Cancel	

Enter Serial Number Upload License File

To install a license, follow these instructions:

- 1 Obtain the license file from the "System > Software Licenses" tab at [NetApp Support Site](#). You will need to provide your cloud service serial number and Cloud Manager Account ID.
- 2 Click Upload File and then select the file.

Upload License File Upload

Add Backup License [Cancel](#)

Result

Cloud Manager adds the license so that Cloud Backup is active.

Update a Cloud Backup BYOL license

If your licensed term is nearing the expiration date, or if your licensed capacity is reaching the limit, you'll be notified in the Backup UI. This status also appears in the Digital Wallet page and in [Notifications](#).

The screenshot shows the 'Data Services Licenses' tab in the Digital Wallet. It displays two sections: 'Services License Distribution' and 'Capacity License Distribution'. In the 'Services License Distribution' section, there is a circular chart showing '4 Total Licenses'. Below it, a card indicates 'Cloud Backup (1)' with a warning icon, stating: 'Your license 901201 will expire in 7 days: July 15. Update your license by contacting us through the chat icon in the lower-right of Cloud Manager.' In the 'Capacity License Distribution' section, two bars show 'Cloud Backup' at 200 TB and 'Cloud Tiering' at 200 TB, both labeled 'Total Capacity'. Below these sections is a table titled '4 Service Licenses' with columns for Service, Serial Number, License Capacity, and License Expiry. The first row for 'Cloud Backup' shows the serial number 90120130000000000021, a capacity of 200 TB, and an expiry date of July 15, 2021. A red box highlights the 'July 15, 2021' text. At the top right of the table is a blue 'Add License' button.

Service	Serial Number	License Capacity	License Expiry
Cloud Backup	90120130000000000021	200 TB	July 15, 2021
Cloud Tiering			
Cloud Sync			

You can update your Cloud Backup license before it expires so that there is no interruption in your ability to back up and restore your data.

Steps

1. Click the chat icon in the lower-right of Cloud Manager, or contact Support, to request an extension to your term or additional capacity to your Cloud Backup license for the particular serial number.

After you pay for the license and it is registered with the NetApp Support Site, Cloud Manager automatically updates the license in the Digital Wallet and the Data Services Licenses page will reflect the change in 5 to 10 minutes.

1. If Cloud Manager can't automatically update the license, then you'll need to manually upload the license file.
 - a. You can [obtain the license file from the NetApp Support Site](#).
 - b. On the Digital Wallet page *Data Services Licenses* tab, click **...** for the service serial number you are updating, and click **Update License**.

The screenshot shows the 'Data Services Licenses' tab in the Digital Wallet. It displays a table of service licenses. The first row for 'Cloud Backup' has a '...' button next to its serial number. A tooltip for this button contains two options: 'Update License' and 'Remove License'. A red box highlights the 'Update License' button. The table columns are Service, Serial Number, License Capacity, and License Expiry. The 'Cloud Backup' row shows a serial number of 90120130000000000021, a capacity of 200 TB, and an expiry date of January 1, 2022.

Service	Serial Number	License Capacity	License Expiry
Cloud Backup	90120130000000000021	200 TB	January 1, 2022
Cloud Tiering	90120130000000000022	200 TB	January 1, 2022
Cloud Sync			

- c. In the *Update License* page, upload the license file and click **Update License**.

Result

Cloud Manager updates the license so that Cloud Backup continues to be active.

Managing backups for your ONTAP and Kubernetes systems

You can manage backups for your Cloud Volumes ONTAP, on-premises ONTAP, and Kubernetes systems by changing the backup schedule, enabling/disabling volume backups, deleting backups, and more.

Note that the following tasks are performed the same way for ONTAP clusters (Cloud Volumes ONTAP and on-premises ONTAP) and for Kubernetes clusters, but the text on the UI pages is slightly different. ONTAP cluster UI pages are shown in the examples.



Do not manage or change backup files directly from your cloud provider environment. This may corrupt the files and will result in an unsupported configuration.

Viewing the volumes that are being backed up

You can view a list of all the volumes that are currently being backed up in the Backup Dashboard.

Steps

1. Click the **Backup & Restore** tab.
2. Click the **Volumes** tab to view the list of volumes for Cloud Volumes ONTAP and on-premises ONTAP systems, or click the **Kubernetes** tab to view the list of persistent volumes for Kubernetes systems.

Source Working Environment	Source Volume	Source SVM	Last Backup	Backups	Backup Status
CVO_AWS On	Source Volume Name On	Source SVM Name	May 22 2019, 00:00:00	2,050 Backups	Active
CVO_AWS On	Source Volume Name On	Source SVM Name	May 22 2019, 00:00:00	2,050 Backups	Active
CVO_AWS On	Source Volume Name On	Source SVM Name	May 22 2019, 00:00:00	2,050 Backups	Active

If you are looking for specific volumes in certain working environments, you can refine the list by working environment and volume, or you can use the search filter.

Editing an existing backup policy

You can change the attributes for a backup policy that is currently applied to volumes in a working environment. Changing the backup policy affects all existing volumes that are using the policy.

Steps

- From the **Volumes** tab, select **Backup Settings**.

The screenshot shows the Volumes tab interface. At the top, there are tabs for Volumes, Restore, Kubernetes, and Job Monitor. Below the tabs, a dropdown menu is set to 'All Backup Working Environments'. On the right side of the page, there is a 'Backup Settings' button, which is highlighted with a red box. The main area displays metrics: 5 Working Environments, 57 Protected Volumes, and a total backup capacity of 15.1 TB. To the right, a 'Protected Volumes Status' section shows 57 healthy backup volumes and 0 failed backup volumes.

- From the *Backup Settings* page, click **...** for the working environment where you want to change the settings, and select **Manage Policies**.

The screenshot shows the 'Backup Settings' page with two working environments listed: 'Working Name' and 'EnvironmentN'. Each environment has an 'Active' status, 4 and 3 total policies respectively, and 100 and 50/100 total protected volumes. On the right, a context menu is open over the 'Working Name' environment, with the 'Manage Policies' option highlighted by a red box. Other options in the menu include 'Manage Volumes', 'Delete All Backups', 'Deactivate Backup', and 'Unregister'.

- From the *Manage Policies* page, click **Edit Policy** for the backup policy you want to change in that working environment.

The screenshot shows the 'Manage Policies' page for the 'Working Name' environment. It lists two policies: '7 Daily, 50 Weekly, 12 Monthly Policy' (Active, Archival Policy, S3 Glacier storage class, 100 associated volumes) and 'NetApp 3 Months Retention Policy' (Not Active, Archival Policy, S3 Glacier storage class, 0 associated volumes). A blue 'Edit Policy' button is highlighted with a red box and a cursor icon, indicating it is the target for the next step.

- From the *Edit Policy* page, change the schedule and backup retention and click **Save**.

Edit Policy

Working Environment: Working Name

Policy - Retention & Schedule	<input checked="" type="checkbox"/> Hourly	Number of backups to retain	12	▼
	<input type="checkbox"/> Daily	Number of backups to retain	7	▼
	<input type="checkbox"/> Weekly	Number of backups to retain	50	▼
	<input type="checkbox"/> Monthly	Number of backups to retain	12	▼

If your cluster is running ONTAP 9.10.1 or greater, and you are using AWS or Azure for your cloud storage, you also have the option to enable or disable tiering of backups to archival storage after a certain number of days.

[Learn more about using Azure archival storage.](#)

[Learn more about using AWS archival storage.](#)

Archival Policy <div style="border: 2px solid red; padding: 2px; display: inline-block;">Azure</div>	<p>Backups reside in Cool Azure Blob storage for frequently accessed data. Optionally, you can tier backups to Azure Archive storage for further cost optimization.</p> <p><input checked="" type="checkbox"/> Tier Backups to Archival</p> <p>Archive after (Days) <input type="text" value="30"/></p> <p>Access Tier <input type="button" value="Azure Archive"/></p>
<hr/> Archival Policy <div style="border: 2px solid red; padding: 2px; display: inline-block;">AWS</div>	<p>Backups reside in S3 Standard storage for frequently accessed data. Optionally, you can tier backups to either S3 Glacier or S3 Glacier Deep Archive storage for further cost optimization.</p> <p><input checked="" type="checkbox"/> Tier Backups to Archival</p> <p>Archive after (Days) <input type="text" value="30"/></p> <p>Storage Class <input type="button" value="S3 Glacier"/></p> <p style="margin-left: 20px;">S3 Glacier</p> <p style="margin-left: 20px;">S3 Glacier Deep Archive</p>

Note that any backup files that have been tiered to archival storage are left in that tier if you stop tiering backups to archive - they are not automatically moved back to the standard tier.

Enabling and disabling backups of volumes

You can stop backing up a volume if you do not need backup copies of that volume and you do not want to pay for the cost to store the backups. You can also add a new volume to the backup list if it is not currently being backed up.

Steps

1. From the **Volumes** tab or the **Kubernetes** tab, select **Backup Settings**.

All Backup Working Environments

Backup Settings

Working Environments: 5 | Protected Volumes: 57 | Total Backup Capacity: 15.1 TB

Protected Volumes Status: 57 Healthy Backup Volumes | 0 Failed Backup Volumes

- From the *Backup Settings* page, click **...** for the working environment, or the Kubernetes cluster, and select **Manage Volumes**.

Backup Settings

4 Working Environments

Working Name	Backup Status	Total Policies	Total Protected Volumes
aws Cloud Volumes ONTAP	Active	4	All (100)
EnvironmentN Cloud Volumes ONTAP	Active	3	50/100
			Total Protected Volumes

Manage Policies

Manage Volumes (highlighted by a red box)

Delete All Backups

Deactivate Backup

Unregister

- Select the checkbox for a volume, or volumes, that you want to change, and then click **Activate** or **Deactivate** depending on whether you want to start or stop backups for the volume.

Manage Volumes

Working Environment: CVO_Eng

60 volumes

Volume Name	Volume Type	SVM Name	Used Capacity	Policy	Backup Status	Modified
<input checked="" type="checkbox"/> Volume_1 On	RW	SVM_1	20.25 TiB	30 Daily, 13 Weekly, 3 Monthly, 1 Yearly	Active	
<input type="checkbox"/> Volume_2 On	RW	SVM_1	20.25 TiB	30 Daily, 13 Weekly, 3 Monthly, 1 Yearly	Active	
<input checked="" type="checkbox"/> Volume_3 On	RW	SVM_1	20.25 TiB	30 Daily, 13 Weekly, 3 Monthly, 1 Yearly	Active	
<input type="checkbox"/> Volume_4 On	RW	SVM_1	20.25 TiB	30 Daily, 13 Weekly, 3 Monthly, 1 Yearly	Active	

Activate | Deactivate | Change Policy

Automatically back up future volumes on all storage VMs with the selected backup policy

You can choose to have all volumes added in the future to have backup enabled, or not, by using the checkbox for "Automatically back up future volumes...". If you disable this setting, you'll need to manually enable backups for volumes added in the future.

- Click **Save** to commit your changes.

Note: When stopping a volume from being backed up you'll continue to be charged by your cloud provider for object storage costs for the capacity that the backups use unless you [delete the backups](#).

Adding a new backup policy

When you enable Cloud Backup for a working environment, all the volumes you initially select are backed up using the default backup policy that you defined. If you want to assign different backup policies to certain volumes that have different recovery point objectives (RPO), you can create additional policies for that cluster and assign those policies to other volumes.

If you want to apply a new backup policy to certain volumes in a working environment, you first need to add the backup policy to the working environment. Then you can [apply the policy to volumes in that working environment](#).

Steps

1. From the **Volumes** tab, select **Backup Settings**.

The screenshot shows the AWS Cloud Backup interface. At the top, there are tabs for 'Volumes', 'Restore', 'Kubernetes', and 'Job Monitor'. Below the tabs, a dropdown menu is open with the option 'All Backup Working Environments'. On the right side of the screen, there is a 'Backup Settings' button, which is highlighted with a red box. In the center, there are three main statistics: 'Working Environments' (5), 'Protected Volumes' (57), and 'Total Backup Capacity' (15.1 TB). To the right, there is a 'Protected Volumes Status' section showing '57 Healthy Backup Volumes' and '0 Failed Backup Volumes'.

2. From the *Backup Settings* page, click **...** for the working environment where you want to add the new policy, and select **Manage Policies**.

The screenshot shows the 'Backup Settings' page. It lists two working environments: 'AWS' and 'EnvironmentN'. For each environment, it shows the working name, backup status (Active), total policies (4 and 3 respectively), and total protected volumes (All 100 and 50/100). To the right of the environments, there is a vertical menu with options: 'Manage Policies' (highlighted with a red box), 'Manage Volumes', 'Delete All Backups', 'Deactivate Backup', and 'Unregister'. A hand cursor icon is pointing at the 'Manage Policies' option.

3. From the *Manage Policies* page, click **Add New Policy**.

The screenshot shows the 'Manage Policies' page for the 'Working Environment: Working Name'. It displays two existing policies: '7 Daily, 50 Weekly, 12 Monthly Policy' (Active, Archival Policy, S3 Glacier Storage Class, 100 Associated Volumes) and 'NetApp 3 Months Retention Policy' (Not Active, Archival Policy, S3 Glacier Storage Class, 0 Associated Volumes). At the top right, there is a 'Add New Policy' button, which is highlighted with a red box.

4. From the *Add New Policy* page, define the schedule and backup retention and click **Save**.

Add New Policy

Working Environment: Working Name

Policy - Retention & Schedule	<input type="checkbox"/> Hourly Number of backups to retain <input style="width: 40px; border: 1px solid #ccc; border-radius: 5px; padding: 2px 5px; margin-right: 10px;" type="text" value="xx"/> <input style="border: none; font-size: 1em; font-weight: bold;" type="button" value="▼"/>
<input checked="" type="checkbox"/> Daily Number of backups to retain <input style="width: 40px; border: 1px solid #ccc; border-radius: 5px; padding: 2px 5px; margin-right: 10px;" type="text" value="30"/> <input style="border: none; font-size: 1em; font-weight: bold;" type="button" value="▼"/>	
<input type="checkbox"/> Weekly Number of backups to retain <input style="width: 40px; border: 1px solid #ccc; border-radius: 5px; padding: 2px 5px; margin-right: 10px;" type="text" value="xx"/> <input style="border: none; font-size: 1em; font-weight: bold;" type="button" value="▼"/>	
<input type="checkbox"/> Monthly Number of backups to retain <input style="width: 40px; border: 1px solid #ccc; border-radius: 5px; padding: 2px 5px; margin-right: 10px;" type="text" value="xx"/> <input style="border: none; font-size: 1em; font-weight: bold;" type="button" value="▼"/>	

If your cluster is running ONTAP 9.10.1 or greater, and you are using AWS or Azure for your cloud storage, you also have the option to enable or disable tiering of backups to archival storage after a certain number of days.

[Learn more about using Azure archival storage.](#)

[Learn more about using AWS archival storage.](#)

Archival Policy	Backups reside in Cool Azure Blob storage for frequently accessed data. Optionally, you can tier backups to Azure Archive storage for further cost optimization.
Azure	<input checked="" type="checkbox"/> Tier Backups to Archival Archive after (Days) <input type="text" value="30"/> Access Tier <input type="button" value="Azure Archive"/>
<hr/>	
Archival Policy	Backups reside in S3 Standard storage for frequently accessed data. Optionally, you can tier backups to either S3 Glacier or S3 Glacier Deep Archive storage for further cost optimization.
AWS	<input checked="" type="checkbox"/> Tier Backups to Archival Archive after (Days) <input type="text" value="30"/> Storage Class <input type="button" value="S3 Glacier"/> <input type="button" value="S3 Glacier"/> <input type="button" value="S3 Glacier Deep Archive"/>

Changing the policy assigned to existing volumes

You can change the backup policy assigned to your existing volumes if you want to change the frequency of taking backups, or if you want to change the retention value.

Note that the policy that you want to apply to the volumes must already exist. See how to add a new backup policy for a working environment.

Steps

1. From the **Volumes** tab, select **Backup Settings**.

Backup Settings

All Backup Working Environments

Working Environments: 5 | Protected Volumes: 57 | Total Backup Capacity: 15.1 TB

Protected Volumes Status: 57 Healthy Backup Volumes, 0 Failed Backup Volumes

- From the *Backup Settings* page, click **...** for the working environment where the volumes exist, and select **Manage Volumes**.

Backup Settings

4 Working Environments

Working Name	Backup Status	Total Policies	Total Protected Volumes
Cloud Volumes ONTAP	Active	4	All (100)
Cloud Volumes ONTAP	Active	3	50/100
			Total Protected Volumes

Manage Policies

Manage Volumes (highlighted by a red box)

Delete All Backups

Deactivate Backup

Unregister

- Select the checkbox for a volume, or volumes, that you want to change the policy for, and then click **Change Policy**.

Manage Volumes

Working Environment: CVO_Eng

60 volumes

Volume Name	Volume Type	SVM Name	Used Capacity	Policy	Backup Status	Modified
Volume_1	RW	SVM_1	20.25 TiB	30 Daily, 13 Weekly, 3 Monthly, 1 Yearly	Active	
Volume_2	RW	SVM_1	20.25 TiB	30 Daily, 13 Weekly, 3 Monthly, 1 Yearly	Active	
Volume_3	RW	SVM_1	20.25 TiB	30 Daily, 13 Weekly, 3 Monthly, 1 Yearly	Active	
Volume_4	RW	SVM_1	20.25 TiB	30 Daily, 13 Weekly, 3 Monthly, 1 Yearly	Active	

Activate | Deactivate | **Change Policy** (highlighted by a red box)

Automatically back up future volumes on all storage VMs with the selected [backup policy](#)

- In the *Change Policy* page, select the policy that you want to apply to the volumes, and click **Change Policy**.

30 volumes selected. Choose the policy that you want to assign to these volumes.
Only existing policies display in the list.

Select Policy

Default Policy (30 Daily)

Default Policy
30 Daily

Netapp 3 Months Retention
XX Hourly | XX Daily | XX weekly | XX Monthly

Netapp 1 Year Retention
XX Hourly | XX Daily | XX weekly | XX Monthly

5. Click **Save** to commit your changes.

Creating a manual volume backup at any time

You can create an on-demand backup at any time to capture the current state of the volume. This can be useful if very important changes have been made to a volume and you don't want to wait for the next scheduled backup to protect that data, or if the volume is not currently being backed up and you want to capture its current state.

The backup name includes the timestamp so you can identify your on-demand backup from other scheduled backups.



On-demand volume backup isn't supported on data protection volumes or on Kubernetes persistent volumes.

Steps

1. From the **Volumes** tab, click **...** for the volume and select **Backup Now**.

Volumes Restore Kuberriets Job Monitor

All Backup Working Environments Backup Settings

Protected Volumes Status

1 Working Environments 57 Protected Volumes 15.1 TB Total Backup Capacity

57 Backups

Source Working Environment	Source Volume	Source SVM	Last Backup	Backups	Backup Status
CVO_AWS ■ On	Volume_1 ■ On	SVM_1	May 22 2019, 00:00:00	2,050 Backups	Active
CVO_AWS ■ On	Volume_2 ■ On	SVM_1	May 22 2019, 00:00:00	2,050 Backups	
CVO_AWS ■ On	Volume_3 ■ On	SVM_1	May 22 2019, 00:00:00	2,050 Backups	

Details & Backup List

Backup Now

Pause Backups

The Backup Status column for that volume displays "In Progress" until the backup is created.

Viewing the list of backups for each volume

You can view the list of all backup files that exist for each volume. This page displays details about the source volume, destination location, and backup details such as last backup taken, the current backup policy, backup file size, and more.

This page also enables you perform the following tasks:

- Delete all backup files for the volume
- Delete individual backup files for the volume
- Download a backup report for the volume

Steps

1. From the **Volumes** tab or the **Kubernetes** tab, click **...** for the source volume and select **Details & Backup List**.

The screenshot shows the 'Volumes' tab selected in the top navigation bar. Below it, there's a summary section with counts for Working Environments (1), Protected Volumes (57), and Total Backup Capacity (15.1 TB). To the right, a 'Protected Volumes Status' box shows 57 healthy backup volumes and 0 failed backup volumes. The main area is titled '57 Backups' and contains a table with the following columns: Source Working Environment, Source Volume, Source SVM, Last Backup, Backups, and Backup Status. The table lists three entries for 'CVO_AWS' with 'Volume_1', 'Volume_2', and 'Volume_3' respectively. Each row has a 'Details & Backup List' button, which is highlighted with a red box in the screenshot. The 'Backup Status' column shows 'Active' for all three volumes.

Source Working Environment	Source Volume	Source SVM	Last Backup	Backups	Backup Status
CVO_AWS On	Volume_1 On	SVM_1	May 22 2019, 00:00:00	2,050 Backups	Active
CVO_AWS On	Volume_2 On	SVM_1	May 22 2019, 00:00:00	2,050 Backups	Details & Backup List
CVO_AWS On	Volume_3 On	SVM_1	May 22 2019, 00:00:00	2,050 Backups	Backup Now Pause Backups

The list of all backup files is displayed along with details about the source volume, destination location, and backup details.

The screenshot shows the NetApp Cloud Backup interface. At the top, there are three tabs: 'Source' (with details like Working Environment, Type, Provider, Volume, SVM), 'Destination' (with details like Cloud Provider, Region, Bucket, Account ID), and 'Backup Information' (with Relationship Status, Last Backup, Lag Duration, Backups, and Backup Policy). Below these is a summary section showing '2,050 Backups'. A table below lists backups by Name, Date, and Size, with three entries: 'Backup_2020_Jan' (May 22 2019, 00:00:00, 19,001), 'Backup_2020_Mar' (May 22 2019, 00:00:00, 19,002), and 'Backup_2020_Apr' (May 22 2019, 00:00:00, 19,009). A search bar and action buttons are at the bottom.

Deleting backups

Cloud Backup enables you to delete a single backup file, delete all backups for a volume, or delete all backups of all volumes in a working environment or Kubernetes cluster. You might want to delete all backups if you no longer need the backups or if you deleted the source volume and want to remove all backups.

! If you plan to delete a working environment or cluster that has backups, you must delete the backups **before** deleting the system. Cloud Backup doesn't automatically delete backups when you delete a system, and there is no current support in the UI to delete the backups after the system has been deleted. You'll continue to be charged for object storage costs for any remaining backups.

Deleting all backup files for a working environment

Deleting all backups for a working environment does not disable future backups of volumes in this working environment. If you want to stop creating backups of all volumes in a working environment, you can deactivate backups [as described here](#).

Steps

- From the **Volumes** tab or the **Kubernetes** tab, select **Backup Settings**.

The screenshot shows the 'Volumes' tab of the NetApp Cloud Backup interface. It includes tabs for 'Volumes', 'Restore', 'Kubernetes', and 'Job Monitor'. A dropdown menu shows 'All Backup Working Environments'. On the right, a red box highlights the 'Backup Settings' button. Below it, a summary shows 5 Working Environments, 57 Protected Volumes, 15.1 TB Total Backup Capacity, 57 Healthy Backup Volumes, and 0 Failed Backup Volumes.

- Click **...** for the working environment, or the Kubernetes cluster, where you want to delete all backups and select **Delete All Backups**.

Backup Settings

4 Working Environments

Working Name	Backup Status	Total Policies	Total Protected Volumes	Actions
Cloud Volumes ONTAP	Active	4	All (100)	Manage Policies Manage Volumes Delete All Backups Deactivate Backup Unregister
EnvironmentN	Active	3	50/100	

- In the confirmation dialog box, enter the name of the working environment and click **Delete**.

Deleting all backup files for a volume

Deleting all backups for a volume also disables future backups for that volume.

You can [restart making backups for the volume](#) at any time from the Manage Backups page.

Steps

- From the **Volumes** tab or the **Kubernetes** tab, click **...** for the source volume and select **Details & Backup List**.

Volumes Restore Kubernetes Job Monitor

All Backup Working Environments **Backup Settings**

Protected Volumes Status																									
1 Working Environments	57 Protected Volumes																								
15.1 TB Total Backup Capacity	57 Healthy Backup Volumes																								
	0 Failed Backup Volumes																								
57 Backups	Details & Backup List																								
<table border="1"> <thead> <tr> <th>Source Working Environment</th> <th>Source Volume</th> <th>Source SVM</th> <th>Last Backup</th> <th>Backups</th> <th>Backup Status</th> </tr> </thead> <tbody> <tr> <td>aws CVO_AWS On</td> <td>Volume_1 On</td> <td>SVM_1</td> <td>May 22 2019, 00:00:00</td> <td>2,050 Backups</td> <td>Active</td> </tr> <tr> <td>aws CVO_AWS On</td> <td>Volume_2 On</td> <td>SVM_1</td> <td>May 22 2019, 00:00:00</td> <td>2,050 Backups</td> <td></td> </tr> <tr> <td>aws CVO_AWS On</td> <td>Volume_3 On</td> <td>SVM_1</td> <td>May 22 2019, 00:00:00</td> <td>2,050 Backups</td> <td></td> </tr> </tbody> </table>		Source Working Environment	Source Volume	Source SVM	Last Backup	Backups	Backup Status	aws CVO_AWS On	Volume_1 On	SVM_1	May 22 2019, 00:00:00	2,050 Backups	Active	aws CVO_AWS On	Volume_2 On	SVM_1	May 22 2019, 00:00:00	2,050 Backups		aws CVO_AWS On	Volume_3 On	SVM_1	May 22 2019, 00:00:00	2,050 Backups	
Source Working Environment	Source Volume	Source SVM	Last Backup	Backups	Backup Status																				
aws CVO_AWS On	Volume_1 On	SVM_1	May 22 2019, 00:00:00	2,050 Backups	Active																				
aws CVO_AWS On	Volume_2 On	SVM_1	May 22 2019, 00:00:00	2,050 Backups																					
aws CVO_AWS On	Volume_3 On	SVM_1	May 22 2019, 00:00:00	2,050 Backups																					

The list of all backup files is displayed.

Backup Name	Date	Size	Actions
Backup_2020_Jan	May 22 2019, 00:00:00	19,001	...
Backup_2020_Mar	May 22 2019, 00:00:00	19,002	...
Backup_2020_Apr	May 22 2019, 00:00:00	19,009	...

2. Click **Actions > Delete all Backups.**

3. In the confirmation dialog box, enter the volume name and click **Delete**.

Deleting a single backup file for a volume

You can delete a single backup file. This feature is available only if the volume backup was created from a system with ONTAP 9.8 or greater.

Steps

1. From the **Volumes** tab or the **Kubernetes** tab, click **...** for the source volume and select **Details & Backup List**.

The screenshot shows the NetApp Cloud Volumes ONTAP interface. At the top, there are tabs for Volumes, Restore, Kubernetes, and Job Monitor. The Volumes tab is selected. Below the tabs, there's a dropdown menu set to "All Backup Working Environments". On the right, there's a "Backup Settings" button. The main area displays summary statistics: 1 Working Environment, 57 Protected Volumes, and 15.1 TB Total Backup Capacity. To the right, a "Protected Volumes Status" section shows 57 Healthy Backup Volumes and 0 Failed Backup Volumes. Below this, a table lists 57 Backups. The columns include Source Working Environment, Source Volume, Source SVM, Last Backup, Backups, and Backup Status. The first three rows show entries for CVO_AWS with Source Volumes Volume_1, Volume_2, and Volume_3, respectively. The Backup Status column indicates they are all Active. A red box highlights the "Details & Backup List" link for the first entry.

The list of all backup files is displayed.

This screenshot shows the detailed configuration for a backup relationship. It is divided into three main sections: Source, Destination, and Backup Information. The Source section includes fields for Working Environment (Working Environment Name), Type (Cloud Volumes ONTAP (HA)), Provider (AWS), Volume (Volume Name), and SVM (SVM Name). The Destination section includes Cloud Provider (AWS), Region (us-east-1), Bucket (netapp-backup), and Account ID (012345678901234567890). The Backup Information section shows Relationship Status (Active), Last Backup (Oct 05 2021, 2:41:33 pm), Lag Duration (14 days 3 hours, 38 minutes), Backups (2,050), and Backup Policy (Netapp7YearsRetention). Below this, a table lists 2,050 Backups. The columns are Backup Name, Date, and Size. The first three entries are Backup_2020_Jan, Backup_2020_Mar, and Backup_2020_Apr, each with a size of 19,001, 19,002, and 19,009 respectively. A red box highlights the "Actions" button at the bottom right of the backup list table.

2. Click ... for the volume backup file you want to delete and click **Delete**.

This screenshot shows the same backup list as the previous one, but with a specific action highlighted. A red box surrounds the "Delete" button in the Actions column for the first backup entry, which is Backup_2020_Feb. A hand cursor is shown pointing at the "Delete" button. Other entries in the list include Backup_2020_Jan and Backup_2020_Mar.

3. In the confirmation dialog box, click **Delete**.

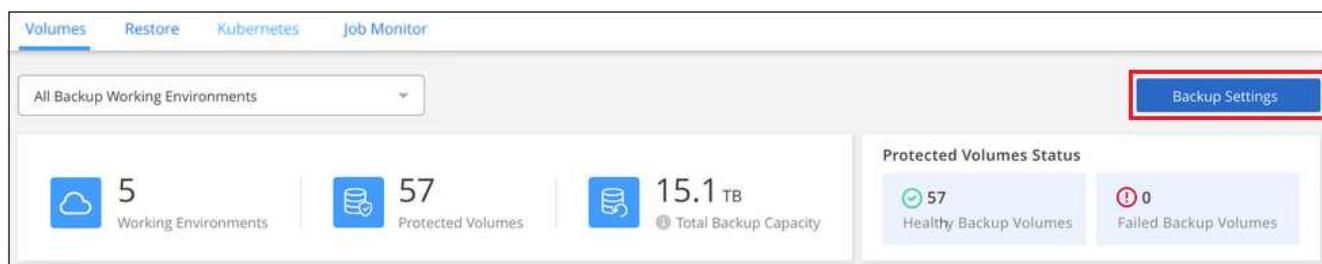
Disabling Cloud Backup for a working environment

Disabling Cloud Backup for a working environment disables backups of each volume on the system, and it also disables the ability to restore a volume. Any existing backups will not be deleted. This does not unregister the backup service from this working environment - it basically allows you to pause all backup and restore activity for a period of time.

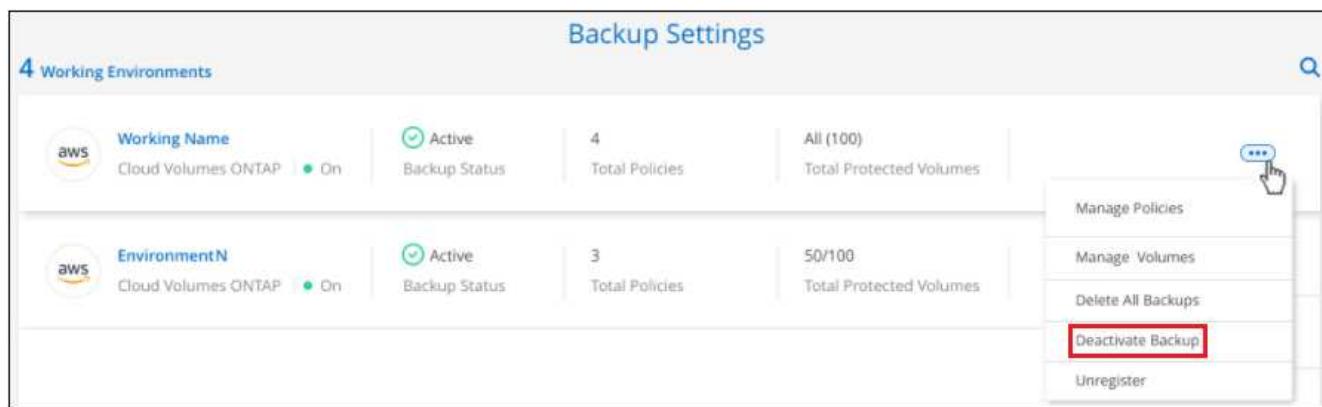
Note that you'll continue to be charged by your cloud provider for object storage costs for the capacity that your backups use unless you [delete the backups](#).

Steps

1. From the **Volumes** tab or the **Kubernetes** tab, select **Backup Settings**.



2. From the *Backup Settings page*, click **...** for the working environment, or the Kubernetes cluster, where you want to disable backups and select **Deactivate Backup**.



3. In the confirmation dialog box, click **Deactivate**.



An **Activate Backup** button appears for that working environment while backup is disabled. You can click this button when you want to re-enable backup functionality for that working environment.

Unregistering Cloud Backup for a working environment

You can unregister Cloud Backup for a working environment if you no longer want to use backup functionality and you want to stop being charged for backups in that working environment. Typically this feature is used when you're planning to delete a working environment, or a Kubernetes cluster, and you want to cancel the backup service.

You can also use this feature if you want to change the destination object store where your cluster backups are

being stored. After you unregister Cloud Backup for the working environment, then you can enable Cloud Backup for that cluster using the new cloud provider information.

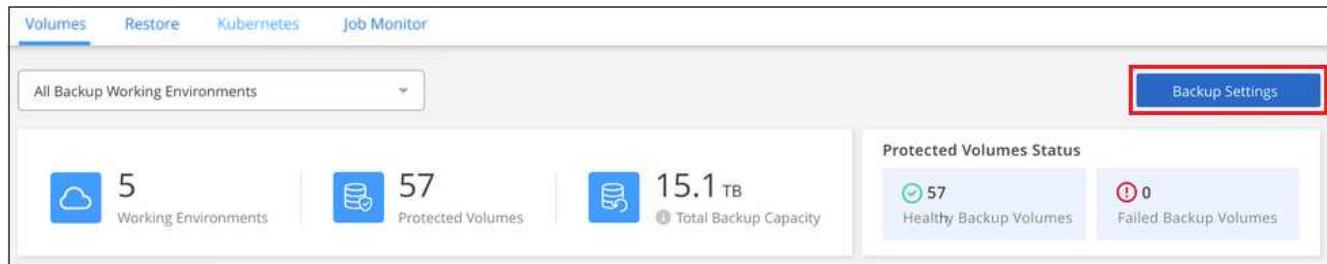
Before you can unregister Cloud Backup, you must perform the following steps, in this order:

- Deactivate Cloud Backup for the working environment
- Delete all backups for that working environment

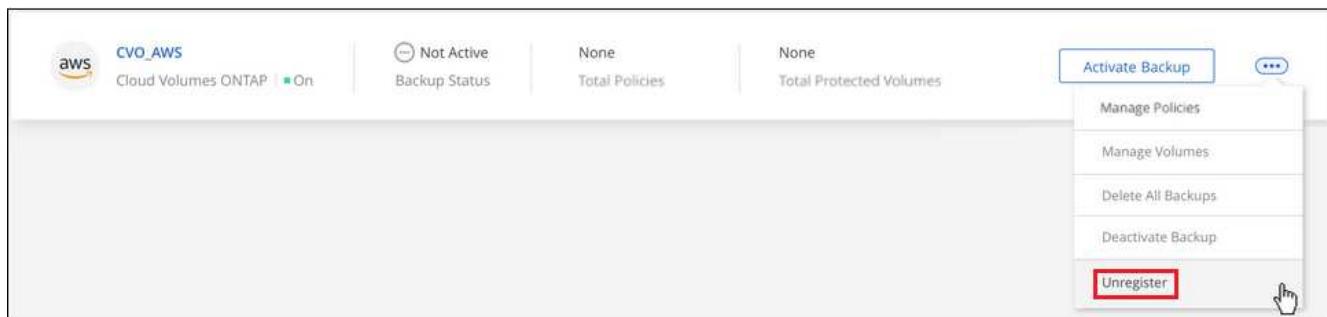
The unregister option is not available until these two actions are complete.

Steps

1. From the **Volumes** tab or the **Kubernetes** tab, select **Backup Settings**.



2. From the *Backup Settings page*, click **...** for the working environment, or the Kubernetes cluster, where you want to unregister the backup service and select **Unregister**.



3. In the confirmation dialog box, click **Unregister**.

Restoring data from backup files

Backups are stored in an object store in your cloud account so that you can restore data from a specific point in time. You can restore an entire volume from a saved backup file, or if you only need to restore a few files, you can restore individual files from a saved backup file.

You can restore an entire volume to the same working environment, to a different working environment that's using the same cloud account. For Cloud Volumes ONTAP and on-premises ONTAP volumes, see [Restoring an ONTAP volume](#). For Kubernetes backups, see [Restoring a Kubernetes volume](#).

You can restore files to a volume in the same working environment, to a volume in a different working environment that's using the same cloud account, or to a volume on an on-premises ONTAP system. See [Restoring files from a backup](#).

Supported working environments and object storage providers

For backups of Cloud Volumes ONTAP and on-prem ONTAP volumes, you can restore a volume, or individual files, from a backup file to the following working environments:

Backup File Location	Destination Working Environment	
	Volume Restore	File Restore
Amazon S3	Cloud Volumes ONTAP in AWS On-premises ONTAP system	Cloud Volumes ONTAP in AWS On-premises ONTAP system
Azure Blob	Cloud Volumes ONTAP in Azure On-premises ONTAP system	Cloud Volumes ONTAP in Azure On-premises ONTAP system
Google Cloud Storage	Cloud Volumes ONTAP in Google On-premises ONTAP system	
NetApp StorageGRID	On-premises ONTAP system	

Note: If the backup file resides in archival storage, only volume restore is supported. File restore is not currently supported from archival storage.

For backups of Kubernetes volumes, you can restore a volume from a backup file to the following working environments:

Backup File Location	Destination Working Environment	
	Volume Restore	File Restore
Amazon S3	Kubernetes cluster in AWS	
Azure Blob	Kubernetes cluster in Azure	
Google Cloud Storage	Kubernetes cluster in GCP	

The Restore Dashboard

You access the Restore Dashboard by clicking the **Backup & Restore** tab from the top of Cloud Manager, or you can click  > **View Restore Dashboard** from the Backup & Restore service from the Services panel.



The Cloud Backup service must already be activated for at least one working environment.

The screenshot shows the 'Backup & Restore' service dashboard. At the top, there are summary statistics: '27.96 TB Restored Data', '15 Restored Volumes' (with a size of 1.71 TB), and '124 Restored Files' (with a size of 26.25 TB). Below these are two prominent buttons: 'Restore Volumes' and 'Restore Files', both circled in red. Further down, there are two tabs: 'Restored Volumes (15)' and 'Restored Files (124)'. A search icon is located at the top right. The main area is a table with columns: Volume Name, Restore Date, and Status. It lists three rows of restored volumes, each with expandable details (indicated by up and down arrows) and a status indicator (green checkmark for completed, blue circle for in progress).

Volume Name	Restore Date	Status
VolumeVeryLongName1	Nov 19 2020, 4:15:05 pm	Completed Successfully
VolumeVeryLongName2	Nov 19 2020, 4:15:05 pm	In Progress
VolumeVeryLongName3	Nov 19 2020, 4:15:05 pm	Completed Successfully

The Restore Dashboard provides buttons for you to restore volumes and files. Clicking the *Restore Volumes* or *Restore Files* buttons starts a wizard that walks you through the steps to restore that data.

The dashboard also provides a list of all the volumes and all the files you have restored in case you need a history of previous restore actions. You can expand the row for each restored volume or file to view the details about the source and destination locations for the volume or file.

Note that you can also initiate a volume or file restore operation from a working environment in the Services panel. When started from this location the source working environment selection is automatically filled with the name of the current working environment.

The screenshot shows the 'Services' panel. Under the 'Backup & Restore' section, which is turned 'On', there are several options: 'View Backup List', 'View Backup Settings', 'View Restore Dashboard', 'Restore Volume' (which is highlighted with a red box), and 'Restore Single Files'. A hand cursor is shown pointing at the 'Restore Volume' button.

Restoring volumes from an ONTAP backup file

When you restore a volume from a backup file, Cloud Manager creates a *new* volume using the data from the backup. You can restore the data to a volume in the same working environment or to a different working environment that's located in the same cloud account as the source working environment. You can also restore volumes to an on-premises ONTAP system.

If the backup file for the volume that you want to restore resides in archival storage (available for AWS and Azure starting with ONTAP 9.10.1), the restore operation will take a longer amount of time and will cost more. Additionally, the destination cluster must also be running ONTAP 9.10.1 or greater.

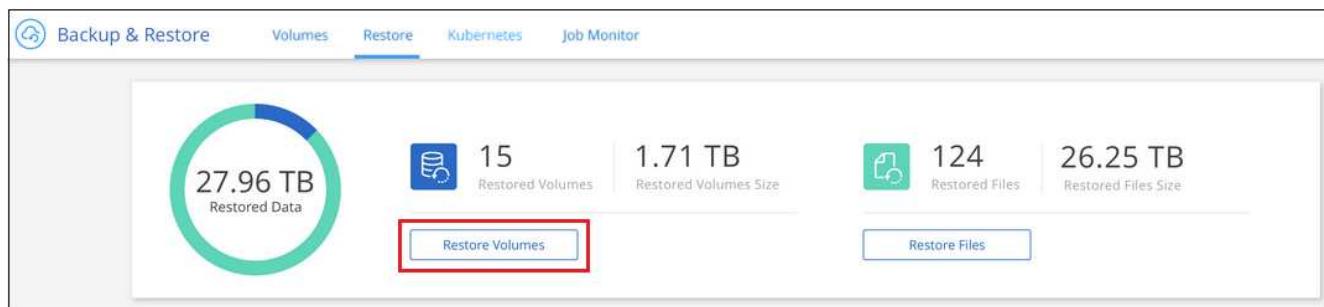
[Learn more about restoring from Azure archival storage.](#)

[Learn more about restoring from AWS archival storage.](#)

Before you start, you should know the name of the volume you want to restore and the date of the backup file you want to use to create the newly restored volume.

Steps

1. Select the **Backup & Restore** tab.
2. Click the **Restore** tab and the Restore Dashboard is displayed.
3. Click **Restore Volumes**.



4. In the *Select Source* page, navigate to the backup file for the volume you want to restore. Select the **Working Environment**, the **Volume**, and the **Backup** that has the date/time stamp that you want to restore.

Backup Name	Date	Size
Backup_2020_Jan	Nov 19 2020, 4:15:05 pm	19,001
Backup_2020_Feb	Nov 19 2020, 4:15:05 pm	19,002
Backup_2020_Mar	Nov 19 2020, 4:15:05 pm	19,009
Backup_2020_Apr	Nov 19 2020, 4:15:05 pm	19,009

5. Click **Continue**.

6. In the **Select Destination** page, select the **Working Environment** where you want to restore the volume.

The screenshot shows the 'Select Destination' page with a header indicating the user is at step 2 of 2. On the left, there are navigation links: 'Select Working Environment >' and 'Destination Volume'. The main area displays a table titled '5 Working Environments' with columns for 'Working Environment Name', 'Type', and 'Provider'. Two rows are visible: 'Working Environment 3' (Cloud Volumes ONTAP, Azure) and 'Working Environment 2' (Cloud Volumes ONTAP, Azure). The row for 'Working Environment 2' has a red box drawn around it, and a hand cursor icon is positioned over the 'Working Environment 2' link.

7. If you select an on-premises ONTAP system and you haven't already configured the cluster connection to the object storage, you are prompted for additional information:

- When restoring from Amazon S3, select the IPspace in the ONTAP cluster where the destination volume will reside, enter the access key and secret key for the user you created to give the ONTAP cluster access to the S3 bucket, and optionally choose a private VPC endpoint for secure data transfer.
- When restoring from Azure Blob, select the IPspace in the ONTAP cluster where the destination volume will reside, select the Azure Subscription to access the object storage, and optionally choose a private endpoint for secure data transfer by selecting the VNet and Subnet.
- When restoring from Google Cloud Storage, select the Google Cloud Project and the Access Key and Secret Key to access the object storage, the region where the backups are stored, and the IPspace in the ONTAP cluster where the destination volume will reside.
- When restoring from StorageGRID, select the Access Key and Secret Key needed to access the object storage, and the IPspace in the ONTAP cluster where the destination volume will reside.

8. Enter the name you want to use for the restored volume, and select the Storage VM where the volume will reside. By default, **<source_volume_name>_restore** is used as the volume name.

The screenshot shows the 'Select Destination' page with a message box stating: 'A new volume will be created in the working environment based on the backup you selected'. On the left, 'Selected Working Environment' is checked, and 'Working Environment Name 2' is selected. Below this, 'Destination Volume >' and 'General_restore' are shown. The main form includes fields for 'Volume Name' (set to 'General_restore'), 'Storage VM' (set to 'svm1'), and 'Restore Priority' (set to 'Low'). To the right, 'Volume Information' is displayed with 'Volume Size: 50.00 GB', 'Backup Policy: CloudBackupService', and 'Protocol: NFS'.

You can select the Aggregate that the volume will use for its' capacity only when restoring a volume to an on-premises ONTAP system.

And if you are restoring the volume from a backup file that resides in an archival storage tier (available

starting with ONTAP 9.10.1), then you can select the Restore Priority.

[Learn more about restoring from Azure archival storage.](#)

[Learn more about restoring from AWS archival storage.](#)

9. Click **Restore** and you are returned to the Restore Dashboard so you can review the progress of the restore operation.

Result

Cloud Manager creates a new volume based on the backup you selected. You can [manage this new volume](#) as required.

Note that restoring a volume from a backup file that resides in archival storage can take many minutes or hours depending on the archive tier and the restore priority.

Restoring files from an ONTAP backup file

If you only need to restore a few files from a volume, you can choose to restore individual files instead of restoring the entire volume. You can restore files to a volume in the same working environment, or to a different working environment that's using the same cloud account. You can also restore files to an on-premises ONTAP system.

All the files are restored to the same destination volume that you choose. If you want to restore files to different volumes, you need run the restore process a second time.



You can't restore individual files if the backup file resides in archival storage (available starting with ONTAP 9.10.1). In this case, you can either restore files from a backup file that has not been archived, or you can restore the entire volume from the archived backup.

Prerequisites

- The ONTAP version must be 9.6 or greater in your Cloud Volumes ONTAP or on-premises ONTAP systems to perform file restore operations.
- Restoring individual files from a backup file uses a separate Restore instance/virtual machine. See the [AWS Requirements](#) or [Azure Requirements](#) to make sure your environment is ready.
- Restoring files also requires that specific EC2 permissions are added to the user role that provides Cloud Manager with permissions. [Make sure all the permissions are configured correctly.](#)
- AWS cross-account restore requires manual action in the cloud provider console. See the AWS topic [granting cross-account bucket permissions](#) for details.

File Restore process

The process goes like this:

1. When you want to restore one or more files from a volume, click the **Restore** tab, click **Restore Files**, and select the backup file in which the file (or files) reside.
2. The Restore instance starts up and displays the folders and files that exist within the backup file.

Note: The Restore instance is deployed in your cloud providers' environment the first time you restore a file.

3. Choose the file (or files) that you want to restore from that backup.

4. Select the location where you want the file(s) to be restored (the working environment, volume, and folder), and click **Restore**.
5. The file(s) are restored, and then the Restore instance is shut down to save costs after a period of inactivity.

Restoring files from a backup file

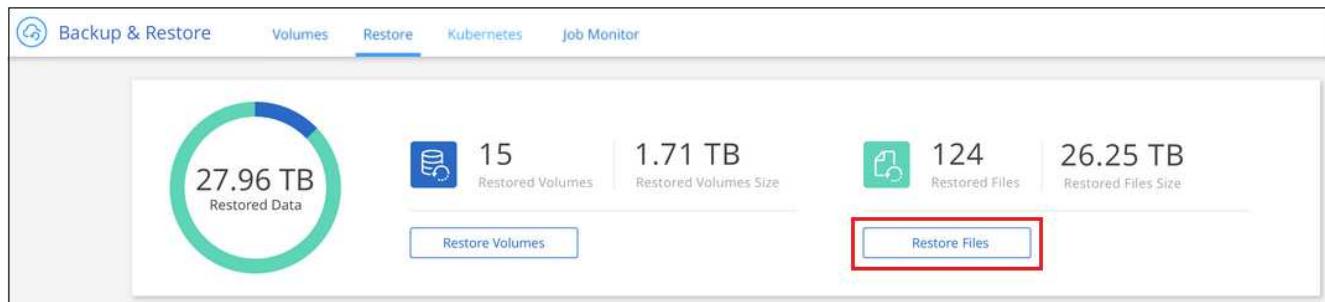
Follow these steps to restore files from a volume backup to a volume. You should know the name of the volume and the date of the backup file that you want to use to restore the file, or files. This functionality uses Live Browsing so that you can view the list of directories and files within the backup file.

The following video shows a quick walkthrough of restoring a single file:

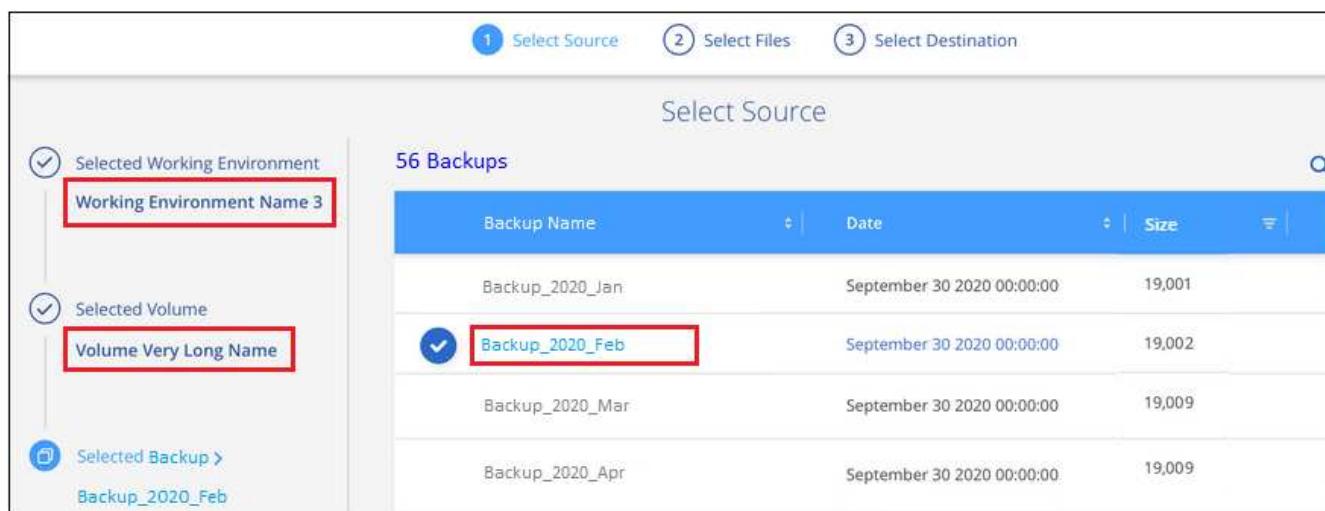
 | <https://img.youtube.com/vi/ROAY6gPL9N0/maxresdefault.jpg>

Steps

1. Select the **Backup & Restore** tab.
2. Click the **Restore** tab and the Restore Dashboard is displayed.
3. Click the **Restore Files** button.



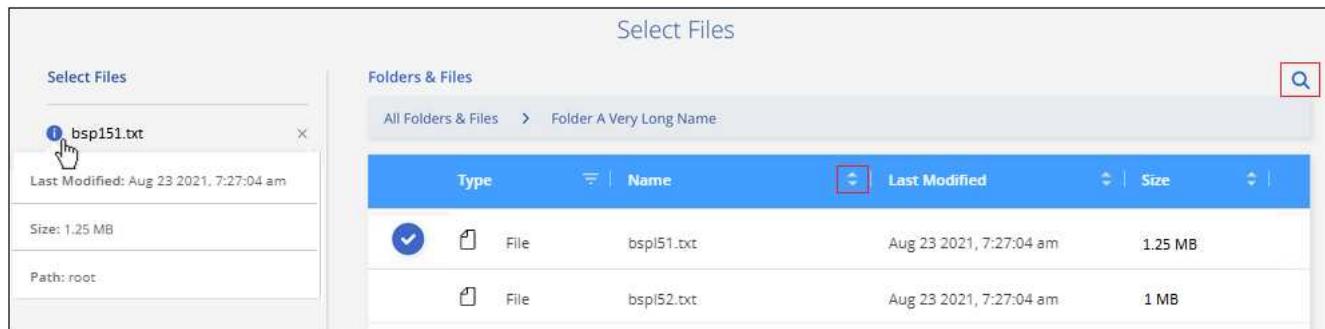
4. In the *Select Source* page, navigate to the backup file for the volume that contains the files you want to restore. Select the **Working Environment**, the **Volume**, and the **Backup** that has the date/time stamp from which you want to restore files.



Backup Name	Date	Size
Backup_2020_Jan	September 30 2020 00:00:00	19,001
Backup_2020_Feb	September 30 2020 00:00:00	19,002
Backup_2020_Mar	September 30 2020 00:00:00	19,009
Backup_2020_Apr	September 30 2020 00:00:00	19,009

5. Click **Continue** and the Restore instance is started. After a few minutes the Restore instance displays the list of folders and files from the volume backup.

Note: The Restore instance is deployed in your cloud providers' environment the first time you restore a file, so this step could take a few minutes longer the first time.



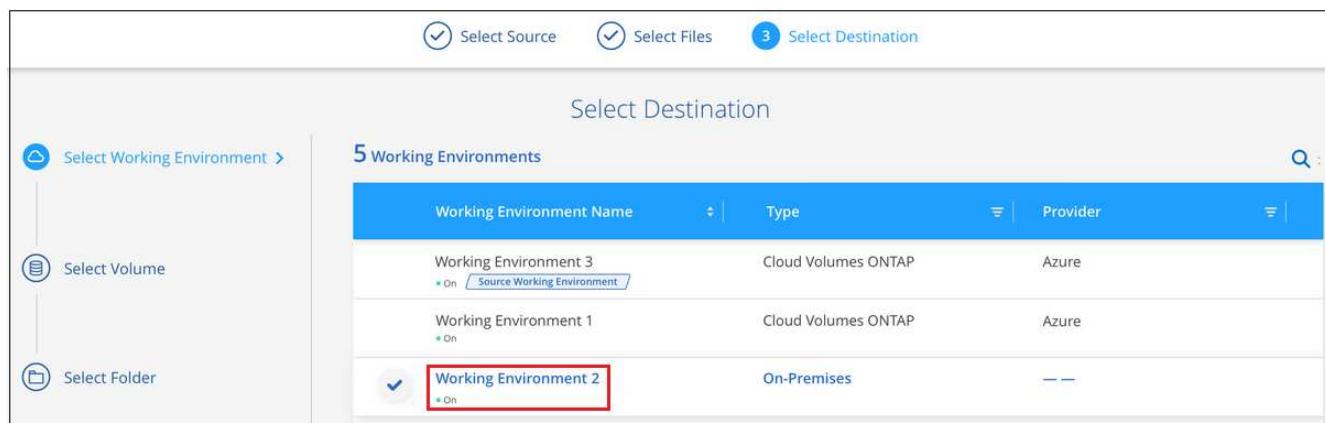
The screenshot shows the 'Select Files' interface. On the left, a sidebar displays a selected file: 'bsp151.txt' (Type: File, Last Modified: Aug 23 2021, 7:27:04 am, Size: 1.25 MB, Path: root). The main area shows a list of files under 'Folders & Files' with a search bar. The table has columns: Type, Name, Last Modified, and Size. Two files are listed: 'bsp151.txt' and 'bsp152.txt', both modified on Aug 23 2021 at 7:27:04 am, with sizes 1.25 MB and 1 MB respectively.

6. In the **Select Files** page, select the file or files that you want to restore and click **Continue**.

- You can click the search icon and enter the name of the file to navigate directly to the file.
- You can click the file name if you see it.
- You can navigate down levels in folders using the **>** button at the end of the row to find the file.

As you select files they are added to the left side of the page so you can see the files that you have already chosen. You can remove a file from this list if needed by clicking the **x** next to the file name.

7. In the **Select Destination** page, select the **Working Environment** where you want to restore the files.



The screenshot shows the 'Select Destination' interface. At the top, there are three tabs: 'Select Source' (checked), 'Select Files' (checked), and 'Select Destination' (highlighted). The main area is titled 'Select Destination' and shows '5 Working Environments'. A sidebar on the left lists 'Select Working Environment', 'Select Volume', and 'Select Folder'. The table has columns: Working Environment Name, Type, and Provider. Three working environments are listed: 'Working Environment 3' (Cloud Volumes ONTAP, Azure), 'Working Environment 1' (Cloud Volumes ONTAP, Azure), and 'Working Environment 2' (On-Premises, --). 'Working Environment 2' is highlighted with a red border.

If you select an on-premises cluster and you haven't already configured the cluster connection to the object storage, you are prompted for additional information:

- When restoring from Amazon S3, enter the IPspace in the ONTAP cluster where the destination volumes reside, and the AWS Access Key and Secret Key needed to access the object storage.
- When restoring from Azure Blob, enter the IPspace in the ONTAP cluster where the destination volumes reside.

8. Then select the **Volume** and the **Folder** where you want to restore the files.

Type	Name	Last Modified	Size	
Folder	dir1	Nov 04 2020, 2:39:01 am	--	>
Folder	restored	May 04 2020, 11:40:01 pm	--	>
Folder	testing	Sep 20 2020, 4:00:01 am	--	>
Folder	results	Oct 25 2020, 6:30:01 am	--	>

You have a few options for the location when restoring files.

- When you have chosen **Select Target Folder**, as shown above:
 - You can select any folder.
 - You can hover over a folder and click **>** at the end of the row to drill down into subfolders, and then select a folder.
 - If you have selected the same destination Working Environment and Volume as where the source file was located, you can select **Maintain Source Folder Path** to restore the file, or all files, to the same folder where they existed in the source structure. All the same folders and sub-folders must already exist; folders are not created.
9. Click **Restore** and you are returned to the Restore Dashboard so you can review the progress of the restore operation.

The Restore instance is shut down after a certain period of inactivity to save you money so that you incur costs only when it is active.

Restoring volumes from a Kubernetes backup file

When you restore a persistent volume from a backup file, Cloud Manager creates a *new* volume using the data from the backup. You can restore the data to a volume in the same Kubernetes cluster or to a different Kubernetes cluster that's located in the same cloud account as the source Kubernetes cluster.

Before you start, you should know the name of the volume you want to restore and the date of the backup file you want to use to create the newly restored volume.

Steps

1. Select the **Backup & Restore** tab.
2. Click the **Kubernetes** tab and the Kubernetes Dashboard is displayed.

The screenshot shows the 'Backup & Restore' interface with the 'Kubernetes' tab selected. At the top, there are summary statistics: 1 Kubernetes Cluster, 57 Protected PVs, and a total backup size of 15.1 TB. Below this is a table titled '57 Backups' listing three entries for 'Kubernetes_Cloud_AWS'. Each entry includes columns for Source Kubernetes Cluster, Source Persistent Volume, Source Namespace, Last Backup, Backups, and Backup Status. The first two entries show 'Active' status, while the third shows 'Paused'. A red box highlights the 'Details & Backup List' button next to the first entry.

3. Locate the volume you want to restore, click ..., and then **Volume Details**.

The list of all backup files for that volume is displayed along with details about the source volume, destination location, and backup details.

This screenshot shows the 'Volume Details' page for a specific volume. It is divided into three main sections: 'Source', 'Destination', and 'Backup Information'. The 'Source' section lists the Kubernetes Cluster (eks1), Type (EKS), Provider (AWS), Persistent Volume (pvc-05881c70-cf5f-4edc-8537...), and Namespace (default). The 'Destination' section lists the Cloud Provider (AWS), Bucket (netapp-backup-vsa5twmc9ae), Region (us-west-1), and Account ID (123456789012). The 'Backup Information' section shows the Relationship Status (enabled), Last Backup (Dec 07 2021, 2:20:30 pm), Lag Duration (1 hour), Snapshot (2), and Backup Policy (24 hourly | 30 daily | 52 weekly). Below this is a table titled '2 Backups' showing two entries with columns for Backup Name, Date, Size, and a 'Restore' button. The 'Restore' button for the second backup is highlighted with a red box and a mouse cursor icon.

4. Locate the specific backup file that you want to restore based on the date/time stamp, click ..., and then **Restore**.

5. In the *Select Destination* page, select the *Kubernetes cluster* where you want to restore the volume, the *Namespace*, the *Storage Class*, and the new *Persistent volume name*.

Select Destination

Select Kubernetes Cluster

eks1

Namespace

default

Storage Class

basic

PVC Name

pvc-05881c70-cf5f-4edc-8537-a0a5ce36f9a1-restor

Cancel **Restore**

This screenshot shows a modal dialog titled 'Select Destination'. It contains four dropdown menus: 'Select Kubernetes Cluster' (set to 'eks1'), 'Namespace' (set to 'default'), 'Storage Class' (set to 'basic'), and 'PVC Name' (set to 'pvc-05881c70-cf5f-4edc-8537-a0a5ce36f9a1-restor'). At the bottom of the dialog are two buttons: 'Cancel' and 'Restore'.

6. Click **Restore** and you are returned to the Kubernetes Dashboard so you can review the progress of the restore operation.

Result

Cloud Manager creates a new volume in the Kubernetes cluster based on the backup you selected.

Reference

AWS S3 archival storage classes and restore retrieval times

Cloud Backup supports two S3 archival storage classes and most regions.

Supported S3 archival storage classes for Cloud Backup

When backup files are initially created they're stored in S3 *Standard* storage. This tier is optimized for storing data that's infrequently accessed; but that also allows you to access it immediately. After 30 days the backups transition to the S3 *Standard-Infrequent Access* storage class to save on costs.

If your source clusters are running ONTAP 9.10.1 or greater, you can choose to tier backups to either S3 *Glacier* or S3 *Glacier Deep Archive* storage after a certain number of days (typically more than 30 days) for further cost optimization. Data in these tiers can't be accessed immediately when needed, and will require a higher retrieval cost, so you need to consider how often you may need to restore data from these archived backup files. See the section about [restoring data from archival storage](#).

Note that when you configure Cloud Backup with this type of lifecycle rule, you must not configure any lifecycle rules when setting up the bucket in your AWS account.

[Learn about S3 storage classes](#).

Restoring data from archival storage

While storing older backup files in archival storage is much less expensive than Standard or Standard-IA

storage, accessing data from a backup file in archive storage for restore operations will take a longer amount of time and will cost more money.

How much does it cost to restore data from Amazon S3 Glacier and Amazon S3 Glacier Deep Archive?

There are 3 restore priorities you can choose when retrieving data from Amazon S3 Glacier, and 2 restore priorities when retrieving data from Amazon S3 Glacier Deep Archive. S3 Glacier Deep Archive costs less than S3 Glacier:

Archive Tier	Restore Priority & Cost		
	High	Standard	Low
S3 Glacier	Fastest retrieval, highest cost	Slower retrieval, lower cost	Slowest retrieval, lowest cost
S3 Glacier Deep Archive		Faster retrieval, higher cost	Slower retrieval, lowest cost

Each method has a different per-GB retrieval fee and per-request fee. For detailed S3 Glacier pricing by AWS Region, visit the [Amazon S3 pricing page](#).

How long will it take to restore my objects archived in Amazon S3 Glacier?

There are 2 parts that make up the total restore time:

- **Retrieval time:** The time to retrieve the backup file from archive and place it in Standard storage. This is sometimes called the "rehydration" time. The retrieval time is different depending on the restore priority you choose.

Archive Tier	Restore Priority & Retrieval Time		
	High	Standard	Low
S3 Glacier	3-5 minutes	3-5 hours	5-12 hours
S3 Glacier Deep Archive		12 hours	48 hours

- **Restore time:** The time to restore the data from the backup file in Standard storage. This time is no different than the typical restore operation directly from Standard storage - when not using an archival tier.

For more information about Amazon S3 Glacier and S3 Glacier Deep Archive retrieval options, refer to [the Amazon FAQ about these storage classes](#).

Azure archival tiers and restore retrieval times

Cloud Backup supports one Azure archival access tier and most regions.

Supported Azure Blob access tiers for Cloud Backup

When backup files are initially created they're stored in the *Cool* access tier. This tier is optimized for storing data that's infrequently accessed; but when needed, can be accessed immediately.

If your source clusters are running ONTAP 9.10.1 or greater, you can choose to tier backups from *Cool* to *Azure Archive* storage after a certain number of days (typically more than 30 days) for further cost optimization. Data in this tier can't be accessed immediately when needed, and will require a higher retrieval cost, so you need to consider how often you may need to restore data from these archived backup files. See the next

section about [restoring data from archival storage](#).

Note that when you configure Cloud Backup with this type of lifecycle rule, you must not configure any lifecycle rules when setting up the container in your Azure account.

[Learn about Azure Blob access tiers](#).

Restoring data from archival storage

While storing older backup files in archival storage is much less expensive than Cool storage, accessing data from a backup file in Azure Archive for restore operations will take a longer amount of time and will cost more money.

How much does it cost to restore data from Azure Archive?

There are two restore priorities you can choose when retrieving data from Azure Archive:

- **High:** Fastest retrieval, higher cost
- **Standard:** Slower retrieval, lower cost

Each method has a different per-GB retrieval fee and per-request fee. For detailed Azure Archive pricing by Azure Region, visit the [Azure pricing page](#).

How long will it take to restore my data archived in Azure Archive?

There are 2 parts that make up the restore time:

- **Retrieval time:** The time to retrieve the archived backup file from Azure Archive and place it in Cool storage. This is sometimes called the "rehydration" time. The retrieval time is different depending on the restore priority you choose:
 - **High:** < 1 hour
 - **Standard:** < 15 hours
- **Restore time:** The time to restore the data from the backup file in Cool storage. This time is no different than the typical restore operation directly from Cool storage - when not using an archival tier.

For more information about Azure Archive retrieval options, refer to [this Azure FAQ](#).

Cross-account and cross-region configurations

These topics describe how to configure Cloud Backup for cross account configurations when using different cloud providers.

- [Configure Cloud Backup for multi-account access in AWS](#)
- [Configure Cloud Backup for multi-account access in Azure](#)

Configure backup for multi-account access in AWS

Cloud Backup enables you to create backup files in an AWS account that is different than where your source Cloud Volumes ONTAP volumes reside. And both of those accounts can be different than the account where the Cloud Manager Connector resides.

These steps are required only when you are [backing up Cloud Volumes ONTAP data to Amazon S3](#).

Follow the steps below to set up your configuration in this manner.

Set up VPC peering between accounts

1. Log in to second account and Create Peering Connection:
 - a. Select a local VPC: Select the VPC of the second account.
 - b. Select another VPC: Enter the account ID of the first account.
 - c. Select the Region where the Cloud Manager Connector is running. In this test setup both accounts are running in same region.
 - d. VPC ID: Log into first account and enter the acceptor VPC ID. This is the VPC ID of the Cloud Manager Connector.

The screenshot shows the 'Create Peering Connection' interface in the AWS Management Console. The 'Peering connection name tag' field is set to 'cbs-multi-account'. Under 'Select a local VPC to peer with', the 'VPC (Requester)*' dropdown is set to 'vpc-82f55afa'. A table shows one CIDR range: 'CIDRs' (10.0.0.0/16), 'Status' (associated), and 'Status Reason' (associated). Under 'Select another VPC to peer with', the 'Account' dropdown shows 'Another account' selected, and the 'Account ID*' field contains '464262061435'. The 'Region' dropdown shows 'This region (us-east-1)' selected. The 'VPC ID (Acceptor)*' field contains 'vpc-116d9174'.

A Success dialog displays.



The status of the peering connection shows as Pending Acceptance.

	Name	Peering Connection	Status	Requester VPC	Acceptor VPC	Requester CIDRs	Acceptor CIDRs	Requester Owner	Acceptor Owner
<input checked="" type="checkbox"/>	cbs-multi-ac...	pcx-049758069d9...	Pending Acceptance	vpc-82f55afa VP...	vpc-116d9174	10.0.0.0/16	-	733004784675	464262061435
<input type="checkbox"/>	cbs-multi-peer	pcx-05f2d310cb7f...	Deleted	vpc-82f55afa VP...	vpc-116d9174	-	-	733004784675	464262061435
<input type="checkbox"/>	New_Peering	pcx-6d55ca04	Active	vpc-b16c90d4 V...	vpc-fc2aa39a De...	172.31.0.0/16	192.168.0.0/16	733004784675	733004784675

2. Log into the first account and accept the peering request:

The screenshot shows the 'Create Peering Connection' button at the top left. Below it is a search bar and a table of peering connections. A context menu is open over the row for 'pcx-049758069d9b7c140', with 'Accept Request' highlighted in orange.

Name	Peering Connection	Status	Requester VPC	Acceptor VPC	Requester CIDRs	Acceptor CIDRs	Requester Owner	Acceptor Owner	
<input type="checkbox"/>	cbs-multi-peer	pcx-05f2d310cb7f...	Deleted	vpc-82f55afa VP...	vpc-116d9174	-	-	733004784675	464262061435
<input type="checkbox"/>	New_Peering	pcx-6d55ca04	Active	vpc-b16c90d4 V...	vpc-fc2aa39a De...	172.31.0.0/16	192.168.0.0/16	733004784675	733004784675
<input checked="" type="checkbox"/>	cbs-multi-ac...	pcx-049758069d9...	Pending Acceptance	vpc-82f55afa VP...	vpc-116d9174	10.0.0.0/16	-	733004784675	464262061435

Accept VPC Peering Connection Request

Are you sure you want to accept this VPC peering connection request (pcx-049758069d9b7c140)?

Requester Account ID	733004784675	Acceptor Account ID	464262061435 (This account)
Requester VPC ID	vpc-82f55afa	Acceptor VPC ID	vpc-116d9174
Requester VPC Region	us-east-1	Acceptor VPC Region	us-east-1
Requester VPC CIDR	10.0.0.0/16	Acceptor VPC CIDR	-

[Cancel](#) [Yes, Accept](#)

a. Click **Yes**.

Accept VPC Peering Connection Request

Your VPC Peering Connection has been established.

To send and receive traffic across this VPC peering connection, you must add a route to the peered VPC in one or more of your VPC route tables. [Learn more](#)

[Modify my route tables now](#)

[Close](#)

The connection now shows as Active. We have also added a Name tag to identify the peering connection called cbs-multi-account.

	Name	Peering Connection	Status	Requester VPC	Acceptor VPC	Requester CIDRs	Acceptor CIDRs	Requester Owner	Acceptor Owner
<input type="checkbox"/>		pcx-00475531514cb0d8	Active	vpc-0647747d M...	vpc-116d9174	10.2.0.0/24	172.31.0.0/16	464262061435	464262061435
<input type="checkbox"/>	estycvoconnect	pcx-0305041f9cc2dfbd	Active	vpc-116d9174	vpc-445d4f21	172.31.0.0/16	10.129.0.0/20	464262061435	759995470648
<input checked="" type="checkbox"/>	cbs-multi-account	pcx-049758069d9b7c140	Active	vpc-82f55afa	vpc-116d9174	10.0.0.0/16	172.31.0.0/16	733004784675	464262061435
<input type="checkbox"/>	hill-vpc-peer-chen	pcx-0d0e5c7fc4360254d	Active	vpc-0d12df59528f...	vpc-824dc0e4 nf...	10.0.0.0/24	10.20.30.0/24	464262061435	464262061435

b. Refresh the peering connection in the second account and notice that the status changes to Active.

	Name	Peering Connection	Status	Requester VPC	Acceptor VPC	Requester CIDRs	Acceptor CIDRs	Requester Owner	Acceptor Owner
<input checked="" type="checkbox"/>	cbs-multi-account	pcx-049758069d9b7c140	Active	vpc-82f55afa VP...	vpc-116d9174	10.0.0.0/16	172.31.0.0/16	733004784675	464262061435
<input type="checkbox"/>	New_Peering	pcx-6d55ca04	Active	vpc-b16c90d4 V...	vpc-fc2aa39a De...	172.31.0.0/16	192.168.0.0/16	733004784675	733004784675

Add a route to the route tables in both accounts

1. Go to VPC > Subnet > Route table.

The screenshot shows the 'Details' tab of a subnet configuration. Key fields include:

Subnet ID	State	VPC	IPv4 CIDR
subnet-4d315328	Available	vpc-116d9174	172.31.64.0/20
Available IPv4 addresses	IPv6 CIDR	Availability Zone	Availability Zone ID
3587	-	us-east-1a	use1-az1
Network border group	Route table	Network ACL	Default subnet
us-east-1	rtb-4da55528	acl-c37384a6	Yes
Auto-assign public IPv4 address	Auto-assign IPv6 address	Auto-assign customer-owned IPv4 address	Customer-owned IPv4 pool
Yes	No	No	-
Outpost ID	Owner	Subnet ARN	
-	464262061435	arn:aws:ec2:us-east-1:464262061435:subnet/subnet-4d315328	

Below the table, tabs for 'Flow logs', 'Route table' (which is highlighted with a red box), 'Network ACL', 'Sharing', and 'Tags' are visible.

2. Click on the Routes tab.

The screenshot shows the 'Routes' tab of a route table configuration. Key fields include:

Name	Route Table ID	Explicit subnet association	Main	VPC ID	Owner
rtb-4da55528	subnet-4d315328	-	Yes	vpc-116d9174	464262061435

Below the table, tabs for 'Summary', 'Routes' (which is highlighted with a red box), 'Subnet Associations', 'Edge Associations', 'Route Propagation', and 'Tags' are visible. A button labeled 'Edit routes' is also present.

View: All routes

Destination	Target	Status	Propagated
172.31.0.0/16	local	active	No
pl-63a5400a	vpce-098587ed33c36408c	active	No

3. Click **Edit routes**.

The screenshot shows the 'Edit routes' dialog. It lists existing routes and allows adding new ones. The 'Add route' button is highlighted with a red box.

Destination	Target	Status	Propagated
172.31.0.0/16	local	active	No
10.20.30.0/24	pcx-0791b47f6f9a27d65	active	No
10.129.0.0/20	pcx-0305041f9cc2dfbdb	active	No

* Required

Cancel Save routes

4. Click **Add route**, and from the Target drop-down list select **Peering Connection**, and then select the peering connection that you created.

- In the Destination, enter the other account's subnet CIDR.

The screenshot shows the 'Edit routes' dialog. In the 'Target' column for the row with destination '10.0.0.0/24', a dropdown menu is open, displaying several route entries. The entry 'pcx-049758069d9b7c140 cbs-multi-account' is highlighted with a yellow background. The dialog also includes fields for 'Destination' (10.0.0.0/24), 'Target' (pcx-), and 'Status' (active). A red box highlights the 'Destination' and 'Target' fields. A red 'X' icon is visible in the top right corner of the dialog.

- Click **Save routes** and a Success dialog displays.

The screenshot shows a success dialog box with a green header bar containing a checkmark icon and the text 'Routes successfully edited'. A blue 'Close' button is at the bottom right.

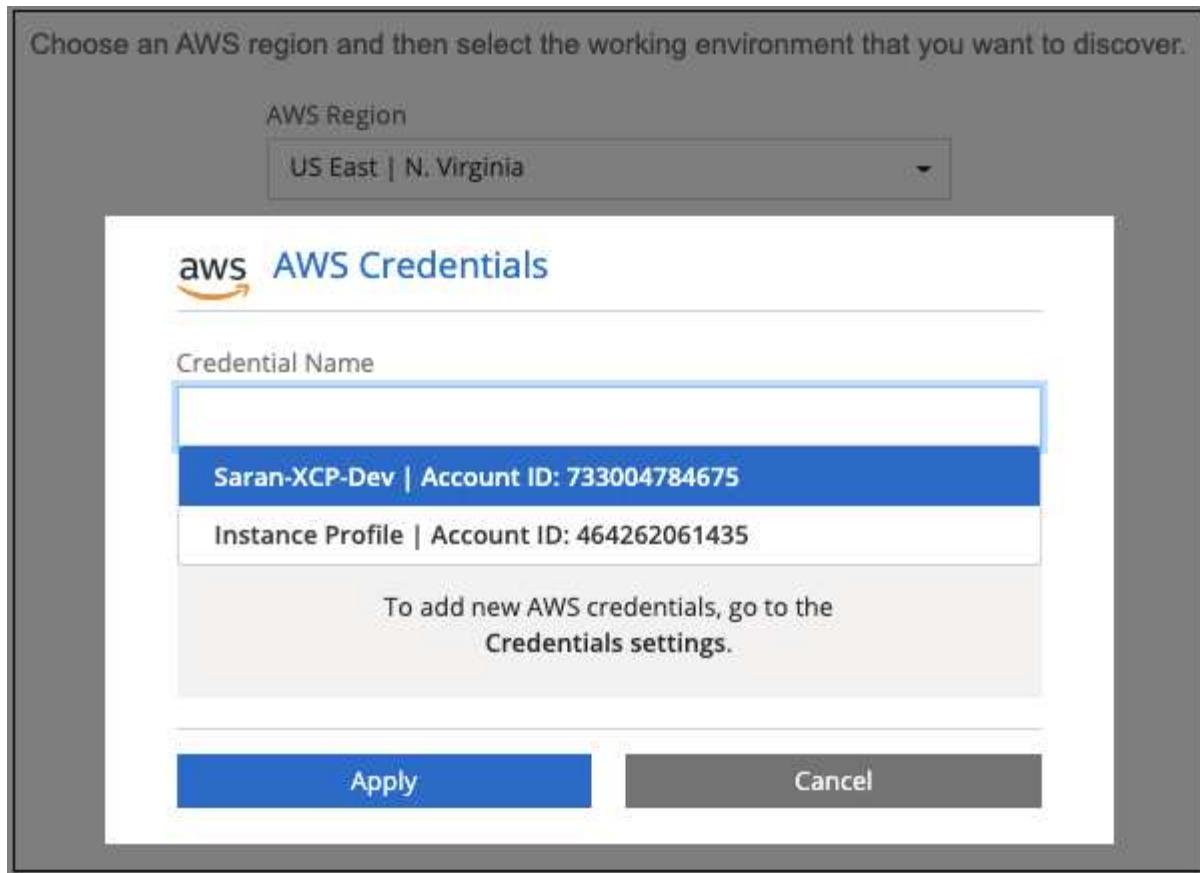
Add the second AWS account credentials in Cloud Manager

- Add the second AWS account, for example, *Saran-XCP-Dev*.

The screenshot shows the 'Credentials' page with two entries listed:

- AWS Instance Profile**: Credential Type: AWS Keys. It shows an AWS Account ID (464262061435) and an IAM Role (aws-sub-a2).
- Saran-XCP-Dev**: Credential Type: AWS Keys. It shows an AWS Account ID (733004784675) and an AWS Access Key (AKIAZVKT5MQRZRAWW3HI). It also lists 0 Working Environments.

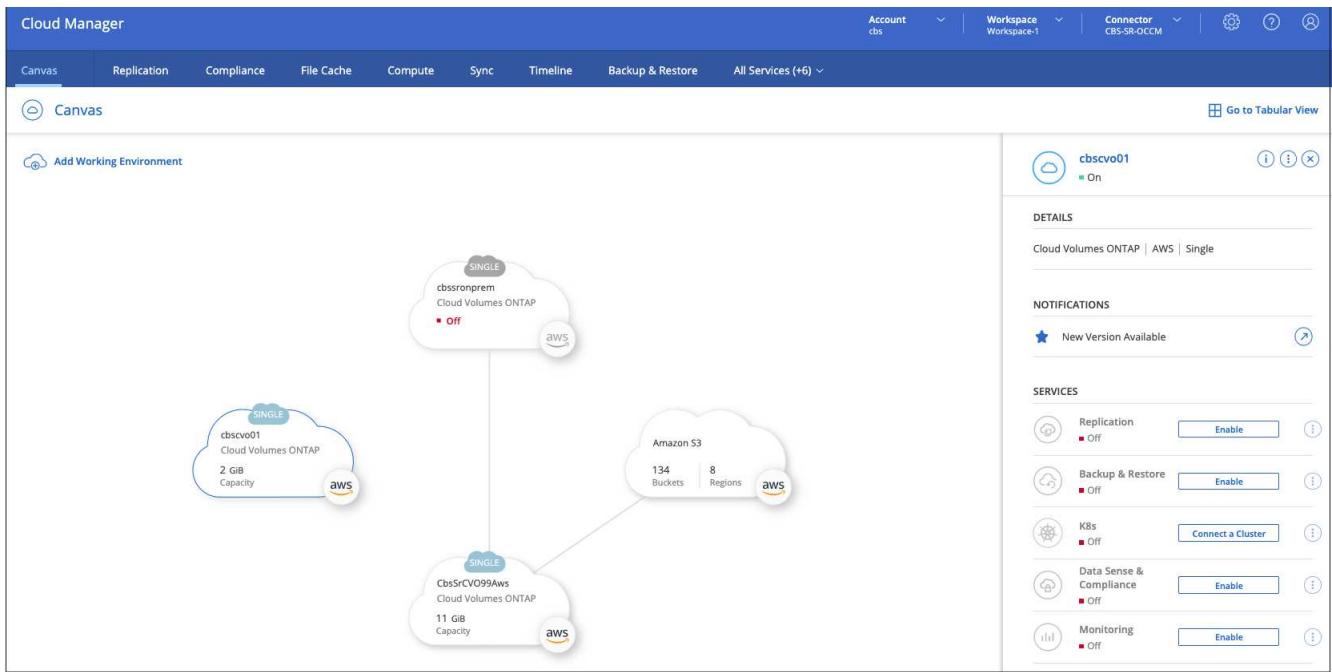
- In the Discover Cloud Volumes ONTAP page, select the newly added credentials.



3. Select the Cloud Volumes ONTAP system you want to discover from second account. You can also deploy a new Cloud Volumes ONTAP system in the second account.

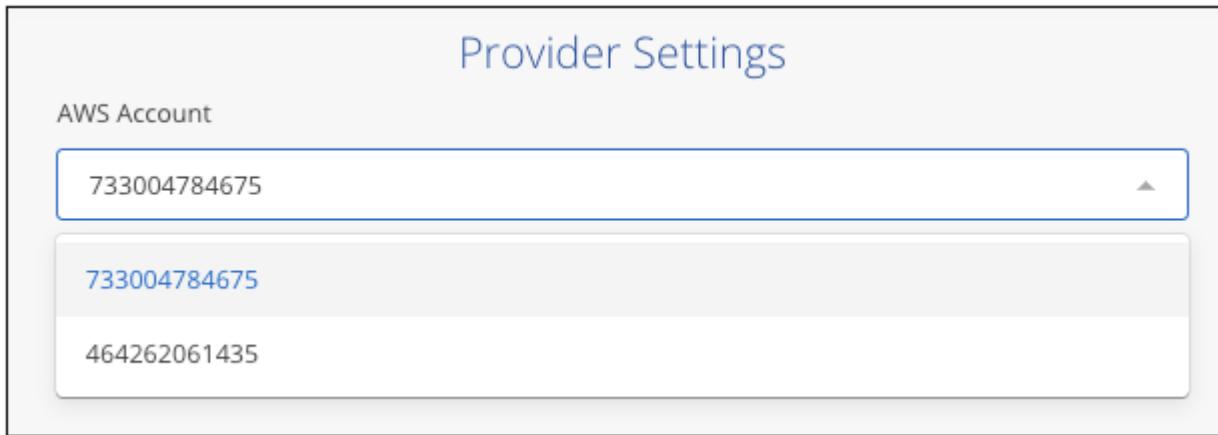
Add an Existing Cloud Volumes ONTAP		Region				
This working environment will be created in Cloud Provider Account: Saran-XCP-Dev Account ID: 733004784675 Switch Account						
↑ Previous Step						
Choose an AWS region and then select the working environment that you want to discover.						
AWS Region US East N. Virginia						
Cloud Volumes ONTAP instances found						
Name	VPC Name	Availability Zone	Subnet Id	Cloud Formation Name	Cluster Address	Type
cbscvo01	VPC-NAT	us-east-1f	subnet-68e8d464	cbscvo01	10.0.0.80	Cloud Volumes ONTAP
testbyolliraz	VPC for VSA	us-east-1a	subnet-c1d99699	testbyolliraz	172.31.5.142	Cloud Volumes ONTAP
idanAwsHa991001	VPC for VSA	us-east-1a	subnet-c1d99699	idanAwsHa991001	172.31.5.234,172.31.5.110	HA Cloud Volumes ONTAP
Continue						

The Cloud Volumes ONTAP system from the second account is now added to Cloud Manager which is running in a different account.



Enable backup in the other AWS account

1. In Cloud Manager, enable backup for the Cloud Volumes ONTAP system running in the first account, but select the second account as the location for creating the backup files.



2. Then select a backup policy and the volumes you want to back up, and Cloud Backup attempts to create a new bucket in the selected account.

However, adding the bucket to the Cloud Volumes ONTAP system will fail because Cloud Backup uses the instance profile to add the bucket and the Cloud Manager instance profile doesn't have access to the resources in the second account.

3. Get the working environment ID for the Cloud Volumes ONTAP system.



Cloud Backup creates every bucket with the prefix Netapp-backup- and will include the working environment ID; for example: 87ULeA10

4. In the EC2 portal, go to S3 and search for the bucket with name ending with 87ULeA10 and you'll see the bucket name displayed as Netapp-backup-vsa87ulea10.

Name	AWS Region	Access	Creation date
netapp-backup-vsa87uleai0	US East (N. Virginia) us-east-1	Bucket and objects not public	May 25, 2021, 17:50:08 (UTC+05:30)

5. Click on the bucket, then click the Permissions tab, and then click **Edit** in the Bucket policy section.

6. Add a bucket policy for the newly created bucket to provide access to the Cloud Manager's AWS account, and then Save the changes.

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Sid": "PublicRead",
      "Effect": "Allow",
      "Principal": {
        "AWS": "arn:aws:iam::464262061435:root"
      },
      "Action": [
        "s3>ListBucket",
        "s3:GetBucketLocation",
        "s3GetObject",
        "s3PutObject",
        "s3DeleteObject"
      ],
      "Resource": [
        "arn:aws:s3::::netapp-backup-vsa87uleai0",
        "arn:aws:s3::::netapp-backup-vsa87uleai0/*"
      ]
    }
  ]
}
```

Note that "AWS": "arn:aws:iam::464262061435:root" gives complete access to this bucket for all resources in account 464262061435. If you want to reduce it to specific role, level, you can update the policy with specific role(s). If you are adding individual roles, ensure that occm role also added, otherwise backups will not get updated in the Cloud Backup UI.

For example: "AWS": "arn:aws:iam::464262061435:role/cvo-instance-profile-version10-d8e-
iamInstanceRole-IKJPJ1HC2E7R"

7. Retry enabling Cloud Backup on the Cloud Volumes ONTAP system and this time it should be successful.

Configure backup for multi-account access in Azure

Cloud Backup enables you to create backup files in an Azure account that is different than where your source Cloud Volumes ONTAP volumes reside. And both of those accounts can be different than the account where the Cloud Manager Connector resides.

These steps are required only when you are [backing up Cloud Volumes ONTAP data to Azure Blob storage](#).

Follow the steps below to set up your configuration in this manner.

Set up VNet peering between accounts

Note that if you want Cloud Manager to manage your Cloud Volumes ONTAP system in a different account/region, then you need to setup VNet peering. VNet peering is not required for storage account

connectivity.

1. Log in to the Azure portal and from home, select Virtual Networks.
2. Select the subscription you are using as subscription 1 and click on the VNet where you want to set up peering.

The screenshot shows the Azure Virtual networks page. At the top, there are navigation links: Home > Virtual networks. Below that, it says NetApp HCL (netapphcl.onmicrosoft.com). There are buttons for New, Manage view, Refresh, Export to CSV, Open query, Assign tags, and Feedback. Filter options include Subscription == OCCM Dev, Resource group == all, Location == all, and Add filter. The main area shows a table with 60 records, filtered by Subscription == OCCM Dev. The columns are Name, Resource group, and Location. One row, 'cbsnetwork', is highlighted with a red box.

Name	Resource group	Location
cbsnetwork	occm_group_eastasia	East Asia
Vnet1	occm_group_australiaeast	Australia East
Vnet1	occm_group_australiasoutheast	Australia Southeast

3. Select **cbsnetwork** and from the left panel, click on **Peerings**, and then click **Add**.

The screenshot shows the 'Add Peering' configuration page. It has fields for Subscription (OCCM Automation) and Virtual network (cbse2vnet). Under Traffic to remote virtual network, 'Allow (default)' is selected. Under Traffic forwarded from remote virtual network, 'Allow (default)' is selected. Under Virtual network gateway or Route Server, 'None (default)' is selected. At the bottom is a blue 'Add' button.

4. Enter the following information on the Peering page and then click **Add**.

- Peering link name for this network: you can give any name to identify the peering connection.
- Remote virtual network peering link name: enter a name to identify the remote VNet.

- Keep all the selections as default values.
- Under subscription, select the subscription 2.
- Virtual network, select the virtual network in subscription 2 to which you want to set up the peering.

cbsnetwork | Peerings

Virtual network

Search (Cmd+/)

Add Refresh

Overview Activity log Access control (IAM) Tags Diagnose and solve problems

Settings

Address space Connected devices Subnets DDoS protection Firewall Security DNS servers Peerings

Name	Peering status	Peer
cbsnetwork	Connected	cbse2evnet

5. Perform the same steps in subscription 2 VNet and specify the subscription and remote VNet details of subscription 1.

Subscription * ⓘ
OCCM Dev

Virtual network * ⓘ
cbsnetwork

Traffic to remote virtual network ⓘ
 Allow (default)
 Block all traffic to the remote virtual network

Traffic forwarded from remote virtual network ⓘ
 Allow (default)
 Block traffic that originates from outside this virtual network

Virtual network gateway or Route Server ⓘ
 Use this virtual network's gateway or Route Server
 Use the remote virtual network's gateway or Route Server
 None (default)

Add

The peering settings are added.

cbse2evnet | Peerings

Virtual network

Search (Cmd+/) < Add Refresh

Name	Peering status	Peer
cbsnetworkpeer	Connected	cbsnetwork

Overview

Activity log

Access control (IAM)

Tags

Diagnose and solve problems

Settings

Address space

Connected devices

Subnets

DDoS protection

Firewall

Security

DNS servers

Peerings

Create a private endpoint for the storage account

Now you need to create a private endpoint for the storage account. In this example, the storage account is created in subscription 1 and the Cloud Volumes ONTAP system is running in subscription 2.



You need network contributor permission to perform the following action.

```
{  
  "id": "/subscriptions/d333af45-0d07-4154-  
943dc25fbbce1b18/providers/Microsoft.Authorization/roleDefinitions/4d97b98  
b-1d4f-4787-a291-c67834d212e7",  
  "properties": {  
    "roleName": "Network Contributor",  
    "description": "Lets you manage networks, but not access to them.",  
    "assignableScopes": [  
      "/"  
    ],  
    "permissions": [  
      {  
        "actions": [  
          "Microsoft.Authorization/*/read",  
          "Microsoft.Insights/alertRules/*",  
          "Microsoft.Network/*",  
          "Microsoft.ResourceHealth/availabilityStatuses/read",  
          "Microsoft.Resources/deployments/*",  
          "Microsoft.Resources/subscriptions/resourceGroups/read",  
          "Microsoft.Support/*"  
        ],  
        "notActions": [],  
        "dataActions": [],  
        "notDataActions": []  
      }  
    ]  
  }  
}
```

1. Go to the storage account > Networking > Private endpoint connections and click **+ Private endpoint**.

The screenshot shows the Azure Storage account interface for 'netappbackupvsatxdkmfym'. The left sidebar includes links for Activity log, Tags, Diagnose and solve problems, Access Control (IAM), Data migration, Events, Storage Explorer (preview), Containers, File shares, Queues, and Tables. The main area is titled 'Networking' under 'Security + networking'. The 'Private endpoint connections' tab is selected, showing a table with columns: Connection name, Connection state, Private endpoint, and Description. A message 'No results' is displayed. At the top, there are buttons for '+ Private endpoint', 'Approve', 'Reject', 'Remove', and 'Refresh', along with a search bar and a filter dropdown.

2. In the Private Endpoint *Basics* page:

- Select subscription 2 (where the Cloud Manager Connector and Cloud Volumes ONTAP system are deployed) and the resource group.
- Enter an endpoint name.
- Select the region.

The screenshot shows the 'Create a private endpoint' page. The 'Basics' tab is selected. The page has five tabs: Basics, Resource, Configuration, Tags, and Review + create. A note says: 'Use private endpoints to privately connect to a service or resource. Your private endpoint must be in the same region as your virtual network, but can be in a different region from the private link resource that you are connecting to.' Below are sections for Project details and Instance details.

Project details

Subscription * (OCCM Dev)

Resource group * (cbsoccmdevcvo-rg)

Instance details

Name * (cbse2e)

Region * ((Asia Pacific) East Asia)

3. In the *Resource* page, select Target sub-resource as **blob**.

Create a private endpoint

✓ Basics 2 Resource 3 Configuration 4 Tags 5 Review + create

Private Link offers options to create private endpoints for different Azure resources, like your private link service, a SQL server, or an Azure storage account. Select which resource you would like to connect to using this private endpoint. [Learn more](#)

Subscription	OCCM Dev (d333af45-0d07-4154-943d-c25fbbe1b18)
Resource type	Microsoft.Storage/storageAccounts
Resource	test150521
Target sub-resource *	<input type="text" value="blob"/> ▼

4. In the Configuration page:

- Select the virtual network and subnet.
- Click the **Yes** radio button to "Integrate with private DNS zone".

Create a private endpoint

✓ Basics ✓ Resource 3 Configuration 4 Tags 5 Review + create

Networking

To deploy the private endpoint, select a virtual network subnet. [Learn more](#)

Virtual network *	<input type="text" value="cbsnetwork"/> ▼
Subnet *	<input type="text" value="default (10.2.0.0/24)"/> ▼

Tip: If you have a network security group (NSG) enabled for the subnet above, it will be disabled for private endpoints on this subnet only. Other resources on the subnet will still have NSG enforcement.

Private DNS integration

To connect privately with your private endpoint, you need a DNS record. We recommend that you integrate your private endpoint with a private DNS zone. You can also utilize your own DNS servers or create DNS records using the host files on your virtual machines. [Learn more](#)

Integrate with private DNS zone Yes No

Configuration name	Subscription	Private DNS zone
privatelink-blob-core-...	OCCM Dev	privatelink.blob.core.windows.net

Review + create < Previous Next : Tags >

5. In the Private DNS zone list, ensure that the Private Zone is selected from the correct Region, and click **Review + Create**.

Configuration name	Subscription	Private DNS zone
privatelink-blob-core-...	OCCM Dev	privatelink.blob.core.windows.net
		<input type="button" value="Filter private DNS zones"/>
		occm_group_centralus
		privatelink.blob.core.windows.net
		occm_group_eastus
		privatelink.blob.core.windows.net
		occm_group_eastus2
		privatelink.blob.core.windows.net

Now the storage account (in subscription 1) has access to the Cloud Volumes ONTAP system which is running in subscription 2.

6. Retry enabling Cloud Backup on the Cloud Volumes ONTAP system and this time it should be successful.

Protect data using SnapCenter Service

Learn about SnapCenter Service

SnapCenter Service provides data protection capabilities for applications running on NetApp® Cloud Storage. SnapCenter Service enabled within NetApp Cloud Manager offers efficient, application consistent, policy-based backup and restore of SAP HANA® Systems residing on Azure NetApp Files.

Architecture

The architecture of SnapCenter Service include the following components.

- SnapCenter Service UI is integrated with Cloud Manager UI.

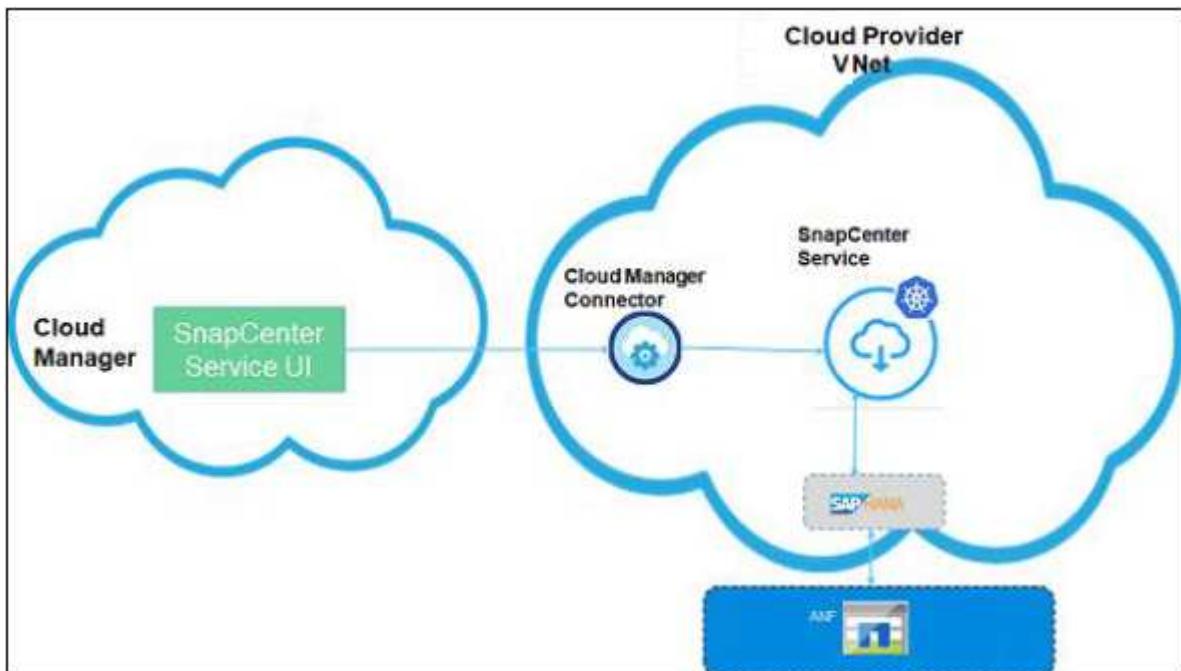
The SnapCenter Service UI is served from the Cloud Manager SAAS framework managed by NetApp that offers multiple storage and data management capabilities.

- Cloud Manager Connector is a component from Cloud Manager that manages the life cycle of the SnapCenter Service and several other services.
- SnapCenter Service is a set of data protection services hosted on Azure Kubernetes Service(AKS) that orchestrates the data protection workflows.



The Cloud Manager Connector and SnapCenter Service are deployed in your Cloud network.

The following diagram shows the relationship between each component of SnapCenter Service:



For any user initiated request, the SnapCenter Service UI communicates with the Cloud Manager SaaS which upon validating the request forwards the call to the Cloud Manager Connector. The Connector then communicates to SnapCenter Service and SnapCenter Service invokes Azure NetApp Files management APIs

and HANA system commands to perform data protection operations.

SnapCenter Service can be deployed in the same VNet as that of the HANA system, or in a different one. If SnapCenter Service and HANA systems are on different network, you should establish a network connectivity between them.

Supported functionalities

SnapCenter Service supports the following functionalities.

- Adding SAP HANA systems
- Backing up SAP HANA systems
 - Supports both snapshot-based and file-based backups
 - Supports on-demand backup of SAP HANA systems
 - Supports scheduled backup of SAP HANA systems using system-defined policies or custom policies

You can specify different scheduling frequencies such as hourly, daily, weekly, and monthly in the policy.

- Supports backing up of both non-data volumes and global non-data volumes
- Retaining backups based on the policy
- Restoring SAP HANA systems from user specified backup
- Monitoring backups and other jobs
- Housekeeping of data and log backup catalogs on the HANA systems
- Displaying the protection summary, configuration details, and job status on the Dashboard
- Sending alerts through email

Limitations

SnapCenter Service 1.0 has the following limitations.

- Internationalization is not supported, you should use English browsers.
- Only a Cloud Manager user with “Account Admin” role can enable the SnapCenter Service.
- Limitations related to Azure Kubernetes Service (AKS) cluster node failure
 - In the AKS cluster if one of the nodes goes offline, the inflight jobs might fail but subsequent jobs will be executed.
 - In the AKS cluster if one of the node goes down, you cannot add SAP HANA systems and but other operations will run without any issue.

You should bring up the node to add HANA systems.

- Scheduler does not support high-availability configuration.

If the MySQL node which is used by the scheduler goes down, you should bring up the node for scheduled operations to continue.

Get started

Get started with SnapCenter Service to protect your data in a few steps.

1

Access Cloud Manager

You should [sign up to NetApp Cloud Central](#), [log into Cloud Manager](#), and then set up a [NetApp account](#).

Only an Account Admin can deploy the SnapCenter Service. However, both Account Admin and SnapCenter Admin can perform different operations. [Learn more](#)

2

Ensure that the prerequisites are met

You should ensure that all the [prerequisites](#) to create a Connector and enable SnapCenter Service are met.

3

Create a Connector in Azure for SnapCenter Service

You should [create a Connector in Azure for SnapCenter Service](#).

If you have a connector that meets all the prerequisites, you can use that.

4

Set up and discover Azure NetApp Files

Create an Azure NetApp Files working environment in Cloud Manager to create and manage NetApp accounts, capacity pools, volumes, and snapshots. [Learn more](#)

5

Enable SnapCenter Service

You should [enable SnapCenter Service](#) using the Cloud Manager UI. When the SnapCenter Service is enabled, Azure Kubernetes Service (AKS) cluster is created that will host the SnapCenter Service.

6

Install the HDBSQL client

You should [install the HDBSQL client](#) to perform data protection operations on SAP HANA databases. The HDBSQL client is used to communicate with the SAP HANA systems.

7

Protect SAP HANA systems

You should manually [add the SAP HANA systems](#).

You can then [back up your SAP HANA system](#) using system-defined or custom policies. In the event of data loss, you can [restore the SAP HANA system](#) using the backup of that system.

Prerequisites to create Connector and enable SnapCenter Service

Before you create a Connector in Azure and enable SnapCenter Service, you should ensure certain things.

- Ensure that the subnet chosen for the Connector should not overlap with the following IP address ranges reserved for Azure Kubernetes Service (AKS): 169.254.0.0/16, 172.30.0.0/16, 172.31.0.0/16, and 192.0.2.0/24.
- Ensure that there are no AKS running in the chosen subnet.
- Ensure that the chosen subnet can access the SAP HANA systems on the respective ports.
- If the VNet of the chosen subnet is different from the VNet of the SAP HANA systems, ensure that the VNets can communicate with each other through VPN gateway, peering, or other means.
- If you want to enable SnapCenter Service behind firewall, you should perform the actions mentioned in [Network requirements](#).

You should upfront decide whether you want to enable SnapCenter Service behind firewall. After enabling SnapCenter Service, you cannot configure it to run behind firewall. This is an AKS limitation.

Network requirements

Set up your network so that the Connector can manage resources and processes within your cloud environment.

Firewall configuration

If you want to enable SnapCenter Service behind firewall, you should perform the following actions.



If you are using Azure firewall, you can perform these steps using a script. For information, see [Azure Firewall configuration](#).

Steps

1. Add the below network rules to the firewall.

Destination endpoint	Protocol	Port	Comments
Service tags - AzureCloud.<Region>:1194	UDP	1194	Not required if you are planning to have a private Connector and private SnapCenter Service cluster.
Service tags - AzureCloud.<Region>:9000	TCP	9000	Not required if you are planning to have a private Connector and private SnapCenter Service cluster.
FQDN - ntp.ubuntu.com:123	UDP	123	Required for time synchronization in Azure virtual machines.
Service tags - AzureCloud.<Region>:443	TCP	443	Not required if you are planning to have a private Connector and private SnapCenter Service cluster.

2. Add an application rule in the firewall with the following FQDN tag and port details:
 - FQDN Tag - AzureKubernetesService
 - HTTPS: 443
3. Add an Application rule with the below endpoints as target FQDNs with protocol and port as HTTPS: 443.

Endpoints	Purpose
https://management.azure.com https://login.microsoftonline.com	Enables Cloud Manager to deploy and manage Cloud Volumes ONTAP in most Azure regions.
https://management.microsoftazure.de https://login.microsoftonline.de	Enables Cloud Manager to deploy and manage Cloud Volumes ONTAP in the Azure Germany regions.
https://management.usgovcloudapi.net https://login.microsoftonline.com	Enables Cloud Manager to deploy and manage Cloud Volumes ONTAP in the Azure US Gov regions.
https://api.services.cloud.netpp.com	Allows API requests to NetApp Cloud Central.
https://cloud.support.netapp.com.s3.us-west-1.amazonaws.com	Provides access to software images, manifests, and templates.
https://cognito-idp.us-east-1.amazonaws.com https://cognito-identity.us-east-1.amazonaws.com https://sts.amazonaws.com https://cloud-support-netapp-com-accelerated.s3.amazonaws.com	Enables the Connector to access and download manifests, templates, and Cloud Volumes ONTAP upgrade images.
https://cloudmanagerinfraprod.azurecr.io	Access to software images of container components for an infrastructure that's running Docker and provides a solution for service integrations with Cloud Manager.
https://kinesis.us-east-1.amazonaws.com	Enables NetApp to stream data from audit records.
https://cloudmanager.cloud.netapp.com	Communication with the Cloud Manager service, which includes NetApp accounts.
https://netapp-cloud-account.auth0.com	Communication with NetApp Cloud Central for centralized user authentication.
https://support.netapp.com	Communication with NetApp AutoSupport.
https://cloud-support-netapp-com.s3.us-west-1.amazonaws.com	Communication with NetApp for system licensing and support registration.
https://client.infra.support.netapp.com.s3.us-west-1.amazonaws.com https://cloud-support-netapp-com-accelerated.s3.us-west-1.amazonaws.com	Enables NetApp to collect information needed to troubleshoot support issues.
*.blob.core.windows.net	Required for HA pairs when using a proxy.
https://auth0.com	Required for Auth0 authentication.
https://registry-1.docker.io https://auth.docker.io https://production.cloudflare.docker.com	Retrieves the dependencies of SnapCenter Service workflow engine.

Endpoints	Purpose
https://externl-log.cloudmanager.netapp.com	Allows communication to transfer the logs to the Cloud Manager log repository.

4. Select the subnet where you are planning to install SnapCenter Service.
5. Create a route table with routes:
 - to forward the traffic from the subnet to the firewall internal IP address
 - to forward the traffic from firewall public IP address to the internet.
6. Attach the route table to the subnet.

For information on the networking requirements for Cloud Manager Connector, see [Networking requirements for the Connector](#).

Azure Firewall configuration

If you want to enable SnapCenter Service behind Azure firewall, you should perform the following actions.

What you will need

- You should have created the firewall (classic mode).
- You should have created the VNet and subnet for SnapCenter Service.
- If your firewall resource and VNet of the SnapCenter Service are in different tenants, you should log into both the tenants in the Azure shell.
- If your Firewall VNet and SnapCenter VNet are different, you should establish peering between the VNets.

Steps

1. Download the [scs_azure_firewall_config.sh](#) script to your local system.
2. Log into [Microsoft Azure portal](#).
3. Click  to open the cloud shell and select the Bash console.
 - a. Upload the script to Azure cloud shell.
 - b. Assign the permission to run the script.

```
chmod +x ./scs_azure_firewall_config.sh
```

- c. Run the script.

```
./scs_azure_firewall_config.sh -fwsubid <Firewall_SubscriptionID> -fwname
<Firewall_name> -fwrg <Firewall_Resource_group> -scssubid
<SnapCenter_Service_SubscriptionID> -scsvnet <SnapCenter_Service_VNet_name>
-scsubnet <SnapCenter_Service_Subnet_name> -scsvnetrg
<SnapCenter_Service_VNet_Resource_Group> -scsrg
<SnapCenter_Service_Resource_group>
```



If you have not created the resource group, the script creates the resource group. While creating the Connector, you can use the same resource group so that all the SnapCenter Service related resources are in the same resource group.

Results

- Firewall rules are configured.
- A resource group is created for SnapCenter Service.
- A route table is created in the SnapCenter Service resource group.
- The route table rules are configured.
- The route table is attached to the subnet.

Connectivity to HANA Systems

SnapCenter Service cluster needs to communicate with HANA systems in the user's network using HDBSQL command. The communication channel between SnapCenter cluster and HANA systems need to be allowed using various network architecture such as:

- Connector and SnapCenter Service cluster are deployed in the same VNet as that of HANA systems
- Connector and SnapCenter Service cluster are deployed in a different VNet as that of HANA systems and the communication is established using VNet peering between the 2 VNets.
- Connector and SnapCenter Service cluster are deployed in a different VNet as that of HANA systems, and the communication is established using VPN gateway between the 2 VNets.

Security Group configuration

If network security group (NSG) is configured in the HANA Systems, it should allow inbound communication from the port of the SnapCenter Service to the port of HANA System as specified in User Store Key.

- Protocol: All TCP
- Subnet: SnapCenter AKS cluster subnet
- Purpose: To execute HDBSQL command

The HANA services running in the SnapCenter AKS cluster supports SSL communication with HANA systems that have SSL enabled.

Create a Connector in Azure for SnapCenter Service

An Account Admin should deploy a Connector before you can use the Cloud Manager features. The Connector enables Cloud Manager to manage resources and processes within your public cloud environment.

By default, you can create a Connector in Azure from Azure Marketplace. While performing the steps to [create the connector from Azure Marketplace](#), you should remember the following:

- Wherever Cloud Manager for Cloud Volumes ONTAP is specified, the same can be leveraged for SnapCenter Service.
- For the Cloud Manager Name specify your Connector VM name for better identification. This will be shown

as connector name in the Cloud Manager UI.

- If you have configured the Connector without public IP or configured a firewall, you should have a jump host to connect to the Connector machine.

If you have [user consent](#) enabled in your Azure Active Directory or if your tenant admin can provide the consent, you can create the Connector from Cloud Manager UI.

User consent is enabled

If the user consent is enabled in your Azure active directory, [create the Connector from Cloud Manager](#).

User consent is disabled

1. Perform one of the following:

- If the admin consent workflow is configured in your active directory, you should [request for admin consent](#).
- If the admin consent workflow is not configured, you should:
 - a. [Construct the URL for granting tenant-wide admin consent](#).



Specify the clientID as `989efff4-9a9e-46fa-9f17-de39e15714f9`. This is the Cloud Manager Azure application ID named in the Cloud Manager wizard.

- b. Ask your tenant admin to run the URL in a browser and provide his consent.

The displayed errors can be ignored by your Admin.

2. [Create the Connector from Cloud Manager](#).



The username and password or the key that was provided while creating the Connector would be required to connect to the machine

Enable SnapCenter Service for Azure NetApp Files

You can enable the SnapCenter Service using the Cloud Manager UI. When the SnapCenter Service is enabled, Azure Kubernetes Service (AKS) cluster is created that will host the SnapCenter Service.

What you will need

- You should register the "Microsoft.ContainerService" resource provider in your Azure subscription. For information, see [how to register resource provider](#).
- You should ensure that all the [prerequisites](#) are met.

About this task

The AKS cluster will be created in the same resource group and the same subnet that was chosen while creating the Connector. If your Connector is created without public IP address, then the AKS cluster will be created in private mode.

A user assigned managed identity with necessary permissions is required to create and manage AKS cluster.

The user assigned managed identity will be created and should be assigned to the Connector VM.

Steps

1. Log into Cloud Manager.
2. Select the Connector that was created in the Cloud Manager.

Ensure that the Connector has the network connectivity to the SAP HANA systems to be protected.

3. Click **All Services > SnapCenter > Enable**.

4. Perform one of the following:

- If you have created the Connector from Cloud Manager UI and if you have permissions to create and assign roles, the user assigned managed identity will be created automatically by SnapCenter Service installation.
 - a. Select **Use Azure login**.
 - b. On the Get Ready page, click **Continue**.
 - c. Specify the Azure credentials.



You should ensure that the Azure login account has the sufficient permissions. For information on the permissions and how to assign the permissions, see [Permissions required for Azure login account](#).

- If you have created the Connector from Azure marketplace or if you do not have permissions to create and assign roles, follow the below steps to create the user assigned managed identity.
 - a. Select **Use Azure CLI script**.
 - b. Contact your admin if you do not have sufficient permissions on your Azure account.

For information on the permissions and how to assign the permissions, see [Permissions required for Azure login account](#).

- c. Download the [prerequisite_azure.sh](#) script to your local system.
- d. Log into [Microsoft Azure portal](#).
- e. Click to open the cloud shell and select the Bash console.
- f. Upload the script to Azure cloud shell.
- g. Assign the permission to run the script.

```
chmod +x ./prerequisite_azure.sh
```

- h. Run the script.

```
./prerequisite_azure.sh -s <subscription_ID> -g  
<connector_resourcegroup_name> -c <connector_VM_name>
```

5. On the Cluster Configuration page, perform the following:

- a. Select the cluster configuration.
 - If you select **High Availability**, an Azure Kubernetes Service (AKS) cluster with 3 worker nodes will be created across available zones.

- If you select **Single Node**, an AKS cluster with single node will be created.

b. Specify the Kubernetes Pod address range.

Ensure that the Kubernetes Pod address range does not overlap with IP ranges of your virtual network, peered virtual networks, and on-premises networks that are connected. Also, the range should not overlap with the Service address range and Docker bridge address.

c. Specify the Kubernetes Service address.

Ensure that the Kubernetes service address range does not overlap with the IP ranges of your virtual network, peered virtual networks, and on-premise networks that are connected. Also, the range should not overlap with the Pod address range and Docker bridge address.

d. Specify the Docker bridge network.

Ensure that the Docker Bridge address does not overlap with the IP ranges of your virtual network, peered virtual networks, and on-premise networks that are connected. Also, the range should not overlap with the Pod address range and Service address range.

e. If the Connector is created without a public IP and if you are using custom DNS servers on your VNet, select **Support Custom DNS servers**.



You should create a virtual network link in the private DNS zone for the VNets where your custom DNS servers are hosted. The private DNS zone name and the resource group name are displayed on the UI.

6. On the Review page, review the details and click **Enable**.

7. After enabling the SnapCenter Service successfully, click **Finish**.

Results

- After successfully enabling the SnapCenter Service, the AKS cluster will be created. You can view the AKS cluster details by clicking



If you have failed to enable the SnapCenter Service, you can fix the issue and click **Retry**.

- After creating the user assigned managed identity, it will be assigned to a custom role.

- The user assigned managed identity will be assigned to a custom role with the below permissions at the scope of Connector resource group:

```
"Microsoft.Resources/subscriptions/resourceGroups/read",
"Microsoft.ContainerService/managedClusters/read",
"Microsoft.ContainerService/managedClusters/write",
"Microsoft.ContainerService/managedClusters/delete",
"Microsoft.ContainerService/managedClusters/listClusterUserCredential
/action",
"Microsoft.ManagedIdentity/userAssignedIdentities/assign/action",
"Microsoft.ManagedIdentity/userAssignedIdentities/read",
"Microsoft.Compute/virtualMachines/read",
"Microsoft.Network/networkInterfaces/read"
```

- The user assigned managed identity will be assigned to a custom role with the below permissions at the scope of Connector's VNet:

```
"Microsoft.Authorization/roleAssignments/read",
"Microsoft.Network/virtualNetworks/subnets/join/action",
"Microsoft.Network/virtualNetworks/subnets/read",
"Microsoft.Network/virtualNetworks/read",
"Microsoft.Network/virtualNetworks/join/action"
```

- If route table is configured on the subnet for routing to firewall, then the user assigned managed identity will be assigned to a custom role with the below permissions at the scope of the route table.

```
"Microsoft.Network/routeTables/*",
"Microsoft.Network/networkInterfaces/effectiveRouteTable/action",
"Microsoft.Network/networkWatchers/nextHop/action"
```

- If the Connector is installed without public IP, then the user assigned managed identity will be assigned to a custom role with the below permission at the scope of private DNS zone.

```
"Microsoft.Network/privateDnsZones/*"
```

Permissions required for Azure login account

Azure login account is used to create the user assigned managed identity, required roles, and assigning the identity to the Connector VM.



The credentials of the login account is not stored anywhere in the SnapCenter Service and are not used to call APIs. The credentials are used only in the UI.

Steps

1. Create a custom role using the [SnapCenter_Deployment_Role1.json](#) file.

You should replace the <Subscription_ID> in the SnapCenter_Deployment_Role1.json file with your Azure subscription ID.

2. Assign the role to the login account at the scope of Connector's resource group.
3. Create a custom role using the [SnapCenter_Deployment_Role2.json](#) file.

You should replace the <Subscription_ID> in the SnapCenter_Deployment_Role2.json file with your Azure subscription ID.

4. Assign the role to the login account at the scope of Connector's VNet or higher.
5. If you have [configured firewall](#), create a custom role using the [SnapCenter_Deployment_Role3.json](#) file.

You should replace the <Subscription_ID> in the SnapCenter_Deployment_Role3.json file with your Azure subscription ID.

6. Assign the role to the login account at the scope of route table which is attached to the SnapCenter subnet.

Install the HDBSQL client

After enabling the SnapCenter Service, install the HDBSQL client to perform data protection operations on SAP HANA databases. The HDBSQL client is used to communicate with the SAP HANA systems.

Steps

1. Download HDB Client software from your SAP account.

It is an archive file with (.SAR) extension. Example: IMDB_CLIENT20_008_20-80002082.SAR



The HDB Client software version should be 2.4.202.1590784230 or later.

2. Download the latest SAPCAR utility from your SAP account. Example: SAPCAR_1010-70006178.EXE
3. On the Cloud Manager UI, click **Connector** to obtain the connector name.
4. Log into [Microsoft Azure portal](#).
5. Click **Virtual machines**.
6. Search for the Cloud Manager Connector and copy the public IP address assigned to the Connector.

If the Connector does not have public IP enabled, you should use a jump host.

7. Copy the SAPCAR utility and HDB Client archive (.SAR) file to the Connector machine.

To copy the file to the Connector path, you need the credentials, or the key provided while creating the Connector.

```
° scp <SAPCAR_utility> <username>@<IP_ADDRESS>:/home/<username>
° scp <HDB_Client_archive> <username>@<IP_ADDRESS>:/home/<username>
```

The file are copied to /home/<username>.

8. Log into the Connector VM with the ssh credentials or key.

9. Run the following commands in the Connector VM to install the HDBSQL client in the AKS.

- a.

```
sudo cp /home/<username>/<SAPCAR_utility>
/var/lib/docker/volumes/cloudmanager_snapcenter_volume/_data/
```
- b.

```
sudo cp /home/<username>/< HDB_Client_archive>
/var/lib/docker/volumes/cloudmanager_snapcenter_volume/_data/
```
- c.

```
sudo docker exec -it cloudmanager_snapcenter /bin/bash
/opt/netapp/hdbclient/hdbclient.sh --archivefile <HDB_Client_archive>
--archiveutil <SAPCAR_utility>
```

Find more information

[How to move files using SCP](#)

Protect SAP HANA systems

Add SAP HANA systems

Manually add the SAP HANA systems. Auto discovery of SAP HANA system is not supported.

While adding the SAP HANA systems, you should add the HDB user store keys. The HDB secure user store key is used to store the connection information of SAP HANA systems securely on the client and HDBSQL client uses the secure user store key to connect to SAP HANA systems.



You cannot add or modify SAP HANA systems if a node in the AKS cluster is down.

Steps

1. On the SnapCenter Service page, click **SAP HANA Systems > Add**.
2. On the System Details page, perform the following actions:
 - a. Select the system type.
 - b. Specify the SID of the SAP HANA system.
 - c. Specify the SAP HANA system name.
 - d. Click HDB Secure User Store Keys text box to add user store keys details.

Specify the key name, system details, username, and password.

- e. Click **Add**.



You should add user store keys for each host if you are adding a multi-host SAP HANA system.

3. Click **Continue**.
4. On the Storage Footprint page, perform the following:
 - a. Select the working environment and specify the NetApp account.
 - b. Select the required volumes.

- c. Click **Add Storage**.
5. Click **Continue**.
6. Review all the details and click **Add**.

You can also edit or remove the SAP HANA systems that were added to the SnapCenter Service. When you remove the SAP HANA system, all the associated backups and catalog entries will be deleted and no longer be protected.

Add non-data volumes

After adding the multitenant database container or single container type SAP HANA system, you can add the non-data volumes of the HANA system.

Steps

1. On the SnapCenter Service page, click SAP HANA Systems.

All the systems added to the SnapCenter Service are displayed.

2. Click **...** corresponding to the multitenant database container or single container type system to which you want to add the non-data volumes.
3. Click **Add Non-Data Volumes**.
4. Click **Add New Storage**.

Back up SAP HANA systems

You can either perform an on-demand backup or schedule backups of your SAP HANA system using system-defined or custom policies. SnapCenter Service supports both snapshot-based and file-based backups.

Create backup policies

Policies specify the backup type, backup frequency, schedules, retention type, retention count, and other characteristics of data protection operations. You can create policies using the Cloud Manager UI.

By default, two system-defined policies, one each for snapshot-based and file-based backup operations are available.

Steps

1. On the SnapCenter Service page, click **Policies > Add**.
2. On the Create Backup Policy page, perform the following actions:
 - a. Specify a policy name.
 - b. Select the type of backup you want to create using this policy.
 - c. Specify the backup name.

The suffix timestamp is added by default. You can select the other suffixes that should be included in the backup name and define the order in which the suffixes should appear.

- d. Specify the schedule frequency and the start and end time for the scheduled backups.

- e. Specify the number of snapshot copies to be retained or specify the days for which the snapshot copies should be retained.
3. Click **Add**.

You can view, edit, or delete policies by clicking **...** corresponding to the policy.

Create on-demand backups

Create on-demand backups of SAP HANA systems either by associating a policy or by not associating any policy.

Steps

1. On the SnapCenter Service page, click **SAP HANA Systems**.

All the systems added to the SnapCenter Service are displayed.

2. Click **...** corresponding to the system that you want to protect.

3. Click **On-Demand Backup**.

4. On the On-Demand Backup page, perform one of the following actions:

- If you want to associate the backup to a policy, select the policy and click **Create Backup**.
- If you do not want to associate the backup to a policy, perform the following actions:
 - a. In the Policy field, select **None**.
 - b. Select the backup type.

If you are backing up a non-data volume, you can only select **Snapshot Based** as the backup type.

- c. Specify the retention period.

- d. Click **Create Backup**.

Create scheduled backups

Create scheduled backups by associating policies with the SAP HANA system.

Steps

1. On the SnapCenter Service page, click **SAP HANA Systems**.

All the systems added to the SnapCenter Service are displayed.

2. Click **...** corresponding to the system that you want to protect.

3. Click **Protect**.

4. Select the policies that you want to use to protect the SAP HANA system.

5. Click **Protect**.

Find more information

[SAP HANA backup and recovery on Azure NetApp Files with SnapCenter Service](#)

Restore SAP HANA systems

In the event of data loss, restore the SAP HANA system from one of the backups of that system.

Only storage restore is supported. You should put the HANA system in recovery mode using SAP HANA Studio or SAP HANA Cockpit before restoring because recovery of HANA system is not supported.

Steps

1. On the SnapCenter Service page, click **SAP HANA Systems**.

The systems added to the SnapCenter Service are displayed.

2. Click **...** corresponding to the system that you want to restore.
3. Click **View Backups**.
4. In the Backups section, click **...** corresponding to the backup that you want to use to restore the system.
5. Click **Restore**.
6. Review the message and select **Yes, Restore** to confirm.

After restoring the database, if you do a point-in-time recovery of the SAP HANA system using HANA Studio then the data backup catalog entries which were deleted by SnapCenter Service as per the retention setting, might be restored.



If the deleted data backup catalog entries are restored because of the recovery operation, SnapCenter Service will not be able to detect and delete them. This could result in SnapCenter Service not cleaning the log catalog properly.

You can verify the backup entries in SnapCenter Service to find out which all data backup catalog entries are newly restored and manually delete those entries.

Find more information

[SAP HANA backup and recovery on Azure NetApp Files with SnapCenter Service](#)

Manage operations

You can monitor the status of the jobs executed, receive email notifications, and view dashboard.

Monitor jobs

Click **Job Monitor** on the SnapCenter Service page to view the status of the jobs. The Job Monitor page displays an overall summary and lists all the jobs.

You can then click **...** corresponding to a particular job to view the details.

The screenshot shows the SnapCenter Service interface with the 'Job Monitor' tab selected. At the top, a summary bar displays job counts: 192 Failed (red), 7 Warning (yellow), 0 Running (blue), 0 Queued (grey), and 323 Successful (green). Below this is a table titled '522 Jobs' showing a list of recent operations. The columns include ID, Status, Description, Start Time, and End Time. Most jobs are marked as 'Successful' with green checkmarks.

ID	Status	Description	Start Time	End Time
542	Successful	Backup of NDV hana resource with policy NDVPolicyTest and sched...	05/04/2021, 06:56:00 AM	05/04/2021, 06:56:06 AM
541	Successful	Initialize SnapshotBased backup of policy NDVPolicyTest for Hourly...	05/04/2021, 06:56:00 AM	05/04/2021, 06:56:00 AM
540	Successful	Registration of HANA System with SID 'A42', Systemname 'As' and ...	05/04/2021, 06:01:30 AM	05/04/2021, 06:01:48 AM
539	Failed	Backup of A42 hrp System hana resource with policy SAP Hana Sna...	05/04/2021, 04:00:00 AM	05/04/2021, 04:00:32 AM
538	Successful	Initialize SnapshotBased backup of policy SAP Hana Snapshot Base...	05/04/2021, 04:00:00 AM	05/04/2021, 04:00:00 AM
537	Failed	Backup of A42System hana resource with policy AutoPolicy_16197...	05/04/2021, 03:34:00 AM	05/04/2021, 03:34:02 AM
536	Failed	Backup of Retorenew1 hana resource with policy AutoPolicy_16197...	05/04/2021, 03:34:00 AM	05/04/2021, 03:34:32 AM
535	Successful	Initialize SnapshotBased backup of policy AutoPolicy_1619726683...	05/04/2021, 03:34:00 AM	05/04/2021, 03:34:01 AM

Email notification

The email notifications are sent by default for a failed on-demand backup, scheduled backup, and restore operations. Only a Cloud Manager user with “Account Admin” role will receive the email.

View dashboard

Click **Overview** on the SnapCenter Service page to view the protection summary, configuration details, and job status.

The screenshot shows the SnapCenter Service interface with the 'Overview' tab selected. On the left, there's a 'Protection Summary' section with three categories: PROTECTED (1, 31 Backups), NO RECENT BACKUPS (3), and NEEDS ATTENTION (3). Below this is a 'Configurations' section showing SYSTEMS (7) and VOLUMES (18, with 10 Data, 4 Non-Data, and 4 Global Non-Data). On the right, there's a 'Jobs' section showing a summary of recent operations: 63 Failed, 2 Warning, 0 Running, 0 Queued, and 80 Successful. Below this is a list of recent jobs with their descriptions and timestamps.

Protection Summary		Jobs	
PROTECTED	1 31 Backups	Failed	63
NO RECENT BACKUPS	3	Warning	2
NEEDS ATTENTION	3	Running	0
		Queued	0
		Successful	80

Job Details	Timestamp
[542] Backup of NDV hana resource with policy NDVPolicyTest and schedule type Hourly	35 mins ago
[541] Initialize SnapshotBased backup of policy NDVPolicyTest for Hourly schedule	35 mins ago
[540] Registration of HANA System with SID 'A42', Systemname 'As' and of type 'MDC'	1.5 hrs ago
[539] Backup of A42 hrp System hana resource with policy SAP Hana Snapshot Based Backup and schedule type Hourly	3.5 hrs ago
[538] Initialize SnapshotBased backup of policy SAP Hana Snapshot Based Backup for Hourly schedule	3.5 hrs ago

Troubleshoot issues

Issue: Redis Pods get stuck in a CrashLoopBackOff state

Description

In a high availability configuration, the AKS cluster does not come back to working state if all the nodes of the cluster are down. When you restart all the nodes, you might find all the Redis Pods to be in CrashLoopBackOff state.

Solution

You should run the following commands to restore the system.

1. Log into the Connector.

2. Delete all the Redis Pods.

```
° docker exec -it cloudmanager_snapcenter-sh  
° kubectl scale --replicas=0 sts sc-dependencies-redis-node -n snapcenter
```

3. Verify if all the Redis Pods are deleted.

```
kubectl get pods -n snapcenter
```

4. If the Redis Pods are not deleted, run the following commands:

```
° kubectl delete pod sc-dependencies-redis-node-0 -n snapcenter  
° kubectl delete pod sc-dependencies-redis-node-1 -n snapcenter  
° kubectl delete pod sc-dependencies-redis-node-2 -n snapcenter
```

5. After all the Redis Pods are deleted, run:

```
kubectl scale --replicas=3 sts sc-dependencies-redis-node -n snapcenter
```

6. Verify if all the deleted pods are up and running.

```
Kubectl get pods -n snapcenter
```

Issue: Jobs are failing after restarting the cluster nodes

Description

In a high availability configuration, the AKS cluster does not come back to working state if all the nodes of the cluster are down. When you restart all the nodes, you might see jobs are failing with granular tasks either greyed out or timed out.

Solution

You should run the following commands:

1. Log into the Connector.

2. Save the RabbitMQ statefulset (sts) deployment.

```
° docker exec -it cloudmanager_snapcenter-sh  
° kubectl get sts rabbitmq -o yaml -n snapcenter > rabbitmq_sts.yaml
```

3. Identify the persistent volumes (PVs) attached to RabbitMQ pods.

```
kubectl get pv | grep rabbitmq
```

4. Delete the persistent volume claims (PVCs) attached to RabbitMQ pods.

```
kubectl get pvc -n snapcenter| grep rabbitmq | awk {'print $1'} | xargs  
kubectl delete pvc -n snapcenter
```

5. Delete each of the PVs that you identified earlier in step 3.

```
kubectl delete pv 'pvname'
```

6. Create a RabbitMQ sts.

```
kubectl create -f rabbitmq_sts.yaml -n snapcenter
```

Issue: Backup operation fails during tenant database creation

Description

While creating a tenant database if an on-demand or a scheduled backup is initiated, the backup operation fails.

Solution

Creating a tenant database is a maintenance operation on the SAP HANA system.

You should put the SAP HANA system in the maintenance mode using SnapCenter Service before creating the tenant database. After putting the SAP HANA system in maintenance mode no operations can be initiated.

After creating the tenant database, you should bring back the SAP HANA system to production mode.

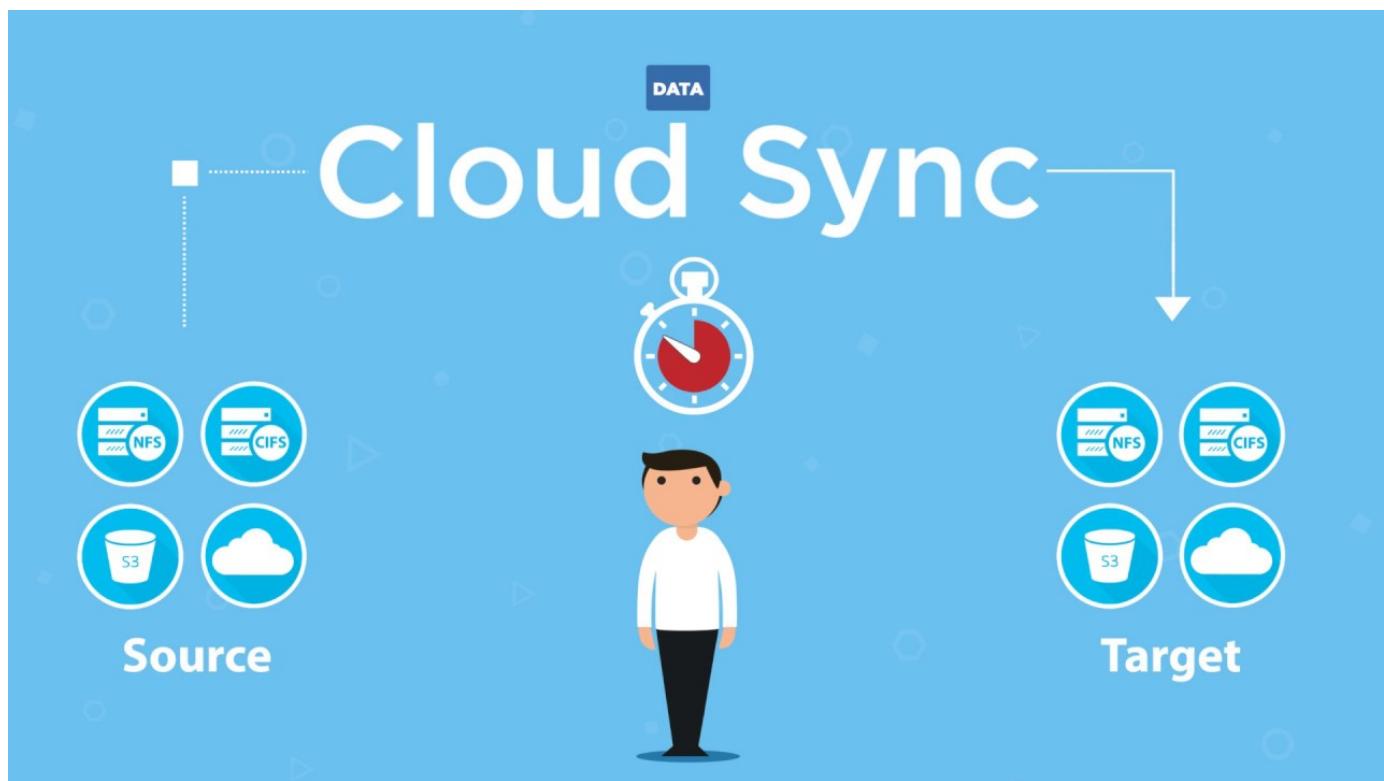
Copy and synchronize data

Cloud Sync overview

The NetApp Cloud Sync service offers a simple, secure, and automated way to migrate your data to any target, in the cloud or on your premises. Whether it's a file-based NAS dataset (NFS or SMB), Amazon Simple Storage Service (S3) object format, a NetApp StorageGRID® appliance, or any other cloud provider object store, Cloud Sync can convert and move it for you.

Features

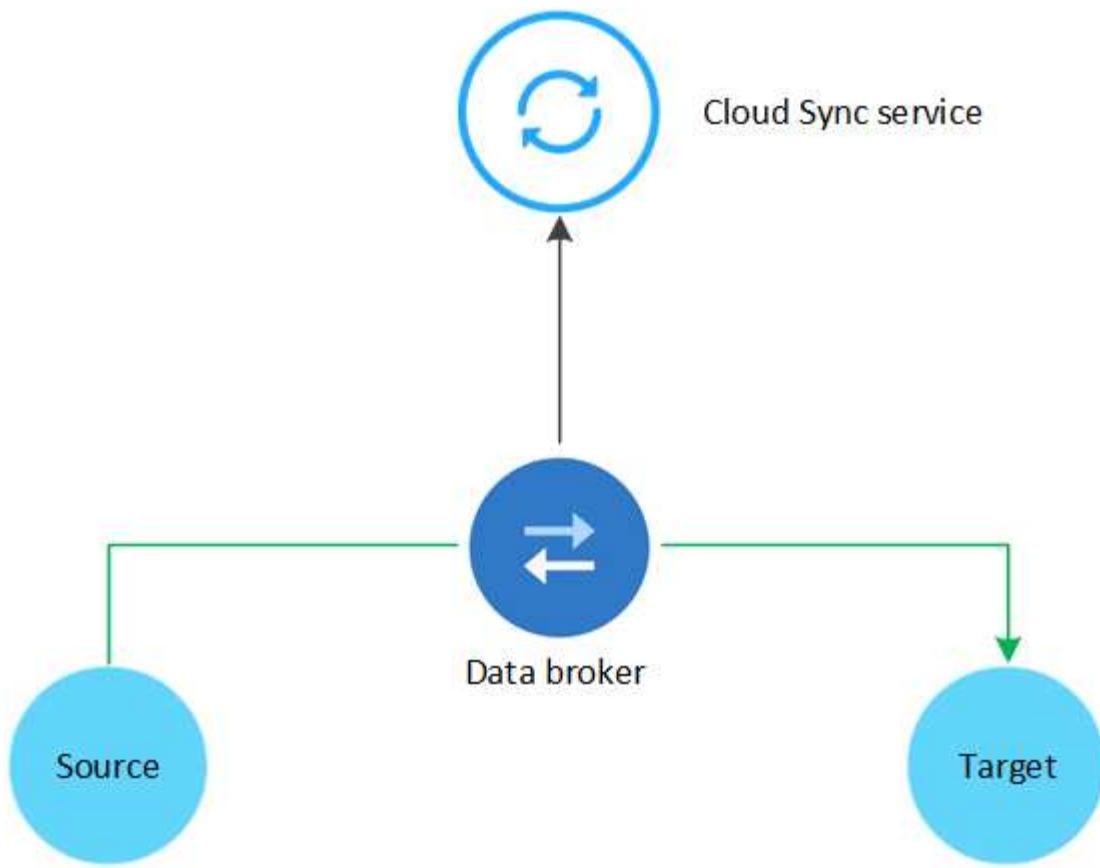
Watch the following video for an overview of Cloud Sync:



How Cloud Sync works

Cloud Sync is a software-as-a-service (SaaS) platform that consists of a data broker group, a cloud-based interface available through Cloud Manager, and a source and target.

The following image shows the relationship between Cloud Sync components:



The NetApp data broker software syncs data from a source to a target (this is called a *sync relationship*). You can run the data broker in AWS, Azure, Google Cloud Platform, or on your premises. A data broker group, which consists of one or more data brokers, needs an outbound internet connection over port 443 so it can communicate with the Cloud Sync service and contact a few other services and repositories. [View the list of endpoints.](#)

After the initial copy, the service syncs any changed data based on the schedule that you set.

Supported storage types

Cloud Sync supports the following storage types:

- Any NFS server
- Any SMB server
- Amazon EFS
- Amazon FSx for ONTAP
- Amazon S3
- Azure Blob
- Azure NetApp Files
- Box (available as a preview)
- Cloud Volumes Service
- Cloud Volumes ONTAP
- Google Cloud Storage

- IBM Cloud Object Storage
- On-premises ONTAP cluster
- ONTAP S3 Storage
- SFTP (using API only)
- StorageGRID

[Review the supported sync relationships.](#)

Cost

There are two types of costs associated with using Cloud Sync: resource charges and service charges.

Resource charges

Resource charges are related to the compute and storage costs for running one or more data brokers in the cloud.

Service charges

There are two ways to pay for sync relationships after your 14-day free trial ends. The first option is to subscribe from AWS or Azure, which enables you to pay hourly or annually. The second option is to purchase licenses directly from NetApp. Read the following sections for more details.

Marketplace subscription

Subscribing to the Cloud Sync service from AWS or Azure enables you to pay at an hourly rate, or to pay annually. [You can subscribe through either AWS or Azure](#), depending on where you want to be billed.

Hourly subscription

With an hourly pay-as-you-go subscription, you're charged hourly based on the number of sync relationships that you create.

- [View pricing in Azure](#)
- [View pay-as-you-go pricing in AWS](#)

Annual subscription

An annual subscription provides a license for 20 sync relationships that you pay for up front. If you go above 20 sync relationships and you've subscribed through AWS, you pay for the additional relationships by the hour.

[View annual pricing in AWS](#)

Licenses from NetApp

Another way to pay for sync relationships up front is by purchasing licenses directly from NetApp. Each license enables you to create up to 20 sync relationships.

You can use these licenses with an AWS or Azure subscription. For example, if you have 25 sync relationships, you can pay for the first 20 sync relationships using a license and then pay-as-you-go from AWS or Azure with the remaining 5 sync relationships.

[Learn how to purchase licenses and add them to Cloud Sync.](#)

License terms

Customers who purchase a Bring Your Own License (BYOL) to the Cloud Sync service should be aware of limitations associated with the license entitlement.

- Customers are entitled to leverage the BYOL license for a term not to exceed one year from the date of delivery.
- Customers are entitled to leverage the BYOL license to establish and not to exceed a total of 20 individual connections between a source and a target (each a “sync relationship”).
- A customer’s entitlement expires at the conclusion of the one-year license term, irrespective as to whether Customer has reached the 20 sync relationship limitation.
- In the event the Customer chooses to renew its license, unused sync relationships associated from the previous license grant DO NOT roll over to the license renewal.

Data privacy

NetApp doesn’t have access to any credentials that you provide while using the Cloud Sync service. The credentials are stored directly on the data broker machine, which resides in your network.

Depending on the configuration that you choose, Cloud Sync might prompt you for credentials when you create a new relationship. For example, when setting up a relationship that includes an SMB server, or when deploying the data broker in AWS.

These credentials are always saved directly to the data broker itself. The data broker resides on a machine in your network, whether it’s on premises or in your cloud account. The credentials are never made available to NetApp.

The credentials are locally encrypted on the data broker machine using HashiCorp Vault.

Limitations

- Cloud Sync is not supported in China.
- In addition to China, the Cloud Sync data broker is not supported in the following regions:
 - Azure US Gov
 - Azure US DoD

Get started

Quick start for Cloud Sync

Getting started with the Cloud Sync service includes a few steps.

1

Prepare your source and target

Verify that your source and target are supported and set up. The most important requirement is to verify connectivity between the data broker group and the source and target locations. [Learn more](#).

2

Prepare a location for the NetApp data broker

The NetApp data broker software syncs data from a source to a target (this is called a *sync relationship*). You can run the data broker in AWS, Azure, Google Cloud Platform, or on your premises. A data broker group, which consists of one or more data brokers, needs an outbound internet connection over port 443 so it can communicate with the Cloud Sync service and contact a few other services and repositories. [View the list of endpoints](#).

Cloud Sync guides you through the installation process when you create a sync relationship, at which point you can deploy a data broker in the cloud or download an install script for your own Linux host.

- [Review AWS installation](#)
- [Review Azure installation](#)
- [Review GCP installation](#)
- [Review Linux host installation](#)

3

Create your first sync relationship

Log in to [Cloud Manager](#), click **Sync**, and then drag and drop your selections for the source and target. Follow the prompts to complete the setup. [Learn more](#).

4

Pay for your sync relationships after your free trial ends

Subscribe from AWS or Azure to pay-as-you-go or to pay annually. Or purchase licenses directly from NetApp. Just go to the License Settings page in Cloud Sync to set it up. [Learn more](#).

Preparing the source and target

Prepare to sync data by verifying that your source and target are supported and setup.

Supported sync relationships

Cloud Sync enables you to sync data from a source to a target (this is called a *sync relationship*). You should understand the supported relationships before you get started.

Source location	Supported target locations
Amazon EFS	<ul style="list-style-type: none"> • Amazon EFS • Amazon FSx for ONTAP • Amazon S3 • Azure Blob • Azure NetApp Files • Cloud Volumes ONTAP • Cloud Volumes Service • Google Cloud Storage • IBM Cloud Object Storage • NFS server • On-premises ONTAP cluster • SMB server • StorageGRID
Amazon FSx for ONTAP	<ul style="list-style-type: none"> • Amazon EFS • Amazon FSx for ONTAP • Amazon S3 • Azure Blob • Azure NetApp Files • Cloud Volumes ONTAP • Cloud Volumes Service • Google Cloud Storage • IBM Cloud Object Storage • NFS server • On-premises ONTAP cluster • SMB Server • StorageGRID

Source location	Supported target locations
Amazon S3	<ul style="list-style-type: none"> • Amazon EFS • Amazon FSx for ONTAP • Amazon S3 • Azure Blob • Azure NetApp Files • Box ^{2,3} • Cloud Volumes ONTAP • Cloud Volumes Service • Google Cloud Storage • IBM Cloud Object Storage • NFS server • On-premises ONTAP cluster • SMB Server • StorageGRID
Azure Blob	<ul style="list-style-type: none"> • Amazon EFS • Amazon FSx for ONTAP • Amazon S3 • Azure Blob • Azure NetApp Files • Cloud Volumes ONTAP • Cloud Volumes Service • Google Cloud Storage • IBM Cloud Object Storage • NFS server • On-premises ONTAP cluster • SMB Server • StorageGRID

Source location	Supported target locations
Azure NetApp Files	<ul style="list-style-type: none"> • Amazon EFS • Amazon FSx for ONTAP • Amazon S3 • Azure Blob • Azure NetApp Files • Cloud Volumes ONTAP • Cloud Volumes Service • Google Cloud Storage • IBM Cloud Object Storage • NFS server • On-premises ONTAP cluster • SMB server • StorageGRID
Box ²	<ul style="list-style-type: none"> • Amazon S3 • IBM Cloud Object Storage • NFS server • SMB Server • StorageGRID
Cloud Volumes ONTAP	<ul style="list-style-type: none"> • Amazon EFS • Amazon FSx for ONTAP • Amazon S3 • Azure Blob • Azure NetApp Files • Cloud Volumes ONTAP • Cloud Volumes Service • Google Cloud Storage • IBM Cloud Object Storage • NFS server • On-premises ONTAP cluster • SMB Server • StorageGRID

Source location	Supported target locations
Cloud Volumes Service	<ul style="list-style-type: none"> • Amazon EFS • Amazon FSx for ONTAP • Amazon S3 • Azure Blob • Azure NetApp Files • Cloud Volumes ONTAP • Cloud Volumes Service • Google Cloud Storage • IBM Cloud Object Storage • NFS server • On-premises ONTAP cluster • SMB Server • StorageGRID
Google Cloud Storage	<ul style="list-style-type: none"> • Amazon EFS • Amazon FSx for ONTAP • Amazon S3 • Azure Blob • Azure NetApp Files • Cloud Volumes ONTAP • Cloud Volumes Service • Google Cloud Storage • IBM Cloud Object Storage • NFS server • On-premises ONTAP cluster • ONTAP S3 Storage • SMB Server • StorageGRID

Source location	Supported target locations
IBM Cloud Object Storage	<ul style="list-style-type: none"> • Amazon EFS • Amazon FSx for ONTAP • Amazon S3 • Azure Blob • Azure NetApp Files • Box ^{2,3} • Cloud Volumes ONTAP • Cloud Volumes Service • Google Cloud Storage • IBM Cloud Object Storage • NFS server • On-premises ONTAP cluster • SMB Server • StorageGRID
NFS server	<ul style="list-style-type: none"> • Amazon EFS • Amazon FSx for ONTAP • Amazon S3 • Azure Blob • Azure NetApp Files • Cloud Volumes ONTAP • Cloud Volumes Service • Google Cloud Storage • IBM Cloud Object Storage • NFS server • On-premises ONTAP cluster • SMB Server • StorageGRID

Source location	Supported target locations
On-prem ONTAP cluster	<ul style="list-style-type: none"> • Amazon EFS • Amazon FSx for ONTAP • Amazon S3 • Azure Blob • Azure NetApp Files • Cloud Volumes ONTAP • Cloud Volumes Service • Google Cloud Storage • IBM Cloud Object Storage • NFS server • On-premises ONTAP cluster • SMB Server • StorageGRID
ONTAP S3 Storage	<ul style="list-style-type: none"> • Google Cloud Storage • SMB server • StorageGRID • ONTAP S3 Storage
SFTP ¹	S3
SMB server	<ul style="list-style-type: none"> • Amazon EFS • Amazon FSx for ONTAP • Amazon S3 • Azure Blob • Azure NetApp Files • Cloud Volumes ONTAP • Cloud Volumes Service • Google Cloud Storage • IBM Cloud Object Storage • NFS server • On-premises ONTAP cluster • ONTAP S3 Storage • SMB Server • StorageGRID

Source location	Supported target locations
StorageGRID	<ul style="list-style-type: none"> • Amazon EFS • Amazon FSx for ONTAP • Amazon S3 • Azure Blob • Azure NetApp Files • Box ^{2,3} • Cloud Volumes ONTAP • Cloud Volumes Service • Google Cloud Storage • IBM Cloud Object Storage • NFS server • On-premises ONTAP cluster • ONTAP S3 Storage • SMB Server • StorageGRID

Notes:

1. Sync relationships with this source/target are supported by using the Cloud Sync API only.
2. Box support is available as a preview.
3. You can choose a specific Azure Blob storage tier when a Blob container is the target:
 - Hot storage
 - Cool storage
4. You can choose a specific S3 storage class when Amazon S3 is the target:
 - Standard (this is the default class)
 - Intelligent-Tiering
 - Standard-Infrequent Access
 - One Zone-Infrequent Access
 - Glacier
 - Glacier Deep Archive
5. You can choose a specific storage class when a Google Cloud Storage bucket is the target:
 - Standard
 - Nearline
 - Coldline
 - Archive

Source and target requirements

Verify that your source and targets meet the following requirements.

Networking

- The source and target must have a network connection to the data broker group.

For example, if an NFS server is in your data center and a data broker is in AWS, then you need a network connection (VPN or Direct Connect) from your network to the VPC.

- NetApp recommends configuring the source, the target, and data brokers to use a Network Time Protocol (NTP) service. The time difference between the three components should not exceed 5 minutes.

Target directory

When you create a sync relationship, Cloud Sync enables you to select an existing target directory and then optionally create a new folder inside that directory. So be sure that your preferred target directory already exists.

Permissions to read directories

In order to show every directory or folder in a source or target, Cloud Sync needs read permissions on the directory or folder.

NFS

Permissions must be defined on the source/target with uid/gid on files and directories.

Object storage

- For AWS and Google Cloud, a data broker must have list object permissions (these permissions are provided by default if you follow the data broker installation steps).
- For Azure, StorageGRID, and IBM, the credentials that you enter when setting up a sync relationship must have list object permissions.

SMB

The SMB credentials that you enter when setting up a sync relationship must have list folder permissions.



The data broker ignores the following directories by default: .snapshot, ~snapshot, .copy-offload

Amazon S3 bucket requirements

Make sure that your Amazon S3 bucket meets the following requirements.

Supported data broker locations for Amazon S3

Sync relationships that include S3 storage require a data broker deployed in AWS or on your premises. In either case, Cloud Sync prompts you to associate the data broker with an AWS account during installation.

- [Learn how to deploy the AWS data broker](#)
- [Learn how to install the data broker on a Linux host](#)

Supported AWS regions

All regions are supported except for the China regions.

Permissions required for S3 buckets in other AWS accounts

When setting up a sync relationship, you can specify an S3 bucket that resides in an AWS account that isn't associated with a data broker.

The permissions included in this JSON file must be applied to that S3 bucket so a data broker can access it. These permissions enable the data broker to copy data to and from the bucket and to list the objects in the bucket.

Note the following about the permissions included in the JSON file:

1. <BucketName> is the name of the bucket that resides in the AWS account that isn't associated with a data broker.
2. <RoleARN> should be replaced with one of the following:
 - If a data broker was manually installed on a Linux host, *RoleARN* should be the ARN of the AWS user for which you provided AWS credentials when deploying a data broker.
 - If a data broker was deployed in AWS using the CloudFormation template, *RoleARN* should be the ARN of the IAM role created by the template.

You can find the Role ARN by going to the EC2 console, selecting the data broker instance, and clicking the IAM role from the Description tab. You should then see the Summary page in the IAM console that contains the Role ARN.

Summary

[Delete role](#)

Role ARN	arn:aws:iam::[REDACTED]:role/tanyaBroker0304-DataBrokerIamRole-1VMHWXMW3AQ05	
Role description	Edit	

Azure Blob storage requirements

Make sure that your Azure Blob storage meets the following requirements.

Supported data broker locations for Azure Blob

A data broker can reside in any location when a sync relationship includes Azure Blob storage.

Supported Azure regions

All regions are supported except for the China, US Gov, and US DoD regions.

Connection string required for relationships that include Azure Blob and NFS/SMB

When creating a sync relationship between an Azure Blob container and an NFS or SMB server, you need to provide Cloud Sync with the storage account connection string:

The screenshot shows the 'Access keys' page for an Azure storage account. The left sidebar includes links for Overview, Activity log, Access control (IAM), Tags, Diagnose and solve problems, and Storage Explorer (preview). The 'Settings' section has tabs for Access keys (which is selected and highlighted with a red box), CORS, Configuration, and Encryption. The main content area displays the storage account name 'a63cde60b553020'. It shows two access keys: 'key1' with the key value 'vScjFdVZqIPyO/'. Below that is a connection string labeled 'DefaultEndpoints'. A red box highlights the 'DefaultEndpoints' connection string.

If you want to sync data between two Azure Blob containers, then the connection string must include a [shared access signature \(SAS\)](#). You also have the option to use a SAS when syncing between a Blob container and an NFS or SMB server.

The SAS must allow access to the Blob service and all resource types (Service, Container, and Object). The SAS must also include the following permissions:

- For the source Blob container: Read and List
- For the target Blob container: Read, Write, List, Add, and Create

a63cde60b553020 - Shared access signature

Storage account

Search (Ctrl+ /)

Overview

Activity log

Access control (IAM)

Tags

Diagnose and solve problems

Storage Explorer (preview)

Settings

Access keys

CORS

Configuration

Encryption

Shared access signature

Firewalls and virtual networks

Advanced Threat Protection (pr...)

Properties

Locks

Allowed services

Blob File Queue Table

Allowed resource types

Service Container Object

Allowed permissions

Read Write Delete List Add Create Update Process

Start and expiry date/time

Start: 2018-10-23 10:07:32 AM

End: 2019-10-23 6:07:32 PM
(UTC-04:00) --- Current Time Zone ---

Allowed IP addresses

for example, 168.1.5.65 or 168.1.5.65-168.1.5.70

Allowed protocols

HTTPS only HTTPS and HTTP

Signing key

key1

Generate SAS and connection string

Azure NetApp Files requirement

Use the Premium or Ultra service level when you sync data to or from Azure NetApp Files. You might experience failures and performance issues if the disk service level is Standard.



Consult a solutions architect if you need help determining the right service level. The volume size and volume tier determines the throughput that you can get.

[Learn more about Azure NetApp Files service levels and throughput.](#)

Box requirements

- To create a sync relationship that includes Box, you'll need to provide the following credentials:
 - Client ID
 - Client secret
 - Private key
 - Public key ID
 - Passphrase
 - Enterprise ID

- If you create a sync relationship from Amazon S3 to Box, you must use a data broker group that has a unified configuration where the following settings are set to 1:
 - Scanner Concurrency
 - Scanner Processes Limit
 - Transferrer Concurrency
 - Transferrer Processes Limit

[Learn how to define a unified configuration for a data broker group.](#)

Google Cloud Storage bucket requirements

Make sure that your Google Cloud Storage bucket meets the following requirements.

Supported data broker locations for Google Cloud Storage

Sync relationships that include Google Cloud Storage require a data broker deployed in Google Cloud or on your premises. Cloud Sync guides you through the data broker installation process when you create a sync relationship.

- [Learn how to deploy the Google Cloud data broker](#)
- [Learn how to install the data broker on a Linux host](#)

Supported GCP regions

All regions are supported.

Permissions required for buckets in other Google Cloud projects

When setting up a sync relationship, you can choose from Google Cloud buckets in different projects, if you provide the required permissions to the data broker's service account. [Learn how to set up the service account.](#)

ONTAP requirements

If the sync relationship includes Cloud Volumes ONTAP or an on-prem ONTAP cluster and you selected NFSv4 or later, then you'll need to enable NFSv4 ACLs on the ONTAP system. This is required to copy the ACLs.

Permissions for a SnapMirror destination

If the source for a sync relationship is a SnapMirror destination (which is read-only), "read/list" permissions are sufficient to sync data from the source to a target.

NFS server requirements

- The NFS server can be a NetApp system or a non-NetApp system.
- The file server must allow a data broker host to access the exports.
- NFS versions 3, 4.0, 4.1, and 4.2 are supported.

The desired version must be enabled on the server.

- If you want to sync NFS data from an ONTAP system, ensure that access to the NFS export list for an SVM

is enabled (`vserver nfs modify -vserver svm_name -showmount enabled`).



The default setting for showmount is *enabled* starting with ONTAP 9.2.

ONTAP S3 Storage requirements

When you set up a sync relationship that includes [ONTAP S3 Storage](#), you'll need to provide the following:

- The IP address of the LIF that's connected to ONTAP S3
- The access key and secret key that ONTAP is configured to use

SMB server requirements

- The SMB server can be a NetApp system or a non-NetApp system.
- You need to provide Cloud Sync with credentials that have permissions on the SMB server.
 - For a source SMB server, the following permissions are required: list and read.

Members of the Backup Operators group are supported with a source SMB server.

- For a target SMB server, the following permissions are required: list, read, and write.
- The file server must allow a data broker host to access the exports.
- SMB versions 1.0, 2.0, 2.1, 3.0 and 3.11 are supported.
- Grant the "Administrators" group with "Full Control" permissions to the source and target folders.

If you don't grant this permission, then the data broker might not have sufficient permissions to get the ACLs on a file or directory. If this occurs, you'll receive the following error: "getxattr error 95"

SMB limitation for hidden directories and files

An SMB limitation affects hidden directories and files when syncing data between SMB servers. If any of the directories or files on the source SMB server were hidden through Windows, the hidden attribute isn't copied to the target SMB server.

SMB sync behavior due to case-insensitivity limitation

The SMB protocol is case-insensitive, which means uppercase and lowercase letters are treated as being the same. This behavior can result in overwritten files and directory copy errors, if a sync relationship includes an SMB server and data already exists on the target.

For example, let's say that there's a file named "a" on the source and a file named "A" on the target. When Cloud Sync copies the file named "a" to the target, file "A" is overwritten by file "a" from the source.

In the case of directories, let's say that there's a directory named "b" on the source and a directory named "B" on the target. When Cloud Sync tries to copy the directory named "b" to the target, Cloud Sync receives an error that says the directory already exists. As a result, Cloud Sync always fails to copy the directory named "b."

The best way to avoid this limitation is to ensure that you sync data to an empty directory.

Networking overview for Cloud Sync

Networking for Cloud Sync includes connectivity between the data broker group and the source and target locations, and an outbound internet connection from data brokers over port 443.

Data broker location

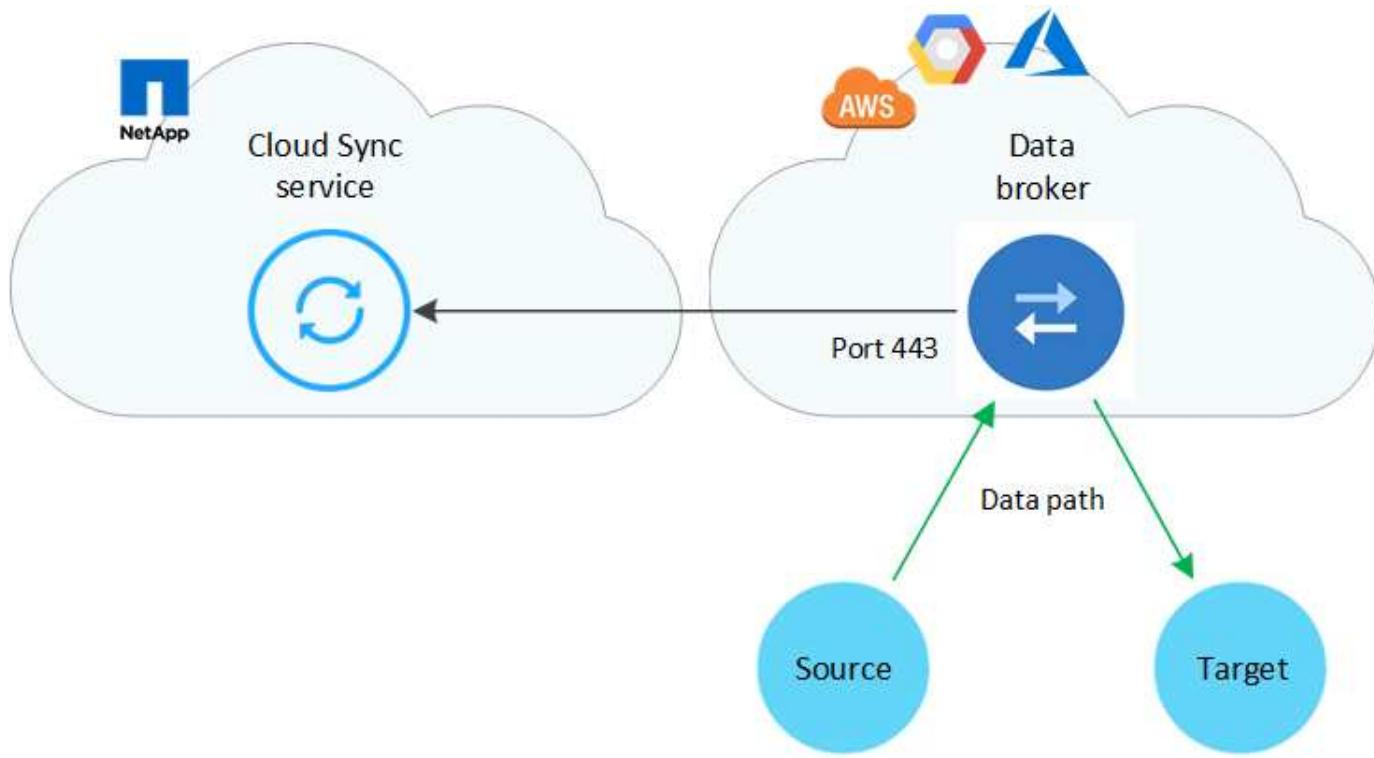
A data broker group consists of one or more data brokers installed in the cloud or on your premises.

Data broker in the cloud

The following image shows a data broker running in the cloud, in either AWS, GCP, or Azure. The source and target can be in any location, as long as there's a connection to the data broker. For example, you might have a VPN connection from your data center to your cloud provider.

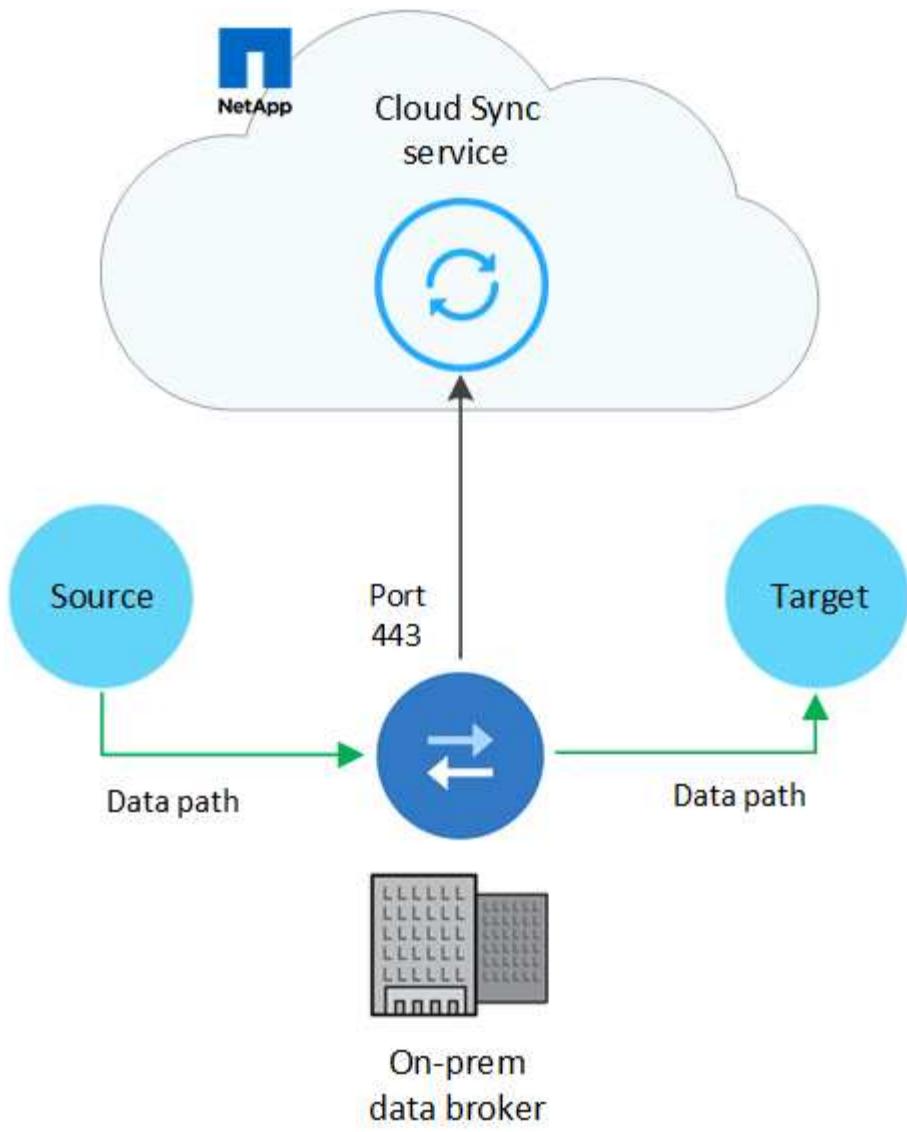


When Cloud Sync deploys the data broker in AWS, Azure, or GCP, it creates a security group that enables the required outbound communication.



Data broker on your premises

The following image shows the data broker running on-prem, in a data center. Again, the source and target can be in any location, as long as there's a connection to the data broker.



Networking requirements

- The source and target must have a network connection to the data broker group.

For example, if an NFS server is in your data center and a data broker is in AWS, then you need a network connection (VPN or Direct Connect) from your network to the VPC.

- A data broker needs an outbound internet connection so it can poll the Cloud Sync service for tasks over port 443.
- NetApp recommends configuring the source, target, and data brokers to use a Network Time Protocol (NTP) service. The time difference between the three components should not exceed 5 minutes.

Networking endpoints

The NetApp data broker requires outbound internet access over port 443 to communicate with the Cloud Sync service and to contact a few other services and repositories. Your local web browser also requires access to endpoints for certain actions. If you need to limit outbound connectivity, refer to the following list of endpoints when configuring your firewall for outbound traffic.

Data broker endpoints

A data broker contacts the following endpoints:

Endpoints	Purpose
https://olcentgbl.trafficmanager.net	To contact a repository for updating CentOS packages for the data broker host. This endpoint is contacted only if you manually install the data broker on a CentOS host.
https://rpm.nodesource.com https://registry.npmjs.org https://nodejs.org:	To contact repositories for updating Node.js, npm, and other 3rd party packages used in development.
https://tgz.pm2.io	To access a repository for updating PM2, which is a 3rd party package used to monitor Cloud Sync.
https://sq.s.us-east-1.amazonaws.com https://kinesis.us-east-1.amazonaws.com	To contact the AWS services that Cloud Sync uses for operations (queuing files, registering actions, and delivering updates to the data broker).
https://s3.region.amazonaws.com For example: s3.us-east-2.amazonaws.com:443 See AWS documentation for a list of S3 endpoints	To contact Amazon S3 when a sync relationship includes an S3 bucket.
https://s3.us-east-1.amazonaws.com	When you download data broker logs from Cloud Sync, the data broker zips its logs directory and uploads the logs to a predefined S3 bucket in the us-east-1 region.
https://cf.cloudsync.netapp.com https://repo.cloudsync.netapp.com	To contact the Cloud Sync service.
https://support.netapp.com	To contact NetApp support when using a BYOL license for sync relationships.
https://fedoraproject.org	To install 7z on the data broker virtual machine during installation and updates. 7z is needed to send AutoSupport messages to NetApp technical support.
https://sts.amazonaws.com	To verify AWS credentials when the data broker is deployed in AWS or when it's deployed on your premises and AWS credentials are provided. The data broker contacts this endpoint during deployment, when it's updated, and when it's restarted.
https://cloudmanager.cloud.netapp.com https://netapp-cloud-account.auth0.com	To contact Cloud Data Sense when you use Data Sense to select the source files for a new sync relationship.

Web browser endpoints

Your web browser needs access to the following endpoint to download logs for troubleshooting purposes:

logs.cloudsync.netapp.com:443

How to install a data broker

Creating a new data broker in AWS

When you create a new data broker group, choose Amazon Web Services to deploy the data broker software on a new EC2 instance in a VPC. Cloud Sync guides you through the installation process, but the requirements and steps are repeated on this page to help you prepare for installation.

You also have the option to install the data broker on an existing Linux host in the cloud or on your premises. [Learn more.](#)

Supported AWS regions

All regions are supported except for the China regions.

Networking requirements

- The data broker needs an outbound internet connection so it can poll the Cloud Sync service for tasks over port 443.

When Cloud Sync deploys the data broker in AWS, it creates a security group that enables the required outbound communication. Note that you can configure the data broker to use a proxy server during the installation process.

If you need to limit outbound connectivity, see [the list of endpoints that the data broker contacts](#).

- NetApp recommends configuring the source, target, and data broker to use a Network Time Protocol (NTP) service. The time difference between the three components should not exceed 5 minutes.

Permissions required to deploy the data broker in AWS

The AWS user account that you use to deploy the data broker must have the permissions included in [this NetApp-provided policy](#).

Requirements to use your own IAM role with the AWS data broker

When Cloud Sync deploys the data broker, it creates an IAM role for the data broker instance. You can deploy the data broker using your own IAM role, if you prefer. You might use this option if your organization has strict security policies.

The IAM role must meet the following requirements:

- The EC2 service must be allowed to assume the IAM role as a trusted entity.
- [The permissions defined in this JSON file](#) must be attached to the IAM role so the data broker can function properly.

Follow the steps below to specify the IAM role when deploying the data broker.

Creating the data broker

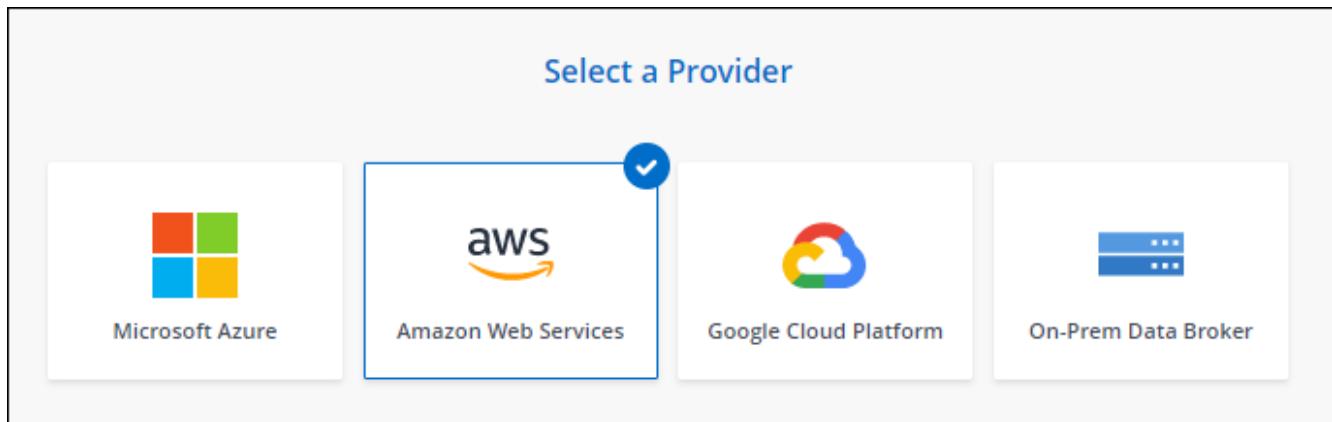
There are a few ways to create a new data broker. These steps describe how to install a data broker in AWS when creating a sync relationship.

Steps

1. Click **Create New Sync**.
2. On the **Define Sync Relationship** page, choose a source and target and click **Continue**.

Complete the steps until you reach the **Data Broker Group** page.

3. On the **Data Broker Group** page, click **Create Data Broker** and then select **Amazon Web Services**.



4. Enter a name for the data broker and click **Continue**.
5. Enter an AWS access key so Cloud Sync can create the data broker in AWS on your behalf.

The keys aren't saved or used for any other purposes.

If you'd rather not provide access keys, click the link at the bottom of the page to use a CloudFormation template instead. When you use this option, you don't need to provide credentials because you are logging in directly to AWS.

The following video shows how to launch the data broker instance using a CloudFormation template:

► https://docs.netapp.com/us-en/occm//media/video_cloud_sync.mp4 (video)

6. If you entered an AWS access key, select a location for the instance, select a key pair, choose whether to enable a public IP address, and then select an existing IAM role, or leave the field blank so Cloud Sync creates the role for you.

If you choose your own IAM role, [you'll need to provide the required permissions](#).

Basic Settings

Location <p>Region <input style="width: 100%; height: 25px; border: 1px solid #ccc; border-radius: 5px; margin-bottom: 5px;" type="text" value="US West Oregon"/></p> <p>VPC <input style="width: 100%; height: 25px; border: 1px solid #ccc; border-radius: 5px; margin-bottom: 5px;" type="text" value="vpc-3c46c059 - 10.60.21.0/25"/></p> <p>Subnet <input style="width: 100%; height: 25px; border: 1px solid #ccc; border-radius: 5px;" type="text" value="10.60.21.0/25"/></p>	Connectivity <p>Key Pair <input style="width: 100%; height: 25px; border: 1px solid #ccc; border-radius: 5px; margin-bottom: 5px;" type="text" value="newKey"/></p> <p>Enable Public IP? <input checked="" type="radio"/> Enable <input type="radio"/> Disable</p> <p>IAM Role (optional) <input style="width: 100%; height: 25px; border: 1px solid #ccc; border-radius: 5px;" type="text"/></p>
---	---

7. Specify a proxy configuration, if a proxy is required for internet access in the VPC.
8. After the data broker is available, click **Continue** in Cloud Sync.

The following image shows a successfully deployed instance in AWS:

1 Data Broker Group

ben-data-broker			
1 Data Brokers	N/A Transfer Rate	0 Relationships	<input checked="" type="checkbox"/> 1 Active Data Brokers Status

9. Complete the pages in the wizard to create the new sync relationship.

Result

You have deployed a data broker in AWS and created a new sync relationship. You can use this data broker group with additional sync relationships.

Details about the data broker instance

Cloud Sync creates a data broker in AWS using the following configuration.

Instance type

m5n.xlarge when available in the region, otherwise m5.xlarge

vCPUs

4

RAM

16 GB

Operating system

Amazon Linux 2

Disk size and type

10 GB GP2 SSD

Creating a new data broker in Azure

When you create a new data broker group, choose the Microsoft Azure to deploy the data broker software on a new virtual machine in a VNet. Cloud Sync guides you through the installation process, but the requirements and steps are repeated on this page to help you prepare for installation.

You also have the option to install the data broker on an existing Linux host in the cloud or on your premises. [Learn more.](#)

Supported Azure regions

All regions are supported except for the China, US Gov, and US DoD regions.

Networking requirements

- The data broker needs an outbound internet connection so it can poll the Cloud Sync service for tasks over port 443.

When Cloud Sync deploys the data broker in Azure, it creates a security group that enables the required outbound communication.

If you need to limit outbound connectivity, see [the list of endpoints that the data broker contacts](#).

- NetApp recommends configuring the source, target, and data broker to use a Network Time Protocol (NTP) service. The time difference between the three components should not exceed 5 minutes.

Authentication method

When you deploy the data broker, you'll need to choose an authentication method: a password or an SSH public-private key pair.

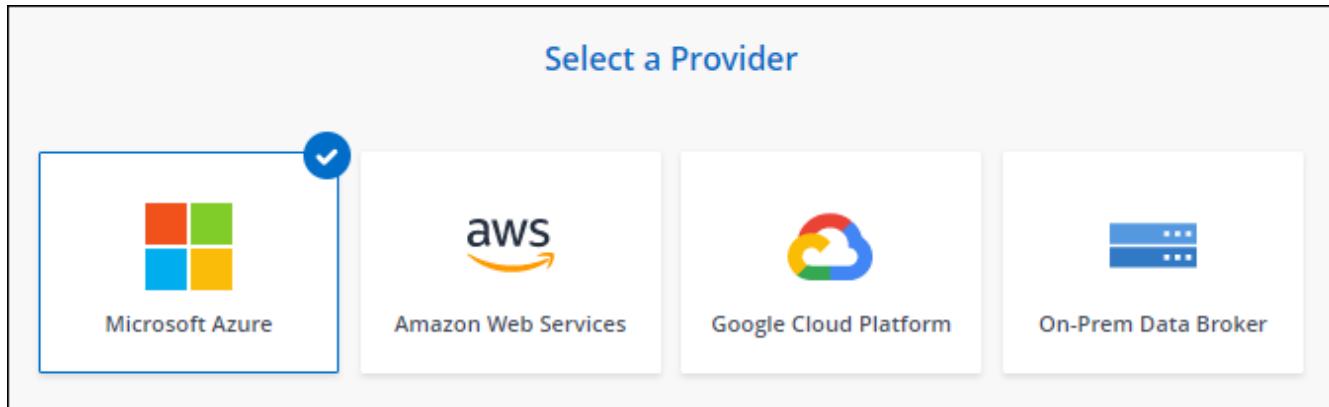
For help with creating a key pair, refer to [Azure Documentation: Create and use an SSH public-private key pair for Linux VMs in Azure](#).

Creating the data broker

There are a few ways to create a new data broker. These steps describe how to install a data broker in Azure when you create a sync relationship.

Steps

1. Click **Create New Sync**.
2. On the **Define Sync Relationship** page, choose a source and target and click **Continue**.
Complete the steps until you reach the **Data Broker Group** page.
3. On the **Data Broker Group** page, click **Create Data Broker** and then select **Microsoft Azure**.



4. Enter a name for the data broker and click **Continue**.
5. If you're prompted, log in to your Microsoft account. If you're not prompted, click **Log in to Azure**.

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

6. Choose a location for the data broker and enter basic details about the virtual machine.

Location		Virtual Machine	
Subscription	OCCM Dev	VM Name	netappdatabroker
Azure Region	West US 2	User Name	databroker
VNet	Vnet1	Authentication Method:	<input checked="" type="radio"/> Password <input type="radio"/> Public Key
Subnet	Subnet1	Enter Password	*****
Resource Group:			
<input checked="" type="radio"/> Generate a new group <input type="radio"/> Use an existing group			

7. Specify a proxy configuration, if a proxy is required for internet access in the VNet.

8. Click **Continue** and keep the page open until the deployment is complete.

The process can take up to 7 minutes.

9. In Cloud Sync, click **Continue** once the data broker is available.

10. Complete the pages in the wizard to create the new sync relationship.

Result

You have deployed a data broker in Azure and created a new sync relationship. You can use this data broker with additional sync relationships.

Getting a message about needing admin consent?

If Microsoft notifies you that admin approval is required because Cloud Sync needs permission to access resources in your organization on your behalf, then you have two options:

1. Ask your AD admin to provide you with the following permission:

In Azure, go to **Admin Centers > Azure AD > Users and Groups > User Settings** and enable **Users can consent to apps accessing company data on their behalf**.

2. Ask your AD admin to consent on your behalf to **CloudSync-AzureDataBrokerCreator** using the following URL (this is the admin consent endpoint):

`https://login.microsoftonline.com/{FILL HERE YOUR TENANT ID}/v2.0/adminconsent?client_id=8ee4ca3a-bafa-4831-97cc-5a38923cab85&redirect_uri=https://cloudsync.netapp.com&scope=https://management.azure.com/user_impersonationhttps://graph.microsoft.com/User.Read`

As shown in the URL, our app URL is `https://cloudsync.netapp.com` and the application client ID is `8ee4ca3a-bafa-4831-97cc-5a38923cab85`.

Details about the data broker VM

Cloud Sync creates a data broker in Azure using the following configuration.

VM type

Standard DS4 v2

vCPUs

8

RAM

28 GB

Operating system

CentOS 7.7

Disk size and type

64 GB Premium SSD

Creating a new data broker in Google Cloud

When you create a new data broker group, choose Google Cloud Platform to deploy the data broker software on a new virtual machine instance in a Google Cloud VPC. Cloud Sync guides you through the installation process, but the requirements and steps are repeated on this page to help you prepare for installation.

You also have the option to install the data broker on an existing Linux host in the cloud or on your premises.

[Learn more.](#)

Supported GCP regions

All regions are supported.

Networking requirements

- The data broker needs an outbound internet connection so it can poll the Cloud Sync service for tasks over port 443.

When Cloud Sync deploys the data broker in GCP, it creates a security group that enables the required outbound communication.

If you need to limit outbound connectivity, see [the list of endpoints that the data broker contacts](#).

- NetApp recommends configuring the source, target, and data broker to use a Network Time Protocol (NTP) service. The time difference between the three components should not exceed 5 minutes.

Permissions required to deploy the data broker in GCP

Ensure that the GCP user who deploys the data broker has the following permissions:

- `compute.networks.list`
- `compute.regions.list`
- `deploymentmanager.deployments.create`
- `deploymentmanager.deployments.delete`
- `deploymentmanager.operations.get`
- `iam.serviceAccounts.list`

Permissions required for the service account

When you deploy the data broker, you need to select a service account that has the following permissions:

- `logging.logEntries.create`
- `resourcemanager.projects.get`
- `storage.buckets.get`
- `storage.buckets.list`
- `storage.objects.*`
- `iam.serviceAccounts.signJwt`



The "iam.serviceAccounts.signJwt" permission is required only if you're planning to set up the data broker to use an external HashiCorp vault.

Creating the data broker

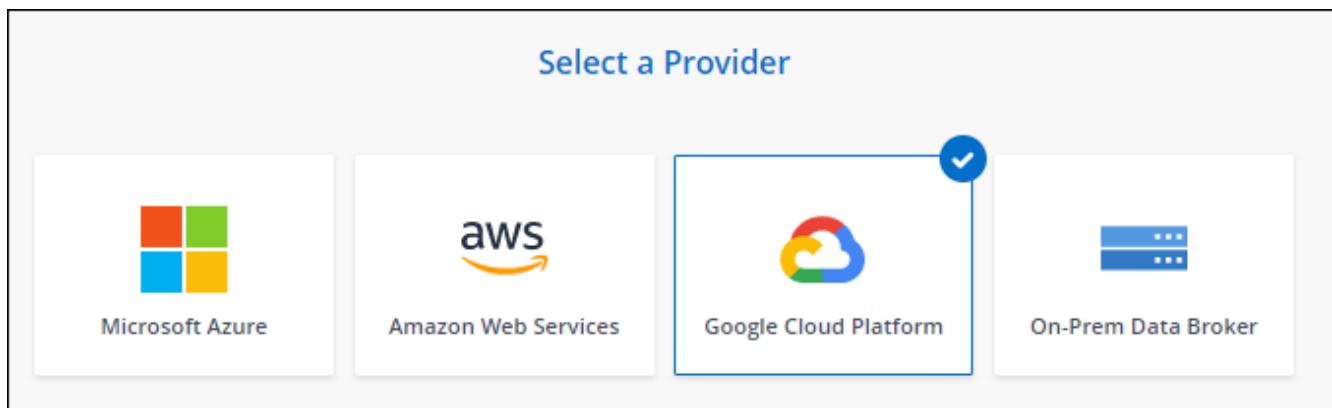
There are a few ways to create a new data broker. These steps describe how to install a data broker in Google Cloud when you create a sync relationship.

Steps

1. Click **Create New Sync**.
2. On the **Define Sync Relationship** page, choose a source and target and click **Continue**.

Complete the steps until you reach the **Data Broker Group** page.

3. On the **Data Broker Group** page, click **Create Data Broker** and then select **Microsoft Azure**.



4. Enter a name for the data broker and click **Continue**.
5. If you're prompted, log in with your Google account.

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

6. Select a project and service account and then choose a location for the data broker, including whether you want to enable or disable a public IP address.

If you don't enable a public IP address, then you'll need to define a proxy server in the next step.

Basic Settings

Project	Location
Project	Region
<input type="text" value="OCCM-Dev"/>	<input type="text" value="us-west1"/>
Service Account	Zone
<input type="text" value="test"/>	<input type="text" value="us-west1-a"/>
Select a Service Account that includes these permissions	VPC
	<input type="text" value="default"/>
	Subnet
	<input type="text" value="default"/>
	Public IP
	<input type="text" value="Enable"/>

7. Specify a proxy configuration, if a proxy is required for internet access in the VPC.

If a proxy is required for internet access, then the proxy must be in Google Cloud and use the same service account as the data broker.

8. Once the data broker is available, click **Continue** in Cloud Sync.

The instance takes approximately 5 to 10 minutes to deploy. You can monitor the progress from the Cloud Sync service, which automatically refreshes when the instance is available.

9. Complete the pages in the wizard to create the new sync relationship.

Result

You've deployed a data broker in Google Cloud and created a new sync relationship. You can use this data broker with additional sync relationships.

Providing permissions to use buckets in other Google Cloud projects

When you create a sync relationship and choose Google Cloud Storage as the source or target, Cloud Sync enables you to choose from the buckets that the data broker's service account has permissions to use. By default, this includes the buckets that are in the *same* project as the data broker service account. But you can choose buckets from *other* projects if you provide the required permissions.

Steps

1. Open the Google Cloud Platform console and load the Cloud Storage service.

2. Click the name of the bucket that you'd like to use as a source or target in a sync relationship.
3. Click **Permissions**.
4. Click **Add**.
5. Enter the name of the data broker's service account.
6. Select a role that provides [the same permissions as shown above](#).
7. Click **Save**.

Result

When you set up a sync relationship, you can now choose that bucket as the source or target in the sync relationship.

Details about the data broker VM instance

Cloud Sync creates a data broker in Google Cloud using the following configuration.

Machine type

n1-standard-4

vCPUs

4

RAM

15 GB

Operating system

Red Hat Enterprise Linux 7.7

Disk size and type

20 GB HDD pd-standard

Installing the data broker on a Linux host

When you create a new data broker group, choose the On-Prem Data Broker option to install the data broker software on an on-premises Linux host, or on an existing Linux host in the cloud. Cloud Sync guides you through the installation process, but the requirements and steps are repeated on this page to help you prepare for installation.

Linux host requirements

- **Operating system:**

- CentOS 7.0, 7.7, and 8.0

- CentOS Stream is not supported.

- Red Hat Enterprise Linux 7.7 and 8.0

- Ubuntu Server 20.04 LTS

- SUSE Linux Enterprise Server 15 SP1

The command `yum update all` must be run on the host before you install the data broker.

A 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 installation.

- **RAM:** 16 GB
- **CPU:** 4 cores
- **Free disk space:** 10 GB
- **SELinux:** We recommend that you disable [SELinux](#) on the host.

SELinux enforces a policy that blocks data broker software updates and can block the data broker from contacting endpoints required for normal operation.

Networking requirements

- The Linux host must have a connection to the source and target.
- The file server must allow the Linux host to access the exports.
- Port 443 must be open on the Linux host for outbound traffic to AWS (the data broker constantly communicates with the Amazon SQS service).
- NetApp recommends configuring the source, target, and data broker to use a Network Time Protocol (NTP) service. The time difference between the three components should not exceed 5 minutes.

Enabling access to AWS

If you plan to use the data broker with a sync relationship that includes an S3 bucket, then you should prepare the Linux host for AWS access. When you install the data broker, you'll need to provide AWS keys for an AWS user that has programmatic access and specific permissions.

Steps

1. Create an IAM policy using [this NetApp-provided policy](#). [View AWS instructions](#).
2. Create an IAM user that has programmatic access. [View AWS instructions](#).

Be sure to copy the AWS keys because you need to specify them when you install the data broker software.

Enabling access to Google Cloud

If you plan to use the data broker with a sync relationship that includes a Google Cloud Storage bucket, then you should prepare the Linux host for GCP access. When you install the data broker, you'll need to provide a key for a service account that has specific permissions.

Steps

1. Create a GCP service account that has Storage Admin permissions, if you don't already have one.
2. Create a service account key saved in JSON format. [View GCP instructions](#).

The file should contain at least the following properties: "project_id", "private_key", and "client_email"



When you create a key, the file gets generated and downloaded to your machine.

3. Save the JSON file to the Linux host.

Enabling access to Microsoft Azure

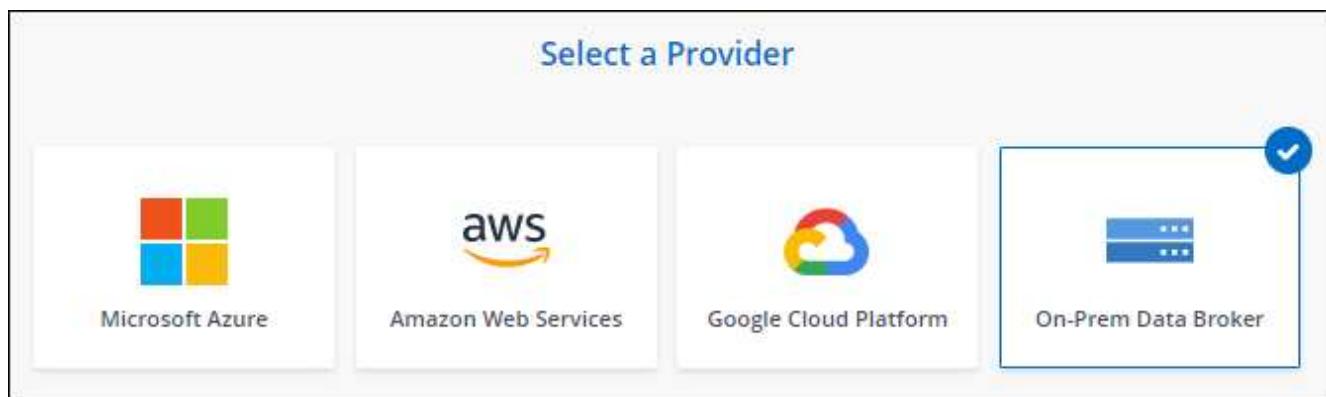
Access to Azure is defined per relationship by providing a storage account and a connection string in the Sync Relationship wizard.

Installing the data broker

You can install a data broker on a Linux host when you create a sync relationship.

Steps

1. Click **Create New Sync**.
2. On the **Define Sync Relationship** page, choose a source and target and click **Continue**.
Complete the steps until you reach the **Data Broker Group** page.
3. On the **Data Broker Group** page, click **Create Data Broker** and then select **On-Prem Data Broker**.



Even though the option is labeled **On-Prem Data Broker**, it applies to a Linux host on your premises or in the cloud.

4. Enter a name for the data broker and click **Continue**.

The instructions page loads shortly. You'll need to follow these instructions—they include a unique link to download the installer.

5. On the instructions page:
 - a. Select whether to enable access to **AWS**, **Google Cloud**, or both.
 - b. Select an installation option: **No proxy**, **Use proxy server**, or **Use proxy server with authentication**.
 - c. Use the commands to download and install the data broker.

The following steps provide details about each possible installation option. Follow the instructions page to get the exact command based on your installation option.

- d. Download the installer:
 - No proxy:

```
curl <URI> -o data_broker_installer.sh
```
 - Use proxy server:

```
curl <URI> -o data_broker_installer.sh -x <proxy_host>:<proxy_port>
```

- Use proxy server with authentication:

```
curl <URI> -o data_broker_installer.sh -x  
<proxy_username>:<proxy_password>@<proxy_host>:<proxy_port>
```

URI

Cloud Sync displays the URI of the installation file on the instructions page, which loads when you follow the prompts to deploy the On-Prem Data Broker. That URI isn't repeated here because the link is generated dynamically and can be used only once. [Follow these steps to obtain the URI from Cloud Sync.](#)

- Switch to superuser, make the installer executable and install the software:



Each command listed below includes parameters for AWS access and GCP access. Follow the instructions page to get the exact command based on your installation option.

- No proxy configuration:

```
sudo -s  
chmod +x data_broker_installer.sh  
./data_broker_installer.sh -a <aws_access_key> -s <aws_secret_key> -g  
<absolute_path_to_the_json_file>
```

- Proxy configuration:

```
sudo -s  
chmod +x data_broker_installer.sh  
./data_broker_installer.sh -a <aws_access_key> -s <aws_secret_key> -g  
<absolute_path_to_the_json_file> -h <proxy_host> -p <proxy_port>
```

- Proxy configuration with authentication:

```
sudo -s  
chmod +x data_broker_installer.sh  
./data_broker_installer.sh -a <aws_access_key> -s <aws_secret_key> -g  
<absolute_path_to_the_json_file> -h <proxy_host> -p <proxy_port> -u  
<proxy_username> -w <proxy_password>
```

AWS keys

These are the keys for the user that you should have prepared [following these steps](#). The AWS keys are stored on the data broker, which runs in your on-premises or cloud network. NetApp doesn't use the keys outside of the data broker.

JSON file

This is the JSON file that contains a service account key that you should have prepared [following these steps](#).

- Once the data broker is available, click **Continue** in Cloud Sync.
- Complete the pages in the wizard to create the new sync relationship.

Create sync relationships

When you create a sync relationship, the Cloud Sync service copies files from the source to the target. After the initial copy, the service syncs any changed data every 24 hours.

Before you can create some types of sync relationships, you'll first need to create a working environment in Cloud Manager.

Create sync relationships for specific types of working environments

If you want to create sync relationships for any of the following, then you first need to create or discover the working environment:

- Amazon FSx for ONTAP
- Azure NetApp Files
- Cloud Volumes ONTAP
- On-prem ONTAP clusters

Steps

1. Create or discover the working environment.
 - [Create an Amazon FSx for ONTAP working environment](#)
 - [Setting up and discovering Azure NetApp Files](#)
 - [Launching Cloud Volumes ONTAP in AWS](#)
 - [Launching Cloud Volumes ONTAP in Azure](#)
 - [Launching Cloud Volumes ONTAP in GCP](#)
 - [Adding existing Cloud Volumes ONTAP systems](#)
 - [Discovering ONTAP clusters](#)
2. Click **Canvas**.
3. Select a working environment that matches any of the types listed above.
4. Select the action menu next to Sync.

The screenshot shows the Cloud Manager interface. On the left, under 'Canvas', there is a 'CloudVolumesONTAP' volume icon labeled 'SINGLE' with 'Cloud Volumes ONTAP' and '51 GiB Capacity'. To its right is an 'aws' icon. On the right, a detailed view of the 'CloudVolumesONTAP' volume is shown. It has a status bar at the top with three icons: a cloud, 'CloudVolumesONTAP', and 'On'. Below this are four configuration sections: 'Compliance' (Off, Enable button), 'Monitoring' (On, Sync data from this location button), 'File Cache' (Off, Sync data to this location button), and 'Sync' (On, View Dashboard button). A tooltip for the 'Sync' section indicates '559.16TiB Data Synced'. A hand cursor icon is positioned over the 'Sync' section.

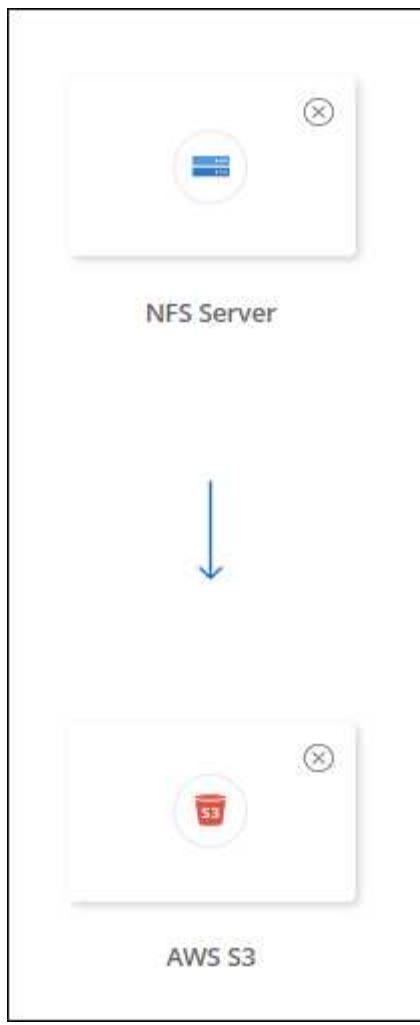
5. Select **Sync data from this location** or **Sync data to this location** and follow the prompts to set up the sync relationship.

Create other types of sync relationships

Use these steps to sync data to or from a supported storage type other than Amazon FSx for ONTAP, Azure NetApp Files, Cloud Volumes ONTAP, or on-prem ONTAP clusters. The steps below provide an example that shows how to set up a sync relationship from an NFS server to an S3 bucket.

1. In Cloud Manager, click **Sync**.
2. On the **Define Sync Relationship** page, choose a source and target.

The following steps provide an example of how to create a sync relationship from an NFS server to an S3 bucket.



3. On the **NFS Server** page, enter the IP address or fully qualified domain name of the NFS server that you want to sync to AWS.
4. On the **Data Broker Group** page, follow the prompts to create a data broker virtual machine in AWS, Azure, or Google Cloud Platform, or to install the data broker software on an existing Linux host.

For more details, refer to the following pages:

- [Create a data broker in AWS](#)
- [Create a data broker in Azure](#)
- [Create a data broker in Google Cloud](#)
- [Installing the data broker on a Linux host](#)

5. After you install the data broker, click **Continue**.

Select a Data Broker Group

1 Data Broker Group

Data Broker Group 1			
2 Data Brokers	1.81 KB/s Transfer Rate	1 Relationships	2 Active Data Brokers Status

6. On the **Directories** page, select a top-level directory or subdirectory.

If Cloud Sync is unable to retrieve the exports, click **Add Export Manually** and enter the name of an NFS export.



If you want to sync more than one directory on the NFS server, then you must create additional sync relationships after you are done.

7. On the **AWS S3 Bucket** page, select a bucket:

- Drill down to select an existing folder within the bucket or to select a new folder that you create inside the bucket.
- Click **Add to the list** to select an S3 bucket that is not associated with your AWS account. [Specific permissions must be applied to the S3 bucket.](#)

8. On the **Bucket Setup** page, set up the bucket:

- Choose whether to enable S3 bucket encryption and then select an AWS KMS key, enter the ARN of a KMS key, or select AES-256 encryption.
- Select an S3 storage class. [View the supported storage classes.](#)

Bucket Setup

Selected S3 bucket:
appinstall

Activate S3 Bucket Encryption

Encryption type:

AWS KMS encryption: select a key

AWS KMS encryption: enter a key ARN

AES-256 encryption

S3 Storage Class: Standard

9. On the **Settings** page, define how source files and folders are synced and maintained in the target location:

Schedule

Choose a recurring schedule for future syncs or turn off the sync schedule. You can schedule a relationship to sync data as often as every 1 minute.

Retries

Define the number of times that Cloud Sync should retry to sync a file before skipping it.

Compare By

Choose whether Cloud Sync should compare certain attributes when determining whether a file or directory has changed and should be synced again.

Even if you uncheck these attributes, Cloud Sync still compares the source to the target by checking the paths, file sizes, and file names. If there are any changes, then it syncs those files and directories.

You can choose to enable or disable Cloud Sync from comparing the following attributes:

- **mtime**: The last modified time for a file. This attribute isn't valid for directories.
- **uid**, **gid**, and **mode**: Permission flags for Linux.

Copy for Objects

Enable this option to copy object storage metadata and tags. If a user changes the metadata on the source, Cloud Sync copies this object in the next sync, but if a user changes the tags on the source (and not the data itself), Cloud Sync doesn't copy the object in the next sync.

You can't edit this option after you create the relationship.

Copying tags is supported with sync relationships that include an S3-compatible endpoint (S3, StorageGRID, or IBM Cloud Object Storage).

Copying metadata is supported with "cloud-to-cloud" relationships between any of the following endpoints:

- AWS S3
- Azure Blob
- Google Cloud Storage
- IBM Cloud Object Storage
- StorageGRID

Recently Modified Files

Choose to exclude files that were recently modified prior to the scheduled sync.

Delete Files on Source

Choose to delete files from the source location after Cloud Sync copies the files to the target location. This option includes the risk of data loss because the source files are deleted after they're copied.

If you enable this option, you also need to change a parameter in the local.json file on the data broker. Open the file and update it as follows:

```
{  
  "workers": {  
    "transferrer": {  
      "delete-on-source": true  
    }  
  }  
}
```

Delete Files on Target

Choose to delete files from the target location, if they were deleted from the source. The default is to never delete files from the target location.

File Types

Define the file types to include in each sync: files, directories, and symbolic links.

Exclude File Extensions

Specify file extensions to exclude from the sync by typing the file extension and pressing **Enter**. For example, type *log* or *.log* to exclude *.log files. A separator isn't required for multiple extensions. The following video provides a short demo:

► https://docs.netapp.com/us-en/occm//media/video_file_extensions.mp4 (video)

File Size

Choose to sync all files regardless of their size or just files that are in a specific size range.

Date Modified

Choose all files regardless of their last modified date, files modified after a specific date, before a specific date, or between a time range.

Date Created

When an SMB server is the source, this setting enables you to sync files that were created after a specific date, before a specific date, or between a specific time range.

ACL - Access Control List

Copy ACLs from an SMB server by enabling a setting when you create a relationship or after you create a relationship.

10. On the **Tags/Metadata** page, choose whether to save a key-value pair as a tag on all files transferred to the S3 bucket or to assign a metadata key-value pair on all files.

The screenshot shows the 'Relationship Tags' configuration step in a wizard. At the top, there are tabs: 'AWS S3 Bucket' (selected), 'Settings', 'Tags/Metadata' (numbered 6), and 'Review' (numbered 7). Below the tabs, the section title is 'Relationship Tags'. A note says 'Cloud Sync assigns the relationship tags to all of the files transferred to the S3 bucket.' Another note says 'This enables you to search for the transferred files by using the tag values.' There are two radio buttons: 'Save on Object's Tags' (selected) and 'Save On Object's Metadata'. Below these are two input fields: 'Tag Key' (with placeholder 'Up to 128 characters') and 'Tag Value' (with placeholder 'Up to 256 characters'). At the bottom left is a blue '+' button labeled 'Add Relationship Tag'. To the right is a note: 'Optional Field | [Up to 5]'. The entire interface has a light gray background.



This same feature is available when syncing data to StorageGRID and IBM Cloud Object Storage. For Azure and Google Cloud Storage, only the metadata option is available.

11. Review the details of the sync relationship and then click **Create Relationship**.

Result

Cloud Sync starts syncing data between the source and target.

Create sync relationships from Cloud Data Sense

Cloud Sync is integrated with Cloud Data Sense. From within Data Sense, you can select the source files that you'd like to sync to a target location using Cloud Sync.

After you initiate a data sync from Cloud Data Sense, all of the source information is contained in a single step and only requires you to enter a few key details. You then choose the target location for the new sync relationship.

The screenshot shows the 'Selected Data Sense Source' configuration screen. At the top, there are tabs: 'Sync Relationship' (selected), 'Data Sense Integration' (numbered 1), 'Data Broker Group' (numbered 2), 'NFS Server' (numbered 3), 'Directories' (numbered 4), and a right arrow. Below the tabs, there is a 'How does it work?' button and a 'Selected Data Sense Source' section. This section displays the following details:
- Source: Azure NetApp Files /cifs1
- Host: 1.1.1.1
- Working Environment: cifs
- Volume: \\1.1.1.1\\cifs1
Below this, a note says 'A few more things before we continue' followed by a 'Define SMB Credentials:' section with fields for 'User Name', 'Password', and 'Domain (Optional)'. The entire interface has a light gray background.

Learn how to start a sync relationship from Cloud Data Sense.

Paying for sync relationships after your free trial ends

There are two ways to pay for sync relationships after your 14-day free trial ends. The first option is to subscribe from AWS or Azure to pay-as-you-go or to pay annually. The second option is to purchase licenses directly from NetApp.

You can subscribe from either the AWS Marketplace or the Azure Marketplace. You can't subscribe from both.

You have the option to use licenses from NetApp with a Marketplace subscription. For example, if you have 25 sync relationships, you can pay for the first 20 sync relationships using a license and then pay-as-you-go from AWS or Azure with the remaining 5 sync relationships.

[Learn more about how licenses work.](#)

What if I don't immediately pay after my free trial ends?

You won't be able to create any additional relationships. Existing relationships are not deleted, but you cannot make any changes to them until you subscribe or enter a license.

Subscribing from AWS

AWS enables you to pay-as-you-go or to pay annually.

Steps to pay-as-you-go

1. Click **Sync > Licensing**.
2. Select **AWS**.
3. Click **Subscribe** and then click **Continue**.
4. Subscribe from the AWS Marketplace, and then log back in to the Cloud Sync service to complete the registration.

The following video shows the process:

► https://docs.netapp.com/us-en/occm//media/video_cloud_sync_registering.mp4 (*video*)

Steps to pay annually

1. [Go to the AWS Marketplace page](#).
2. Click **Continue to Subscribe**.
3. Select your contract options and click **Create contract**.

Subscribing from Azure

Azure enables you to pay-as-you-go or to pay annually.

What you'll need

An Azure user account that has Contributor or Owner permissions in the relevant subscription.

Steps

1. Click **Sync > Licensing**.
2. Select **Azure**.

3. Click **Subscribe** and then click **Continue**.
4. In the Azure portal, click **Create**, select your options, and click **Subscribe**.
Select **Monthly** to pay by the hour, or **Yearly** to pay for a year up front.
5. When deployment is complete, click the name of the SaaS resource in the notification pop-up.
6. Click **Configure Account** to return to Cloud Sync.

The following video shows the process:

► https://docs.netapp.com/us-en/occm//media/video_cloud_sync_registering_azure.mp4 (video)

Purchasing licenses from NetApp and adding them to Cloud Sync

To pay for your sync relationships up front, you must purchase one or more licenses and add them to the Cloud Sync service.

What you'll need

You'll need the serial number for your license and the user name and password for the NetApp Support Site account that the license is associated with.

Steps

1. Purchase a license by [contacting NetApp](#).
2. In Cloud Manager, click **Sync > Licensing**.
3. Click **Add License** and add the required information:
 - a. Enter the serial number.
 - b. Select the NetApp Support Site account that is associated with the license that you're adding:
 - If your account was already added to Cloud Manager, select it from the drop-down list.
 - If your account wasn't added yet, click **Add NSS Credentials**, enter the user name and password, click **Register**, and then select it from the drop-down list.
 - c. Click **Add**.

Updating a license

If you extended a Cloud Sync license that you purchased from NetApp, the new expiration date won't update automatically in Cloud Sync. You need to add the license again to refresh the expiration date.

Steps

1. In Cloud Manager, click **Sync > Licensing**.
2. Click **Add License** and add the required information:
 - a. Enter the serial number.
 - b. Select the NetApp Support Site account that is associated with the license that you're adding.
 - c. Click **Add**.

Result

Cloud Sync updates the existing license with the new expiration date.

Tutorials

Copying ACLs from SMB shares

Cloud Sync can copy access control lists (ACLs) between a source SMB share and a target SMB share, or from a source SMB share to object storage (except for ONTAP S3). If needed, you also have the option to manually preserve ACLs between SMB shares by using robocopy.



Cloud Sync doesn't support copying ACLs back from object storage to SMB shares.

Choices

- [Set up Cloud Sync to automatically copy ACLs](#)
- [Manually copy the ACLs between SMB shares](#)

Setting up Cloud Sync to copy ACLs from an SMB server

Copy ACLs from an SMB server by enabling a setting when you create a relationship or after you create a relationship.

What you'll need

This feature works with *any* type of data broker: the AWS, Azure, Google Cloud Platform, or on-prem data broker. The on-prem data broker can run [any supported operating system](#).

Steps for a new relationship

1. From Cloud Sync, click **Create New Sync**.
2. Drag and drop **SMB Server** to the source, choose an SMB server or object storage as the target, and click **Continue**.
3. On the **SMB Server** page:
 - a. Enter a new SMB server or select an existing server and click **Continue**.
 - b. Enter credentials for the SMB server.
 - c. Select **Copy Access Control Lists to the target** and click **Continue**.

Select an SMB Source

SMB Version : 2.1 ▾

Selected SMB Server:
10.20.30.152 X

Define SMB Credentials:

User Name user1	Password *****	Domain (Optional)
--------------------	-------------------	-------------------

ACL - Access Control List

Copy Access Control Lists to the target

Notice: Copying ACLs can affect sync performance.
You can change this setting after you create the relationship.

- Follow the remaining prompts to create the sync relationship.

When you copy ACLs from SMB to object storage, you can choose to copy the ACLs to the object's tags or on the object's metadata, depending on the target. For Azure and Google Cloud Storage, only the metadata option is available.

The following screenshot shows an example of the step where you can make this choice.

AWS S3 Bucket ✓ Settings 6 Tags/Metadata 7 Review

Relationship Metadata

Cloud Sync assigns the relationship metadata to all of the files transferred to the S3 bucket.

Save on Object's Tags Save On Object's Metadata

Metadata Key Up to 128 characters	Metadata Value Up to 256 characters
--------------------------------------	--

+ Add Relationship Metadata Optional Field | [Up to 5]

Steps for an existing relationship

- Hover over the sync relationship and click the action menu.
- Click **Settings**.
- Select **Copy Access Control Lists to the target**.
- Click **Save Settings**.

Result

When syncing data, Cloud Sync preserves the ACLs between the source and target SMB shares, or from a source SMB share to object storage.

Manually copying ACLs between SMB shares

You can manually preserve ACLs between SMB shares by using the Windows robocopy command.

Steps

1. Identify a Windows host that has full access to both SMB shares.
 2. If either of the endpoints require authentication, use the **net use** command to connect to the endpoints from the Windows host.
- You must perform this step before you use robocopy.
3. From Cloud Sync, create a new relationship between the source and target SMB shares or sync an existing relationship.
 4. After the data sync is complete, run the following command from the Windows host to sync the ACLs and ownership:

```
robocopy /E /COPY:SOU /secfix [source] [target] /w:0 /r:0 /XD ~snapshots  
/UNILOG:"[logfilepath]"
```

Both *source* and *target* should be specified using the UNC format. For example: \\<server>\<share>\<path>

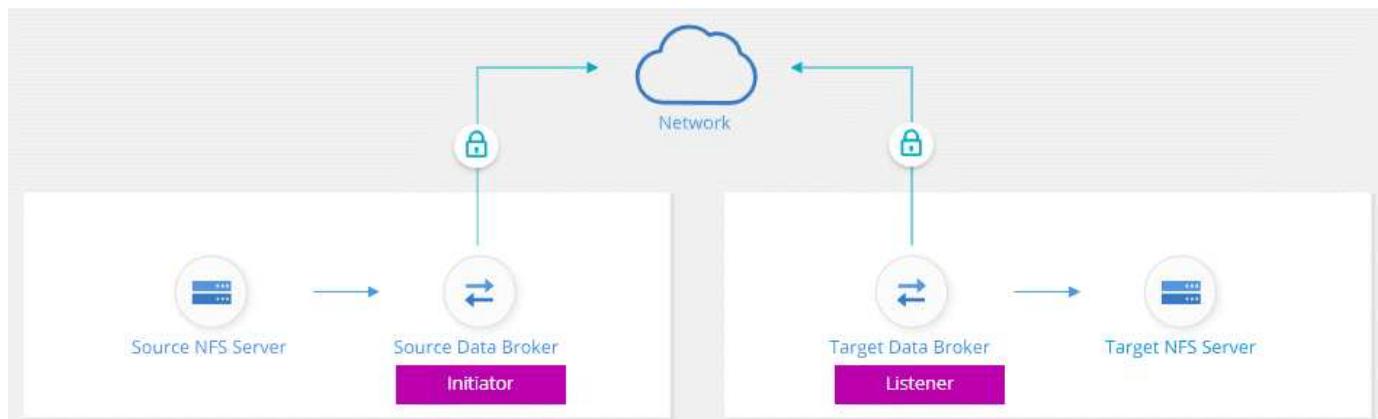
Syncing NFS data using data-in-flight encryption

If your business has strict security policies, you can sync NFS data using data-in-flight encryption. This feature is supported from an NFS server to another NFS server and from Azure NetApp Files to Azure NetApp Files.

For example, you might want to sync data between two NFS servers that are in different networks. Or you might need to securely transfer data on Azure NetApp Files across subnets or regions.

How data-in-flight encryption works

Data-in-flight encryption encrypts NFS data when it's sent over the network between two data brokers. The following image shows a relationship between two NFS servers and two data brokers:



One data broker functions as the *initiator*. When it's time to sync data, it sends a connection request to the other data broker, which is the *listener*. That data broker listens for requests on port 443. You can use a different port, if needed, but be sure to check that the port is not in use by another service.

For example, if you sync data from an on-premises NFS server to a cloud-based NFS server, you can choose which data broker listens for the connection requests and which sends them.

Here's how in-flight encryption works:

1. After you create the sync relationship, the initiator starts an encrypted connection with the other data broker.
2. The source data broker encrypts data from the source using TLS 1.3.
3. It then sends the data over the network to the target data broker.
4. The target data broker decrypts the data before sending it to the target.
5. After the initial copy, the service syncs any changed data every 24 hours. If there is data to sync, the process starts with the initiator opening an encrypted connection with the other data broker.

If you prefer to sync data more frequently, [you can change the schedule after you create the relationship](#).

Supported NFS versions

- For NFS servers, data-in-flight encryption is supported with NFS versions 3, 4.0, 4.1, and 4.2.
- For Azure NetApp Files, data-in-flight encryption is supported with NFS versions 3 and 4.1.

Proxy server limitation

If you create an encrypted sync relationship, the encrypted data is sent over HTTPS and isn't routable through a proxy server.

What you'll need to get started

Be sure to have the following:

- Two NFS servers that meet [source and target requirements](#) or Azure NetApp Files in two subnets or regions.
- The IP addresses or fully qualified domain names of the servers.
- Network locations for two data brokers.

You can select an existing data broker but it must function as the initiator. The listener data broker must be a *new* data broker.

If you want to use an existing data broker group, the group must have only one data broker. Multiple data brokers in a group aren't supported with encrypted sync relationships.

If you have not yet deployed a data broker, review the data broker requirements. Because you have strict security policies, be sure to review the networking requirements, which includes outbound traffic from port 443 and the [Internet endpoints](#) that the data broker contacts.

- [Review AWS installation](#)
- [Review Azure installation](#)

- Review GCP installation
- Review Linux host installation

Syncing NFS data using data-in-flight encryption

Create a new sync relationship between two NFS servers or between Azure NetApp Files, enable the in-flight encryption option, and follow the prompts.

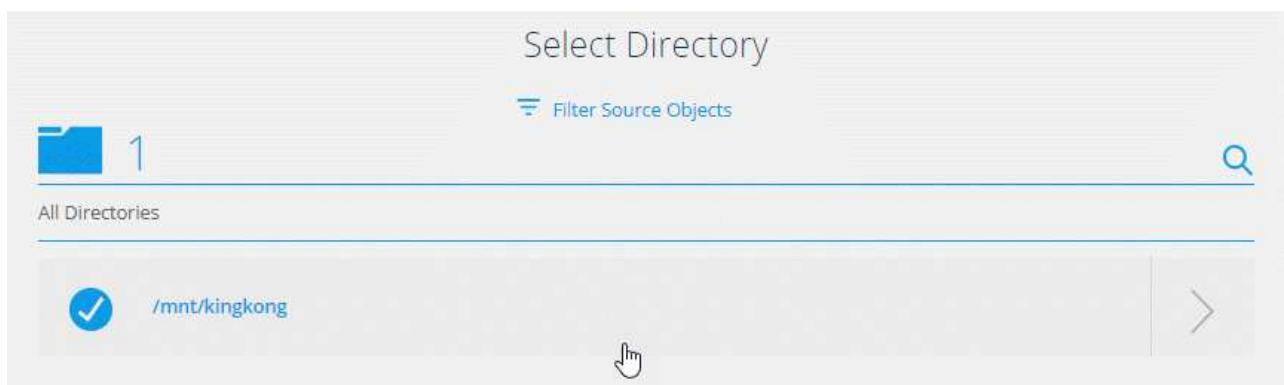
Steps

1. Click **Create New Sync**.
2. Drag and drop **NFS Server** to the source and target locations or **Azure NetApp Files** to the source and target locations and select **Yes** to enable data-in-flight encryption.
3. Follow the prompts to create the relationship:
 - a. **NFS Server/Azure NetApp Files**: Choose the NFS version and then specify a new NFS source or select an existing server.
 - b. **Define Data Broker Functionality**: Define which data broker *listens* for connection requests on a port and which one *initiates* the connection. Make your choice based on your networking requirements.
 - c. **Data Broker**: Follow the prompts to add a new source data broker or select an existing data broker.

Note the following:

- If you want to use an existing data broker group, the group must have only one data broker. Multiple data brokers in a group aren't supported with encrypted sync relationships.
- If the source data broker acts as the listener, then it must be a new data broker.
- If you need a new data broker, Cloud Sync prompts you with the installation instructions. You can deploy the data broker in the cloud or download an installation script for your own Linux host.
- d. **Directories**: Choose the directories that you want to sync by selecting all directories, or by drilling down and selecting a subdirectory.

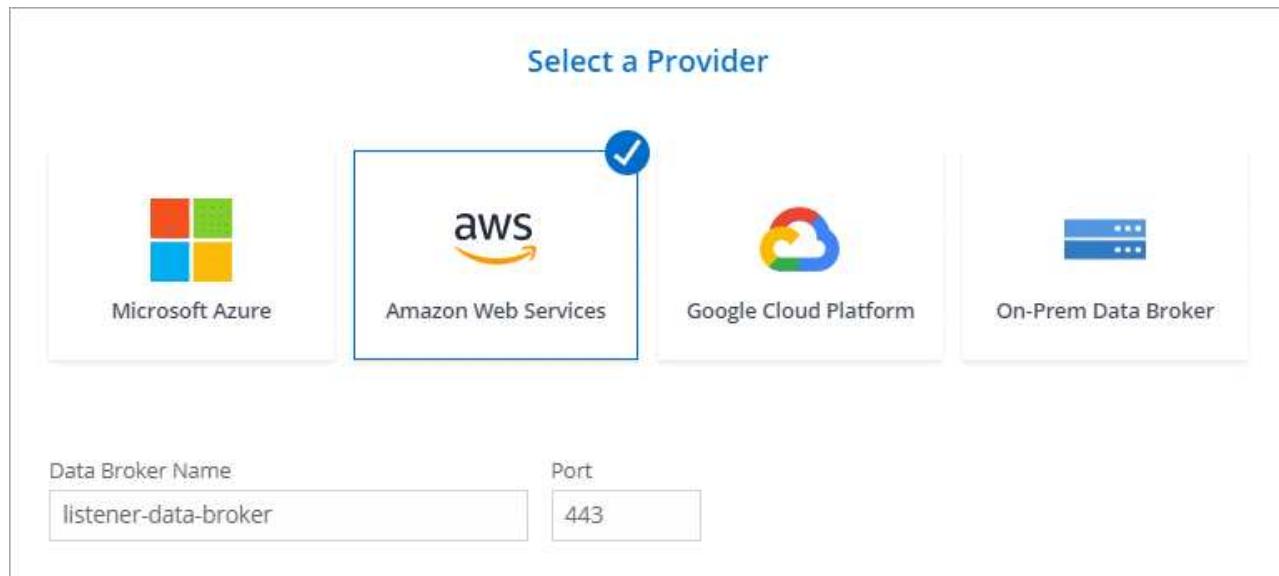
Click **Filter Source Objects** to modify settings that define how source files and folders are synced and maintained in the target location.



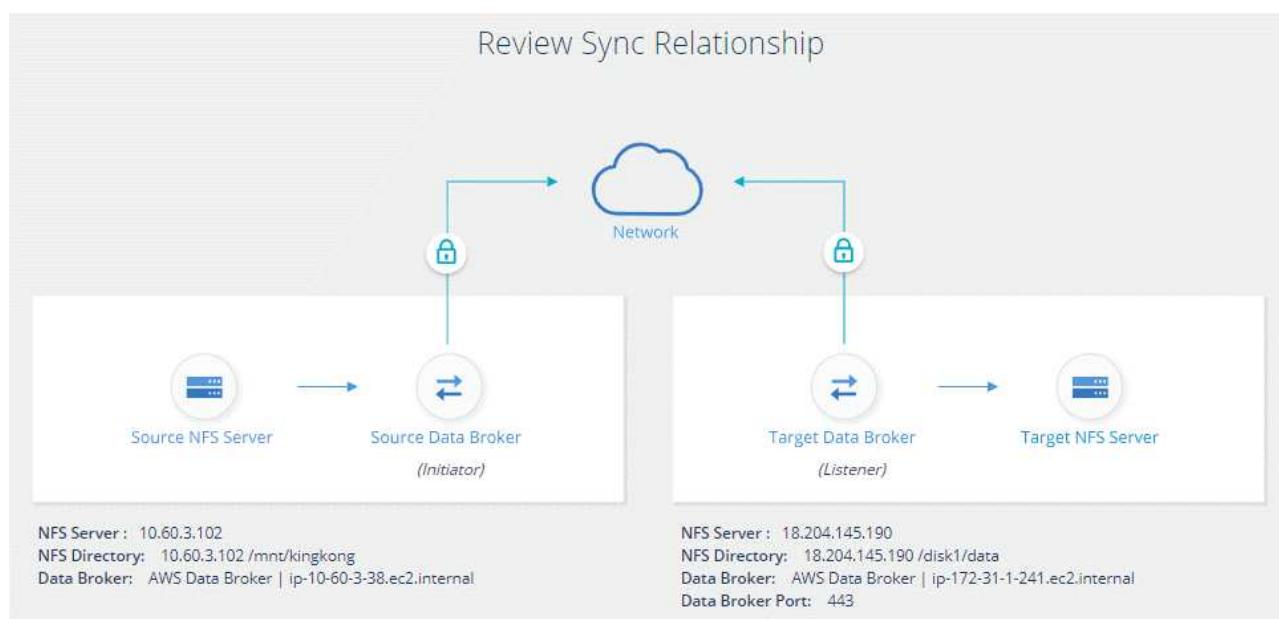
- e. **Target NFS Server/Target Azure NetApp Files**: Choose the NFS version and then enter a new NFS target or select an existing server.
- f. **Target Data Broker**: Follow the prompts to add a new source data broker or select an existing data broker.

If the target data broker acts as the listener, then it must be a new data broker.

Here's an example of the prompt when the target data broker functions as the listener. Notice the option to specify the port.



- g. **Target Directories:** Select a top-level directory, or drill down to select an existing subdirectory or to create a new folder inside an export.
- h. **Settings:** Define how source files and folders are synced and maintained in the target location.
- i. **Review:** Review the details of the sync relationship and then click **Create Relationship**.



Result

Cloud Sync starts creating the new sync relationship. When it's done, click **View in Dashboard** to view details about the new relationship.

Setting up a data broker group to use an external HashiCorp Vault

When you create a sync relationship that requires Amazon S3, Azure, or Google Cloud credentials, you need to specify those credentials through the Cloud Sync user interface or API. An alternative is to set up the data

broker group to access the credentials (or *secrets*) directly from an external HashiCorp Vault.

This feature is supported through the Cloud Sync API with sync relationships that require Amazon S3, Azure, or Google Cloud credentials.

1

Prepare the vault

Prepare the vault to supply credentials to the data broker group by setting up the URLs. The URLs to the secrets in the vault must end with *Creds*.

2

Prepare the data broker group

Prepare the data broker group to fetch credentials from the external vault by modifying the local config file for each data broker in the group.

3

Create a sync relationship using the API

Now that everything is set up, you can send an API call to create a sync relationship that uses your vault to get the secrets.

Preparing the vault

You'll need to provide Cloud Sync with the URL to the secrets in your vault. Prepare the vault by setting up those URLs. You need to set up URLs to the credentials for each source and target in the sync relationships that you plan to create.

The URL must be set up as follows:

```
/<path>/<requestid>/<endpoint-protocol>Creds
```

Path

The prefix path to the secret. This can be any value that's unique to you.

Request ID

A request ID that you need to generate. You'll need to provide the ID in one of the headers in the API POST request when you create the sync relationship.

Endpoint protocol

One of the following protocols, as defined [in the post relationship v2 documentation](#): S3, AZURE, or GCP (each must be in uppercase).

Creds

The URL must end with *Creds*.

Examples

The following examples show URLs to secrets.

Example for the full URL and path for source credentials

```
http://example.vault.com:8200/my-path/all-secrets/hb312vdasr2/S3Creds
```

As you can see in the example, the prefix path is `/my-path/all-secrets/`, the request ID is `hb312vdasr2` and the source endpoint is S3.

Example for the full URL and path for target credentials

`http://example.vault.com:8200/my-path/all-secrets/n32hcbnejk2/AZURECreds`

The prefix path is `/my-path/all-secrets/`, the request ID is `n32hcbnejk2`, and the target endpoint is Azure.

Preparing the data broker group

Prepare the data broker group to fetch credentials from the external vault by modifying the local config file for each data broker in the group.

Steps

1. SSH to a data broker in the group.
2. Edit the `local.json` file that resides in `/opt/netapp/databroker/config`.
3. Set `enable` to `true` and set the config parameter fields under `external-integrations.hashicorp` as follows:

enabled

- Valid values: true/false
- Type: Boolean
- Default value: false
- True: The data broker gets secrets from your own external HashiCorp Vault
- False: The data broker stores credentials in its local vault

url

- Type: string
- Value: The URL to your external vault

path

- Type: string
- Value: Prefix path to the secret with your credentials

Reject-unauthorized

- Determines if you want the data broker to reject unauthorized external vault
- Type: Boolean
- Default: false

auth-method

- The authentication method that the data broker should use to access credentials from the external vault
- Type: string
- Valid values: "aws-iam" / "role-app" / "gcp-iam"

role-name

- Type: string
- Your role name (in case you use aws-iam or gcp-iam)

Secretid & rootid

- Type: string (in case you use app-role)

Namespace

- Type: string
- Your namespace (X-Vault-Namespace header if needed)

4. Repeat these steps for any other data brokers in the group.

Example for aws-role authentication

```
{  
    "external-integrations": {  
        "hashicorp": {  
            "enabled": true,  
            "url": "https://example.vault.com:8200",  
            "path": "/my-path/all-secrets",  
            "reject-unauthorized": false,  
            "auth-method": "aws-role",  
            "aws-role": {  
                "role-name": "my-role"  
            }  
        }  
    }  
}
```

Example for gcp-iam authentication

```
{
  "external-integrations": {
    "hashicorp": {
      "enabled": true,
      "url": http://ip-10-20-30-55.ec2.internal:8200,
      "path": "v1/secret",
      "namespace": "",
      "reject-unauthorized": true,
      "auth-method": "gcp-iam",
      "aws-iam": {
        "role-name": ""
      },
      "app-role": {
        "root_id": "",
        "secret_id": ""
      }
    },
    "gcp-iam": {
      "role-name": "my-iam-role"
    }
  }
}
```

Setting up permissions when using gcp-iam authentication

If you're using the *gcp-iam* authentication method, then the data broker must have the following GCP permission:

- `iam.serviceAccounts.signJwt`

[Learn more about GCP permission requirements for the data broker.](#)

Creating a new sync relationship using secrets from the vault

Now that everything is set up, you can send an API call to create a sync relationship that uses your vault to get the secrets.

Post the relationship using the Cloud Sync REST API.

```

Headers:
Authorization: Bearer <user-token>
Content-Type: application/json
x-account-id: <accountid>
x-netapp-external-request-id-src: request ID as part of path for source
credentials
x-netapp-external-request-id-trg: request ID as part of path for target
credentials
Body: post relationship v2 body

```

- To obtain a user token and your Cloud Central account ID, refer to this page in the documentation.
- To build a body for your post relationship, refer to the relationships-v2 API call.

Example

Example for the POST request:

```

url: https://api.cloudsync.netapp.com/api/relationships-v2
headers:
"x-account-id": "CS-SasdW"
"x-netapp-external-request-id-src": "hb312vdasr2"
"Content-Type": "application/json"
"Authorization": "Bearer eyJhbGciOiJSUzI1NiIsInR5cCI6IkpXVCIsImtpZCI6Ik...
Body:
{
  "dataBrokerId": "5e6e111d578dtyuu1555sa60",
  "source": {
    "protocol": "s3",
    "s3": {
      "provider": "sgws",
      "host": "1.1.1.1",
      "port": "443",
      "bucket": "my-source"
    },
    "target": {
      "protocol": "s3",
      "s3": {
        "bucket": "my-target-bucket"
      }
    }
  }
}

```

Managing sync relationships

You can manage sync relationships at any time by immediately syncing data, changing schedules, and more.

Performing an immediate data sync

Rather than wait for the next scheduled sync, you can press a button to immediately sync data between the source and target.

Steps

1. From the **Dashboard**, navigate to the sync relationship and click 
2. Click **Sync Now** and then click **Sync** to confirm.

Result

Cloud Sync starts the data sync process for the relationship.

Accelerating sync performance

Accelerate the performance of a sync relationship by adding an additional data broker to the group that manages the relationship. The additional data broker must be a *new* data broker.

How this works

If the data broker group manages other sync relationships, then the new data broker that you add to the group also accelerates the performance of those sync relationships.

For example, let's say you have three relationships:

- Relationship 1 is managed by data broker group A
- Relationship 2 is managed by data broker group B
- Relationship 3 is managed by data broker group A

You want to accelerate the performance of relationship 1 so you add a new data broker to data broker group A. Because group A also manages sync relationship 3, the sync performance for relationship 3 is automatically accelerated as well.

Steps

1. Ensure that at least one of the existing data brokers in the relationship are online.
2. From the **Dashboard**, navigate to the sync relationship and click 
3. Click **Accelerate**.
4. Follow the prompts to create a new data broker.

Result

Cloud Sync adds the new data broker to the group. The performance of the next data sync should be accelerated.

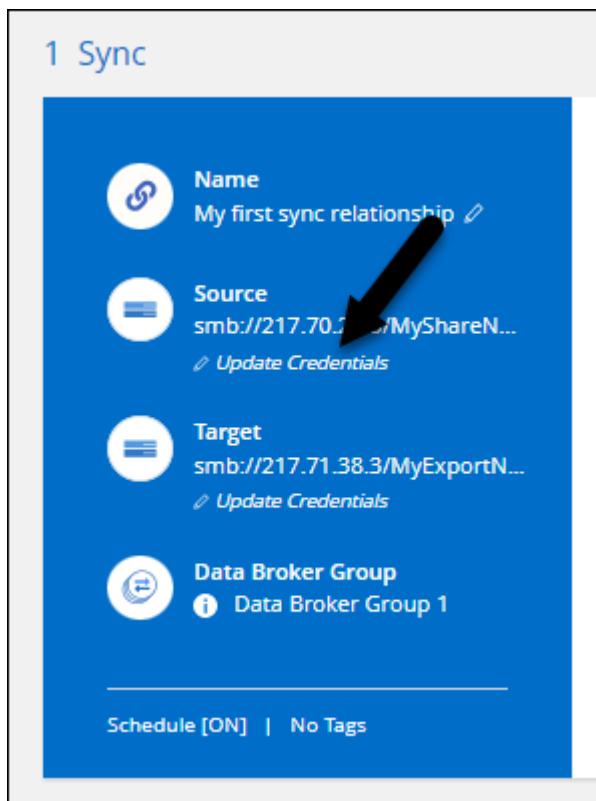
Updating credentials

You can update the data broker with the latest credentials of the source or target in an existing sync relationship. Updating the credentials can help if your security policies require you to update credentials on a periodic basis.

Updating credentials is supported with any source or target that Cloud Sync requires credentials for: Azure Blob, Box, IBM Cloud Object Storage, StorageGRID, ONTAP S3 Storage, SFTP, and SMB servers.

Steps

1. From the **Sync Dashboard**, go to a sync relationship that requires credentials and then click **Update Credentials**.



2. Enter the credentials and click **Update**.

A note about SMB servers: if the domain is new, then you'll need to specify it when you update the credentials. If the domain hasn't changed, then you don't need to enter it again.

If you entered a domain when you created the sync relationship, but you don't enter a new domain when you update the credentials, then Cloud Sync will keep using the original domain that you provided.

Result

Cloud Sync updates the credentials on the data broker. It can take up 10 minutes until the data broker starts using the updated credentials for data syncs.

Changing the settings for a sync relationship

Modify settings that define how source files and folders are synced and maintained in the target location.

1. From the **Dashboard**, navigate to the sync relationship and click 
2. Click **Settings**.
3. Modify any of the settings.

General

Schedule	ON Every 1 Day
Retries	Retry 3 times before skipping file

Files and Directories

Compare By	The following attributes (and size): uid, gid, mode, mtime
Recently Modified Files	Exclude files that are modified up to 30 Seconds before a scheduled sync
Delete Files On Source	Never delete files from the source location
Delete Files On Target	Never delete files from the target location
File Types	Include All: Files, Directories, Symbolic Links
Exclude File Extensions	None
File Size	All
Date Modified	All
Date Created	All
ACL - Access Control List	Inactive

 [Reset to defaults](#)

Here's a brief description of each setting:

Schedule

Choose a recurring schedule for future syncs or turn off the sync schedule. You can schedule a relationship to sync data as often as every 1 minute.

Retries

Define the number of times that Cloud Sync should retry to sync a file before skipping it.

Compare By

Choose whether Cloud Sync should compare certain attributes when determining whether a file or directory has changed and should be synced again.

Even if you uncheck these attributes, Cloud Sync still compares the source to the target by checking the paths, file sizes, and file names. If there are any changes, then it syncs those files and directories.

You can choose to enable or disable Cloud Sync from comparing the following attributes:

- **mtime**: The last modified time for a file. This attribute isn't valid for directories.
- **uid, gid, and mode**: Permission flags for Linux.

Copy for Objects

You can't edit this option after you create the relationship.

Recently Modified Files

Choose to exclude files that were recently modified prior to the scheduled sync.

Delete Files on Source

Choose to delete files from the source location after Cloud Sync copies the files to the target location. This option includes the risk of data loss because the source files are deleted after they're copied.

If you enable this option, you also need to change a parameter in the local.json file on the data broker. Open the file and update it as follows:

```
{  
  "workers": {  
    "transferrer": {  
      "delete-on-source": true  
    }  
  }  
}
```

Delete Files on Target

Choose to delete files from the target location, if they were deleted from the source. The default is to never deletes files from the target location.

File Types

Define the file types to include in each sync: files, directories, and symbolic links.

Exclude File Extensions

Specify file extensions to exclude from the sync by typing the file extension and pressing **Enter**. For example, type *log* or *.log* to exclude *.log files. A separator isn't required for multiple extensions. The following video provides a short demo:

► https://docs.netapp.com/us-en/occm//media/video_file_extensions.mp4 (video)

File Size

Choose to sync all files regardless of their size or just files that are in a specific size range.

Date Modified

Choose all files regardless of their last modified date, files modified after a specific date, before a specific date, or between a time range.

Date Created

When an SMB server is the source, this setting enables you to sync files that were created after a specific date, before a specific date, or between a specific time range.

ACL - Access Control List

Copy ACLs from an SMB server by enabling a setting when you create a relationship or after you create a relationship.

4. Click **Save Settings**.

Result

Cloud Sync modifies the sync relationship with the new settings.

Deleting relationships

You can delete a sync relationship, if you no longer need to sync data between the source and target. This action doesn't delete the data broker group (or the individual data broker instances) and it does not delete data from the target.

Steps

1. From the **Dashboard**, navigate to the sync relationship and click 
2. Click **Delete** and then click **Delete** again to confirm.

Result

Cloud Sync deletes the sync relationship.

Manage data broker groups

A data broker group syncs data from a source location to a target location. At least one data broker is required in a group for each sync relationship that you create. Manage data broker groups by adding a new data broker to a group, by viewing information about groups, and more.

Data broker groups

Grouping data brokers together can help improve the performance of sync relationships.

Determining the number of data brokers in a group

In many cases, a single data broker can meet the performance requirements for a sync relationship. If it doesn't, you can accelerate sync performance by adding additional data brokers to the group. But you should first check other factors that can impact sync performance. [Learn more about how to determine when multiple data brokers are required.](#)

Groups can manage several relationships

A data broker group can manage one or more sync relationships at a time.

For example, let's say you have three relationships:

- Relationship 1 is managed by data broker group A
- Relationship 2 is managed by data broker group B
- Relationship 3 is managed by data broker group A

You want to accelerate the performance of relationship 1 so you add a new data broker to data broker group A. Because group A also manages sync relationship 3, the sync performance for relationship is automatically accelerated as well.

New data brokers only

You can only add new data brokers to a group. You can't add existing data brokers to a group.

Add a new data broker

There are several ways to create a new data broker:

- When creating a new sync relationship

[Learn how to create a new data broker when creating a sync relationship.](#)

- From the **Manage Data Brokers** page by clicking **Add New Data Broker** which creates the data broker in a new group
- From the **Manage Data Brokers** page by creating a new data broker in an existing group

Things you should know

- You can't add data brokers to a group that manages an encrypted sync relationship.
- If you want to create a data broker in an existing group, the data broker must be an on-prem data broker or the same type of data broker.

For example, if a group includes an AWS data broker, then you can create an AWS data broker or on-prem data broker in that group. You can't create an Azure data broker or GCP data broker because they aren't the same data broker type.

Steps to create a data broker in a new group

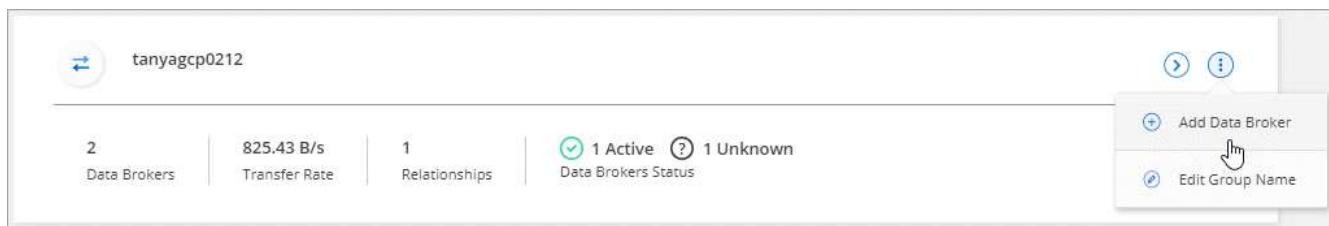
1. Click **Sync > Manage Data Brokers**.
2. Click **Add New Data Broker**.
3. Follow the prompts to create the data broker.

For help, refer to the following pages:

- [Create a data broker in AWS](#)
- [Create a data broker in Azure](#)
- [Create a data broker in Google Cloud](#)
- [Installing the data broker on a Linux host](#)

Steps to create a data broker in an existing group

1. Click **Sync > Manage Data Brokers**.
2. Click the action menu and select **Add Data Broker**.



3. Follow the prompts to create the data broker in the group.

For help, refer to the following pages:

- [Create a data broker in AWS](#)
- [Create a data broker in Azure](#)
- [Create a data broker in Google Cloud](#)
- [Installing the data broker on a Linux host](#)

Security recommendations

To ensure the security of your data broker machine, NetApp recommends the following:

- SSH should not permit X11 Forwarding
- SSH should not permit TCP connection forwarding
- SSH should not permit tunnels
- SSH should not accept client environment variables

These security recommendations can help prevent unauthorized connections to the data broker machine.

View a data broker's configuration

You might want to view details about a data broker to identify things like its host name, IP address, available CPU and RAM, and more.

Cloud Sync provides the following details about a data broker:

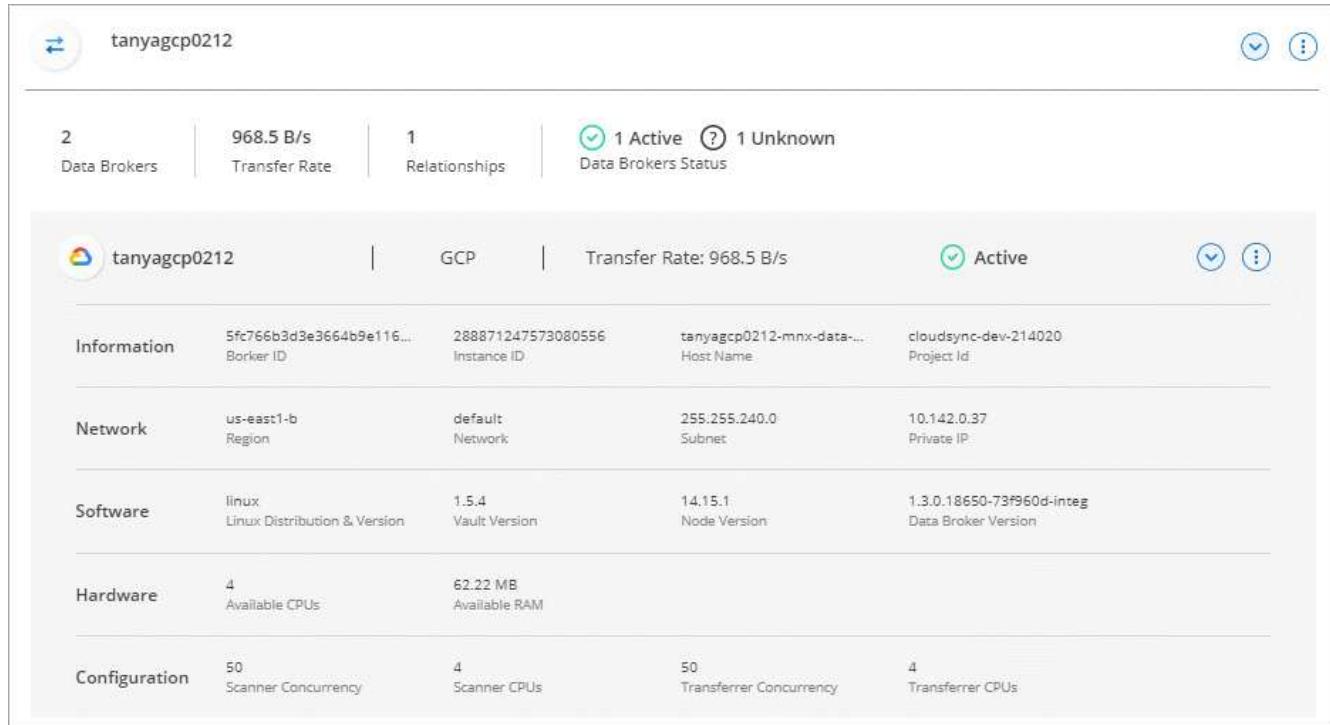
- Basic information: Instance ID, host name, etc.
- Network: Region, network, subnet, private IP, etc.
- Software: Linux distribution, data broker version, etc.
- Hardware: CPU and RAM
- Configuration: Details about the data broker's two kinds of main processes—scanner and transcoder



The scanner scans the source and target and decides what should be copied. The transcoder does the actual copying. NetApp personnel might use these configuration details to suggest actions that can optimize performance.

Steps

1. Click **Sync > Manage Data Brokers**.
2. Click  to expand the list of data brokers in a group.
3. Click  to view details about a data broker.



tanyagcp0212				
2 Data Brokers	968.5 B/s Transfer Rate	1 Relationships	1 Active 1 Unknown Data Brokers Status	⋮
 tanyagcp0212	GCP	Transfer Rate: 968.5 B/s	Active	⋮
Information	5fc766b3d3e3664b9e116... Broker ID	288871247573080556 Instance ID	tanyagcp0212-mnx-data-... Host Name	cloudsync-dev-214020 Project Id
Network	us-east1-b Region	default Network	255.255.240.0 Subnet	10.142.0.37 Private IP
Software	linux Linux Distribution & Version	1.5.4 Vault Version	14.15.1 Node Version	1.3.0.18650-73f960d-integ Data Broker Version
Hardware	4 Available CPUs	62.22 MB Available RAM		
Configuration	50 Scanner Concurrency	4 Scanner CPUs	50 Transferrer Concurrency	4 Transferrer CPUs

Remove a data broker from a group

You might remove a data broker from a group if it's no longer needed or if the initial deployment failed. This action only deletes the data broker from Cloud Sync's records. You'll need to manually delete the data broker and any additional cloud resources yourself.

Things you should know

- Cloud Sync deletes a group when you remove the last data broker from the group.
- You can't remove the last data broker from a group if there is a relationship using that group.

Steps

1. Click **Sync > Manage Data Brokers**.
2. Click  to expand the list of data brokers in a group.
3. Click the action menu for a data broker and select **Remove Data Broker**.

The screenshot shows the Cloud Sync interface with the title 'tanyagcp0212'. Below it, there's a summary section with metrics: 2 Data Brokers, 968.5 B/s Transfer Rate, 1 Relationships, and a status bar showing 1 Active and 1 Unknown broker. The main list contains two entries: 'tanyagcp0212' (GCP, Active) and 'tanya1' (ONPREM, Unknown). A context menu is open over the 'tanya1' entry, with the 'Remove Data Broker' option being pointed at.

4. Click **Remove Data Broker**.

Result

Cloud Sync removes the data broker from the group.

Edit a group's name

Change the name of a data broker group at any time.

Steps

1. Click **Sync > Manage Data Brokers**.
2. Click the action menu and select **Edit Group Name**.

The screenshot shows the Cloud Sync interface with the title 'tanyagcp0212'. Below it, there's a summary section with metrics: 2 Data Brokers, 968.5 B/s Transfer Rate, 1 Relationships, and a status bar showing 1 Active and 1 Unknown broker. The main list contains one entry: 'tanyagcp0212'. A context menu is open over the entry, with the 'Edit Group Name' option being pointed at.

3. Enter a new name and click **Save**.

Result

Cloud Sync updates the name of the data broker group.

Address issues with a data broker

Cloud Sync displays a status for each data broker that can help you troubleshoot issues.

Steps

1. Identify any data brokers that have a status of "Unknown" or "Failed."

The screenshot shows the Cloud Sync interface for a group named "tanyagcp0212". At the top, there are three icons: a double arrow, a refresh, and a settings gear. Below the header, there's a summary bar with the following information:

2 Data Brokers	968.5 B/s Transfer Rate	1 Relationships	1 Active (green checkmark) 1 Unknown (grey question mark)
Data Brokers Status			

Below the summary, there are two data broker entries:

tanyagcp0212 (GCP)	Transfer Rate: 968.5 B/s	Active (green checkmark)	More Options (blue gear, right arrow, three dots)
tanya1 (ONPREM)	Transfer Rate: N/A	Unknown (grey question mark)	More Options (blue gear, right arrow, three dots)

2. Hover over the icon to see the failure reason.

3. Correct the issue.

For example, you might need to simply restart the data broker if it's offline, or you might need to remove data broker if the initial deployment failed.

Define a unified configuration for a data broker group

If a sync relationship encounters errors during the sync process, unifying the concurrency of the data broker group can help to decrease the number of sync errors. Be aware that changes to the group's configuration can affect performance by slowing down the transfer.

We don't recommend changing the configuration on your own. You should consult with NetApp to understand when to change the configuration and how to change it.

Steps

1. Click **Manage Data Brokers**.
2. Click the Settings icon for a data broker group.

The screenshot shows the Cloud Sync interface for a group named "demo01". At the top, there are three icons: a double arrow, a refresh, and a settings gear. Below the header, there's a summary bar with the following information:

2 Data Brokers	2.33 MB/s Transfer Rate	22 Relationships	2 Active (green checkmark)
Data Brokers Status			

3. Change the settings as needed and then click **Unify Configuration**.

Note the following:

- You can pick and choose which settings to change—you don't need to change all four at once.
- After a new configuration is sent to a data broker, the data broker automatically restarts and uses the new configuration.
- It can take up to a minute until this change takes place and is visible in the Cloud Sync interface.
- If a data broker isn't running, its configuration won't change because Cloud Sync can't communicate with it. The configuration will change after the data broker restarts.

- After you set a unified configuration, any new data brokers will automatically use the new configuration.

Creating and viewing reports to tune your configuration

Create and view reports to get information that you can use with the help of NetApp personnel to tune a data broker's configuration and improve performance.

Each report provides in-depth details about a path in a sync relationship. For example, the report for a file system shows how many directories and files there are, the distribution of file size, how deep and wide the directories are, and more.

Creating reports

Each time that you create a report, Cloud Sync scans the path and then compiles the details into a report.

Steps

1. Click **Sync > Reports**.

The paths (source or target) in each of your sync relationships display in a table.

2. In the **Reports Actions** column, go to a specific path and click **Create**, or click the action menu and select **Create New**.
3. When the report is ready, click the action menu and select **View**.

Here's a sample report for a file system path.

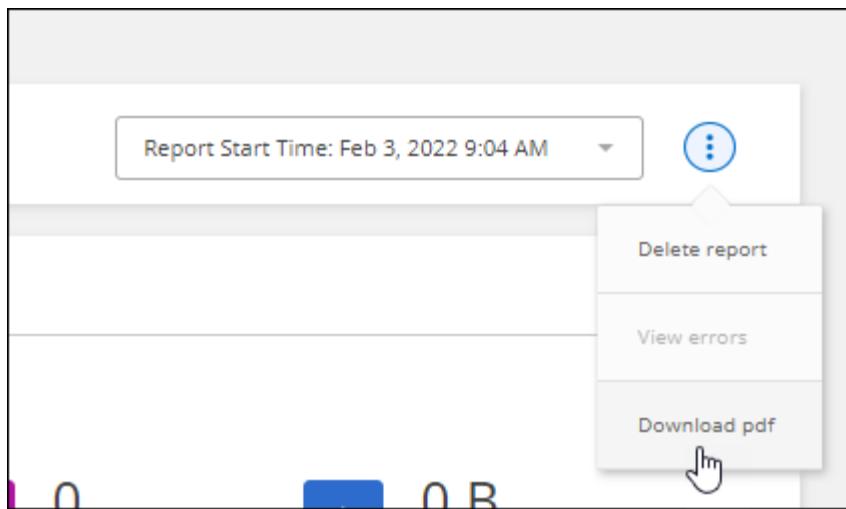
And here's a sample report for object storage.

Downloading reports

You can download a report in PDF so that you can view it offline or share it.

Steps

1. Click **Sync > Reports**.
2. In the **Reports Actions** column, click the action menu and select **View**.
3. In the top right of the report, click the action menu and select **Download pdf**.



Viewing report errors

The Paths table identifies whether any errors are present in the most recent report. An error identifies an issue that Cloud Sync faced when scanning the path.

For example, a report might contain permission denied errors. This type of error can affect Cloud Sync's ability to scan the entire set of files and directories.

After you view the list of errors, you can then address the issues and run the report again.

Steps

1. Click **Sync > Reports**.
2. In the **Errors** column, identify whether any errors are present in a report.
3. If errors are present, click the arrow next to the number of errors.

20 Paths								Actions
Path	Reports #	Last Report Date	Last Scan Duration	Last Report Status	Errors	Reports	Actions	
nfs://1.1.1.1/data1/success	2 Reports	Apr 12, 2021 11:34 AM	Less than a minute	Completed	None	...		
nfs://4.4.4.4/data1/success	2 Reports	Apr 19, 2021 3:21 PM	Less than a minute	Completed	None	...		
s3://phoebe/failed	1 Report	Apr 20, 2021 3:30 PM	Less than a minute	Failed	None	...		
s3://phoebe	2 Reports	Apr 19, 2021 1:23 PM	Less than a minute	Completed	1 ↗	...		
s3://large	1 Report	Apr 20, 2021 3:30 PM	Less than a minute	Completed	1 ↗	...		

4. Use the information in the error to correct the issue.

After you resolve the issue, the error shouldn't appear the next time that you run the report.

Deleting reports

You might delete a report if it contained an error that you fixed, or if the report is related to a sync relationship that you removed.

Steps

1. Click **Sync > Reports**.
2. In the **Reports Actions** column, click the action menu for a path and select **Delete last report** or **Delete all reports**.
3. Confirm that you want to delete the report or reports.

Uninstalling the data broker

If needed, run an uninstall script to remove the data broker and the packages and directories that were created when the data broker was installed.

Steps

1. Log in to the data broker host.
2. Change to the data broker directory: /opt/netapp/databroker
3. Run the following commands:

```
chmod +x uninstaller-DataBroker.sh  
./uninstaller-DataBroker.sh
```

4. Press 'y' to confirm the uninstallation.

Cloud Sync APIs

The Cloud Sync capabilities that are available through the web UI are also available through the RESTful API.

Getting started

To get started with the Cloud Sync API, you need to obtain a user token and your Cloud Central account ID. You'll need to add the token and account ID to the Authorization header when making API calls.

Steps

1. Obtain a user token from NetApp Cloud Central.

```
POST https://netapp-cloud-account.auth0.com/oauth/token  
Header: Content-Type: application/json  
Body:  
{  
    "username": "<user_email>",  
    "scope": "profile",  
    "audience": "https://api.cloud.netapp.com",  
    "client_id": "UavhOIXMWQs5i1WdDxauXe5Mqkb34Njq",  
    "grant_type": "password",  
    "password": "<user_password>"  
}
```

2. Obtain your Cloud Central account ID.

```
GET https://api.cloudsync.netapp.com/api/accounts
Headers: Authorization: Bearer <user_token>
Content-Type: application/json
```

This API will return a response like the following:

```
[  
  {  
    "accountId": "account-JeL97Ry3",  
    "name": "Test"  
  }  
]
```

3. Add the user token and account ID in the Authorization header of each API call.

Example

The following example shows an API call to create a data broker in Microsoft Azure. You would simply replace <user_token> and <accountId> with the token and ID that you obtained in the previous steps.

```
POST https://api.cloudsync.netapp.com/api/data-brokers
Headers: Authorization: Bearer <user_token>
Content-Type: application/json
x-account-id: <accountId>
Body: { "name": "databroker1", "type": "AZURE" }
```

What should I do when the token expires?

The user token from NetApp Cloud Central has an expiration date. To refresh the token, you need to call the API from step 1 again.

The API response includes an "expires_in" field that states when the token expires.

API reference

Documentation for each Cloud Sync API is available from <https://api.cloudsync.netapp.com/docs>.

Using list APIs

List APIs are asynchronous APIs, so the result does not return immediately (for example: GET /data-brokers/{id}/list-nfs-export-folders and GET /data-brokers/{id}/list-s3-buckets). The only response from the server is HTTP status 202. To get the actual result, you must use the GET

/messages/client API.

Steps

1. Call the list API that you want to use.
2. Use the GET /messages/client API to view the result of the operation.
3. Use the same API by appending it with the ID that you just received: GET
`http://api.cloudsync.netapp.com/api/messages/client?last=<id_from_step_2>`

Note that the ID changes each time that you call the GET /messages/client API.

Example

When you call the list-s3-buckets API, a result is not immediately returned:

```
GET http://api.cloudsync.netapp.com/api/data-brokers/<data-broker-id>/list-s3-buckets
Headers: Authorization: Bearer <user_token>
Content-Type: application/json
x-account-id: <accountId>
```

The result is HTTP status code 202, which means the message was accepted, but was not processed yet.

To get the result of the operation, you need to use the following API:

```
GET http://api.cloudsync.netapp.com/api/messages/client
Headers: Authorization: Bearer <user_token>
Content-Type: application/json
x-account-id: <accountId>
```

The result is an array with one object that includes an ID field. The ID field represents the last message that the server sent. For example:

```
[  
  {  
    "header": {  
      "requestId": "init",  
      "clientId": "init",  
      "agentId": "init"  
    },  
    "payload": {  
      "init": {}  
    },  
    "id": "5801"  
  }  
]
```

You would now make the following API call using the ID that you just received:

```
GET  
http://api.cloudsync.netapp.com/api/messages/client?last=<id_from_step_2>  
Headers: Authorization: Bearer <user_token>  
Content-Type: application/json  
x-account-id: <accountId>
```

The result is an array of messages. Inside each message is a payload object, which consists of the name of the operation (as key) and its result (as value). For example:

```

[
  {
    "payload": {
      "list-s3-buckets": [
        {
          "tags": [
            {
              "Value": "100$",
              "Key": "price"
            }
          ],
          "region": {
            "displayName": "US West (Oregon)",
            "name": "us-west-2"
          },
          "name": "small"
        }
      ]
    },
    "header": {
      "requestId": "f687ac55-2f0c-40e3-9fa6-57fb8c4094a3",
      "clientId": "5beb032f548e6e35f4ed1ba9",
      "agentId": "5bed61f4489fb04e34a9aac6"
    },
    "id": "5802"
  }
]

```

Cloud Sync technical FAQ

This FAQ can help if you're just looking for a quick answer to a question.

Getting started

The following questions relate to getting started with Cloud Sync.

How does Cloud Sync work?

Cloud Sync uses the NetApp data broker software to sync data from a source to a target (this is called a *sync relationship*).

A data broker group controls the sync relationships between your sources and targets. After you set up a sync relationship, Cloud Sync analyzes your source system and breaks it up into multiple replication streams to push to your selected target data.

After the initial copy, the service syncs any changed data based on the schedule that you set.

How does the 14-day free trial work?

The 14-day free trial starts when you sign up for the Cloud Sync service. You're not subject to NetApp charges for Cloud Sync relationships you create for 14 days. However, all resource charges for any data brokers that you deploy still applies.

How much does Cloud Sync cost?

There are two types of costs associated with using Cloud Sync: service charges and resource charges.

Service charges

For pay-as-you-go pricing, Cloud Sync service charges are hourly, based on the number of sync relationships that you create.

- [View pay-as-you-go pricing in AWS](#)
- [View annual pricing in AWS](#)
- [View pricing in Azure](#)

Cloud Sync licenses are also available through your NetApp representative. Each license enables 20 sync relationships for 12 months.

[Learn more about licenses.](#)



Cloud Sync relationships are free for Cloud Volumes Service and Azure NetApp Files.

Resource charges

The resource charges are related to the compute and storage costs for running the data broker in the cloud.

How is Cloud Sync billed?

There are two ways to pay for sync relationships after your 14-day free trial ends. The first option is to subscribe from AWS or Azure, which enables you to pay-as-you-go or to pay annually. The second option is to purchase licenses directly from NetApp.

Can I use Cloud Sync outside the cloud?

Yes, you can use Cloud Sync in a non-cloud architecture. The source and target can reside on-premises and so can the data broker software.

Note the following key points about using Cloud Sync outside of the cloud:

- For on-premises synchronization, a private Amazon S3 bucket is available through NetApp StorageGRID.
- A data broker group needs an internet connection to communicate with the Cloud Sync service.
- If you don't purchase a license directly from NetApp, you will need an AWS or Azure account for the PAYGO Cloud Sync service billing.

What's a data broker group?

Each data broker belongs to a data broker group. Grouping data brokers together helps improve the performance of sync relationships.

How do I access Cloud Sync?

Cloud Sync is available from Cloud Manager in the **Sync** tab.

Supported sources and targets

The following questions related to the source and targets that are supported in a sync relationship.

Which sources and targets does Cloud Sync support?

Cloud Sync supports many different types of sync relationships. [View the entire list.](#)

What versions of NFS and SMB does Cloud Sync support?

Cloud Sync supports NFS version 3 and later, and SMB version 1 and later.

[Learn more about sync requirements.](#)

When Amazon S3 is the target, can the data be tiered to a specific S3 storage class?

Yes, you can choose a specific S3 storage class when AWS S3 is the target:

- Standard (this is the default class)
- Intelligent-Tiering
- Standard-Infrequent Access
- One Zone-Infrequent Access
- Glacier
- Glacier Deep Archive

What about storage tiers for Azure Blob storage?

You can choose a specific Azure Blob storage tier when a Blob container is the target:

- Hot storage
- Cool storage

Do you support Google Cloud storage tiers?

Yes, you can choose a specific storage class when a Google Cloud Storage bucket is the target:

- Standard
- Nearline
- Coldline
- Archive

Networking

The following questions relate to networking requirements for Cloud Sync.

What are the networking requirements for Cloud Sync?

The Cloud Sync environment requires that a data broker group is connected with the source and the target through the selected protocol or object storage API (Amazon S3, Azure Blob, IBM Cloud Object Storage).

In addition, a data broker group needs an outbound internet connection over port 443 so it can communicate with the Cloud Sync service and contact a few other services and repositories.

For more details, [review networking requirements](#).

Can I use a proxy server with the data broker?

Yes.

Cloud Sync supports proxy servers with or without basic authentication. If you specify a proxy server when you deploy a data broker, all HTTP and HTTPS traffic from the data broker is routed through the proxy. Note that non-HTTP traffic such as NFS or SMB can't be routed through a proxy server.

The only proxy server limitation is when using data-in-flight encryption with an NFS or Azure NetApp Files sync relationship. The encrypted data is sent over HTTPS and isn't routable through a proxy server.

Data synchronization

The following questions relate to how data synchronization works.

How often does synchronization occur?

The default schedule is set for daily synchronization. After the initial synchronization, you can:

- Modify the sync schedule to your desired number of days, hours, or minutes
- Disable the sync schedule
- Delete the sync schedule (no data will be lost; only the sync relationship will be removed)

What is the minimum sync schedule?

You can schedule a relationship to sync data as often as every 1 minute.

Does the data broker group retry when a file fails to sync? Or does it timeout?

A data broker group doesn't timeout when a single file fails to transfer. Instead, the data broker group retries 3 times before skipping the file. The retry value is configurable in the settings for a sync relationship.

[Learn how to change the settings for a sync relationship.](#)

What if I have a very large dataset?

If a single directory contains 600,000 files or more, [contact us](#) so that we can help you configure the data broker group to handle the payload. We might need to add additional memory to the data broker group.

Note that there's no limit to the total number of files in the mount point. The extra memory is required for large directories with 600,000 files or more, regardless of their level in the hierarchy (top directory or subdirectory).

Security

The following questions related to security.

Is Cloud Sync secure?

Yes. All Cloud Sync service networking connectivity is done using [Amazon Simple Queue Service \(SQS\)](#).

All communication between the data broker group and Amazon S3, Azure Blob, Google Cloud Storage, and IBM Cloud Object Storage is done through the HTTPS protocol.

If you're using Cloud Sync with on-premises (source or destination) systems, here's a few recommended connectivity options:

- An AWS Direct Connect, Azure ExpressRoute, or Google Cloud Interconnect connection, which is non-internet routed (and can only communicate with the cloud networks that you specify)
- A VPN connection between your on-premises gateway device and your cloud networks
- For extra secure data transfer with S3 buckets, Azure Blob storage, or Google Cloud Storage, an Amazon Private S3 Endpoint, Azure Virtual Network service endpoints, or Private Google Access may be established.

Any of these methods establishes a secure connection between your on-premises NAS servers and a Cloud Sync data broker group.

Is data encrypted by Cloud Sync?

- Cloud Sync supports data-in-flight encryption between source and target NFS servers. [Learn more](#).
- For SMB, Cloud Sync supports SMB 3.0 and 3.11 data that you've encrypted on the server side. Cloud Sync copies the encrypted data from the source to the target where the data remains encrypted.

Cloud Sync cannot encrypt SMB data itself.

- When an Amazon S3 bucket is the target in a sync relationship, you can choose whether to enable data encryption using AWS KMS encryption or AES-256 encryption.

Permissions

The following questions relate to data permissions.

Are SMB data permissions synced to the target location?

You can set up Cloud Sync to preserve access control lists (ACLs) between a source SMB share and a target SMB share, and from a source SMB share to object storage (except for ONTAP S3).



Cloud Sync doesn't support copying ACLs from object storage to SMB shares.

[Learn how to copy ACLs between SMB shares](#).

Are NFS data permissions synced to the target location?

Cloud Sync automatically copies NFS permissions between NFS servers as follows:

- NFS version 3: Cloud Sync copies the permissions and the user/group owner.
- NFS version 4: Cloud Sync copies the ACLs.

Object storage metadata

Cloud Sync copies object storage metadata from the source to the target for the following types of sync relationships:

- Amazon S3 → Amazon S3¹
- Amazon S3 → StorageGRID
- StorageGRID → Amazon S3
- StorageGRID → StorageGRID
- StorageGRID → Google Cloud Storage
- Google Cloud Storage → StorageGRID¹
- Google Cloud Storage → IBM Cloud Object Storage¹
- Google Cloud Storage → Amazon S3¹
- Amazon S3 → Google Cloud Storage
- IBM Cloud Object Storage → Google Cloud Storage
- StorageGRID → IBM Cloud Object Storage
- IBM Cloud Object Storage → StorageGRID
- IBM Cloud Object Storage → IBM Cloud Object Storage

¹ For these sync relationships, you need to [enable a setting when you create the sync relationship](#).

Performance

The following questions relate to Cloud Sync performance.

What does the progress indicator for a sync relationship represent?

The sync relationship shows the throughput of the data broker group's network adapter. If you accelerated sync performance by using multiple data brokers, then the throughput is the sum of all traffic. This throughput refreshes every 20 seconds.

I'm experiencing performance issues. Can we limit the number of concurrent transfers?

If you have very large files (multiple TiBs each), it can take a long time to complete the transfer process and performance might be impacted.

Limiting the number of concurrent transfers can help. [Contact us for help](#).

Why am I experiencing low performance with Azure NetApp Files?

When you sync data to or from Azure NetApp Files, you might experience failures and performance issues if the disk service level is Standard.

Change the service level to Premium or Ultra to enhance the sync performance.

[Learn more about Azure NetApp Files service levels and throughput.](#)

Why am I experiencing low performance with Cloud Volumes Service for AWS?

When you sync data to or from a cloud volume, you might experience failures and performance issues if the level of performance for the cloud volume is Standard.

Change the Service level to Premium or Extreme to enhance the sync performance.

How many data brokers are required in a group?

When you create a new relationship, you start with a single data broker in a group (unless you selected an existing data broker that belongs to an accelerated sync relationship). In many cases, a single data broker can meet the performance requirements for a sync relationship. If it doesn't, you can accelerate sync performance by adding additional data brokers to the group. But you should first check other factors that can impact sync performance.

Multiple factors can impact data transfer performance. The overall sync performance might be impacted due to network bandwidth, latency, and network topology, as well as the data broker VM specs and storage system performance. For example, a single data broker in a group can reach 100 MB/s, while disk throughput on the target might only allow 64 MB/s. As a result, the data broker group keeps trying to copy the data, but the target can't meet the performance of the data broker group.

So be sure to check the performance of your networking and the disk throughput on the target.

Then you can consider accelerating sync performance by adding an additional data brokers to a group to share the load of that relationship. [Learn how to accelerate sync performance](#).

Deleting things

The following questions relate to deleting sync relationships and data from sources and targets.

What happens if I delete my Cloud Sync relationship?

Deleting a relationship stops all future data syncs and terminates payment. Any data that was synced to the target remains as-is.

What happens if I delete something from my source server? Is it removed from the target too?

By default, if you have an active sync relationship, the item deleted on the source server is not deleted from the target during the next synchronization. But there is an option in the sync settings for each relationship, where you can define that Cloud Sync will delete files in the target location if they were deleted from the source.

[Learn how to change the settings for a sync relationship.](#)

What happens if I delete something from my target? Is it removed from my source too?

If an item is deleted from the target, it will not be removed from the source. The relationship is one-way—from source to target. On the next sync cycle, Cloud Sync compares the source to the target, identifies that the item is missing, and Cloud Sync copies it again from the source to the target.

Troubleshooting

[NetApp Knowledgebase: Cloud Sync FAQ: Support and Troubleshooting](#)

Data broker deep dive

The following question relates to the data broker.

Can you explain the architecture of the data broker?

Sure. Here are the most important points:

- The data broker is a node.js application running on a Linux host.
- Cloud Sync deploys the data broker as follows:
 - AWS: From an AWS CloudFormation template
 - Azure: From Azure Resource Manager
 - Google: From Google Cloud Deployment Manager
 - If you use your own Linux host, you need to manually install the software
- The data broker software automatically upgrades itself to the latest version.
- The data broker uses AWS SQS as a reliable and secure communication channel and for control and monitoring. SQS also provides a persistency layer.
- You can add additional data brokers to a group to increase transfer speed and add high availability. There is service resiliency if one data broker fails.

Gain insight into data privacy

Learn about Cloud Data Sense

Cloud Data Sense is a data governance service for Cloud Manager that scans your corporate on-premises and cloud data sources and working environments to map and classify data, and to identify private information. This can help reduce your security and compliance risk, decrease storage costs, and assist with your data migration projects.

[Learn about the use cases for Cloud Data Sense.](#)

Features

Cloud Data Sense provides several tools that can help you with your compliance efforts. You can use Data Sense to:

- Identify Personal Identifiable Information (PII)
- Identify a wide scope of sensitive information as required by GDPR, CCPA, PCI, and HIPAA privacy regulations
- Respond to Data Subject Access Requests (DSAR)
- Notify Cloud Manager users through email when files contain certain PII (you define this criteria using [Policies](#))
- View and modify [Azure Information Protection \(AIP\) labels](#) in your files
- Add custom tags to files (for example, "needs to be moved") and assign a Cloud Manager user so that person can own updates to the files
- Copy, move, and delete files

Cloud Data Sense also provides tools that can help with your governance efforts. You can use Cloud Data Sense to:

- Identify the stale data, non-business data, duplicate files, and very large files in your systems.

You can use this information to decide whether you want to move, delete, or tier some files to less expensive object storage.

- View the size of data and whether any of the data contains sensitive information prior to moving it.

This is useful if you are planning to migrate data from on-premises locations to the cloud.

Supported working environments and data sources

Cloud Data Sense can scan data from the following types of working environments and data sources:

Working environments:

- Cloud Volumes ONTAP (deployed in AWS, Azure, or GCP)
- On-premises ONTAP clusters
- Azure NetApp Files

- Amazon FSx for ONTAP
- Amazon S3

Data sources:

- Non-NetApp file shares
- Object storage (that uses S3 protocol)
- Databases
- OneDrive accounts
- SharePoint accounts

Data Sense supports NFS versions 3.x, 4.0, and 4.1, and CIFS versions 1.x, 2.0, 2.1, and 3.0.



A Beta feature released in 2021 allows you to run compliance scans on the backup files (created using [Cloud Backup](#)) from your on-prem ONTAP volumes. This gives you the option to have Cloud Data Sense scan your on-prem ONTAP volumes directly, or scan the backup files made from those volumes.

Cost

- The cost to use Cloud Data Sense depends on the amount of data that you're scanning. The first 1 TB of data that Data Sense scans in a Cloud Manager workspace is free. This includes all data from all working environments and data sources. A subscription to the AWS, Azure, or GCP Marketplace, or a BYOL license from NetApp, is required to continue scanning data after that point. See [pricing](#) for details.

[Learn how to license Cloud Data Sense.](#)

Note: When scanning backup files created from your on-prem ONTAP systems, the scanned data does not count against the capacity purchased in your PAYGO subscription or BYOL license.

- Installing Cloud Data Sense in the cloud requires deploying a cloud instance, which results in charges from the cloud provider where it is deployed. See [the type of instance that is deployed for each cloud provider](#). There is no cost if you install Data Sense on an on-premises system.
- Cloud Data Sense requires that you have deployed a Connector. In many cases you already have a Connector because of other storage and services you are using in Cloud Manager. The Connector instance results in charges from the cloud provider where it is deployed. See [the type of instance that is deployed for each cloud provider](#). There is no cost if you install the Connector on an on-premises system.

Data transfer costs

Data transfer costs depend on your setup. If the Cloud Data Sense instance and data source are in the same Availability Zone and region, then there are no data transfer costs. But if the data source, such as a Cloud Volumes ONTAP cluster or S3 Bucket, is in a *different* Availability Zone or region, then you'll be charged by your cloud provider for data transfer costs. See these links for more details:

- [AWS: Amazon EC2 Pricing](#)
- [Microsoft Azure: Bandwidth Pricing Details](#)
- [Google Cloud: Storage Transfer Service pricing](#)

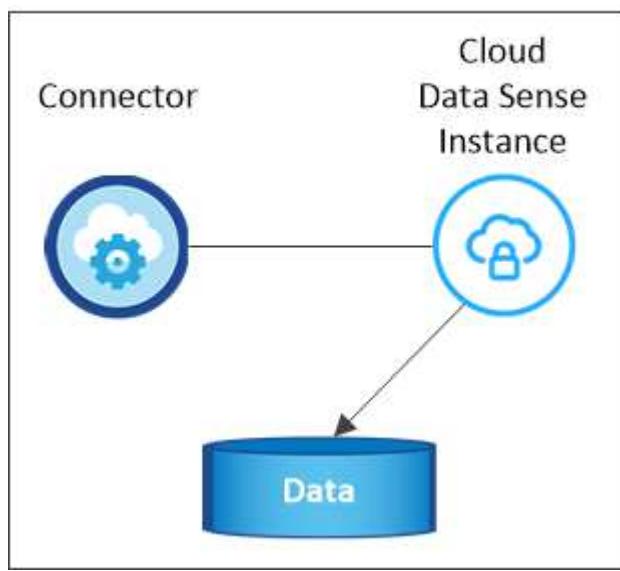
The Cloud Data Sense instance

When you deploy Data Sense in the cloud, Cloud Manager deploys the instance in the same subnet as the Connector. [Learn more about Connectors](#).



If the Connector is installed on-prem, it deploys the Cloud Data Sense instance in same VPC or VNet as the first Cloud Volumes ONTAP system in the request. You can install Data Sense on-prem as well.

VPC or VNet



Note the following about the default instance:

- In AWS, Cloud Data Sense runs on an [m5.4xlarge instance](#) with a 500 GB GP2 disk. The operating system image is Amazon Linux 2 (Red Hat 7.3.1).

In regions where m5.4xlarge isn't available, Data Sense runs on an m4.4xlarge instance instead.

- In Azure, Cloud Data Sense runs on a [Standard_D16s_v3 VM](#) with a 512 GB disk. The operating system image is CentOS 7.8.
- In GCP, Cloud Data Sense runs on an [n2-standard-16 VM](#) with a 512 GB Standard persistent disk. The operating system image is CentOS 7.9.

In regions where n2-standard-16 isn't available, Data Sense runs on an n2d-standard-16 or n1-standard-16 VM instead.

- The instance is named *CloudCompliance* with a generated hash (UUID) concatenated to it. For example: *CloudCompliance-16bb6564-38ad-4080-9a92-36f5fd2f71c7*
- Only one Data Sense instance is deployed per Connector.
- Upgrades of Data Sense software is automated as long as the instance has internet access.



The instance should remain running at all times because Cloud Data Sense continuously scans the data.

Using a smaller instance type

You can deploy Data Sense on a system with fewer CPUs and less RAM, but there are some limitations when using these less powerful systems.

System size	Specs	Limitations
Extra Large (default)	16 CPUs, 64 GB RAM, 500 GB SSD	None
Medium	8 CPUs, 32 GB RAM, 200 GB SSD	Slower scanning, and can only scan up to 1 million files.
Small	8 CPUs, 16 GB RAM, 100 GB SSD	Same limitations as "Medium", plus the ability to identify data subject names inside files is disabled.

When deploying Data Sense in the cloud, email ng-contact-data-sense@netapp.com for assistance if you want to use one of these smaller systems. We'll need to work with you to deploy these smaller cloud configurations.

When deploying Data Sense on-premises, just use a Linux host with the smaller specifications. You do not need to contact NetApp for assistance.

How Cloud Data Sense works

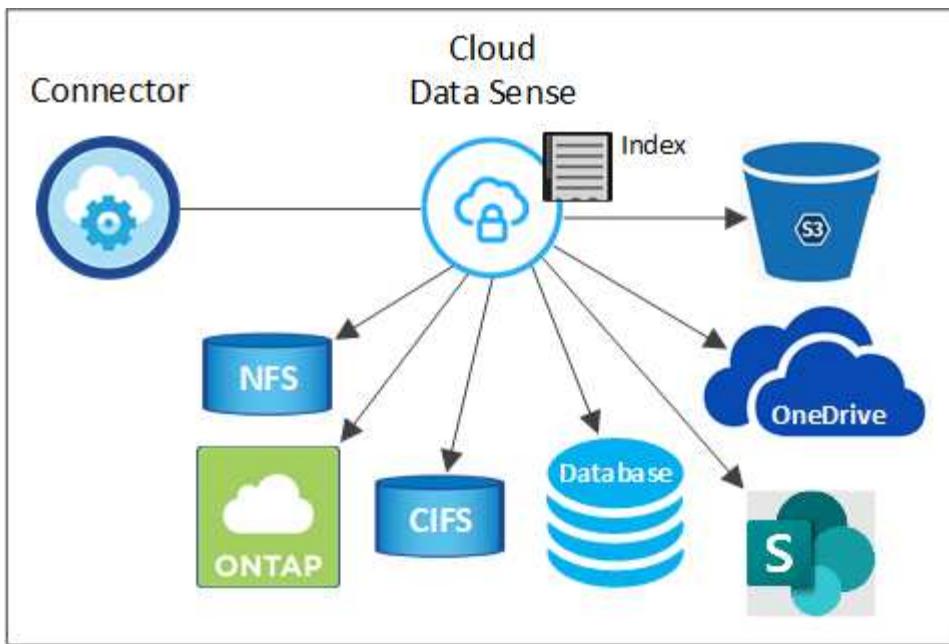
At a high-level, Cloud Data Sense works like this:

1. You deploy an instance of Data Sense in Cloud Manager.
2. You enable high-level mapping or deep-level scanning on one or more working environments or data sources.
3. Data Sense scans the data using an AI learning process.
4. You use the provided dashboards and reporting tools to help in your compliance and governance efforts.

How scans work

After you enable Cloud Data Sense and select the volumes, buckets, database schemas, or OneDrive or SharePoint user data you want to scan, it immediately starts scanning the data to identify personal and sensitive data. It maps your organizational data, categorizes each file, and identifies and extracts entities and predefined patterns in the data. The result of the scan is an index of personal information, sensitive personal information, data categories, and file types.

Data Sense connects to the data like any other client by mounting NFS and CIFS volumes. NFS volumes are automatically accessed as read-only, while you need to provide Active Directory credentials to scan CIFS volumes.



After the initial scan, Data Sense continuously scans your data to detect incremental changes (this is why it's important to keep the instance running).

You can enable and disable scans at the volume level, at the bucket level, at the database schema level, at the OneDrive user level, and at the SharePoint site level.

What's the difference between Mapping and Classification scans

Cloud Data Sense enables you to run a general "mapping" scan on selected working environments and data sources. Mapping provides only a high-level overview of your data, whereas Classification provides deep-level scanning of your data. Mapping can be done on your data sources very quickly because it does not access files to see the data inside.

Many users like this functionality because they want to quickly scan their data to identify the data sources that require more research - and then they can enable classification scans only on those data sources or volumes.

The table below shows some of the differences:

Feature	Classification	Mapping
Scan speed	Slow	Fast
List of file types and used capacity	Yes	Yes
Number of files and used capacity	Yes	Yes
Age and size of files	Yes	Yes
Ability to run a Data Mapping Report	Yes	Yes
Data Investigation page to view file details	Yes	No
Search for names within files	Yes	No
Create policies that provide custom search results	Yes	No
Categorize data using AIP labels and Status tags	Yes	No
Copy, delete, and move source files	Yes	No

Feature	Classification	Mapping
Ability to run other reports	Yes	No

Information that Cloud Data Sense indexes

Data Sense collects, indexes, and assigns categories to your data (files). The data that Data Sense indexes includes the following:

Standard metadata

Cloud Data Sense collects standard metadata about files: the file type, its size, creation and modification dates, and so on.

Personal data

Personally identifiable information such as email addresses, identification numbers, or credit card numbers. [Learn more about personal data](#).

Sensitive personal data

Special types of sensitive information, such as health data, ethnic origin, or political opinions, as defined by GDPR and other privacy regulations. [Learn more about sensitive personal data](#).

Categories

Cloud Data Sense takes the data that it scanned and divides it into different types of categories. Categories are topics based on AI analysis of the content and metadata of each file. [Learn more about categories](#).

Types

Cloud Data Sense takes the data that it scanned and breaks it down by file type. [Learn more about types](#).

Name entity recognition

Cloud Data Sense uses AI to extract natural persons' names from documents. [Learn about responding to Data Subject Access Requests](#).

Networking overview

Cloud Manager deploys the Cloud Data Sense instance with a security group that enables inbound HTTP connections from the Connector instance.

When using Cloud Manager in SaaS mode, the connection to Cloud Manager is served over HTTPS, and the private data sent between your browser and the Data Sense instance are secured with end-to-end encryption, which means NetApp and third parties can't read it.

If you need to use the local user interface instead of the SaaS user interface for any reason, you can still [access the local UI](#).

Outbound rules are completely open. Internet access is needed to install and upgrade the Data Sense software and to send usage metrics.

If you have strict networking requirements, [learn about the endpoints that Cloud Data Sense contacts](#).

User access to compliance information

The role each user has been assigned provides different capabilities within Cloud Manager and within Cloud Data Sense:

- An **Account Admin** can manage compliance settings and view compliance information for all working environments.
- A **Workspace Admin** can manage compliance settings and view compliance information only for systems that they have permissions to access. If a Workspace Admin can't access a working environment in Cloud Manager, then they can't see any compliance information for the working environment in the Data Sense tab.
- Users with the **Compliance Viewer** role can only view compliance information and generate reports for systems that they have permission to access. These users cannot enable/disable scanning of volumes, buckets, or database schemas. These users can't copy, move, or delete files either.

Learn more about [Cloud Manager roles](#) and how to [add users with specific roles](#).

Get started

Deploy Cloud Data Sense

Deploy Cloud Data Sense in the cloud

Complete a few steps to deploy Cloud Data Sense in the cloud.

Note that you can also [deploy Data Sense on a Linux host that has internet access](#). The type of installation may be a good option if you prefer to scan on-premises ONTAP systems using a Data Sense instance that's also located on premises—but this is not a requirement. The software functions exactly the same way regardless of which installation method you choose.

Quick start

Get started quickly by following these steps, or scroll down to the remaining sections for full details.

1

Create a Connector

If you don't already have a Connector, create a Connector now. See [creating a Connector in AWS](#), [creating a Connector in Azure](#), or [creating a Connector in GCP](#).

You can also [deploy the Connector on-premises](#) on a Linux host in your network or in the cloud.

2

Review prerequisites

Ensure that your environment can meet the prerequisites. This includes outbound internet access for the instance, connectivity between the Connector and Cloud Data Sense over port 443, and more. [See the complete list](#).

The default configuration requires 16 vCPUs for the Cloud Data Sense instance. See [more details about the instance type](#).

3

Deploy Cloud Data Sense

Launch the installation wizard to deploy the Cloud Data Sense instance in the cloud.

4

Subscribe to the Cloud Data Sense service

The first 1 TB of data that Cloud Data Sense scans in Cloud Manager is free. A Cloud Manager subscription through your cloud provider Marketplace, or a BYOL license from NetApp, is required to continue scanning data after that point.

Create a Connector

If you don't already have a Connector, create a Connector in your cloud provider. See [creating a Connector in AWS](#) or [creating a Connector in Azure](#), or [creating a Connector in GCP](#). In most cases you will probably have a Connector set up before you attempt to activate Cloud Data Sense because most [Cloud Manager features require a Connector](#), but there are cases where you'll need to set one up now.

There are some scenarios where you have to use a Connector that's deployed in a specific cloud provider:

- When scanning data in Cloud Volumes ONTAP in AWS, Amazon FSx for ONTAP, or in AWS S3 buckets, you use a connector in AWS.
- When scanning data in Cloud Volumes ONTAP in Azure or in Azure NetApp Files, you use a connector in Azure.
- When scanning data in Cloud Volumes ONTAP in GCP, you use a Connector in GCP.

On-prem ONTAP systems, non-NetApp file shares, generic S3 Object storage, databases, OneDrive folders, and SharePoint accounts can be scanned when using any of these cloud Connectors.

Note that you can also [deploy the Connector on-premises](#) on a Linux host in your network or in the cloud. Some users planning to install Data Sense on-prem may also choose to install the Connector on-prem.

As you can see, there may be some situations where you need to use [multiple Connectors](#).



If you're planning on scanning Azure NetApp Files volumes, you need to make sure you're deploying in the same region as the volumes you wish to scan.

Review prerequisites

Review the following prerequisites to make sure that you have a supported configuration before you deploy Cloud Data Sense in the cloud.

Enable outbound internet access from Cloud Data Sense

Cloud Data Sense requires outbound internet access. If your virtual or physical network uses a proxy server for internet access, ensure that the Data Sense instance has outbound internet access to contact the following endpoints. When you deploy Data Sense in the cloud, it's located in the same subnet as the Connector.

Review the appropriate table below depending on whether you are deploying Cloud Data Sense in AWS, Azure, or GCP.

Required endpoints for AWS deployments:

Endpoints	Purpose
https://cloudmanager.cloud.netapp.com	Communication with the Cloud Manager service, which includes NetApp accounts.

Endpoints	Purpose
https://netapp-cloud-account.auth0.com https://auth0.com	Communication with NetApp Cloud Central for centralized user authentication.
https://cloud-compliance-support-netapp.s3.us-west-2.amazonaws.com https://hub.docker.com https://auth.docker.io https://registry-1.docker.io https://index.docker.io/ https://dseasb33srnnr.cloudfront.net/ https://production.cloudflare.docker.com/	Provides access to software images, manifests, and templates.
https://kinesis.us-east-1.amazonaws.com	Enables NetApp to stream data from audit records.
https://cognito-idp.us-east-1.amazonaws.com https://cognito-identity.us-east-1.amazonaws.com https://user-feedback-store-prod.s3.us-west-2.amazonaws.com https://customer-data-production.s3.us-west-2.amazonaws.com	Enables Cloud Data Sense to access and download manifests and templates, and to send logs and metrics.

Required endpoints for Azure and GCP deployments:

Endpoints	Purpose
https://cloudmanager.cloud.netapp.com	Communication with the Cloud Manager service, which includes NetApp accounts.
https://netapp-cloud-account.auth0.com https://auth0.com	Communication with NetApp Cloud Central for centralized user authentication.
https://support.compliance.cloudmanager.cloud.netapp.com/ https://hub.docker.com https://auth.docker.io https://registry-1.docker.io https://index.docker.io/ https://dseasb33srnnr.cloudfront.net/ https://production.cloudflare.docker.com/	Provides access to software images, manifests, templates, and to send logs and metrics.
https://support.compliance.cloudmanager.cloud.netapp.com/	Enables NetApp to stream data from audit records.

Ensure that Cloud Manager has the required permissions

Ensure that Cloud Manager has permissions to deploy resources and create security groups for the Cloud Data Sense instance. You can find the latest Cloud Manager permissions in [the policies provided by NetApp](#).

Note: If you created the Connector in GCP using Cloud Manager 3.9.10 or greater, then you're all set. If you created the Connector using an earlier version, then you'll need to add the following permissions to the GCP service account associated with the Connector to deploy Cloud Data Sense to GCP.

```
compute.instances.addAccessConfig  
compute.subnetworks.use  
compute.subnetworks.useExternalIp
```

Check your vCPU limits

Ensure that your cloud provider's vCPU limit allows for the deployment of an instance with 16 cores. You'll need to verify the vCPU limit for the relevant instance family in the region where Cloud Manager is running. See [the required instance types](#).

See the following links for more details on vCPU limits:

- [AWS documentation: Amazon EC2 service quotas](#)
- [Azure documentation: Virtual machine vCPU quotas](#)
- [Google Cloud documentation: Resource quotas](#)

Note that you can deploy Data Sense on a system with fewer CPUs and less RAM, but there are limitations when using these systems. See [Using a smaller instance type](#) for details.

Ensure that the Cloud Manager Connector can access Cloud Data Sense

Ensure connectivity between the Connector and the Cloud Data Sense instance. The security group for the Connector must allow inbound and outbound traffic over port 443 to and from the Data Sense instance. This connection enables deployment of the Data Sense instance and enables you to view information in the Compliance and Governance tabs.

Cloud Data Sense is supported in Government regions in AWS and Azure. Additional inbound and outbound rules are required for AWS and AWS GovCloud deployments. See [Rules for the Connector in AWS](#) for details.

Ensure that you can keep Cloud Data Sense running

The Cloud Data Sense instance needs to stay on to continuously scan your data.

Ensure web browser connectivity to Cloud Data Sense

After Cloud Data Sense is enabled, ensure that users access the Cloud Manager interface from a host that has a connection to the Data Sense instance.

The Data Sense instance uses a private IP address to ensure that the indexed data isn't accessible to the internet. As a result, the web browser that you use to access Cloud Manager must have a connection to that private IP address. That connection can come from a direct connection to your cloud provider (for example, a VPN), or from a host that's inside the same network as the Data Sense instance.

Deploy Data Sense in the cloud

Follow these steps to deploy an instance of Cloud Data Sense in the cloud.

Steps

1. In Cloud Manager, click **Data Sense**.
2. Click **Activate Data Sense**.

The screenshot shows the Data Sense dashboard. At the top left is a blue circular icon with a white cloud and gear symbol, followed by the text "Data Sense". Below it is a link "How does it work? ⓘ". The main title "Classify and take Control of your data with Cloud Data Sense" is displayed in large, bold, dark blue font. A brief description follows: "Driven by powerful artificial intelligence, NetApp Cloud Data Sense gives you control of your data. Map, classify and understand all your cloud and on-premises data to stay secure and compliant, reduce storage costs, and get assistance with data migration projects." A blue button labeled "Activate Data Sense" is highlighted with a red border. To the right is a detailed data visualization section titled "Data Overview" which includes "Nearly Saving Opportunities" (with three categories: Non-Business Data, Business Data, and Non-Business Data), "Highlights" (with metrics like 708K files and 566K bytes), and "Data Replication" and "Open Permissions" charts.

3. Click **Activate Data Sense** to start the cloud deployment wizard.

The screenshot shows the "Select where to deploy Data Sense" step of the wizard. It has two main options: "Deploy Data Sense in the Cloud" (marked as "Recommended") and "Deploy Data Sense On-Premises". Each option has an "Activate Data Sense" button to its right, which is highlighted with a red border. A note below the first option states: "We recommend deploying Data Sense in the Cloud. Selecting this option will deploy the instance in the same location as the Cloud Manager Connector instance." There are also up and down arrows on the right side of the screen.

4. The wizard displays progress as it goes through the deployment steps. It will stop and ask for input if it runs into any issues.

The screenshot shows the "Deploying Cloud Data Sense" progress page. It displays a message: "This may take up to 15 minutes. Check this page periodically to make sure the deployment continues successfully." On the left is a vertical stack of three icons: a document with a checkmark, a magnifying glass, and a cloud with a gear. To the right of these icons are three status messages: "Deploying Cloud Data Sense instance", "Verifying connectivity to the Cloud Manager and to the Internet", and "Initializing Cloud Data Sense". At the bottom is a blue "Cancel deployment" button.

5. When the instance is deployed, click **Continue to configuration** to go to the *Configuration* page.

Result

Cloud Manager deploys the Cloud Data Sense instance in your cloud provider.

What's Next

From the Configuration page you can select the data sources that you want to scan.

You can also [set up licensing for Cloud Data Sense](#) at this time. You will not be charged until the amount of data exceeds 1 TB.

Deploy Cloud Data Sense on a Linux host that has internet access

Complete a few steps to deploy Cloud Data Sense on a Linux host in your network, or in the cloud, that has internet access.

The on-prem installation may be a good option if you prefer to scan on-premises ONTAP systems using a Data Sense instance that's also located on premises — but this is not a requirement. The software functions exactly the same way regardless of which installation method you choose.

Note that you can also [deploy Data Sense in an on-premises site that doesn't have internet access](#) for completely secure sites.

Quick start

Get started quickly by following these steps, or scroll down to the remaining sections for full details.

1

Create a Connector

If you don't already have a Connector, create a Connector now. See [creating a Connector in AWS](#), [creating a Connector in Azure](#), or [creating a Connector in GCP](#).

You can also [deploy the Connector on-premises](#) on a Linux host in your network or in the cloud.

2

Review prerequisites

Ensure that your environment can meet the prerequisites. This includes outbound internet access for the instance, connectivity between the Connector and Cloud Data Sense over port 443, and more. [See the complete list](#).

You also need a Linux system that meets the [following requirements](#).

3

Deploy Cloud Data Sense

Download the Cloud Data Sense software from the NetApp Support Site and copy the installer file to the Linux host you plan to use. Then launch the installation wizard and follow the prompts to deploy the Data Sense instance.

4

Subscribe to the Cloud Data Sense service

The first 1 TB of data that Cloud Data Sense scans in Cloud Manager is free. A subscription to your cloud provider Marketplace, or a BYOL license from NetApp, is required to continue scanning data after that point.

Create a Connector

If you don't already have a Connector, create a Connector in your cloud provider. See [creating a Connector in AWS](#) or [creating a Connector in Azure](#), or [creating a Connector in GCP](#). In most cases you will probably have a Connector set up before you attempt to activate Cloud Data Sense because most [Cloud Manager features require a Connector](#), but there are cases where you'll need to set one up now.

There are some scenarios where you have to use a Connector that's deployed in a specific cloud provider:

- When scanning data in Cloud Volumes ONTAP in AWS, Amazon FSx for ONTAP, or in AWS S3 buckets, you use a connector in AWS.
- When scanning data in Cloud Volumes ONTAP in Azure or in Azure NetApp Files, you use a connector in Azure.
- When scanning data in Cloud Volumes ONTAP in GCP, you use a connector in GCP.

On-prem ONTAP systems, non-NetApp file shares, generic S3 Object storage, databases, OneDrive folders, and SharePoint accounts can be scanned using any of these cloud Connectors.

Note that you can also [deploy the Connector on-premises](#) on a Linux host in your network or in the cloud. Some users planning to install Data Sense on-prem may also choose to install the Connector on-prem.

As you can see, there may be some situations where you need to use [multiple Connectors](#).



If you're planning on scanning Azure NetApp Files volumes, you need to make sure you're deploying in the same region as the volumes you wish to scan.

Prepare the Linux host system

Data Sense software must run on a host that meets specific operating system requirements, RAM requirements, software requirements, and so on.

- Operating system: Red Hat Enterprise Linux or CentOS version 8.0 or 8.1
 - Version 7.8 can be used, but the Linux kernel version must be 4.14 or greater
 - The OS must be capable of installing the docker engine (for example, disable the `firewalld` service if needed)
- Disk: SSD with 500 GiB available on /, or
 - 100 GiB available on /opt
 - 400 GiB available on /var
- RAM: 64 GB (swap memory must be disabled on the host)
- CPU: 16 cores

Note that you can deploy Data Sense on a system with fewer CPUs and less RAM, but there are limitations when using these systems. See [Using a smaller instance type](#) for details.

- A Red Hat Enterprise Linux system must be registered with Red Hat Subscription Management. If it's not registered, the system can't access repositories to update required 3rd party software during installation.
- The following software must be installed on the host. If it doesn't already exist on the host, then the installer will install the software for you:
 - Docker Engine version 19 or later. [View installation instructions](#).

- Python 3 version 3.6 or later. [View installation instructions](#).

Verify Cloud Manager and Data Sense prerequisites

Review the following prerequisites to make sure that you have a supported configuration before you deploy Cloud Data Sense on a Linux system.

Enable outbound internet access from Cloud Data Sense

Cloud Data Sense requires outbound internet access. If your virtual or physical network uses a proxy server for internet access, ensure that the Data Sense instance has outbound internet access to contact the following endpoints.

Endpoints	Purpose
https://cloudmanager.cloud.netapp.com	Communication with the Cloud Manager service, which includes NetApp accounts.
https://netapp-cloud-account.auth0.com https://auth0.com	Communication with NetApp Cloud Central for centralized user authentication.
https://support.compliance.cloudmanager.cloud.netapp.com/ https://hub.docker.com https://auth.docker.io https://registry-1.docker.io https://index.docker.io/ https://dseasb33srnnr.cloudfront.net/ https://production.cloudflare.docker.com/	Provides access to software images, manifests, templates, and to send logs and metrics.
https://support.compliance.cloudmanager.cloud.netapp.com/	Enables NetApp to stream data from audit records.
https://github.com/docker https://download.docker.com http://mirror.centos.org http://mirrorlist.centos.org http://mirror.centos.org/centos/7/extras/x86_64/Packages/container-selinux-2.107-3.el7.noarch.rpm	Provides prerequisite packages for installation.

Ensure that Cloud Manager has the required permissions

Ensure that Cloud Manager has permissions to deploy resources and create security groups for the Cloud Data Sense instance. You can find the latest Cloud Manager permissions in [the policies provided by NetApp](#).

Note: If you created the Connector in GCP using Cloud Manager 3.9.10 or greater, then you're all set. If you created the Connector using an earlier version, then you'll need to add the following permissions to the GCP service account associated with the Connector to deploy Cloud Data Sense to GCP.

```
compute.instances.addAccessConfig
compute.subnetworks.use
compute.subnetworks.useExternalIp
```

Ensure that the Cloud Manager Connector can access Cloud Data Sense

Ensure connectivity between the Connector and the Cloud Data Sense instance. The security group for the Connector must allow inbound and outbound traffic over port 443 to and from the Data Sense instance.

This connection enables deployment of the Data Sense instance and enables you to view information in the Compliance and Governance tabs.

Make sure port 8080 is open so you can see the installation progress in Cloud Manager.

Ensure that you can keep Cloud Data Sense running

The Cloud Data Sense instance needs to stay on to continuously scan your data.

Ensure web browser connectivity to Cloud Data Sense

After Cloud Data Sense is enabled, ensure that users access the Cloud Manager interface from a host that has a connection to the Data Sense instance.

The Data Sense instance uses a private IP address to ensure that the indexed data isn't accessible to the internet. As a result, the web browser that you use to access Cloud Manager must have a connection to that private IP address. That connection can come from a direct connection to your cloud provider (for example, a VPN), or from a host that's inside the same network as the Data Sense instance.

Deploy Data Sense on premises

For typical configurations you'll install the software on a single host system. [See those steps here](#).

For very large configurations where you'll be scanning petabytes of data, you can include multiple hosts to provide additional processing power. [See those steps here](#).

See [Preparing the Linux host system](#) and [Reviewing prerequisites](#) for the full list of requirements before you deploy Cloud Data Sense.

Upgrades to Data Sense software is automated as long as the instance has internet connectivity.



Cloud Data Sense is currently unable to scan S3 buckets, Azure NetApp Files, or FSx for ONTAP when the software is installed on premises. In these cases you'll need to deploy a separate Connector and instance of Data Sense in the cloud and [switch between Connectors](#) for your different data sources.

Single-host installation for typical configurations

Follow these steps when installing Data Sense software on a single on-premises host.

What you'll need

- Verify that your Linux system meets the [host requirements](#).
- (Optional) Verify that the system has the two prerequisite software packages installed (Docker Engine and Python 3). The installer will install this software if it is not already on the system.
- Make sure you have root privileges on the Linux system.
- Verify that your offline environment meets the required [permissions and connectivity](#).

Steps

1. Download the Cloud Data Sense software from the [NetApp Support Site](#). The file you should select is named **cc_onprem_installer_<version>.tar.gz**.

2. Copy the installer file to the Linux host you plan to use (using `scp` or some other method).
3. In Cloud Manager, click **Data Sense**.
4. Click **Activate Data Sense**.

The screenshot shows the 'Data Sense' dashboard. At the top left is a cloud icon with a blue 'B' and the text 'Data Sense'. Below it is a link 'How does it work?'. The main title 'Classify and take Control of your data with Cloud Data Sense' is displayed in large blue text. A descriptive paragraph follows: 'Driven by powerful artificial intelligence, NetApp Cloud Data Sense gives you control of your data. Map, classify and understand all your cloud and on-premises data to stay secure and compliant, reduce storage costs, and get assistance with data migration projects.' A prominent blue button labeled 'Activate Data Sense' is centered at the bottom of the dashboard, with a red box drawn around it.

5. Click **Activate Data Sense** to start the on-prem deployment wizard.

The screenshot shows a dialog titled 'Select where to deploy Data Sense'. It has two main sections: 'Deploy Data Sense in the Cloud' (Recommended) and 'Deploy Data Sense On-Premises'. The 'On-Premises' section contains a sub-section with a note: 'For special situations, for example, if you wish to scan on-premises Working Environments and you prefer Compliance accesses the data from an on-premises location.' A blue button labeled 'Activate Data Sense' is located in the 'On-Premises' section, with a red box drawn around it.

6. In the *Deploy Data Sense On Premises* dialog, copy the provided command and paste it in a text file so you can use it later, and click **Close**. For example:

```
sudo ./install.sh -a 12345 -c 27AG75 -t 2198qq
```

7. Unzip the installer file on the host machine, for example:

```
tar -xzf cc_onprem_installer_1.7.2.tar.gz
```

8. When prompted by the installer, you can enter the required values in a series of prompts, or you can enter the complete command in the first prompt:

Enter parameters as prompted:	Enter the full command:
<ol style="list-style-type: none"> 1. Paste the information you copied from step 6: <code>sudo ./install.sh -a <account_id> -c <agent_id> -t <token></code> 2. Enter the IP address or host name of the Data Sense host machine so it can be accessed by the Connector instance. 3. Enter the IP address or host name of the Cloud Manager Connector host machine so it can be accessed by the Data Sense instance. 4. Enter proxy details as prompted. If your Cloud Manager already uses a proxy, there is no need to enter this information again here since Data Sense will automatically use the proxy used by Cloud Manager. 	<p>Alternatively, you can create the whole command in advance and enter it in the first prompt:</p> <pre>sudo ./install.sh -a <account_id> -c <agent_id> -t <token> --host <ds_host> --cm-host <cm_host> --proxy-host <proxy_host> --proxy-port <proxy_port> --proxy-scheme <proxy_scheme> --proxy-user <proxy_user> --proxy-password <proxy_password></pre>

Variable values:

- *account_id* = NetApp Account ID
- *agent_id* = Connector ID
- *token* = jwt user token
- *ds_host* = IP address or host name of the Data Sense Linux system.
- *cm_host* = IP address or host name of the Cloud Manager Connector system.
- *proxy_host* = IP or host name of the proxy server if the host is behind a proxy server.
- *proxy_port* = Port to connect to the proxy server (default 80).
- *proxy_scheme* = Connection scheme: https or http (default http).
- *proxy_user* = Authenticated user to connect to the proxy server, if basic authentication is required.
- *proxy_password* = Password for the user name that you specified.

Result

The Cloud Data Sense installer installs packages, installs docker, registers the installation, and installs Data Sense. Installation can take 10 to 20 minutes.

If there is connectivity over port 8080 between the host machine and the Connector instance, you will see the installation progress in the Data Sense tab in Cloud Manager.

What's Next

From the Configuration page you can select the data sources that you want to scan.

You can also [set up licensing for Cloud Data Sense](#) at this time. You will not be charged until the amount of data exceeds 1 TB.

Multi-host installation for large configurations

For very large configurations where you'll be scanning petabytes of data, you can include multiple hosts to provide additional processing power. When using multiple host systems, the primary system is called the

Manager node and the additional systems that provide extra processing power are called *Scanner nodes*.

Follow these steps when installing Data Sense software on multiple on-premises hosts.

What you'll need

- Verify that all your Linux systems for the Manager and Scanner nodes meet the [host requirements](#).
- (Optional) Verify that the systems have the two prerequisite software packages installed (Docker Engine and Python 3). The installer will install this software if it is not already on the systems.
- Make sure you have root privileges on the Linux systems.
- Verify that your environment meets the required [permissions and connectivity](#).
- You must have the IP addresses of the scanner node hosts that you plan to use.
- The following ports and protocols must be enabled on all hosts:

Port	Protocols	Description
2377	TCP	Cluster management communications
7946	TCP, UDP	Inter-node communication
4789	UDP	Overlay network traffic
50	ESP	Encrypted IPsec overlay network (ESP) traffic
111	TCP, UDP	NFS Server for sharing files between the hosts (needed from each scanner node to manager node)
2049	TCP, UDP	NFS Server for sharing files between the hosts (needed from each scanner node to manager node)

Steps

1. Follow steps 1 through 7 from the [Single-host installation](#) on the manager node.
2. As shown in step 8, when prompted by the installer, you can enter the required values in a series of prompts, or you can enter the complete command in the first prompt.

In addition to the variables available for a single-host installation, a new option **-n <node_ip>** is used to specify the IP addresses of the scanner nodes. Multiple scanner node IPs are separated by a comma.

For example, this command adds 3 scanner nodes:

```
sudo ./install.sh -a <account_id> -c <agent_id> -t <token> --host <ds_host>
--cm-host <cm_host> -n <node_ip1>,<node_ip2>,<node_ip3> --proxy-host
<proxy_host> --proxy-port <proxy_port> --proxy-scheme <proxy_scheme> --proxy
-user <proxy_user> --proxy-password <proxy_password>
```

3. Before the manager node installation completes, a dialog displays the installation command needed for the scanner nodes. Copy the command and save it in a text file. For example:

```
sudo ./node_install.sh -m 10.11.12.13 -t ABCDEF-1-3u69m1-1s35212
```

4. On **each** scanner node host:
 - a. Copy the Data Sense installer file (**cc_onprem_installer_<version>.tar.gz**) to the host machine (using **scp** or some other method).
 - b. Unzip the installer file.

- c. Paste and execute the command that you copied in step 3.

When the installation finishes on all scanner nodes and they have been joined to the manager node, the manager node installation finishes as well.

Result

The Cloud Data Sense installer finishes installing packages, docker, and registers the installation. Installation can take 10 to 20 minutes.

What's Next

From the Configuration page you can select the data sources that you want to scan.

You can also [set up licensing for Cloud Data Sense](#) at this time. You will not be charged until the amount of data exceeds 1 TB.

Deploy Cloud Data Sense on prem without internet access

Complete a few steps to deploy Cloud Data Sense on a host in an on-premises site that doesn't have internet access. This type of installation is perfect for your secure sites.

Note that you can also [deploy Data Sense in an on-premises site that has internet access](#).

Supported data sources

When installed in this manner (sometimes called an "offline" or "dark" site), Data Sense can only scan data from data sources that are also local to the on-premises site. At this time, Data Sense can scan the following local data sources:

- On-premises ONTAP systems
- Database schemas
- Non-NetApp NFS or CIFS file shares
- Object Storage that uses the Simple Storage Service (S3) protocol

There is no support currently for scanning Cloud Volumes ONTAP, Azure NetApp Files, FSx for ONTAP, OneDrive accounts, SharePoint accounts, or AWS S3 accounts.

Limitations

Most Data Sense features work when it is deployed in a site with no internet access. However, certain features that require internet access are not supported, for example:

- Managing Microsoft Azure Information Protection (AIP) labels
- Automated software upgrades from Cloud Manager

Both the Cloud Manager Connector and Data Sense will require periodic manual upgrades to enable new features. You can see the Data Sense version at the bottom of the Data Sense UI pages. Check the [Cloud Manager What's New](#) to see the new features in each release and for when a software update package is available. Then you can follow the steps to [upgrade your Data Sense software](#).

Quick start

Get started quickly by following these steps, or scroll down to the remaining sections for full details.

1

Install the Cloud Manager Connector

If you don't already have a Connector installed at your offline on-premises site, [deploy the Connector](#) on a Linux host now.

2

Review Data Sense prerequisites

Ensure that your Linux system meets the [host requirements](#), that it has all required software installed, and that your offline environment meets the required [permissions and connectivity](#).

3

Deploy Data Sense

Download the Cloud Data Sense software from the NetApp Support Site and copy the installer file to the Linux host you plan to use. Then launch the installation wizard and follow the prompts to deploy the Cloud Data Sense instance.

4

Subscribe to the Cloud Data Sense service

The first 1 TB of data that Cloud Data Sense scans in Cloud Manager is free. A BYOL license from NetApp is required to continue scanning data after that point.

Install the Cloud Manager Connector

If you don't already have a Cloud Manager Connector installed at your offline on-premises site, [deploy the Connector](#) on a Linux host in your offline site.

Prepare the Linux host system

Data Sense software must run on a host that meets specific operating system requirements, RAM requirements, software requirements, and so on.

- Operating system: Red Hat Enterprise Linux or CentOS version 8.0 or 8.1
 - Version 7.8 can be used, but the Linux kernel version must be 4.14 or greater
 - The OS must be capable of installing the Docker Engine (for example, disable the *firewalld* service if needed)
- Disk: SSD with 500 GiB available on /, or
 - 100 GiB available on /opt
 - 400 GiB available on /var
- RAM: 64 GB (swap memory must be disabled on the host)
- CPU: 16 cores

Note that you can deploy Data Sense on a system with fewer CPUs and less RAM, but there are limitations when using these systems. See [Using a smaller instance type](#) for details.

The following software must be installed on the host before you install Data Sense:

- Docker Engine version 19 or later. [View installation instructions](#).
- Python 3 version 3.6 or later. [View installation instructions](#).

Verify Cloud Manager and Data Sense prerequisites

Review the following prerequisites to make sure that you have a supported configuration before you deploy Cloud Data Sense.

- Ensure that Cloud Manager has permissions to deploy resources and create security groups for the Cloud Data Sense instance.
- Ensure that the Cloud Manager Connector can access the Data Sense instance. The security group for the Connector must allow inbound and outbound traffic over port 443 to and from the Data Sense instance.

This connection enables deployment of the Data Sense instance and enables you to view compliance and governance information.

Make sure port 8080 is open so you can see the installation progress in Cloud Manager.

- Ensure that you can keep Cloud Data Sense running. The Cloud Data Sense instance needs to stay on to continuously scan your data.
- Ensure web browser connectivity to Cloud Data Sense. After Cloud Data Sense is enabled, ensure that users access the Cloud Manager interface from a host that has a connection to the Data Sense instance.

The Data Sense instance uses a private IP address to ensure that the indexed data isn't accessible to others. As a result, the web browser that you use to access Cloud Manager must have a connection to that private IP address. That connection can come from a host that's inside the same network as the Data Sense instance.

Deploy Data Sense

For typical configurations you'll install the software on a single host system. [See those steps here](#).

For very large configurations where you'll be scanning petabytes of data, you can include multiple hosts to provide additional processing power. [See those steps here](#).

Single-host installation for typical configurations

Follow these steps when installing Data Sense software on a single on-premises host in an offline environment.

What you'll need

- Verify that your Linux system meets the [host requirements](#).
- Verify that you have installed the two prerequisite software packages (Docker Engine and Python 3).
- Make sure you have root privileges on the Linux system.
- Verify that your offline environment meets the required [permissions and connectivity](#).

Steps

1. On an internet-configured system, download the Cloud Data Sense software from the [NetApp Support Site](#). The file you should select is named **DataSense-offline-bundle-<version>.tar.gz**.

2. Copy the installer bundle to the Linux host you plan to use in the dark site.
3. Unzip the installer bundle on the host machine, for example:

```
tar -xzf DataSense-offline-bundle-v1.7.2.tar.gz
```

This extracts required software and the actual installation file **cc_onprem_installer_<version>.tar.gz**.

4. Launch Cloud Manager and click the **Data Sense** tab.
5. Click **Activate Data Sense**.

How does it work? ⓘ

Classify and take Control of your data with Cloud Data Sense

Driven by powerful artificial intelligence, NetApp Cloud Data Sense gives you control of your data. Map, classify and understand all your cloud and on-premises data to stay secure and compliant, reduce storage costs, and get assistance with data migration projects.

Activate Data Sense

Nearly Saving Opportunities

Type	Count	Size
Non-Data	52	20
Business Data	43	18
Unused Data	65	40

Highlights

Category	Count
Unused Data	70K files
Open Permissions	568K files

6. Click **Deploy** to start the on-prem deployment wizard.

A Data Connector is required to use Governance and Compliance services.

Learn more about deploying Data Sense ⓘ

Deploy the Data Connector On-Premises

Deploy

Select this option for special situations. For example, if you are planning on scanning on-premises data and you prefer the Data Connector accesses the data from an on-premises location.

7. In the *Deploy Data Sense On Premises* dialog, copy the provided command and paste it in a text file so you can use it later, and click **Close**. For example:

```
sudo ./install.sh -a 12345 -c 27AG75 -t 2198qq --darksite
```

8. Unzip the installation file on the host machine, for example:

```
tar -xzf cc_onprem_installer_1.7.2.tar.gz
```

9. When prompted by the installer, you can enter the required values in a series of prompts, or you can enter the complete command in the first prompt:

Enter parameters as prompted:	Enter the full command:
<ol style="list-style-type: none">1. Paste the information you copied from step 7: <code>sudo ./install.sh -a <account_id> -c <agent_id> -t <token> --darksite</code>2. Enter the IP address or host name of the Data Sense host machine so it can be accessed by the Connector instance.3. Enter the IP address or host name of the Cloud Manager Connector host machine so it can be accessed by the Data Sense instance.4. Enter proxy details as prompted. If your Cloud Manager already uses a proxy, there is no need to enter this information again here since Data Sense will automatically use the proxy used by Cloud Manager.	<p>Alternatively, you can create the whole command in advance and enter it in the first prompt:</p> <pre>sudo ./install.sh -a <account_id> -c <agent_id> -t <token> --host <ds_host> --cm-host <cm_host> --proxy-host <proxy_host> --proxy-port <proxy_port> --proxy-scheme <proxy_scheme> --proxy-user <proxy_user> --proxy-password <proxy_password> --darksite</pre>

Variable values:

- *account_id* = NetApp Account ID
- *agent_id* = Connector ID
- *token* = jwt user token
- *ds_host* = IP address or host name of the Data Sense Linux system.
- *cm_host* = IP address or host name of the Cloud Manager Connector system.
- *proxy_host* = IP or host name of the proxy server if the host is behind a proxy server.
- *proxy_port* = Port to connect to the proxy server (default 80).
- *proxy_scheme* = Connection scheme: https or http (default http).
- *proxy_user* = Authenticated user to connect to the proxy server, if basic authentication is required.
- *proxy_password* = Password for the user name that you specified.

Result

The Data Sense installer installs packages, registers the installation, and installs Data Sense. Installation can take 10 to 20 minutes.

If there is connectivity over port 8080 between the host machine and the Connector instance, you will see the installation progress in the Data Sense tab in Cloud Manager.

What's Next

From the Configuration page you can select the local [on-prem ONTAP clusters](#) and [databases](#) that you want to scan.

Multi-host installation for large configurations

For very large configurations where you'll be scanning petabytes of data, you can include multiple hosts to

provide additional processing power. When using multiple host systems, the primary system is called the *Manager node* and the additional systems that provide extra processing power are called *Scanner nodes*.

Follow these steps when installing Data Sense software on multiple on-premises hosts in an offline environment.

What you'll need

- Verify that all your Linux systems for the Manager and Scanner nodes meet the [host requirements](#).
- Verify that you have installed the two prerequisite software packages (Docker Engine and Python 3).
- Make sure you have root privileges on the Linux systems.
- Verify that your offline environment meets the required [permissions and connectivity](#).
- You must have the IP addresses of the scanner node hosts that you plan to use.
- The following ports and protocols must be enabled on all hosts:

Port	Protocols	Description
2377	TCP	Cluster management communications
7946	TCP, UDP	Inter-node communication
4789	UDP	Overlay network traffic
50	ESP	Encrypted IPsec overlay network (ESP) traffic
111	TCP, UDP	NFS Server for sharing files between the hosts (needed from each scanner node to manager node)
2049	TCP, UDP	NFS Server for sharing files between the hosts (needed from each scanner node to manager node)

Steps

1. Follow steps 1 through 8 from the [Single-host installation](#) on the manager node.
2. As shown in step 9, when prompted by the installer, you can enter the required values in a series of prompts, or you can enter the complete command in the first prompt.

In addition to the variables available for a single-host installation, a new option **-n <node_ip>** is used to specify the IP addresses of the scanner nodes. Multiple node IPs are separated by a comma.

For example, this command adds 3 scanner nodes:

```
sudo ./install.sh -a <account_id> -c <agent_id> -t <token> --host <ds_host>
--cm-host <cm_host> -n <node_ip1>,<node_ip2>,<node_ip3> --proxy-host
<proxy_host> --proxy-port <proxy_port> --proxy-scheme <proxy_scheme> --proxy
--user <proxy_user> --proxy-password <proxy_password> --darksite
```

3. Before the manager node installation completes, a dialog displays the installation command needed for the scanner nodes. Copy the command and save it in a text file. For example:

```
sudo ./node_install.sh -m 10.11.12.13 -t ABCDEF-1-3u69m1-1s35212
```

4. On **each** scanner node host:

- Copy the Data Sense installer file (**cc_onprem_installer_<version>.tar.gz**) to the host machine.
- Unzip the installer file.

- c. Paste and run the command that you copied in step 3.

When the installation finishes on all scanner nodes and they have been joined to the manager node, the manager node installation finishes as well.

Result

The Cloud Data Sense installer finishes installing packages, and registers the installation. Installation can take 15 to 25 minutes.

What's Next

From the Configuration page you can select the local [on-prem ONTAP clusters](#) and [databases](#) that you want to scan.

Upgrade Data Sense software

Since Data Sense software is updated with new features on a regular basis, you should get into a routine to check for new versions periodically to make sure you're using the newest software and features. You'll need to upgrade Data Sense software manually because there's no internet connectivity to perform the upgrade automatically.

Before you begin

- Data Sense software can be upgraded one major version at a time. For example, if you have version 1.7.x installed, you can upgrade only to 1.8.x. If you are a few major versions behind, you'll need to upgrade the software multiple times.
- Verify that your on-prem Connector software has been upgraded to the newest available version. [See the Connector upgrade steps](#).

Steps

1. On an internet-configured system, download the Cloud Data Sense software from the [NetApp Support Site](#). The file you should select is named **DataSense-offline-bundle-<version>.tar.gz**.
2. Copy the software bundle to the Linux host where Data Sense is installed in the dark site.
3. Unzip the software bundle on the host machine, for example:

```
tar -xvf DataSense-offline-bundle-v1.8.2.tar.gz
```

This extracts the upgrade script **start_darksite_upgrade.sh** and any required third-party software.

4. Run the upgrade script on the host machine, for example:

```
start_darksite_upgrade.sh
```

Result

The Data Sense software is upgraded on your host. The update can take 5 to 10 minutes.

Note that no upgrade is required on scanner nodes if you have deployed Data Sense on multiple hosts systems for scanning very large configurations.

You can verify that the software has been updated by checking the version at the bottom of the Data Sense UI

pages.

Activate scanning on your data sources

Getting started with Cloud Data Sense for Cloud Volumes ONTAP and on-premises ONTAP

Complete a few steps to start scanning your Cloud Volumes ONTAP and on-premises ONTAP volumes using Cloud Data Sense.

Quick start

Get started quickly by following these steps, or scroll down to the remaining sections for full details.

1

Discover the data sources that you want to scan

Before you can scan volumes, you must add the systems as working environments in Cloud Manager:

- For Cloud Volumes ONTAP systems, these working environments should already be available in Cloud Manager
- For on-premises ONTAP systems, [Cloud Manager must discover the ONTAP clusters](#)

2

Deploy the Cloud Data Sense instance

[Deploy Cloud Data Sense](#) if there isn't already an instance deployed.

3

Enable Cloud Data Sense and select the volumes to scan

Click **Data Sense**, select the **Configuration** tab, and activate compliance scans for volumes in specific working environments.

4

Ensure access to volumes

Now that Cloud Data Sense is enabled, ensure that it can access all volumes.

- The Cloud Data Sense instance needs a network connection to each Cloud Volumes ONTAP subnet or on-prem ONTAP system.
- Security groups for Cloud Volumes ONTAP must allow inbound connections from the Data Sense instance.
- Make sure these ports are open to the Data Sense instance:
 - For NFS – ports 111 and 2049.
 - For CIFS – ports 139 and 445.
- NFS volume export policies must allow access from the Data Sense instance.
- Data Sense needs Active Directory credentials to scan CIFS volumes.

Click **Compliance > Configuration > Edit CIFS Credentials** and provide the credentials.

5

Manage the volumes you want to scan

Select or deselect the volumes that you want to scan and Cloud Data Sense will start or stop scanning them.

Discovering the data sources that you want to scan

If the data sources you want to scan are not already in your Cloud Manager environment, you can add them to the canvas at this time.

Your Cloud Volumes ONTAP systems should already be available in the Canvas in Cloud Manager. For on-premises ONTAP systems, you'll need to have [Cloud Manager discover these clusters](#).

Deploying the Cloud Data Sense instance

Deploy Cloud Data Sense if there isn't already an instance deployed.

If you are scanning Cloud Volumes ONTAP and on-premises ONTAP systems that are accessible over the internet, you can [deploy Cloud Data Sense in the cloud or in an on-premises location that has internet access](#).

If you are scanning on-premises ONTAP systems that have been installed in a dark site that has no internet access, you need to [deploy Cloud Data Sense in the same on-premises location that has no internet access](#). This also requires that the Cloud Manager Connector is deployed in that same on-premises location.

Upgrades to Data Sense software is automated as long as the instance has internet connectivity.

Enabling Cloud Data Sense in your working environments

You can enable Cloud Data Sense on Cloud Volumes ONTAP systems (in AWS, Azure, and GCP) and on on-premises ONTAP clusters.

 Following these steps for on-prem ONTAP clusters scans the volumes directly on the on-prem ONTAP system. If you are already creating backup files from those on-prem systems using [Cloud Backup](#), you can scan the backup files in the cloud instead. Go to [Scanning backup files from on-premises ONTAP systems](#) for details.

1. At the top of Cloud Manager, click **Data Sense** and then select the **Configuration** tab.

The screenshot shows the Data Sense Configuration interface. It displays two working environments: 'Working Environment 1' (On-Premises ONTAP) and 'Working Environment 2' (Cloud Volumes ONTAP). Each environment has a corresponding icon (a server for On-Premises and a cloud for Cloud Volumes). Below each icon, the environment name and type are listed. Under each environment, there are two blue buttons: 'Map all Volumes' and 'Map & Classify all Volumes'. Between these buttons is a link that says 'Or select scanning type for each volume'.

2. Select how you want to scan the volumes in each working environment. [Learn about mapping and classification scans](#):

- To map all volumes, click **Map all Volumes**.
- To map and classify all volumes, click **Map & Classify all Volumes**.
- To customize scanning for each volume, click **Or select scanning type for each volume**, and then choose the volumes you want to map and/or classify.

See [Enabling and disabling compliance scans on volumes](#) for details.

3. In the confirmation dialog box, click **Approve** to have Data Sense start scanning your volumes.

Result

Cloud Data Sense starts scanning the volumes you selected in the working environment. Results will be available in the Compliance dashboard as soon as Cloud Data Sense finishes the initial scans. The time that it takes depends on the amount of data—it could be a few minutes or hours.

Verifying that Cloud Data Sense has access to volumes

Make sure that Cloud Data Sense can access volumes by checking your networking, security groups, and export policies. You'll need to provide Data Sense with CIFS credentials so it can access CIFS volumes.

Steps

1. Make sure that there's a network connection between the Cloud Data Sense instance and each network that includes volumes for Cloud Volumes ONTAP or on-prem ONTAP clusters.
2. Ensure that the security group for Cloud Volumes ONTAP allows inbound traffic from the Data Sense instance.

You can either open the security group for traffic from the IP address of the Data Sense instance, or you can open the security group for all traffic from inside the virtual network.

3. Ensure the following ports are open to the Data Sense instance:

- For NFS – ports 111 and 2049.

- For CIFS – ports 139 and 445.
4. Ensure that NFS volume export policies include the IP address of the Data Sense instance so it can access the data on each volume.
 5. If you use CIFS, provide Data Sense with Active Directory credentials so it can scan CIFS volumes.
 - a. At the top of Cloud Manager, click **Data Sense**.
 - b. Click the **Configuration** tab.



- c. For each working environment, click **Edit CIFS Credentials** and enter the user name and password that Data Sense needs to access CIFS volumes on the system.

The credentials can be read-only, but providing admin credentials ensures that Data Sense can read any data that requires elevated permissions. The credentials are stored on the Cloud Data Sense instance.

After you enter the credentials, you should see a message that all CIFS volumes were authenticated successfully.

The screenshot shows the Scan Status page for Cloud Volumes ONTAP. At the top left is a back arrow and the text "Scan Status". Below this, there is a section for "Cloud Volumes ONTAP". It shows the following data:

Name:	Volumes:	CIFS Credentials Status:
Newdatastore	• 12 Continuously Scanning • 8 Not Scanning	✓ Valid CIFS credentials for all accessible volumes

Below this are two buttons: "View Details" and "Edit CIFS Credentials".

6. On the **Configuration** page, click **View Details** to review the status for each CIFS and NFS volume and correct any errors.

For example, the following image shows four volumes; one of which Cloud Data Sense can't scan due to network connectivity issues between the Data Sense instance and the volume.

cognigoWE Scan Configuration

44/79 Volumes selected for Data Sense scan

Scan	Storage Repository (Volume)	Type	Status	Required Action
Off Map Map & Classify	AdiProtest2501	NFS	● Continuously Scanning	
Off Map Map & Classify	AlexTest	NFS	● No Access	Access to the NFS volume was denied. Make sure tha...
Off Map Map & Classify	AlexTestSecond	NFS	● Not Scanning	
Off Map Map & Classify	MoreDataNeed1000	NFS	● Continuously Scanning	

[Edit CIFS Credentials](#)

Enabling and disabling compliance scans on volumes

You can start or stop mapping-only scans, or mapping and classification scans, in a working environment at any time from the Configuration page. You can also change from mapping-only scans to mapping and classification scans, and vice-versa. We recommend that you scan all volumes.

cognigoWE Scan Configuration

44/79 Volumes selected for Data Sense scan

Scan	Storage Repository (Volume)	Type	Status	Required Action
Off Map Map & Classify	AdiNFSVol_copy	NFS	● No Access	Access to the NFS volume was denied. Make sure tha...
Off Map Map & Classify	AdiProtest2501	NFS	● Continuously Scanning	
Off Map Map & Classify	AlexTest	NFS	● No Access	Access to the NFS volume was denied. Make sure tha...
Off Map Map & Classify	AlexTestSecond	NFS	● Not Scanning	
Off Map Map & Classify	MoreDataNeed1000	NFS	● Continuously Scanning	

[Edit CIFS Credentials](#)

To:	Do this:
Enable mapping-only scans on a volume	In the volume area, click Map
Enable full scanning on a volume	In the volume area, click Map & Classify
Disable scanning on a volume	In the volume area, click Off
Enable mapping-only scans on all volumes	In the heading area, click Map
Enable full scanning on all volumes	In the heading area, click Map & Classify
Disable scanning on all volumes	In the heading area, click Off



New volumes added to the working environment are automatically scanned only when you have set the **Map** or **Map & Classify** setting in the heading area. When set to **Custom** or **Off** in the heading area, you'll need to activate mapping and/or full scanning on each new volume you add in the working environment.

Scanning data protection volumes

By default, data protection (DP) volumes are not scanned because they are not exposed externally and Cloud Data Sense cannot access them. These are the destination volumes for SnapMirror operations from an on-premises ONTAP system or from a Cloud Volumes ONTAP system.

Initially, the volume list identifies these volumes as **Type DP** with the **Status Not Scanning** and the **Required Action Enable Access to DP volumes**.



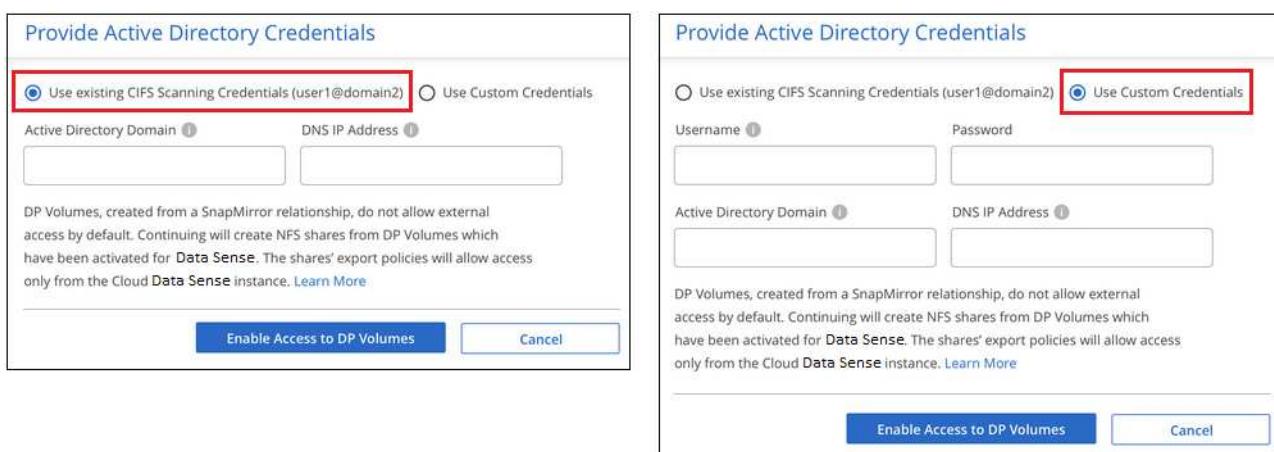
The screenshot shows a table of volumes with the following data:

Scan	Storage Repository (Volume)	Type	Status	Required Action
Off	VolumeName1	DP	Not Scanning	Enable access to DP Volumes
Off	VolumeName2	NFS	Continuously Scanning	
Off	VolumeName3	CIFS	Not Scanning	

Steps

If you want to scan these data protection volumes:

1. Click **Enable Access to DP volumes** at the top of the page.
2. Review the confirmation message and click **Enable Access to DP volumes** again.
 - Volumes that were initially created as NFS volumes in the source ONTAP system are enabled.
 - Volumes that were initially created as CIFS volumes in the source ONTAP system require that you enter CIFS credentials to scan those DP volumes. If you already entered Active Directory credentials so that Cloud Data Sense can scan CIFS volumes you can use those credentials, or you can specify a different set of Admin credentials.



The screenshots show two versions of the 'Provide Active Directory Credentials' dialog:

Left Dialog (Existing Credentials):
Selected: Use existing CIFS Scanning Credentials (user1@domain2)
 Use Custom Credentials
Fields: Active Directory Domain, DNS IP Address
Note: DP Volumes, created from a SnapMirror relationship, do not allow external access by default. Continuing will create NFS shares from DP Volumes which have been activated for Data Sense. The shares' export policies will allow access only from the Cloud Data Sense instance. [Learn More](#)

Right Dialog (Custom Credentials):
Selected: Use existing CIFS Scanning Credentials (user1@domain2)
 Use Custom Credentials
Fields: Username, Password, Active Directory Domain, DNS IP Address
Note: DP Volumes, created from a SnapMirror relationship, do not allow external access by default. Continuing will create NFS shares from DP Volumes which have been activated for Data Sense. The shares' export policies will allow access only from the Cloud Data Sense instance. [Learn More](#)

3. Activate each DP volume that you want to scan [the same way you enabled other volumes](#).

Result

Once enabled, Cloud Data Sense creates an NFS share from each DP volume that was activated for scanning. The share export policies only allow access from the Data Sense instance.

Note: If you had no CIFS data protection volumes when you initially enabled access to DP volumes, and later

add some, the button **Enable Access to CIFS DP** appears at the top of the Configuration page. Click this button and add CIFS credentials to enable access to these CIFS DP volumes.



Active Directory credentials are only registered in the storage VM of the first CIFS DP volume, so all DP volumes on that SVM will be scanned. Any volumes that reside on other SVMs will not have the Active Directory credentials registered, so those DP volumes won't be scanned.

Scanning backup files from on-premises ONTAP systems

If you don't want Cloud Data Sense to scan volumes directly on your on-prem ONTAP systems, a Beta feature released in January 2021 allows you to run compliance scans on backup files created from your on-prem ONTAP volumes. So if you're already creating backup files to the cloud using [Cloud Backup](#), you can use this feature to run compliance scans on those backup files.

When scanning backup files created from your on-prem ONTAP systems, the scanned data does not count against the capacity purchased in your PAYGO subscription or BYOL license.

Note: When Data Sense scans backup files it uses permissions granted through the Cloud Restore instance to access the backup files. Typically the Restore instance powers down when not actively restoring files, but it remains **On** when scanning backup files. See [more information about the Restore instance](#).

Steps

If you want to scan the backup files from on-prem ONTAP systems:

1. At the top of Cloud Manager, click **Data Sense** and then select the **Configuration** tab.
2. From the list of working environments, click the **BACKUP** button from the list of filters.

All the on-premises ONTAP working environments that have backup files are listed. If you don't have any backup files from an on-prem system, then the working environment is not shown.

The screenshot shows the Cloud Manager interface with the 'Data Sense' tab selected. The 'Configuration' tab is highlighted. Below it, the 'Working Environments' section shows '(2/20) Working Environments'. A 'Filter by:' dropdown menu is open, with the 'BACKUP' option highlighted and surrounded by a red box. Below the filter menu, there is a list of working environments. The first item is 'Working Environment 1 (back up)', described as 'Cloud Backup of ONTAP' and 'BETA'. Underneath this item are two blue buttons: 'Map all backed up Volumes' and 'Map & Classify all backed up Volumes'. Below these buttons is the text 'Or select scanning type for each volume'. Two red arrows point to the 'Map all backed up Volumes' button and the 'Or select scanning type for each volume' text respectively.

3. Select how you want to scan the backup volumes:
 - To map all volumes, click **Map all backed up Volumes**.
 - To map and classify all volumes, click **Map & Classify all backed up Volumes**.
 - To customize scanning for each backed up volume, click **Or select scanning type for each volume**, and then choose the volumes you want to map and/or classify.

See [Enabling and disabling compliance scans on volumes](#) for details.

Scanning on-prem volumes versus backups of those volumes

When you view the entire list of working environments you will see two listings for each on-prem cluster if they have backed up files.

The screenshot shows the 'Configuration' tab with two sections:

- Working Environment 1** (On-Premises ONTAP):
 - 1 [Map all Volumes](#)
 - [Map & Classify all Volumes](#)
- Working Environment 1 (back up)** (Cloud Backup of ONTAP BETA):
 - 2 [Map all backed up Volumes](#)
 - [Map & Classify all backed up Volumes](#)

Below each section is the text "Or select scanning type for each volume".

The first item is the on-prem cluster and the actual volumes.

The second item is the backup files of those volumes from that same on-prem cluster.

Choose the first option to scan the volumes on the on-prem system. Choose the second option to scan the backup files from those volumes. Do not scan both on-prem volumes and backup files of the same cluster.

Getting started with Cloud Data Sense for Azure NetApp Files

Complete a few steps to get started with Cloud Data Sense for Azure NetApp Files.

Quick start

Get started quickly by following these steps, or scroll down to the remaining sections for full details.

1

Discover the Azure NetApp Files systems you want to scan

Before you can scan Azure NetApp Files volumes, [Cloud Manager must be set up to discover the configuration](#).

2

Deploy the Cloud Data Sense instance

[Deploy Cloud Data Sense in Cloud Manager](#) if there isn't already an instance deployed.

3

Enable Cloud Data Sense and select the volumes to scan

Click **Compliance**, select the **Configuration** tab, and activate compliance scans for volumes in specific working environments.

4

Ensure access to volumes

Now that Cloud Data Sense is enabled, ensure that it can access all volumes.

- The Cloud Data Sense instance needs a network connection to each Azure NetApp Files subnet.
- Make sure these ports are open to the Data Sense instance:
 - For NFS – ports 111 and 2049.
 - For CIFS – ports 139 and 445.
- NFS volume export policies must allow access from the Data Sense instance.
- Data Sense needs Active Directory credentials to scan CIFS volumes.

Click **Compliance > Configuration > Edit CIFS Credentials** and provide the credentials.

5

Manage the volumes you want to scan

Select or deselect the volumes that you want to scan and Cloud Data Sense will start or stop scanning them.

Discovering the Azure NetApp Files system that you want to scan

If the Azure NetApp Files system you want to scan is not already in Cloud Manager as a working environment, you can add it to the canvas at this time.

[See how to discover the Azure NetApp Files system in Cloud Manager.](#)

Deploying the Cloud Data Sense instance

[Deploy Cloud Data Sense](#) if there isn't already an instance deployed.

Data Sense must be deployed in the cloud when scanning Azure NetApp Files volumes, and it must be deployed in the same region as the volumes you wish to scan.

Note: Deploying Cloud Data Sense in an on-premises location is not currently supported when scanning Azure NetApp Files volumes.

Upgrades to Data Sense software is automated as long as the instance has internet connectivity.

Enabling Cloud Data Sense in your working environments

You can enable Cloud Data Sense on your Azure NetApp Files volumes.

1. At the top of Cloud Manager, click **Data Sense** and then select the **Configuration** tab.

The screenshot shows the 'Configuration' tab for 'Azure Netapp Files'. At the top, there's a 'View Dashboard >' link and a 'Configuration' section header. Below that is a 'Azure Netapp Files' icon and the text 'Azure NetApp Files'. There are two large blue buttons: 'Map all Volumes' and 'Map & Classify all Volumes'. Below these buttons is the text 'Or select scanning type for each volume'.

2. Select how you want to scan the volumes in each working environment. [Learn about mapping and classification scans](#):
 - To map all volumes, click **Map all Volumes**.
 - To map and classify all volumes, click **Map & Classify all Volumes**.
 - To customize scanning for each volume, click **Or select scanning type for each volume**, and then choose the volumes you want to map and/or classify.

See [Enabling and disabling compliance scans on volumes](#) for details.

3. In the confirmation dialog box, click **Approve** to have Data Sense start scanning your volumes.

Result

Cloud Data Sense starts scanning the volumes you selected in the working environment. Results will be available in the Compliance dashboard as soon as Cloud Data Sense finishes the initial scans. The time that it takes depends on the amount of data—it could be a few minutes or hours.

Verifying that Cloud Data Sense has access to volumes

Make sure that Cloud Data Sense can access volumes by checking your networking, security groups, and export policies. You'll need to provide Data Sense with CIFS credentials so it can access CIFS volumes.

Steps

1. Make sure that there's a network connection between the Cloud Data Sense instance and each network that includes volumes for Azure NetApp Files.

 For Azure NetApp Files, Cloud Data Sense can only scan volumes that are in the same region as Cloud Manager.
2. Ensure the following ports are open to the Data Sense instance:
 - For NFS – ports 111 and 2049.
 - For CIFS – ports 139 and 445.
3. Ensure that NFS volume export policies include the IP address of the Data Sense instance so it can access the data on each volume.
4. If you use CIFS, provide Data Sense with Active Directory credentials so it can scan CIFS volumes.
 - a. At the top of Cloud Manager, click **Data Sense**.
 - b. Click the **Configuration** tab.

The screenshot shows the Data Sense interface with the 'Configuration' tab highlighted by a red box. Below the tabs, a section titled '6 Working Environments' is displayed. Under this section, there is a card for 'Azure NetApp Files' which shows '3 Volumes'. To the right of the card are two buttons: 'Configuration' and a three-dot menu icon.

- c. For each working environment, click **Edit CIFS Credentials** and enter the user name and password that Data Sense needs to access CIFS volumes on the system.

The credentials can be read-only, but providing admin credentials ensures that Data Sense can read any data that requires elevated permissions. The credentials are stored on the Cloud Data Sense instance.

After you enter the credentials, you should see a message that all CIFS volumes were authenticated successfully.

The screenshot shows the 'Scan Status' page for 'Cloud Volumes ONTAP'. It displays the following information:

- Name: Newdatastore
- Volumes:
 - 12 Continuously Scanning
 - 8 Not Scanning
- CIFS Credentials Status:
 - Valid CIFS credentials for all accessible volumes
- Buttons: 'View Details' and 'Edit CIFS Credentials'

5. On the **Configuration** page, click **View Details** to review the status for each CIFS and NFS volume and correct any errors.

For example, the following image shows four volumes; one of which Cloud Data Sense can't scan due to network connectivity issues between the Data Sense instance and the volume.

The screenshot shows the 'cognigoWE Scan Configuration' page. It lists four volumes with their status:

Scan	Storage Repository (Volume)	Type	Status	Required Action		
Off	Map	Map & Classify	AdiProtest2501	NFS	Continuously Scanning	
Off	Map	Map & Classify	AlexTest	NFS	No Access	Access to the NFS volume was denied. Make sure tha...
Off	Map	Map & Classify	AlexTestSecond	NFS	Not Scanning	
Off	Map	Map & Classify	MoreDataNeed1000	NFS	Continuously Scanning	

Enabling and disabling compliance scans on volumes

You can start or stop mapping-only scans, or mapping and classification scans, in a working environment at any time from the Configuration page. You can also change from mapping-only scans to mapping and classification scans, and vice-versa. We recommend that you scan all volumes.

cognigoWE Scan Configuration

44/79 Volumes selected for Data Sense scan

Scan	Storage Repository (Volume)	Type	Status	Required Action
Off	AdiNFSVol_copy	NFS	No Access	Access to the NFS volume was denied. Make sure tha...
Off	AdiProtest2501	NFS	Continuously Scanning	
Off	AlexTest	NFS	No Access	Access to the NFS volume was denied. Make sure tha...
Off	AlexTestSecond	NFS	Not Scanning	
Off	MoreDataNeed1000	NFS	Continuously Scanning	

To:	Do this:
Enable mapping-only scans on a volume	In the volume area, click Map
Enable full scanning on a volume	In the volume area, click Map & Classify
Disable scanning on a volume	In the volume area, click Off
Enable mapping-only scans on all volumes	In the heading area, click Map
Enable full scanning on all volumes	In the heading area, click Map & Classify
Disable scanning on all volumes	In the heading area, click Off



New volumes added to the working environment are automatically scanned only when you have set the **Map** or **Map & Classify** setting in the heading area. When set to **Custom** or **Off** in the heading area, you'll need to activate mapping and/or full scanning on each new volume you add in the working environment.

Get started with Cloud Data Sense for Amazon FSx for ONTAP

Complete a few steps to get started scanning Amazon FSx for ONTAP volume with Cloud Data Sense.

Before you begin

- You need an active Connector in AWS to deploy and manage Data Sense.
- The security group you selected when creating the working environment must allow traffic from the Cloud Data Sense instance. You can find the associated security group using the ENI connected to the FSx for ONTAP file system and edit it using the AWS Management Console.

[AWS security groups for Linux instances](#)

[AWS security groups for Windows instances](#)

[AWS elastic network interfaces \(ENI\)](#)

Quick start

Get started quickly by following these steps or scroll down for full details.

1

Discover the FSx for ONTAP file systems you want to scan

Before you can scan FSx for ONTAP volumes, [you must have an FSx working environment with volumes configured](#).

2

Deploy the Cloud Data Sense instance

[Deploy Cloud Data Sense in Cloud Manager](#) if there isn't already an instance deployed.

3

Enable Cloud Data Sense and select the volumes to scan

Click **Data Sense**, select the **Configuration** tab, and activate compliance scans for volumes in specific working environments.

4

Ensure access to volumes

Now that Cloud Data Sense is enabled, ensure that it can access all volumes.

- The Cloud Data Sense instance needs a network connection to each FSx for ONTAP subnet.
- Make sure the following ports are open to the Data Sense instance:
 - For NFS – ports 111 and 2049.
 - For CIFS – ports 139 and 445.
- NFS volume export policies must allow access from the Data Sense instance.
- Data Sense needs Active Directory credentials to scan CIFS volumes.

[Click Compliance > Configuration > Edit CIFS Credentials](#) and provide the credentials.

5

Manage the volumes you want to scan

Select or deselect the volumes you want to scan and Cloud Data Sense will start or stop scanning them.

Discovering the FSx for ONTAP file system that you want to scan

If the FSx for ONTAP file system you want to scan is not already in Cloud Manager as a working environment, you can add it to the canvas at this time.

[See how to discover or create the FSx for ONTAP file system in Cloud Manager.](#)

Deploying the Cloud Data Sense instance

[Deploy Cloud Data Sense](#) if there isn't already an instance deployed.

You should deploy Data Sense in the same AWS network as the Connector for AWS and the FSx volumes you wish to scan.

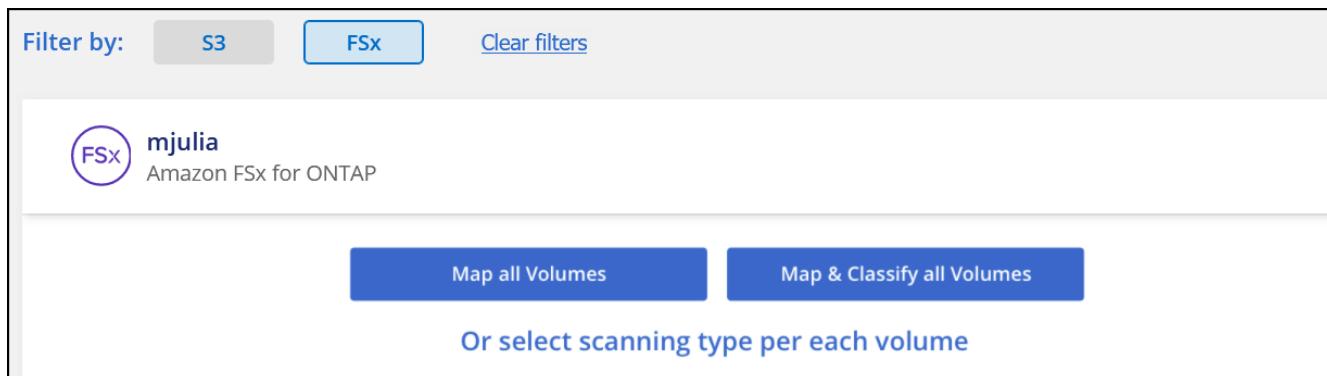
Note: Deploying Cloud Data Sense in an on-premises location is not currently supported when scanning FSx volumes.

Upgrades to Data Sense software is automated as long as the instance has internet connectivity.

Enabling Cloud Data Sense in your working environments

You can enable Cloud Data Sense for FSx for ONTAP volumes.

1. At the top of Cloud Manager, click **Data Sense** and then select the **Configuration** tab.



2. Select how you want to scan the volumes in each working environment. [Learn about mapping and classification scans](#):

- To map all volumes, click **Map all Volumes**.
- To map and classify all volumes, click **Map & Classify all Volumes**.
- To customize scanning for each volume, click **Or select scanning type for each volume**, and then choose the volumes you want to map and/or classify.

See [Enabling and disabling compliance scans on volumes](#) for details.

3. In the confirmation dialog box, click **Approve** to have Data Sense start scanning your volumes.

Result

Cloud Data Sense starts scanning the volumes you selected in the working environment. Results will be available in the Compliance dashboard as soon as Cloud Data Sense finishes the initial scans. The time that it takes depends on the amount of data—it could be a few minutes or hours.

Verifying that Cloud Data Sense has access to volumes

Make sure Cloud Data Sense can access volumes by checking your networking, security groups, and export policies.

You'll need to provide Data Sense with CIFS credentials so it can access CIFS volumes.

Steps

1. On the *Configuration* page, click **View Details** to review the status and correct any errors.

For example, the following image shows a volume Cloud Data Sense can't scan due to network connectivity issues between the Data Sense instance and the volume.

Scan	Storage Repository (Volume)	Type	Status	Required Action
Off	Map	Map & Classify	jrmclone	NFS ● No Access Check network connectivity between the Data Sense ...

2. Make sure there's a network connection between the Cloud Data Sense instance and each network that includes volumes for FSx for ONTAP.



For FSx for ONTAP, Cloud Data Sense can scan volumes only in the same region as Cloud Manager.

3. Ensure the following ports are open to the Data Sense instance.

- For NFS – ports 111 and 2049.
- For CIFS – ports 139 and 445.

4. Ensure NFS volume export policies include the IP address of the Data Sense instance so it can access the data on each volume.

5. If you use CIFS, provide Data Sense with Active Directory credentials so it can scan CIFS volumes.

- a. At the top of Cloud Manager, click **Data Sense**.
- b. Click the **Configuration** tab.
- c. For each working environment, click **Edit CIFS Credentials** and enter the user name and password that Data Sense needs to access CIFS volumes on the system.

The credentials can be read-only, but providing admin credentials ensures that Data Sense can read any data that requires elevated permissions. The credentials are stored on the Cloud Data Sense instance.

After you enter the credentials, you should see a message that all CIFS volumes were authenticated successfully.

Enabling and disabling compliance scans on volumes

You can start or stop mapping-only scans, or mapping and classification scans, in a working environment at any time from the Configuration page. You can also change from mapping-only scans to mapping and classification scans, and vice-versa. We recommend that you scan all volumes.

cognigoWE Scan Configuration					
44/79 Volumes selected for Data Sense scan					
Scan	Storage Repository (Volume)	Type	Status	Required Action	
Off	Map	Map & Classify	AdiNFSVol_copy	NFS ● No Access	Access to the NFS volume was denied. Make sure tha...
Off	Map	Map & Classify	AdiProtest2501	NFS ● Continuously Scanning	
Off	Map	Map & Classify	AlexTest	NFS ● No Access	Access to the NFS volume was denied. Make sure tha...
Off	Map	Map & Classify	AlexTestSecond	NFS ● Not Scanning	
Off	Map	Map & Classify	MoreDataNeed1000	NFS ● Continuously Scanning	

To:	Do this:
Enable mapping-only scans on a volume	In the volume area, click Map
Enable full scanning on a volume	In the volume area, click Map & Classify
Disable scanning on a volume	In the volume area, click Off
Enable mapping-only scans on all volumes	In the heading area, click Map
Enable full scanning on all volumes	In the heading area, click Map & Classify
Disable scanning on all volumes	In the heading area, click Off



New volumes added to the working environment are automatically scanned only when you have set the **Map** or **Map & Classify** setting in the heading area. When set to **Custom** or **Off** in the heading area, you'll need to activate mapping and/or full scanning on each new volume you add in the working environment.

Scanning data protection volumes

By default, data protection (DP) volumes are not scanned because they are not exposed externally and Cloud Data Sense cannot access them. These are the destination volumes for SnapMirror operations from an FSx for ONTAP file system.

Initially, the volume list identifies these volumes as **Type DP** with the **Status Not Scanning** and the **Required Action Enable Access to DP volumes**.

'Working Environment Name' Configuration

22/28 Volumes selected for compliance scan

Scan	Storage Repository (Volume)	Type	Status	Required Action
Off Map Map & Classify	VolumeName1	DP	Not Scanning	Enable access to DP Volumes ⓘ
Off Map Map & Classify	VolumeName2	NFS	Continuously Scanning	
Off Map Map & Classify	VolumeName3	CIFS	Not Scanning	

Enable Access to DP Volumes

Edit CIFS Credentials

Steps

If you want to scan these data protection volumes:

1. Click **Enable Access to DP volumes** at the top of the page.
2. Review the confirmation message and click **Enable Access to DP volumes** again.
 - Volumes that were initially created as NFS volumes in the source FSx for ONTAP file system are enabled.
 - Volumes that were initially created as CIFS volumes in the source FSx for ONTAP file system require that you enter CIFS credentials to scan those DP volumes. If you already entered Active Directory credentials so that Cloud Data Sense can scan CIFS volumes you can use those credentials, or you can specify a different set of Admin credentials.

3. Activate each DP volume that you want to scan [the same way you enabled other volumes](#).

Result

Once enabled, Cloud Data Sense creates an NFS share from each DP volume that was activated for scanning. The share export policies only allow access from the Data Sense instance.

Note: If you had no CIFS data protection volumes when you initially enabled access to DP volumes, and later add some, the button **Enable Access to CIFS DP** appears at the top of the Configuration page. Click this button and add CIFS credentials to enable access to these CIFS DP volumes.



Active Directory credentials are only registered in the storage VM of the first CIFS DP volume, so all DP volumes on that SVM will be scanned. Any volumes that reside on other SVMs will not have the Active Directory credentials registered, so those DP volumes won't be scanned.

Getting started with Cloud Data Sense for Amazon S3

Cloud Data Sense can scan your Amazon S3 buckets to identify the personal and sensitive data that resides in S3 object storage. Cloud Data Sense can scan any bucket in the account, regardless if it was created for a NetApp solution.

Quick start

Get started quickly by following these steps, or scroll down to the remaining sections for full details.

1

Set up the S3 requirements in your cloud environment

Ensure that your cloud environment can meet the requirements for Cloud Data Sense, including preparing an IAM role and setting up connectivity from Data Sense to S3. [See the complete list](#).

2

Deploy the Cloud Data Sense instance

[Deploy Cloud Data Sense](#) if there isn't already an instance deployed.

3

Activate Data Sense on your S3 working environment

Select the Amazon S3 working environment, click **Enable**, and select an IAM role that includes the required

permissions.

4

Select the buckets to scan

Select the buckets that you'd like to scan and Cloud Data Sense will start scanning them.

Reviewing S3 prerequisites

The following requirements are specific to scanning S3 buckets.

Set up an IAM role for the Cloud Data Sense instance

Cloud Data Sense needs permissions to connect to the S3 buckets in your account and to scan them. Set up an IAM role that includes the permissions listed below. Cloud Manager prompts you to select an IAM role when you enable Data Sense on the Amazon S3 working environment.

```
{  
    "Version": "2012-10-17",  
    "Statement": [  
        {  
            "Effect": "Allow",  
            "Action": [  
                "s3:Get*",  
                "s3>List*",  
                "s3:PutObject"  
            ],  
            "Resource": "*"  
        },  
        {  
            "Effect": "Allow",  
            "Action": [  
                "iam:GetPolicyVersion",  
                "iam:GetPolicy",  
                "iam>ListAttachedRolePolicies"  
            ],  
            "Resource": [  
                "arn:aws:iam::*:policy/*",  
                "arn:aws:iam::*:role/*"  
            ]  
        }  
    ]  
}
```

Provide connectivity from Cloud Data Sense to Amazon S3

Cloud Data Sense needs a connection to Amazon S3. The best way to provide that connection is through a VPC Endpoint to the S3 service. For instructions, see [AWS Documentation: Creating a Gateway Endpoint](#).

When you create the VPC Endpoint, be sure to select the region, VPC, and route table that corresponds to

the Cloud Data Sense instance. You must also modify the security group to add an outbound HTTPS rule that enables traffic to the S3 endpoint. Otherwise, Data Sense can't connect to the S3 service.

If you experience any issues, see [AWS Support Knowledge Center: Why can't I connect to an S3 bucket using a gateway VPC endpoint?](#)

An alternative is to provide the connection by using a NAT Gateway.



You can't use a proxy to get to S3 over the internet.

Deploying the Cloud Data Sense instance

[Deploy Cloud Data Sense in Cloud Manager](#) if there isn't already an instance deployed.

You need to deploy the instance using a Connector deployed in AWS so that Cloud Manager automatically discovers the S3 buckets in this AWS account and displays them in an Amazon S3 working environment.

Note: Deploying Cloud Data Sense in an on-premises location is not currently supported when scanning S3 buckets.

Upgrades to Data Sense software is automated as long as the instance has internet connectivity.

Activating Data Sense on your S3 working environment

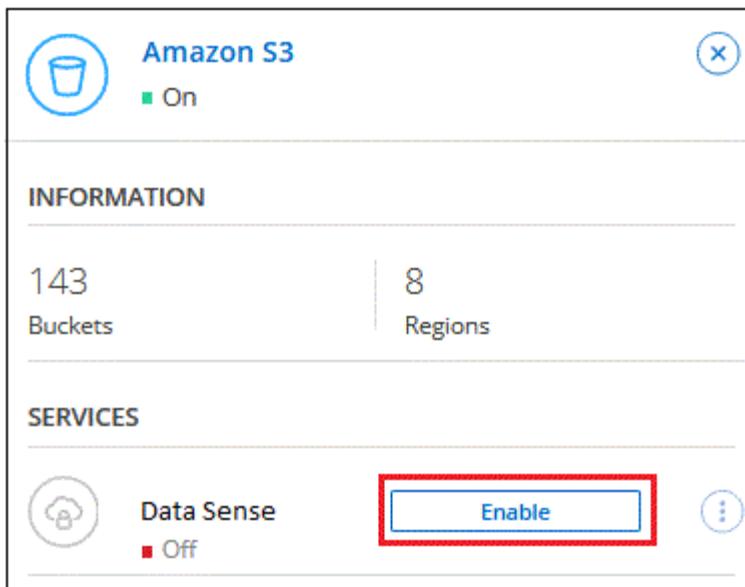
Enable Cloud Data Sense on Amazon S3 after you verify the prerequisites.

Steps

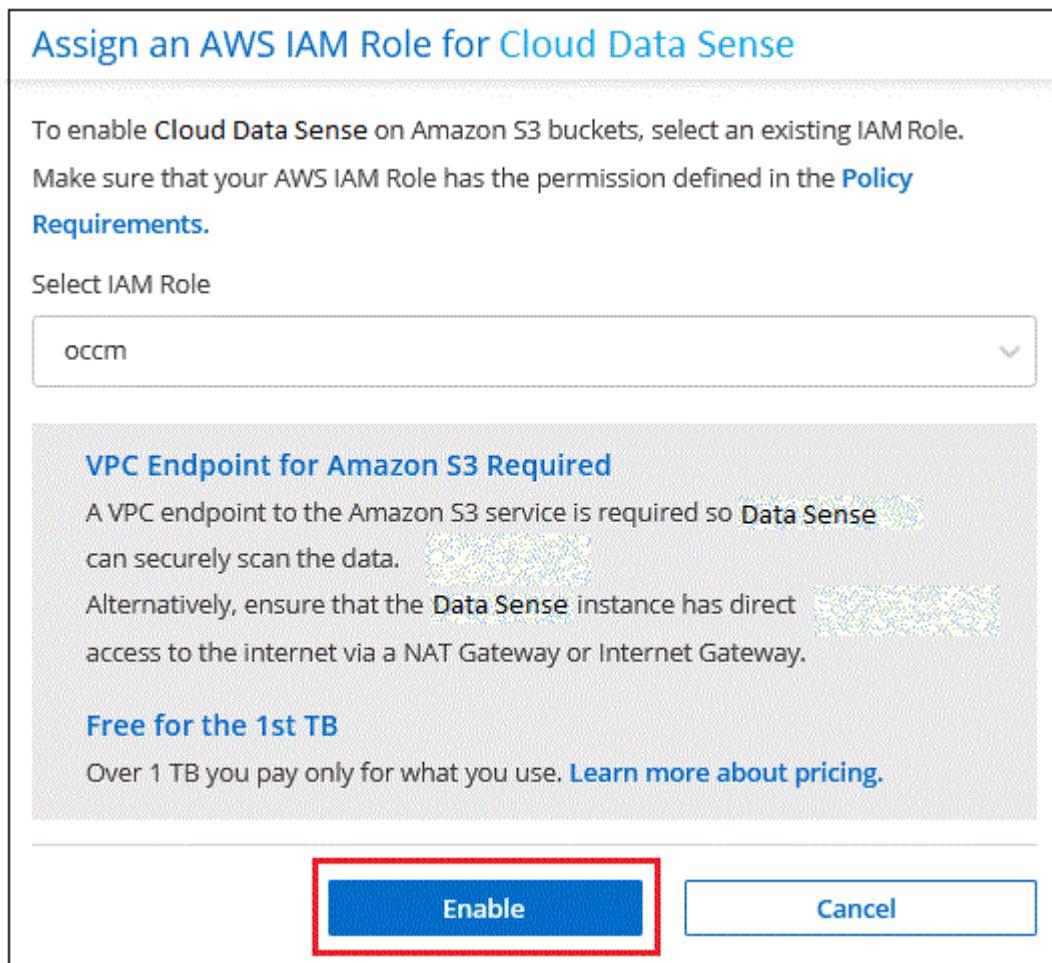
1. At the top of Cloud Manager, click **Canvas**.
2. Select the Amazon S3 working environment.



3. In the Data Sense pane on the right, click **Enable**.



4. When prompted, assign an IAM role to the Cloud Data Sense instance that has [the required permissions](#).



5. Click **Enable**.



You can also enable compliance scans for a working environment from the Configuration page by clicking the button and selecting **Activate Data Sense**.

Result

Cloud Manager assigns the IAM role to the instance.

Enabling and disabling compliance scans on S3 buckets

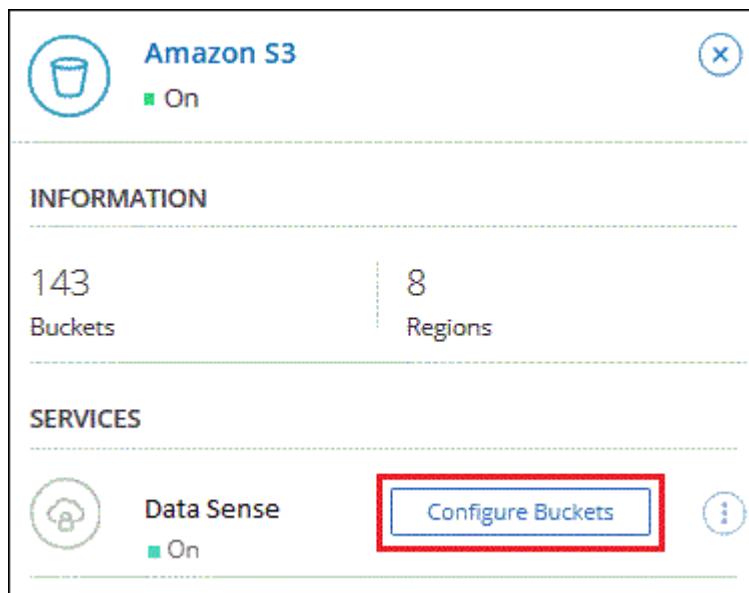
After Cloud Manager enables Cloud Data Sense on Amazon S3, the next step is to configure the buckets that you want to scan.

When Cloud Manager is running in the AWS account that has the S3 buckets you want to scan, it discovers those buckets and displays them in an Amazon S3 working environment.

Cloud Data Sense can also [scan S3 buckets that are in different AWS accounts](#).

Steps

1. Select the Amazon S3 working environment.
2. In the pane on the right, click **Configure Buckets**.



3. Enable mapping-only scans, or mapping and classification scans, on your buckets.

Amazon S3 Configuration				
15/28 Buckets in Scan Scope.				
Scan	Bucket Name	Status	Required Action	
Off	BucketName1	● Not Scanning	Add Credentials	
Map	BucketName2	● Continuously Scanning		
Off	BucketName3	● Not Scanning		

To:	Do this:
Enable mapping-only scans on a bucket	Click Map
Enable full scans on a bucket	Click Map & Classify

To:	Do this:
Disable scanning on a bucket	Click Off

Result

Cloud Data Sense starts scanning the S3 buckets that you enabled. If there are any errors, they'll appear in the Status column, alongside the required action to fix the error.

Scanning buckets from additional AWS accounts

You can scan S3 buckets that are under a different AWS account by assigning a role from that account to access the existing Cloud Data Sense instance.

Steps

1. Go to the target AWS account where you want to scan S3 buckets and create an IAM role by selecting **Another AWS account**.

Create role

1 2 3 4

Select type of trusted entity

 AWS service EC2, Lambda and others	 Another AWS account Belonging to you or 3rd party	 Web identity Cognito or any OpenID provider	 SAML 2.0 federation Your corporate directory
--	---	---	--

Allows entities in other accounts to perform actions in this account. [Learn more](#)

Specify accounts that can use this role

Account ID* ⓘ

Options Require external ID (Best practice when a third party will assume this role)
 Require MFA ⓘ

Be sure to do the following:

- Enter the ID of the account where the Cloud Data Sense instance resides.
- Change the **Maximum CLI/API session duration** from 1 hour to 12 hours and save that change.
- Attach the Cloud Data Sense IAM policy. Make sure it has the required permissions.

```
{  
    "Version": "2012-10-17",  
    "Statement": [  
        {  
            "Effect": "Allow",  
            "Action": [  
                "s3:Get*",  
                "s3>List*",  
                "s3:PutObject"  
            ],  
            "Resource": "*"  
        },  
    ]  
}
```

2. Go to the source AWS account where the Data Sense instance resides and select the IAM role that is attached to the instance.
 - a. Change the **Maximum CLI/API session duration** from 1 hour to 12 hours and save that change.
 - b. Click **Attach policies** and then click **Create policy**.
 - c. Create a policy that includes the "sts:AssumeRole" action and specify the ARN of the role that you created in the target account.

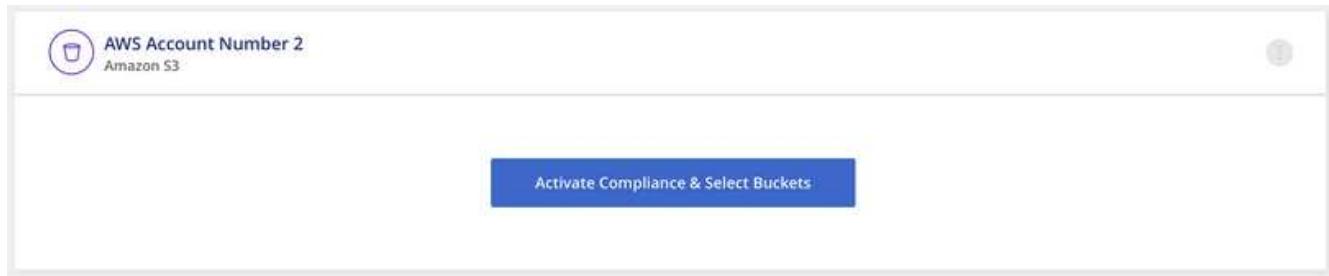
```

{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Effect": "Allow",
            "Action": "sts:AssumeRole",
            "Resource": "arn:aws:iam::<ADDITIONAL-ACCOUNT-ID>:role/<ADDITIONAL_ROLE_NAME>"
        },
        {
            "Effect": "Allow",
            "Action": [
                "iam:GetPolicyVersion",
                "iam:GetPolicy",
                "iam>ListAttachedRolePolicies"
            ],
            "Resource": [
                "arn:aws:iam::*:policy/*",
                "arn:aws:iam::*:role/*"
            ]
        }
    ]
}

```

The Cloud Data Sense instance profile account now has access to the additional AWS account.

3. Go to the **Amazon S3 Configuration** page and the new AWS account is displayed. Note that it can take a few minutes for Cloud Data Sense to sync the new account's working environment and show this information.



4. Click **Activate Data Sense & Select Buckets** and select the buckets you want to scan.

Result

Cloud Data Sense starts scanning the new S3 buckets that you enabled.

Scanning database schemas

Complete a few steps to start scanning your database schemas with Cloud Data Sense.

Quick start

Get started quickly by following these steps, or scroll down to the remaining sections for full details.

1

Review database prerequisites

Ensure that your database is supported and that you have the information necessary to connect to the database.

2

Deploy the Cloud Data Sense instance

[Deploy Cloud Data Sense](#) if there isn't already an instance deployed.

3

Add the database server

Add the database server that you want to access.

4

Select the schemas

Select the schemas that you want to scan.

Reviewing prerequisites

Review the following prerequisites to make sure that you have a supported configuration before you enable Cloud Data Sense.

Supported databases

Cloud Data Sense can scan schemas from the following databases:

- Amazon Relational Database Service (Amazon RDS)
- MongoDB
- MySQL
- Oracle
- PostgreSQL
- SAP HANA
- SQL Server (MSSQL)



The statistics gathering feature **must be enabled** in the database.

Database requirements

Any database with connectivity to the Cloud Data Sense instance can be scanned, regardless of where it is hosted. You just need the following information to connect to the database:

- IP Address or host name
- Port

- Service name (only for accessing Oracle databases)
- Credentials that allow read access to the schemas

When choosing a user name and password, it's important to choose one that has full read permissions to all the schemas and tables you want to scan. We recommend that you create a dedicated user for the Cloud Data Sense system with all the required permissions.

Note: For MongoDB, a read-only Admin role is required.

Deploying the Cloud Data Sense instance

Deploy Cloud Data Sense if there isn't already an instance deployed.

If you are scanning database schemas that are accessible over the internet, you can [deploy Cloud Data Sense in the cloud](#) or [deploy Data Sense in an on-premises location that has internet access](#).

If you are scanning database schemas that have been installed in a dark site that has no internet access, you need to [deploy Cloud Data Sense in the same on-premises location that has no internet access](#). This also requires that the Cloud Manager Connector is deployed in that same on-premises location.

Upgrades to Data Sense software is automated as long as the instance has internet connectivity.

Adding the database server

Add the database server where the schemas reside.

1. From the Working Environments Configuration page, click **Add Data Source > Add Database Server**.

The screenshot shows the 'Working Environments' configuration page. At the top right, there is a blue button labeled 'Add Data Source'. A dropdown menu is open, showing three options: 'Add Database Server' (which is highlighted with a red box), 'Add OneDrive Account', and 'Add AWS S3 accounts'. Below the button, there is a table with three rows. The first row shows 'Working Environment Name 1 | 127 Volumes' with a status of 'Cloud Volumes ONTAP'. The second row shows '87' volumes with a status of 'Continuously Scanning' and a link to 'View Details'. The third row shows '28' volumes with a status of 'Not Scanning' and a link to 'View Details'. The table also includes a column for 'Continuously scanning all selected Volumes'.

2. Enter the required information to identify the database server.
 - Select the database type.
 - Enter the port and the host name or IP address to connect to the database.
 - For Oracle databases, enter the Service name.
 - Enter the credentials so that Cloud Data Sense can access the server.
 - Click **Add DB Server**.

Add DB Server

To activate Compliance on Databases, first add a Database Server. After this step, you'll be able to select which Database Schemas you would like to activate Compliance for.

Database

Database Type

Host Name or IP Address

Port

Service Name

Credentials

Username

Password

Add DB Server

Cancel

The database is added to the list of working environments.

Enabling and disabling compliance scans on database schemas

You can stop or start full scanning of your schemas at any time.



There is no option to select mapping-only scans for database schemas.

1. From the **Configuration** page, click the **Configuration** button for the database you want to configure.

Configuration

Oracle DB 1 | 41 Schemas
Oracle

No Schemas selected for Compliance

7 Not Scanning
[View Details](#)

Configuration

2. Select the schemas that you want to scan by moving the slider to the right.

'Working Environment Name' Configuration			
28/28 Schemas selected for compliance scan			Edit Credentials
Scan	Schema Name	Status	Required Action
<input checked="" type="checkbox"/>	DB1 - SchemaName1	● Not Scanning	Add Credentials
<input checked="" type="checkbox"/>	DB1 - SchemaName2	● Continuously Scanning	
<input checked="" type="checkbox"/>	DB1 - SchemaName3	● Continuously Scanning	
<input checked="" type="checkbox"/>	DB1 - SchemaName4	● Continuously Scanning	

Result

Cloud Data Sense starts scanning the database schemas that you enabled. If there are any errors, they'll appear in the Status column, alongside the required action to fix the error.

Scanning OneDrive accounts

Complete a few steps to start scanning files in your user's OneDrive folders with Cloud Data Sense.

Quick start

Get started quickly by following these steps, or scroll down to the remaining sections for full details.

1

Review OneDrive prerequisites

Ensure that you have the Admin credentials to log into the OneDrive account.

2

Deploy the Cloud Data Sense instance

[Deploy Cloud Data Sense](#) if there isn't already an instance deployed.

3

Add the OneDrive account

Using Admin user credentials, log into the OneDrive account that you want to access so that it is added as a new working environment.

4

Add the users and select the users to scan

Add the list of users from the OneDrive account that you want to scan and select the type of scanning. You can add up to 100 users at time.

Reviewing OneDrive requirements

Review the following prerequisites to make sure that you have a supported configuration before you enable Cloud Data Sense.

- You must have the Admin login credentials for the OneDrive for Business account that provides read access to all user files.
- You will need a line-separated list of the email addresses for all the users whose OneDrive folders you want to scan.

Deploying the Cloud Data Sense instance

Deploy Cloud Data Sense if there isn't already an instance deployed.

Data Sense can be [deployed in the cloud](#) or in an on-premises location that has internet access.

Upgrades to Data Sense software is automated as long as the instance has internet connectivity.

Adding the OneDrive account

Add the OneDrive account where the user files reside.

Steps

1. From the Working Environments Configuration page, click **Add Data Source > Add OneDrive Account**.

The screenshot shows the 'Working Environments' configuration page. At the top, there's a header with '(2/20) Working Environments' and several buttons: '+ Add Active Directory', 'Integrate AIP Labels', and 'Add Data Source'. Below the header, there's a filter bar with tabs for 'CVO' (selected), 'ANF', 'S3', 'DB', and 'APPS', along with a 'Clear filters' button. The main area displays a list of working environments. One environment is shown in detail: 'Working Environment Name 1 | 127 Volumes' (Cloud Volumes ONTAP). Below this, there are three summary cards: '87 Continuously Scanning' (with a green checkmark icon), '28 Not Scanning' (with a red X icon), and 'Continuously scanning selected Volumes' (with a blue info icon). To the right of the main area is a sidebar with a list of options: 'Add File Shares Group', 'Add Database Server', 'Add OneDrive Account' (which is highlighted with a red box), and 'Add AWS S3 accounts'. The 'Add OneDrive Account' option is the target for step 1.

2. In the Add a OneDrive account dialog, click **Sign in to OneDrive**.
3. In the Microsoft page that appears, select the OneDrive account and enter the required Admin user and password, then click **Accept** to allow Cloud Data Sense to read data from this account.

The OneDrive account is added to the list of working environments.

Adding OneDrive users to compliance scans

You can add individual OneDrive users, or all of your OneDrive users, so that their files will be scanned by Cloud Data Sense.

Steps

1. From the **Configuration** page, click the **Configuration** button for the OneDrive account.

The screenshot shows the 'Configuration' page for a OneDrive account. At the top, there's a header with 'Configuration' and a 'Add Data Source' button. Below the header, there's a list of accounts. One account is shown in detail: 'OneDrive Account 1 | 41 Users' (OneDrive). To the right of this detail card is a blue button with a magnifying glass icon labeled 'Configuration', which is highlighted with a red box. This button is the target for step 1.

2. If this is the first time adding users for this OneDrive account, click **Add your first OneDrive users**.

'Working Environment Name' Configuration

No OneDrive users are being scanned

+ Add your first OneDrive users

If you are adding additional users from a OneDrive account, click **Add OneDrive users**.

Working Environment 4 Configuration

24 users are being scanned for compliance

+ Add OneDrive users

Scan	Username	Status	Required Action
Off Map Map & Classify	user2@example.com	Continuously Scanning	...
Off Map Map & Classify	user3@example.com	Continuously Scanning	...

3. Add the email addresses for the users whose files you want to scan - one email address per line (up to 100 maximum per session) - and click **Add Users**.

Add OneDrive users

Provide a list of OneDrive users for Cloud Data Sense to scan their data, line-separated. You can add up to 100 users at a time.

Type or paste below the OneDrive user accounts to add

User Accounts

user@example.com
user@example.com
user@example.com
user@example.com
user@example.com
user@example.com
user@example.com

Add Users Cancel

A confirmation dialog displays the number of users who were added.

If the dialog lists any users who could not be added, capture this information so that you can resolve the issue. In some cases you can re-add the user with a corrected email address.

4. Enable mapping-only scans, or mapping and classification scans, on user files.

To:	Do this:
Enable mapping-only scans on user files	Click Map
Enable full scans on user files	Click Map & Classify
Disable scanning on user files	Click Off

Result

Cloud Data Sense starts scanning the files for the users you added, and the results are displayed in the Dashboard and in other locations.

Removing a OneDrive user from compliance scans

If users leave the company or if their email address changes, you can remove individual OneDrive users from having their files scanned at any time. Just click **Remove OneDrive User** from the Configuration page.

The screenshot shows the 'Working Environment 4 Configuration' interface. At the top, it says '24 users are being scanned for compliance'. Below is a table with columns: Scan, Username, Status, and Required Action. A user row for 'user2@example.com' is selected, showing 'Continuously Scanning'. To the right of the table is a red box highlighting the 'Remove OneDrive User' button, which has a delete icon and the text 'Remove OneDrive User'.

Scanning SharePoint accounts

Complete a few steps to start scanning files in your SharePoint accounts with Cloud Data Sense.

Quick start

Get started quickly by following these steps, or scroll down to the remaining sections for full details.

1

Review SharePoint prerequisites

Ensure that you have the Admin credentials to log into the SharePoint account, and that you have the URLs for the SharePoint sites that you want to scan.

2

Deploy the Cloud Data Sense instance

[Deploy Cloud Data Sense](#) if there isn't already an instance deployed.

3

Log into the SharePoint account

Using Admin user credentials, log into the SharePoint account that you want to access so that it is added as a new data source/working environment.

4

Add the SharePoint site URLs to scan

Add the list of SharePoint site URLs that you want to scan in the SharePoint account, and select the type of scanning. You can add up to 100 URLs at time.

Reviewing SharePoint requirements

Review the following prerequisites to make sure you are ready to enable Cloud Data Sense on a SharePoint account.

- You must have the Admin login credentials for the SharePoint account that provides read access to all SharePoint sites.
- You will need a line-separated list of the SharePoint site URLs for all the data you want to scan.

Deploying the Cloud Data Sense instance

Deploy Cloud Data Sense if there isn't already an instance deployed.

Data Sense can be [deployed in the cloud](#) or in an on-premises location that has internet access.

Upgrades to Data Sense software is automated as long as the instance has internet connectivity.

Adding the SharePoint account

Add the SharePoint account where the user files reside.

Steps

1. From the Working Environments Configuration page, click **Add Data Source > Add SharePoint Online Account**.

The screenshot shows the 'Working Environments' configuration page with the following details:

- (2/20) Working Environments**: Shows 127 volumes under 'Working Environment Name 1 | 127 Volumes'.
- Filter by:** Buttons for CVO, ANF, S3, DB, APPS, and Clear filters.
- Actions:** Buttons for '+ Add Active Directory', 'Integrate AIP Labels', and 'Add Data Source' (with a dropdown arrow).
- Working Environment Details:**
 - Working Environment Name 1**: 127 Volumes, Cloud Volumes ONTAP.
 - Scanning Status:** 87 volumes are **Continuously Scanning**, 28 volumes are **Not Scanning**, and 1 volume is **Continuously scanning selected Volumes**.
 - View Details** links are provided for each status category.
- Add Data Source Menu:** A dropdown menu listing options:
 - Add File Shares Group
 - Add Database Server
 - Add OneDrive Account
 - Add SharePoint Online Account** (highlighted with a red border)
 - Add AWS S3 accounts

2. In the Add a SharePoint Online Account dialog, click **Sign in to SharePoint**.
3. In the Microsoft page that appears, select the SharePoint account and enter the required Admin user and password, then click **Accept** to allow Cloud Data Sense to read data from this account.

The SharePoint account is added to the list of working environments.

Adding SharePoint sites to compliance scans

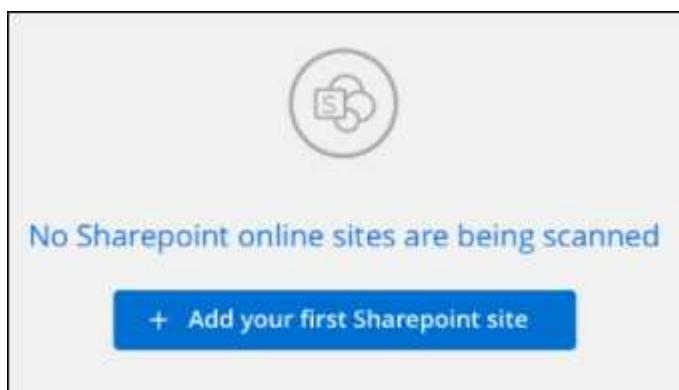
You can add individual SharePoint sites, or all of the SharePoint sites in the account, so that the associated files will be scanned by Cloud Data Sense.

Steps

1. From the **Configuration** page, click the **Configuration** button for the SharePoint account.



2. If this is the first time adding sites for this SharePoint account, click **Add your first SharePoint site**.



If you are adding additional users from a SharePoint account, click **Add SharePoint Sites**.



3. Add the URLs for the sites whose files you want to scan - one URL per line (up to 100 maximum per session) - and click **Add Sites**.

Add Sharepoint Online Sites

Provide a list of Sharepoint sites for Cloud Data Sense to scan their data, line-separated. You can add up to 100 sites at a time.

Type or paste below the Sharepoint Site URL to add

Site URL

https://netapp.sharepoint.com/sites/ComplianceUserStories
https://netapp.sharepoint.com/sites/ComplianceUserStories
https://netapp.sharepoint.com/sites/ComplianceUserStories
https://netapp.sharepoint.com/sites/ComplianceUserStories
https://netapp.sharepoint.com/sites/ComplianceUserStories
https://netapp.sharepoint.com/sites/ComplianceUserStories

Add Sites **Cancel**

A confirmation dialog displays the number of sites that were added.

If the dialog lists any sites that could not be added, capture this information so that you can resolve the issue. In some cases you can re-add the site with a corrected URL.

4. Enable mapping-only scans, or mapping and classification scans, on the files in the SharePoint sites.

To:	Do this:
Enable mapping-only scans on files	Click Map
Enable full scans on files	Click Map & Classify
Disable scanning on files	Click Off

Result

Cloud Data Sense starts scanning the files in the SharePoint sites you added, and the results are displayed in the Dashboard and in other locations.

Removing a SharePoint site from compliance scans

If you remove a SharePoint site in the future, or decide not to scan files in a SharePoint site, you can remove individual SharePoint sites from having their files scanned at any time. Just click **Remove SharePoint Site** from the Configuration page.

Scan	Site URL	Status	Required Action
Off	Map	Map & Classify	Site URL Continuously Scanning ...
Off	Map	Map & Classify	Site URL Continuously Scanning Remove SharePoint Site

Scanning file shares

Complete a few steps to start scanning non-NetApp NFS or CIFS file shares directly with Cloud Data Sense. These file shares can reside on-premises or in the cloud.

Quick start

Get started quickly by following these steps, or scroll down to the remaining sections for full details.

1

Review file share prerequisites

For CIFS (SMB) shares, ensure that you have credentials to access the shares.

2

Deploy the Cloud Data Sense instance

[Deploy Cloud Data Sense](#) if there isn't already an instance deployed.

3

Create a group to hold the file shares

The group is a container for the file shares that you want to scan, and it is used as the working environment name for those file shares.

4

Add the file shares and select the shares to scan

Add the list of file shares that you want to scan and select the type of scanning. You can add up to 100 file shares at a time.

Reviewing file share requirements

Review the following prerequisites to make sure that you have a supported configuration before you enable Cloud Data Sense.

- The shares can be hosted anywhere, including in the cloud or on-premises. These are file shares that reside on non-NetApp storage systems.
- There needs to be network connectivity between the Data Sense instance and the shares.
- Make sure these ports are open to the Data Sense instance:
 - For NFS – ports 111 and 2049.
 - For CIFS – ports 139 and 445.
- You will need the list of shares you want to add in the format <host_name>:<share_path>. You can

enter the shares individually, or you can supply a line-separated list of the file shares you want to scan.

- For CIFS (SMB) shares, ensure that you have Active Directory credentials that provide read access to the shares. Admin credentials are preferred in case Cloud Data Sense needs to scan any data that requires elevated permissions.

Deploying the Cloud Data Sense instance

Deploy Cloud Data Sense if there isn't already an instance deployed.

Data Sense can be [deployed in the cloud](#) or in an on-premises location that has internet access.

Upgrades to Data Sense software is automated as long as the instance has internet connectivity.

Creating the group for the file shares

You must add a files shares "group" before you can add your file shares. The group is a container for the file shares that you want to scan, and the group name is used as the working environment name for those file shares.

You can mix NFS and CIFS shares in the same group, however, all CIFS file shares in a group need to be using the same Active Directory credentials. If you plan to add CIFS shares that use different credentials, you must make a separate group for each unique set of credentials.

Steps

1. From the Working Environments Configuration page, click **Add Data Source > Add File Shares Group**.

The screenshot shows the 'Working Environments' configuration page. At the top, there's a header '(2/20) Working Environments' and several filter buttons: CVO (selected), ANF, S3, DB, ONEDR, BACKUP, and Clear filters. On the right, there's a 'Add Data Source' button with a dropdown arrow. Below the filters, there's a list of environments. One environment, 'Working Environment Name 1 | 127 Volumes Cloud Volumes ONTAP', is shown with its status: 'Continuously Scanning' (87 volumes) and 'Not Scanning' (28 volumes). To the right of the environment list, there's a sidebar with four options: 'Add File Shares Group' (highlighted with a red box), 'Add Database Server', 'Add OneDrive Account', and 'Add AWS S3 accounts'. The 'Add File Shares Group' option is the target for the first step in the process.

2. In the Add Files Shares Group dialog, enter the name for the group of shares and click **Continue**.

The new File Shares Group is added to the list of working environments.

Adding file shares to a group

You add file shares to the File Shares Group so that the files in those shares will be scanned by Cloud Data Sense. You add the shares in the format <host_name>:<share_path>.

You can add individual file shares, or you can supply a line-separated list of the file shares you want to scan. You can add up to 100 shares at a time.

When adding both NFS and CIFS shares in a single group, you'll need to run through the process twice - once adding NFS shares, and then again adding the CIFS shares.

Steps

1. From the *Working Environments* page, click the **Configuration** button for the File Shares Group.

(1/20) Working Environments

Filter by: CVO ANF S3 DB ONEDR SHARES Clear filters

Shares Group 1 | 41 Shares File Shares Group Configuration ...

2. If this is the first time adding file shares for this File Shares Group, click **Add your first Shares**.

'Working Environment Name' Configuration

If you are adding file shares to an existing group, click **Add Shares**.

Working Environment 2 Configuration

2/22 Shares selected for compliance scan

Scan	Share name	Protocol	Status	Required Action
Off Map Map & Classify	Sharepath2	CIFS	Continuously Scanning	...
Off Map Map & Classify	Sharepath3	NFS	Continuously Scanning	...

3. Select the protocol for the file shares you are adding, add the file shares that you want to scan - one file share per line - and click **Continue**.

When adding CIFS (SMB) shares, you need to enter the Active Directory credentials that provide read access to the shares. Admin credentials are preferred.

Adding Shares

Directly add any NFS or CIFS (SMB) File Shares, located in the cloud or on-premises.

Select Protocol

You'll be able to add additional shares from the other protocol later.

NFS CIFS (SMB)

Type or paste below the Shares to add

Provide a list of shares, line-separated. You can add up to 100 at a time (able to add more later).

Hostname:SHAREPATH
Hostname:SHAREPATH
Hostname:SHAREPATH

Provide CIFS Credentials ⓘ

Username Password

Continue **Cancel**

A confirmation dialog displays the number of shares that were added.

If the dialog lists any shares that could not be added, capture this information so that you can resolve the issue. In some cases you can re-add the share with a corrected host name or share name.

4. Enable mapping-only scans, or mapping and classification scans, on each file share.

To:	Do this:
Enable mapping-only scans on file shares	Click Map
Enable full scans on file shares	Click Map & Classify
Disable scanning on file shares	Click Off

Result

Cloud Data Sense starts scanning the files in the file shares you added, and the results are displayed in the Dashboard and in other locations.

Removing a file share from compliance scans

If you no longer need to scan certain file shares, you can remove individual file shares from having their files scanned at any time. Just click **Remove Share** from the Configuration page.

Working Environment 2 Configuration

2/22 Shares selected for compliance scan

+ Add Shares Edit CIFS Credentials

Scan	Share name	Protocol	Status	Required Action
Off	Map	Map & Classify	Sharepath1	NFS
			● Not Scanning	Add new credentials ...
				Remove Share

Scanning object storage that uses S3 protocol

Complete a few steps to start scanning data within object storage directly with Cloud Data Sense. Data Sense can scan data from any Object Storage service which uses the Simple Storage Service (S3) protocol. This includes NetApp StorageGRID, IBM Cloud Object Store, Azure Blob (using MinIO), Linode, B2 Cloud Storage, Amazon S3, and more.

Quick start

Get started quickly by following these steps, or scroll down to the remaining sections for full details.

1

Review object storage prerequisites

You need to have the endpoint URL to connect with the object storage service.

You need to have the Access Key and Secret Key from the object storage provider so that Cloud Data Sense can access the buckets.

2

Deploy the Cloud Data Sense instance

[Deploy Cloud Data Sense](#) if there isn't already an instance deployed.

3

Add the Object Storage Service

Add the object storage service to Cloud Data Sense.

4

Select the buckets to scan

Select the buckets that you'd like to scan and Cloud Data Sense will start scanning them.

Reviewing object storage requirements

Review the following prerequisites to make sure that you have a supported configuration before you enable Cloud Data Sense.

- You need to have the endpoint URL to connect with the object storage service.
- You need to have the Access Key and Secret Key from the object storage provider so that Data Sense can

access the buckets.

- Support for Azure Blob requires that you use the [MinIO service](#).

Deploying the Cloud Data Sense instance

Deploy Cloud Data Sense if there isn't already an instance deployed.

Data Sense can be [deployed in the cloud](#) or in an on-premises location that has internet access.

Upgrades to Data Sense software is automated as long as the instance has internet connectivity.

Adding the object storage service to Cloud Data Sense

Add the object storage service.

Steps

1. From the Working Environments Configuration page, click **Add Data Source > Add Object Storage Service**.

The screenshot shows the 'Working Environments' configuration page. At the top, there is a header with '(2/20) Working Environments' and several filter buttons: CVO (selected), ANF, S3, DB, ONEDR, BACKUP, and Clear filters. To the right of the filters is a 'Add Data Source' button with a dropdown arrow. Below the filters, there is a list of working environments. The first item is 'Working Environment Name 1 | 127 Volumes' (Cloud Volumes ONTAP). Below this are two more items: '87 Continuously Scanning' and '28 Not Scanning'. On the far right, there is a sidebar with several options: 'Add File Shares Group', 'Add Database Server', 'Add OneDrive Account', 'Add AWS S3 accounts', and 'Add Object Storage Service'. The 'Add Object Storage Service' option is highlighted with a red box.

2. In the Add Object Storage Service dialog, enter the details for the object storage service and click **Continue**.
 - a. Enter the name you want to use for the Working Environment. This name should reflect the name of the object storage service to which you are connecting.
 - b. Enter the Endpoint URL to access the object storage service.
 - c. Enter the Access Key and Secret Key so that Cloud Data Sense can access the buckets in the object storage.

Add Object Storage Service

Cloud Data Sense can scan data from any Object Storage service which uses the S3 protocol. This includes NetApp StorageGRID, IBM Object Store, and more.

To continue, enter the following information. In the next steps you'll need to select the buckets you want to scan.

Name the Working Environment

object_myIBM

Endpoint URL

http://my.endpoint.com

Access Key

AJUKD0574NDJG86795

Secret Key

Continue

Cancel

Result

The new Object Storage Service is added to the list of working environments.

Enabling and disabling compliance scans on object storage buckets

After you enable Cloud Data Sense on your Object Storage Service, the next step is to configure the buckets that you want to scan. Data Sense discovers those buckets and displays them in the working environment you created.

Steps

1. In the Configuration page, click **Configuration** from the Object Storage Service working environment.

(1/20) Working Environments

Filter by: CVO ANF S3 DB ONEDR BCKUP OB.STG Clear filters

Rstor Integrated | 41 Buckets
Object Storage Service

Configuration

23 Continuously Scanning View Details

All Buckets selected for Compliance

Continuously scanning all selected Buckets

2. Enable mapping-only scans, or mapping and classification scans, on your buckets.

Rstor Integrated Configuration			
3/55 Buckets selected for Compliance scan.			🔍
Scan	Storage Repository (Bucket)	Status	Required Action
Off	Map	Map & Classify	logs-759995470648-us-east-1
Off	Map	Map & Classify	logs-759995470648-us-west-2
Off	Map	Map & Classify	carstock

To:	Do this:
Enable mapping-only scans on a bucket	Click Map
Enable full scans on a bucket	Click Map & Classify
Disable scanning on a bucket	Click Off

Result

Cloud Data Sense starts scanning the buckets that you enabled. If there are any errors, they'll appear in the Status column, alongside the required action to fix the error.

Integrate your Active Directory with Cloud Data Sense

You can integrate a global Active Directory with Cloud Data Sense to enhance the results that Data Sense reports about file owners and which users and groups have access to your files.

When you set up certain data sources (listed below), you need to enter Active Directory credentials in order for Data Sense to scan CIFS volumes. This integration provides Data Sense with file owner and permissions details for those data sources. The Active Directory entered for those data sources may be different than the global Active Directory credentials you enter here. Data Sense will look in all integrated Active Directories for user and permission details.

This helps in the following locations in Data Sense:

- You can use the "File Owner" [filter](#) and see results in the file's metadata in the Investigation pane. Instead of the file owner containing the SID (Security Identifier), it is populated with the actual user name.
- You can see [full file permissions](#) for each file when you click the "View all Permissions" button.
- In the [Governance dashboard](#), the Open Permissions panel will show a greater level of detail about your data.



Local user SIDs, and SIDs from unknown domains, are not translated to the actual user name.

Supported data sources

An Active Directory integration with Cloud Data Sense can identify data from within the following data sources:

- On-premises ONTAP systems
- Cloud Volumes ONTAP
- Azure NetApp Files
- FSx for ONTAP
- Non-NetApp CIFS file shares (not for NFS file shares)

There is no support for identifying user and permission information from Database schemas, OneDrive accounts, SharePoint accounts, Amazon S3 accounts, or Object Storage that uses the Simple Storage Service (S3) protocol.

Connecting to your Active Directory server

After you've deployed Data Sense and have activated scanning on your data sources, you can integrate Data Sense with your Active Directory.

The Active Directory credentials can be read-only, but providing admin credentials ensures that Data Sense can read any data that requires elevated permissions. The credentials are stored on the Cloud Data Sense instance.

Requirements

- You must have an Active Directory already set up for the users in your company.
- You must have the information for the Active Directory:
 - DNS Server IP Address, or multiple IP Addresses
 - User Name and Password for the server
 - Domain Name (Active Directory Name)
 - Whether you are using secure LDAP (LDAPS) or not
 - LDAP Server Port (typically 389 for LDAP, and 636 for secure LDAP)
- The following ports must be open for outbound communication by the Data Sense instance:

Protocol	Port	Destination	Purpose
TCP & UDP	389	Active Directory	LDAP
TCP	636	Active Directory	LDAP over SSL
TCP	3268	Active Directory	Global Catalog
TCP	3269	Active Directory	Global Catalog over SSL

Steps

1. From the Cloud Data Sense Configuration page, click **Add Active Directory**.

The screenshot shows the Cloud Data Sense Configuration page. At the top, there are tabs for Data Sense, Governance, Compliance, Investigation, Policies, and Configuration. The Configuration tab is selected. Below the tabs, there is a header bar with the text "8 Working Environments" and three buttons: "+ Add Active Directory" (highlighted with a red box), "API Labels Integrated" (with a dropdown arrow), and "Add Data Source" (with a dropdown arrow). At the bottom of the header bar, there are filter buttons for S3, ANF, CVO, DB, APPS, SHARES, and FSx, along with a "Clear filters" link.

2. In the Connect to Active Directory dialog, enter the Active Directory details and click **Connect**. Multiple IP

Addresses can be added by adding a comma between entries.

The screenshot shows a dialog box titled "Connect to Active Directory". It contains the following fields:

- Username: mar1234
- Password: (redacted)
- DNS Server IP address: 12.13.14.15, 12.13.14.16
- Domain Name: mar@netapp.com
- LDAP Server Port: 389
- LDAP Secure Connection

At the bottom are two buttons: "Connect" (highlighted with a red border) and "Cancel".

Data Sense integrates to the Active Directory, and a new section is added to the Configuration page.

The screenshot shows the "Active Directory" section of the Configuration page. It includes the following elements:

- Active Directory Name: mar1234
- IP Address: 12.13.14.15
- Buttons: Edit (blue button), More Options (three dots icon)
- Status indicators: Active Directory Integrated (green checkmark), API Labels Integrated (green checkmark), Add Data Source (button)

Managing your Active Directory integration

If you need to modify any values in your Active Directory integration, click the **Edit** button and make the changes.

You can also delete the integration if you no longer need it by clicking the button and then **Remove Active Directory**.

Set up licensing for Cloud Data Sense

The first 1 TB of data that Cloud Data Sense scans in a Cloud Manager workspace is free. A BYOL license from NetApp, or a Cloud Manager subscription from your cloud provider's marketplace, is required to continue scanning data after that point.

A few notes before you read any further:

- If you've already subscribed to the Cloud Manager pay-as-you-go (PAYGO) subscription in your cloud provider's marketplace, then you're automatically subscribed to Cloud Data Sense as well. You won't need

to subscribe again.

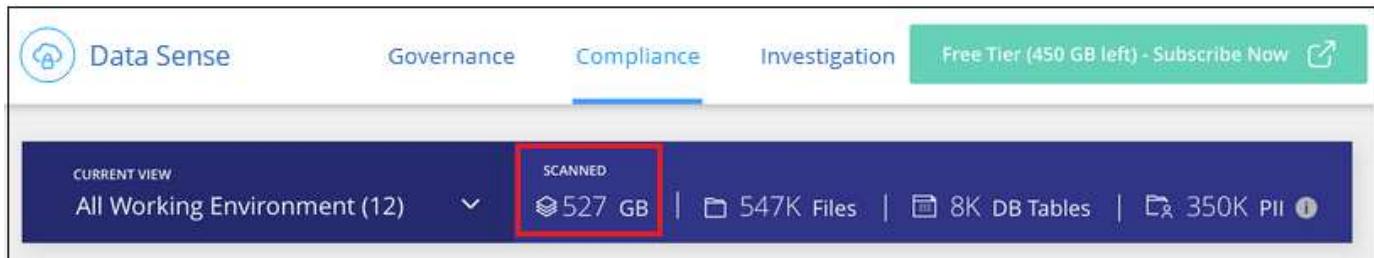
- The Cloud Data Sense bring-your-own-license (BYOL) is a *floating* license that you can use across all the working environments and data sources in the workspace that you plan to scan. You'll see an active subscription in the Digital Wallet.
- There is no charge for scanning backup files created from your on-prem ONTAP volumes (created using [Cloud Backup](#)). This data doesn't count against the capacity purchased in your license.

[Learn more about the licensing and costs related to Cloud Data Sense.](#)

Use a Cloud Data Sense PAYGO subscription

Pay-as-you-go subscriptions from your cloud provider's marketplace enable you to license the use of Cloud Volumes ONTAP systems and many Cloud Data Services, such as Cloud Data Sense.

You can subscribe at any time and you will not be charged until the amount of data exceeds 1 TB. You can always see the total amount of data that is being scanned from the Data Sense Dashboard. And the *Subscribe Now* button makes it easy to subscribe when you are ready.

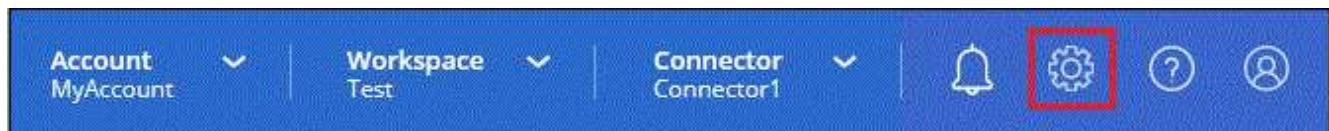


Note: If you are prompted by Cloud Data Sense to subscribe, but you already have an Azure subscription, you're probably using the old **Cloud Manager** subscription and you need to change to the new **NetApp Cloud Manager** subscription. See [how to change to the new NetApp Cloud Manager plan in Azure](#).

Steps

These steps must be completed by a user who has the *Account Admin* role.

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



2. Find the credentials for the AWS Instance Profile, Azure Managed Service Identity, or Google Project.

The subscription must be added to the Instance Profile, Managed Service Identity, or Google Project. Charging won't work otherwise.

If you already have a subscription (shown below for AWS), then you're all set—there's nothing else that you need to do.

The screenshot shows the AWS Instance Profile page. At the top, it says "aws Instance Profile" and "Credential Type: AWS Keys". Below that, there's a section for "AWS Account ID" which is blurred. To the right of this, a red arrow points down to a "Subscription" section. This section contains the text "metering service subscription QA !!!!", "Subscription", "OCCM", "IAM Role", and "2 Working Environments".

3. If you don't have a subscription yet, hover over the credentials, click the action menu, and click **Associate Subscription**.

The screenshot shows the same AWS Instance Profile page as before, but now the "Subscription" section has changed. It now says "No Subscription" instead of "metering service subscription QA !!!!". The other details like OCCM, IAM Role, and Working Environments remain the same.

4. Select an existing subscription and click **Associate**, or click **Add Subscription** and follow the steps.

The following video shows how to associate an [AWS Marketplace](#) subscription to an AWS subscription:

- ▶ https://docs.netapp.com/us-en/occm//media/video_subscribing_aws.mp4 (video)

The following video shows how to associate an [Azure Marketplace](#) subscription to an Azure subscription:

- ▶ https://docs.netapp.com/us-en/occm//media/video_subscribing_azure.mp4 (video)

The following video shows how to associate a [GCP Marketplace](#) subscription to a GCP subscription:

- ▶ https://docs.netapp.com/us-en/occm//media/video_subscribing_gcp.mp4 (video)

Change to the new Cloud Manager plan in Azure

Cloud Data Sense (Cloud Compliance) was added to the Azure Marketplace subscription named **NetApp Cloud Manager** as of October 2020. If you already have the original Azure **Cloud Manager** subscription it will not allow you to use Cloud Data Sense.

You need to follow these steps to change to the new **NetApp Cloud Manager** subscription before you can start using Cloud Data Sense.



If your existing Subscription was issued with a special private offer, you need to contact NetApp so that we can issue a new special private offer with Data Sense included.

Steps

1. In the upper right of the Cloud Manager console, click the Settings icon, and select **Credentials**.
2. Find the credentials for the Azure Managed Service Identity that you want to change the subscription for and hover over the credentials and click **Associate Subscription**.

The details for your current Marketplace Subscription are displayed.

3. Log in to the [Azure portal](#) and select **Software as a Service (SaaS)**.
4. Select the subscription for which you want to change the plan and click **Change Plan**.

The screenshot shows the Azure portal's Software as a Service (SaaS) blade. On the left, there's a list of subscriptions: 'shiranSub3008' (selected), 'shiran0510', and 'shiranDemoSub'. The 'shiranSub3008' row is highlighted with a red box. On the right, the 'Overview' tab is selected. It displays 'Offer and plan details' for 'Cloud Manager - Cloud Manager - Monthly NetApp'. A message says 'Your subscription was configured successfully.' Below it is a link 'Open SaaS Account on publisher's site'. The 'Cloud Manager - Monthly' section shows a green checkmark next to 'Subscribed' and the text 'OLD PLAN - DOES NOT INCLUDE DATA SENSE'. A red box highlights the 'Change plan' button. Below it are links 'View this offer in Marketplace', 'Terms of use', and 'Privacy policy'. To the right, under 'Billing term & price', it says 'Monthly \$0.00 per month'. Under 'Plus:', there's a long list of services and their costs, such as 'CVO Explore HA upto 2TB in HA pair \$0.49/node/hour: \$0.49 per node' and 'Cloud Tiering for On Prem ONTAP (\$0.07/TB/hour): \$0.07 per tb/hour'.

5. In the Change Plan page, select the **NetApp Cloud Manager** plan and click the **Change Plan** button.

Change plan

Subscription plans

i You can only change plans within the billing term of the current plan. If you would like to make further changes please view this offer in the Marketplace, you might need to unsubscribe and resubscribe to a new subscription plan to accomodate more changes.

Billing term Monthly Yearly

Software plan	Description	Price
<input checked="" type="radio"/> NetApp Cloud Manager	PLAN - INCLUDES DATA SENSE	\$0.00 per month Plus: CVO Explore HA upto 2TB in HA pair \$0.49/node/hour: \$0.49 per node CVO Premium plan, up to 368TB (\$3.19/node/hour): \$3.19 per node CVO Standard plan, up to 10TB (\$1.98/node/hour): \$1.98 per node Cloud Data Sense \$50/TB/Month: \$0.068 per tb/hour CVO Premium HA 368TB in HA pair \$2.56/node/hour: \$2.56 per node CVO Standar HA 10TB in HA pair \$1.77/node/hour: \$1.77 per node Cloud Tiering for On Prem ONTAP (\$0.07/TB/hour): \$0.07 per tb/hour Backup CVO to Blob \$50/TB per month (calc hourly): \$0.07 per tb/hour CVO Explore plan, up to 2TB (\$0.75/node/hour): \$0.75 per node
<input type="radio"/> Cloud Manager	OLD PLAN - DOES NOT INCLUDE DATA SENSE	\$0.00 per month Plus: CVO Explore HA upto 2TB in HA pair \$0.49/node/hour: \$0.49 per node Backup CVO to Blob \$50/TB per month (calc hourly): \$0.07 per tb/hour CVO Standar HA 10TB in HA pair \$1.77/node/hour: \$1.77 per node Restore CVO to Blob \$50/TB per month (calc hourly): \$0.07 per tb/hour CVO Standard plan, up to 10TB (\$1.98/node/hour): \$1.98 per node CVO Premium HA 368TB in HA pair \$2.56/node/hour: \$2.56 per node CVO Premium plan, up to 368TB (\$3.19/node/hour): \$3.19 per node Cloud Tiering for On Prem ONTAP (\$0.07/TB/hour): \$0.07 per tb/hour CVO Explore plan, up to 2TB (\$0.75/node/hour): \$0.75 per node

Change plan

Cancel

6. Return to Cloud Manager, select the subscription, and hover over the “i” above subscription in the Credentials card to verify your subscription has changed.

Use a Cloud Data Sense BYOL license

Bring-your-own licenses from NetApp provide 1-, 2-, or 3-year terms. The **BYOL Cloud Data Sense** license is a *floating* license where the total capacity is shared among **all** of your working environments and data sources, making initial licensing and renewal easy.

If you don't have a Cloud Data Sense license, contact us to purchase one:

- [Send email to purchase a license.](#)
- Click the chat icon in the lower-right of Cloud Manager to request a license.

Optionally, if you have an unassigned node-based license for Cloud Volumes ONTAP that you won't be using, you can convert it to a Cloud Data Sense license with the same dollar-equivalence and the same expiration date. [Go here for details.](#)

You use the Digital Wallet page in Cloud Manager to manage Cloud Data Sense BYOL licenses. You can add new licenses and update existing licenses.

Obtain your Cloud Data Sense license file

After you have purchased your Cloud Data Sense license, you activate the license in Cloud Manager by entering the Cloud Data Sense serial number and NSS account, or by uploading the NLF license file. The steps below show how to get the NLF license file if you plan to use that method.

Steps

1. Sign in to the [NetApp Support Site](#) and click **Systems > Software Licenses**.
2. Enter your Cloud Data Sense license serial number.

Software Licenses

Serial Number	481*					
Serial #	Cluster SN	License Name	License Key	Host ID	Value	End Date
Serial #	Cluster SN	License Name	Host ID	Value	End Date	
4810	SUBS-CLD-DAT-SENSE-TB-2Y	Get NetApp License File	100	12/31/9998		

3. Under **License Key**, click **Get NetApp License File**.
4. Enter your Cloud Manager Account ID (this is called a Tenant ID on the support site) and click **Submit** to download the license file.

Get License

SERIAL NUMBER:	4810
LICENSE:	SUBS-CLD-DAT-SENSE-TB-2Y
SALES ORDER:	3005
TENANT ID:	<input type="text" value="Enter Tenant ID"/> Example: account-xxxxxxxx
Cancel	Submit

You can find your Cloud Manager Account ID by selecting the **Account** drop-down from the top of Cloud Manager, and then clicking **Manage Account** next to your account. Your Account ID is in the Overview tab.

Add Cloud Data Sense BYOL licenses to your account

After you purchase a Cloud Data Sense license for your Cloud Manager account, you need to add the license to Cloud Manager to use the Cloud Data Sense service.

Steps

1. Click **All Services > Digital Wallet > Data Services Licenses**.
2. Click **Add License**.
3. In the *Add License* dialog, enter the license information and click **Add License**:
 - If you have the Data Sense license serial number and know your NSS account, select the **Enter Serial Number** option and enter that information.

If your NetApp Support Site account isn't available from the drop-down list, [add the NSS account to Cloud Manager](#).

- If you have the Data Sense license file, select the **Upload License File** option and follow the prompts to attach the file.

Add License

A license must be installed with an active subscription. The license enables you to use the Cloud Manager service for a certain period of time and for a maximum amount of space.

Enter Serial Number Upload License File

Serial Number
Enter Serial Number

NetApp Support Site Account
Select Support Site Account

Add License **Cancel**

To install a license, follow these instructions:

- 1 Obtain the license file from the "System > Software Licenses" tab at [NetApp Support Site](#). You will need to provide your cloud service serial number and Cloud Manager Account ID.
- 2 Click Upload File and then select the file.

Upload License File
Upload License File

Add License **Cancel**

Result

Cloud Manager adds the license so that your Cloud Data Sense service is active.

Update a Cloud Data Sense BYOL license

If your licensed term is nearing the expiration date, or if your licensed capacity is reaching the limit, you'll be notified in Cloud Data Sense.



This status also appears in the Digital Wallet page.

Digital Wallet Node-Based Licenses Capacity-Based Licenses Data Services Licenses

Services License Distribution
4 Total Licenses

Capacity License Distribution
Cloud Data Sense 200 TB Total Capacity

4 Service Licenses

Service	Serial Number	License Capacity	License Expiry	...
Cloud Data Sense	9012013000000000021	200 TB	July 15, 2021	...

You can update your Cloud Data Sense license before it expires so that there is no interruption in your ability to scan your data.

Steps

1. Click the chat icon in the lower-right of Cloud Manager to request an extension to your term or additional capacity to your Cloud Data Sense license for the particular serial number. You can also [send an email to request an update to your license](#).

After you pay for the license and it is registered with the NetApp Support Site, Cloud Manager automatically updates the license in the Digital Wallet and the Data Services Licenses page will reflect the change in 5 to 10 minutes.

2. If Cloud Manager can't automatically update the license (for example, when installed in a dark site), then you'll need to manually upload the license file.
 - a. You can [obtain the license file from the NetApp Support Site](#).
 - b. On the Digital Wallet page in the *Data Services Licenses* tab, click **...** for the service serial number you are updating, and click **Update License**.

4 Service Licenses				
Service	Serial Number	License Capacity	License Expiry	
Cloud Tiering	90120130000000000021	300 TB	January 1, 2022	...
Cloud Data Sense	90120130000000000022	200 TB	January 1, 2022	...

- c. In the *Update License* page, upload the license file and click **Update License**.

Result

Cloud Manager updates the license so that your Cloud Data Sense service continues to be active.

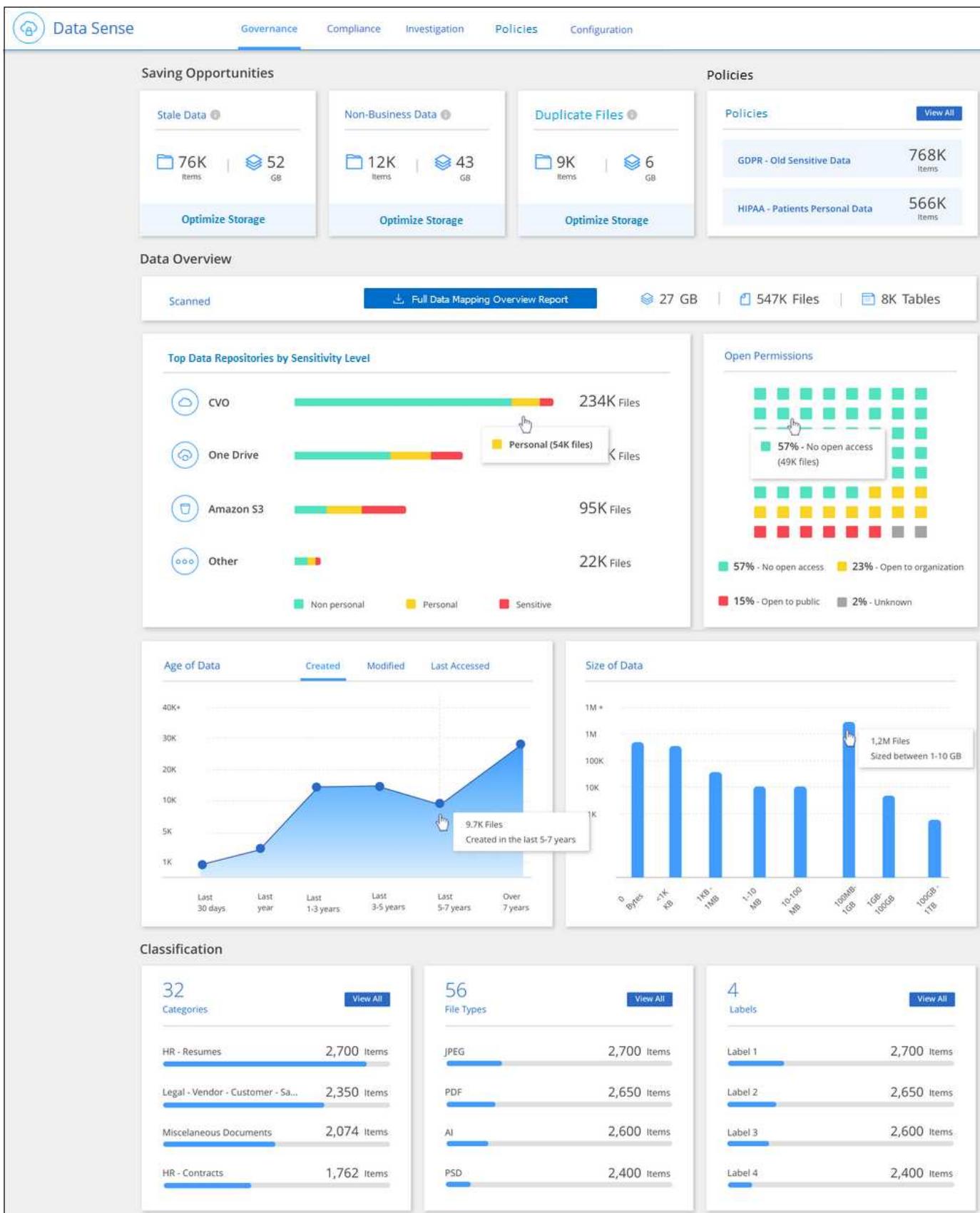
Viewing governance details about the data stored in your organization

Gain control of the costs related to the data on your organizations' storage resources. Cloud Data Sense identifies the amount of stale data, non-business data, duplicate files, and very large files in your systems so you can decide whether you want to remove or tier some files to less expensive object storage.

Additionally, if you are planning to migrate data from on-premises locations to the cloud, you can view the size of the data and whether any of the data contains sensitive information prior to moving it.

The Governance dashboard

The Governance dashboard provides information so that you can increase the efficiency and control the costs related to the data stored on your storage resources.



Saving Opportunities

You may want to investigate the items in the *Saving Opportunities* area to see if there is any data you should delete or tier to less expensive object storage. Click each item to view the filtered results in the Investigation

page.

- **Stale Data** - Data that was last modified over 3 years ago.
- **Non-Business Data** - Data considered not to be business related, based on their Category or File Type.
This includes:
 - Application Data
 - Audio
 - Executables
 - Images
 - Logs
 - Videos
 - Miscellaneous (general "other" category)
- **Duplicate Files** - Files that are duplicated in other locations in the data sources you are scanning. [See what types of duplicate files are displayed.](#)

Policies with the largest number of results

Click the name of a Policy in the *Policy* area to display the results in the Investigation page. Click **View All** to view the list of all available Policies.

Click [here](#) to learn more about Policies.

Data Overview

A quick overview of all the data that is being scanned. Click the button to download a full data mapping report that includes Usage Capacity, Age of Data, Size of Data, and File Types for all working environments and data sources. See [Data Mapping Report](#) for complete details.

Top data repositories listed by data sensitivity

The *Top Data Repositories by Sensitivity Level* area lists up to the top four data repositories (working environments and data sources) that contain the most sensitive items. The bar chart for each working environment is divided into:

- Non-Personal data
- Personal data
- Sensitive Personal data

You can hover over each section to see the total number of items in each category.

Click each area to view the filtered results in the Investigation page so that you can investigate further.

Data listed by types of Open Permissions

The *Open Permissions* area shows the percentage for each type of permissions that exist for all files that are being scanned. The chart shows the following types of permissions:

- No Open Access
- Open to Organization

- Open to Public
- Unknown Access

You can hover over each section to see the total number of files in each category. Click each area to view the filtered results in the Investigation page so that you can investigate further.



Files in OneDrive accounts, SharePoint accounts, and in databases are not represented in this chart.

Age of Data and Size of Data graphs

You may want to investigate the items in the *Age* and *Size* graphs to see if there is any data you should delete or tier to less expensive object storage.

You can hover over a point in the charts to see details about the age or size of the data in that category. Click to view all the files filtered by that age or size range.

- **Age of Data graph** - Categorizes data based on the time it was created, the last time it was accessed, or the last time it was modified.
- **Size of Data graph** - Categorizes data based on size.

Most identified data Classifications

The *Classification* area provides a list of the most identified [Categories](#), [File types](#), and [AIP Labels](#) in your scanned data.

Categories

Categories can help you understand what's happening with your data by showing you the types of information that you have. For example, a category like "resumes" or "employee contracts" can include sensitive data. When you investigate the results, you might find that employee contracts are stored in an insecure location. You can then correct that issue.

See [Viewing files by categories](#) for more information.

File types

Reviewing your file types can help you control your sensitive data because you might find that certain file types are not stored correctly.

See [Viewing file types](#) for more information.

AIP labels

If you have subscribed to Azure Information Protection (AIP), you can classify and protect documents and files by applying labels to content. Reviewing the most used AIP labels that are assigned to files enables you to see which labels are most used in your files.

See [AIP Labels](#) for more information.

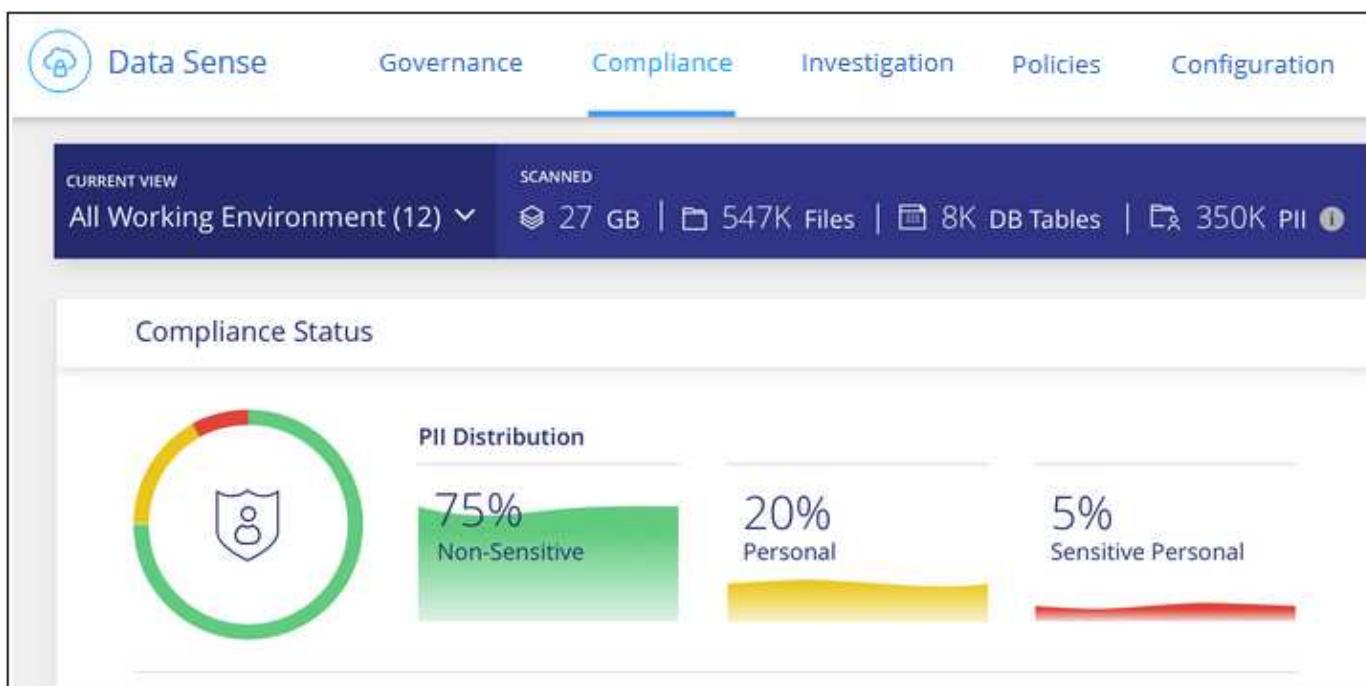
Viewing compliance details about the data stored in your organization

Gain control of your private data by viewing details about the personal data and sensitive personal data in your organization. You can also gain visibility by reviewing the categories and file types that Cloud Data Sense found in your data.



The capabilities described in this section are available only if you have chosen to perform a full classification scan on your data sources. Data sources that have had a mapping-only scan do not show file-level details.

By default, the Cloud Data Sense dashboard displays compliance data for all working environments and databases.



If you want to see data for only some of the working environments, [select those working environments](#).

You can also filter the results from the Data Investigation page and download a report of the results as a CSV file. See [Filtering data in the Data Investigation page](#) for details.

Viewing files that contain personal data

Cloud Data Sense automatically identifies specific words, strings, and patterns (Regex) inside the data. For example, Personal Identification Information (PII), credit card numbers, social security numbers, bank account numbers, and more. [See the full list](#).

Additionally, if you have added a database server to be scanned, the *Data Fusion* feature allows you to scan your files to identify whether unique identifiers from your databases are found in those files or other databases. See [Adding personal data identifiers using Data Fusion](#) for details.

For some types of personal data, Data Sense uses *proximity validation* to validate its findings. The validation occurs by looking for one or more predefined keywords in proximity to the personal data that was found. For

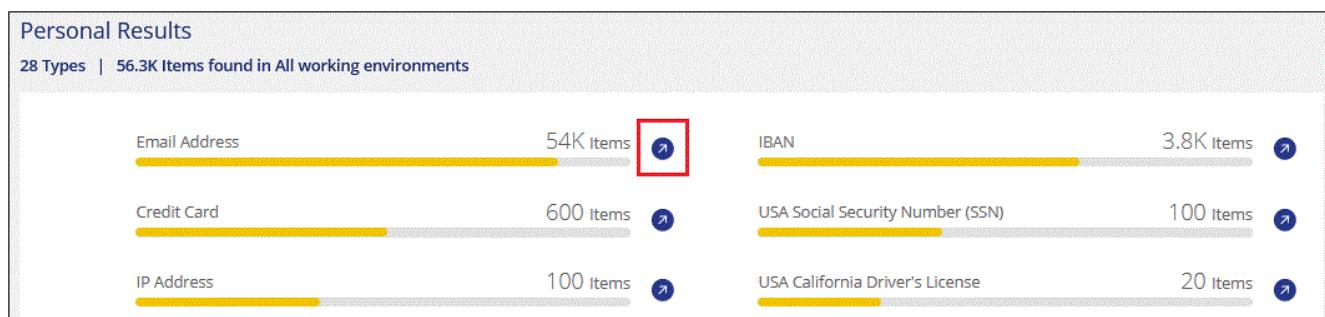
example, Data Sense identifies a U.S. social security number (SSN) as a SSN if it sees a proximity word next to it—for example, *SSN* or *social security*. The table of personal data shows when Data Sense uses proximity validation.

Steps

1. At the top of Cloud Manager, click **Data Sense** and click the **Compliance** tab.
2. To investigate the details for all personal data, click the icon next to the personal data percentage.



3. To investigate the details for a specific type of personal data, click **View All** and then click the **Investigate Results** icon for a specific type of personal data; for example, email addresses.



4. Investigate the data by searching, sorting, expanding details for a specific file, clicking **Investigate Results** to see masked information, or by downloading the file list.

File Name

customer-data.xls

S3 838 0 63 XLS

Working Environment (Account): S3 - 759995470648

Storage Repository (Bucket): compliantdemofiles

File Path: /Patterns/NEW SSN/custo...

Category: Miscellaneous Spreadsheets

File Size: 142.35 KB

Last Modified: 2019-12-16 12:18

Open Permissions: NOT PUBLIC

Duplicates: 2 View Details

Assign a Label to this file

Delete this file

Give feedback on this result

Viewing files that contain sensitive personal data

Cloud Data Sense automatically identifies special types of sensitive personal information, as defined by privacy regulations such as [articles 9 and 10 of the GDPR](#). For example, information regarding a person's health, ethnic origin, or sexual orientation. See the full list.

Cloud Data Sense uses artificial intelligence (AI), natural language processing (NLP), machine learning (ML), and cognitive computing (CC) to understand the meaning of the content that it scans in order to extract entities and categorize it accordingly.

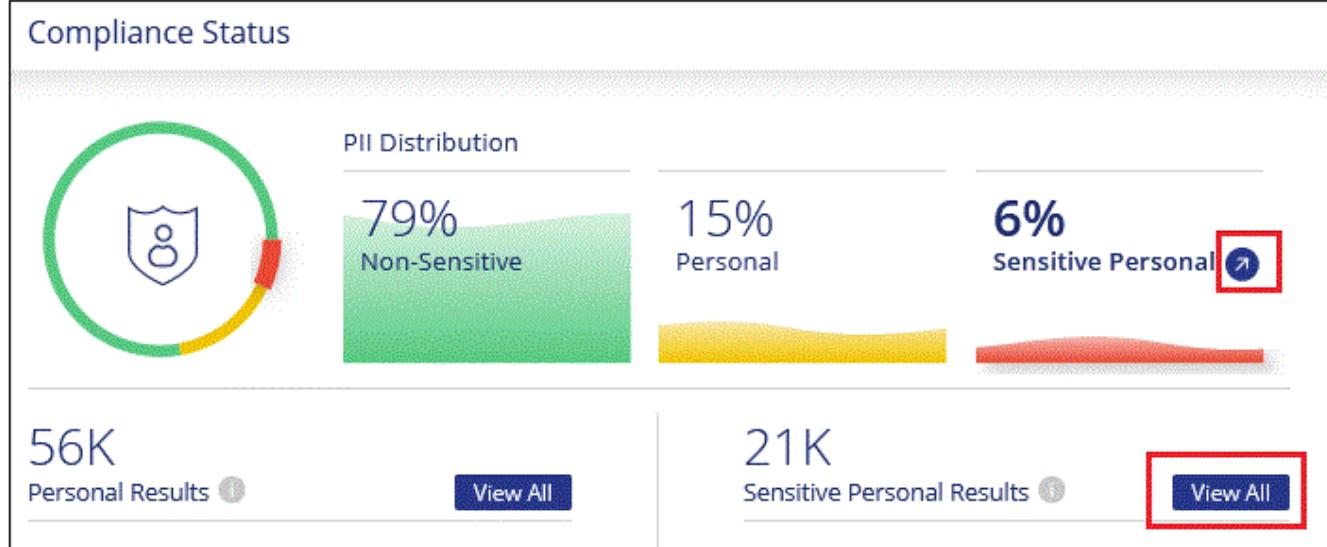
For example, one sensitive GDPR data category is ethnic origin. Because of its NLP abilities, Data Sense can distinguish the difference between a sentence that reads "George is Mexican" (indicating sensitive data as specified in article 9 of the GDPR), versus "George is eating Mexican food."



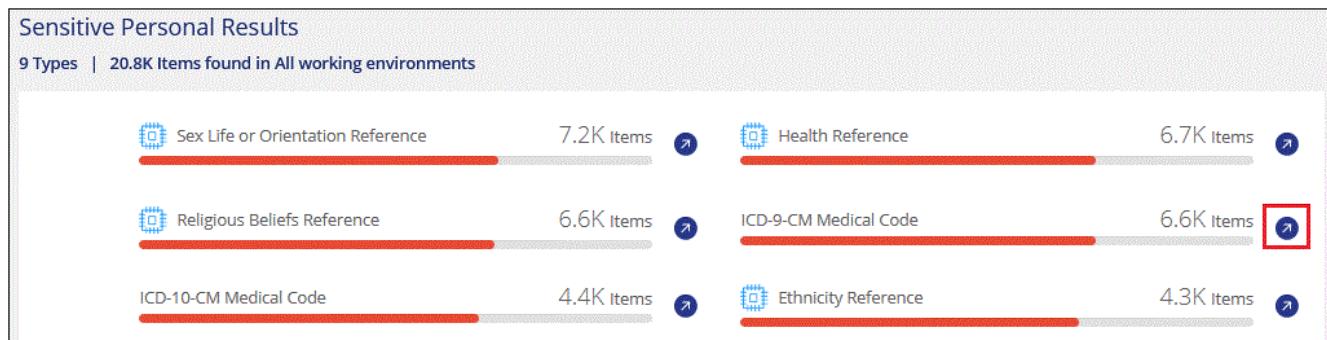
Only English is supported when scanning for sensitive personal data. Support for more languages will be added later.

Steps

1. At the top of Cloud Manager, click **Data Sense** and click the **Compliance** tab.
2. To investigate the details for all sensitive personal data, click the icon next to the sensitive personal data percentage.



- To investigate the details for a specific type of sensitive personal data, click **View All** and then click the **Investigate Results** icon for a specific type of sensitive personal data.



- Investigate the data by searching, sorting, expanding details for a specific file, clicking **Investigate Results** to see masked information, or by downloading the file list.

Viewing files by categories

Cloud Data Sense takes the data that it scanned and divides it into different types of categories. Categories are topics based on AI analysis of the content and metadata of each file. [See the list of categories](#).

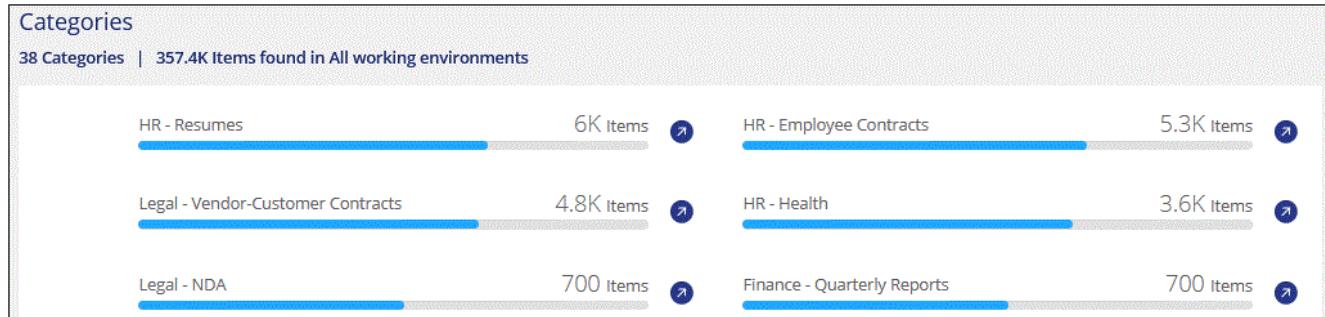
Categories can help you understand what's happening with your data by showing you the types of information that you have. For example, a category like resumes or employee contracts can include sensitive data. When you investigate the results, you might find that employee contracts are stored in an insecure location. You can then correct that issue.



English, German, and Spanish are supported for categories. Support for more languages will be added later.

Steps

- At the top of Cloud Manager, click **Data Sense** and click the **Compliance** tab.
- Click the **Investigate Results** icon for one of the top 4 categories directly from the main screen, or click **View All** and then click the icon for any of the categories.



3. Investigate the data by searching, sorting, expanding details for a specific file, clicking **Investigate Results** to see masked information, or by downloading the file list.

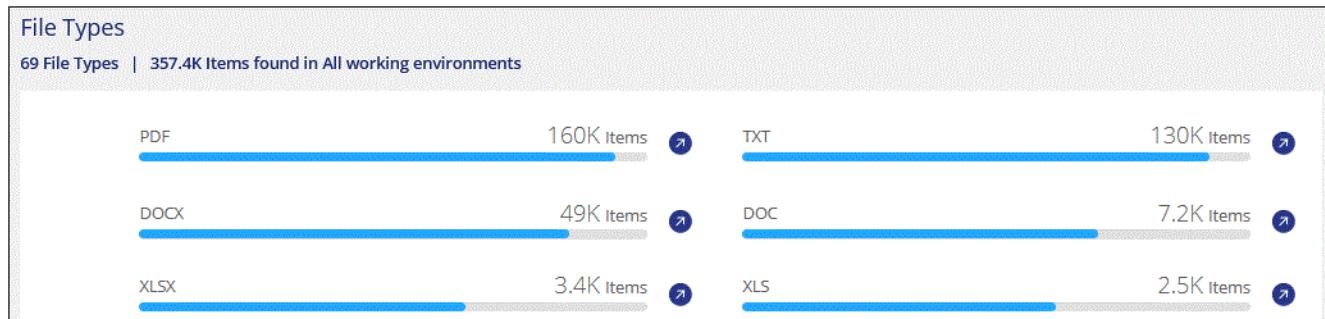
Viewing files by file types

Cloud Data Sense takes the data that it scanned and breaks it down by file type. Reviewing your file types can help you control your sensitive data because you might find that certain file types are not stored correctly. [See the list of file types](#).

For example, you might be storing CAD files that include very sensitive information about your organization. If they are unsecured, you can take control of the sensitive data by restricting permissions or moving the files to another location.

Steps

1. At the top of Cloud Manager, click **Data Sense** and click the **Compliance** tab.
2. Click the **Investigate Results** icon for one of the top 4 file types directly from the main screen, or click **View All** and then click the icon for any of the file types.



3. Investigate the data by searching, sorting, expanding details for a specific file, clicking **Investigate Results** to see masked information, or by downloading the file list.

Viewing file metadata

In the Data Investigation results pane you can click for any single file to view the file metadata.

In addition to showing you the working environment and volume where the file resides, the metadata shows much more information, including the file permissions, file owner, whether there are duplicates of this file, and assigned AIP label (if you have [integrated AIP in Cloud Data Sense](#)). This information is useful if you're planning to [create Policies](#) because you can see all the information that you can use to filter your data.

Note that not all information is available for all data sources - just what is appropriate for that data source. For example, volume name, permissions, and AIP labels are not relevant for database files.

When viewing the details for a single file there are a few actions you can take on the file:

- You can move or copy the file to any NFS share. See [Moving source files to an NFS share](#) and [Copying source files to an NFS share](#) for details.
- You can delete the file. See [Deleting source files](#) for details.
- You can assign a certain Status to the file. See [Applying Status tags](#) for details.
- You can assign the file to a Cloud Manager user to be responsible for any follow-up actions that need to be done on the file. See [Assigning users to a file](#) for details.
- If you have integrated AIP labels with Cloud Data Sense, you can assign a label to this file, or change to a different label if one already exists. See [Assigning AIP labels manually](#) for details.

Viewing permissions for files

To view a list of all users or groups who have access to a file, and the types of permissions they have, click **[View all Permissions](#)**.

The screenshot shows a file details page for 'Expense Report TPO-1060.pdf'. At the top, there are filters for 'Personal', 'Sensitive Personal', 'Data Subjects', and 'File Type'. Below the filters, the file name is listed along with its location ('cvo'), version count (6), and other details like file path and category. A red box highlights the 'View all Permissions' button, which is also shown in a larger callout box titled 'Permissions list for file Expense Report TPO-1060.pdf'. The permissions table includes columns for 'Group or User', 'Read', and 'Write', listing four users: user1@company.com, user2@company.com, dist_list_IT@company.com, and user4@company.com.

Group or User	Read	Write
user1@company.com	✓	✗
user2@company.com	✓	✓
dist_list_IT@company.com	✓	✗
user4@company.com	✓	✓

This button is available only for files in CIFS shares.

Note that if you see SIDs (Security IDentifiers) instead of user and group names, you should integrate your Active Directory into Data Sense. [See how to do this.](#)

Checking for duplicate files in your storage systems

You can view if duplicate files are being stored in your storage systems. This is useful if you want to identify areas where you can save storage space. It can also be helpful to make sure certain files that have specific permissions or sensitive information are not unnecessarily duplicated in your storage systems.

You can download the list of duplicate files and send it to your storage admin so they can decide which files, if any, can be deleted. Or you can [delete the file](#) yourself if you are confident that a specific version of the file is not needed.

Viewing all duplicated files

If you want a list of all files that are duplicated in the working environments and data sources you are scanning, you can use the filter called **Duplicates > Has duplicates** in the Data Investigation page.

All files with duplicates from all file types (not including databases), with a minimum size of 50 MB, and/or containing personal or sensitive personal information, will show in the Results page.

Viewing if a specific file is duplicated

If you want to see if a single file has duplicates, in the Data Investigation results pane you can click **✓** for any single file to view the file metadata. If there are duplicates of a certain file, this information appears next to the **Duplicates** field.

To view the list of duplicate files and where they are located, click **View Details**. In the next page click **View**

Duplicates to view the files in the Investigation page.

The screenshot shows the Cloud Data Sense interface. At the top left, there are file metadata: Last Modified (2019-08-06 07:51), Open Permissions (NO OPEN PERMISSIONS), File Owner (Asaf Ley), and Duplicates (3). A red box highlights the 'View Details' link next to the Duplicates count. A modal window titled 'Duplicates of File 'Name 1'' is open, displaying the following information: Duplicates: 3, Total Size of all Duplicates: 1GB, and File Hash: xxxxxx. Two buttons at the bottom of the modal are 'View Duplicates' (highlighted with a red box) and 'Close'. Below the modal, a table lists '3 items' with columns: File Name, Personal, Sensitive Personal, Data Subjects, and File Type. The table entries are:

File Name	Personal	Sensitive Personal	Data Subjects	File Type
Expense Report EXP-TPO-106038887654	cvo	6	3	16 PDF
Expense Report EXP-TPO-106038887654	cvo	6	3	16 PDF
Expense Report EXP-TPO-106038887654	cvo	6	3	16 PDF



You can use the "file hash" value provided in this page and enter it directly in the Investigation page to search for a specific duplicate file at any time - or to be used in a Policy.

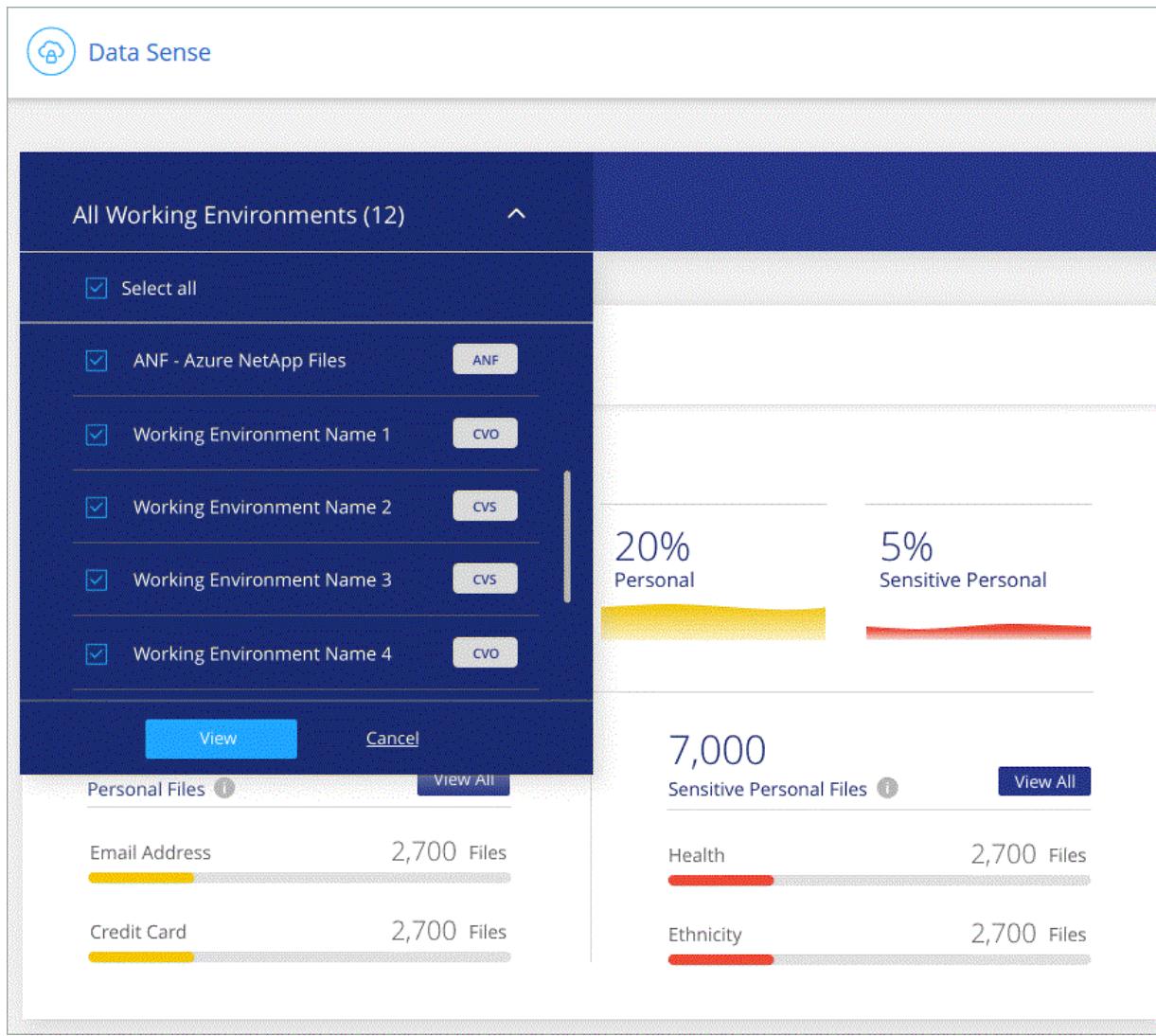
Viewing Dashboard data for specific working environments

You can filter the contents of the Cloud Data Sense dashboard to see compliance data for all working environments and databases, or for just specific working environments.

When you filter the dashboard, Data Sense scopes the compliance data and reports to just those working environments that you selected.

Steps

1. Click the filter drop-down, select the working environments that you'd like to view data for, and click **View**.



Filtering data in the Data Investigation page

You can filter the contents of the investigation page to display only the results you want to see. If you want to save a CSV version of the content as a report after you have refined it, click the button.

The screenshot shows the Data Investigation interface. At the top, there are two tabs: "Unstructured (252K Files)" (selected) and "Structured (0 Tables)". Below the tabs is a search bar with placeholder text "Search by File or DB Table name or location" and a download icon. On the left, a sidebar titled "FILTERS:" lists various categories with a "Clear All" button. The main area displays a table titled "252K items" with the following columns: "File Name", "Personal", "Sensitive Personal", "Data Subjects", and "File Type". The table contains several rows of data, each with a checkbox, file name, sensitivity level (ANF), count (0 or 797), data subject (111), and file type (TXT). The data appears to be mostly identical entries for "cgdp_yes_adam.txt".

- The top-level tabs allow you to view data from files (unstructured data) or from databases (structured data).
- The controls at the top of each column allow you to sort the results in numerical or alphabetical order.
- The left-pane filters enable you to refine the results by selecting from the following attributes:
 - Policies
 - Open Permissions
 - File Owner
 - Label
 - Working Environment Type (note that OneDrive and SharePoint are categorized under "Cloud Apps")
 - Working Environment name
 - Storage Repository (for example, a volume or a schema)
 - File Path
 - Category
 - Sensitivity Level
 - Personal Data
 - Sensitive Personal Data
 - Data Subject
 - File Type
 - File Size
 - Created Time
 - Last Modified
 - Last Accessed (For the [types of files that we scan for content](#) this is the last time Data Sense scanned the file.)
 - Duplicates
 - File Hash

- Tags
- Assigned To
- The *Policies* filter at the top of the Filters pane lists the custom filters that provide commonly requested combinations of filters; like a saved database query or Favorites list. Go [here](#) to view the list of predefined Policies and to see how you can create your own custom Policies.

What's included in each file list report (CSV file)

From each Investigation page you can click the  button to download file lists (in CSV format) that include details about the identified files. If Data Sense is scanning both Structured (database tables) and Unstructured (files) data, there are two reports contained in the downloaded ZIP file.

If there are more than 10,000 results, only the top 10,000 appear in the list.

The **Unstructured Data Report** includes the following information:

- File name
- Location type
- Working environment type
- Working environment name
- Storage repository (for example, a volume)
- Protocol type
- File path
- File type
- File size
- Created time
- Discovered time (when Data Sense first discovered the file)
- Last modified
- Last accessed
- File owner
- Category
- Personal information
- Sensitive personal information
- Deletion detection date

A deletion detection date identifies the date that the file was deleted or moved. This enables you to identify when sensitive files have been moved. Deleted files aren't part of the file number count that appears in the dashboard or on the Investigation page. The files only appear in the CSV reports.

The **Structured Data Report** includes the following information:

- DB Table name
- Location type
- Working environment type

- Working environment name
- Storage repository (for example, a schema)
- Column count
- Row count
- Personal information
- Sensitive personal information

Organizing your private data

Cloud Data Sense provides many ways for you to manage and organize your private data. This makes it easier to see the data that is most important to you.

- If you are subscribed to [Azure Information Protection \(AIP\)](#) to classify and protect your files, you can use Cloud Data Sense to manage those AIP labels.
- You can add Tags to files that you want to mark for organization or for some type of follow-up.
- You can assign a Cloud Manager user to a specific file, or to multiple files, so that person can be responsible for managing the file.
- Using the "Policy" functionality you can create your own custom search queries so that you can easily see the results by clicking one button.
- You can send email alerts to Cloud Manager users when certain critical Policies return results.



The capabilities described in this section are available only if you have chosen to perform a full classification scan on your data sources. Data sources that have had a mapping-only scan do not show file-level details.

Should I use tags or labels?

Below is a comparison of Data Sense tagging and Azure Information Protection labeling.

Tags	Labels
File tags are an integrated part of Data Sense.	Requires that you have subscribed to Azure Information Protection (AIP).
The tag is only kept in the Data Sense database - it is not written to the file. It does not change the file, or the file accessed or modified times.	The label is part of the file and when the label changes, the file changes. This change also changes the file accessed and modified times.
You can have multiple tags on a single file.	You can have one label on a single file.
The tag can be used for internal Data Sense action, such as copy, move, delete, run a policy, etc.	Other systems that can read the file can see the label - which can be used for additional automation.
Only a single API call is used to see if a file has a tag.	

Categorizing your data using AIP labels

You can manage AIP labels in the files that Cloud Data Sense is scanning if you have subscribed to [Azure Information Protection \(AIP\)](#). AIP enables you to classify and protect documents and files by applying labels to

content. Data Sense enables you to view the labels that are already assigned to files, add labels to files, and change labels when a label already exists.

Cloud Data Sense supports AIP labels within the following file types: .DOC, .DOCX, .PDF, .PPTX, .XLS, .XLSX.

- You can't currently change labels in files larger than 30 MB. For OneDrive and SharePoint accounts the maximum file size is 4 MB.
- If a file has a label which doesn't exist anymore in AIP, Cloud Data Sense considers it as a file without a label.
- If you have deployed the Data Sense instance in an on-prem location that has no internet access (also known as a dark site), then the AIP label functionality is unavailable.

Integrating AIP labels in your workspace

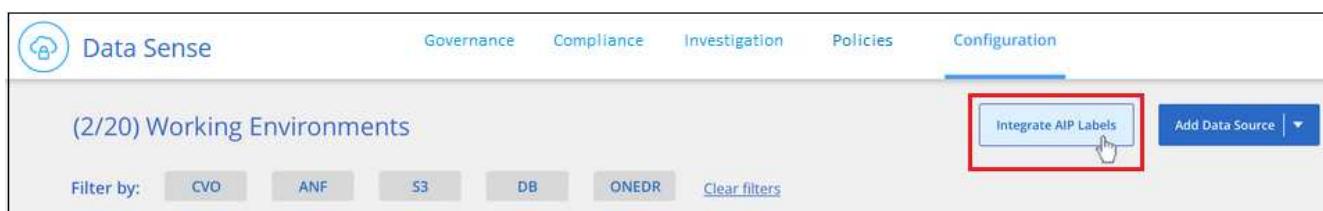
Before you can manage AIP labels, you need to integrate the AIP label functionality into Cloud Data Sense by signing into your existing Azure account. Once enabled, you can manage AIP labels within files for all [working environments and data sources](#) in your Cloud Manager workspace.

Requirements

- You must have an account and an Azure Information Protection license.
- You must have the login credentials for the Azure account.
- If you plan to change labels in files that reside in Amazon S3 buckets, ensure that the permission s3:PutObject is included in the IAM role. See [setting up the IAM role](#).

Steps

1. From the Cloud Data Sense Configuration page, click **Integrate AIP Labels**.



2. In the Integrate AIP Labels dialog, click **Sign in to Azure**.
3. In the Microsoft page that appears, select the account and enter the required credentials.
4. Return to the Cloud Data Sense tab and you'll see the message "*AIP Labels were integrated successfully with the account <account_name>*".
5. Click **Close** and you'll see the text *AIP Labels integrated* at the top of the page.



Result

You can view and assign AIP labels from the results pane of the Investigation page. You can also assign AIP labels to files using Policies.

Viewing AIP labels in your files

You can view the current AIP label that is assigned to a file.

In the Data Investigation results pane, click  for the file to expand the file metadata details.



The screenshot shows the Data Investigation results pane. At the top, there are tabs for "Unstructured (32K Files)" and "Structured (323 DB Tables)". Below the tabs is a header row with columns: File Name, Personal, Sensitive Personal, Data Subjects, and File Type. The first file listed is "Expense Report EXP-TPO-10603888765435" with values: cvo, 6, 3, 16, PDF. The second file listed is "Expense Report EXP-TPO-10603888765435" with values: cvo, 6 (with a blue circular icon), 3 (with a blue circular icon), 16 (with a blue circular icon), PDF (with a blue circular icon). Below these files, there is a section titled "Working Environment: WorkingEnvironment1" and another titled "Repository: Volume Name". At the bottom right of the expanded section, there is a "Label" button with a yellow square icon and the word "Finance".

Assigning AIP labels manually

You can add, change, and remove AIP labels from your files using Cloud Data Sense.

Follow these steps to assign an AIP label to a single file.

Steps

1. In the Data Investigation results pane, click  for the file to expand the file metadata details.

The screenshot shows the Data Investigation results pane. At the top, there are two tabs: "Unstructured (32K Files)" and "Structured (323 DB Tables)". Below the tabs is a header with columns: File Name, Personal, Sensitive Personal, Data Subjects, and File Type. The first row of data is for an "Expense Report EXP-TPO-10603888765435". The second row is also for the same file, with a red box highlighting the "Edit" icon in the "Data Subjects" column.

On the left side of the second row, there is a list of file metadata:

- Working Environment: WorkingEnvironment1
- Repository: Volume Name
- File Path: /Prod/labs-base/Expense Report EXP-TPO-1060388.pdf
- Category: Legal
- File Size: 22 MB
- Last Modified: 2019-08-06 07:51
- Open Permissions: NO OPEN PERMISSIONS | View all Permissions
- File Owner: Assaf Vol

To the right of the metadata is a modal window titled "Assign a Label to this file". It contains three options: "General" (blue square), "Finance" (yellow square, highlighted with a red border), and "Confidential" (red square).

2. Click **Assign a Label to this file** and then select the label.

The label appears in the file metadata.

To assign an AIP label to multiple files:

Steps

1. In the Data Investigation results pane, select the file, or files, that you want to label.

The screenshot shows the Data Investigation results pane with 2345 items. The title bar includes buttons for Tags, Assign to, Label, Copy, Move, and Delete. Below the title bar is a header with columns: File Name, Personal, Sensitive Personal, Data Subjects, and File Type.

Two files are selected for labeling, indicated by checked checkboxes in the "File Name" column:

- Expense Report EXP-TPO-106038887654
- Expense Report EXP-TPO-106038887654

The other two files in the list have unchecked checkboxes.

- To select individual files, check the box for each file (Volume_1).
- To select all files on the current page, check the box in the title row (File Name).

2. From the button bar, click **Label** and select the AIP label.



The AIP label is added to the metadata for all selected files.

Assigning AIP labels automatically with Policies

You can assign an AIP label to all the files that meet the criteria of the Policy. You can specify the AIP label when creating the Policy, or you can add the label when editing any Policy.

Labels are added or updated in files continuously as Cloud Data Sense scans your files.

Depending on whether a label is already applied to a file, and the classification level of the label, the following actions are taken when changing a label:

If the file...	Then...
Has no label	The label is added
Has an existing label of a lower level of classification	The higher level label is added
Has an existing label of a higher level of classification	The higher level label is retained
Is assigned a label both manually and by a Policy	The higher level label is added
Is assigned two different labels by two Policies	The higher level label is added

Follow these steps to add an AIP label to an existing Policy.

Steps

- From the Policies List page, click **Edit** for the Policy where you want to add (or change) the AIP label.

Policy Name	Label	E-mail notifications	Action
GDPR - Old Sensitive Data	General	Monthly	Edit
HIPAA - Patients Personal Data	OFF	OFF	Edit

2. In the Edit Policy page, check the box to enable automatic labels for files that match the Policy parameters, and select the label (for example, **General**).

The screenshot shows the 'Edit Policy' interface. It includes fields for naming the policy ('Name this Policy: HIPAA - Patient Personal Data') and giving it a description ('Give it a description to quickly identify it: Files containing patient health information that is more than 30 days old'). There are also checkboxes for sending email updates and automatically labeling matches. A dropdown menu titled 'select label' is open, showing three options: 'General' (highlighted with a red box), 'Finance', and 'Confidential'. A cursor is pointing at the 'General' option.

3. Click **Save Policy** and the label appears in the Policy description.



If a Policy was configured with a label, but the label has since been removed from AIP, the label name is turned to OFF and the label is not assigned anymore.

Removing the AIP integration

If you no longer want the ability to manage AIP labels in files, you can remove the AIP account from the Cloud Data Sense interface.

Note that no changes are made to the labels you have added using Data Sense. The labels that exist in files will stay as they currently exist.

Steps

1. From the *Configuration* page, click **AIP Labels integrated > Remove Integration**.

The screenshot shows the 'Configuration' page with a blue header bar. On the left, there's a green circular icon with a checkmark next to the text 'AIP Labels integrated'. To its right is a blue button labeled 'Add Data Source'. Below these are two buttons: a white one with a red border and a red circle containing a white 'X', labeled 'Remove Integration', and a blue one labeled 'Cancel'.

2. Click **Remove Integration** from the confirmation dialog.

Applying tags to manage your scanned files

You can add a tag to files that you want to mark for some type of follow-up. For example, you may have found some duplicate files and you want to delete one of them, but you need to check to see which one should be deleted. You could add a tag of "Check to delete" to the file so you know this file requires some research and some type of future action.

Data Sense enables you to view the tags that are assigned to files, add or remove tags from files, and change the name or delete an existing tag.

Note that the tag is not added to the file in the same way as AIP Labels are part of the file metadata. The tag is just seen by Cloud Manager users using Cloud Data Sense so you can see if a file needs to be deleted or checked for some type of follow-up.



Tags assigned to files in Cloud Data Sense are not related to the tags you can add to resources, such as volumes or virtual machine instances. Data Sense tags are applied at the file level.

Viewing files that have certain tags applied

You can view all the files that have specific tags assigned.

1. Click the **Investigation** tab from Cloud Data Sense.
2. In the Data Investigation page, click **Tags** in the Filters pane and then select the required tags.

The screenshot shows the 'FILTERS' pane of the Cloud Data Sense interface. At the top, there's a 'Clear All' button. Below it is a search bar labeled 'Search filters'. Under 'Working Environment', there are 4 items. The 'Tags' section has 6 items. The 'Action Required' tag is checked (indicated by a blue circle with a white checkmark), while 'Not For Review', 'For Review', and 'Approved Deletion' are unchecked (indicated by blue circles with white squares).

Tag	Status
Action Required	Selected
Not For Review	Not Selected
For Review	Not Selected
Approved Deletion	Not Selected

The Investigation Results pane displays all the files that have those tags assigned.

Assigning tags to files

You can add tags to a single file or to a group of files.

To add a tag to a single file:

Steps

1. In the Data Investigation results pane, click **▼** for the file to expand the file metadata details.
2. Click the **Tags** field and the currently assigned tags are displayed.

3. Add the tag or tags:

- To assign an existing tag, click in the **New Tag...** field and start typing the name of the tag. When the tag you are looking for appears, select it and press **Enter**.
- To create a new tag and assign it to the file, click in the **New Tag...** field, enter the name of the new tag, and press **Enter**.

The screenshot shows the Data Investigation results pane for a file named "Expense Report EXP-TPO-106038887654". The top bar includes navigation icons and a PDF link. Below the bar, there's a "Tags" section with a "New" button and a "View All" link. A context menu is open over the "Approved" tag, with options like "Approved", "For Review", and "Another Tag". The main pane displays file details: Working Environment (WorkingEnvironment1), Repository (Volume Name), File Path (/Prod/labs-base/Expense Report EXP-TPO-1060388.pdf), Category (Legal), File Size (22 MB), Last Modified (2019-08-06 07:51), and Open Permissions (NO OPEN PERMISSIONS). A "View all Permissions" link is also present.

The tag appears in the file metadata.

To add a tag to multiple files:

Steps

1. In the Data Investigation results pane, select the file, or files, that you want to tag.

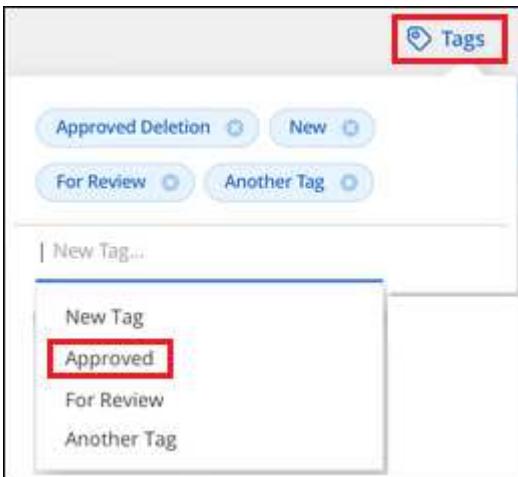
The screenshot shows the Data Investigation results pane with 2345 items. The "File Name" column has checkboxes next to each row. The first two rows have their checkboxes checked, while the others are unchecked. The columns include File Name, Personal, Sensitive Personal, Data Subjects, File Type, and a dropdown arrow. Above the table, there are buttons for Tags, Assign to, Label, Copy, Move, and Delete. The "File Name" column header has a checked checkbox icon above it.

- To select individual files, check the box for each file (Volume_1).
 - To select all files on the current page, check the box in the title row (File Name).
2. From the button bar, click **Tags** and the currently assigned tags are displayed.

3. Add the tag or tags:

- To assign an existing tag, click in the **New Tag...** field and start typing the name of the tag. When the tag you are looking for appears, select it and press **Enter**.
- To create a new tag and assign it to the file, click in the **New Tag...** field, enter the name of the new tag, and press **Enter**.

tag, and press **Enter**.



4. Approve adding the tags in the confirmation dialog and the tags are added to the metadata for all selected files.

Deleting tags from files

You can delete a tag if you don't need to use it anymore.

Just click the **x** for an existing tag.



If you had selected multiple files, the tag is removed from all the files.

Assigning users to manage certain files

You can assign a Cloud Manager user to a specific file, or to multiple files, so that person can be responsible for any follow-up actions that need to be done on the file. This capability is often used with the feature to add custom Status tags to a file.

For example, you might have a file that contains certain personal data that allows too many users read and write access (open permissions). So you could assign the Status tag "Change permissions" and assign this file to user "Joan Smith" so they can decide how to fix the issue. When they have fixed the issue they could change the Status tag to "Completed".

Note that the user name is not added to the file as part of the file metadata - it is just seen by Cloud Manager users when using Cloud Data Sense.

A new Filter in the Investigation page enables you to easily view all files that have the same person in the "Assigned To" field.

To assign a user to a single file:

Steps

1. In the Data Investigation results pane, click **▼** for the file to expand the file metadata details.
2. Click the **Assigned to** field and select the user name.

The screenshot shows a file metadata interface. On the left, there's a list of file details: Working Environment (WorkingEnvironment1), Repository (Volume Name), File Path (/Prod/labs-base/Expense Report EXP-TPO-1060388.pdf), Category (Legal), File Size (22 MB), Created (2013-01-05 08:22), Last Modified (2019-08-06 07:51), and Last Accessed (2019-08-06 07:51). On the right, there's a sidebar with a search bar and a list of users: None, Ariel (which is highlighted with a red box), and Nadav.

The User name appears in the file metadata.

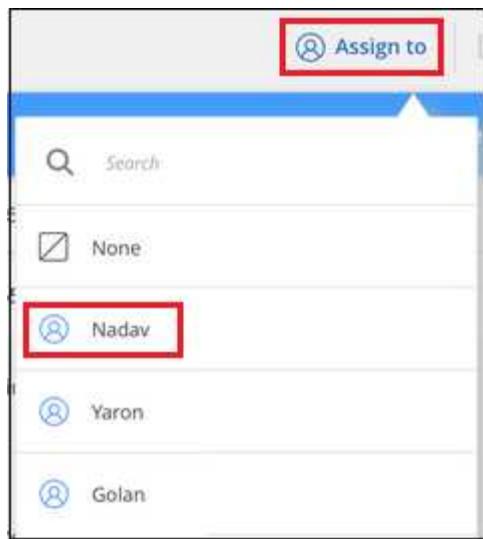
To assign a user to multiple files:

Steps

1. In the Data Investigation results pane, select the file, or files, that you want to assign to a user.

2345 items							Tags	Assign to	Label	Copy	Move	Delete
<input type="checkbox"/>	File Name	Personal	Sensitive Personal	Data Subjects	File Type	Actions						
<input checked="" type="checkbox"/>	Expense Report EXP-TPO-10603887654	cvo	6	3	16	PDF						
<input checked="" type="checkbox"/>	Expense Report EXP-TPO-10603887654	cvo	6	3	6	PDF						
<input type="checkbox"/>	Expense Report EXP-TPO-10603887654	cvo	6	3	6	PDF						
<input type="checkbox"/>	Expense Report EXP-TPO-10603887654	cvo	6	3	6	PDF						

- To select individual files, check the box for each file (Volume_1).
 - To select all files on the current page, check the box in the title row (File Name).
2. From the button bar, click **Assign to** and select the user name:



The user is added to the metadata for all selected files.

Controlling your data using Policies

Policies are like a favorites list of custom filters that provide search results in the Investigation page for commonly requested compliance queries. Cloud Data Sense provides a set of predefined Policies based on common customer requests. You can create custom Policies that provide results for searches specific to your organization.

Policies provide the following functionality:

- [Predefined Policies](#) from NetApp based on user requests
- Ability to create your own custom Policies
- Launch the Investigation page with the results from your Policies in one click
- Send email alerts to Cloud Manager users when certain critical Policies return results so you can get notifications to protect your data
- Assign AIP (Azure Information Protection) labels automatically to all files that match the criteria defined in a Policy
- Delete files automatically (once per day) when certain Policies return results so you can protect your data automatically

The **Policies** tab in the Compliance Dashboard lists all the predefined and custom Policies available on this instance of Cloud Data Sense.

The screenshot shows the 'Policies List' section of the Data Sense interface. It displays two predefined policies:

- GDPR - Old Sensitive Data**: A Predefined Policy. Description: "Data with European IDs for GDPR received from XDR database, sharing with Legal area in charged of Jon Doe. Also, this lines can take up to 2 lines, we need to limit character input so the description does not take more than 2 lines here in the component." Status: Auto delete: OFF, Label: OFF, Email notification: OFF. Buttons: Edit, More.
- HIPAA - Patients Personal Data**: Last modified: 17-10-20. Description: "The Health Insurance Portability and Accountability Act of 1996 (HIPAA) is a federal law that required the creation of national standards to protect sensitive patient health information from being disclosed without the patient's consent or knowledge." Status: Auto delete: OFF, Label: OFF, Email notification: Weekly. Buttons: Edit, More.

In addition, Policies appear in the list of Filters in the Investigation page.

Viewing Policy results in the Investigation page

To display the results for a Policy in the Investigation page, click the button for a specific Policy, and then select **Investigate Results**.

The screenshot shows the 'Policies List' section of the Data Sense interface. It displays the same two policies as before. For the **GDPR - Old Sensitive Data** policy, the 'More' button has been clicked, revealing additional options:

- Investigate Results** (highlighted with a red box)
- Delete Policy**

Creating custom Policies

You can create your own custom Policies that provide results for searches specific to your organization.

Steps

1. From the Data Investigation page, define your search by selecting all the filters you want to use. See [Filtering data in the Data Investigation page](#) for details.
2. Once you have all the filter characteristics just the way you want them, click **Create Policy from this search**.

The screenshot shows the 'Data Investigation' interface with the 'FILTERS' tab selected. A search bar at the top right contains the placeholder 'Search filters'. Below it is a list of filter categories: 'Policies', 'Working Environment' (with a count of 4), 'Storage Repository', 'Category', 'Private Data' (with a count of 6), and 'File Type'. At the bottom of the filter list is a blue button labeled 'Create Policy from this search', which is highlighted with a red rectangular border.

3. Name the Policy and select other actions that can be performed by the Policy:
 - a. Enter a unique name and description.
 - b. Optionally, check the box to automatically delete files that match the Policy parameters. Learn more about [deleting source files using a policy](#).
 - c. Optionally, check the box if you want notification emails sent to Cloud Manager users, and choose the interval at which the email is sent. Learn more about [sending email alerts based on policy results](#).
 - d. Optionally, check the box to automatically assign AIP labels to files that match the Policy parameters, and select the label. (Only if you have already integrated AIP labels. Learn more about [AIP labels](#).)
 - e. Click **Create Policy**.

Create Policy

This will create a new Policy according to the current selected filters and search term. You can view or delete this later from the "Policies" tab.

Note it may take up to 15 minutes for results to be displayed for a new Policy.

Name this Policy

New Policy to view all files that were created over 60 days ago

Give it a detailed description that explains what it searches for

See if any files greater than 60 days old should be deleted from the system

Automatically delete files that match this policy (Every Day)

Send email updates about this Policy to Cloud Manager users on this account every Day

Automatically label this Policy's matches with: Select a label

Create Policy

Cancel

Result

The new Policy appears in the Policies tab.

Sending email alerts when non-compliant data is found

Cloud Data Sense can send email alerts to Cloud Manager users when certain critical Policies return results so you can get notifications to protect your data. You can choose to send the email notifications on a daily, weekly, or monthly basis.

You can configure this setting when creating the Policy or when editing any Policy.

Follow these steps to add email updates to an existing Policy.

Steps

1. From the Policies List page, click **Edit** for the Policy where you want to add (or change) the email setting.

 Data Sense Governance Compliance Investigation Policies Configuration 2

Policies List

GDPR - Old Sensitive Data Predefined Policy 	Label:  General	E-mail notifications: Monthly 	
Data with European IDs for GDPR received from XDR database, sharing with Legal area in charge of Jon Doe. Also, this lines can take up to 2 lines, we need to limit character input so the description does not take more than 2 lines here in the component.			
HIPAA - Patients Personal Data Last modified: 17-10-20	Label: OFF	E-mail notifications: OFF 	
The Health Insurance Portability and Accountability Act of 1996 (HIPAA) is a federal law that required the creation of national standards to protect sensitive patient health information from being disclosed without the patient's consent or knowledge.			

2. In the Edit Policy page, check the box if you want notification emails sent to Cloud Manager users, and choose the interval at which the email is sent (for example, every **Week**).

Edit Policy

Saving this filtered view will create a new Policy, you can view/edit it in the "Policy" tab

Name this Policy

Give it a description to quickly identify it

Send email updates about this Policy to Cloud Manager users on this account every 

- [Day](#)
- [Week](#)
- [Month](#)

3. Click **Save Policy** and the interval at which the email is sent appears in the Policy description.

Result

The first email is sent now if there are any results from the Policy - but only if any files meet the Policy criteria. No personal information is sent in the notification emails. The email indicates that there are files that match the Policy criteria, and it provides a link to the Policy results.

Editing Policies

You can modify certain parts of a Policy depending on the type of Policy:

- Custom Policies - You can modify the *Name*, the *Description*, whether email notifications are sent, and whether AIP labels are added.
- Predefined Policies - You can modify only whether email notifications are sent and whether AIP labels are

added.



If you need to change the filter parameters for a custom Policy, you'll need to create a new Policy with the parameters you want, and then delete the old Policy.

To modify a Policy, click the **Edit** button, enter your changes on the *Edit Policy* page, and click **Save Policy**.

Deleting Policies

You can delete any custom Policy that you created if you no longer need it. You can't delete any of the predefined Policies.



To delete a Policy, click the **Delete Policy** button for a specific Policy, click **Delete Policy**, and then click **Delete Policy** again in the confirmation dialog.

List of predefined Policies

Cloud Data Sense provides the following system-defined Policies:

Name	Description	Logic
S3 publicly-exposed private data	S3 Objects containing personal or sensitive personal information, with open Public read access.	S3 Public AND contains personal OR sensitive personal info
PCI DSS – Stale data over 30 days	Files containing Credit Card information, last modified over 30 days ago.	Contains credit card AND last modified over 30 days
HIPAA – Stale data over 30 days	Files containing Health information, last modified over 30 days ago.	Contains health data (defined same way as in HIPAA report) AND last modified over 30 days
Private data – Stale over 7 years	Files containing personal or sensitive personal information, last modified over 7 years ago.	Files containing personal or sensitive personal information, last modified over 7 years ago
GDPR – European citizens	Files containing more than 5 identifiers of an EU country's citizens or DB Tables containing identifiers of an EU country's citizens.	Files containing over 5 identifiers of an (one) EU citizens or DB Tables containing rows with over 15% of columns with one country's EU identifiers. (any one of the national identifiers of the European countries. Does not include Brazil, California, USA SSN, Israel, South Africa)
CCPA – California residents	Files containing over 10 California Driver's License identifiers or DB Tables with this identifier.	Files containing over 10 California Driver's License identifiers OR DB Tables containing California Driver's license
Data Subject names – High risk	Files with over 50 Data Subject names.	Files with over 50 Data Subject names

Name	Description	Logic
Email Addresses – High risk	Files with over 50 Email Addresses, or DB Columns with over 50% of their rows containing Email Addresses	Files with over 50 Email Addresses, or DB Columns with over 50% of their rows containing Email Addresses
Personal data – High risk	Files with over 20 Personal data identifiers, or DB Columns with over 50% of their rows containing Personal data identifiers.	Files with over 20 personal, or DB Columns with over 50% of their rows containing personal
Sensitive Personal data – High risk	Files with over 20 Sensitive Personal data identifiers, or DB Columns with over 50% of their rows containing Sensitive Personal data.	Files with over 20 sensitive personal, or DB Columns with over 50% of their rows containing sensitive personal

Managing your private data

Cloud Data Sense provides many ways for you to manage your private data. Some functionality makes it easier to prepare for migrating your data, while other functionality allows you to make changes to the data.

- You can copy files to a destination NFS share if you want to make a copy of certain data and move it to a different NFS location.
- You can clone an ONTAP volume to a new volume, while including only selected files from the source volume in the new cloned volume. This is useful for situations where you're migrating data and you want to exclude certain files from the original volume.
- You can copy and synchronize files from a source repository to a directory in a specific destination location. This is useful for situations where you're migrating data from one source system to another while there is still some final activity on the source files.
- You can move source files that Data Sense is scanning to any NFS share.
- You can delete files that seem insecure or too risky to leave in your storage system, or that you have identified as duplicate.

 The capabilities described in this section are available only if you have chosen to perform a full classification scan on your data sources. Data sources that have had a mapping-only scan do not show file-level details.

Copying source files

You can copy any source files that Data Sense is scanning. There are three types of copy operations depending on what you're trying to accomplish:

- **Copy files** from the same, or different, volumes or data sources to a destination NFS share.
This is useful if you want to make a copy of certain data and move it to a different NFS location.
- **Clone an ONTAP volume** to a new volume in the same aggregate, but include only selected files from the source volume in the new cloned volume.

This is useful for situations where you're migrating data and you want to exclude certain files from the original volume. This action uses the [NetApp FlexClone](#) functionality to quickly duplicate the volume and then remove the files that you **didn't** select.

- **Copy and synchronize files** from a single source repository (ONTAP volume, S3 bucket, NFS share, etc.) to a directory in a specific destination (target) location.

This is useful for situations where you're migrating data from one source system to another. After the initial copy, the service syncs any changed data based on the schedule that you set. This action uses the [NetApp Cloud Sync](#) functionality to copy and sync data from a source to a target.

Copying source files to an NFS share

You can copy source files that Data Sense is scanning to any NFS share. The NFS share doesn't need to be integrated with Data Sense, you just need to know the name of the NFS share where all selected files will be copied in the format <host_name>:<share_path>.



You can't copy files that reside in databases or in volume backups.

Requirements

- You must have the Account Admin or Workspace Admin role to copy files.
- Copying files requires that the destination NFS share allows access from the Data Sense instance.
- You can copy a maximum of 100,000 files at a time.

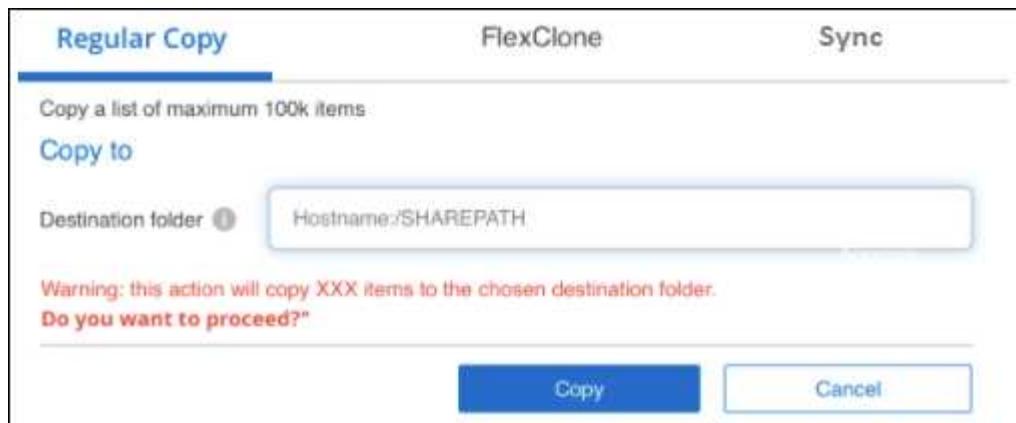
Steps

1. In the Data Investigation results pane, select the file, or files, that you want to copy, and click **Copy**.

File Name	Personal	Sensitive Personal	Data Subjects	File Type
Expense Report EXP-TPO-106038887654	cvo	6	3	16 PDF
Expense Report EXP-TPO-106038887654	cvo	6	3	6 PDF
Expense Report EXP-TPO-106038887654	cvo	6	3	6 PDF
Expense Report EXP-TPO-106038887654	cvo	6	3	6 PDF

- To select individual files, check the box for each file (Volume_1).
- To select all files on the current page, check the box in the title row (File Name).
- To select all files on all pages, check the box in the title row (File Name), and then in the pop-up message All 20 Items on this page selected Select all Items in list (63K Items), click **Select all items in list (xxx items)**.

2. In the **Copy Files** dialog, select the **Regular Copy** tab.



3. Enter the name of the NFS share where all selected files will be copied in the format <host_name>:<share_path>, and click **Copy**.

A dialog appears with the status of the copy operation.

You can view the progress of the copy operation in the [Actions Status pane](#).

Note that you can also copy an individual file when viewing the metadata details for a file. Just click **Copy File**.

Cloning volume data to a new volume

You can clone an existing ONTAP volume that Data Sense is scanning using NetApp *FlexClone* functionality. This allows you to quickly duplicate the volume while including only those files you selected. This is useful if you're migrating data and you want to exclude certain files from the original volume, or if you want to create a copy of a volume for testing.

The new volume is created in the same aggregate as the source volume. Ensure that you have enough space for this new volume in the aggregate before you start this task. Contact your storage administrator if necessary.

Note: FlexGroup volumes can't be cloned because they're not supported by FlexClone.

Requirements

- You must have the Account Admin or Workspace Admin role to copy files.
- All selected files must be from the same volume, and the volume must be online.
- The volume must be from a Cloud Volumes ONTAP or on-premises ONTAP system. No other data sources are currently supported.

- The FlexClone license must be installed on the cluster. This license is installed by default on Cloud Volumes ONTAP systems.

Steps

- In the Data Investigation pane, create a filter by selecting a single **Working Environment** and a single **Storage Repository** to make sure all the files are from the same ONTAP volume.

The screenshot shows the 'Data Investigation' pane with the following filters applied:

- FILTERS:** Clear All
- Working Environment Type**: +
- Working Environment**: 1 (highlighted with a blue circle)
- Storage Repository**: 1 (highlighted with a blue circle)
- Selected Options:**
 - datascence (130K)
 - cifs_labs (1.5K)

Apply any other filters so that you're seeing only the files that you want to clone to the new volume.

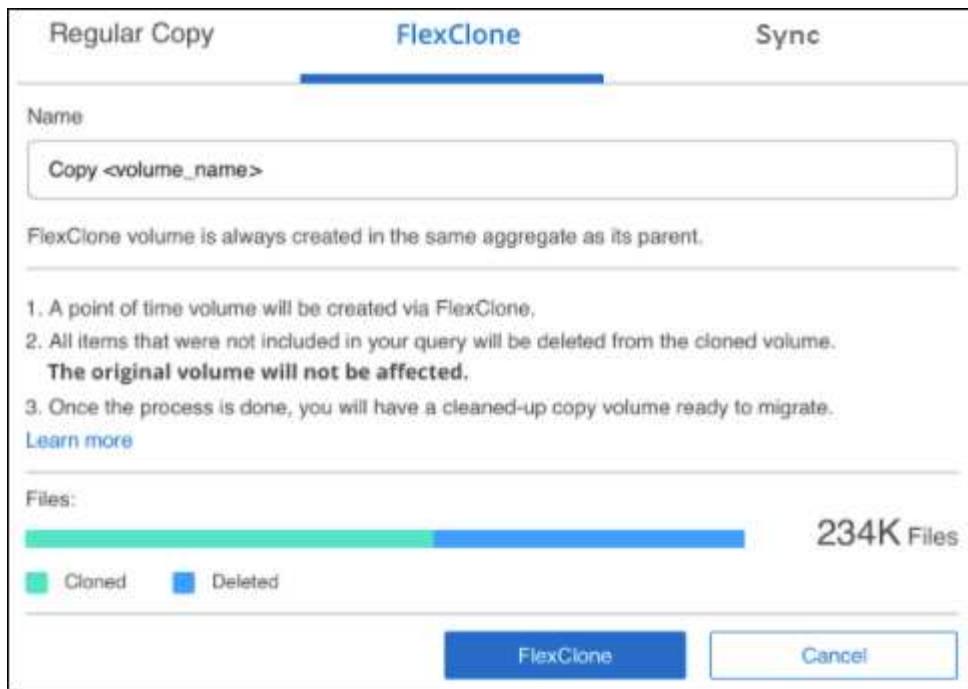
- In the Investigation results pane, select the files that you want to clone and click **Copy**.

The screenshot shows the investigation results pane with the following details:

- 2345 items
- File Name, Personal, Sensitive Personal, Data Subjects, File Type columns
- Checkboxes for selecting files
- Buttons: Tags, Assign to, Label, Copy (highlighted with a red box), Move, Delete
- Annotations:
 - Red box labeled 1 surrounds the checkbox for the first file in the list.
 - Red box labeled 2 surrounds the 'Copy' button.
- Data rows (only the first few are visible):

File Name	Personal	Sensitive Personal	Data Subjects	File Type	
Expense Report EXP-TPO-106038887654	cvo	6	3	16	PDF
Expense Report EXP-TPO-106038887654	cvo	6	3	6	PDF
Expense Report EXP-TPO-106038887654	cvo	6	3	6	PDF
Expense Report EXP-TPO-106038887654	cvo	6	3	6	PDF

- To select individual files, check the box for each file (Volume_1).
 - To select all files on the current page, check the box in the title row (File Name).
 - To select all files on all pages, check the box in the title row (File Name), and then in the pop-up message **All 20 Items on this page selected Select all Items in list (63K Items)**, click **Select all items in list (xxx items)**.
- In the **Copy Files** dialog, select the **FlexClone** tab. This page shows the total number of files that will be cloned from the volume (the files you selected), and the number of files that are not included/deleted (the files you didn't select) from the cloned volume.



4. Enter the name of the new volume, and click **FlexClone**.

A dialog appears with the status of the clone operation.

Result

The new, cloned volume is created in the same aggregate as the source volume.

You can view the progress of the clone operation in the [Actions Status pane](#).

If you initially selected **Map all volumes** or **Map & Classify all volumes** when you enabled Data Sense for the working environment where the source volume resides, then Data Sense will scan the new cloned volume automatically. If you didn't use either of these selections initially, then if you want to scan this new volume, you'll need to [enable scanning on the volume manually](#).

Copying and synchronizing source files to a target system

You can copy source files that Data Sense is scanning from any supported unstructured data source to a directory in a specific target destination location ([target locations that are supported by Cloud Sync](#)). After the initial copy, any data changed in the files are synchronized based on the schedule that you configure.

This is useful for situations where you're migrating data from one source system to another. This action uses the [NetApp Cloud Sync](#) functionality to copy and sync data from a source to a target.



You can't copy and sync files that reside in databases, OneDrive accounts, or SharePoint accounts.

Requirements

- You must have the Account Admin or Workspace Admin role to copy and sync files.
- All selected files must be from the same source repository (ONTAP volume, S3 bucket, NFS or CIFS share, etc.).
- You can copy a maximum of 200,000 files at a time.

- You'll need to activate the Cloud Sync service and configure a minimum of one data broker that can be used to transfer files between the source and target systems. Review the Cloud Sync requirements beginning with the [Quick Start description](#).

Note that the Cloud Sync service has separate service charges for your sync relationships, and will incur resource charges if you deploy the data broker in the cloud.

Steps

1. In the Data Investigation pane, create a filter by selecting a single **Working Environment** and a single **Storage Repository** to make sure all the files are from the same repository.

Data Investigation

FILTERS: Clear All

Working Environment Type +

Working Environment 1 +

Storage Repository 1 -

<input checked="" type="checkbox"/> datasence	(130K)
<input type="checkbox"/> cifs_labs	(1.5K)

Apply any other filters so that you're seeing only the files that you want to copy and sync to the destination system.

2. In the Investigation results pane, select all files on all pages by checking the box in the title row

(**File Name**), then in the pop-up message [All 20 Items on this page selected](#) [Select all Items in list \(63K Items\)](#) click **Select all items in list (xxx items)**, and then click **Copy**.

126.3K items | 20 selected

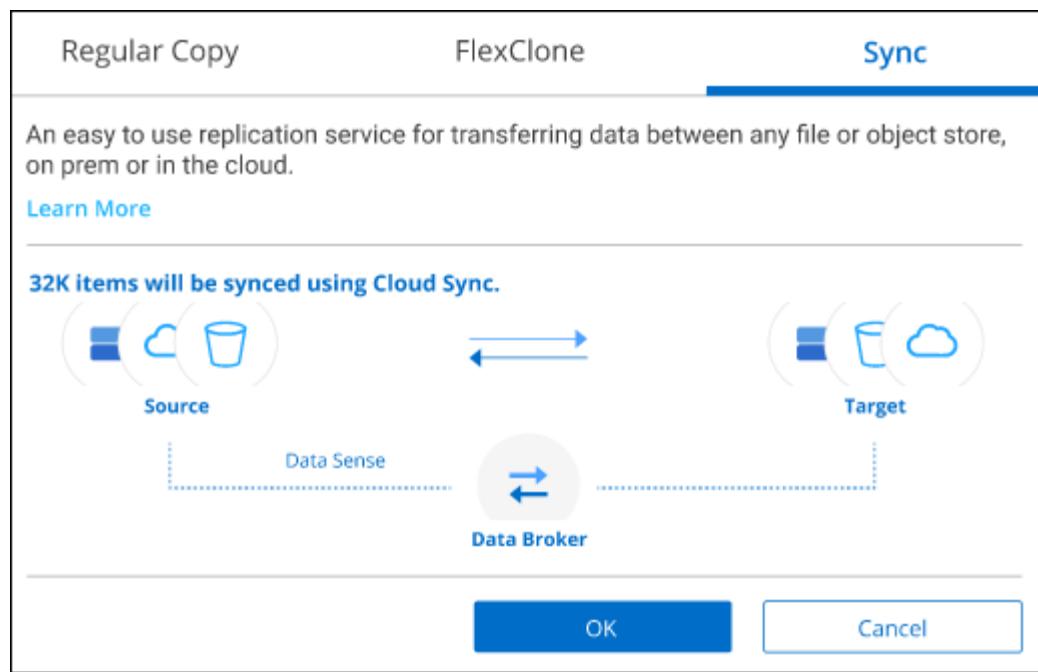
Tags | Assign to | Label | Move | Copy | Delete

File Name 1

All 20 Items on this page selected Select all Items in list (126.3K Items) 2

<input checked="" type="checkbox"/>	CRM_Customers.txt	cvo	652	0	1	TXT	▼
<input checked="" type="checkbox"/>	truepositive.txt	cvo	0	61	11	TXT	▼
<input checked="" type="checkbox"/>	test_file.txt	cvo	6	611	111	TXT	▼
<input checked="" type="checkbox"/>	test_positive.txt	cvo	0	65	51	TXT	▼

3. In the **Copy Files** dialog, select the **Sync** tab.



4. If you are sure that you want to sync the selected files to a destination location, click **OK**.

The Cloud Sync UI is opened in Cloud Manager.

You are prompted to define the sync relationship. The Source system is pre-populated based on the repository and files you already selected in Data Sense.

5. You'll need to select the Target system and then select (or create) the Data Broker you plan to use. Review the Cloud Sync requirements beginning with the [Quick Start description](#).

Result

The files are copied to the target system and they'll be synchronized based on the schedule you define. If you select a one-time sync then the files are copied and synchronized one time only. If you choose a periodic sync, then the files are synchronized based on the schedule. Note that if the source system adds new files that match the query you created using filters, those *new* files will be copied to the destination and synchronized in the future.

Note that some of the usual Cloud Sync operations are disabled when it is invoked from Data Sense:

- You can't use the **Delete Files on Source** or **Delete Files on Target** buttons.
- Running a report is disabled.

Moving source files to an NFS share

You can move source files that Data Sense is scanning to any NFS share. The NFS share doesn't need to be integrated with Data Sense (see [Scanning file shares](#)).



You can't move files that reside in databases or files that reside in volume backups.

Requirements

You must have the Account Admin or Workspace Admin role to move files.

Moving files requires that the NFS share allows access from the Data Sense instance.

Steps

1. In the Data Investigation results pane, select the file, or files, that you want to move.

2345 items							Tags	Assign to	Label	Copy	Move	Delete
<input type="checkbox"/>	File Name	Personal	Sensitive Personal	Data Subjects	File Type							
<input checked="" type="checkbox"/>	Expense Report EXP-TPO-106038887654	cvo	6	3	16	PDF						
<input checked="" type="checkbox"/>	Expense Report EXP-TPO-106038887654	cvo	6	3	6	PDF						
<input type="checkbox"/>	Expense Report EXP-TPO-106038887654	cvo	6	3	6	PDF						
<input type="checkbox"/>	Expense Report EXP-TPO-106038887654	cvo	6	3	6	PDF						

- To select individual files, check the box for each file (Volume_1).
 - To select all files on the current page, check the box in the title row (File Name).
2. From the button bar, click **Move**.

Move Multiple Files

This file will be moved to the destination folder you provide and will no longer be available at its current location.

Moving files is supported only to destination folders in NFS Shares. Any NFS Share is supported, no matter where its hosted, as long as the Share's export policy allows access from the Data Connector instance IP Address.

File Name 1

File Name 2

File Name 3

Enter the NFS destination folder path to continue

Move Files **Cancel**

3. In the *Move Files* dialog, enter the name of the NFS share where all selected files will be moved in the format <host_name>:<share_path>, and click **Move Files**.

Note that you can also move an individual file when viewing the metadata details for a file. Just click **Move File**.

The screenshot shows the Data Investigation pane with two files listed:

- Expense Report EXP-TPO-10603888765435: CVO, 6, 3, 16, PDF
- Expense Report EXP-TPO-10603888765435: CVO, 6, 3, 16, PDF

For the second file, there is a detailed view panel showing:

- Working Environment: WorkingEnvironment1
- Repository: Volume Name
- File Path: /Prod/labs-base/Expense Report EXP-TPO-1060388.pdf

A red box highlights the "Move File" button in the file actions panel.

Deleting source files

You can permanently remove source files that seem insecure or too risky to leave in your storage system, or that you've identified as a duplicate. This action is permanent and there is no undo or restore.

You can delete files manually from the Investigation pane, or automatically using Policies.



You can't delete files that reside in databases or files that reside in volume backups.

Deleting files requires the following permissions:

- For NFS data – the export policy needs to be defined with write permissions.
- For CIFS data – the CIFS credentials need to have write permissions.
- For S3 data - the IAM role must include the following permission: s3:DeleteObject.

Deleting source files manually

Requirements

- You must have the Account Admin or Workspace Admin role to delete files.
- You can delete a maximum of 100,000 files at a time.

Steps

- In the Data Investigation results pane, select the file, or files, that you want to delete.

The screenshot shows the Data Investigation pane with four files listed, where the first two have been selected (indicated by checked checkboxes in the left column).

File Name	Personal	Sensitive Personal	Data Subjects	File Type
Expense Report EXP-TPO-10603888765435	CVO	6	3	16 PDF
Expense Report EXP-TPO-10603888765435	CVO	6	3	16 PDF
Expense Report EXP-TPO-106038887654	CVO	6	3	6 PDF
Expense Report EXP-TPO-106038887654	CVO	6	3	6 PDF

A red box highlights the "Delete" button in the top right corner of the pane.

- To select individual files, check the box for each file (Volume_1).

- To select all files on the current page, check the box in the title row (**File Name**).
 - To select all files on all pages, check the box in the title row (**File Name**), and then in the pop-up message **All 20 Items on this page selected Select all Items in list (63K Items)**, click **Select all items in list (xxx items)**.
- From the button bar, click **Delete**.
 - Because the delete operation is permanent, you must type "permanently delete" in the subsequent *Delete File* dialog and click **Delete File**.

You can view the progress of the delete operation in the [Actions Status pane](#).

Note that you can also delete an individual file when viewing the metadata details for a file. Just click **Delete file**.

The screenshot shows a table with columns: File Name, Personal, Sensitive Personal, Data Subjects, and File Type. There are two rows of data. Each row has a checkbox in the first column. The second column contains file names and their types (cvo). The third column shows counts (6, 3, 16). The fourth column shows counts (16, 16) with small circular icons next to them. The fifth column shows file types (PDF, PDF). The last column has dropdown arrows. Below the table, there are three labels: Working Environment: WorkingEnvironment1, Repository: Volume Name, and File Path: /Prod/labs-base/Expense Report EXP-TPO-1060388.pdf. To the right of these labels is a button labeled 'Assign a Label to this file'. At the bottom right of the table area is a button labeled 'Delete this file' with a trash icon, which is enclosed in a red rectangular box.

Deleting source files automatically using Policies

You can create a custom Policy to delete files that match the policy. For example, you may want to delete files that contain sensitive information and were discovered by Data Sense in the past 30 days.

Only Account Admins can create a policy to automatically delete files.



All files that match the policy will be permanently deleted once a day.

Steps

- From the Data Investigation page, define your search by selecting all the filters you want to use. See [Filtering data in the Data Investigation page](#) for details.
- Once you have all the filter characteristics just the way you want them, click **Create Policy from this search**.
- Name the Policy and select other actions that can be performed by the Policy:
 - Enter a unique name and description.
 - Check the box to "Automatically delete files that match this policy" and type **permanently delete** to confirm that you want files permanently deleted by this policy.
 - Click **Create Policy**.

Create Policy

This will create a new Policy according to the current selected filters and search term. You can view or delete this later from the "Policies" tab.

Note it may take up to 15 minutes for results to be displayed for a new Policy.

Name this Policy

Delete files with sensitive data

Give it a detailed description that explains what it searches for

Delete files that contain sensitive information and that were discovered in the past 30 days

Automatically delete files that match this policy (Every Day)

Type "*permanently delete*" to continue with the deletion.

permanently delete

Send email updates about this Policy to Cloud Manager users on this account every Day

Automatically label this Policy's matches with: Select a label

Create Policy

Cancel

Result

The new Policy appears in the Policies tab. Files that match the policy are deleted once per day when the policy runs.

You can view the list of files that have been deleted in the [Actions Status pane](#).

Viewing the status of your compliance actions

When you run an action from the Investigation Results pane across many files, for example, deleting 100 files, the process can take some time. You can monitor the status of these asynchronous actions in the *Action Status* pane so you'll know when it has been applied to all files. This allows you to see the actions that have completed successfully, those currently in progress, and those that have failed so you can diagnose and fix any problems.

The status can be:

- Finished
- In Progress
- Queued
- Canceled

- Failed

Note that you can Cancel any actions that have the "Queued" or "In Progress" status.

Steps

1.



In the bottom-right of the Data Sense UI you can see the **Actions Status** button.

2. Click this button and the most recent 20 actions are listed.

You can click the name of an action to view details corresponding to that operation.

Adding personal data identifiers using Data Fusion

A feature we call *Data Fusion* allows you to scan your organizations' data to identify whether unique identifiers from your databases are found in files or other databases - basically making your own list of "personal data" that is identified in Cloud Data Sense scans. This gives you the full picture about where potentially sensitive data resides in *all* your files.

Since you are scanning your own databases, whatever language your data is stored in will be used to identify data in future Cloud Data Sense scans.



The capabilities described in this section are available only if you have chosen to perform a full classification scan on your data sources. Data sources that have had a mapping-only scan do not show file-level details.

Creating custom personal data identifiers from your databases

You can choose the additional identifiers that Cloud Data Sense will look for in its' scans by selecting a specific column, or columns, in a database table. For example, the diagram below shows how data fusion is used to scan your volumes, buckets, and databases for occurrences of all your Customer IDs from your Oracle database.

Databases -- Structured Data

Database: Oracle

Schema: Accounts

Table: Customers

Column: Customer ID

Account	Name	Customer ID	Address
1234	ABC Co	135876	125 Main St
1235	XYZ Co	213536	35A Brick R
1236	Cat Co	359264	55 Wind Av
1237	Dog Co	472637	11025 Cor
1238	Zebra Co	582455	36 Sahara
...

Scan your volumes and buckets for occurrences of the Customer IDs in your Oracle database

Files -- Unstructured Data

File in Volume 1

xxxxxxxxxxxx
xx213536xxx
xxxxxxxxxxxx
xx472637xxx
xxxxxxxxxxxx
xxxxxxxxxxxx

File in Volume 2

xxxxxxxxxxxx
xxxxxxxxxxxx
xxxxxxxxxxxx
xxxxxxxxxxxx
xxxxxxxxxxxx
xxx472637xx

File in Bucket 1

xxxxxxxxxxxx
xxxxxxxxxxxx
xx213536xxx
xxxxxxxxxxxx
xxxxxxxxxxxx
xxxxxxxxxxxx



As you can see, two unique Customer IDs have been found in two volumes and in one S3 bucket. Any matches in database tables will also be identified.

Steps

You must have [added at least one database server](#) to Cloud Data Sense before you can add data fusion sources.

1. In the Configuration page, click **Manage Data Fusion** in the database where the source data resides.

The screenshot shows the 'Configuration' page for Oracle DB 1. At the top, there's a summary: 'Oracle DB 1 | 41 Schemas'. Below it, a message says 'No Schemas selected for Compliance'. To the right, there's a status indicator showing '7' and 'Not Scanning' with a 'View Details' link. At the bottom right, there are buttons for 'Manage Data Fusion' (which is highlighted with a red box), 'Configuration', and three vertical dots for more options.

2. Click **Add Data Fusion source** on the next page.
3. In the *Add Data Fusion Source* page:
 - a. Select the Database Schema from the drop-down menu.
 - b. Enter the Table name in that schema.
 - c. Enter the Column, or Columns, that contain the unique identifiers you want to use.

When adding multiple columns, enter each column name, or table view name, on a separate line.

4. Click **Add Data Fusion Source**.

The Data Fusion inventory page displays the database source columns that you have configured for Cloud Data Sense to scan.

Database Schema	Table	Data Fusion Source Columns	...
SchemaName1	Table 1	Column 12, Column 14, Column 18	...
SchemaName2	Table 2	Column 12, Column 14, Column 18	...

Results

After the next scan, the results will include this new information in the Dashboard under the "Personal" results section, and in the Investigation page in the "Personal Data" filter. Each source column you added appears in the filter list as "Table.Column", for example `Customers.Customer_ID`.

Deleting a Data Fusion source

If at some point you decide not to scan your files using a certain Data Fusion source, you can select the source row from the Data Fusion inventory page and click **Delete Data Fusion Source**.



Viewing compliance reports

Cloud Data Sense provides reports that you can use to better understand the status of your organization's data privacy program.

By default, the Cloud Data Sense dashboards display compliance and governance data for all working environments and databases. If you want to view reports that contain data for only some of the working environments, [select those working environments](#).

 The reports described in this section are available only if you have chosen to perform a full classification scan on your data sources. Data sources that have had a mapping-only scan can only generate the Data Mapping Report.



NetApp can't guarantee 100% accuracy of the personal data and sensitive personal data that Cloud Data Sense identifies. You should always validate the information by reviewing the data.

Privacy Risk Assessment Report

The Privacy Risk Assessment Report provides an overview of your organization's privacy risk status, as required by privacy regulations such as GDPR and CCPA. The report includes the following information:

Compliance status

A [severity score](#) and the distribution of data, whether it's non-sensitive, personal, or sensitive personal.

Assessment overview

A breakdown of the types of personal data found, as well as the categories of data.

Data subjects in this assessment

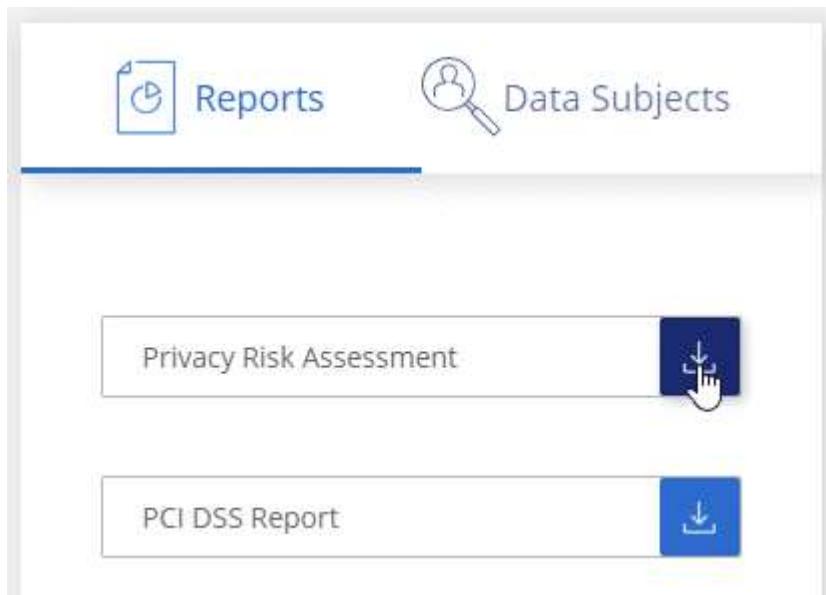
The number of people, by location, for which national identifiers were found.

Generating the Privacy Risk Assessment Report

Go to the Data Sense tab to generate the report.

Steps

1. At the top of Cloud Manager, click **Data Sense**.
2. Click **Compliance**, and then click the download icon next to **Privacy Risk Assessment** under **Reports**.



Result

Cloud Data Sense generates a PDF report that you can review and send to other groups as needed.

Severity score

Cloud Data Sense calculates the severity score for the Privacy Risk Assessment Report on the basis of three variables:

- The percentage of personal data out of all data.
- The percentage of sensitive personal data out of all data.
- The percentage of files that include data subjects, determined by national identifiers such as national IDs, Social Security numbers, and tax ID numbers.

The logic used to determine the score is as follows:

Severity score	Logic
0	All three variables are exactly 0%
1	One of the variables are larger than 0%
2	One of the variables are larger than 3%
3	Two of the variables are larger than 3%
4	Three of the variables are larger than 3%
5	One of the variables are larger than 6%
6	Two of the variables are larger than 6%
7	Three of the variables are larger than 6%
8	One of the variables are larger than 15%
9	Two of the variables are larger than 15%
10	Three of the variables are larger than 15%

PCI DSS Report

The Payment Card Industry Data Security Standard (PCI DSS) Report can help you identify the distribution of credit card information across your files. The report includes the following information:

Overview

How many files contain credit card information and in which working environments.

Encryption

The percentage of files containing credit card information that are on encrypted or unencrypted working environments. This information is specific to Cloud Volumes ONTAP.

Ransomware Protection

The percentage of files containing credit card information that are on working environments that do or don't have ransomware protection enabled. This information is specific to Cloud Volumes ONTAP.

Retention

The timeframe in which the files were last modified. This is helpful because you shouldn't keep credit card information for longer than you need to process it.

Distribution of Credit Card Information

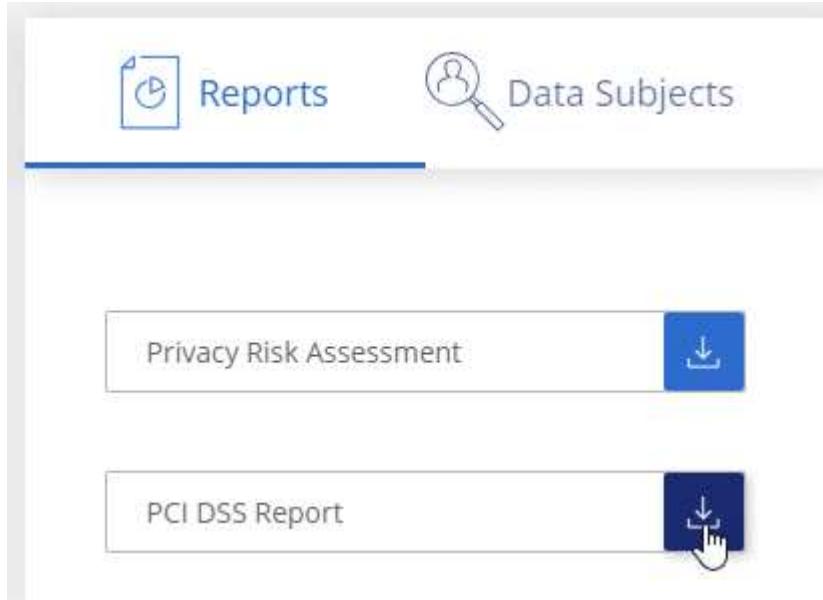
The working environments where the credit card information was found and whether encryption and ransomware protection are enabled.

Generating the PCI DSS Report

Go to the Data Sense tab to generate the report.

Steps

1. At the top of Cloud Manager, click **Data Sense**.
2. Click **Compliance**, and then click the download icon next to **PCI DSS Report** under **Reports**.



Result

Cloud Data Sense generates a PDF report that you can review and send to other groups as needed.

HIPAA Report

The Health Insurance Portability and Accountability Act (HIPAA) Report can help you identify files containing health information. It is designed to aid in your organization's requirement to comply with HIPAA data privacy laws. The information Cloud Data Sense looks for includes:

- Health reference pattern
- ICD-10-CM Medical code
- ICD-9-CM Medical code
- HR – Health category
- Health Application Data category

The report includes the following information:

Overview

How many files contain health information and in which working environments.

Encryption

The percentage of files containing health information that are on encrypted or unencrypted working environments. This information is specific to Cloud Volumes ONTAP.

Ransomware Protection

The percentage of files containing health information that are on working environments that do or don't have ransomware protection enabled. This information is specific to Cloud Volumes ONTAP.

Retention

The timeframe in which the files were last modified. This is helpful because you shouldn't keep health information for longer than you need to process it.

Distribution of Health Information

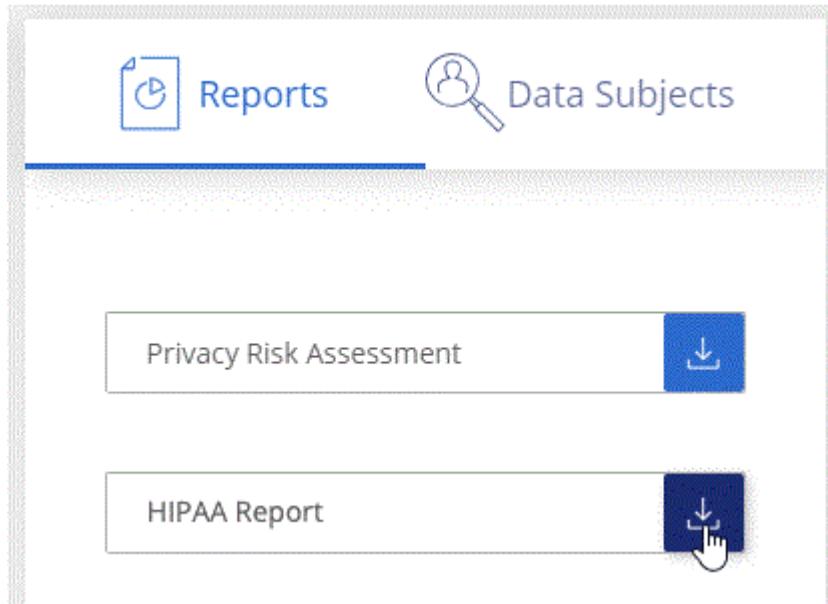
The working environments where the health information was found and whether encryption and ransomware protection are enabled.

Generating the HIPAA Report

Go to the Data Sense tab to generate the report.

Steps

1. At the top of Cloud Manager, click **Data Sense**.
2. Click **Compliance**, and then click the download icon next to **HIPAA Report** under **Reports**.



Result

Cloud Data Sense generates a PDF report that you can review and send to other groups as needed.

Data Mapping Report

The Data Mapping Report provides an overview of the data being stored in your corporate data sources to assist you with decisions of migration, back up, security, and compliance processes. The report first lists an overview report summarizing all your working environments and data sources, and then provides a breakdown for each working environment.

The report includes the following information:

Usage Capacity

For all working environments: Lists the number of files and the used capacity for each working environment.
For single working environments: Lists the files that are using the most capacity.

Age of Data

Provides three charts and graphs for when files were created, last modified, or last accessed. Lists the number of files, and their used capacity, based on certain date ranges.

Size of Data

Lists the number of files that exist within certain size ranges in your working environments.

File Types

Lists the total number of files and the used capacity for each type of file being stored in your working environments.

Generating the Data Mapping Report

Go to the Data Sense tab to generate the report.

Steps

1. At the top of Cloud Manager, click **Data Sense**.
2. Click **Governance**, and then click the **Full Data Mapping Overview Report** button from the Governance Dashboard.



Result

Cloud Data Sense generates a PDF report that you can review and send to other groups as needed.

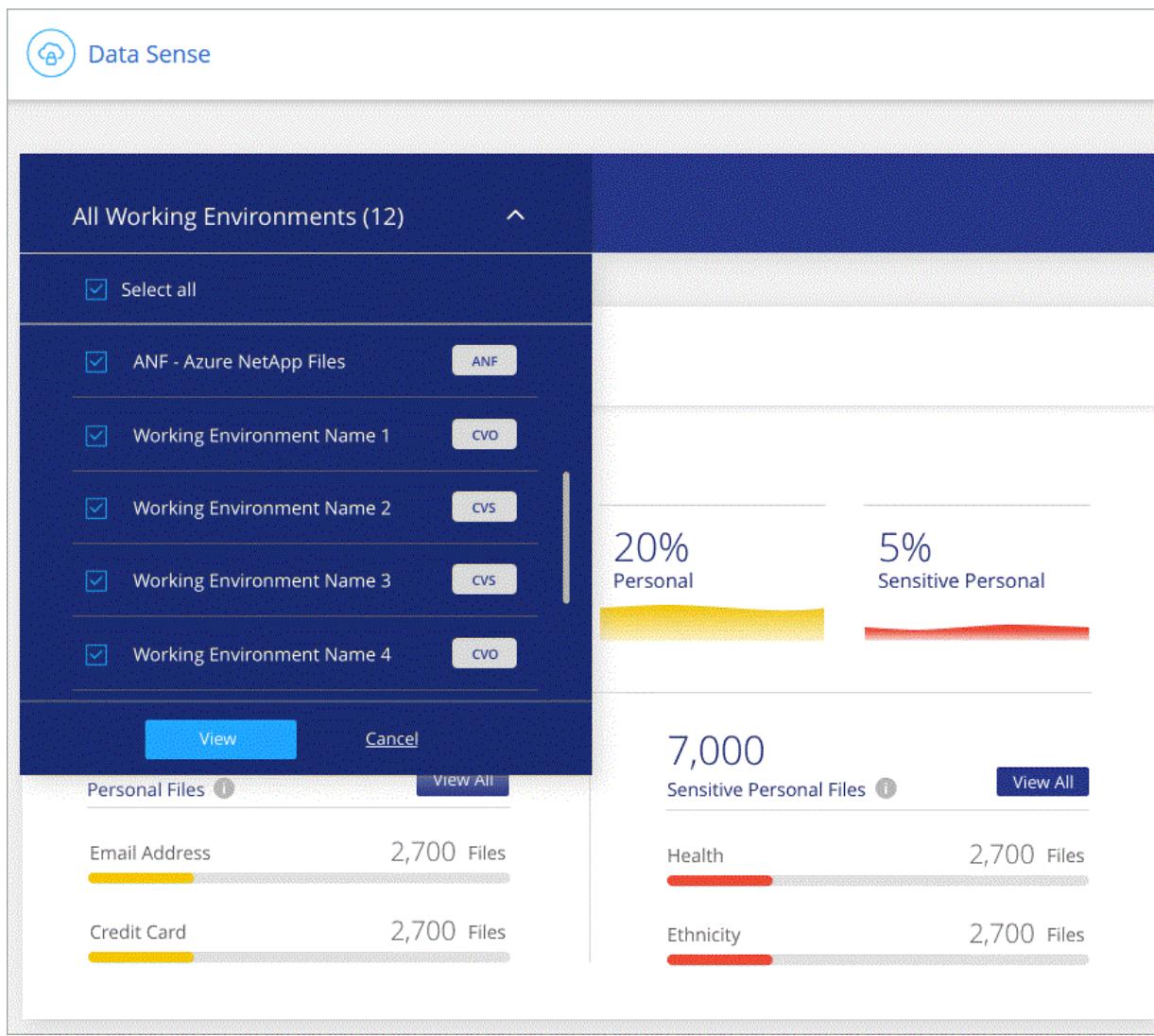
Selecting the working environments for reports

You can filter the contents of the Cloud Data Sense Compliance dashboard to see compliance data for all working environments and databases, or for just specific working environments.

When you filter the dashboard, Data Sense scopes the compliance data and reports to just those working environments that you selected.

Steps

1. Click the filter drop-down, select the working environments that you'd like to view data for, and click **View**.



Responding to a Data Subject Access Request

Respond to a Data Subject Access Request (DSAR) by searching for a subject's full name or known identifier (such as an email address) and then downloading a report. The report is designed to aid in your organization's requirement to comply with GDPR or similar data privacy laws.



The DSAR capabilities are available only if you have chosen to perform a full classification scan on your data sources. Data sources that have had a mapping-only scan do not provide file-level details.



NetApp can't guarantee 100% accuracy of the personal data and sensitive personal data that Cloud Data Sense identifies. You should always validate the information by reviewing the data.

What is a Data Subject Access Request?

Privacy regulations such as the European GDPR grant data subjects (such as customers or employees) the right to access their personal data. When a data subject requests this information, this is known as a DSAR.

(data subject access request). Organizations are required to respond to these requests "without undue delay", and at the latest within one month of receipt.

How can Cloud Data Sense help you respond to a DSAR?

When you perform a data subject search, Cloud Data Sense finds all of the files, buckets, OneDrive, and SharePoint accounts that have that person's name or identifier in it. Data Sense checks the latest pre-indexed data for the name or identifier. It doesn't initiate a new scan.

After the search is complete, you can then download the list of files for a Data Subject Access Request report. The report aggregates insights from the data and puts it into legal terms that you can send back to the person.



Data subject search is not supported within databases at this time.

Searching for data subjects and downloading reports

Search for the data subject's full name or known identifier and then download a file list report or DSAR report. You can search by [any personal information type](#).



English, German, and Spanish are supported when searching for the names of data subjects. Support for more languages will be added later.

Steps

1. At the top of Cloud Manager, click **Data Sense**.
2. Click **Data Subjects**.
3. Search for the data subject's full name or known identifier.

Here's an example that shows a search for the name *john doe*:

The screenshot shows the 'Data Subjects' section of the Cloud Data Sense interface. At the top, there are two navigation items: 'Reports' with a document icon and 'Data Subjects' with a magnifying glass over a person icon. Below this is a back arrow labeled '< Back'. A search bar contains the text 'john doe Results' with a clear 'X' button. To the right of the search bar is a blue icon of a person with a document and the number '203' above the text 'Files Found'. Below this are two buttons: 'Download DSAR Report' with a download icon and 'Investigate Results' with a magnifying glass icon.

4. Choose one of the available options:

- **Download DSAR Report:** A formal response to the access request that you can send to the data subject. This report contains automatically-generated information based on data that Cloud Data Sense found on the data subject and is designed to be used as a template. You should complete the form and review it internally before sending it to the data subject.
- **Investigate Results:** A page that enables you to investigate the data by searching, sorting, expanding details for a specific file, and by downloading the file list.



If there are more than 10,000 results, only the top 10,000 appear in the file list.

Categories of private data

There are many types of private data that Cloud Data Sense can identify in your volumes, Amazon S3 buckets, databases, OneDrive folders, and SharePoint accounts. See the categories below.



If you need Cloud Data Sense to identify other private data types, such as additional national ID numbers or healthcare identifiers, email ng-contact-data-sense@netapp.com with your request.

Types of personal data

The personal data found in files can be general personal data or national identifiers. The third column identifies whether Cloud Data Sense uses **proximity validation** to validate its findings for the identifier.

The items in this category can be recognized in any language.

Note that you can add to the list of personal data that is found in your files if you are scanning a database server. The *Data Fusion* feature allows you to choose the additional identifiers that Cloud Data Sense will look for in its' scans by selecting columns in a database table. See [Adding personal data identifiers using Data Fusion](#) for details.

Type	Identifier	Proximity validation?
General	Email address	No
	Credit card number	No
	IBAN number (International Bank Account Number)	No
	IP address	No

Type	Identifier	Proximity validation?
National Identifiers		

Type	Portuguese Tax Identification Number (NIF)	Yes
	Romanian ID (CNP Identifier)	Yes Proximity Validation?
	Slovenian ID (EMSO)	
	South African ID	Yes
	Spanish Tax Identification Number	Yes
	Swedish ID	Yes
	U.K. ID (NINO)	Yes
	USA Social Security Number (SSN)	Yes

Types of sensitive personal data

The sensitive personal data that Cloud Data Sense can find in files includes the following list. The items in this category can be recognized only in English at this time.

Criminal Procedures Reference

Data concerning a natural person's criminal convictions and offenses.

Ethnicity Reference

Data concerning a natural person's racial or ethnic origin.

Health Reference

Data concerning a natural person's health.

ICD-9-CM Medical Codes

Codes used in the medical and health industry.

ICD-10-CM Medical Codes

Codes used in the medical and health industry.

Philosophical Beliefs Reference

Data concerning a natural person's philosophical beliefs.

Political Opinions Reference

Data concerning a natural person's political opinions.

Religious Beliefs Reference

Data concerning a natural person's religious beliefs.

Sex Life or Orientation Reference

Data concerning a natural person's sex life or sexual orientation.

Types of categories

Cloud Data Sense categorizes your data as follows. Most of these categories can be recognized in English, German, and Spanish.

Category	Type	English	German	Spanish
Finance	Balance Sheets	✓	✓	✓
	Purchase Orders	✓	✓	✓
	Invoices	✓	✓	✓
	Quarterly Reports	✓	✓	✓
HR	Background Checks	✓		✓
	Compensation Plans	✓	✓	✓
	Employee Contracts	✓		✓
	Employee Reviews	✓		✓
	Health	✓		✓
	Resumes	✓	✓	✓
Legal	NDAs	✓	✓	✓
	Vendor-Customer contracts	✓	✓	✓
Marketing	Campaigns	✓	✓	✓
	Conferences	✓	✓	✓
Operations	Audit Reports	✓	✓	✓
Sales	Sales Orders	✓	✓	
Services	RFI	✓		✓
	RFP	✓		✓
	SOW	✓	✓	✓
	Training	✓	✓	✓
Support	Complaints and Tickets	✓	✓	✓

The following Metadata is also categorized, and are identified in the same supported languages:

- Application Data
- Archive Files
- Audio
- Business Application Data
- CAD Files
- Code
- Corrupted
- Database and index files
- Design Files
- Email Application Data
- Encrypted

- Executables
- Financial Application Data
- Health Application Data
- Images
- Logs
- Miscellaneous Documents
- Miscellaneous Presentations
- Miscellaneous Spreadsheets
- Miscellaneous "Unknown"
- Structured Data
- Videos
- Zero-Byte Files

Types of files

Cloud Data Sense scans all files for category and metadata insights and displays all file types in the file types section of the dashboard.

But when Data Sense detects Personal Identifiable Information (PII), or when it performs a DSAR search, only the following file formats are supported:

.CSV, .DCM, .DICOM, .DOC, .DOCX, .JSON, .PDF, .PPTX, .RTF, .TXT, .XLS, and .XLSX.

Accuracy of information found

NetApp can't guarantee 100% accuracy of the personal data and sensitive personal data that Cloud Data Sense identifies. You should always validate the information by reviewing the data.

Based on our testing, the table below shows the accuracy of the information that Data Sense finds. We break it down by *precision* and *recall*:

Precision

The probability that what Data Sense finds has been identified correctly. For example, a precision rate of 90% for personal data means that 9 out of 10 files identified as containing personal information, actually contain personal information. 1 out of 10 files would be a false positive.

Recall

The probability for Data Sense to find what it should. For example, a recall rate of 70% for personal data means that Data Sense can identify 7 out of 10 files that actually contain personal information in your organization. Data Sense would miss 30% of the data and it won't appear in the dashboard.

We are constantly improving the accuracy of our results. Those improvements will be automatically available in future Data Sense releases.

Type	Precision	Recall
Personal data - General	90%-95%	60%-80%

Type	Precision	Recall
Personal data - Country identifiers	30%-60%	40%-60%
Sensitive personal data	80%-95%	20%-30%
Categories	90%-97%	60%-80%

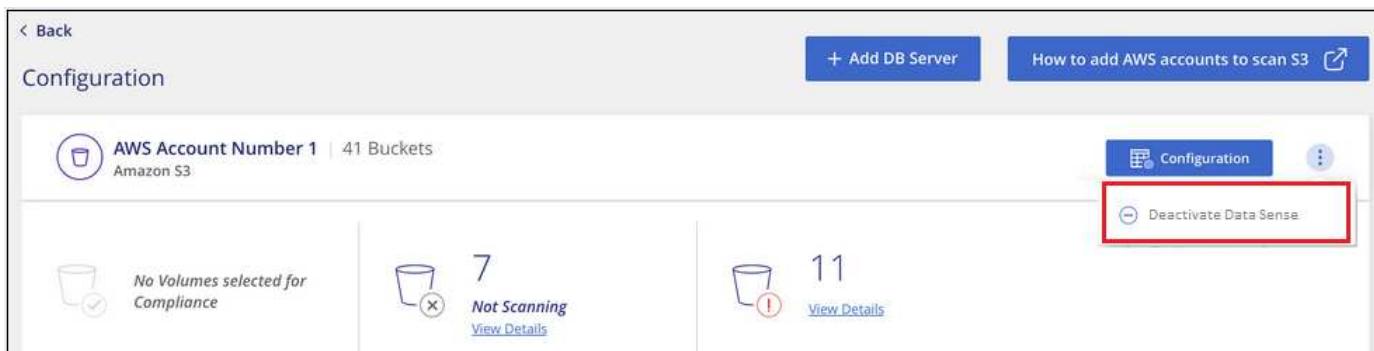
Removing data sources from Cloud Data Sense

If you need to, you can stop Cloud Data Sense from scanning one or more working environments, databases, file share groups, OneDrive accounts, or SharePoint accounts. You can also delete the Cloud Data Sense instance if you no longer want to use Data Sense with your working environments.

Deactivating compliance scans for a working environment

When you deactivate scans, Cloud Data Sense no longer scans the data on the working environment and it removes the indexed compliance insights from the Data Sense instance (the data from the working environment itself isn't deleted).

- From the *Configuration* page, click the  button in the row for the working environment, and then click **Deactivate Data Sense**.



You can also disable compliance scans for a working environment from the Services panel when you select the working environment.

Removing a database from Cloud Data Sense

If you no longer want to scan a certain database, you can delete it from the Cloud Data Sense interface and stop all scans.

- From the *Configuration* page, click the  button in the row for the database, and then click **Remove DB Server**.

Configuration

Oracle DB 1 | 41 Schemas

No Schemas selected for Compliance

7 Not Scanning [View Details](#)

11 No Access - Action Required [View Details](#)

Configuration

Deactivate Data Sense

Remove DB Server

+ Credentials

Removing a OneDrive or SharePoint account from Cloud Data Sense

If you no longer want to scan user files from a certain OneDrive account, or from a specific SharePoint account, you can delete the account from the Cloud Data Sense interface and stop all scans.

Steps

1. From the *Configuration* page, click the button in the row for the OneDrive or SharePoint account, and then click **Remove OneDrive Account** or **Remove SharePoint Account**.

Configuration

Add Data Source ▾

OneDrive Account 1 | 41 Users

OneDrive

Configuration

Remove OneDrive Account

2. Click **Delete Account** from the confirmation dialog.

Removing a group of file shares from Cloud Data Sense

If you no longer want to scan user files from a file shares group, you can delete the File Shares Group from the Cloud Data Sense interface and stop all scans.

Steps

1. From the *Configuration* page, click the button in the row for the File Shares Group, and then click **Remove File Shares Group**.

Configuration

Add Data Source ▾

Shares Group 1 | 41 Shares

File Shares Group

Configuration

Remove Shares Group

2. Click **Delete Group of Shares** from the confirmation dialog.

Reducing the Data Sense scan speed

Data scans have a negligible impact on your storage systems and on your data. However, if you are concerned with even a very small impact, you can configure Data Sense to perform "slow" scans. When enabled, slow scanning is used on all data sources - you can't configure slow scanning for a single working environment or data source.



The scan speed can't be reduced when scanning databases.

Steps

1. From the bottom of the *Configuration* page, move the slider to the right to activate slow scanning.

The screenshot shows the '6 Working Environments' configuration page. It displays two environments: 'S3 - 800707617106 (s3-compliance-cross... | 22 Buckets)' and 'S3 - 759995470648 | 90 Buckets'. Each environment has a summary card with bucket counts and scanning status. At the bottom of the page, there is a button labeled 'Activate Slow Scan' with a red box around it.

The top of the Configuration page indicates that slow scanning is enabled.

The screenshot shows the '6 Working Environments' configuration page. It displays the same two environments as before. A message at the top of the page says 'Slow Scan enabled - Disable' with a red box around it.

2. You can disable slow scanning by clicking **Disable** from this message.

Deleting the Cloud Data Sense instance

You can delete the Cloud Data Sense instance if you no longer want to use Data Sense. Deleting the instance also deletes the associated disks where the indexed data resides.

1. Go to your cloud provider's console and delete the Cloud Data Sense instance.

The instance is named *CloudCompliance* with a generated hash (UUID) concatenated to it. For example: *CloudCompliance-16bb6564-38ad-4080-9a92-36f5fd2f71c7*

Frequently asked questions about Cloud Data Sense

This FAQ can help if you're just looking for a quick answer to a question.

What is Cloud Data Sense?

Cloud Data Sense is a cloud offering that uses Artificial Intelligence (AI) driven technology to help organizations understand data context and identify sensitive data across your storage systems. The systems can be Azure NetApp Files configurations, Amazon FSx for ONTAP, Cloud Volumes ONTAP systems (hosted in AWS, Azure, or GCP), Amazon S3 buckets, on-prem ONTAP systems, non-NetApp file shares, generic S3 object storage, databases, OneDrive accounts, and SharePoint accounts.

Cloud Data Sense provides pre-defined parameters (such as sensitive information types and categories) to address new data compliance regulations for data privacy and sensitivity, such as GDPR, CCPA, HIPAA, and more.

Why should I use Cloud Data Sense?

Cloud Data Sense can empower you with data to help you:

- Comply with data compliance and privacy regulations.
- Comply with data retention policies.
- Easily locate and report on specific data in response to data subjects, as required by GDPR, CCPA, HIPAA, and other data privacy regulations.

What are the common use cases for Cloud Data Sense?

- Identify Personal Identifiable Information (PII).
- Identify a wide scope of sensitive information as required by GDPR and CCPA privacy regulations.
- Comply with new and upcoming data privacy regulations.

[Learn more about the use cases for Cloud Data Sense.](#)

What types of data can be scanned with Cloud Data Sense?

Cloud Data Sense supports scanning of unstructured data over NFS and CIFS protocols that are managed by Cloud Volumes ONTAP, Azure NetApp Files, Amazon FSx for ONTAP, on-prem ONTAP systems, and in non-NetApp file shares. Data Sense supports NFS versions 3.x, 4.0, and 4.1, and CIFS versions 1.x, 2.0, 2.1, and 3.0.

Data Sense can also scan data stored on Amazon S3 buckets and in generic S3 object storage.

Additionally, Data Sense can scan databases that are located anywhere, and user files from OneDrive and SharePoint accounts.

[Learn how scans work.](#)

Which cloud providers are supported?

Cloud Data Sense operates as part of Cloud Manager and supports AWS, Azure, and GCP. This provides your organization with unified privacy visibility across different cloud providers.

How do I access Cloud Data Sense?

Cloud Data Sense is operated and managed through Cloud Manager. You can access Data Sense features from the **Data Sense** tab in Cloud Manager.

How does Cloud Data Sense work?

Cloud Data Sense deploys another layer of Artificial Intelligence alongside your Cloud Manager system and storage systems. It then scans the data on volumes, buckets, databases, and OneDrive accounts and indexes the data insights that are found.

[Learn more about how Cloud Data Sense works.](#)

How much does Cloud Data Sense cost?

The cost to use Cloud Data Sense depends on the amount of data that you're scanning. The first 1 TB of data that Data Sense scans in a Cloud Manager workspace is free. A subscription to the AWS, Azure, or GCP Marketplace, or a BYOL license from NetApp, is required to continue scanning data after that point. See [pricing](#) for details.

What type of instance or VM is required for Cloud Data Sense?

When [deployed in the cloud](#):

- In AWS, Cloud Data Sense runs on an m5.4xlarge instance with a 500 GB GP2 disk.
- In Azure, Cloud Data Sense runs on a Standard_D16s_v3 VM with a 512 GB disk.
- In GCP, Cloud Data Sense runs on an n2-standard-16 VM with a 512 GB Standard persistent disk.

You can install Data Sense software on a Linux host that has internet access in your network or in the cloud. Everything works the same and you continue to manage your scan configuration and results through Cloud Manager. See [Deploying Cloud Data Sense on premises](#) for system requirements and installation details.

Additionally, you can [deploy Data Sense in an on-premises site that doesn't have internet access](#) for completely secure sites.

Note that you can deploy Data Sense on a system with fewer CPUs and less RAM, but there are limitations when using these systems. See [Using a smaller instance type](#) for details.

[Learn more about how Cloud Data Sense works.](#)

How often does Cloud Data Sense scan my data?

Data changes frequently, so Cloud Data Sense scans your data continuously with no impact to your data. While the initial scan of your data might take longer, subsequent scans only scan the incremental changes, which reduces system scan times.

[Learn how scans work.](#)

Data scans have a negligible impact on your storage systems and on your data. However, if you are concerned with even a very small impact, you can configure Data Sense to perform "slow" scans. [See how to reduce the scan speed.](#)

Does Cloud Data Sense offer reports?

Yes. The information offered by Cloud Data Sense can be relevant to other stakeholders in your organizations, so we enable you to generate reports to share the insights.

The following reports are available for Data Sense:

Privacy Risk Assessment report

Provides privacy insights from your data and a privacy risk score. [Learn more](#).

Data Subject Access Request report

Enables you to extract a report of all files that contain information regarding a data subject's specific name or personal identifier. [Learn more](#).

PCI DSS report

Helps you identify the distribution of credit card information across your files. [Learn more](#).

HIPAA report

Helps you identify the distribution of health information across your files. [Learn more](#).

Data Mapping report

Provides information about the size and number of files in your working environments. This includes usage capacity, age of data, size of data, and file types. [Learn more](#).

Reports on a specific information type

Reports are available that include details about the identified files that contain personal data and sensitive personal data. You can also see files broken down by category and file type. [Learn more](#).

Does scan performance vary?

Scan performance can vary based on the network bandwidth and the average file size in your environment. It can also depend on the size characteristics of the host system (either in the cloud or on-premises). See [The Cloud Data Sense instance](#) and [Deploying Cloud Data Sense](#) for more information.

When initially adding new data sources you can also choose to only perform a "mapping" scan instead of a full "classification" scan. Mapping can be done on your data sources very quickly because it does not access files to see the data inside. [See the difference between a mapping and classification scan](#).

Which file types are supported?

Cloud Data Sense scans all files for category and metadata insights and displays all file types in the file types section of the dashboard.

When Data Sense detects Personal Identifiable Information (PII), or when it performs a DSAR search, only the following file formats are supported:

.CSV, .DCM, .DICOM, .DOC, .DOCX, .JSON, .PDF, .PPTX, .RTF, .TXT, .XLS, and .XLSX.

How do I enable Cloud Data Sense?

First you need to deploy an instance of Cloud Data Sense in Cloud Manager. Once the instance is running, you can enable the service on existing working environments and databases from the **Data Sense** tab or by selecting a specific working environment.

[Learn how to get started.](#)



Activating Cloud Data Sense results in an immediate initial scan. Scan results display shortly after.

How do I disable Cloud Data Sense?

You can disable Cloud Data Sense from scanning an individual working environment, database, file share group, OneDrive account, or SharePoint account from the Data Sense Configuration page.

[Learn more.](#)



To completely remove the Cloud Data Sense instance, you can manually remove the Data Sense instance from your cloud provider's portal or on-prem location.

What happens if data tiering is enabled on your ONTAP volumes?

You might want to enable Cloud Data Sense on ONTAP systems that tier cold data to object storage. If data tiering is enabled, Data Sense scans all of the data—data that's on disks and cold data tiered to object storage.

The compliance scan doesn't heat up the cold data—it stays cold and tiered to object storage.

Can I use Cloud Data Sense to scan on-premises ONTAP storage?

Yes. As long as you have discovered the on-prem ONTAP cluster as a working environment in Cloud Manager, you can scan any of the volume data.

Alternatively, you can run compliance scans on backup files created from your on-prem ONTAP volumes. So if you're already creating backup files from your on-prem systems using [Cloud Backup](#), you can run compliance scans on those backup files.

[Learn more.](#)

Can Cloud Data Sense send notifications to my organization?

Yes. In conjunction with the Policies feature, you can send email alerts to Cloud Manager users (daily, weekly, or monthly) when a Policy returns results so you can get notifications to protect your data. Learn more about [Policies](#).

You can also download status reports from the Governance page and Investigation page that you can share internally in your organization.

Can I customize the service to my organization's needs?

Cloud Data Sense provides out-of-the-box insights to your data. These insights can be extracted and used for your organization's needs.

Additionally, you can use the **Data Fusion** capability to have Data Sense scan all your data based on criteria found in specific columns in databases you are scanning—essentially allowing you to make your own custom personal data types.

[Learn more.](#)

Can Cloud Data Sense work with the AIP labels I have embedded in my files?

Yes. You can manage AIP labels in the files that Cloud Data Sense is scanning if you have subscribed to [Azure Information Protection \(AIP\)](#). You can view the labels that are already assigned to files, add labels to files, and change existing labels.

[Learn more.](#)

Can I limit Cloud Data Sense information to specific users?

Yes, Cloud Data Sense is fully integrated with Cloud Manager. Cloud Manager users can only see information for the working environments they are eligible to view according to their workspace privileges.

Additionally, if you want to allow certain users to just view Data Sense scan results without having the ability to manage Data Sense settings, you can assign those users the *Cloud Compliance Viewer* role.

[Learn more.](#)

Secure your data from ransomware and internal attacks

Learn about Ransomware Protection

Ransomware attacks can cost a business time, resources, and reputation. The Ransomware Protection service enables you to view relevant information about cybersecurity and assess how resilient your data is to a cyber attack. It also provides you with a list of alerts and remediations for making your data more secure.

[Learn about the use cases for Ransomware Protection[^]].

Link to Cloud Central Ransomware Protection page



The Ransomware Protection service is currently a Beta offering.

Features

Ransomware Protection currently provides several features that can help you with your cyberstorage protection efforts. Additional features will be added in the future. Current features identify when:

- Volumes in your working environments aren't being protected using [Cloud Backup](#).
- Data in your working environments and data sources aren't being scanned using [Cloud Data Sense](#) to identify compliance and privacy concerns, and find optimization opportunities.
- An abnormal increase in the percentage of encrypted files in a working environment or data source has occurred.

This can be an indicator that a ransomware attack has commenced on your network.

- Sensitive data is found in files and the access permissions level is too high in a working environment or data source.
- Users have been added to your Active Directory Domain Administrator Groups.

[See how to view these potential issues in the Ransomware Protection dashboard.](#)

When using Cloud Volumes ONTAP systems, there are some additional ransomware protections you can deploy directly from the working environment. [See how to add additional protection against ransomware.](#)

Supported working environments and data sources

[Cloud Data Sense](#) is a prerequisite to using the Ransomware Protection service. After Data Sense is installed and activated, you can use Ransomware Protection to see how resilient your data is to a cyber attack on the following types of working environments and data sources:

Working environments:

- Cloud Volumes ONTAP (deployed in AWS, Azure, or GCP)
- On-premises ONTAP clusters
- Azure NetApp Files

- Amazon FSx for ONTAP
- Amazon S3

Data sources:

- Non-NetApp file shares
- Object storage (that uses S3 protocol)
- Databases
- OneDrive accounts
- SharePoint accounts

Ransomware Protection also monitors your global Active Directory configuration if you have [configured this in Cloud Data Sense](#).

How Ransomware Protection works

At a high-level, Ransomware Protection works like this:

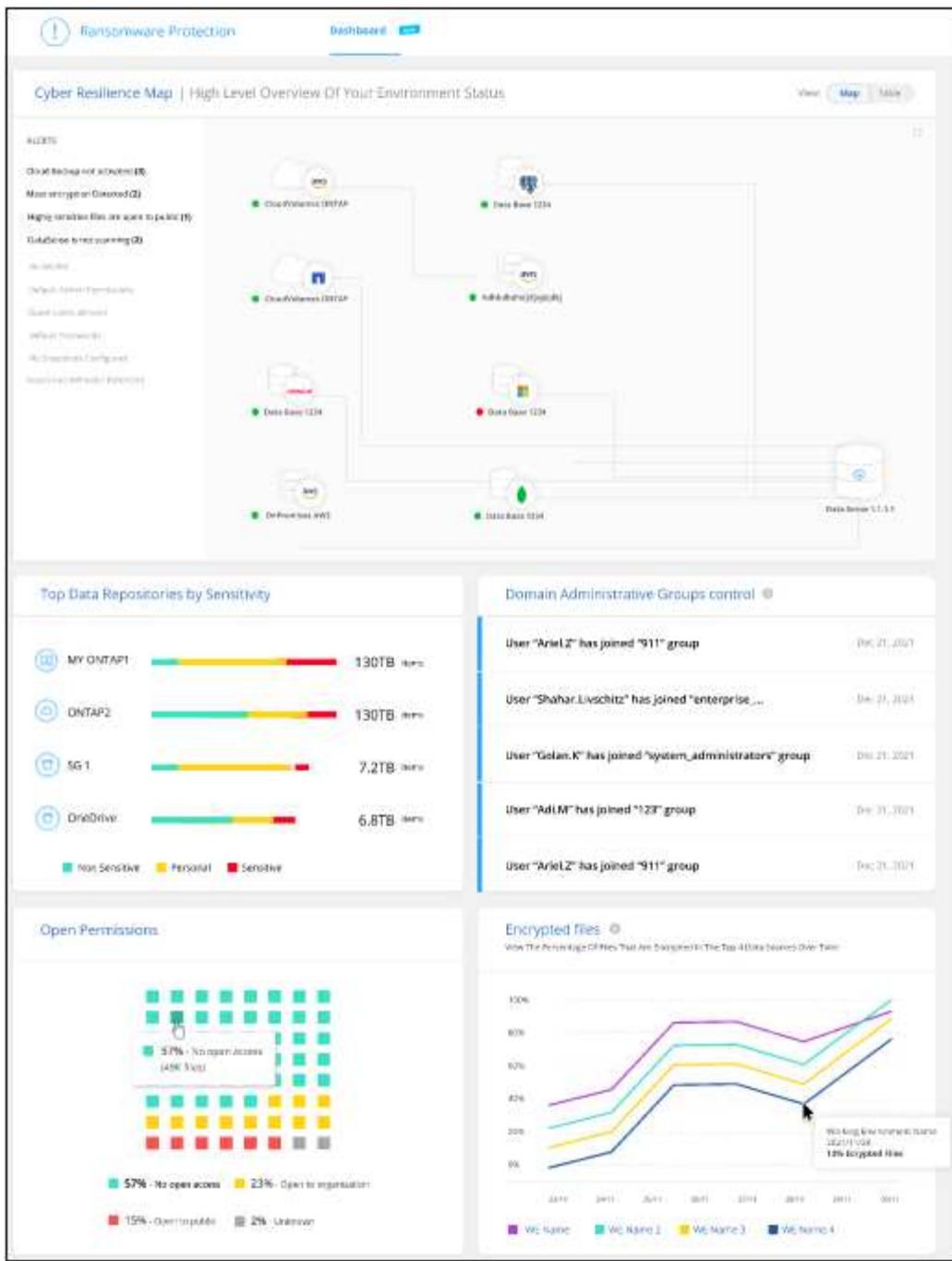
1. Ransomware Protection gathers information from Data Sense, Cloud Backup, and from other Cloud Manager resources, to populate the Ransomware Protection Dashboard.
2. You use the Ransomware Protection dashboard to gather an overview of how well protected your systems are.
3. You use the provided reporting tools to help in your cyberstorage protection efforts.

Cost

There is no separate cost for the Ransomware Protection service during the Beta.

Managing cyber security recommendations for your data sources

Use the Ransomware Protection dashboard to view an overview of the cyber resilience of all your working environments and data sources. You can drill down in each area to find more details and possible remediations.



Cyber Resilience Map

The Cyber Resilience Map is the main area in the dashboard. It enables you to see all your working environments and data sources in a visual manner and be able to view relevant cyber-resilience information.

ALERTS

Cloud BackUp Missing (3)

Mass encryption Detected (2)

Highly sensitive files are open to public (1)

Data Sense is not scanning (2)

No WORM

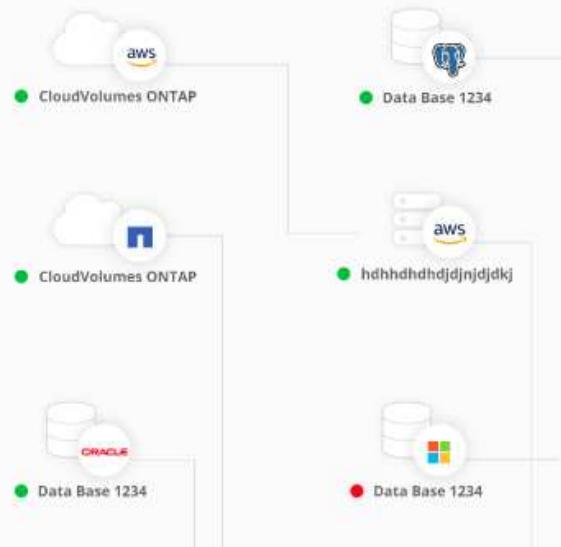
Default Admin Permissions

Guest users allowed

Default Passwords

No Snapshots Configured

Suspicious Behavior Detected

**Working environment name**

Dec 21, 2021

- High Encryption Rate

[Go to investigation page](#)

2021-12-21

- Sensitive Data with wide permissions found

[Go to investigation](#)

21/12/2021

- One or more volumes are not backed up by Cloud BackUp Service

[Configure Backup](#)

21/12/2021

- DataSense is not scanning your working environment

[Configure DataSense Scan](#)

The map consists of three parts:

Left panel

Shows a list of alerts for which the service is monitoring across all of your data sources. It also indicates the number of each particular alert that is active in your environment. Having a large number of one type of alert may be a good reason to try to resolve those alerts first.

Center panel

Shows all of your data sources, services, and Active Directory in a graphical format. Healthy environments have a green indicator and environments that have alerts have a red indicator.

Right panel

After you click on a data source that has a red indicator, this panel shows the alerts for that data source and provides recommendations to resolve the alert. Alerts are sorted so that the most recent alerts are listed first. Many recommendations lead you to another Cloud Manager service where you can resolve the issue.

These are the currently tracked alerts and suggested remediations.

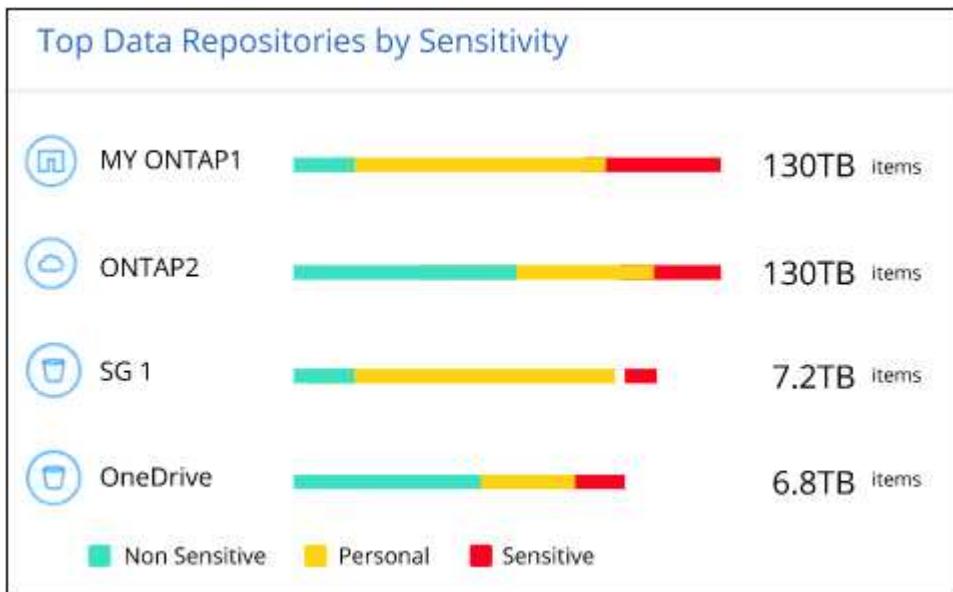
Alert	Description	Remediation
High data encryption rates detected	An abnormal increase in the percentage of encrypted files, or corrupted files, in the data source has occurred. This means that there was a greater than 20% increase in the percentage of encrypted files in the past 7 days. For example, if 50% of your files are encrypted, then a day later this number increases to 60%, you would see this alert.	Click the link to launch the Data Sense Investigation page . There you can select the filters for the specific <i>Working Environment</i> and <i>Category (Encrypted and Corrupted)</i> to view the list of all encrypted and corrupted files.

Alert	Description	Remediation
Sensitive data with wide permissions found	Sensitive data is found in files and the access permissions level is too high in a data source.	Click the link to launch the Data Sense Investigation page . There you can select the filters for the specific <i>Working Environment</i> , <i>Sensitivity Level (Sensitive Personal)</i> , and <i>Open Permissions</i> to view the list of the files that have this issue.
One or more volumes are not backed up using Cloud Backup	Some volumes in the working environment aren't being protected using Cloud Backup .	Click the link to launch Cloud Backup and then you can identify the volumes that aren't being backed up in the working environment, and then decide if you want to enable backups on those volumes.
One or more repositories (volumes, buckets, etc.) in your data sources are not being scanned by Data Sense	Some data in your data sources isn't being scanned using Cloud Data Sense to identify compliance and privacy concerns and find optimization opportunities.	Click the link to launch Data Sense and enable scanning and mapping for the items that are not being scanned.

Top data repositories by data sensitivity

The *Top Data Repositories by Sensitivity Level* area lists up to the top four data repositories (working environments and data sources) that contain the most sensitive items. The bar chart for each working environment is divided into:

- Non-Sensitive data
- Personal data
- Sensitive Personal data



You can hover over each section to see the total number of items in each category.

Click each area to view the filtered results in the Data Sense Investigation page so that you can investigate further.

Domain Administrator Group control

The *Domain Administrator Group control* area shows the most recent five users who have been added into your domain administrator groups so that you can see if all the users should be allowed in those groups. You must have [integrated a global Active Directory](#) into Cloud Data Sense for this panel to be active.

Domain Administrative Groups control ⓘ	
User "Ariel.Z" has joined "911" group	Dec 21, 2021
User "Shahar.Livschitz" has joined "enterprise_..."	Dec 21, 2021
User "Golan.K" has joined "system_administrators" group	Dec 21, 2021
User "Adi.M" has joined "123" group	Dec 21, 2021

The default administrative admin groups include “Administrators”, “Domain Admins”, “Enterprise Admins”, “Enterprise Key Admins”, and “Key Admins”.

Data listed by types of open permissions

The *Open Permissions* area shows the percentage for each type of permission that exist for all files that are being scanned. The chart is provided from Data Sense and it shows the following types of permissions:

- No Open Access
- Open to Organization
- Open to Public
- Unknown Access



You can hover over each section to see the percentage and total number of files in each category.

Click each area to view the filtered results in the Data Sense Investigation page so that you can investigate further.



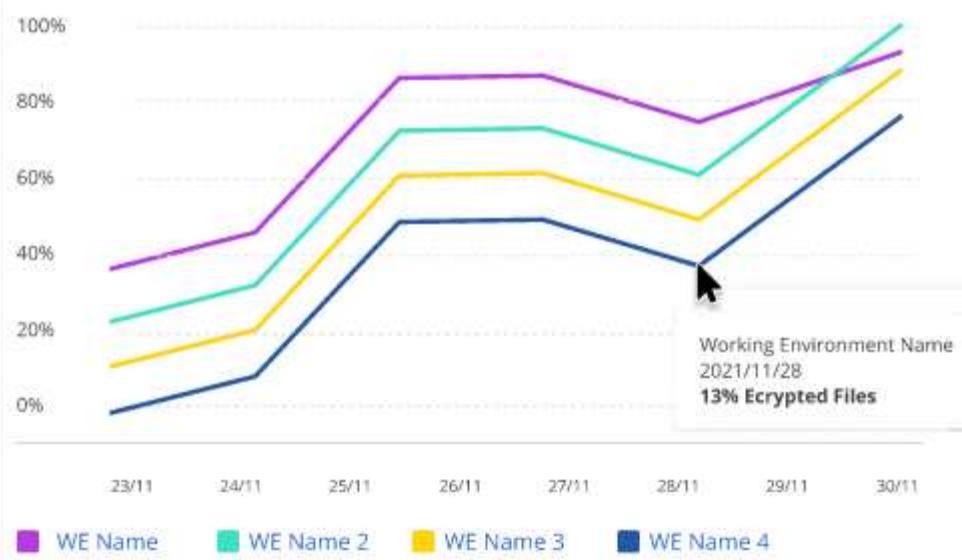
Files in OneDrive accounts, SharePoint accounts, and in databases are not represented in this chart.

Data listed by encrypted files

The *Encrypted Files* area shows the top 4 data sources with the highest percentage of files that are encrypted, over time. These are typically items that have been password protected. It does this by comparing the encryption rates over the past 7 days to see which data sources have a greater than 20% increase. An increase of this amount could mean that ransomware is already attacked your system.

Encrypted files ⓘ

View The Percentage Of Files That Are Encrypted In The Top 4 Data Sources Over Time



Click a line for one of the data sources to view the filtered results in the Data Sense Investigation page so that you can investigate further.

Tier on-premises data to the cloud

Learn about Cloud Tiering

NetApp's Cloud Tiering service extends your data center to the cloud by automatically tiering inactive data from on-premises ONTAP clusters to object storage. This frees valuable space on the cluster for more workloads, without making changes to the application layer. Cloud Tiering can reduce costs in your data center and enables you to switch from a CAPEX model to an OPEX model.

The Cloud Tiering service leverages the capabilities of *FabricPool*. FabricPool is a NetApp Data Fabric technology that enables automated tiering of data to low-cost object storage. Active (hot) data remains on the local tier (on-premises ONTAP aggregates), while inactive (cold) data is moved to the cloud tier—all while preserving ONTAP data efficiencies.

Note: Starting with ONTAP 9.8 you can tier data from aggregates consisting of HDDs in addition to high-performance SSDs. Prior to that release you can tier data only from AFF systems or FAS systems with all-SSD aggregates. See [Requirements for using FabricPool](#) for details.

Features

Cloud Tiering offers automation, monitoring, reports, and a common management interface:

- Automation makes it easier to set up and manage data tiering from on-prem ONTAP clusters to the cloud
- You can choose the default cloud provider storage class/access tier, or use lifecycle management to move older tiered data to a more cost-effective tier
- A single pane of glass removes the need to independently manage FabricPool across several clusters
- Reports show the amount of active and inactive data on each cluster
- A tiering health status helps you identify and correct issues as they occur
- If you have Cloud Volumes ONTAP systems, you'll find them in the Cluster Dashboard so you get a full view of data tiering in your hybrid cloud infrastructure

For more details about the value that Cloud Tiering provides, [check out the Cloud Tiering page on NetApp Cloud Central](#).



Cloud Volumes ONTAP systems are read-only from Cloud Tiering. You set up tiering for Cloud Volumes ONTAP from the working environment in Cloud Manager.

Supported object storage providers

You can tier inactive data from an on-premises ONTAP cluster to the following object storage providers:

- Amazon S3
- Microsoft Azure Blob
- Google Cloud Storage
- S3-compatible object storage
- NetApp StorageGRID



You can tier data from NAS volumes to the public cloud or to private clouds, like StorageGRID. When tiering data that is accessed by SAN protocols, NetApp recommends using private clouds due to connectivity considerations.

Object storage tiers

Each ONTAP cluster tiers inactive data to a single object store. When you set up data tiering, you have the choice to add a new bucket/container or to select an existing bucket/container, along with a storage class or access tier.

- [Learn about supported AWS S3 storage classes](#)
- [Learn about supported Azure Blob access tiers](#)
- [Learn about supported Google Cloud storage classes](#)

Cloud Tiering uses the cloud provider default storage class/access tier for your inactive data. However, you can apply a lifecycle rule so that the data automatically transitions from the default storage class to another storage class after a certain number of days. This can help keep your costs down by moving very cold data to less expensive storage.



You can't select lifecycle rules for data tiered to StorageGRID or S3-compatible storage.

Pricing and licenses

Pay for Cloud Tiering through a pay-as-you-go subscription, a bring-your-own Cloud Tiering license, or a combination of both. A 30-day free trial is available for your first cluster if you don't have a license.

There are no charges when tiering data to StorageGRID. Neither a BYOL license or PAYGO registration is required.

[View pricing details.](#)

30-day free trial

If you don't have a Cloud Tiering license, a 30-day free trial of Cloud Tiering starts when you set up tiering to your first cluster. After that 30-day free trial ends, you'll need to pay for Cloud Tiering through a pay-as-you-go subscription, a BYOL license, or a combination of both.

If your free trial ends and you haven't subscribed or added a license, then ONTAP no longer tiers cold data to object storage, but existing data is still available for access.

Pay-as-you-go subscription

Cloud Tiering offers consumption-based licensing in a pay-as-you-go model. After subscribing through your cloud provider's marketplace, you pay per GB for data that's tiered—there's no up-front payment. You are billed by your cloud provider through your monthly bill.

You should subscribe even if you have a free trial or if you bring your own license (BYOL):

- Subscribing ensures that there's no disruption of service after your free trial ends.

When the trial ends, you'll be charged hourly according to the amount of data that you tier.

- If you tier more data than allowed by your BYOL license, then data tiering continues through your pay-as-you-go subscription.

For example, if you have a 10 TB license, all capacity beyond the 10 TB is charged through the pay-as-you-go subscription.

You won't be charged from your pay-as-you-go subscription during your free trial or if you haven't exceeded your Cloud Tiering BYOL license.

[Learn how to set up a pay-as-you-go subscription.](#)

Bring your own license

Bring your own license by purchasing a **Cloud Tiering** license from NetApp. You can purchase 2-, 12-, 24-, or 36-month term licenses and specify any amount of tiering capacity. The BYOL Cloud Tiering license is a *floating* license that you can use across multiple on-premises ONTAP clusters. The total tiering capacity that you define in your Cloud Tiering license can be used by all of your on-prem clusters.

After you purchase a Cloud Tiering license, you'll need use the Digital Wallet page in Cloud Manager to add the license. [See how to use a Cloud Tiering BYOL license.](#)

As noted above, we recommend that you set up a pay-as-you-go subscription, even if you have purchased a BYOL license.

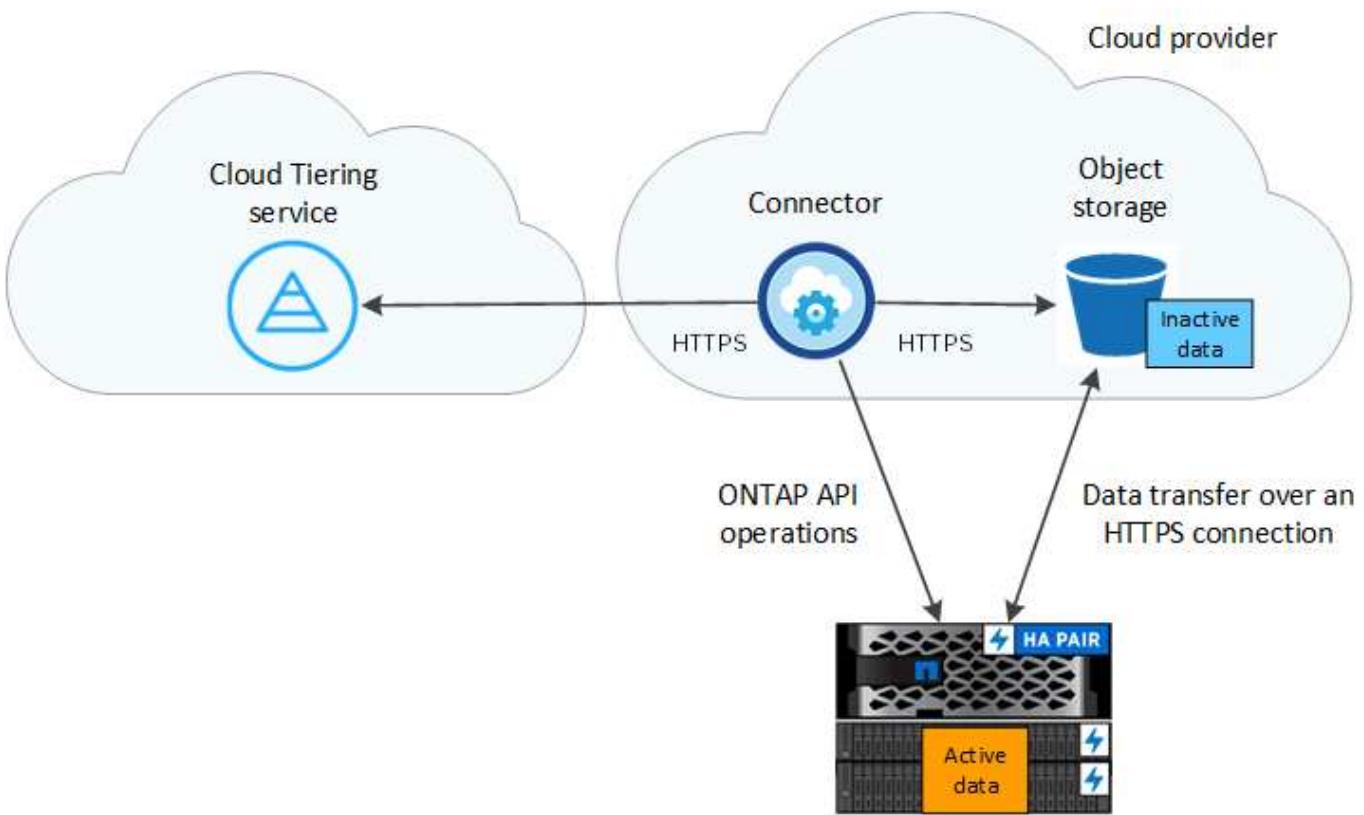


Starting August 21, 2021 the old **FabricPool** license is being replaced by the **Cloud Tiering** license. [Read more about how the Cloud Tiering license is different than the FabricPool license.](#)

How Cloud Tiering works

Cloud Tiering is a NetApp-managed service that uses FabricPool technology to automatically tier inactive (cold) data from your on-premises ONTAP clusters to object storage in your public cloud or private cloud. Connections to ONTAP take place from a Connector.

The following image shows the relationship between each component:



At a high level, Cloud Tiering works like this:

1. You discover your on-prem cluster from Cloud Manager.
2. You set up tiering by providing details about your object storage, including the bucket/container, a storage class or access tier, and lifecycle rules for the tiered data.
3. Cloud Manager configures ONTAP to use the object storage provider and discovers the amount of active and inactive data on the cluster.
4. You choose the volumes to tier and the tiering policy to apply to those volumes.
5. ONTAP starts tiering inactive data to the object store as soon as the data has reached the thresholds to be considered inactive (see [Volume tiering policies](#)).
6. If you have applied a lifecycle rule to the tiered data (only available for some providers), older tiered data is moved to a more cost-effective tier after a certain number of days.

Volume tiering policies

When you select the volumes that you want to tier, you choose a *volume tiering policy* to apply to each volume. A tiering policy determines when or whether the user data blocks of a volume are moved to the cloud.

You can also adjust the **cooling period**. This is the number of days that user data in a volume must remain inactive before it is considered "cold" and moved to object storage. For tiering policies that allow you to adjust the cooling period, the valid values are 2 to 183 days when using ONTAP 9.8 and later, and 2 to 63 days for earlier ONTAP versions; 2 to 63 is the recommended best practice.

No Policy (None)

Keeps the data on a volume in the performance tier, preventing it from being moved to the cloud tier.

Cold snapshots (Snapshot only)

ONTAP tiers cold Snapshot blocks in the volume that are not shared with the active file system to object storage. If read, cold data blocks on the cloud tier become hot and are moved to the performance tier.

Data is tiered only after an aggregate has reached 50% capacity and when the data has reached the cooling period. The default number of cooling days is 2, but you can adjust this number.



Re-heated data is written back to the performance tier only if there is space. If the performance tier capacity is more than 70% full, blocks continue to be accessed from the cloud tier.

Cold user data & snapshots (Auto)

ONTAP tiers all cold blocks in the volume (not including metadata) to object storage. The cold data includes not just Snapshot copies, but also cold user data from the active file system.

If read by random reads, cold data blocks on the cloud tier become hot and are moved to the performance tier. If read by sequential reads, such as those associated with index and antivirus scans, cold data blocks on the cloud tier stay cold and are not written to the performance tier. This policy is available starting with ONTAP 9.4.

Data is tiered only after an aggregate has reached 50% capacity and when the data has reached the cooling period. The default number of cooling days is 31, but you can adjust this number.



Re-heated data is written back to the performance tier only if there is space. If the performance tier capacity is more than 70% full, blocks continue to be accessed from the cloud tier.

All user data (All)

All data (not including metadata) is immediately marked as cold and tiered to object storage as soon as possible. There is no need to wait 48 hours for new blocks in a volume to become cold. Note that blocks located in the volume prior to the All policy being set require 48 hours to become cold.

If read, cold data blocks on the cloud tier stay cold and are not written back to the performance tier. This policy is available starting with ONTAP 9.6.

Take the following into consideration before you choose this tiering policy:

- Tiering data immediately reduces storage efficiencies (inline only).
- You should use this policy only if you are confident that cold data on the volume will not change.
- Object storage is not transactional and will result in significant fragmentation if subjected to change.
- Consider the impact of SnapMirror transfers before assigning the All tiering policy to source volumes in data protection relationships.

Because data is tiered immediately, SnapMirror will read data from the cloud tier rather than the performance tier. This will result in slower SnapMirror operations—possibly slowing other SnapMirror operations later in queue—even if they are using different tiering policies.

- Cloud Backup is similarly affected by volumes set with a tiering policy. [See tiering policy considerations with Cloud Backup](#).

All DP user data (Backup)

All data on a data protection volume (not including metadata) is immediately moved to the cloud tier. If read, cold data blocks on the cloud tier stay cold and are not written back to the performance tier (starting with ONTAP 9.4).



This policy is available for ONTAP 9.5 or earlier. It was replaced with the **All** tiering policy starting with ONTAP 9.6.

Get started

Tiering data from on-premises ONTAP clusters to Amazon S3

Free space on your on-prem ONTAP clusters by tiering inactive data to Amazon S3.

Quick start

Get started quickly by following these steps, or scroll down to the remaining sections for full details.

1

Prepare to tier data to Amazon S3

You need the following:

- An on-prem ONTAP cluster that's running ONTAP 9.2 or later and has an HTTPS connection to Amazon S3. [Learn how to discover a cluster](#).
- An AWS account that has an access key and [the required permissions](#) so the ONTAP cluster can tier inactive data in and out of S3.
- A Connector installed in an AWS VPC or on your premises.
- Networking for the Connector that enables an outbound HTTPS connection to the ONTAP cluster, to S3 storage, and to the Cloud Tiering service.

2

Set up tiering

In Cloud Manager, select an on-prem working environment, click **Enable** for the Tiering service, and follow the prompts to tier data to Amazon S3.

3

Set up licensing

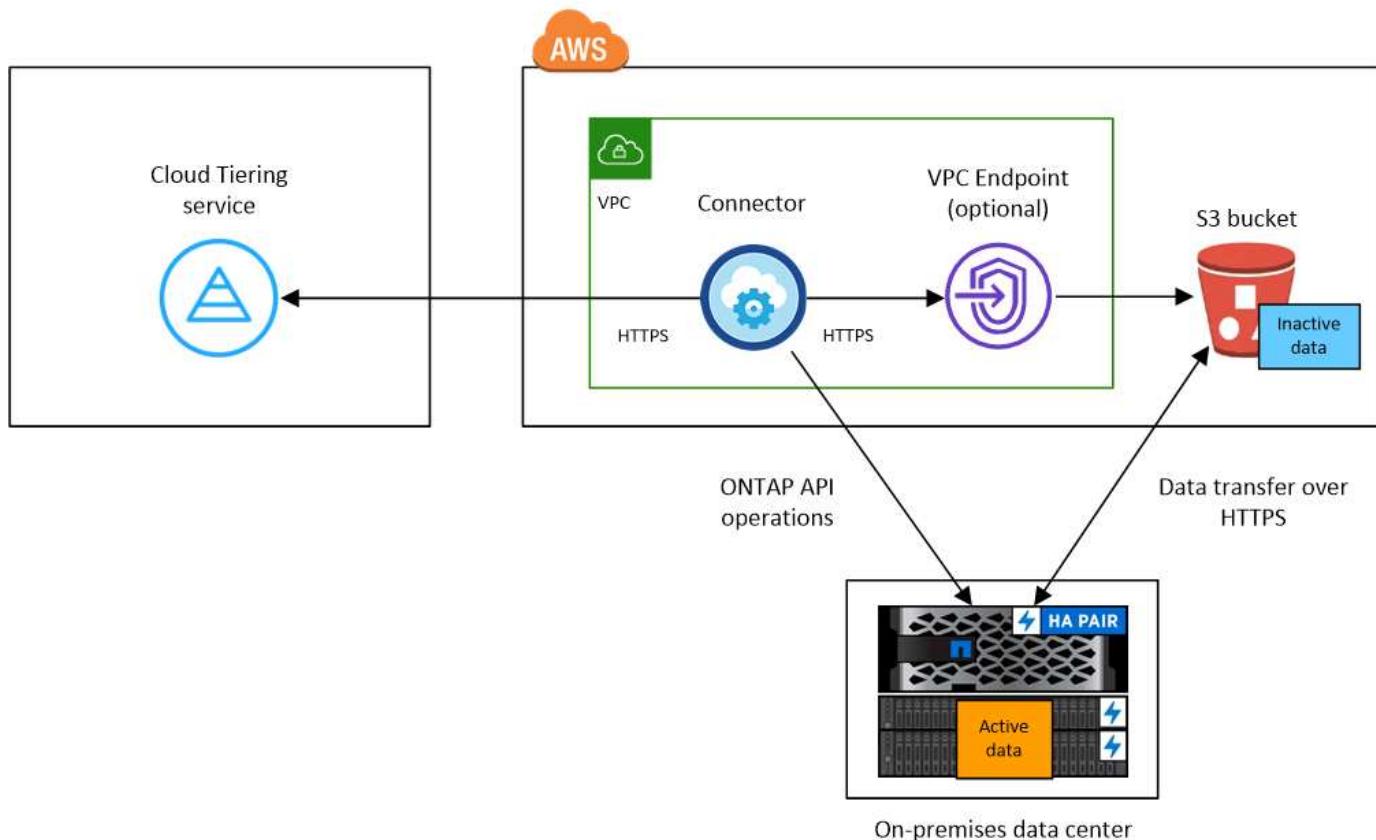
After your free trial ends, pay for Cloud Tiering through a pay-as-you-go subscription, an ONTAP Cloud Tiering BYOL license, or a combination of both:

- To subscribe from the AWS Marketplace, [go to the Cloud Manager Marketplace offering](#), click **Subscribe**, and then follow the prompts.
- To pay using a Cloud Tiering BYOL license, [contact us if you need to purchase one](#), and then [add it to your account from the Cloud Manager Digital Wallet](#).

Requirements

Verify support for your ONTAP cluster, set up your networking, and prepare your object storage.

The following image shows each component and the connections that you need to prepare between them:



Communication between a Connector and S3 is for object storage setup only. The Connector can reside on your premises, instead of in the cloud.

Preparing your ONTAP clusters

Your ONTAP clusters must meet the following requirements when tiering data to Amazon S3.

Supported ONTAP platforms

- When using ONTAP 9.8 and later: You can tier data from AFF systems, or FAS systems with all-SSD aggregates or all-HDD aggregates.
- When using ONTAP 9.7 and earlier: You can tier data from AFF systems, or FAS systems with all-SSD aggregates.

Supported ONTAP version

ONTAP 9.2 or later

Cluster networking requirements

- The ONTAP cluster initiates an HTTPS connection over port 443 to Amazon S3.

ONTAP reads and writes data to and from object storage. The object storage never initiates, it just responds.

Although AWS Direct Connect provides better performance and lower data transfer charges, it's not required between the ONTAP cluster and S3. But doing so is the recommended best practice.

- An inbound connection is required from the Connector, which can reside in an AWS VPC or on your premises.

A connection between the cluster and the Cloud Tiering service is not required.

- An intercluster LIF is required on each ONTAP node that hosts the volumes you want to tier. The LIF must be associated with the *IPspace* that ONTAP should use to connect to object storage.

When you set up data tiering, Cloud Tiering prompts you for the IPspace to use. You should choose the IPspace that each LIF is associated with. That might be the "Default" IPspace or a custom IPspace that you created. Learn more about [LIFs](#) and [IPspaces](#).

Supported volumes and aggregates

The total number of volumes that Cloud Tiering can tier might be less than the number of volumes on your ONTAP system. That's because volumes can't be tiered from some aggregates. Refer to ONTAP documentation for [functionality or features not supported by FabricPool](#).



Cloud Tiering supports FlexGroup volumes, starting with ONTAP 9.5. Setup works the same as any other volume.

Discovering an ONTAP cluster

You need to create an on-prem ONTAP working environment in Cloud Manager before you can start tiering cold data.

[Learn how to discover a cluster.](#)

Creating or switching Connectors

A Connector is required to tier data to the cloud. When tiering data to AWS S3, you can use a Connector that's in an AWS VPC or on your premises. You'll either need to create a new Connector or make sure that the currently selected Connector resides in AWS or on-prem.

- [Learn about Connectors](#)
- [Creating a Connector in AWS](#)
- [Installing the Connector on an existing Linux host](#)
- [Switching between Connectors](#)

Preparing networking for the Connector

Ensure that the Connector has the required networking connections. A Connector can be installed on-prem or in AWS.

Steps

1. Ensure that the network where the Connector is installed enables the following connections:
 - An outbound internet connection to the Cloud Tiering service over port 443 (HTTPS)
 - An HTTPS connection over port 443 to S3
 - An HTTPS connection over port 443 to your ONTAP clusters

2. If needed, enable a VPC Endpoint to S3.

A VPC Endpoint to S3 is recommended if you have a Direct Connect or VPN connection from your ONTAP cluster to the VPC and you want communication between the Connector and S3 to stay in your AWS internal network.

Preparing Amazon S3

When you set up data tiering to a new cluster, you're prompted to create an S3 bucket or to select an existing S3 bucket in the AWS account where the Connector is set up. The AWS account must have permissions and an access key that you can enter in Cloud Tiering. The ONTAP cluster uses the access key to tier data in and out of S3.

The S3 bucket must be in a [region that supports Cloud Tiering](#).

 If you are planning to configure Cloud Tiering to use a lower cost storage class where your tiered data will transition to after a certain number of days, you must not select any life cycle rules when setting up the bucket in your AWS account. Cloud Tiering manages the life cycle transitions.

Steps

1. Provide the following permissions to the IAM user:

```
"s3>ListAllMyBuckets",
"s3>ListBucket",
"s3:GetBucketLocation",
"s3:GetObject",
"s3:PutObject",
"s3>DeleteObject"
```

[AWS Documentation: Creating a Role to Delegate Permissions to an IAM User](#)

2. Create or locate an access key.

Cloud Tiering passes the access key on to the ONTAP cluster. The credentials are not stored in the Cloud Tiering service.

[AWS Documentation: Managing Access Keys for IAM Users](#)

Tiering inactive data from your first cluster to Amazon S3

After you prepare your AWS environment, start tiering inactive data from your first cluster.

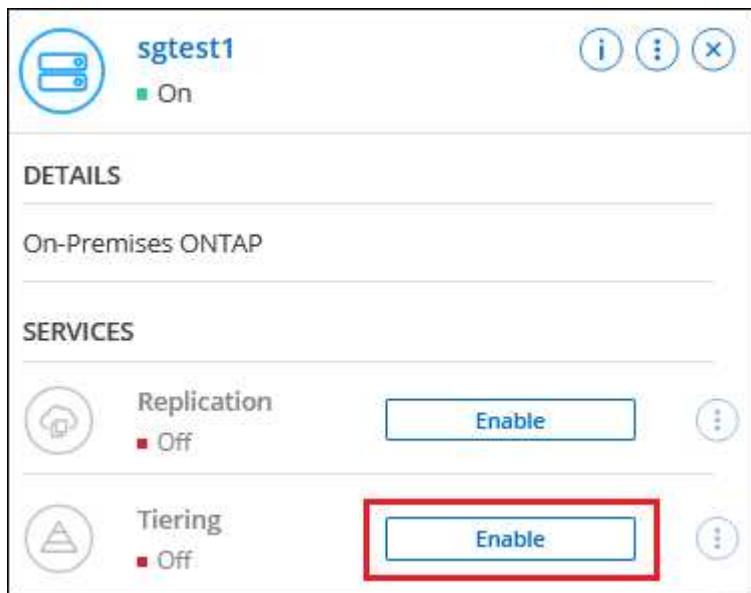
What you'll need

- [An on-premises working environment](#).
- An AWS access key for an IAM user who has the required S3 permissions.

Steps

1. Select an on-prem cluster.

2. Click **Enable** for the Tiering service.



3. **Choose your provider:** This page appears only when using an on-prem Connector. Select **Amazon Web Services** and click **Continue**.
4. Complete the steps on the **Tiering Setup** page:

- a. **S3 Bucket:** Add a new S3 bucket or select an existing S3 bucket that starts with the prefix *fabric-pool* and click **Continue**.

When using an on-prem Connector, you must enter the AWS Account ID that provides access to the existing S3 bucket or new S3 bucket that will be created.

The *fabric-pool* prefix is required because the IAM policy for the Connector enables the instance to perform S3 actions on buckets named with that exact prefix. For example, you could name the S3 bucket *fabric-pool-AFF1*, where AFF1 is the name of the cluster.

- b. **Storage Class Life Cycle:** Cloud Tiering manages the life cycle transitions of your tiered data. Data starts in the *Standard* class, but you can create a rule to move the data to another class after a certain number of days.

Select the S3 storage class that you want to transition the tiered data to and the number of days before the data will be moved, and click **Continue**. For example, the screenshot below shows that tiered data is moved from the *Standard* class to the *Standard-IA* class after 45 days in object storage.

If you choose **Keep data in this storage class**, then the data remains in the *Standard* storage class and no rules are applied. [See supported storage classes](#).

Storage Class Life Cycle Management

We'll move the tiered data through the access tiers that you include in the life cycle. [Learn more about Amazon S3 storage classes.](#)

STORAGE CLASS SETUP

Standard

Move data from Standard after days
 Keep data in this storage class

↓

Standard-IA	No Time Limit
Standard-IA	
Intelligent-Tiering	
One Zone-IA	

Note that the life cycle rule is applied to all objects in the selected bucket.

- c. **Credentials:** Enter the access key ID and secret key for an IAM user who has the required S3 permissions, and click **Continue**.

The IAM user must be in the same AWS account as the bucket that you selected or created on the **S3 Bucket** page.

- d. **Cluster Network:** Select the IPspace that ONTAP should use to connect to object storage, and click **Continue**.

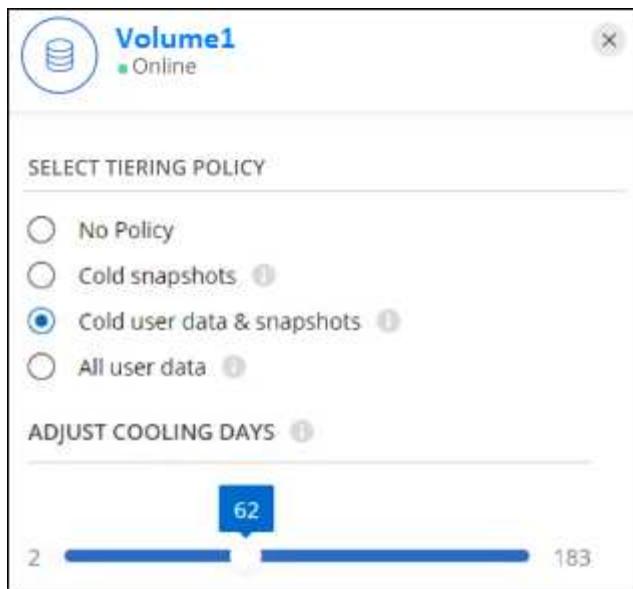
Selecting the correct IPspace ensures that Cloud Tiering can set up a connection from ONTAP to your cloud provider's object storage.

5. On the *Tier Volumes* page, select the volumes that you want to configure tiering for and launch the *Tiering Policy* page:

- To select all volumes, check the box in the title row (**Volume Name**) and click **Configure volumes**.
- To select multiple volumes, check the box for each volume (**Volume_1**) and click **Configure volumes**.
- To select a single volume, click the row (or  icon) for the volume.

6. In the *Tiering Policy* dialog, select a tiering policy, optionally adjust the cooling days for the selected volumes, and click **Apply**.

[Learn more about volume tiering policies and cooling days.](#)



Result

You've successfully set up data tiering from volumes on the cluster to S3 object storage.

What's next?

[Be sure to subscribe to the Cloud Tiering service.](#)

You can also add additional clusters or review information about the active and inactive data on the cluster. For details, see [Managing data tiering from your clusters](#).

Tiering data from on-premises ONTAP clusters to Azure Blob storage

Free space on your on-prem ONTAP clusters by tiering inactive data to Azure Blob storage.

Quick start

Get started quickly by following these steps, or scroll down to the remaining sections for full details.

1

Prepare to tier data to Azure Blob storage

You need the following:

- An on-prem ONTAP cluster that's running ONTAP 9.4 or later and has an HTTPS connection to Azure Blob storage. [Learn how to discover a cluster](#).
- A Connector installed in an Azure VNet or on your premises.
- Networking for a Connector that enables an outbound HTTPS connection to the ONTAP cluster in your data center, to Azure storage, and to the Cloud Tiering service.

2

Set up tiering

In Cloud Manager, select an on-prem working environment, click **Enable** for the Tiering service, and follow the prompts to tier data to Azure Blob storage.

3

Set up licensing

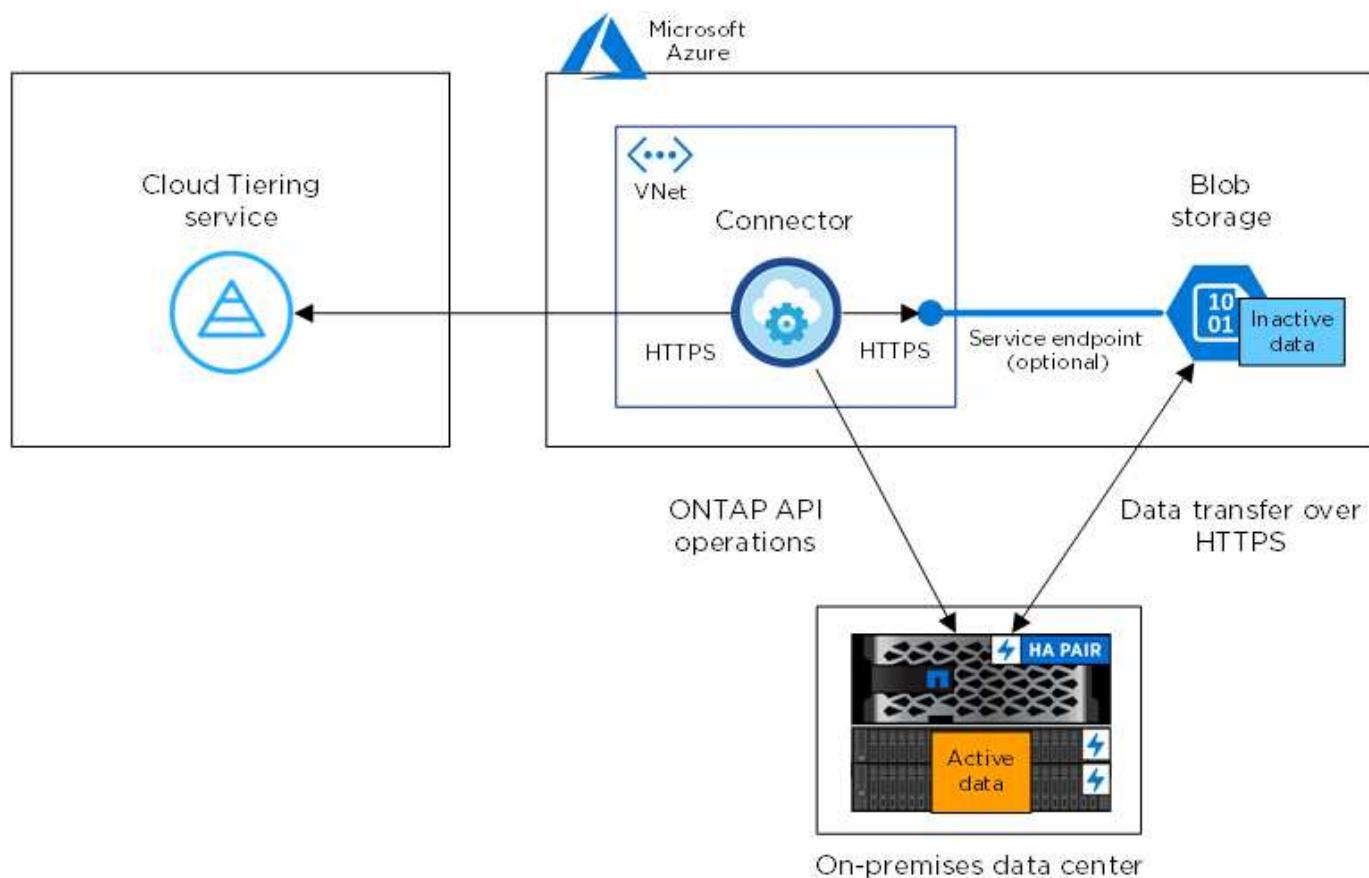
After your free trial ends, pay for Cloud Tiering through a pay-as-you-go subscription, an ONTAP Cloud Tiering BYOL license, or a combination of both:

- To subscribe from the Azure Marketplace, [go to the Cloud Manager Marketplace offering](#), click **Subscribe**, and then follow the prompts.
- To pay using a Cloud Tiering BYOL license, [contact us if you need to purchase one](#), and then [add it to your account from the Cloud Manager Digital Wallet](#).

Requirements

Verify support for your ONTAP cluster, set up your networking, and prepare your object storage.

The following image shows each component and the connections that you need to prepare between them:



Communication between the Connector and Blob storage is for object storage setup only. The Connector can reside on your premises, instead of in the cloud.

Preparing your ONTAP clusters

Your ONTAP clusters must meet the following requirements when tiering data to Azure Blob storage.

Supported ONTAP platforms

- When using ONTAP 9.8 and later: You can tier data from AFF systems, or FAS systems with all-SSD aggregates or all-HDD aggregates.

- When using ONTAP 9.7 and earlier: You can tier data from AFF systems, or FAS systems with all-SSD aggregates.

Supported ONTAP version

ONTAP 9.4 or later

Cluster networking requirements

- The ONTAP cluster initiates an HTTPS connection over port 443 to Azure Blob storage.

ONTAP reads and writes data to and from object storage. The object storage never initiates, it just responds.

Although ExpressRoute provides better performance and lower data transfer charges, it's not required between the ONTAP cluster and Azure Blob storage. But doing so is the recommended best practice.
 - An inbound connection is required from the Connector, which can reside in an Azure VNet or on your premises.

A connection between the cluster and the Cloud Tiering service is not required.
 - An intercluster LIF is required on each ONTAP node that hosts the volumes you want to tier. The LIF must be associated with the *IPspace* that ONTAP should use to connect to object storage.
- When you set up data tiering, Cloud Tiering prompts you for the IPspace to use. You should choose the IPspace that each LIF is associated with. That might be the "Default" IPspace or a custom IPspace that you created. Learn more about [LIFs](#) and [IPspaces](#).

Supported volumes and aggregates

The total number of volumes that Cloud Tiering can tier might be less than the number of volumes on your ONTAP system. That's because volumes can't be tiered from some aggregates. Refer to ONTAP documentation for [functionality or features not supported by FabricPool](#).



Cloud Tiering supports FlexGroup volumes, starting with ONTAP 9.5. Setup works the same as any other volume.

Discovering an ONTAP cluster

You need to create an on-prem ONTAP working environment in Cloud Manager before you can start tiering cold data.

[Learn how to discover a cluster.](#)

Creating or switching Connectors

A Connector is required to tier data to the cloud. When tiering data to Azure Blob storage, you can use a Connector that's in an Azure VNet or on your premises. You'll either need to create a new Connector or make sure that the currently selected Connector resides in Azure or on-prem.

- [Learn about Connectors](#)
- [Creating a Connector in Azure](#)
- [Connector host requirements](#)
- [Installing the Connector on an existing Linux host](#)

- [Switching between Connectors](#)

Verify that you have the necessary Connector permissions

If you created the Connector using Cloud Manager version 3.9.7 or greater, then you're all set.

If you created the Connector using an earlier version of Cloud Manager, then you'll need to edit the permission list to add 2 required permissions:

```
Microsoft.Storage/storageAccounts/managementPolicies/read  
Microsoft.Storage/storageAccounts/managementPolicies/write
```

Preparing networking for the Connector

Ensure that the Connector has the required networking connections. A Connector can be installed on-prem or in Azure.

Steps

1. Ensure that the network where the Connector is installed enables the following connections:
 - An outbound internet connection to the Cloud Tiering service over port 443 (HTTPS)
 - An HTTPS connection over port 443 to Azure Blob storage
 - An HTTPS connection over port 443 to your ONTAP clusters
2. If needed, enable a VNet service endpoint to Azure storage.

A VNet service endpoint to Azure storage is recommended if you have an ExpressRoute or VPN connection from your ONTAP cluster to the VNet and you want communication between the Connector and Blob storage to stay in your virtual private network.

Preparing Azure Blob storage

When you set up tiering, you need to identify the resource group you want to use, and the storage account and Azure container that belong to the resource group. A storage account enables Cloud Tiering to authenticate and access the Blob container used for data tiering.

Cloud Tiering supports only the General Purpose v2 and Premium Block Blob types of storage accounts.

The Blob container must be in a [region that supports Cloud Tiering](#).



If you are planning to configure Cloud Tiering to use a lower cost access tier where your tiered data will transition to after a certain number of days, you must not select any life cycle rules when setting up the container in your Azure account. Cloud Tiering manages the life cycle transitions.

Tiering inactive data from your first cluster to Azure Blob storage

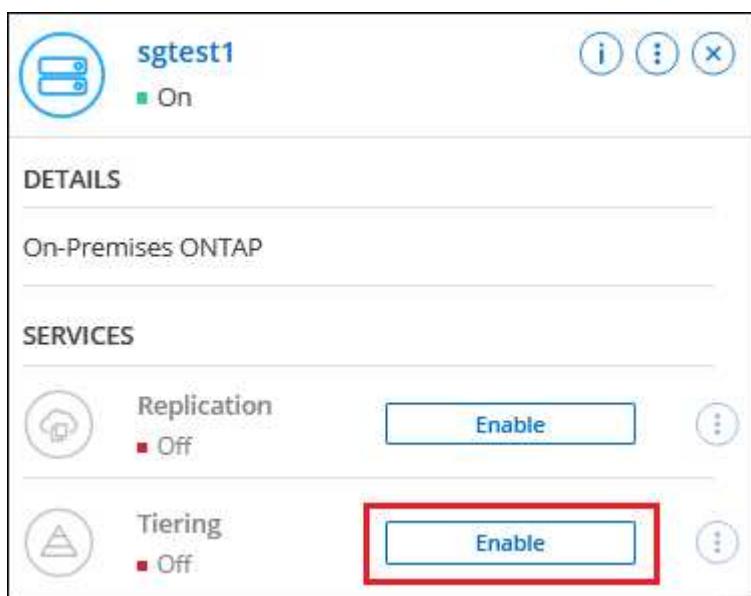
After you prepare your Azure environment, start tiering inactive data from your first cluster.

What you'll need

An on-premises working environment.

Steps

1. Select an on-prem cluster.
2. Click **Enable** for the Tiering service.



3. **Choose your provider:** This page appears only when using an on-prem Connector. Select **Microsoft Azure** and click **Continue**.
4. Complete the steps on the **Tiering Setup** page:
 - a. **Resource Group:** Select a resource group where an existing container is managed, or where you would like to create a new container for tiered data, and click **Continue**.
 - b. **Azure Container:** Add a new Blob container to a storage account, or select an existing container, and click **Continue**.

When using an on-prem Connector, you must enter the Azure Subscription that provides access to the existing container or new container that will be created.

The storage account and containers that appear in this step belong to the resource group that you selected in the previous step.

- c. **Access Tier Life Cycle:** Cloud Tiering manages the life cycle transitions of your tiered data. Data starts in the *Hot* class, but you can create a rule to move the data to the *Cool* class after a certain number of days.

Select the access tier that you want to transition the tiered data to and the number of days before the data will be moved, and click **Continue**. For example, the screenshot below shows that tiered data is moved from the *Hot* class to the *Cool* class after 45 days in object storage.

If you choose **Keep data in this access tier**, then the data remains in the *Hot* access tier and no rules are applied. [See supported access tiers](#).

Access Tier Life Cycle Management

We'll move the tiered data through the access tiers that you include in the life cycle. [Learn more about Azure Blob storage access tiers.](#)

ACCESS TIER SETUP

Hot

- Move data from Hot to Cool after days
 Keep data in this storage class



Cool

- No Time Limit 

Note that the life cycle rule is applied to all blob containers in the selected storage account.

[Verify that you have the necessary Connector permissions](#) for the life cycle management feature.

- d. **Cluster Network:** Select the IPspace that ONTAP should use to connect to object storage, and click **Continue**.

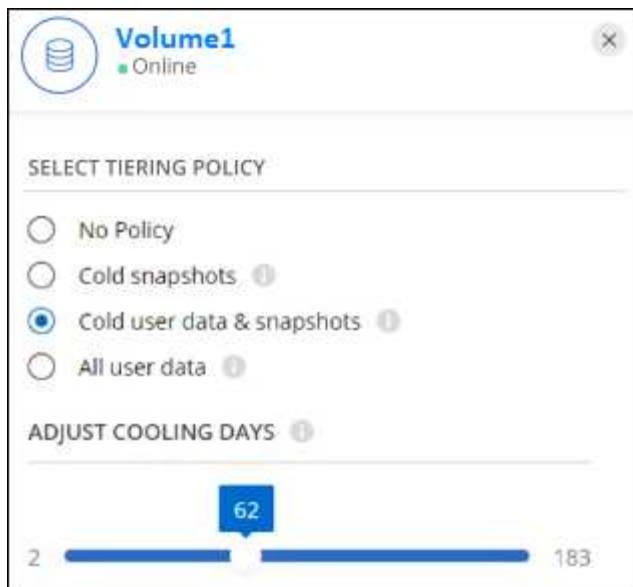
Selecting the correct IPspace ensures that Cloud Tiering can set up a connection from ONTAP to your cloud provider's object storage.

5. On the *Tier Volumes* page, select the volumes that you want to configure tiering for and launch the *Tiering Policy* page:

- To select all volumes, check the box in the title row ( **Volume Name**) and click **Configure volumes**.
- To select multiple volumes, check the box for each volume ( **Volume_1**) and click **Configure volumes**.
- To select a single volume, click the row (or  icon) for the volume.

6. In the *Tiering Policy* dialog, select a tiering policy, optionally adjust the cooling days for the selected volumes, and click **Apply**.

[Learn more about volume tiering policies and cooling days.](#)



Result

You've successfully set up data tiering from volumes on the cluster to Azure Blob object storage.

What's next?

[Be sure to subscribe to the Cloud Tiering service.](#)

You can also add additional clusters or review information about the active and inactive data on the cluster. For details, see [Managing data tiering from your clusters](#).

Tiering data from on-premises ONTAP clusters to Google Cloud Storage

Free space on your on-prem ONTAP clusters by tiering inactive data to Google Cloud Storage.

Quick start

Get started quickly by following these steps, or scroll down to the remaining sections for full details.

1

Prepare to tier data to Google Cloud Storage

You need the following:

- An on-prem ONTAP cluster that's running ONTAP 9.6 or later and has an HTTPS connection to Google Cloud Storage. [Learn how to discover a cluster](#).
- A service account that has the predefined Storage Admin role and storage access keys.
- A Connector installed in a Google Cloud Platform VPC.
- Networking for the Connector that enables an outbound HTTPS connection to the ONTAP cluster in your data center, to Google Cloud Storage, and to the Cloud Tiering service.

2

Set up tiering

In Cloud Manager, select an on-prem working environment, click **Enable** for the Tiering service, and follow the

prompts to tier data to Google Cloud Storage.

3

Set up licensing

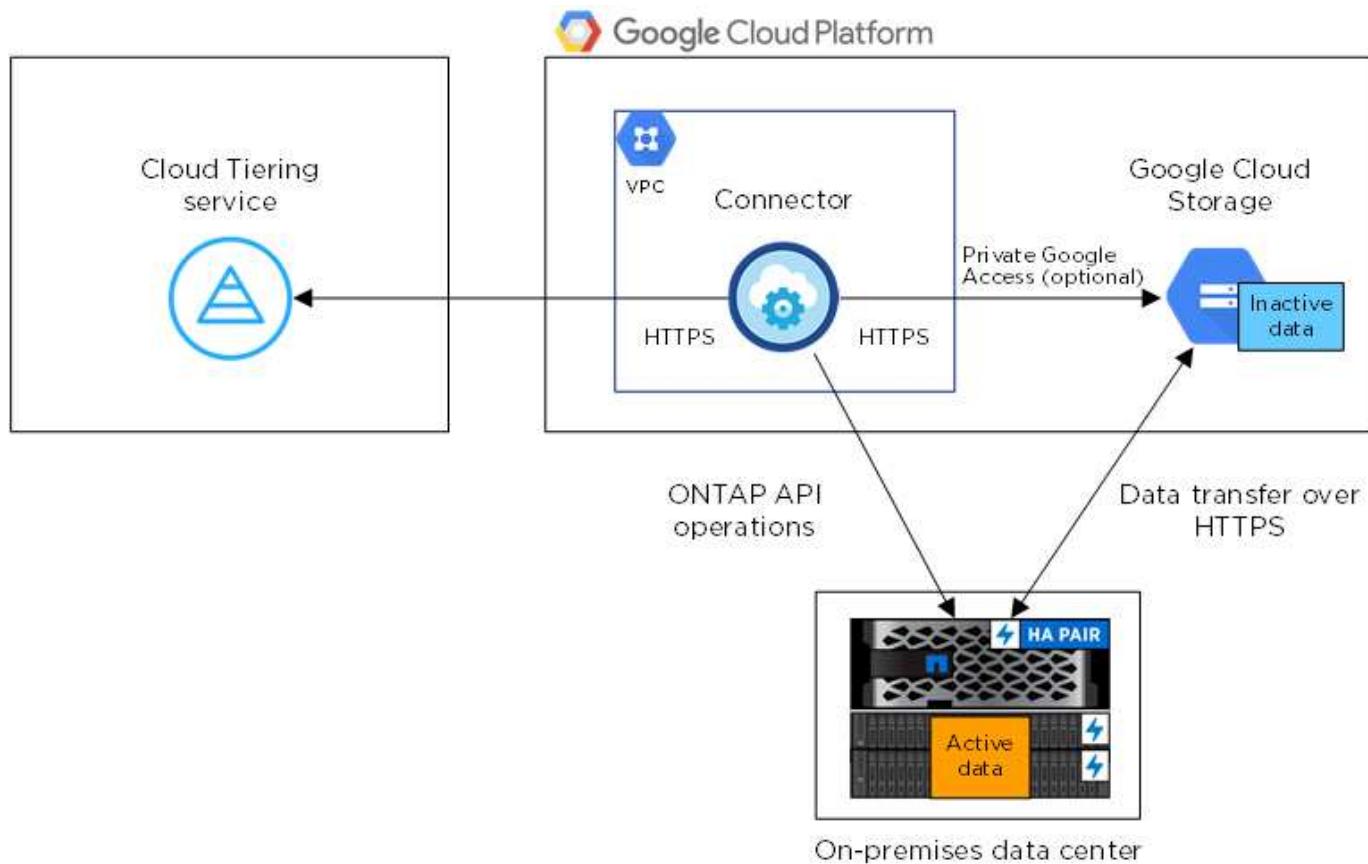
After your free trial ends, pay for Cloud Tiering through a pay-as-you-go subscription, an ONTAP Cloud Tiering BYOL license, or a combination of both:

- To subscribe from the GCP Marketplace, [go to the Cloud Manager Marketplace offering](#), click **Subscribe**, and then follow the prompts.
- To pay using a Cloud Tiering BYOL license, [contact us if you need to purchase one](#), and then [add it to your account from the Cloud Manager Digital Wallet](#).

Requirements

Verify support for your ONTAP cluster, set up your networking, and prepare your object storage.

The following image shows each component and the connections that you need to prepare between them:



Communication between the Connector and Google Cloud Storage is for object storage setup only.

Preparing your ONTAP clusters

Your ONTAP clusters must meet the following requirements when tiering data to Google Cloud Storage.

Supported ONTAP platforms

- When using ONTAP 9.8 and later: You can tier data from AFF systems, or FAS systems with all-SSD aggregates or all-HDD aggregates.
- When using ONTAP 9.7 and earlier: You can tier data from AFF systems, or FAS systems with all-SSD aggregates.

Supported ONTAP versions

ONTAP 9.6 or later

Cluster networking requirements

- The ONTAP cluster initiates an HTTPS connection over port 443 to Google Cloud Storage.
ONTAP reads and writes data to and from object storage. The object storage never initiates, it just responds.
Although a Google Cloud Interconnect provides better performance and lower data transfer charges, it's not required between the ONTAP cluster and Google Cloud Storage. But doing so is the recommended best practice.
- An inbound connection is required from the Connector, which resides in a Google Cloud Platform VPC.
A connection between the cluster and the Cloud Tiering service is not required.
- An intercluster LIF is required on each ONTAP node that hosts the volumes you want to tier. The LIF must be associated with the *IPspace* that ONTAP should use to connect to object storage.

When you set up data tiering, Cloud Tiering prompts you for the *IPspace* to use. You should choose the *IPspace* that each LIF is associated with. That might be the "Default" *IPspace* or a custom *IPspace* that you created. Learn more about [LIFs](#) and [IPspaces](#).

Supported volumes and aggregates

The total number of volumes that Cloud Tiering can tier might be less than the number of volumes on your ONTAP system. That's because volumes can't be tiered from some aggregates. Refer to ONTAP documentation for [functionality or features not supported by FabricPool](#).



Cloud Tiering supports FlexGroup volumes. Setup works the same as any other volume.

Discovering an ONTAP cluster

You need to create an on-prem ONTAP working environment in Cloud Manager before you can start tiering cold data.

[Learn how to discover a cluster.](#)

Creating or switching Connectors

A Connector is required to tier data to the cloud. When tiering data to Google Cloud Storage, a Connector must be available in a Google Cloud Platform VPC. You'll either need to create a new Connector or make sure that the currently selected Connector resides in GCP.

- [Learn about Connectors](#)
- [Creating a Connector in GCP](#)

- [Switching between Connectors](#)

Preparing networking for the Connector

Ensure that the Connector has the required networking connections.

Steps

1. Ensure that the VPC where the Connector is installed enables the following connections:
 - An outbound internet connection to the Cloud Tiering service over port 443 (HTTPS)
 - An HTTPS connection over port 443 to Google Cloud Storage
 - An HTTPS connection over port 443 to your ONTAP clusters
2. Optional: Enable Private Google Access on the subnet where you plan to deploy the Connector.

[Private Google Access](#) is recommended if you have a direct connection from your ONTAP cluster to the VPC and you want communication between the Connector and Google Cloud Storage to stay in your virtual private network. Note that Private Google Access works with VM instances that have only internal (private) IP addresses (no external IP addresses).

Preparing Google Cloud Storage

When you set up tiering, you need to provide storage access keys for a service account that has Storage Admin permissions. A service account enables Cloud Tiering to authenticate and access Cloud Storage buckets used for data tiering. The keys are required so that Google Cloud Storage knows who is making the request.

The Cloud Storage buckets must be in a [region that supports Cloud Tiering](#).



If you are planning to configure Cloud Tiering to use lower cost storage classes where your tiered data will transition to after a certain number of days, you must not select any life cycle rules when setting up the bucket in your GCP account. Cloud Tiering manages the life cycle transitions.

Steps

1. [Create a service account that has the predefined Storage Admin role](#).
2. Go to [GCP Storage Settings](#) and create access keys for the service account:
 - a. Select a project, and click **Interoperability**. If you haven't already done so, click **Enable interoperability access**.
 - b. Under **Access keys for service accounts**, click **Create a key for a service account**, select the service account that you just created, and click **Create Key**.

You'll need to enter the keys later when you set up Cloud Tiering.

Tiering inactive data from your first cluster to Google Cloud Storage

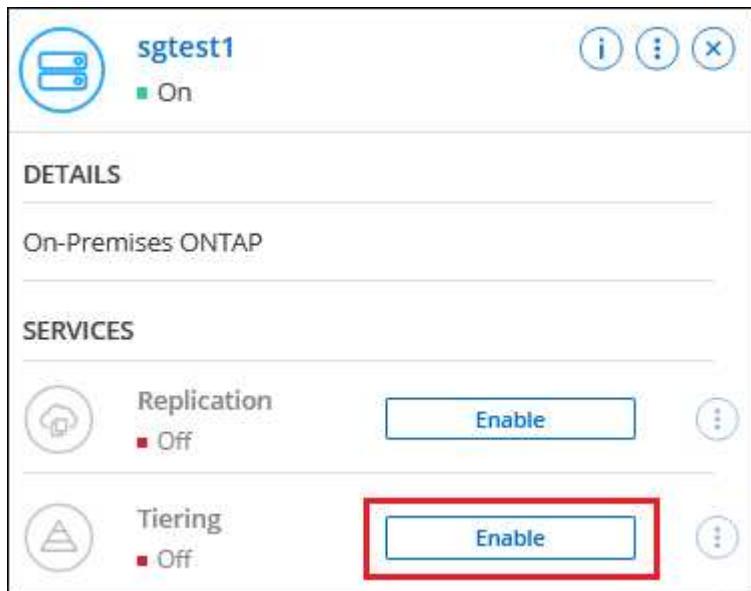
After you prepare your Google Cloud environment, start tiering inactive data from your first cluster.

What you'll need

- [An on-premises working environment](#).
- Storage access keys for a service account that has the Storage Admin role.

Steps

1. Select an on-prem cluster.
2. Click **Enable** for the Tiering service.



3. Complete the steps on the **Tiering Setup** page:

- a. **Bucket:** Add a new Google Cloud Storage bucket or select an existing bucket.
- b. **Storage Class Life Cycle:** Cloud Tiering manages the life cycle transitions of your tiered data. Data starts in the *Standard* class, but you can create rules to move the data to other classes after a certain number of days.

Select the Google Cloud storage class that you want to transition the tiered data to and the number of days before the data will be moved, and click **Continue**. For example, the screenshot below shows that tiered data is moved from the *Standard* class to the *Nearline* class after 30 days in object storage, and then to the *Coldline* class after 60 days in object storage.

If you choose **Keep data in this storage class**, then the data remains in the that storage class. [See supported storage classes.](#)

Storage Class Life Cycle Management

We'll move the tiered data through the storage classes that you include in the life cycle. [Learn more about Google Cloud Storage classes.](#)

STORAGE CLASS SETUP

Standard

Move data from Standard to Nearline after days

Keep data in this storage class



Nearline

Move data from Nearline to Coldline after days

Keep data in this storage class



Coldline

Move data from Coldline to Archive after days

Keep data in this storage class



Archive

No Time Limit

Note that the life cycle rule is applied to all objects in the selected bucket.

c. **Credentials:** Enter the storage access key and secret key for a service account that has the Storage Admin role.

d. **Cluster Network:** Select the IPspace that ONTAP should use to connect to object storage.

Selecting the correct IPspace ensures that Cloud Tiering can set up a connection from ONTAP to your cloud provider's object storage.

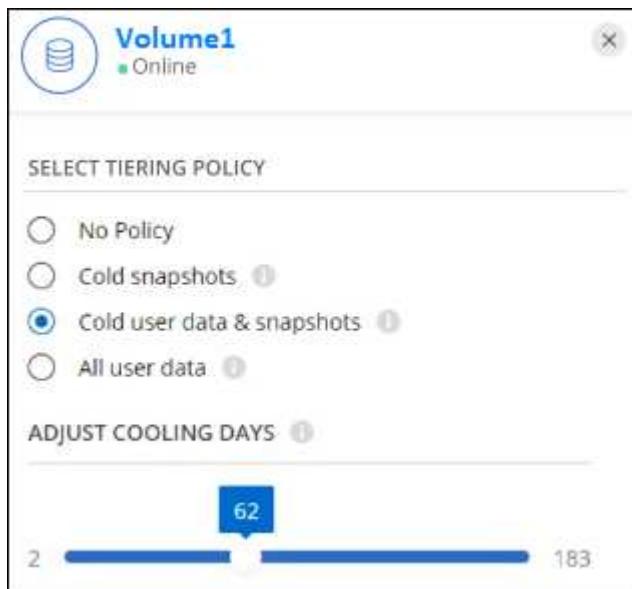
4. Click **Continue** to select the volumes that you want to tier.

5. On the *Tier Volumes* page, select the volumes that you want to configure tiering for and launch the Tiering Policy page:

- To select all volumes, check the box in the title row ( **Volume Name**) and click **Configure volumes**.
- To select multiple volumes, check the box for each volume ( **Volume_1**) and click **Configure volumes**.
- To select a single volume, click the row (or  icon) for the volume.

6. In the *Tiering Policy* dialog, select a tiering policy, optionally adjust the cooling days for the selected volumes, and click **Apply**.

Learn more about volume tiering policies and cooling days.



Result

You've successfully set up data tiering from volumes on the cluster to Google Cloud object storage.

What's next?

[Be sure to subscribe to the Cloud Tiering service.](#)

You can also add additional clusters or review information about the active and inactive data on the cluster. For details, see [Managing data tiering from your clusters](#).

Tiering data from on-premises ONTAP clusters to StorageGRID

Free space on your on-prem ONTAP clusters by tiering inactive data to StorageGRID.

Quick start

Get started quickly by following these steps, or scroll down to the remaining sections for full details.

1

Prepare to tier data to StorageGRID

You need the following:

- An on-prem ONTAP cluster that's running ONTAP 9.4 or later, and a connection over a user-specified port to StorageGRID. [Learn how to discover a cluster](#).
- StorageGRID 10.3 or later with AWS access keys that have S3 permissions.
- A Connector installed on your premises.
- Networking for the Connector that enables an outbound HTTPS connection to the ONTAP cluster, to StorageGRID, and to the Cloud Tiering service.

2

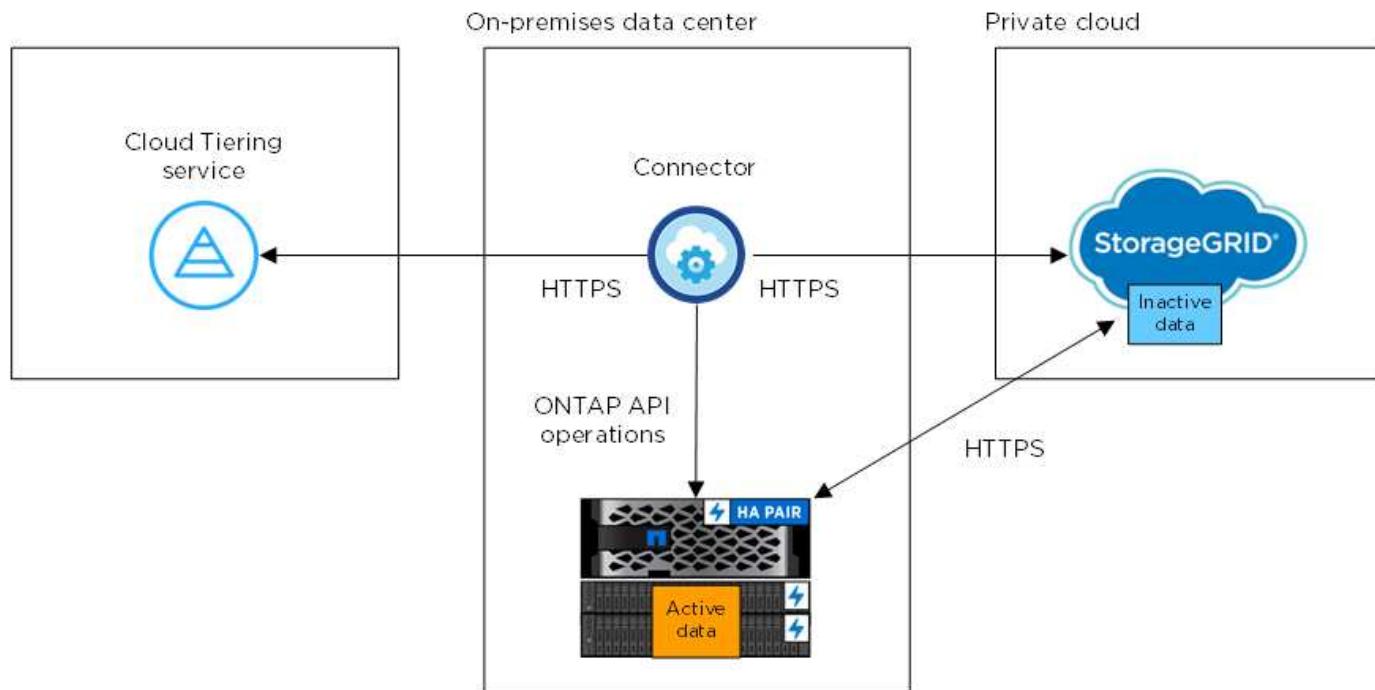
Set up tiering

In Cloud Manager, select an on-prem working environment, click **Enable** for the Tiering service, and follow the prompts to tier data to StorageGRID.

Requirements

Verify support for your ONTAP cluster, set up your networking, and prepare your object storage.

The following image shows each component and the connections that you need to prepare between them:



Communication between the Connector and StorageGRID is for object storage setup only.

Preparing your ONTAP clusters

Your ONTAP clusters must meet the following requirements when tiering data to StorageGRID.

Supported ONTAP platforms

- When using ONTAP 9.8 and later: You can tier data from AFF systems, or FAS systems with all-SSD aggregates or all-HDD aggregates.
- When using ONTAP 9.7 and earlier: You can tier data from AFF systems, or FAS systems with all-SSD aggregates.

Supported ONTAP version

ONTAP 9.4 or later

Licensing

A Cloud Tiering license isn't required in your Cloud Manager account, nor is a FabricPool license required on the ONTAP cluster, when tiering data to StorageGRID.

Cluster networking requirements

- The ONTAP cluster initiates an HTTPS connection over a user-specified port to StorageGRID (the port is configurable during tiering setup).

ONTAP reads and writes data to and from object storage. The object storage never initiates, it just responds.

- An inbound connection is required from the Connector, which must reside on your premises.

A connection between the cluster and the Cloud Tiering service is not required.

- An intercluster LIF is required on each ONTAP node that hosts the volumes you want to tier. The LIF must be associated with the IPspace that ONTAP should use to connect to object storage.

When you set up data tiering, Cloud Tiering prompts you for the IPspace to use. You should choose the IPspace that each LIF is associated with. That might be the "Default" IPspace or a custom IPspace that you created. Learn more about [LIFs](#) and [IPspaces](#).

Supported volumes and aggregates

The total number of volumes that Cloud Tiering can tier might be less than the number of volumes on your ONTAP system. That's because volumes can't be tiered from some aggregates. Refer to ONTAP documentation for [functionality or features not supported by FabricPool](#).



Cloud Tiering supports FlexGroup volumes, starting with ONTAP 9.5. Setup works the same as any other volume.

Discovering an ONTAP cluster

You need to create an on-prem ONTAP working environment in the Cloud Manager Canvas before you can start tiering cold data.

[Learn how to discover a cluster.](#)

Preparing StorageGRID

StorageGRID must meet the following requirements.

Supported StorageGRID versions

StorageGRID 10.3 and later is supported.

S3 credentials

When you set up tiering to StorageGRID, you need to provide Cloud Tiering with an S3 access key and secret key. Cloud Tiering uses the keys to access your buckets.

These access keys must be associated with a user who has the following permissions:

```
"s3>ListAllMyBuckets",
"s3>ListBucket",
"s3GetObject",
"s3PutObject",
"s3DeleteObject",
"s3CreateBucket"
```

Object versioning

You must not enable StorageGRID object versioning on the object store bucket.

Creating or switching Connectors

A Connector is required to tier data to the cloud. When tiering data to StorageGRID, a Connector must be available on your premises. You'll either need to install a new Connector or make sure that the currently selected Connector resides on-prem.

- [Learn about Connectors](#)
- [Connector host requirements](#)
- [Installing the Connector on an existing Linux host](#)
- [Switching between Connectors](#)

Preparing networking for the Connector

Ensure that the Connector has the required networking connections.

Steps

1. Ensure that the network where the Connector is installed enables the following connections:
 - An outbound internet connection to the Cloud Tiering service over port 443 (HTTPS)
 - An HTTPS connection over port 443 to StorageGRID
 - An HTTPS connection over port 443 to your ONTAP cluster

Tiering inactive data from your first cluster to StorageGRID

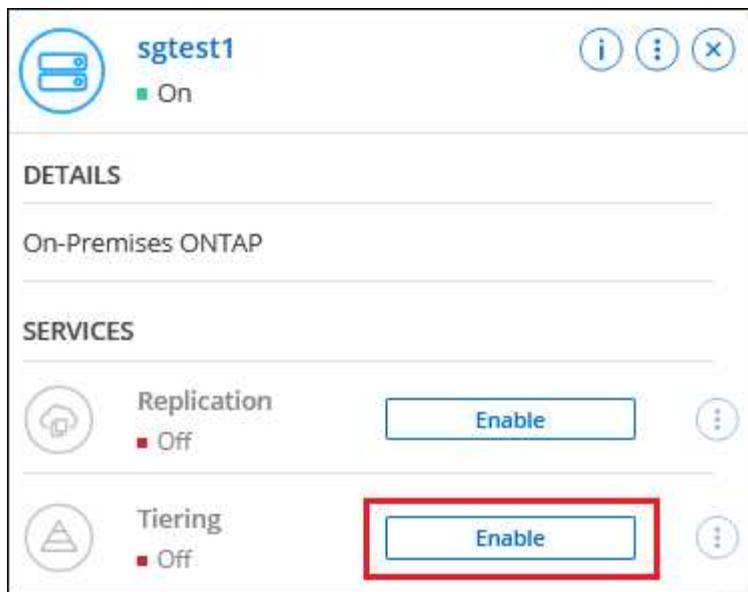
After you prepare your environment, start tiering inactive data from your first cluster.

What you'll need

- [An on-premises working environment.](#)
- The FQDN of the StorageGRID server and the port that will be used for HTTPS communications.
- An AWS access key that has the required S3 permissions.

Steps

1. Select an on-prem cluster.
2. Click **Enable** for the Tiering service.



3. **Choose your provider:** Select **StorageGRID** and click **Continue**.

4. Complete the steps on the **Tiering Setup** page:

- Server:** Enter the FQDN of the StorageGRID server, the port that ONTAP should use for HTTPS communication with StorageGRID, and the access key and secret key for an account that has the required S3 permissions.
- Bucket:** Add a new bucket or select an existing bucket that starts with the prefix *fabric-pool* and click **Continue**.

The *fabric-pool* prefix is required because the IAM policy for the Connector enables the instance to perform S3 actions on buckets named with that exact prefix. For example, you could name the S3 bucket *fabric-pool-AFF1*, where AFF1 is the name of the cluster.

- Cluster Network:** Select the IPspace that ONTAP should use to connect to object storage and click **Continue**.

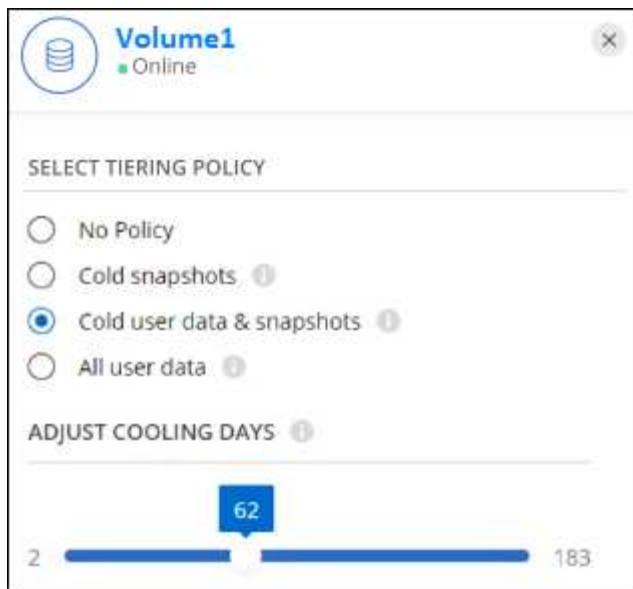
Selecting the correct IPspace ensures that Cloud Tiering can set up a connection from ONTAP to StorageGRID object storage.

5. On the *Tier Volumes* page, select the volumes that you want to configure tiering for and launch the *Tiering Policy* page:

- To select all volumes, check the box in the title row (**Volume Name**) and click **Configure volumes**.
- To select multiple volumes, check the box for each volume (**Volume_1**) and click **Configure volumes**.
- To select a single volume, click the row (or icon) for the volume.

6. In the *Tiering Policy* dialog, select a tiering policy, optionally adjust the cooling days for the selected volumes, and click **Apply**.

[Learn more about volume tiering policies and cooling days.](#)



Result

You've successfully set up data tiering from volumes on the cluster to StorageGRID.

What's next?

You can add additional clusters or review information about the active and inactive data on the cluster. For details, see [Managing data tiering from your clusters](#).

Tiering data from on-premises ONTAP clusters to S3 object storage

Free space on your on-prem ONTAP clusters by tiering inactive data to any object storage service which uses the Simple Storage Service (S3) protocol.

Customers who want to use object stores that are not officially supported as a cloud tier can do so using these instructions. Customers must test and confirm that the object store meets their requirements.

! NetApp does not support nor is liable for any issues arising from any third-party Object Store Service, specifically where it does not have agreed support arrangements with the third party with whom the product originated. It is acknowledged and agreed that NetApp shall not be liable for any associated damage or otherwise be required to provide support on that third-party product.

Quick start

Get started quickly by following these steps, or scroll down to the remaining sections for full details.

1

Prepare to tier data to S3-compatible object storage

You need the following:

- An on-prem ONTAP cluster that's running ONTAP 9.8 or later, and a connection over a user-specified port to the S3-compatible object storage. [Learn how to discover a cluster](#).
- The FQDN, Access Key, and Secret Key for the object storage server so that the ONTAP cluster can

access the bucket.

- A Connector installed on your premises.
- Networking for the Connector that enables an outbound HTTPS connection to the ONTAP cluster, to the S3-compatible object storage, and to the Cloud Tiering service.

2

Set up tiering

In Cloud Manager, select an on-prem working environment, click **Enable** for the Tiering service, and follow the prompts to tier data to S3-compatible object storage.

3

Set up licensing

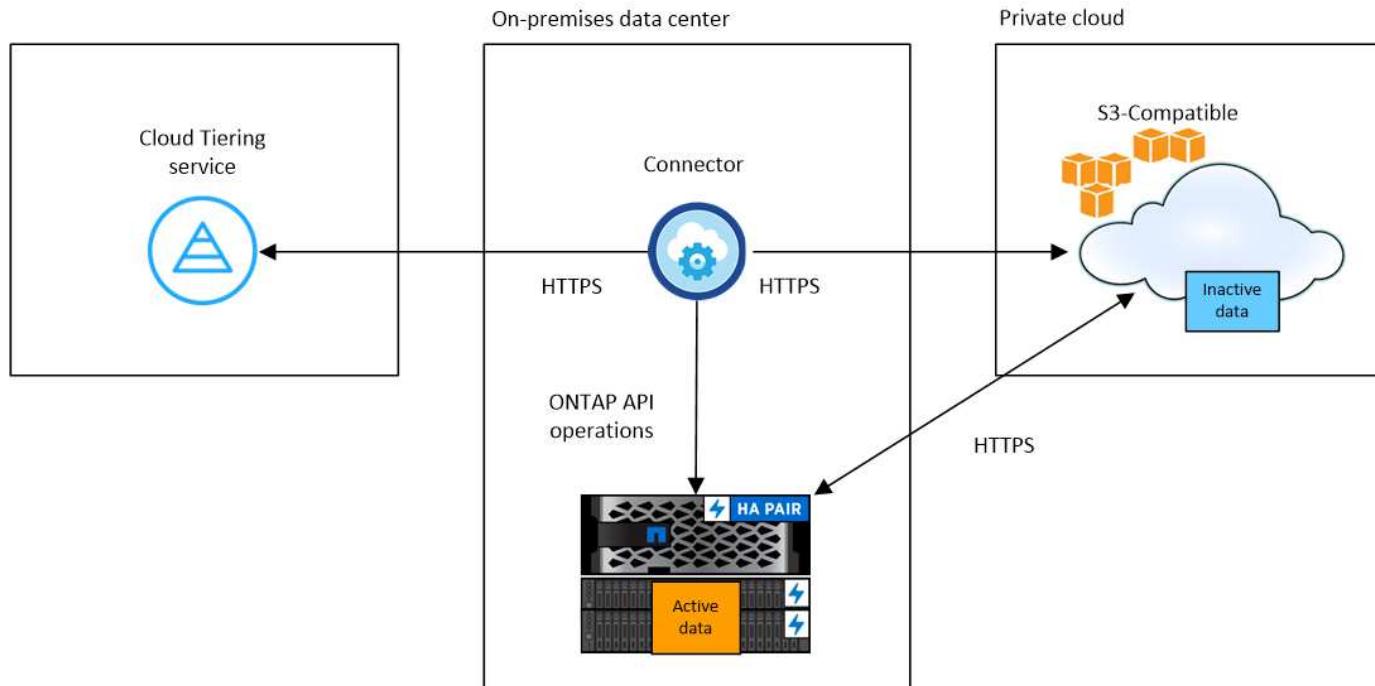
Pay for Cloud Tiering through a pay-as-you-go subscription from your cloud provider, a NetApp Cloud Tiering bring-your-own-license, or a combination of both:

- To subscribe to the Cloud Manager PAYGO offering from the [AWS Marketplace](#), [Azure Marketplace](#), or [GCP Marketplace](#), click **Subscribe** and follow the prompts.
- To pay using a Cloud Tiering BYOL license, [contact us if you need to purchase one](#), and then [add it to your account from the Cloud Manager Digital Wallet](#).

Requirements

Verify support for your ONTAP cluster, set up your networking, and prepare your object storage.

The following image shows each component and the connections that you need to prepare between them:



Communication between the Connector and the S3-compatible object storage server is for object storage setup only.

Preparing your ONTAP clusters

Your ONTAP clusters must meet the following requirements when tiering data to S3-compatible object storage.

Supported ONTAP platforms

You can tier data from AFF systems, or FAS systems with all-SSD aggregates or all-HDD aggregates.

Supported ONTAP version

ONTAP 9.8 or later

Cluster networking requirements

- The ONTAP cluster initiates an HTTPS connection over a user-specified port to S3-compatible object storage (the port is configurable during tiering setup).

ONTAP reads and writes data to and from object storage. The object storage never initiates, it just responds.

- An inbound connection is required from the Connector, which must reside on your premises.

A connection between the cluster and the Cloud Tiering service is not required.

- An intercluster LIF is required on each ONTAP node that hosts the volumes you want to tier. The LIF must be associated with the *IPspace* that ONTAP should use to connect to object storage.

When you set up data tiering, Cloud Tiering prompts you for the IPspace to use. You should choose the IPspace that each LIF is associated with. That might be the "Default" IPspace or a custom IPspace that you created. Learn more about [LIFs](#) and [IPspaces](#).

Supported volumes and aggregates

The total number of volumes that Cloud Tiering can tier might be less than the number of volumes on your ONTAP system. That's because volumes can't be tiered from some aggregates. Refer to ONTAP documentation for [functionality or features not supported by FabricPool](#).



Cloud Tiering supports both FlexVol and FlexGroup volumes.

Discovering an ONTAP cluster

You need to create an on-prem ONTAP working environment in the Cloud Manager Canvas before you can start tiering cold data.

[Learn how to discover a cluster.](#)

Preparing S3-compatible object storage

S3-compatible object storage must meet the following requirements.

S3 credentials

When you set up tiering to S3-compatible object storage, you're prompted to create an S3 bucket or to select an existing S3 bucket. You need to provide Cloud Tiering with an S3 access key and secret key. Cloud Tiering uses the keys to access your bucket.

These access keys must be associated with a user who has the following permissions:

```
"s3>ListAllMyBuckets",
"s3>ListBucket",
"s3.GetObject",
"s3.PutObject",
"s3>DeleteObject",
"s3>CreateBucket"
```

Creating or switching Connectors

A Connector is required to tier data to the cloud. When tiering data to S3-compatible object storage, a Connector must be available on your premises. You'll either need to install a new Connector or make sure that the currently selected Connector resides on-prem.

- [Learn about Connectors](#)
- [Connector host requirements](#)
- [Installing the Connector on an existing Linux host](#)
- [Switching between Connectors](#)

Preparing networking for the Connector

Ensure that the Connector has the required networking connections.

Steps

1. Ensure that the network where the Connector is installed enables the following connections:
 - An outbound internet connection to the Cloud Tiering service over port 443 (HTTPS)
 - An HTTPS connection over port 443 to S3-compatible object storage
 - An HTTPS connection over port 443 to your ONTAP cluster

Tiering inactive data from your first cluster to S3-compatible object storage

After you prepare your environment, start tiering inactive data from your first cluster.

What you'll need

- [An on-premises working environment.](#)
- The FQDN of the S3-compatible object storage server and the port that will be used for HTTPS communications.
- An access key and secret key that has the required S3 permissions.

Steps

1. Select an on-prem cluster.
2. In the right panel, click **Enable** for the Tiering service.

The screenshot shows the 'sgtest1' storage system configuration. Under the 'SERVICES' section, the 'Tiering' service is listed as 'Off' with an 'Enable' button. A red box highlights the 'Enable' button for the Tiering service.

3. **Choose your provider:** Select **S3 Compatible** and click **Continue**.

4. Complete the steps on the **Tiering Setup** page:

- Server:** Enter the FQDN of the S3-compatible object storage server, the port that ONTAP should use for HTTPS communication with the server, and the access key and secret key for an account that has the required S3 permissions.
- Bucket:** Add a new bucket or select an existing bucket and click **Continue**.
- Cluster Network:** Select the IPspace that ONTAP should use to connect to object storage and click **Continue**.

Selecting the correct IPspace ensures that Cloud Tiering can set up a connection from ONTAP to your S3-compatible object storage.

5. On the **Success** page click **Continue** to set up your volumes now.

6. On the **Tier Volumes** page, select the volumes that you want to configure tiering for and click **Configure volumes**:

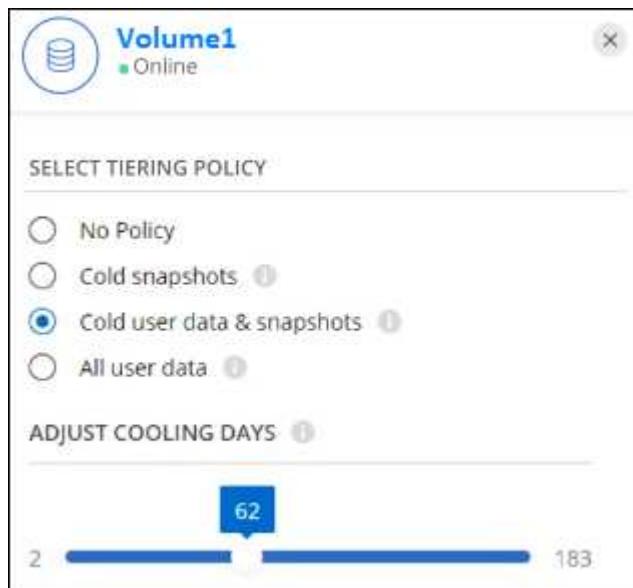
- To select all volumes, check the box in the title row (**Volume Name**) and click **Configure volumes**.
- To select multiple volumes, check the box for each volume (**Volume_1**) and click **Configure volumes**.
- To select a single volume, click the row (or icon) for the volume.

The screenshot shows the 'Tier Volumes' page with three volumes listed: vol2, vol1, and vol3. The 'Configure volumes' button is highlighted with a red box and number 1. The checkbox for selecting multiple volumes is highlighted with a red box and number 2. The edit icon for volume vol1 is highlighted with a red box and number 3.

Volume Name	SVM Name	Volume Size	Used Size	Snapshot Used Size	Cold Data	Tier Status	Tiering Policy
vol2	svm_AFF1	200 GB	4.11 MB	424 KB	2.88 MB	70 %	<input checked="" type="checkbox"/> Tiered Volume Cold snapshots
<input checked="" type="checkbox"/> vol1	svm_AFF1	200 GB	1 MB	0 B	716.8 KB	70 %	<input checked="" type="checkbox"/> Tiered Volume Cold snapshots
<input checked="" type="checkbox"/> vol3	svm_AFF1	200 GB	1 MB	0 B	716.8 KB	70 %	<input checked="" type="checkbox"/> Tiered Volume Cold snapshots

7. In the *Tiering Policy* dialog, select a tiering policy, optionally adjust the cooling days for the selected volumes, and click **Apply**.

[Learn more about volume tiering policies and cooling days.](#)



Result

You've successfully set up data tiering from volumes on the cluster to S3-compatible object storage.

What's next?

[Be sure to subscribe to the Cloud Tiering service.](#)

You can add additional clusters or review information about the active and inactive data on the cluster. For details, see [Managing data tiering from your clusters](#).

Set up licensing for Cloud Tiering

A 30-day free trial of Cloud Tiering starts when you set up tiering from your first cluster. After the free trial ends, you'll need to pay for Cloud Tiering through a pay-as-you-go Cloud Manager subscription from your cloud provider's marketplace, a BYOL license from NetApp, or a combination of both.

A few notes before you read any further:

- If you've already subscribed to the Cloud Manager subscription (PAYGO) in your cloud provider's marketplace, then you're automatically subscribed to Cloud Tiering from on-premises ONTAP systems as well. You'll see an active subscription in the Cloud Tiering **Licensing** tab. You won't need to subscribe again.
- The BYOL Cloud Tiering license is a *floating* license that you can use across multiple on-premises ONTAP clusters in your Cloud Manager account. This is different than in the past where you purchased a *FabricPool* license for each cluster.
- There are no charges when tiering data to StorageGRID, so neither a BYOL license or PAYGO registration is required. This tiered data doesn't count against the capacity purchased in your license.

Learn more about how licensing works for Cloud Tiering.

Use a Cloud Tiering PAYGO subscription

Pay-as-you-go subscriptions from your cloud provider's marketplace enable you to license the use of Cloud Volumes ONTAP systems and many Cloud Data Services, such as Cloud Tiering.

Subscribing from the AWS Marketplace

Subscribe to Cloud Tiering from the AWS Marketplace to set up a pay-as-you-go subscription for data tiering from ONTAP clusters to AWS S3.

Steps

1. In Cloud Manager, click **Tiering > Licensing**.
2. Click **Subscribe** under AWS Marketplace and then click **Continue**.
3. Subscribe from the [AWS Marketplace](#), and then log back in to Cloud Central to complete the registration.

The following video shows the process:

► https://docs.netapp.com/us-en/occm//media/video_subscribing_aws_tiering.mp4 (video)

Subscribing from the Azure Marketplace

Subscribe to Cloud Tiering from the Azure Marketplace to set up a pay-as-you-go subscription for data tiering from ONTAP clusters to Azure Blob storage.

Steps

1. In Cloud Manager, click **Tiering > Licensing**.
2. Click **Subscribe** under Azure Marketplace and then click **Continue**.
3. Subscribe from the [Azure Marketplace](#), and then log back in to Cloud Central to complete the registration.

The following video shows the process:

► https://docs.netapp.com/us-en/occm//media/video_subscribing_azure_tiering.mp4 (video)

Subscribing from the GCP Marketplace

Subscribe to Cloud Tiering from the GCP Marketplace to set up a pay-as-you-go subscription for data tiering from ONTAP clusters to Google Cloud storage.

Steps

1. In Cloud Manager, click **Tiering > Licensing**.
2. Click **Subscribe** under GCP Marketplace and then click **Continue**.
3. Subscribe from the [GCP Marketplace](#), and then log back in to Cloud Central to complete the registration.

The following video shows the process:

► https://docs.netapp.com/us-en/occm//media/video_subscribing_gcp_tiering.mp4 (video)

Use a Cloud Tiering BYOL license

Bring-your-own licenses from NetApp provide 2-, 12-, 24-, or 36-month terms. The **BYOL Cloud Tiering** license is a *floating* license that you can use across multiple on-premises ONTAP clusters in your Cloud Manager account. The total tiering capacity defined in your Cloud Tiering license is shared among **all** of your on-prem clusters, making initial licensing and renewal easy.

If you don't have a Cloud Tiering license, contact us to purchase one:

- [Send email to purchase a license](#).
- Click the chat icon in the lower-right of Cloud Manager to request a license.

Optionally, if you have an unassigned node-based license for Cloud Volumes ONTAP that you won't be using, you can convert it to a Cloud Tiering license with the same dollar-equivalence and the same expiration date. [Go here for details](#).

You use the Digital Wallet page in Cloud Manager to manage Cloud Tiering BYOL licenses. You can add new licenses and update existing licenses.

New Cloud Tiering BYOL licensing starting August 21, 2021

The new **Cloud Tiering** license was introduced on August 21, 2021 for tiering configurations that are supported within Cloud Manager using the Cloud Tiering service. The **FabricPool** license that you may have used in the past to tier on-premises ONTAP data to the cloud is being retained only for configurations that aren't supported within Cloud Manager.

If you have one of these configurations, you'll continue to use a FabricPool license on each cluster (managed using System Manager or the CLI):

- ONTAP installations in the GovCloud or in Dark Sites
- ONTAP clusters in a MetroCluster configuration
- ONTAP clusters using FabricPool Mirror functionality
- ONTAP clusters that are tiering data to IBM Cloud Object Storage or Alibaba Cloud Object Storage

Cloud Manager currently supports tiering to the following cloud storage: Amazon S3, Azure Blob storage, Google Cloud Storage, and S3-compatible object storage.

Note that tiering to StorageGRID does not require a FabricPool or Cloud Tiering license.

If you are currently using FabricPool licensing, you're not affected until your FabricPool license reaches its expiration date or maximum capacity. Contact NetApp when you need to update your license, or earlier to make sure there is no interruption in your ability to tier data to the cloud.

- If you're using a configuration that is supported in Cloud Manager, your FabricPool licenses will be converted to Cloud Tiering licenses and they'll appear in the Digital Wallet. When those initial licenses expire, you'll need to update the Cloud Tiering licenses.
- If you're using a configuration that is not supported in Cloud Manager, then you'll continue using a FabricPool license. [See how to license tiering using System Manager](#).

Here are some things you need to know about the two licenses:

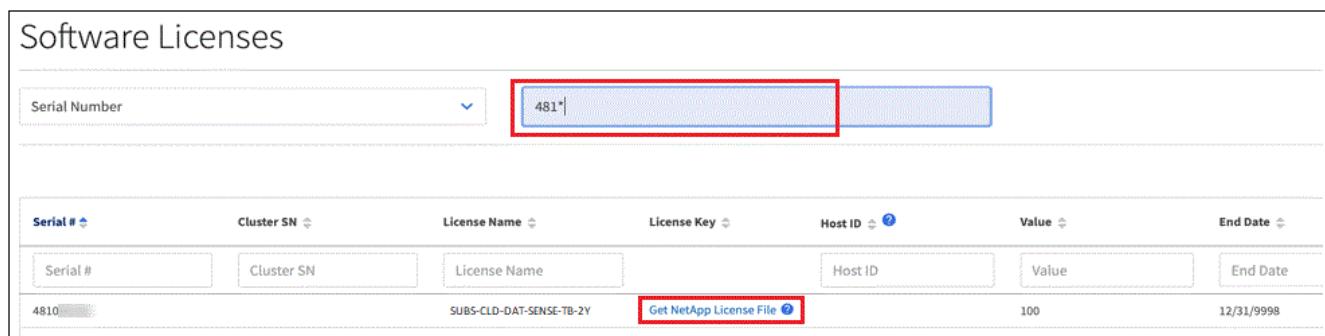
Cloud Tiering license	FabricPool license
It is a <i>floating</i> license that you can use across multiple on-premises ONTAP clusters.	It is a per-cluster license that you purchase and license for every cluster.
It is registered in Cloud Manager in the Digital Wallet.	It is applied to individual clusters using System Manager or the ONTAP CLI.
Tiering configuration and management is done through the Cloud Tiering service in Cloud Manager.	Tiering configuration and management is done through System Manager or the ONTAP CLI.
Once configured, you can use the tiering service without a license for 30 days using the free trial.	Once configured, you can tier the first 10 TB of data for free.

Obtain your Cloud Tiering license file

After you have purchased your Cloud Tiering license, you activate the license in Cloud Manager by entering the Cloud Tiering serial number and NSS account, or by uploading the NLF license file. The steps below show how to get the NLF license file if you plan to use that method.

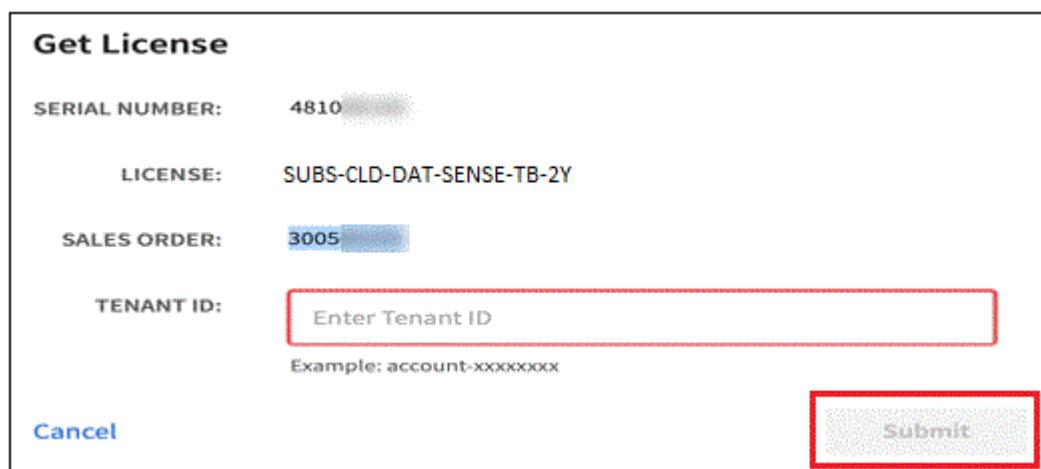
Steps

1. Sign in to the [NetApp Support Site](#) and click **Systems > Software Licenses**.
2. Enter your Cloud Tiering license serial number.



The screenshot shows the 'Software Licenses' page. At the top, there is a dropdown menu labeled 'Serial Number' with '481*' selected. Below this is a table with columns: Serial #, Cluster SN, License Name, License Key, Host ID, Value, and End Date. In the 'License Key' column, there is a link labeled 'Get NetApp License File'. The table also shows a row for serial number 4810 with license SUBS-CLD-DAT-SENSE-TB-2Y.

3. Under **License Key**, click **Get NetApp License File**.
4. Enter your Cloud Manager Account ID (this is called a Tenant ID on the support site) and click **Submit** to download the license file.



The screenshot shows the 'Get License' dialog box. It contains fields for SERIAL NUMBER (4810), LICENSE (SUBS-CLD-DAT-SENSE-TB-2Y), SALES ORDER (3005), and TENANT ID (with placeholder 'Enter Tenant ID'). Below the tenant ID field is an example: 'Example: account-xxxxxxxx'. At the bottom right is a 'Submit' button.

You can find your Cloud Manager Account ID by selecting the **Account** drop-down from the top of Cloud Manager, and then clicking **Manage Account** next to your account. Your Account ID is in the Overview tab.

Add Cloud Tiering BYOL licenses to your account

After you purchase a Cloud Tiering license for your Cloud Manager account, you need to add the license to Cloud Manager to use the Cloud Tiering service.

Steps

1. Click **All Services > Digital Wallet > Data Services Licenses**.
2. Click **Add License**.
3. In the **Add License** dialog, enter the license information and click **Add License**:
 - If you have the tiering license serial number and know your NSS account, select the **Enter Serial Number** option and enter that information.

If your NetApp Support Site account isn't available from the drop-down list, [add the NSS account to Cloud Manager](#).

- If you have the tiering license file, select the **Upload License File** option and follow the prompts to attach the file.

The screenshot shows the 'Add License' dialog box. It has two tabs at the top: 'Enter Serial Number' (selected) and 'Upload License File'. The 'Enter Serial Number' tab contains fields for 'Serial Number' (with placeholder 'Enter Serial Number') and 'NetApp Support Site Account' (with placeholder 'Select Support Site Account'). The 'Upload License File' tab contains instructions: 'To install a license, follow these instructions:' followed by steps 1 and 2, and a 'Upload License File' field with an 'Upload' button.

Result

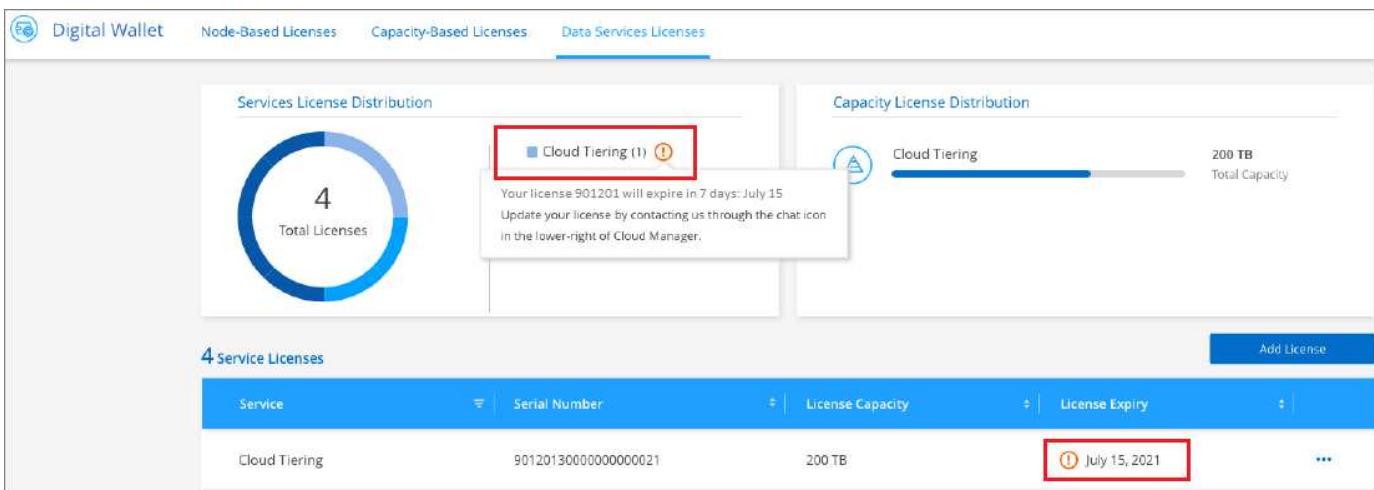
Cloud Manager adds the license so that your Cloud Tiering service is active.

Update a Cloud Tiering BYOL license

If your licensed term is nearing the expiration date, or if your licensed capacity is reaching the limit, you'll be notified in Cloud Tiering.



This status also appears in the Digital Wallet page.

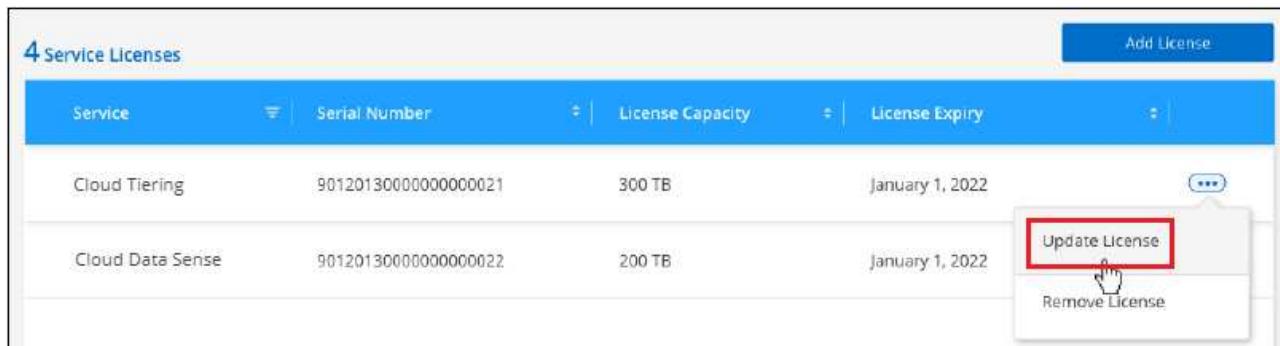


You can update your Cloud Tiering license before it expires so that there is no interruption in your ability to tier your data to the cloud.

Steps

1. Click the chat icon in the lower-right of Cloud Manager to request an extension to your term or additional capacity to your Cloud Tiering license for the particular serial number.

After you pay for the license and it is registered with the NetApp Support Site, Cloud Manager automatically updates the license in the Digital Wallet and the Data Services Licenses page will reflect the change in 5 to 10 minutes.
2. If Cloud Manager can't automatically update the license, then you'll need to manually upload the license file.
 - a. You can [obtain the license file from the NetApp Support Site](#).
 - b. On the Digital Wallet page in the *Data Services Licenses* tab, click **...** for the service serial number you are updating, and click **Update License**.



- c. In the *Update License* page, upload the license file and click **Update License**.

Result

Cloud Manager updates the license so that your Cloud Tiering service continues to be active.

Measure network latency and throughput performance

Run a Cloud Performance Test to measure network latency and throughput performance from an ONTAP cluster to an object store before and after setting up data tiering. The test

also identifies any failures that occurred.

Here are sample performance results:

Your cluster performance results			
Operation	Size	Avg.Latency (ms)	Throughput
PUT	4 MB	502	408.06 MB
GET	4 KB	79	15.05 MB
GET	8 KB	197	28.35 MB
GET	32 KB	291	109.71 MB
GET	256 KB	361	714.39 MB

Before you get started

It's best to run this check when the cluster is under 50% CPU utilization.

Steps for a cluster that hasn't been set up for tiering

1. At the top of Cloud Manager, click **Tiering**.
2. From the **Cluster Dashboard**, click the menu icon for a cluster and select **Cloud Performance Test**.
3. Review the details and click **Continue**.
4. Follow the prompts to provide the required information.

The information that you need to provide is the same as if you were setting up tiering on the cluster.

5. Optionally continue to the Tier Volumes wizard to complete the setup.

Steps for a cluster that has been set up for tiering

1. At the top of Cloud Manager, click **Tiering**.
2. From the **Cluster Dashboard**, click the menu icon for a cluster and select **Cloud Performance Test**.
3. Select a node from the drop-down list.
4. View the results or recheck the performance.

Managing data tiering from your clusters

Now that you've set up data tiering from your on-prem ONTAP clusters, you can tier data from additional volumes, change a volume's tiering policy, discover additional clusters,

and more.

Tiering data from additional volumes

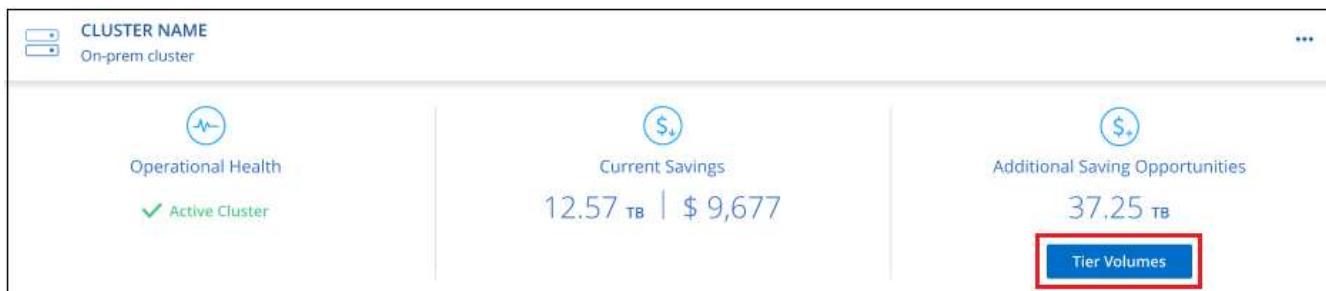
Set up data tiering for additional volumes at any time—for example, after creating a new volume.



You don't need to configure the object storage because it was already configured when you initially set up tiering for the cluster. ONTAP will tier inactive data from any additional volumes to the same object store.

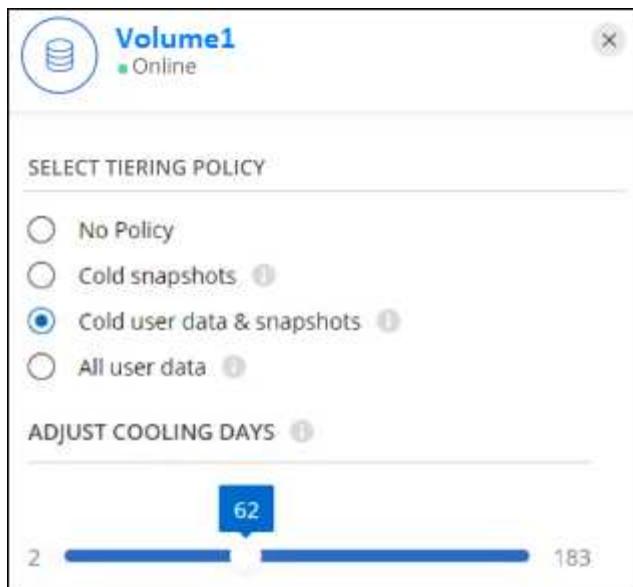
Steps

1. At the top of Cloud Manager, click **Tiering**.
2. From the **Cluster Dashboard**, click **Tier Volumes** for the cluster.



3. On the *Tier Volumes* page, select the volumes that you want to configure tiering for and launch the **Tiering Policy** page:
 - To select all volumes, check the box in the title row (**Volume Name**) and click **Configure volumes**.
 - To select multiple volumes, check the box for each volume (**Volume_1**) and click **Configure volumes**.
 - To select a single volume, click the row (or icon) for the volume.
4. In the *Tiering Policy* dialog, select a tiering policy, optionally adjust the cooling days for the selected volumes, and click **Apply**.

[Learn more about volume tiering policies and cooling days.](#)



Result

The selected volumes start to have their data tiered to the cloud.

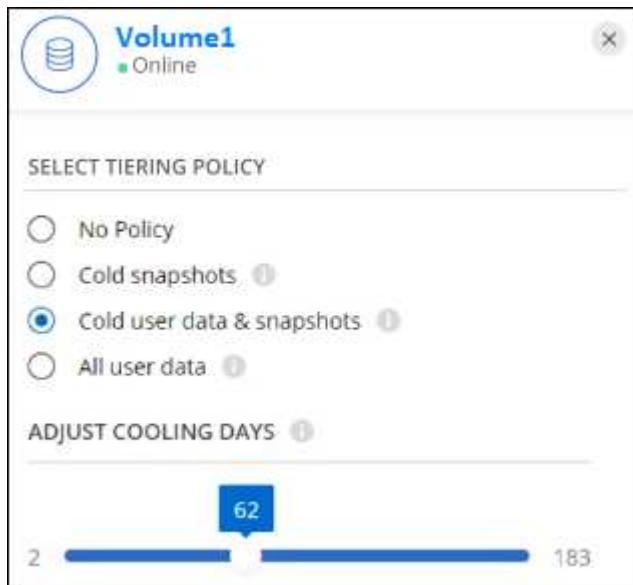
Changing a volume's tiering policy

Changing the tiering policy for a volume changes how ONTAP tiers cold data to object storage. The change starts from the moment that you change the policy. It changes only the subsequent tiering behavior for the volume—it does not retroactively move data to the cloud tier.

Steps

1. At the top of Cloud Manager, click **Tiering**.
2. From the **Cluster Dashboard**, click **Tier Volumes** for the cluster.
3. Click the row for a volume, select a tiering policy, optionally adjust the cooling days, and click **Apply**.

[Learn more about volume tiering policies and cooling days.](#)



Note: If you see options to "Retrieve Tiered Data", see [Migrating data from the cloud tier back to the performance tier](#) for details.

Result

The tiering policy is changed and data begins to be tiered based on the new policy.

Migrating data from the cloud tier back to the performance tier

Tiered data that is accessed from the cloud may be "re-heated" and moved back to the performance tier. However, if you want to proactively promote data to the performance tier from the cloud tier, you can do this in the *Tiering Policy* dialog. This capability is available when using ONTAP 9.8 and greater.

You might do this if you want to stop using tiering on a volume, or if you decide to keep all user data on the performance tier, but keep Snapshot copies on the cloud tier.

There are two options:

Option	Description	Affect on Tiering Policy
Bring back all data	Retrieves all volume data and Snapshot copies tiered in the cloud and promotes them to the performance tier.	Tiering policy is changed to "No policy".
Bring back active file system	Retrieves only active file system data tiered in the cloud and promotes it to the performance tier (Snapshot copies remain in the cloud).	Tiering policy is changed to "Cold snapshots".

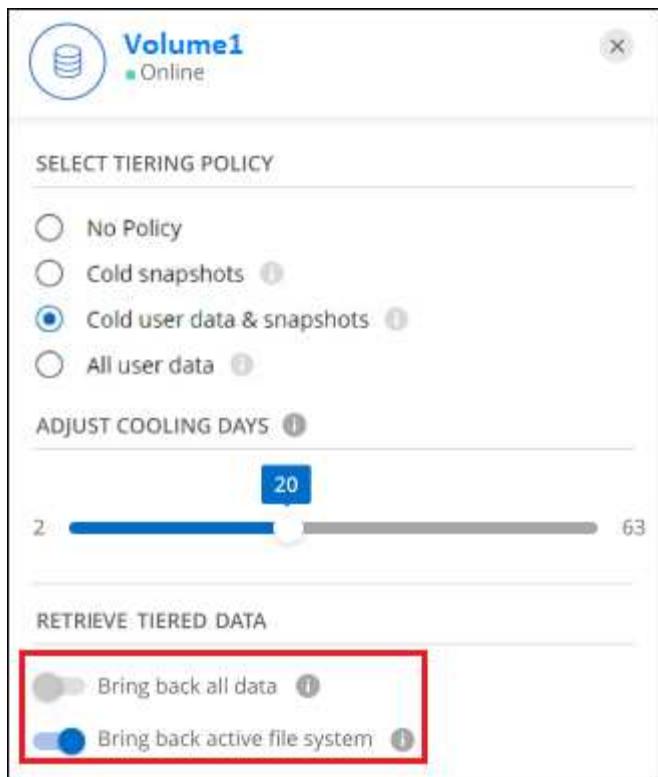


You may be charged by your cloud provider based on that amount of data transferred off the cloud.

Steps

Make sure you have enough space in the performance tier for all the data that is being moved from the cloud.

1. At the top of Cloud Manager, click **Tiering**.
2. From the **Cluster Dashboard**, click **Tier Volumes** for the cluster.
3. Click the icon for the volume, choose the retrieval option you want to use, and click **Apply**.



Result

The tiering policy is changed and the tiered data starts to be migrated back to the performance tier. Depending on the amount of data in the cloud, the transfer process could take some time.

Managing tiering settings on aggregates

Each aggregate in your on-prem ONTAP systems has two settings that you can adjust: the tiering fullness threshold and whether inactive data reporting is enabled.

Tiering fullness threshold

Setting the threshold to a lower number reduces the amount of data required to be stored on the performance tier before tiering takes place. This might be useful for large aggregates that contain little active data.

Setting the threshold to a higher number increases the amount of data required to be stored on the performance tier before tiering takes place. This might be useful for solutions designed to tier only when aggregates are near maximum capacity.

Inactive data reporting

Inactive data reporting (IDR) uses a 31-day cooling period to determine which data is considered inactive. The amount of cold data that is tiered is dependent on the tiering policies set on volumes. This amount might be different than the amount of cold data detected by IDR using a 31-day cooling period.

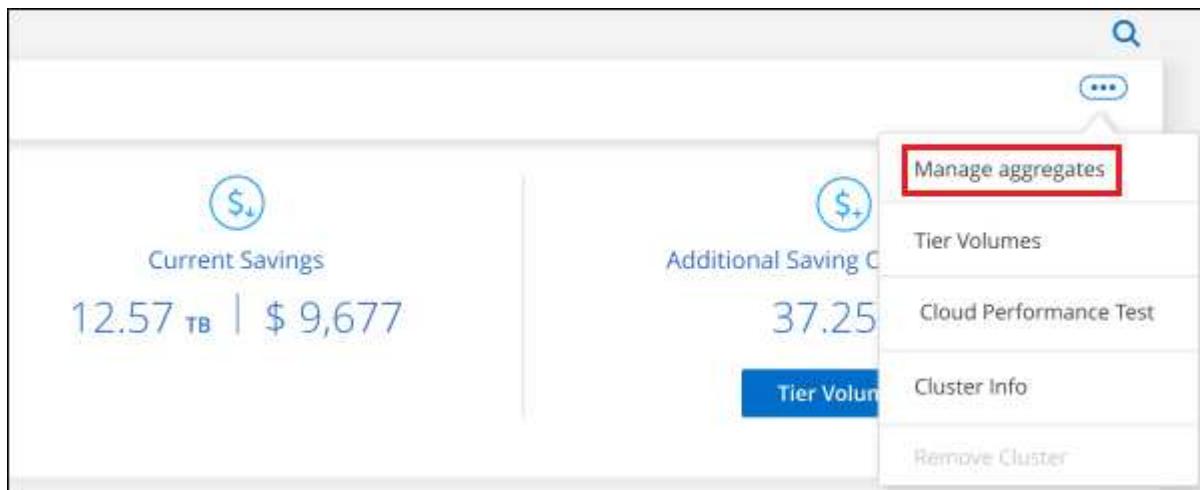


It's best to keep IDR enabled because it helps to identify your inactive data and savings opportunities. IDR must remain enabled if data tiering was enabled on an aggregate.

Steps

1. At the top of Cloud Manager, click **Tiering**.

- From the **Cloud Tiering** page, click the menu icon for a cluster and select **Manage Aggregates**.



- On the **Manage Aggregates** page, click the icon for an aggregate in the table.
- Modify the fullness threshold and choose whether to enable or disable inactive data reporting.



- Click **Apply**.

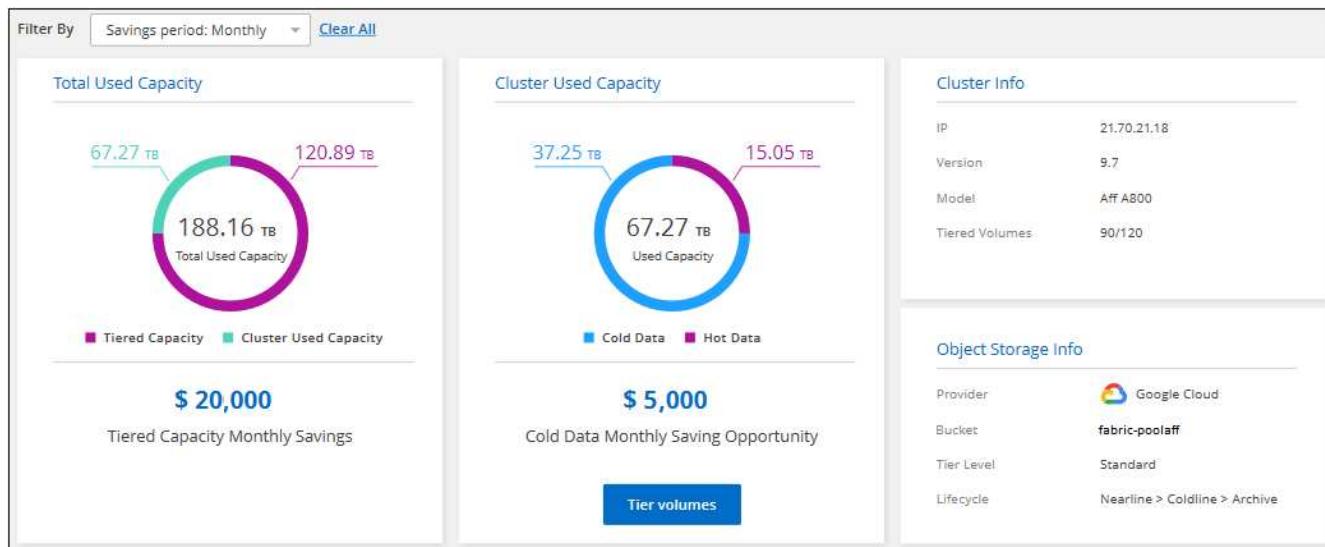
Reviewing tiering info for a cluster

You might want to see how much data is in the cloud tier and how much data is on disks. Or, you might want to see the amount of hot and cold data on the cluster's disks. Cloud Tiering provides this information for each cluster.

Steps

- At the top of Cloud Manager, click **Tiering**.
- From the **Cluster Dashboard**, click the menu icon for a cluster and select **Cluster info**.
- Review details about the cluster.

Here's an example:

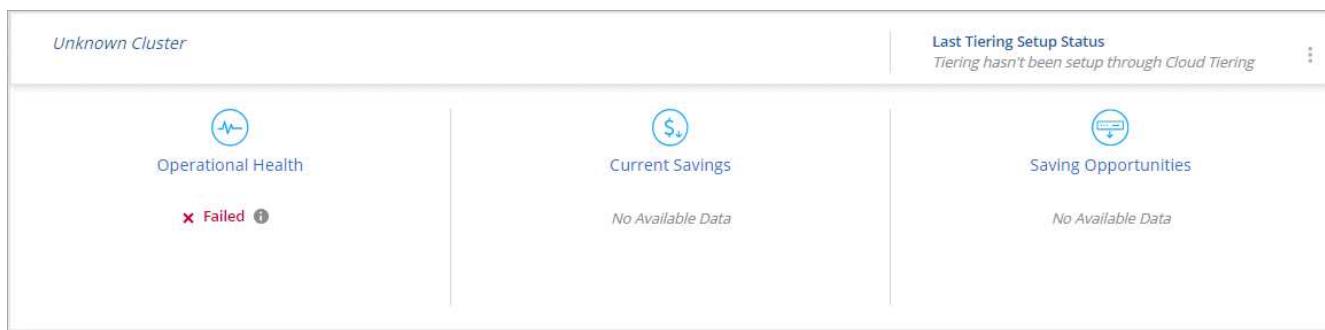


Fixing operational health

Failures can happen. When they do, Cloud Tiering displays a "Failed" operational health status on the Cluster Dashboard. The health reflects the status of the ONTAP system and Cloud Manager.

Steps

1. Identify any clusters that have an operational health of "Failed."



2. Hover over the icon to see the failure reason.

3. Correct the issue:

- a. Verify that the ONTAP cluster is operational and that it has an inbound and outbound connection to your object storage provider.
- b. Verify that Cloud Manager has outbound connections to the Cloud Tiering service, to the object store, and to the ONTAP clusters that it discovers.

Discovering additional clusters from Cloud Tiering

You can add your undiscovered on-prem ONTAP clusters to Cloud Manager from the *Tiering Cluster Dashboard* so that you can enable tiering for the cluster.

Note that buttons also appear on the *Tiering On-Prem Overview* page for you to discover additional clusters.

Steps

1. From Cloud Tiering, click the **Cluster Dashboard** tab.

- To see any undiscovered clusters, click **Show Undiscovered Clusters**.

The screenshot shows the Cloud Tiering Cluster Dashboard. At the top, there are three categories: 'All clusters' (6), 'On-prem cluster' (3), and 'Cloud Volumes ONTAP' (3). Below these, a red box highlights the 'Show Undiscovered Clusters' button.

If your NSS credentials are saved in Cloud Manager, the clusters in your account are displayed in the list.

If your NSS credentials are not saved in Cloud Manager, you are first prompted to add your credentials before you can see the undiscovered clusters.

- Scroll down the page to locate the clusters.

The screenshot shows the Cloud Tiering Cluster Dashboard with four categories: 'All clusters' (6), 'On-prem cluster' (3), 'Cloud Volumes ONTAP' (3), and 'Undiscovered Clusters' (3). Below the categories, a section titled 'Clusters (6/6)' displays operational health, current savings, and additional saving opportunities for discovered clusters. At the bottom, a cluster named '127.***' is listed with its IP address. A red box highlights the 'Discover Cluster' button for this undiscovered cluster.

- Click **Discover Cluster** for the cluster that you want to manage through Cloud Manager and implement data tiering.
- On the *Choose a Location* page **On-Premises ONTAP** is pre-selected, so just click **Continue**.
- On the *ONTAP Cluster Details* page, enter the password for the admin user account and click **Add**.

Note that the cluster management IP address is populated based on information from your NSS account.

- On the *Details & Credentials* page the cluster name is added as the Working Environment Name, so just click **Go**.

Result

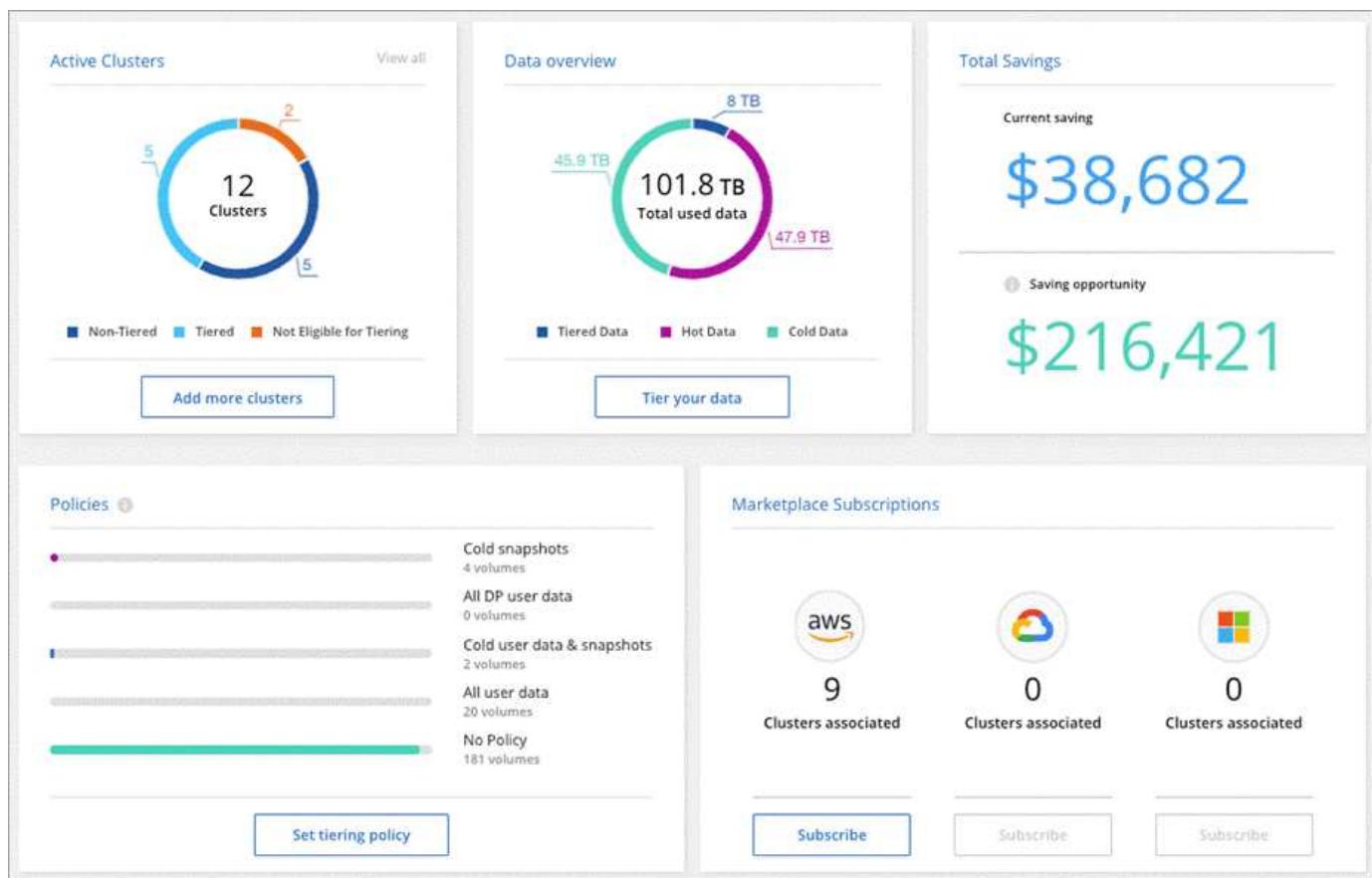
Cloud Manager discovers the cluster and adds it to a working environment in the Canvas using the cluster name as the working environment name.

You can enable the Tiering service or other services for this cluster in the right panel.

Get an overview of data tiering from your clusters

Cloud Tiering provides an aggregated view of data tiering from each of your on-premises clusters. This overview provides a clear picture of your environment and enables you to take proper actions.

Cloud Tiering provides the following details about your environment:



Active Clusters

The number of clusters that are currently tiering data to the cloud, the clusters that aren't tiering data to the cloud, and the number of clusters that don't support data tiering.

Data Overview

The amount of data that was tiered to the cloud, and the amount of hot and cold data on the cluster.

Total Savings

The amount of money that you've saved by tiering data to the cloud, as well as the amount of money that you could save by tiering more data to the cloud.

Policies

The number of times that each tiering policy has been applied to a volume.

Marketplace Subscriptions

The number of clusters associated with each type of Marketplace Subscription and an indication about your subscription status.

Steps

1. Click **Tiering > On-Prem Overview**.

Cloud Tiering technical FAQ

This FAQ can help if you're just looking for a quick answer to a question.

ONTAP

The following questions relate to ONTAP.

What are the requirements for my ONTAP cluster?

It depends on where you tier the cold data. Refer to the following:

- [Tiering data from on-premises ONTAP clusters to Amazon S3](#)
- [Tiering data from on-premises ONTAP clusters to Azure Blob storage](#)
- [Tiering data from on-premises ONTAP clusters to Google Cloud Storage](#)
- [Tiering data from on-premises ONTAP clusters to StorageGRID](#)
- [Tiering data from on-premises ONTAP clusters to S3 object storage](#)

Does Cloud Tiering enable inactive data reporting?

Yes, Cloud Tiering enables inactive data reporting on each aggregate. This setting enables us to identify the amount of inactive data that can be tiered to low-cost object storage.



Cloud Tiering enables inactive data reporting on HDD aggregates if the cluster is running ONTAP 9.6 or later.

Can I tier data from NAS volumes and SAN volumes?

You can tier data from NAS volumes to the public cloud or to private clouds, like StorageGRID. When tiering data that is accessed by SAN protocols, NetApp recommends using private clouds due to connectivity considerations.

What about Cloud Volumes ONTAP?

If you have Cloud Volumes ONTAP systems, you'll find them in the Cluster Dashboard so you get a full view of data tiering in your hybrid cloud infrastructure.

From the Cluster Dashboard, you can view tiering information similar to an on-prem ONTAP cluster: operational health, current savings, savings opportunities, details about volumes and aggregates, and more.

Cloud Volumes ONTAP systems are read-only from Cloud Tiering. You can't set up data tiering on Cloud Volumes ONTAP from Cloud Tiering. [You set up tiering for Cloud Volumes ONTAP from the working environment in Cloud Manager](#).

Object storage

The following questions relate to object storage.

Which object storage providers are supported?

Amazon S3, Azure Blob storage, Google Cloud Storage, NetApp StorageGRID, and S3-compatible object storage providers are supported.

Can I use my own bucket/container?

Yes, you can. When you set up data tiering, you have the choice to add a new bucket/container or to select an existing bucket/container.

Which regions are supported?

- [Supported AWS regions](#)
- [Supported Azure regions](#)
- [Supported Google Cloud regions](#)

Which S3 storage classes are supported?

Cloud Tiering supports data tiering to the *Standard*, *Standard-Infrequent Access*, *One Zone-IA*, or *Intelligent* storage classes. See [Supported S3 storage classes](#) for more details.

Which Azure Blob access tiers are supported?

Cloud Tiering supports data tiering to the *Hot* or *Cool* access tiers for your inactive data. See [Supported Azure Blob access tiers](#) for more details.

Which storage classes are supported for Google Cloud Storage?

Cloud Tiering supports data tiering to the *Standard*, *Nearline*, *Coldline*, and *Archive* storage classes. See [Supported Google Cloud storage classes](#) for more details.

Does Cloud Tiering use one object store for the entire cluster or one per aggregate?

One object store for the entire cluster.

Can I apply policies to my object store to move data around independent of tiering?

Yes. You can enable life cycle management so that Cloud Tiering transitions data from the default storage class/access tier to a more cost-effective tier after a certain number of days.

The life cycle rule is applied to all objects in the selected bucket for Amazon S3 and Google Cloud storage, and to all containers in the selected storage account for Azure Blob.

Connectors

The following questions relate to Connectors.

Where does the Connector need to be installed?

- When tiering data to S3, the Connector can reside in an AWS VPC or on your premises.
- When tiering data to Blob storage, the Connector can reside in an Azure VNet or on your premises.
- When tiering data to Google Cloud Storage, the Connector must reside in a Google Cloud Platform VPC.

- When tiering data to StorageGRID or other S3-Compatible storage providers, the Connector must reside on your premises.

Networking

The following questions relate to networking.

What are the networking requirements?

- The ONTAP cluster initiates an HTTPS connection over port 443 to your object storage provider. ONTAP reads and writes data to and from object storage. The object storage never initiates, it just responds.
- For StorageGRID, the ONTAP cluster initiates an HTTPS connection over a user-specified port to StorageGRID (the port is configurable during tiering setup).
- A Connector needs an outbound HTTPS connection over port 443 to your ONTAP clusters, to the object store, and to the Cloud Tiering service.

For more details, see:

- [Tiering data from on-premises ONTAP clusters to Amazon S3](#)
- [Tiering data from on-premises ONTAP clusters to Azure Blob storage](#)
- [Tiering data from on-premises ONTAP clusters to Google Cloud Storage](#)
- [Tiering data from on-premises ONTAP clusters to StorageGRID](#)
- [Tiering data from on-premises ONTAP clusters to S3 object storage](#)

Permissions

The following questions relate to permissions.

What permissions are required in AWS?

Permissions are required to [manage the S3 bucket](#).

What permissions are required in Azure?

No extra permissions are needed outside of the permissions that you need to provide to Cloud Manager.

What permissions are required in Google Cloud Platform?

Storage Admin permissions are needed for a [service account that has storage access keys](#).

What permissions are required for StorageGRID?

[S3 permissions are needed](#).

What permissions are required for S3-compatible object storage?

[S3 permissions are needed](#).

Reference

Supported S3 storage classes and regions

Cloud Tiering supports several S3 storage classes and most regions.

Supported S3 storage classes

When you set up data tiering to AWS, Cloud Tiering automatically uses the *Standard* storage class for your inactive data. Cloud Tiering can apply a lifecycle rule so the data transitions from the *Standard* storage class to another storage class after a certain number of days. You can choose from the following storage classes:

- Standard-Infrequent Access
- One Zone-IA
- Intelligent-Tiering (where AWS automatically moves data between two tiers — Frequent Access and Infrequent Access - when access patterns change)

If you do not choose another storage class, then the data remains in the *Standard* storage class and no rules are applied.

When you configure a Cloud Tiering lifecycle rule, you must not configure any lifecycle rules when setting up the bucket in your AWS account.

[Learn about S3 storage classes.](#)

Supported AWS regions

Cloud Tiering supports the following AWS regions.

Asia Pacific

- Mumbai
- Seoul
- Singapore
- Sydney
- Tokyo

Europe

- Frankfurt
- Ireland
- London
- Paris
- Stockholm

North America

- Canada Central
- US East (N. Virginia)

- US East (Ohio)
- US West (N. California)
- US West (Oregon)

South America

- São Paulo

Supported Azure Blob access tiers and regions

Cloud Tiering supports two access tiers and most regions.

Supported Azure Blob access tiers

When you set up data tiering to Azure, Cloud Tiering automatically uses the *Hot* access tier for your inactive data. Cloud Tiering can apply a lifecycle rule so the data transitions from the *Hot* access tier to the *Cool* access tier after a certain number of days.

If you do not choose the *Cool* access tier, then the data remains in the *Hot* access tier and no rules are applied.

When you configure a Cloud Tiering lifecycle rule, you must not configure any lifecycle rules when setting up the container in your Azure account.

[Learn about Azure Blob access tiers.](#)

Supported Azure regions

Cloud Tiering supports the following Azure regions.

Africa

- South Africa North

Asia Pacific

- Australia East
- Australia Southeast
- East Asia
- Japan East
- Japan West
- Korea Central
- Korea South
- Southeast Asia

Europe

- France Central
- Germany West Central

- Germany North
- North Europe
- UK South
- UK West
- West Europe

North America

- Canada Central
- Canada East
- Central US
- East US
- East US 2
- North Central US
- South Central US
- West US
- West US 2
- West Central US

South America

- Brazil South

Supported Google Cloud storage classes and regions

Cloud Tiering supports several Google Cloud storage classes and most regions.

Supported GCP storage classes

When you set up data tiering to GCP, Cloud Tiering automatically uses the *Standard* storage class for your inactive data. Cloud Tiering can apply a lifecycle rule so the data transitions from the *Standard* storage class to other storage classes after a certain number of days. You can choose from the following storage classes:

- Nearline
- Coldline
- Archive

If you do not choose another storage class, then the data remains in the *Standard* storage class and no rules are applied.

When you configure a Cloud Tiering lifecycle rule, you must not configure any lifecycle rules when setting up the bucket in your Google account.

[Learn about Google Cloud Storage classes.](#)

Supported Google Cloud regions

Cloud Tiering supports the following regions.

Americas

- Iowa
- Los Angeles
- Montreal
- N. Virginia
- Oregon
- Sao-Paulo
- South Carolina

Asia Pacific

- Hong Kong
- Mumbai
- Osaka
- Singapore
- Sydney
- Taiwan
- Tokyo

Europe

- Belgium
- Finland
- Frankfurt
- London
- Netherlands
- Zurich

Organize your resources using tags

Learn about tagging

Cloud Manager enables you to apply tags to your *existing* resources to help organize and manage those resources. Tags are metadata that you can use to group resources to identify applications, environments, regions, billing codes, cloud providers, and more.

Tags consists of a **tag key** and a **tag value**. For example, you can create a tag key called "Environment" and then add tag values of "Production" and "Test". After they are applied to your resources, you can quickly search for and view resources that match the key/value pair.

You can add tag key/value pairs to *new* resources when you create a working environment or an Azure NetApp Files volume. You can also define tag key/value pairs in [Cloud Manager templates that you build](#) for your storage admins and DevOps engineers.

You can add new tags using the Tagging service, and you can change or delete existing tags.

Features

The Tagging service offers the following features and benefits:

- Create tag keys and tag values that match the terms you use in your environment
- Organize the resources in your environment for easier monitoring and management
- Add, remove, and edit tag keys and tag values by resource type
- Tag ONTAP resources and resources in your environment from AWS and Azure.

Pricing and licenses

The ability to tag your resources requires no licensing and is free to use by all Cloud Manager users with the Account Admin or Workspace Admin role.

Resources that you can tag

You can apply tags to the following resources.

Provider	Service	Resource
ONTAP	Cloud Volumes ONTAP	Aggregate Storage VM Volume
	On-premise ONTAP	Aggregate Storage VM Volume
	Azure NetApp Files	Volume
NetApp-Service	Sync	Relationship

Provider	Service	Resource
AWS	EC2	Instance Security Group Subnet Volume VPC
Azure	Compute	Snapshot Virtual Machine
	Network	Security Group Virtual Network
	Resource	Resource Group
	Storage	Storage Account
GCP	Compute	Instance
	Storage	Bucket

For information about AWS EC2 tags, refer to [AWS Documentation: Tagging your Amazon EC2 Resources](#).

For information about Azure tags, refer to [Azure Documentation: Tagging your Azure resources](#).

For information about Google labels, refer to [Google Cloud Documentation: Tagging your Google Cloud resources](#).

Prerequisites

Verify your AWS Connector permissions

If you created the Connector using Cloud Manager version 3.9.10 or greater, then you're all set. If you created the Connector using an earlier version of Cloud Manager, then you'll need to add some required permissions for the Cloud Manager IAM role to tag AWS EC2 instances:

```
{
  "Action": [
    "ec2:CreateTags",
    "ec2>DeleteTags",
    "ec2:DescribeTags",
    "tag:getResources",
    "tag:getTagKeys",
    "tag:getTagValues",
    "tag:TagResources",
    "tag:UntagResources"
  ],
  "Resource": "*",
  "Effect": "Allow",
  "Sid": "tagServicePolicy"
}
```

Verify your Azure Connector permissions

If you created the Connector using Cloud Manager version 3.9.10 or greater, then you're all set. If you created the Connector using an earlier version of Cloud Manager, then you'll need to add some required permissions for the Cloud Manager Operator IAM role to tag Azure resources:

```
{  
  "id": "<ID>",  
  "properties": {  
    "roleName": "Cloud Manager Operator-<ID>",  
    "description": "Cloud Manager Operator",  
    "assignableScopes": [  
      "/subscriptions/<SUBSCRIPTION-ID>"  
    ],  
    "permissions": [  
      {  
        "actions": [  
          "Microsoft.Resources/tags/read",  
          "Microsoft.Resources/tags/write",  
          "Microsoft.Resources/tags/delete",  
          "Microsoft.ClassicCompute/virtualMachines/read"  
        ],  
        "notActions": [],  
        "dataActions": [],  
        "notDataActions": []  
      }  
    ]  
  }  
}
```

Tag rules and restrictions

The following rules apply when creating tag keys and tag values:

- Maximum key length: 128 characters
- Maximum key value length: 256 characters
- Valid tag and tag value characters: letters, numbers, spaces, and special characters (_ , @, &, * , etc.)
- Tags are case upper/lower sensitive.
- Maximum tags per resource: 30
- Per resource, each tag key must be unique

Tag examples

Key	Values
Env	production test
Dept	finance sales eng
Owner	admin storage

Manage tags for your resources

You can view, add, modify, and delete the tags assigned to your existing resources using the Cloud Manager Tagging service. This allows you to organize and simplify the management of your resources.

Search for resources that have certain tags

If you want to see all the resources that have a certain tag, or a certain tag and tag key value, you can search for those tags. You can search across all resources, or just within certain resource categories.

Steps

1. Select the **AppTemplate** service and click the **Tags** tab.
2. If necessary, choose the credentials for a specific cloud provider in the **Select credentials** field.
3. In the **Resource Type** field, select the resource, for example, **ONTAP:CVO:VOLUME** to search across all Cloud Volumes ONTAP volumes.
4. In the **Tag Key** field, select the tag, for example, **Env** to restrict the search to volumes with the "Env" tag.
5. In the **Tag Value** field, select the key value, for example, **production** to restrict the search to volumes with the tag name "Env" and the tag value "production".

The screenshot shows the AppTemplate service interface with the 'Tags' tab selected. The search criteria are set as follows: Resource Type is 'ONTAP:CVO:VOLUME', Tag Key is 'Env', and Tag Value is 'production'. A blue '+' button is visible on the right side of the search bar.

6. Click the **+** to add this search criteria to the Search area.

The screenshot shows the AppTemplate service interface with the 'Tags' tab selected. The search criteria are now expanded to include the previously added condition: 'ONTAP:CVO:VOLUME : Env : production'. The blue '+' button is highlighted with a red box, indicating it was used to add this criteria. A blue 'Search' button is located at the bottom right.

7. If you are done with your search, click **Search** and the search results appear in the Resources section.

11 Resources				Manage Tags
	ID	Tags	Type	
<input type="checkbox"/>	labsod01dev	Env : production	+1	ONTAP:CVO:VOLUME
<input type="checkbox"/>	urlabsod1	Env : production	+	ONTAP:CVO:VOLUME
<input type="checkbox"/>	urlabsod01dev	Env : production	+1	ONTAP:CVO:VOLUME

If you want to add additional search criteria, follow steps 3 through 6 again and then click **Search**.

Search rules

The following rules apply when defining your search:

- After choosing a Resource Type, you can leave the Tag Key field and Tag Value fields empty if you want to list all the resources that have any key and any key value.
- You can choose a single search, or you can define multiple searches to refine the results in the Resource section.
- When defining multiple sets of search criteria:
 - If the criteria for two searches are for different resource types, then this is treated as an "OR" operation and the result shows the resources from both searches. For example, the following search returns all Azure NetApp Files volumes that have the "Environment:demo" tag value and all Cloud Volumes ONTAP volumes that have the "Environment:demo" tag value.

ONTAP:ANF:VOLUME :	Environment : demo X
ONTAP:CVO:VOLUME :	Environment : demo X

- If the criteria for two searches are for the same resource type, then this is treated as an "AND" operation and the result shows only the resources that match **both** searches. For example, the following search returns Azure NetApp Files volumes that have both the "Environment:demo" tag value and "Group:Finance" tag value.

ONTAP:ANF:VOLUME :	Environment : demo X	Group : Finance X
--------------------	--	---

- If you have defined multiple search criteria and then decide you want to remove one, just click the X to remove it from the Search area.

Add tags to existing resources

You can apply tags to a single resource or to multiple resources. The resources could have existing tags or have no current tags.

See the list of resources that you can tag at this time.

Steps

1. From the **Tags** tab, create your search criteria and click **Search**.
2. Select the resource, or resources, that you want to tag.
 - To select all resources on the page, check the box in the title row (**ID**).
 - To select multiple resources, check the box for each resource (**Volume_1**).
 - To select a single resource, click the  icon for the resource.

11 Resources				Manage Tags		
<input type="checkbox"/>	ID	Tags	Type			
<input type="checkbox"/>	labsod01dev	Env : production 	ONTAP:CVO:VOLUME	+1		
<input type="checkbox"/>	urlabsod1	Env : production 	ONTAP:CVO:VOLUME			
<input type="checkbox"/>	urlabsod01dev	Env : production 	ONTAP:CVO:VOLUME	+1		

3. Click **Manage Tags** and the *Resource Tags* dialog appears. Any existing tags will appear in this dialog.

Resources Tags

1 resource selected

Add New Tag

Tag Key	Tag Value
Env	: production 

Review and Apply **Cancel**

4. Click **Add New Tag** and a blank Tag Key and Tag Value row appears in the dialog.
5. Enter the tag key and tag value. Add more tags at this time if you want more tags on this resource, and then click **Review and Apply**.
6. If your changes look correct in the *Reviewing* page, click **Save** and the new tag is added to the resource, or to all selected resources.

Change tag values for a resource

You can change the tags that are assigned to resources, and you can change the tag value that is applied to an existing tag.

Steps

1. From the **Tags** tab, create your search criteria and click **Search**.
2. Select the resource, or resources, on which you want to change tags.
3. Click **Manage Tags** and the *Resource Tags* dialog appears.

4. Enter a new value for the tag value and click **Review and Apply**.
5. If your change looks correct in the *Reviewing* page, click **Save** and the tag value is changed for the resource, or for all selected resources.

Delete tags from resources

You can delete a tag key/value pair from a single resource or from multiple resources.

Steps

1. From the **Tags** tab, create your search criteria and click **Search**.
 2. Select the resource, or resources, from which you want to remove tags.
 3. Click **Manage Tags** and the *Resource Tags* dialog appears.
-
4. Click the  for the tag key/value pair you want to delete and the row is removed, and then click **Review and Apply**.
 5. If your change looks correct in the *Reviewing* page, click **Save** and the tag key/value pair is removed from the resource, or from all selected resources.

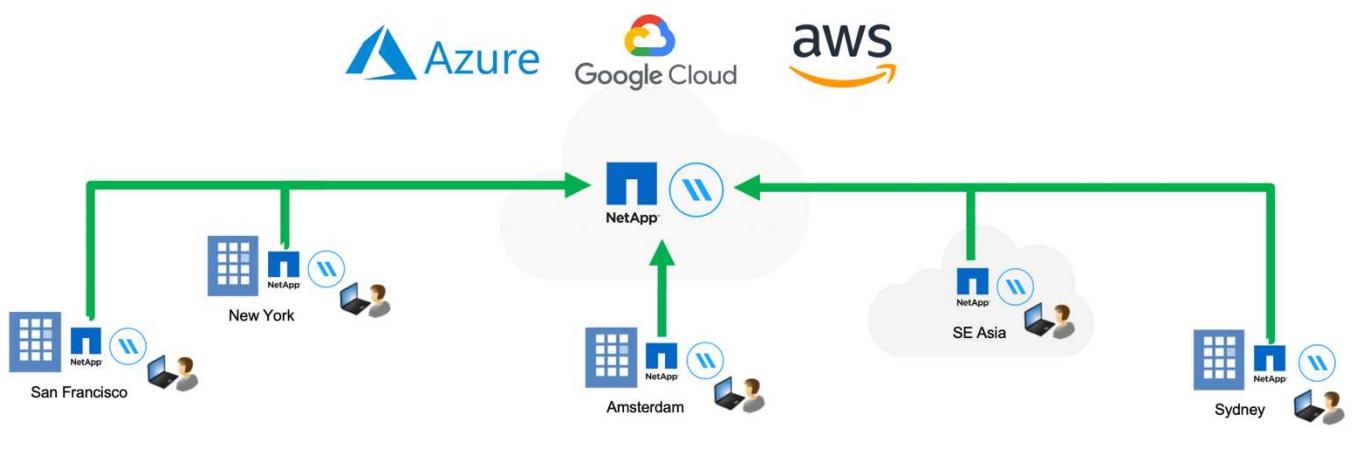
Enable real-time global file sharing

Learn about Global File Cache

NetApp Global File Cache enables you to consolidate silos of distributed file servers into one cohesive global storage footprint in the public cloud. This creates a globally accessible file system in the cloud that all remote locations can use as if they were local.

Overview

Implementing Global File Cache results in a single, centralized storage footprint, versus a distributed storage architecture that requires local data management, backup, security management, storage, and infrastructure footprint in each location.



Features

Global File Cache enables the following features:

- Consolidate and centralize your data into the public cloud and leverage the scalability and performance from enterprise-grade storage solutions
- Create a single set of data for users globally and leverage intelligent file caching to improve global data access, collaboration, and performance
- Rely on a self-sustaining, self-managing cache, and eliminate full data copies and backups. Utilize local file caching for active data and cut storage costs
- Transparent access from branch locations through a global namespace with real time central file locking

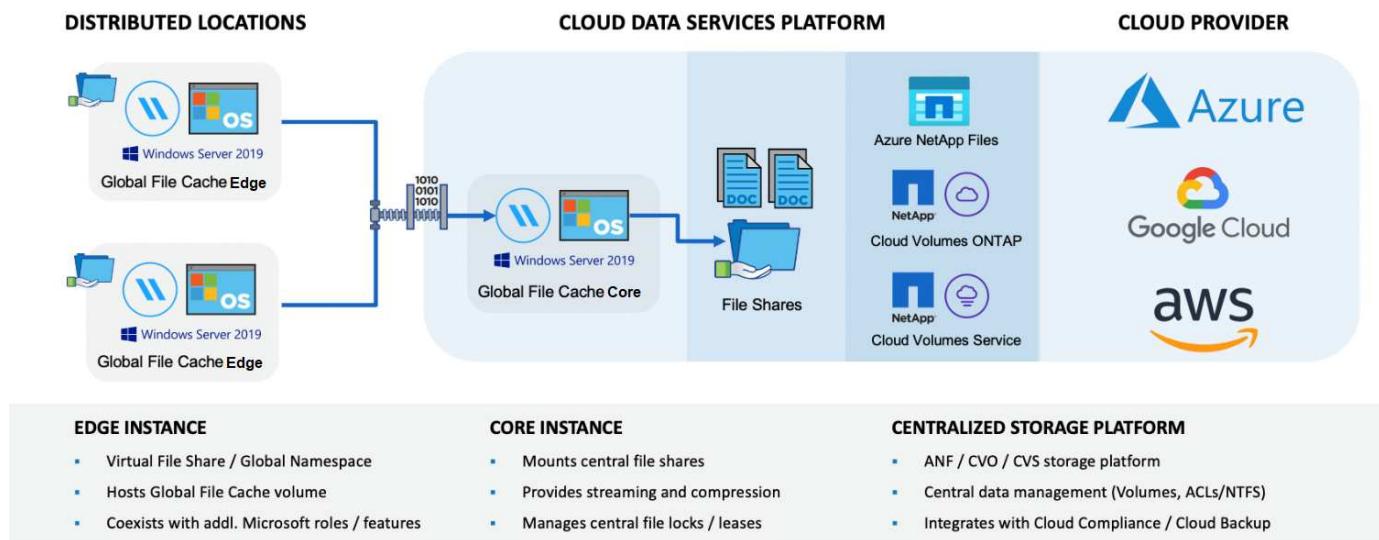
See more about Global File Cache features and use cases [here](#).

Global File Cache components

Global File Cache consists of the following components:

- Global File Cache Management Server
- Global File Cache Core
- Global File Cache Edge (deployed in your remote locations)

The Global File Cache Core instance mounts to your corporate file shares hosted on your backend storage platform of choice (such as Cloud Volumes ONTAP, Cloud Volumes Service, and Azure NetApp Files) and creates the Global File Cache Fabric that provides the ability to centralize and consolidate unstructured data into a single set of data, whether it resides on one or multiple storage platforms in the public cloud.



Supported storage platforms

The supported storage platforms for Global File Cache differ depending on the deployment option you select.

Automated deployment options

Global File Cache is supported with the following types of working environments when deployed using Cloud Manager:

- Cloud Volumes ONTAP in Azure
- Cloud Volumes ONTAP in AWS

This configuration lets you deploy and manage the entire Global File Cache server-side deployment, including Global File Cache Management Server and Global File Cache Core, from within Cloud Manager.

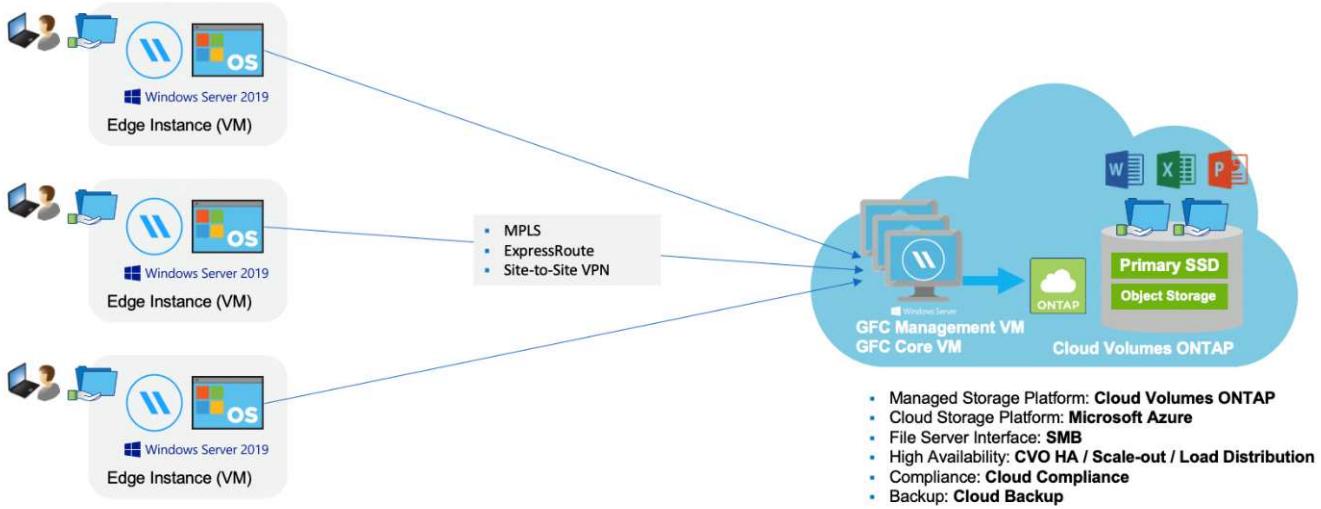
Manual deployment options

Global File Cache configurations are also supported with Cloud Volumes ONTAP, Cloud Volumes Service, Azure NetApp Files, and Amazon FSx for ONTAP systems installed on public cloud storage infrastructure. On-premises solutions are also available on NetApp AFF and FAS platforms. In these installations the Global File Cache server-side components must be configured and deployed manually, not using Cloud Manager.

See the [NetApp Global File Cache User Guide](#) for details.

How Global File Cache works

Global File Cache creates a software fabric that caches active data sets in remote offices globally. As a result, business users are guaranteed transparent data access and optimal performance on a global scale.



The topology referenced in this example is a hub and spoke model, whereby the network of remote offices/locations is accessing one common set of data in the cloud. The key points of this example are:

- Centralized data store:
 - Enterprise public cloud storage platform, such as Cloud Volumes ONTAP
- Global File Cache Fabric:
 - Extension of the central data store to the remote locations
 - Global File Cache Core instance, mounting to corporate file shares (SMB).
 - Global File Cache Edge instances running in each remote location.
 - Presents a virtual file share in each remote location that provides access to central data.
 - Hosts the Intelligent File Cache on a custom-sized NTFS volume (D:\).
- Network configuration:
 - Multiprotocol Label Switching (MPLS), ExpressRoute, or VPN connectivity
- Integration with customer's Active Directory domain services.
- DFS namespace for the use of a global namespace (recommended).

Cost

The cost to use Global File Cache depends on the type of installation you have chosen.

- All installations require that you deploy one or more volumes in the cloud (Cloud Volumes ONTAP, Cloud Volumes Service, or Azure NetApp Files). This results in charges from the selected cloud provider.
- All installations also require that you deploy two or more virtual machines (VMs) in the cloud. This results in charges from the selected cloud provider.
 - Global File Cache Management Server:

In Azure, this runs on a D2s_V3 or equivalent (2 vCPU/8 GB RAM) VM with 127 GB premium SSD

In AWS, this runs on a m4.large or equivalent (2 vCPU/8 GB RAM) instance with 127 GB general purpose SSD

- Global File Cache Core:

In Azure, this runs on a D4s_V3 or equivalent (4 vCPU/16 GB RAM) VM with 127 GB premium SSD

In AWS, this runs on a m4.xlarge or equivalent (4 vCPU/16 GB RAM) instance with 127 GB general purpose SSD

- When installed with Cloud Volumes ONTAP in Azure or AWS (the supported configurations deployed completely through Cloud Manager), there is a charge of \$3,000 per site (for each Global File Cache Edge instance), per year.
- When installed using the manual deployment options the pricing is different. To see a high-level estimate of costs, see [Calculate Your Savings Potential](#) or consult your Global File Cache Solutions Engineer to discuss the best options for your enterprise deployment.

Licensing

Global File Cache includes a software-based License Management Server (LMS), which allows you to consolidate your license management and deploy licenses to all Core and Edge instances using an automated mechanism.

When you deploy your first Core instance in the datacenter or cloud, you can choose to designate that instance as the LMS for your organization. This LMS instance is configured once, connects to the subscription service (over HTTPS) and validates your subscription using the customer ID provided by our support/operations department upon enablement of the subscription. After you have made this designation, you associate your Edge instances with the LMS by providing your customer ID and the IP address of the LMS instance.

When you purchase additional Edge licenses or renew your subscription, our support/operations department updates the license details, for example, the number of sites or subscription end date. After the LMS queries the subscription service, the license details are automatically updated on the LMS instance and will apply to your GFC Core and Edge instances.

See the [NetApp Global File Cache User Guide](#) for additional details about licensing.

Limitations

- The version of Global File Cache supported within Cloud Manager requires that the backend storage platform used as your central storage must be a working environment where you have deployed a Cloud Volumes ONTAP single node or HA pair in Azure or AWS.

Other storage platforms and other cloud providers are not supported at this time using Cloud Manager, but can be deployed using legacy deployment procedures.

These other configurations, for example, Global File Cache using Cloud Volumes ONTAP or Cloud Volumes Service on Microsoft Azure, Google Cloud, or AWS continue to be supported using the legacy procedures. See [Global File Cache overview and onboarding](#) for details.

Release Notes

What's new in version 1.2.0

Released: 17 December 2021

- The OpenSSL module has been upgraded to the latest and more secure version (ver 1.1.1l). This module

is used for secure communication between GFC Edge and GFC Core.

- Enhanced the logging infrastructure.

Fixed issues in version 1.2.0

- The Configuration UI (Optimus) is enhanced to validate the date field entries while adding pre-population jobs.
- Pre-population is enhanced to monitor cache utilization and will skip populating if cache usage reaches close to cache cleaner parameters.
- Removed the hard dependency of the License Management Server (LMS) Service running locally with Policy configuration.
- The GFC Kernel driver is enhanced to avoid a crash in the SMB Server service in Windows Server 2016/2019.
- Fixed an exception in the LMS Service.
- Service Start types for LMS, LMC, and TappN Services are changed from 'Automatic Delayed' to 'Automatic'.

What's new in version 1.1.0

Released: 9 June 2021

- The "Edge Synchronization" feature has been added. This feature keeps multiple Edges at a remote office in sync and the data is always cached/warm. When a file is flushed/fetched at one Edge, then the same file on all Edges participating in Edge Sync is updated and cached. The Optimus UI is enhanced for Edge Sync configuration. See section 8.4 in the [NetApp Global File Cache User Guide](#) for details.
- The OpenSSL module is used for secure communication between GFC Edge and GFC Core. This module has been upgraded to latest and more secure version (ver 1.1.1k).
- The GFC License Registration Page displays the number of licenses when activated through a NetApp subscription.

Fixed issues in version 1.1.0

- The Configuration UI (Optimus) now displays the Edge hostname correctly in the Edit Pre-population page.
- An issue in parsing the json response from the NetApp License subscription server during license registration is fixed.
- Pre-population (TappN) logs are enhanced to log the file transfer status of all the files.

Fixed issues in version 1.0.4

Released: 7 April 2021

- A QoS issue has been fixed where QoS parameters were applied to *all* users instead of just the user who surpassed the limits.
- NSS credentials are now validated before being applied to the licensing system.
- Race conditions between the GFC software and certain antivirus software have been fixed.
- A crash no longer occurs when a locking hierarchy is violated during drop lease operations.

What's new in version 1.0.3

Released: 21 March 2021

- The Global File Cache software installer now adds process information to exclude all GFC processes from Windows Defender software on-demand scanning.
- A new Policy Configuration tab has been added to the Configuration Console to add pre-population jobs from the GFC Core.
- Many enhancements have been made so that the software uses less memory while increasing performance and stability.

Fixed issues in version 1.0.3

- The NetApp license registration and GFC subscription-based registration is only allowed by the cloud-based License Management Server (LMS). The on-premises LMS should use legacy licensing.
- The Configuration UI now adds jobs in pre-population when the License Manager Client Service (LMC) uses hostnames instead of IP address for the LMS during configuration.

Before you begin to deploy Global File Cache

There are many requirements you need to be aware of before you begin to deploy Global File Cache in the cloud and in your remote offices.

Global File Cache Core design considerations

Depending on your requirements, you may need to deploy one or multiple Global File Cache Core instances to create the Global File Cache Fabric. The Core instance is designed to act as a traffic cop between your distributed Global File Cache Edge instances and the data center file server resources, for example, file shares, folders, and files.

When you are designing your Global File Cache deployment you need to determine what's right for your environment in terms of scale, availability of resources, and in terms of redundancy. Global File Cache Core can be deployed in the following ways:

- GFC Core stand-alone instance
- GFC Core Load Distributed design (Cold Standby)

See [Sizing guidelines](#) to understand the maximum number of Edge instances and total users that each configuration can support:

Consult your Global File Cache Solutions Engineer to discuss the best options for your enterprise deployment.

Sizing guidelines

There are a few sizing guideline ratios that you need to keep in mind when configuring the initial system. You should revisit these ratios after some usage history has accumulated to make sure you are using the system optimally. These include:

- Global File Cache Edges/Core ratio
- Distributed users/Global File Cache Edge ratio
- Distributed users/Global File Cache Core ratio

Number of Edge Instances per Core Instance

Our guidelines recommend up to 10 Edge instances per Global File Cache Core instance, with a maximum of 20 Edges per Global File Cache Core instance. This is dependent to a significant degree upon the type and mean file size of the most common workload. In some cases, with more common workloads you can add more Edge instances per Core, but in these cases you should contact NetApp Support to correctly size the number of Edge and Core instances depending on the types and sizes of the file sets.



You can leverage multiple Global File Cache Edge and Core instances simultaneously to scale out your infrastructure depending on the requirements.

Number of concurrent users per Edge instance

Global File Cache Edge handles the heavy lifting in terms of caching algorithms and file-level differencing. A single Global File Cache Edge instance can serve up to 400 users per dedicated physical Edge instance, and up to 200 users for dedicated virtual deployments. This is dependent to a significant degree upon the type and mean file size of the most common workload. For larger collaborative file types, guide towards 50% of the maximum users per Global File Cache Edge lower boundary (depending on physical or virtual deployment). For more common Office items with a mean file size <1MB, guide towards the 100% users per Global File Cache Edge upper boundary (depending on physical or virtual deployment).



Global File Cache Edge detects whether it is running on a virtual or physical instance and it will limit the number of SMB connections to the local virtual file share to the maximum of 200 or 400 concurrent connections.

Number of concurrent users per Core instance

The Global File Cache Core instance is extremely scalable, with a recommended concurrent user count of 3,000 users per Core. This is dependent to a significant degree upon the type and mean file size of the most common workload.

Consult your Global File Cache Solutions Engineer to discuss the best options for your enterprise deployment.

Prerequisites

The prerequisites described in this section are for the components installed in the cloud: the Global File Cache Management Server and the Global File Cache Core.

Global File Cache Edge prerequisites are described [here](#).

Cloud Manager instance

When using Cloud Volumes ONTAP for Azure as your storage platform, ensure that Cloud Manager has permissions as shown in the latest [Cloud Manager policy for Azure](#).

Newly created instances will have all the required permissions by default. If you deployed your instance prior to version 3.8.7 (August 3, 2020), then you will need to add these items.

```
"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",
```

Storage platform (volumes)

The back-end storage platform – in this case, your deployed Cloud Volumes ONTAP instance - should present SMB file shares. Any shares that will be exposed through Global File Cache must allow the Everyone group Full Control at the share level, while restricting permissions through NTFS permissions.

If you have not set up at least one SMB file share on the Cloud Volumes ONTAP instance, then you need to have the following information ready so you can configure this information during installation:

- Active Directory domain name, name server IP address, Active Directory admin credentials.
- The name and size of the volume you want to create, the name of the aggregate on which the volume will be created, and the share name.

We recommend that the volume is large enough to accommodate the total data set for the application along with the ability to scale accordingly as the data set grows. If you have multiple aggregates in the working environment, see [Managing existing aggregates](#) to determine which aggregate has the most available space for the new volume.

Global File Cache Management Server

This Global File Cache Management Server requires external access over HTTPS (TCP port 443) to connect to the cloud provider subscription service and to access these URLs:

- <https://talonazuremicroservices.azurewebsites.net>
- <https://talonlicensing.table.core.windows.net>

This port must be excluded from any WAN optimization devices or firewall restriction policies for the Global File Cache software to operate properly.

The Global File Cache Management Server also requires a unique (geographical) NetBIOS name for the instance (such as GFC-MS1).



One Management Server can support multiple Global File Cache Core instances deployed in different working environments. When deployed from Cloud Manager, each working environment has its own separate backend storage and would not contain the same data.

Global File Cache Core

This Global File Cache Core listens on TCP port range 6618-6630. Depending on your firewall or Network Security Group (NSG) configuration you may need to explicitly allow access to these ports through Inbound

Port Rules. Also, these ports must be excluded from any WAN optimization devices or firewall restriction policies for the Global File Cache software to operate properly.

The Global File Cache Core requirements are:

- A unique (geographical) NetBIOS name for the instance (such as GFC-CORE1)
- Active Directory domain name
 - Global File Cache instances should be joined to your Active Directory domain.
 - Global File Cache instances should be managed in a Global File Cache specific Organizational Unit (OU) and excluded from inherited company GPOs.
- Service account. The services on this Global File Cache Core run as a specific domain user account. This account, also known as the Service Account, must have the following privileges on each of the SMB servers that will be associated with the Global File Cache Core instance:
 - The provisioned Service Account must be a domain user.

Depending on the level of restrictions and GPOs in the network environment, this account might require domain admin privileges.

- It must have "Run as a Service" privileges.
- The password should be set to "Never Expire".
- The account option "User Must Change Password at Next Logon" should be DISABLED (unchecked).
- It must be a member of the back-end file server Built-in Backup Operators group (this is automatically enabled when deployed through Cloud Manager).

License Management Server

- The Global File Cache License Management Server (LMS) should be configured on a Microsoft Windows Server 2016 Standard or Datacenter edition or Windows Server 2019 Standard or Datacenter edition, preferably on the Global File Cache Core instance in the datacenter or cloud.
- If you require a separate Global File Cache LMS instance, you need to install the latest Global File Cache software installation package on a pristine Microsoft Windows Server instance.
- The LMS instance needs to be able to connect to the subscription service (Azure Services / public internet) using HTTPS (TCP port 443).
- The Core and Edge instances need to connect to the LMS instance using HTTPS (TCP port 443).

Networking (External Access)

The Global File Cache LMS requires external access over HTTPS (TCP port 443) to the following URLs.

- If you are using GFC subscription-based licensing:
 - <https://rest.zuora.com/v1/subscriptions/<subscription-no>>
 - <https://rest.zuora.com/oauth/token>
- If you are using NetApp NSS-based licensing:
 - <https://login.netapp.com>
 - https://login.netapp.com/ms_oauth/oauth2/endpoints
 - https://login.netapp.com/ms_oauth/oauth2/endpoints/oauthservice/tokens

- If you are using NetApp legacy-based licensing:
 - <https://talonazuremicroservices.azurewebsites.net>
 - <https://talonlicensing.table.core.windows.net>

Networking

- Firewall: TCP ports should be allowed between Global File Cache Edge and Core instances.
- Global File Cache TCP Ports: 443 (HTTPS), 6618–6630.
- Network optimization devices (such as Riverbed Steelhead) must be configured to pass-thru Global File Cache specific ports (TCP 6618-6630).

Getting started

You use Cloud Manager to deploy the Global File Cache Management Server and Global File Cache Core software in the working environment.

Enable Global File Cache using Cloud Manager

In this configuration you will deploy the Global File Cache Management Server and Global File Cache Core in the same working environment where you created your Cloud Volumes ONTAP system using Cloud Manager.

Watch [this video](#) to see the steps from start to finish.

Quick start

Get started quickly by following these steps or scroll down to the remaining sections for full details:

1

Deploy Cloud Volumes ONTAP

Deploy Cloud Volumes ONTAP in Azure or AWS and configure SMB file shares. For more information, see [Launching Cloud Volumes ONTAP in Azure](#) or [Launching Cloud Volumes ONTAP in AWS](#).

2

Deploy the Global File Cache Management Server

Deploy an instance of the Global File Cache Management Server in the same working environment as the instance of Cloud Volumes ONTAP.

3

Deploy the Global File Cache Core

Deploy an instance, or multiple instances, of the Global File Cache Core in the same working environment as the instance of Cloud Volumes ONTAP and join it to your Active Directory domain.

4

License Global File Cache

Configure the Global File Cache License Management Server (LMS) service on a Global File Cache Core instance. You will need your NSS Credentials or a Customer ID and Subscription Number provided by NetApp to activate your subscription.

5

Deploy the Global File Cache Edge instances

See [Deploying Global File Cache Edge instances](#) to deploy the Global File Cache Edge instances in each remote location. This step is not done using Cloud Manager.

Deploy Cloud Volumes ONTAP as your storage platform

In the current release, Global File Cache supports Cloud Volumes ONTAP deployed in Azure or AWS. For detailed prerequisites, requirements, and deployment instructions, see [Launching Cloud Volumes ONTAP in Azure](#) or [Launching Cloud Volumes ONTAP in AWS](#).

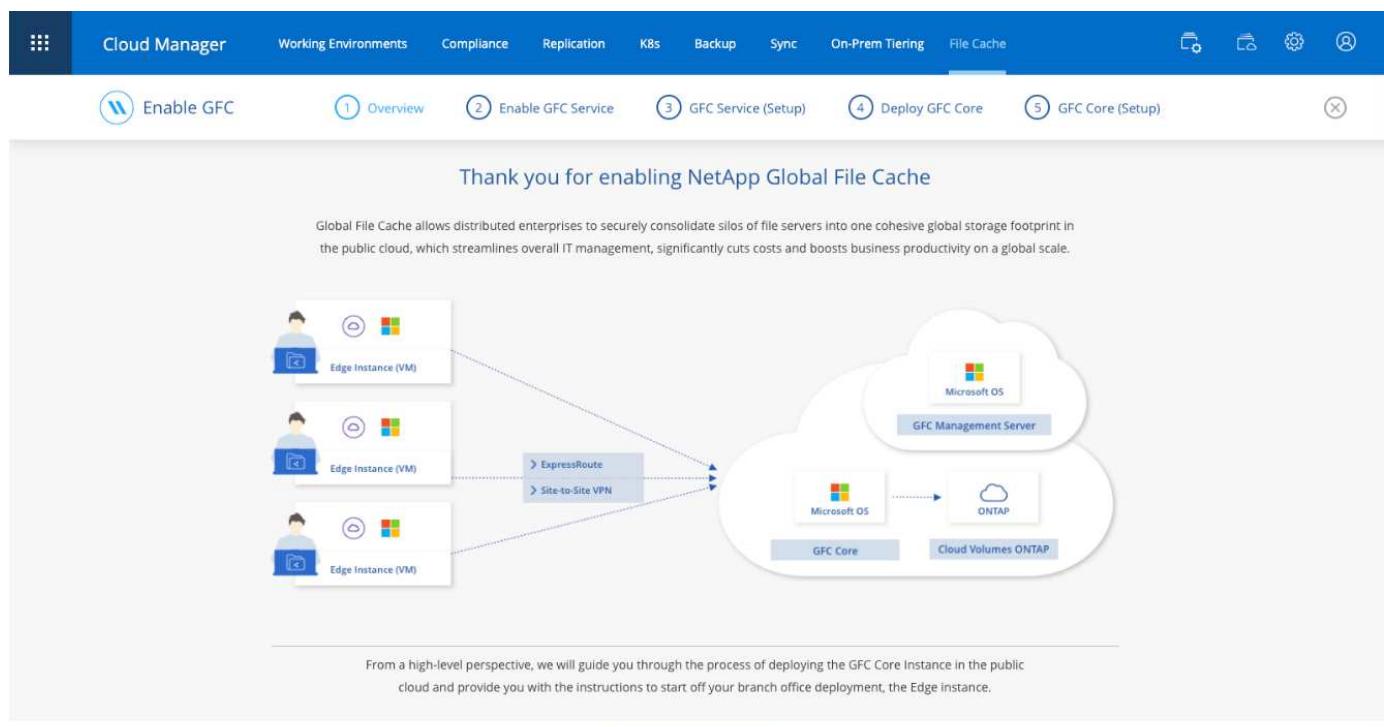
Note the following additional Global File Cache requirement:

- You should configure SMB file shares on the instance of Cloud Volumes ONTAP.

If no SMB file shares are set up on the instance, then you are prompted to configure the SMB shares during the installation of the Global File Cache components.

Enable Global File Cache in your working environment

The Global File Cache wizard walks you through the steps to deploy the Global File Cache Management Server instance and the Global File Cache Core instance, as highlighted below.



Steps

1. Select the working environment where you deployed Cloud Volumes ONTAP.
2. In the Services panel, click **Enable GFC**.



3. Read the Overview page and click **Continue**.
4. If no SMB shares are available on the Cloud Volumes ONTAP instance, you are prompted to enter the SMB Server and SMB Share details to create the share now. For details about the SMB configuration, see [Storage platform](#).

When finished, click **Continue** to create the SMB share.

The "SMB Setup" screen displays the following configuration fields:

SMB Server		SMB Share	
Active Directory Domain	<input type="text" value="gfc.netapp.com"/>	Volume Name	<input type="text" value="Enter Volume Name"/>
Name Server IP Address	<input type="text" value="10.0.2.4"/>	Select Aggregate	<input type="button" value="Select Aggregate"/>
Active Directory Admin User	<input type="text" value="cvoadmin"/>	Share Name	<input type="text" value="Enter Share Name"/>
Active Directory Admin Password	<input type="password" value="*****"/>	Thin provisioning	Enabled <input type="checkbox"/>
		Deduplication	Enabled <input type="checkbox"/>

5. On the Global File Cache Service page, enter the number of Global File Cache Edge instances you plan to deploy, and then make sure your system meets the requirements for Network Configuration and Firewall Rules, Active Directory settings, and Antivirus exclusions. See [Prerequisites](#) for more details.

Enable Global File Cache Service

Licensing Global File Cache:

Once you've completed this deployment process, you will need your NSS Credentials to activate your subscription. If you haven't purchased or received your NetApp Global File Cache licenses, which are available as an Edge-based license, they can be purchased through your iNetApp Partner or NetApp Sales Representative.

How many edge instances are you planning to deploy?

10



Before you begin:

Here are the most important requirements for your environment before you can deploy the NetApp Global File Cache solution:

Configure the required Network Configuration and Firewall Rules for Global File Cache



Create a "Service Account" in your Active Directory domain: GFC.NETAPP.COM



Update Antivirus Exclusions for your Windows Server infrastructure by committing the required exclusions to your Antivirus services



For more information on all the solution requirements [Click Here](#)

Continue

6. After you have verified that the requirements have been met, or that you have the information to meet these requirements, click **Continue**.
7. Enter the admin credentials you will use to access to the Global File Cache Management Server VM and click **Enable GFC Service**. For Azure you enter the credentials as a user name and password; for AWS you select the appropriate key pair. You can change the VM/instance name if you want.

Global File Cache Service (Setup)

Information		Credentials & Virtual Machine	
Subscription Name	OCCM Dev	Local Admin Name	GFCAdmin
Azure Region	eastus	Local Admin Password	*****
VNet	Vnet1	VM Name	GFC-MS1
Subnet	Subnet2		
Resource Group	occm_group_eastus		
Enable GFC Service			

8. After the Global File Cache Management Service is successfully deployed, click **Continue**.
9. For the Global File Cache Core, enter the admin user credentials to join the Active Directory domain, and the service account user credentials. Then click **Continue**.
 - The Global File Cache Core instance must be deployed in the same Active Directory domain as the Cloud Volumes ONTAP instance.
 - The service account is a domain user and it is part of the BUILTIN\Backup Operators group on the Cloud Volumes ONTAP instance.

Deploy Global File Cache Core

Active Directory and Admin Credentials

Provide administrative credentials to join the GFC Core instance to the Active Directory domain

Join Active Directory Domain

Active Directory Domain

Admin User

Enter Admin User

Admin Password

Enter Admin Password

Account User Credentials

Provide Service Account credentials

Service Account User

Enter Service Account User

Service Account Password

Enter Service Account Password

Continue

10. Enter the admin credentials you will use to access to the Global File Cache Core VM and click **Deploy GFC Core**. For Azure you enter the credentials as a user name and password; for AWS you select the appropriate key pair. You can change the VM/instance name if you want.

Global File Cache Core (Setup)

Information		Credentials & Virtual Machine	
Subscription Name	Subscription_1234567891234...	Local Admin Name	Admin@netapp.com
Region	East US Virginia	Local Admin Password	*****
VNet	VNet_1234567	VM Name	GFC-CORE-1234
Subnet	10.0.0.0/24	Local Admin Name & Password are inherited from the Global File Cache Management Service. The Virtual Machine Name is associated to your Cloud Manager Account	
Resource Group	Resource Group 1	Deploy GFC Core	

- After the Global File Cache Core is successfully deployed, click **Go to Dashboard**.

The screenshot shows the Global File Cache Management Instance dashboard. At the top, it displays basic instance details: Hostname (www.working-environment-1.com), Status (ON), IP Address (141.226.210.219), Region (East US), VNet (VNet1), Subnet (10.10.10.10/24), Resource Group (RGName), and CPU Utilization (26%). Below this, under "1 Working Environment", there is one entry: Name (Working Environment_1), Type (High Availability), Status (ON), and Core Instances (2). A blue button labeled "Add Core Instance" is available. At the bottom, the "Instance Core 1" section shows the following details: Hostname (www.working-environment-1.com), IP Address (141.226.210.219), CPU Utilization (26%), Network Inbound (2.5 TB), Network Outbound (2.5 TB), and a blue "Deploy GFC Edge" button.

The Dashboard shows that the Management Server instance and the Core instance are both **On** and working.

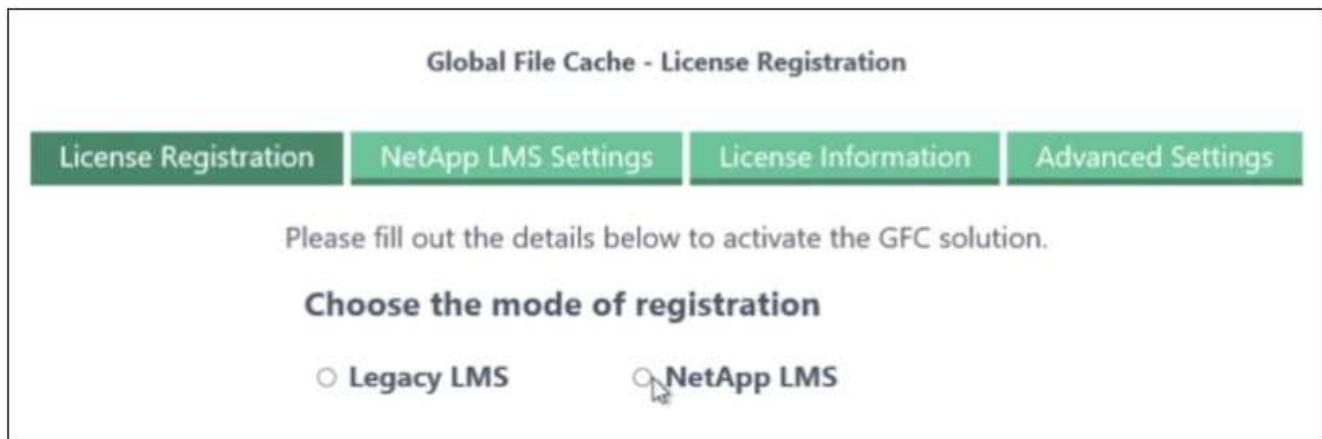
License your Global File Cache installation

Before you can use Global File Cache, you need to configure the Global File Cache License Management Server (LMS) service on a Global File Cache Core instance. You will need your NSS Credentials or a Customer ID and Subscription Number provided NetApp to activate your subscription.

In this example, we will configure the LMS service on a Core instance that you just deployed in the public cloud. This is a one-time process that sets up your LMS service.

Steps

1. Open the Global File Cache License Registration page on the Global File Cache Core (the Core you are designating as your LMS service) using the following URL. Replace <ip_address> with the IP address of the Global File Cache Core:
https://<ip_address>/lms/api/v1/config/lmsconfig.html
2. Click “**Continue to this website (not recommended)**” to continue. A page that allows you to configure the LMS, or check existing license information, is displayed.



The screenshot shows a web-based configuration interface for Global File Cache. At the top, there is a header bar with the title "Global File Cache - License Registration". Below the header, there is a navigation bar with four tabs: "License Registration" (which is highlighted in green), "NetApp LMS Settings" (also highlighted in green), "License Information", and "Advanced Settings". A sub-instruction below the tabs says "Please fill out the details below to activate the GFC solution." Underneath, there is a section titled "Choose the mode of registration" with two options: "Legacy LMS" and "NetApp LMS". The "NetApp LMS" option is currently selected, indicated by a checked radio button and a cursor icon pointing at it.

3. Choose the mode of registration:
 - “NetApp LMS” is used for customers who have purchased NetApp Global File Cache Edge licenses from NetApp or its certified partners. (Preferred)
 - “Legacy LMS” is used for existing or trial customers who have received a Customer ID through NetApp Support. (This option has been deprecated.)
4. For this example, click **NetApp LMS**, enter your Customer ID (preferably your email address), and click **Register LMS**.

Global File Cache - License Registration

License Registration

NetApp LMS Settings

Advanced Settings

Please fill out the details below to activate the GFC solution.

Choose the mode of registration

○ Legacy LMS

NetApp LMS

Customer Id:

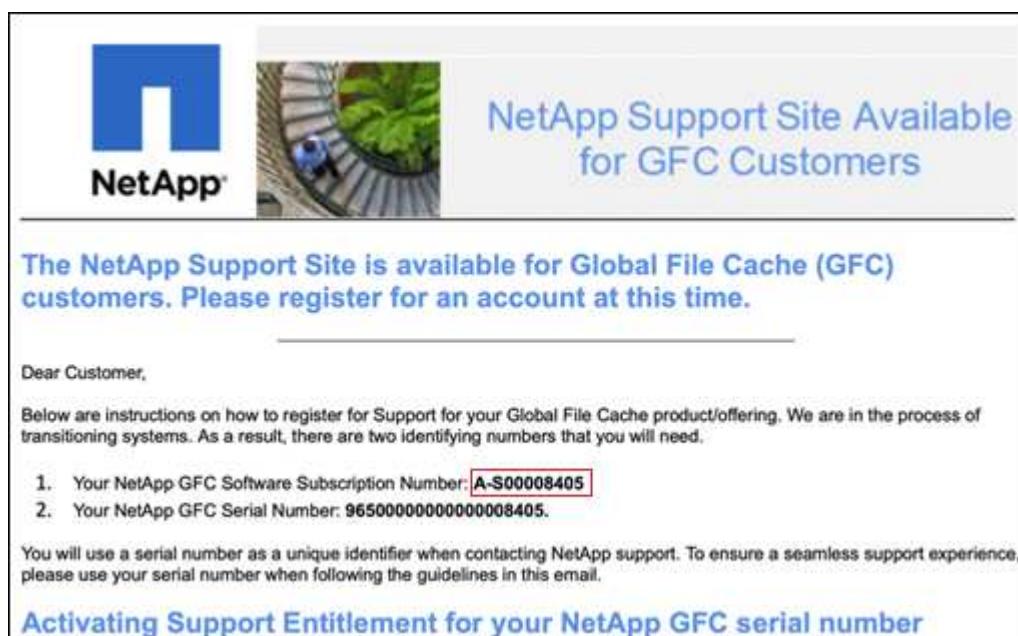
john.doe@company.com

x

* Choose a unique identifier for your GFC deployment, preferably your email address

REGISTERIMS

5. Check for a confirmation email from NetApp that includes your GFC Software Subscription Number and Serial Number.



6. Click the **NetApp LMS Settings** tab.
 7. Select **GFC License Subscription**, enter your GFC Software Subscription Number, and click **Submit**.

Global File Cache - License Registration

License Registration	NetApp LMS Settings	License Information	Advanced Settings
----------------------	---------------------	---------------------	-------------------

NSS Credentials GFC License Subscription

GFC License Subscription:

SUBMIT

You will see a message that your GFC License Subscription was registered successfully and activated for the LMS instance. Any subsequent purchases will automatically be added to the GFC License Subscription.

8. Optionally, you can click the **License Information** tab to view all your GFC license information.

What's Next?

If you have determined that you need to deploy multiple Global File Cache Cores to support your configuration, click **Add Core Instance** from the Dashboard and follow the deployment wizard.

After you have completed your Core deployment, you need to [deploy the Global File Cache Edge instances](#) in each of your remote offices.

Deploy additional Core instances

If your configuration requires more than one Global File Cache Core to be installed because of a large number of Edge instances, you can add another Core to the working environment.

When deploying Edge instances, you will configure some to connect to the first Core and others to the second Core. Both Core instances access the same backend storage (your Cloud Volumes ONTAP instance) in the working environment.

1. From the Global File Cache Dashboard, click **Add Core Instance**.

1 Working Environment										
 Name Working Environment_1	High Availability Type ON	Status ON	2 Core Instances	Add Core Instance						
Instance Core 1 ON <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%; padding: 5px;"> www.working-environment-1.com Hostname </td> <td style="width: 25%; padding: 5px;"> 141.226.210.219 IP Address </td> <td style="width: 25%; padding: 5px;"> 26% CPU Utilization </td> <td style="width: 25%; padding: 5px;"> 2.5 TB Network Inbound </td> <td style="width: 25%; padding: 5px;"> 2.5 TB Network Outbound </td> <td style="width: 15%; text-align: center; padding: 5px;"> Deploy GFC Edge </td> </tr> </table>					www.working-environment-1.com Hostname	141.226.210.219 IP Address	26% CPU Utilization	2.5 TB Network Inbound	2.5 TB Network Outbound	Deploy GFC Edge
www.working-environment-1.com Hostname	141.226.210.219 IP Address	26% CPU Utilization	2.5 TB Network Inbound	2.5 TB Network Outbound	Deploy GFC Edge					

2. Enter the admin user credentials to join the Active Directory domain, and the service account user credentials. Then click **Continue**.

- The Global File Cache Core instance must be in the same Active Directory domain as the Cloud Volumes ONTAP instance.
- The service account is a domain user and it is part of the BUILTIN\Backup Operators group on the Cloud Volumes ONTAP instance.

Deploy Global File Cache Core

Active Directory and Admin Credentials

Provide administrative credentials to join the GFC Core instance to the Active Directory domain

Join Active Directory Domain

Active Directory Domain

Admin User

Enter Admin User

Admin Password

Enter Admin Password

Account User Credentials

Provide Service Account credentials

Service Account User

Enter Service Account User

Service Account Password

Enter Service Account Password

Continue

3. Enter the admin credentials you will use to access to the Global File Cache Core VM and click **Deploy GFC Core**. For Azure you enter the credentials as a user name and password; for AWS you select the appropriate key pair. You can change the VM name if you want.

Global File Cache Core (Setup)

Information

Subscription Name Subscription_1234567891234...

Region East US | Virginia

VNet VNet_1234567

Subnet 10.0.0.0/24

Resource Group Resource Group 1

Credentials & Virtual Machine

Local Admin Name

Admin@netapp.com

Local Admin Password

VM Name

GFC-CORE-1234

Local Admin Name & Password are inherited from the Global File Cache Management Service. The Virtual Machine Name is associated to your Cloud Manager Account

Deploy GFC Core

- After the Global File Cache Core is successfully deployed, click **Go to Dashboard**.

1 Working Environment				
Name	Type	Status	Core Instances	
Working Environment_1	High Availability	ON	2	Add Core Instance
Instance Core 1 ON				
www.working-environment-1.com	Hostname	141.226.210.219	IP Address	2.5 TB Network Inbound
			26% CPU Utilization	2.5 TB Network Outbound
Deploy GFC Edge				
Instance Core 1 ON				
www.working-environment-1.com	Hostname	141.226.210.219	IP Address	2.5 TB Network Inbound
			26% CPU Utilization	2.5 TB Network Outbound
Deploy GFC Edge				

The Dashboard reflects the second Core instance for the working environment.

Before you begin to deploy Global File Cache Edge instances

There are many requirements you need to be aware of before you begin to install Global File Cache Edge software in your remote offices.

Download required resources

Download the Global File Cache Virtual Templates you are planning to use in your branch offices, the software installation package, and additional reference documentation:

- Windows Server 2016 Virtual Template:

[Windows Server 2016 .OVA including NetApp GFC \(VMware VSphere 6.5+\)](#)

[Windows Server 2016 .VHDX including NetApp GFC \(Microsoft Hyper-v\)](#)

- Windows Server 2019 Virtual Template:

[Windows Server 2019 .OVA including NetApp GFC \(VMware VSphere 6.5+\)](#)

[Windows Server 2019 .VHDX including NetApp GFC \(Microsoft Hyper-v\)](#)

- Global File Cache Edge Software:

[NetApp GFC Software Installation Package \(.EXE\)](#)

- Global File Cache SCOM (Microsoft Systems Center Operations Manager) Package:

[NetApp GFC SCOM Management Package \(.ZIP\)](#)

- Global File Cache Documentation:

[NetApp Global File Cache User Guide \(.PDF\)](#)

Designing and deploying Global File Cache Edge

Depending on your requirements, you might need to deploy one or multiple Global File Cache Edge instances based on the concurrent user sessions in a branch office. The Edge instance presents the virtual file share to the end users within the branch office, which has been transparently extended from the associated Global File Cache Core instance. The Global File Cache Edge should contain a D:\ NTFS volume, which contains the cached files within the branch office.

 For the Global File Cache Edge, it is important to understand the [sizing guidelines](#). This will assist you in making the correct design for your Global File Cache deployment. You would also need to determine what's right for your environment in terms of scale, availability of resources, and in terms of redundancy.

Global File Cache Edge instance

When deploying a Global File Cache Edge instance, you need to provision a single VM, either by deploying Windows Server 2016 Standard or Datacenter Edition, or Windows Server 2019 Standard or Datacenter Edition, or using the Global File Cache .OVA or .VHD template, which includes the Windows Server operating system of choice and Global File Cache software.

Quick steps

1. Deploy the Global File Cache Virtual Template, or Windows Server 2016 VM, or Windows Server 2019 Standard or Datacenter edition.
2. Ensure the VM is connected to the network, joined to the domain, and accessible through RDP.

3. Install the latest Global File Cache Edge software.
4. Identify the Global File Cache Management Server and Core instance.
5. Configure the Global File Cache Edge instance.

Global File Cache Edge requirements

Global File Cache Edge is designed to function across all platforms supporting Windows Server 2016 and 2019, bringing simplified IT to corporate remote offices and beyond. Critically, Global File Cache can be deployed on your existing hardware infrastructure, virtualization, or hybrid/public cloud environments in almost every case if they meet a few base-level requirements.

Global File Cache Edge requires the following hardware and software resources to function optimally. For more information about overall sizing guidelines, see [Sizing guidelines](#).

Hardened server appliance

The Global File Cache installation package creates a hardened software appliance on any Microsoft Windows Server instance. *Do Not Uninstall* the Global File Cache Package. Uninstalling Global File Cache will impact the functionality of the server instance and might require a full rebuild of the server instance.

Physical hardware requirements

- Minimum 4 CPU cores
- Minimum 16 GB RAM
- Dedicated single or redundant 1 Gbps NIC
- 10k RPM SAS HDD or SSD (preferred)
- RAID controller with write-back caching functionality enabled

Virtual deployment requirements

Hypervisor platforms are known to be subject to performance degradation from a storage subsystem perspective (for example, latency). For optimal performance using Global File Cache, a physical server instance with SSD is recommended.

For best performance in virtual environments, in addition to the physical host requirements, the following requirements and resource reservations must be met:

Microsoft Hyper-V 2012 R2 and later:

- Processor (CPU): CPUs must be set as **Static**: Minimum: 4 vCPU cores.
- Memory (RAM): Minimum: 16 GB set as **Static**.
- Hard-disk provisioning: Hard Disks must be configured as **Fixed Disk**.

VMware vSphere 6.x and later:

- Processor (CPU): Reservation of CPU Cycles must be set. Minimum: 4 vCPU cores @ 10000 MHz.
- Memory (RAM): Minimum: Reservation of 16 GB.
- Hard-disk provisioning:
 - Disk Provisioning must be set as **Thick Provisioned Eager Zeroed**.

- Hard Disk Shares must be set to **High**.
- Devices.hotplug must be set to **False** using the vSphere Client to prevent Microsoft Windows from presenting Global File Cache drives as removable.
- Networking: Network Interface must be set to **VMXNET3** (may require VM Tools).

Global File Cache runs on Windows Server 2016 and 2019, hence the virtualization platform needs to support the operating system, as well as integration with utilities enhancing the performance of the VM's guest operating system and management of the VM, such as VM Tools.

Partition sizing requirements

- C:\ - minimum 250 GB (system/boot volume)
- D:\ - minimum 1 TB (separate data volume for Global File Cache Intelligent File Cache*)

*Minimum size is 2x the active data set. The cache volume (D:\) can be extended and is only restricted by the limitations of the Microsoft Windows NTFS file system.

Global File Cache Intelligent File Cache disk requirements

Disk Latency on the Global File Cache Intelligent File Cache disk (D:\) should deliver < 0.5ms average I/O disk latency and 1MiBps throughput per concurrent user.

For more information, see the [NetApp Global File Cache User Guide](#).

Networking

- Firewall: TCP ports should be allowed between the Global File Cache Edge and Management Server and Core instances.

Global File Cache TCP Ports: 443 (HTTPS - LMS), 6618 – 6630.

- Network optimization devices (such as Riverbed Steelhead) must be configured to pass-thru Global File Cache specific ports (TCP 6618-6630).

Client workstation and application best practices

Global File Cache transparently integrates into customer's environments, allowing users to access centralized data using their client workstations, running enterprise applications. Using Global File Cache, data is accessed through a direct drive mapping or through a DFS namespace. For more information about the Global File Cache Fabric, Intelligent File Caching, and key aspects of the software, consult the [Before you begin to Deploy Global File Cache](#) section.

To ensure an optimal experience and performance, it is important to comply with the Microsoft Windows Client requirements and best practices as outlined in the Global File Cache User Guide. This applies to all versions of Microsoft Windows.

For more information, see the [NetApp Global File Cache User Guide](#).

Firewall and Antivirus best practices

While Global File Cache makes a reasonable effort to validate that the most common antivirus application suites are compatible with Global File Cache, NetApp cannot guarantee and is not responsible for any incompatibilities or performance issues caused by these programs, or their associated updates, service packs,

or modifications.

Global File Cache does not recommend the installation nor application of monitoring or antivirus solutions on any Global File Cache enabled instance (Core or Edge). Should a solution be installed, by choice or by policy, the following best practices and recommendations must be applied. For common antivirus suites, see Appendix A in the [NetApp Global File Cache User Guide](#).

Firewall settings

- Microsoft firewall:
 - Retain firewall settings as default.
 - Recommendation: Leave Microsoft firewall settings and services at the default setting of OFF, and not started for standard Global File Cache Edge instances.
 - Recommendation: Leave Microsoft firewall settings and services at the default setting of ON, and started for Edge instances that also run the Domain Controller role.
- Corporate firewall:
 - Global File Cache Core instance listens on TCP ports 6618-6630, ensure that Global File Cache Edge instances can connect to these TCP ports.
 - Global File Cache instances require communications to the Global File Cache Management Server on TCP port 443 (HTTPS).
- Network optimization solutions/devices must be configured to pass-thru Global File Cache specific ports.

Antivirus best practices

This section helps you to understand the requirements when running antivirus software on a Windows Server instance running Global File Cache. Global File Cache has tested most commonly used antivirus products including Cylance, McAfee, Symantec, Sophos, Trend Micro, Kaspersky and Windows Defender for use in conjunction with Global File Cache.



Adding antivirus to an Edge appliance can introduce a 10–20% impact on user performance.

For more information, see the [NetApp Global File Cache User Guide](#).

Configure exclusions

Antivirus software or other third-party indexing or scanning utilities should never scan drive D:\ on the Edge instance. These scans of Edge server drive D:\ will result in numerous file open requests for the entire cache namespace. This will result in file fetches over the WAN to all file servers being optimized at the data center. WAN connection flooding and unnecessary load on the Edge instance will occur resulting in performance degradation.

In addition to the D:\ drive, the following Global File Cache directory and processes should generally be excluded from all antivirus applications:

- C:\Program Files\TalonFAST\
- C:\Program Files\TalonFAST\Bin\LMClientService.exe
- C:\Program Files\TalonFAST\Bin\LMServerService.exe
- C:\Program Files\TalonFAST\Bin\Optimus.exe

- C:\Program Files\TalonFAST\Bin\tafsexport.exe
- C:\Program Files\TalonFAST\Bin\tafsutils.exe
- C:\Program Files\TalonFAST\Bin\tapp.exe
- C:\Program Files\TalonFAST\Bin\TappN.exe
- C:\Program Files\TalonFAST\Bin\FTLSummaryGenerator.exe
- C:\Program Files\TalonFAST\Bin\RFASTSetupWizard.exe
- C:\Program Files\TalonFAST\Bin\TService.exe
- C:\Program Files\TalonFAST\Bin\tum.exe
- C:\Program Files\TalonFAST\FastDebugLogs\
- C:\Windows\System32\drivers\tfast.sys
- \\?\TafsMtPt:\ or \\?\TafsMtPt*
- \Device\TalonCacheFS\
- \\?\GLOBALROOT\Device\TalonCacheFS\
- \\?\GLOBALROOT\Device\TalonCacheFS*

NetApp Support policy

Global File Cache instances are designed specifically for Global File Cache as the primary application running on a Windows Server 2016 and 2019 platform. Global File Cache requires priority access to platform resources, for example, disk, memory, network interfaces, and can place high demands on these resources. Virtual deployments require memory/CPU reservations and high-performance disks.

- For branch office deployments of Global File Cache, supported services and applications on the server running Global File Cache are limited to:
 - DNS/DHCP
 - Active Directory domain controller (Global File Cache must be on a separate volume)
 - Print services
 - Microsoft System Center Configuration Manager (SCCM)
 - Global File Cache approved client-side system agents and anti-virus applications
- NetApp Support and maintenance applies only to Global File Cache.
- Line of business productivity software, which are typically resource intensive, for example, database servers, mail servers, and so on, are not supported.
- The customer is responsible for any non-Global File Cache software which might be installed on the server running Global File Cache:
 - If any third-party software package causes software or resource conflicts with Global File Cache or performance is compromised, Global File Cache's support organization might require the customer to disable or remove the software from the server running Global File Cache.
 - It is the customer's responsibility for all installation, integration, support, and upgrade of any software added to the server running the Global File Cache application.
- Systems management utilities/agents such as antivirus tools and licensing agents might be able to coexist. However, except for the supported services and applications listed above, these applications are not

supported by Global File Cache and the same guidelines as above must still be followed:

- It is the customer’s responsibility for all installation, integration, support, and upgrade of any software added.
- If a customer does install any third-party software package that causes, or is suspected to be causing, software or resource conflicts with Global File Cache or performance is compromised, there might be a requirement by Global File Cache’s support organization to disable/remove the software.

Deploy Global File Cache Edge instances

After you have verified that your environment meets all the requirements, you install Global File Cache Edge software in each remote office.

Before you begin

To complete Global File Cache Edge configuration tasks, you need the following information:

- Static IP addresses for each Global File Cache instance
- Subnet mask
- Gateway IP address
- The FQDN you wish to assign to each Global File Cache server
- The DNS suffix (optional)
- The user name and password of an administrative user in the domain
- The FQDN and/or IP address of the associated Core servers
- A volume to be used as the Intelligent File Cache. It is recommended this be at least 2x the size of the active dataset. This should be formatted as NTFS and assigned as D:\.

Commonly used TCP ports

There are several TCP ports used by Global File Cache services. It is mandatory that the devices can communicate on these ports and they be excluded from any WAN optimization devices or firewall restriction policies:

- Global File Cache Licensing TCP Port: 443
- Global File Cache TCP Ports: 6618-6630

Deploy the Global File Cache Virtual Template

The virtual template (.OVA and .VHD) images contain the latest release of the Global File Cache software. If you are deploying Global File Cache using the .OVA or .VHD virtual machine (VM) template, follow the steps as outlined in this section. It is assumed that you understand how to deploy the .OVA or .VHD template on the designated hypervisor platform.

Ensure that VM preferences, including resource reservations, are in line with the requirements as outlined in [Virtual deployment requirements](#).

Steps

1. Extract the package from the template you downloaded.

2. Deploy the virtual template. Refer to the following videos before you start the deployment:
 - [Deploy the Virtual Template on VMware](#)
 - [Deploy the Virtual Template on Hyper-V](#)
3. After the Virtual Template has been deployed, and you have configured the VM settings, start the VM.
4. During initial boot, when the Windows Server 2016 or 2019 operating system is preparing for first use, complete the out-of-the-box experience by installing the correct drivers and installing the necessary components for the respective hardware.
5. When the base install of the Global File Cache Edge instance has been completed, the Windows Server 2016 or 2019 operating system will guide you through an initial configuration wizard to configure operating system specifics such as localization and product key.
6. After the initial configuration wizard has completed, log in locally to the Windows Server 2016 or 2019 operating system with the following credentials:
 - User name: **FASTAdmin**
 - Password: **Tal0nFAST!**
7. Configure your Windows Server VM, join to the organization's Active Directory domain, and proceed to the Global File Cache Edge configuration section.

Configure the Global File Cache Edge instance

The Global File Cache Edge instance connects to a Global File Cache Core to provide users at the branch office access to data center file server resources.



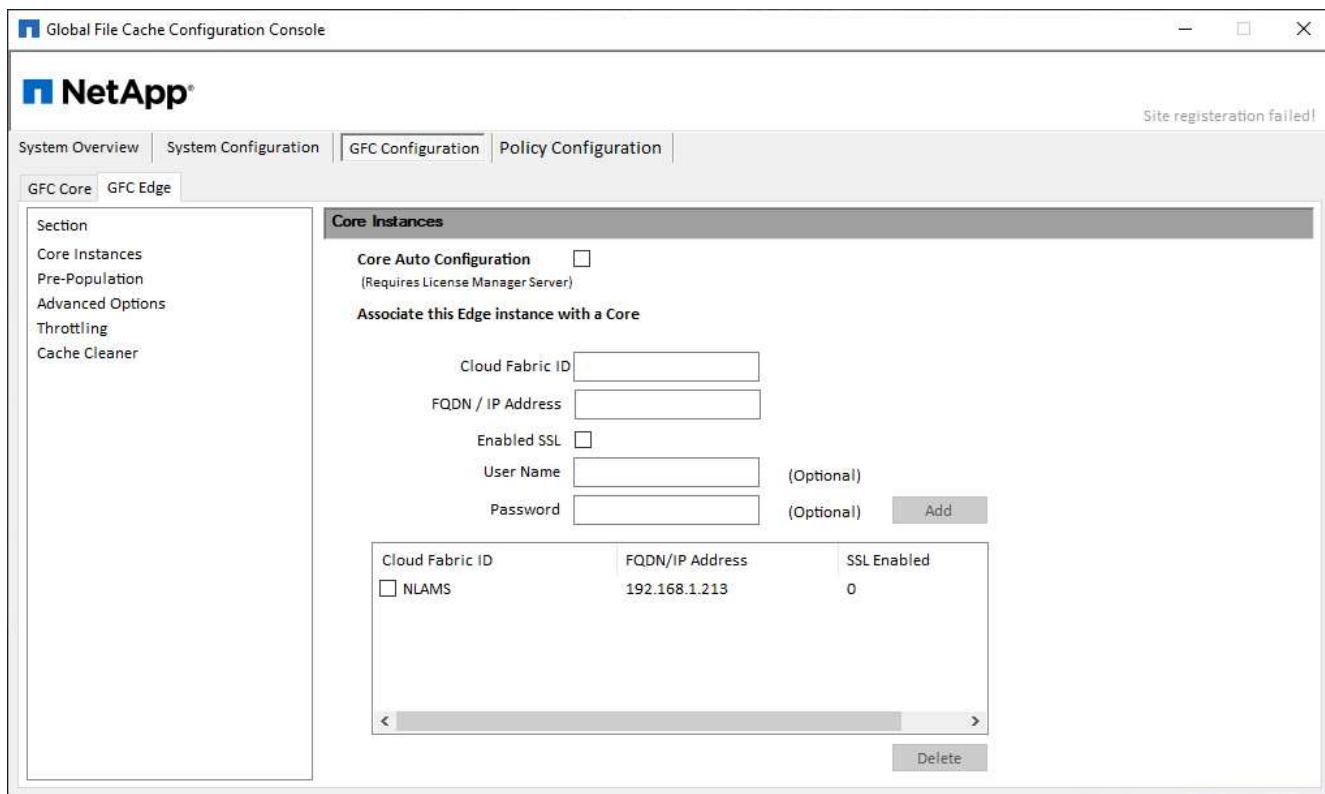
The Edge instance must be licensed as part of your Cloud Volumes ONTAP deployment prior to beginning the configuration. See [Licensing](#) for more information about licensing.

If your configuration requires more than one Global File Cache Core to be installed because of a large number of Edge instances, you will configure some Edge instances to connect to the first Core and others to connect to the second Core. Make sure you have the FQDN or IP address, and other required information, for the correct Core instance.

To configure the Edge instance, complete the following steps:

Steps

1. Click **Perform** next to the unchecked Core Configuration step listed in the "Edge Configuration Steps" section of the Initial Configuration assistant. This opens a new tab, GFC Edge, and shows the section *Core Instances*.
2. Provide the **Cloud Fabric ID** of the Global File Cache Core server. The Cloud Fabric ID is typically the NetBIOS name or the geographical location of the backend file server.
3. Provide the **FQDN/IP Address** of the Global File Cache Core server:
 - a. (Optional) Check the **SSL** box to enable SSL support for enhanced encryption from the Edge to the Core.
 - b. Enter the User Name and Password, which are the credentials of the Service Account used on the Core.
4. Click **Add** to confirm the addition of the Global File Cache Core appliance. A confirmation box will appear. Click **OK** to dismiss it.



Update Global File Cache Edge software

Global File Cache frequently releases updates to the software, either patches, enhancements, or new features/functionality. Although the virtual template (.OVA and .VHD) images contain the latest release of the Global File Cache software, it is possible that a newer version is available on the NetApp Support Download portal.

Ensure that your Global File Cache instances are up to date with the latest version.



This software package can also be used for pristine installations on Microsoft Windows Server 2016 Standard or Datacenter edition, or Windows Server 2019 Standard or Datacenter edition, or used as part of your upgrade strategy.

Below you can find the steps required to update the Global File Cache installation package:

Steps

1. After saving the latest installation package to the desired Windows Server instance, double-click it to run the installation executable.
2. Click **Next** to continue the process.
3. Click **Next** to continue.
4. Accept the Licensing Agreement and click **Next**.
5. Select the desired Installation Destination Location.

NetApp recommends that you use the default installation location.

6. Click **Next** to continue.
7. Select the Start Menu Folder.

8. Click **Next** to continue.
9. Verify your installation selections and click **Install** to begin the installation.

The installation process will start.

10. After the installation has completed, reboot the server when prompted.

What's Next?

For details about Global File Cache Edge advanced configuration, see the [NetApp Global File Cache User Guide](#).

End-user training

You will want to train your users on the best practices for accessing the shared files through Global File Cache.

This is the final phase of the Global File Cache deployment, the end-user implementation phase.

In order to prepare and streamline the end user on-boarding process, use the email template below that will help you to educate end users on what it means to work in a "central data" environment. This will help your users leverage all of the benefits of the Global File Cache solution. We have also published a video that can be shared to "train" users where needed.

Customize and forward the following resources to end users to prepare them for roll-out:

- User Training video
[End user training video](#)
- Email Template
[Mac Email Template \(.emltpl\)](#)

[Windows Email Template \(.msg\)](#)
- Onboarding Communications
[Word Document \(.docx\)](#)

See Chapter 13 in the [NetApp Global File Cache User Guide](#) for additional material.

Additional information

Use the following links to learn more about Global File Cache and other NetApp products:

- Global File Cache FAQ
 - See a list of frequently asked questions and answers [here](#)
- [NetApp Global File Cache User Guide](#)
- NetApp Product Documentation
 - See additional documentation for NetApp cloud products [here](#)
 - See additional documentation for all NetApp products [here](#)
- Customer support for Global File Cache users with Cloud Volumes ONTAP is available through these channels:

- Guided Problem Solving, Case Management, Knowledgebase, Downloads, Tools, and more go [here](#)
- Login to the NetApp Support at <https://mysupport.netapp.com> with your NSS credentials
- For immediate assistance for a P1 issue call: +1 856.481.3990 (Option 2)
- Customer support for Global File Cache users utilizing Cloud Volumes Services and Azure NetApp Files is available through standard support from your provider. Please contact Google Customer Support or Microsoft Customer Support respectively.

Optimize cloud compute costs

Learn about the Compute service

By leveraging [Spot's Cloud Analyzer service](#), Cloud Manager can provide a high-level cost analysis of your cloud compute spending and identify potential savings.

Cloud Analyzer is a cloud infrastructure management solution that uses advanced analytics to provide visibility and insights into your cloud costs. It shows you where you can optimize those costs and lets you implement that optimization using Spot's portfolio of continuous optimization products in just a few clicks.

Features

- A cost analysis that shows current cost for the month, projected monthly costs, and missed savings
- A view of spend efficiency by account, including the estimated additional savings
- A link to Spot's Cloud Analyzer for more in-depth details about the spending for all accounts

Supported cloud providers

This service is supported with AWS.

Cost

There's no cost to use this service through Cloud Manager.

How Cloud Analyzer works with Cloud Manager

At a high-level, Cloud Analyzer integration with Cloud Manager works like this:

1. You click **Compute** and connect your AWS management account.
2. NetApp configures your environment as follows:
 - a. Creates an organization in the Spot platform.
 - b. Sends an email welcoming you to Spot.

You can log in to the Spot service using the same single-sign on credentials that you use with Cloud Central and Cloud Manager.

- c. Cloud Analyzer starts processing your AWS account data.
3. In Cloud Manager, the Compute page refreshes and you use the information to gain insights on past, current, and future cloud costs.
 4. You click **Get Full Analysis** at any time to go to Spot's Cloud Analyzer, which provides a full analysis of your cloud spend and savings opportunities.

Data security

Cloud Analyzer data is encrypted at rest and no credentials are stored for any account.

Start optimizing your cloud compute costs

Connect your AWS account and then view the analysis to start optimizing your cloud compute costs.

Connect Cloud Analyzer to your AWS account

Click **Compute** and connect your AWS payer account.

Steps

1. Click **Compute**.
2. Click **Add AWS Credentials to Start**.
3. Follow the steps on the page to connect your AWS account:
 - a. Log in to your AWS management account.
 - b. Set up cost and usage reports on the AWS account.
 - c. Run the CloudFormation template.
 - d. Paste the Spot RoleARN.

[View more details about these steps.](#)

Connect your AWS Account to Optimize Costs

Connecting your billing data will allow Cloud Analyzer to access your Cost and Usage data.

Step 1

Log in to your AWS Master Payer account.

[Log in](#)

Step 2

Set up your Cost and Usage Reports on your AWS account.
[\(Learn How\)](#) or skip this if the report is already enabled.)

Enter the bucket name where the report is located:

Bucket name
123456789

Step 3

Open CloudFormation with Spot template.
Under capabilities, mark "I acknowledge that AWS CloudFormation might create IAM resources" and click 'Create'.

[Run Template](#)

Step 4

Copy the Spot RoleARN from the Output tab and paste below.

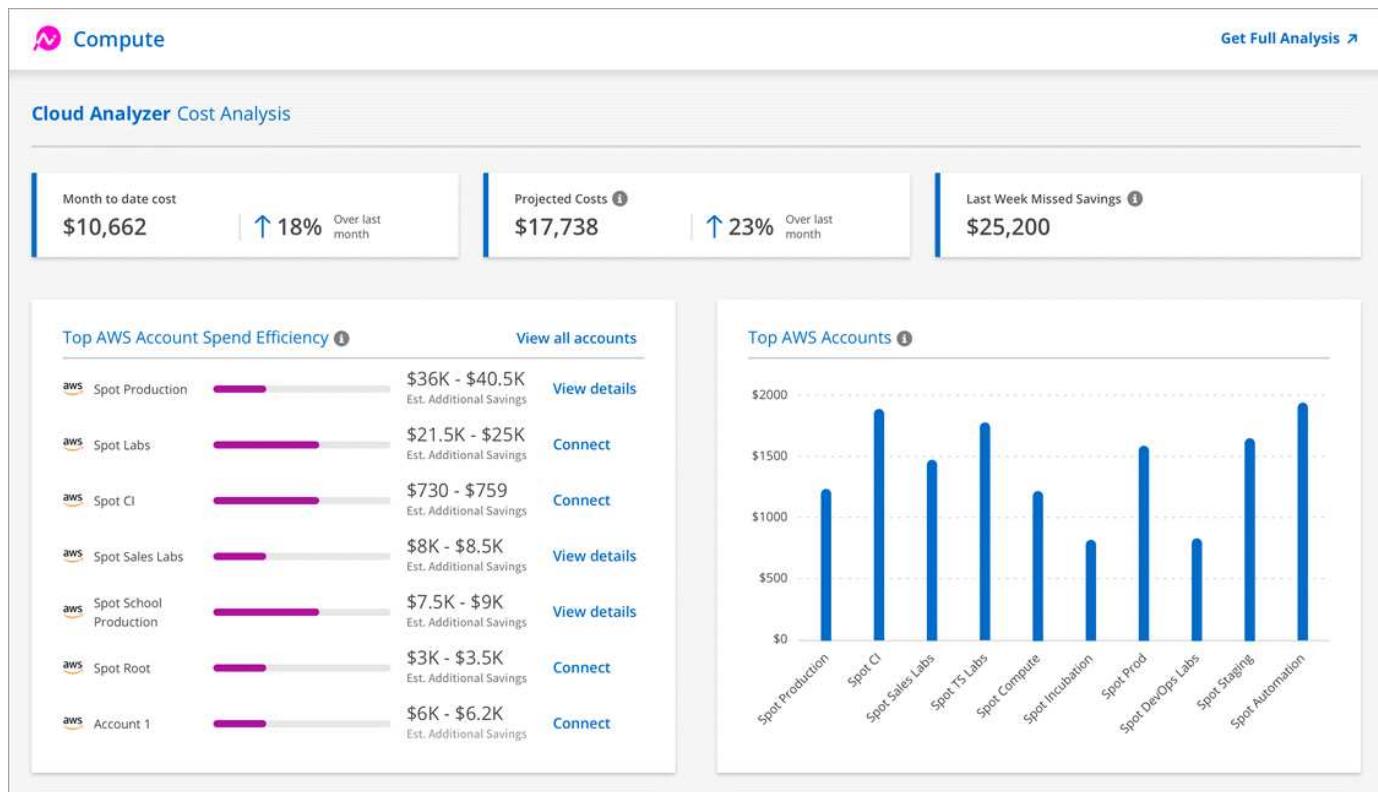
Spot RoleARN
arn:aws:iam:123412341234:role/test123

Result

Cloud Analyzer starts processing your AWS account data. If you have multiple accounts, Cloud Analyzer starts with read-only capabilities for all linked accounts under the management account. If you want to get more details about the potential savings for those accounts, then you'll need to connect them, as well. You can find more details about that process in the section below.

Analyze your compute costs

After Cloud Analyzer processes your account data, the Compute tab shows you insights on past, current, and future cloud costs.



Month to date cost

The total cost of your workloads from the beginning of the current month to present.

Projected Costs

The forecasted cost at the end of the month based on analysis of your usage pattern.

Last Week Missed Savings

Savings that could have been achieved in the previous seven days using optimization of spot instances and reservations.

Top AWS Account Spend Efficiency

The top 10 accounts according to the greatest amount of estimated additional savings.

Each account is assigned an efficiency score based on current and additional potential savings. The estimated additional savings indicates how much can be further saved by leveraging the use of spot and reserved instances.

You can take the following actions to further optimize your accounts:

- **View details:** View your cost optimization opportunities by going to Spot's Cloud Analyzer.
- **Connect:** Connect an account that is not yet managed. You will be directed to the wizard that connects the account.

Top AWS Accounts

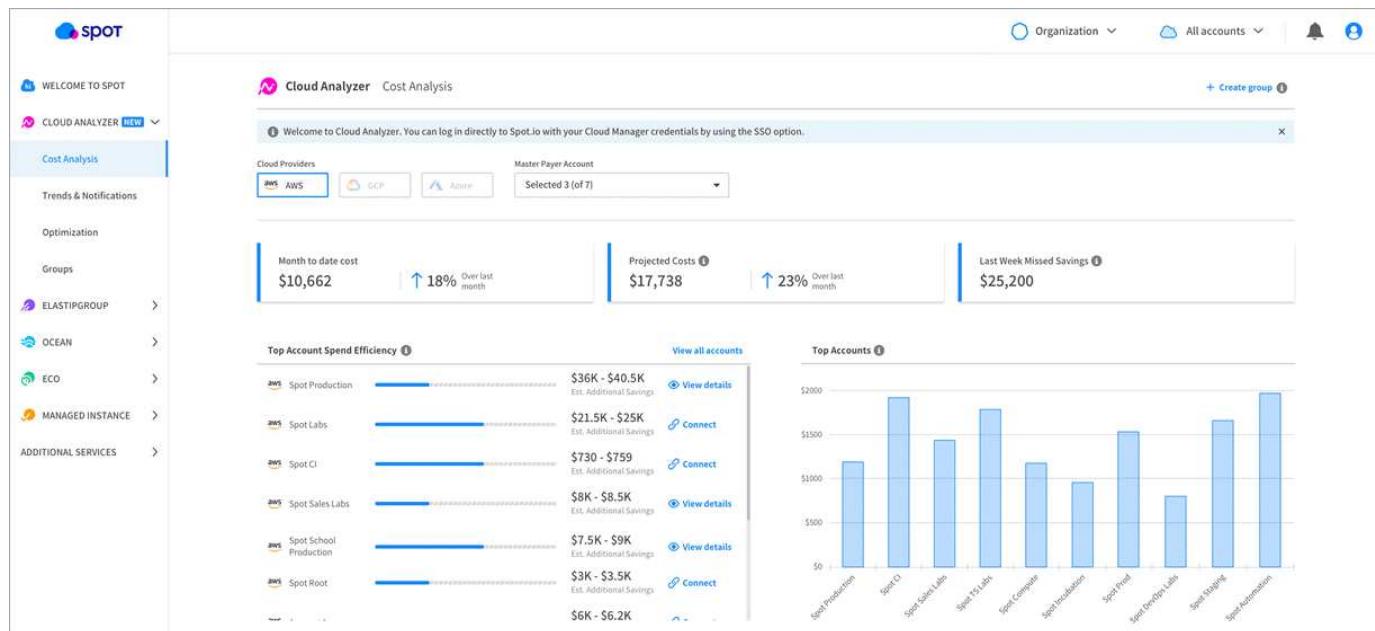
This is a bar graph showing your top ten accounts by cost. The graph is based on the last 30 days of spend activity.

[Learn more about the Cost Analysis page that's available in Spot's Cloud Analyzer.](#)

Go to Cloud Analyzer for more analysis and recommendations

Click **Get Full Analysis** at any time to access more charts and analysis, in-depth recommendations, a use case optimization breakdown (containers, ElasticApps, and reservations), and more.

Here's an example of what you'll see in Cloud Analyzer:



- [View the product page for Cloud Analyzer to learn more about its capabilities.](#)
- [View the documentation for Spot to get help using Cloud Analyzer.](#)

Viewing your Amazon S3 buckets

After you install a Connector in AWS, Cloud Manager can automatically discover information about the Amazon S3 buckets that reside in the AWS account where it's installed.

You can see details about your S3 buckets, including the region, access level, storage class, and whether the bucket is used with Cloud Volumes ONTAP for backups or data tiering. And you can scan the S3 buckets with Cloud Data Sense.

Steps

1. [Install a Connector](#) in the AWS account where you want to view your Amazon S3 buckets.

You should automatically see an Amazon S3 working environment shortly after.



2. Click the working environment and select an action from the right pane.

Amazon S3

■ On

INFORMATION

241	15
Buckets	Regions

SERVICES

Cloud Compliance	Enable Compliance	⋮
■ Off		

View Buckets

3. Click **Enable Compliance** to scan the S3 buckets for personal and sensitive data.

For more details, see [Getting started with Cloud Data Sense for Amazon S3](#).

4. Click **View Buckets** to view details about the S3 buckets in your AWS account.

Administer Cloud Manager

Manage Connectors

Finding the system ID for a Connector

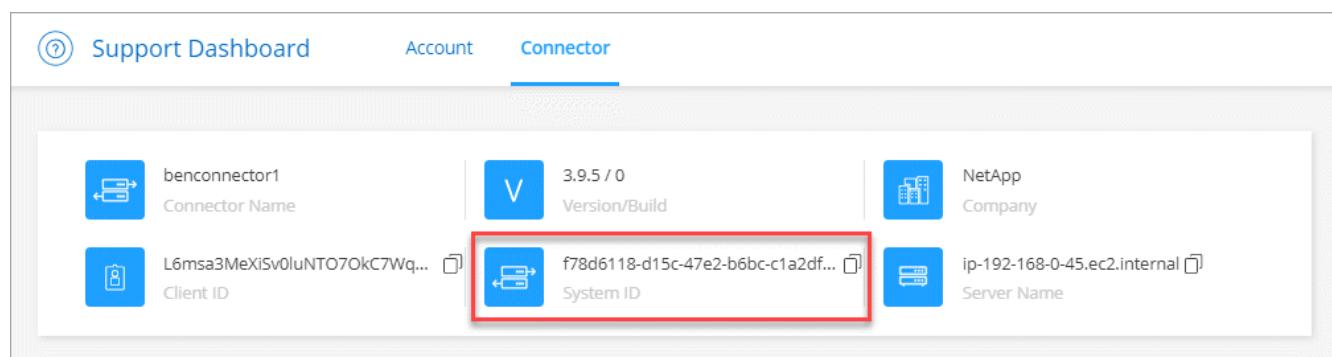
To help you get started, your NetApp representative might ask you for the system ID for a Connector. The ID is typically used for licensing and troubleshooting purposes.

Steps

1. In the upper right of the Cloud Manager console, click the Help icon.
2. Click **Support > Connector**.

The system ID appears at the top.

Example



Managing existing Connectors

After you create one or more Connectors, you can manage them by switching between Connectors, connecting to the local user interface running on a Connector, and more.

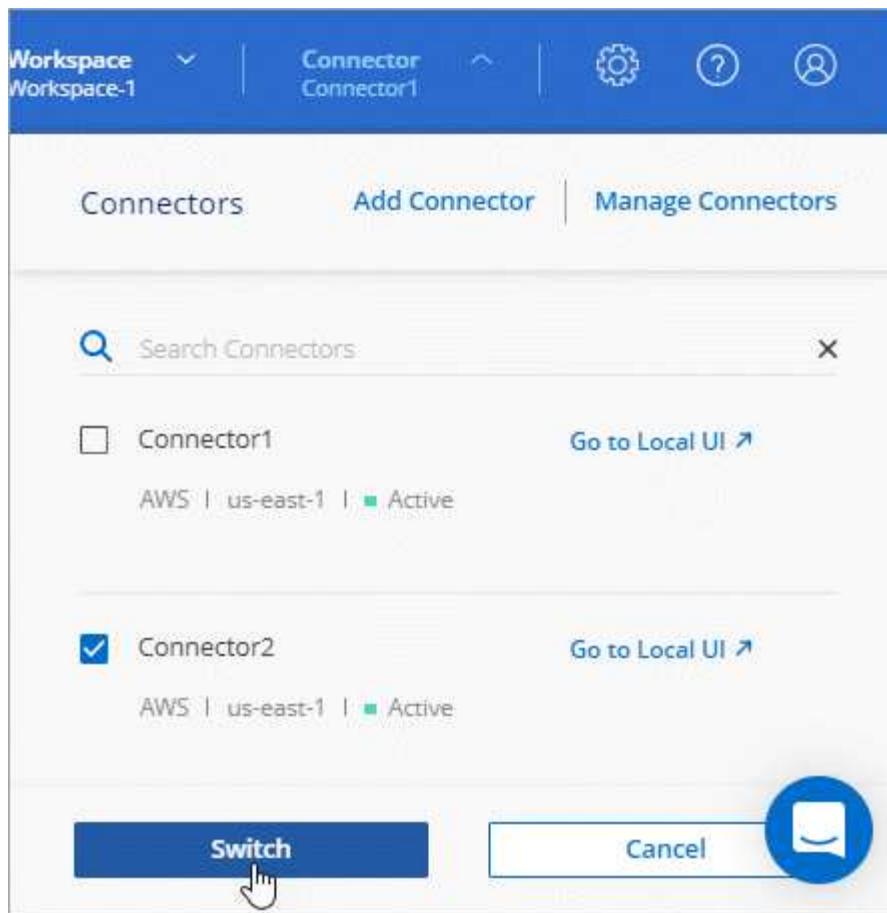
Switch between Connectors

If you have multiple Connectors, you can switch between them to see the Working Environments that are associated with a specific Connector.

For example, let's say that you're working in a multi-cloud environment. You might have one Connector in AWS and another in Google Cloud. You'd need to switch between those Connectors to manage the Cloud Volumes ONTAP systems running in those clouds.

Step

1. Click the **Connector** drop-down, select another Connector, and then click **Switch**.



Cloud Manager refreshes and shows the Working Environments associated with the selected Connector.

Access the local UI

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 for a few tasks that need to be performed from the Connector itself:

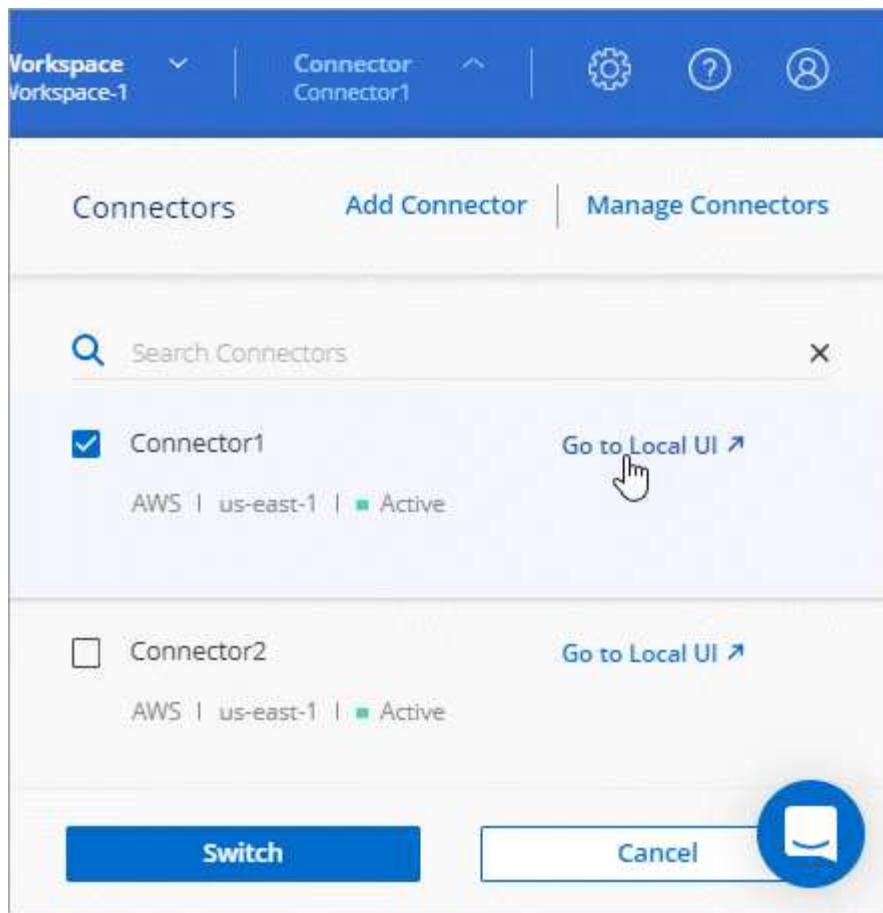
- [Setting a proxy server](#)
- Installing a patch (you'll typically work with NetApp personnel to install a patch)
- Downloading AutoSupport messages (usually directed by NetApp personnel when you have issues)

Steps

1. [Log in to the Cloud Manager SaaS interface](#) from a machine that has a network connection to the Connector instance.

If the Connector doesn't have a public IP address, you'll need a VPN connection or you'll need to connect from a jump host that's in the same network as the Connector.

2. Click the **Connector** drop-down and then click **Go to Local UI**.



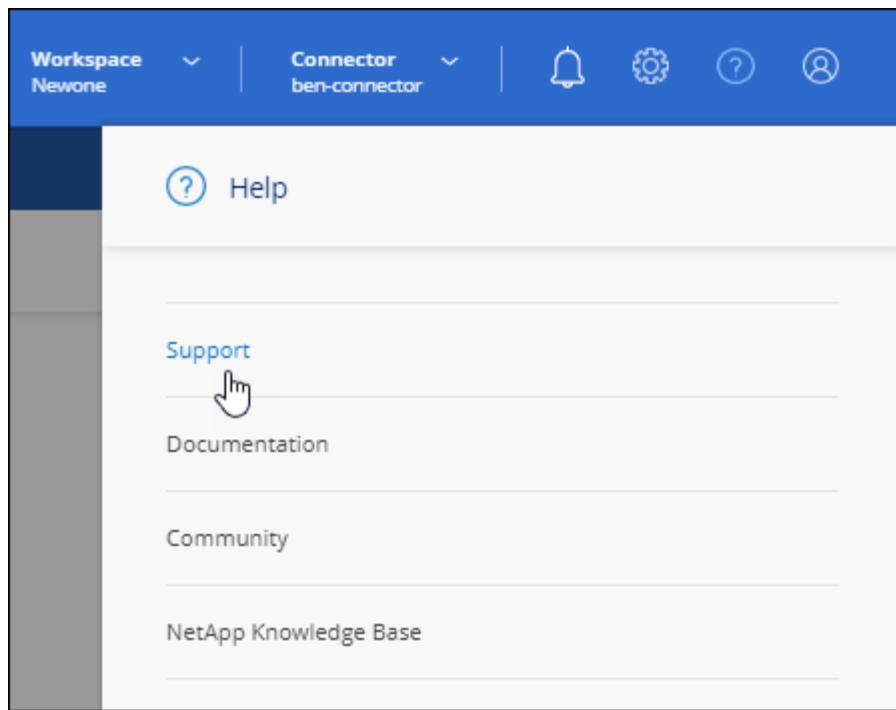
The Cloud Manager interface running on the Connector loads in a new browser tab.

Download or send an AutoSupport message

If you're having problems, NetApp personnel might ask you to send an AutoSupport message to NetApp support for troubleshooting purposes.

Steps

1. Connect to the Connector local UI, as described in the section above.
2. In the upper right of the Cloud Manager console, click the Help icon, and select **Support**.



3. Click **Connector**.
4. Depending on how you need to send the information to NetApp support, choose one of the following options:
 - a. Select the option to download the AutoSupport message to your local machine. You can then send it to NetApp Support using a preferred method.
 - b. Click **Send AutoSupport** to directly send the message to NetApp Support.

The screenshot shows the 'Connector' tab of the Cloud Manager 'Support Dashboard'. The top navigation bar includes 'Cloud Manager', 'Account MyAccount', 'Workspace Newone', 'Connector ben-connector', and various service links. The 'Connector' tab is active, showing connector details: 'ben-connector' (Connector Name), '3.9.14 / 2745' (Version/Build), 'NetApp Company' (Company), 'syL1Kg' (Client ID), '58ced4e...' (System ID), and 'ip-192-168-0-27.ec2.internal' (Server Name). Below this, a section for 'Connector' shows status 'Active: Monday, 12:00' and a 'Send AutoSupport' button with two green callout bubbles labeled 'a' and 'b'. A note at the bottom states: 'Cloud Volumes ONTAP instances must have an outbound internet connection to send AutoSupport message' with a 'Send AutoSupport' link.

Apply security updates

Update the operating system on the Connector to ensure that it's patched with the latest security updates.

Steps

1. Access the CLI shell on the Connector host.
2. Run the following commands with elevated privileges:

```
sudo -s  
service service-manager stop  
yum -y update -security  
service service-manager start
```

Edit a Connector's URIs

Add and remove the URIs for a Connector.

Steps

1. Click the **Connector** drop-down from the Cloud Manager header.
2. Click **Manage Connectors**.
3. Click the action menu for a Connector and click **Edit URIs**.
4. Add and remove URIs and then click **Apply**.

Fix download failures when using a Google Cloud NAT gateway

The Connector automatically downloads software updates for Cloud Volumes ONTAP. The download can fail if your configuration uses a Google Cloud NAT gateway. You can correct this issue by limiting the number of parts that the software image is divided into. This step must be completed by using the Cloud Manager API.

Step

1. Submit a PUT request to `/occm/config` with the following JSON as body:

```
{  
  "maxDownloadSessions": 32  
}
```

The value for `maxDownloadSessions` can be 1 or any integer greater than 1. If the value is 1, then the downloaded image will not be divided.

Note that 32 is an example value. The value that you should use depends on your NAT configuration and the number of sessions that you can have simultaneously.

[Learn more about the `/occm/config` API call.](#)

Upgrade the Connector on-prem without internet access

If you [installed the Connector on an on-premises host that doesn't have internet access](#), you can upgrade the

Connector when a newer version is available from the NetApp Support Site.

The Connector needs to restart during the upgrade process so the user interface will be unavailable during the upgrade.

Steps

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

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

4. Run the installation script:

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

5. After the upgrade is complete, you can verify the Connector's version by going to **Help > Support > Connector**.

What about software upgrades on hosts that have internet access?

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

Remove Connectors from Cloud Manager

If a Connector is inactive, you can remove it from the list of Connectors in Cloud Manager. You might do this if you deleted the Connector virtual machine or if you uninstalled the Connector software.

Note the following about removing a Connector:

- This action doesn't delete the virtual machine.
- This action can't be reverted—once you remove a Connector from Cloud Manager, you can't add it back to Cloud Manager.

Steps

1. Click the **Connector** drop-down from the Cloud Manager header.
2. Click **Manage Connectors**.
3. Click the action menu for an inactive Connector and click **Remove Connector**.

Connector Name	Status	Cloud Provider	Region
Connector1	Active	aws	US East (N. Virginia)
Connector2	Inactive	aws	US East (N. Virginia)

Context menu options for Connector2:

- Go to Local UI ↗
- Connector Id: iEMkyjIEyG4U5fxpmpmsnZS... ⓘ
- Edit URIs
- Remove Connector** (highlighted)

4. Enter the name of the Connector to confirm and then click Remove.

Result

Cloud Manager removes the Connector from its records.

Uninstall the Connector software

Uninstall the Connector software to troubleshoot issues or to permanently remove the software from the host. The steps that you need to use depends on whether you installed the Connector on a host that has internet access or a host in a restricted network that doesn't have internet access.

Uninstall from a host with internet access

The online Connector includes an un-installation script that you can use to un-install the software.

Step

1. From the Linux host, run the un-installation script:

```
/opt/application/netapp/cloudmanager/bin/uninstall.sh [silent]
```

silent runs the script without prompting you for confirmation.

Uninstall from a host without internet access

Use these commands if you downloaded the Connector software from the NetApp Support Site and installed it in a restricted network that doesn't have internet access.

Step

1. From the Linux host, run the following commands:

```
docker-compose -f /opt/application/netapp/ds/docker-compose.yml down -v
rm -rf /opt/application/netapp/ds
```

Default configuration for the Connector

If you need to troubleshoot the Connector, it might help to understand how it's configured.

Default configuration with internet access

- If you deployed the Connector from Cloud Manager (or directly from a cloud provider's marketplace), note the following:

- In AWS, the user name for the EC2 Linux instance is ec2-user.
- The operating system for the image is as follows:
 - AWS: Red Hat Enterprise Linux 7.6 (HVM)
 - Azure: CentOS 7.6
 - GCP: CentOS 7.9

The operating system does not include a GUI. You must use a terminal to access the system.

- When deployed from Cloud Manager, the default system disk is as follows:

- AWS: 50 GiB gp2 disk
- Azure: 100 GiB premium SSD disk
- Google Cloud: 100 GiB SSD persistent disk

- The Connector installation folder resides in the following location:

/opt/application/netapp/cloudmanager

- Log files are contained in the following folders:

- /opt/application/netapp/cloudmanager/log

The logs in this folder provide details about the Connector and docker images.

- /opt/application/netapp/cloudmanager/docker_occm/data/log

The logs in this folder provide details about cloud services and the Cloud Manager service that runs on the Connector.

- The Cloud Manager service is named occm.
- The occm service is dependent on the MySQL service.

If the MySQL service is down, then the occm service is down too.

- Cloud Manager installs the following packages on the Linux host, if they are not already installed:

- 7Zip
- AWSCLI
- Docker
- Java
- Kubectl
- MySQL

- Tridentctl
- Pull
- Wget
- The Connector uses the following ports on the Linux host:
 - 80 for HTTP access
 - 443 for HTTPS access
 - 3306 for the Cloud Manager database
 - 8080 for the Cloud Manager API proxy
 - 8666 for the Service Manager API
 - 8777 for the Health-Checker Container Service API

Default configuration without internet access

The following configuration applies if you manually installed the Connector on an on-premises Linux host that doesn't have internet access. [Learn more about this installation option.](#)

- The Connector installation folder resides in the following location:

/opt/application/netapp/ds

- Log files are contained in the following folders:

/var/lib/docker/volumes/ds_occmdata/_data/log

The logs in this folder provide details about the Connector and docker images.

- All services are running inside docker containers

The services are dependent on the docker runtime service running

- The Connector uses the following ports on the Linux host:

- 80 for HTTP access
- 443 for HTTPS access

Manage cloud provider credentials

AWS

AWS credentials and permissions

Cloud Manager enables you to choose the AWS credentials to use when deploying Cloud Volumes ONTAP. You can deploy all of your Cloud Volumes ONTAP systems using the initial AWS credentials, or you can add additional credentials.

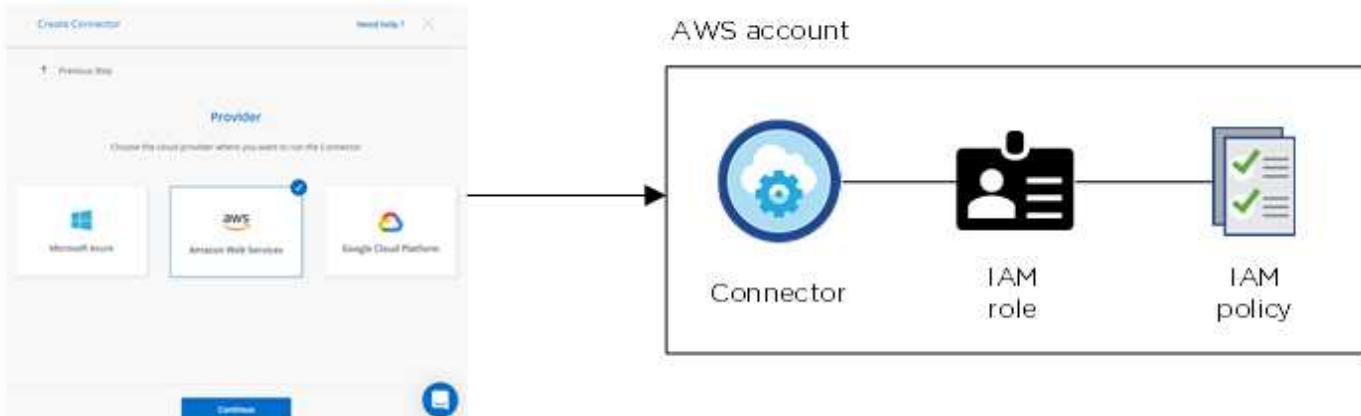
Initial AWS credentials

When you deploy a Connector from Cloud Manager, you need to use an AWS account that has permissions to launch the Connector instance. The required permissions are listed in the [Connector deployment policy for](#)

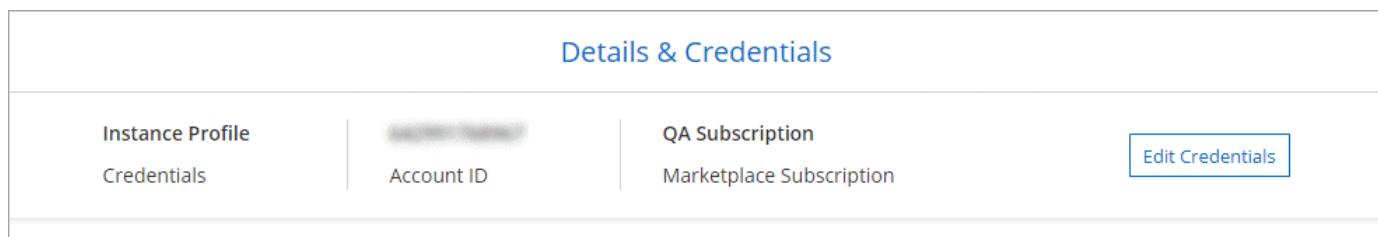
AWS

When Cloud Manager launches the Connector instance in AWS, it creates an IAM role and an instance profile for the instance. It also attaches a policy that provides Cloud Manager with permissions to manage resources and processes within that AWS account. [Review how Cloud Manager uses the permissions](#).

Cloud Manager

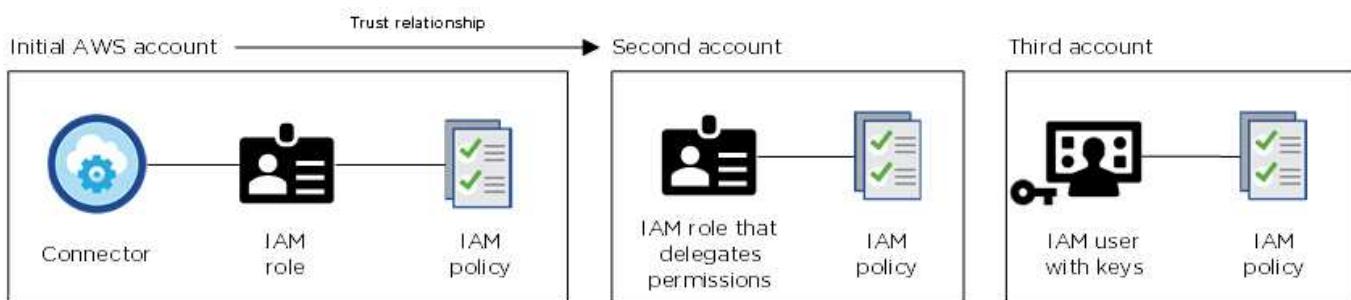


Cloud Manager selects these AWS credentials by default when you create a new working environment for Cloud Volumes ONTAP:



Additional AWS credentials

If you want to launch Cloud Volumes ONTAP in different AWS accounts, then you can either [provide AWS keys for an IAM user or the ARN of a role in a trusted account](#). The following image shows two additional accounts, one providing permissions through an IAM role in a trusted account and another through the AWS keys of an IAM user:



You would then [add the account credentials to Cloud Manager](#) by specifying the Amazon Resource Name (ARN) of the IAM role, or the AWS keys for the IAM user.

After you add another set of credentials, you can switch to them when creating a new working environment:

Edit Account & Add Subscription

Credentials

Keys | Account ID: [REDACTED]

Instance Profile | Account ID: [REDACTED]

● QA Subscription

Associate Subscription to Credentials

To create a pay-as-you-go Cloud Volumes ONTAP system, you need to select AWS credentials that are associated with a subscription to Cloud Volumes ONTAP from the AWS Marketplace.

[Add Subscription](#)

[Apply](#)

[Cancel](#)

What about Marketplace deployments and on-prem deployments?

The sections above describe the recommended deployment method for the Connector, which is from Cloud Manager. You can also deploy a Connector in AWS from the [AWS Marketplace](#) and you can [install the Connector on-premises](#).

If you use the Marketplace, permissions are provided in the same way. You just need to manually create and set up the IAM role, and then provide permissions for any additional accounts.

For on-premises deployments, you can't set up an IAM role for the Cloud Manager system, but you can provide permissions just like you would for additional AWS accounts.

How can I securely rotate my AWS credentials?

As described above, Cloud Manager enables you to provide AWS credentials in a few ways: an IAM role associated with the Connector instance, by assuming an IAM role in a trusted account, or by providing AWS

access keys.

With the first two options, Cloud Manager uses the AWS Security Token Service to obtain temporary credentials that rotate constantly. This process is the best practice—it's automatic and it's secure.

If you provide Cloud Manager with AWS access keys, you should rotate the keys by updating them in Cloud Manager at a regular interval. This is a completely manual process.

Manage AWS credentials and subscriptions for Cloud Manager

Add and manage AWS credentials so that Cloud Manager has the permissions that it needs to deploy and manage cloud resources in your AWS accounts. If you manage multiple AWS subscriptions, you can assign each one of them to different AWS credentials from the Credentials page.

Overview

You can add AWS credentials to an existing Connector or directly to Cloud Manager:

- Add AWS credentials to an existing Connector

Adding new AWS credentials to an existing Connector enables you to deploy Cloud Volumes ONTAP in another AWS account using the same Connector. [Learn how to add AWS credentials to a Connector](#).

- Add AWS credentials directly to Cloud Manager

Adding new AWS credentials to Cloud Manager enable you to create an FSx for ONTAP working environment. [Learn how to add AWS credentials to Cloud Manager](#).

How to rotate credentials

Cloud Manager enables you to provide AWS credentials in a few ways: an IAM role associated with the Connector instance, by assuming an IAM role in a trusted account, or by providing AWS access keys. [Learn more about AWS credentials and permissions](#).

With the first two options, Cloud Manager uses the AWS Security Token Service to obtain temporary credentials that rotate constantly. This process is the best practice because it's automatic and it's secure.

If you provide Cloud Manager with AWS access keys, you should rotate the keys by updating them in Cloud Manager at a regular interval. This is a completely manual process.

Add credentials to a Connector

Add AWS credentials to enable the Connector to deploy and manage Cloud Volumes ONTAP in other AWS accounts. You can either provide the ARN of an IAM role in another account or provide AWS access keys.

Grant permissions

Before you add additional AWS credentials to a Connector, you need to provide the required permissions. The permissions enable Cloud Manager to manage resources and processes within that AWS account. How you provide the permissions depends on whether you want to provide Cloud Manager with the ARN of a role in a trusted account or AWS keys.



When you deployed a Connector from Cloud Manager, Cloud Manager automatically added AWS credentials for the account in which you deployed the Connector. This initial account is not added if you manually installed the Connector software on an existing system. [Learn about AWS credentials and permissions](#).

Choices

- Grant permissions by assuming an IAM role in another account
- Grant permissions by providing AWS keys

Grant permissions by assuming an IAM role in another account

You can set up a trust relationship between the source AWS account in which you deployed the Connector instance and other AWS accounts by using IAM roles. You would then provide Cloud Manager with the ARN of the IAM roles from the trusted accounts.

Steps

1. Go to the IAM console in the target account where you want to deploy Cloud Volumes ONTAP.
2. Under Access Management, click **Roles > Create Role** and follow the steps to create the role.

Be sure to do the following:

- Under **Trusted entity type**, select **AWS account**.
 - Select **Another AWS account** and enter the ID of the account where the Connector instance resides.
 - Create a policy using the Cloud Manager IAM policy, which is available from the [Cloud Manager Policies page](#).
3. Copy the Role ARN of the IAM role so that you can paste it in Cloud Manager later on.

Result

The account now has the required permissions. [You can now add the credentials to a Connector](#).

Grant permissions by providing AWS keys

If you want to provide Cloud Manager with AWS keys for an IAM user, then you need to grant the required permissions to that user. The Cloud Manager IAM policy defines the AWS actions and resources that Cloud Manager is allowed to use.

Steps

1. Download the Cloud Manager IAM policy from the [Cloud Manager Policies page](#).
2. From the IAM console, create your own policy by copying and pasting the text from the Cloud Manager IAM policy.

[AWS Documentation: Creating IAM Policies](#)

3. Attach the policy to an IAM role or an IAM user.
 - [AWS Documentation: Creating IAM Roles](#)
 - [AWS Documentation: Adding and Removing IAM Policies](#)

Result

The account now has the required permissions. [You can now add the credentials to a Connector](#).

Add the credentials

After you provide an AWS account with the required permissions, you can add the credentials for that account to an existing Connector. This enables you to launch Cloud Volumes ONTAP systems in that account using the same Connector.

Before you get started

If you just created these credentials in your cloud provider, it might take a few minutes until they are available for use. Wait a few minutes before you add the credentials to Cloud Manager.

Steps

1. Ensure that the correct Connector is currently selected in Cloud Manager.
2. In the upper right of the Cloud Manager console, click the Settings icon, and select **Credentials**.



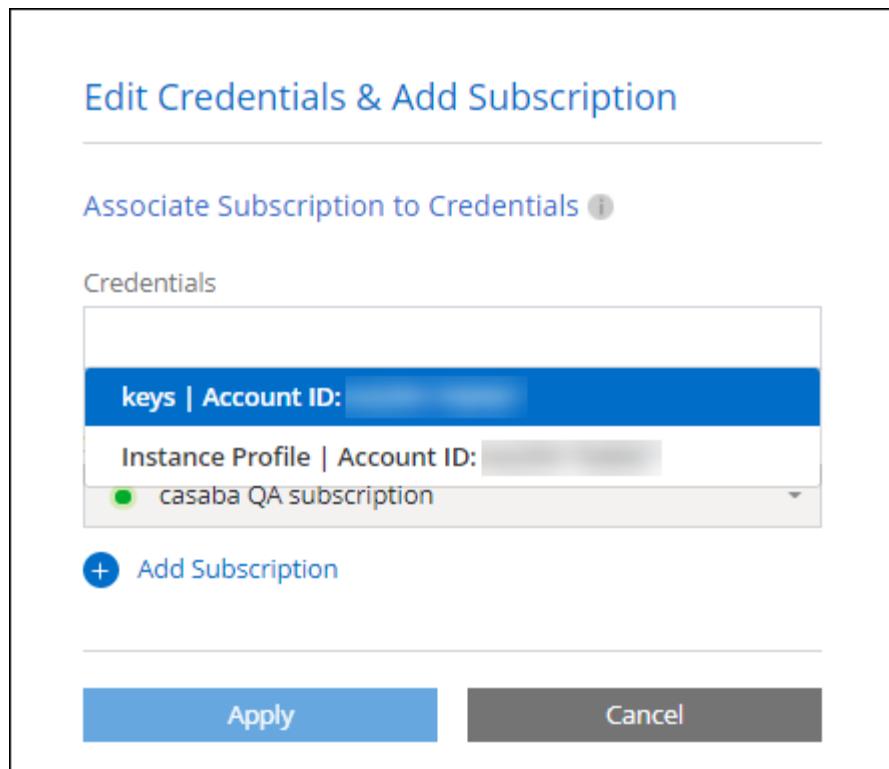
3. Click **Add Credentials** and follow the steps in the wizard.
 - a. **Credentials Location:** Select **Amazon Web Services > Connector**.
 - b. **Define Credentials:** Provide the ARN (Amazon Resource Name) of a trusted IAM role, or enter an AWS access key and secret key.
 - c. **Marketplace Subscription:** Associate a Marketplace subscription with these credentials by subscribing now or by selecting an existing subscription.

To pay for Cloud Volumes ONTAP at an hourly rate (PAYGO) or with an annual contract, AWS credentials must be associated with a subscription to Cloud Volumes ONTAP from the AWS Marketplace.

- d. **Review:** Confirm the details about the new credentials and click **Add**.

Result

You can now switch to a different set of credentials from the Details and Credentials page when creating a new working environment:



Add credentials to Cloud Manager

Add AWS credentials to Cloud Manager by providing the ARN of an IAM role that gives Cloud Manager the permissions needed to create an FSx for ONTAP working environment.

Set up the IAM role

Set up an IAM role that enables the Cloud Manager SaaS to assume the role.

Steps

1. Go to the IAM console in the target account.
2. Under Access Management, click **Roles > Create Role** and follow the steps to create the role.

Be sure to do the following:

- Under **Trusted entity type**, select **AWS account**.
- Select **Another AWS account** and enter the ID of the Cloud Manager SaaS: 733004784675
- Create a policy that includes the following permissions:

```

{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Sid": "VisualEditor0",
            "Effect": "Allow",
            "Action": [
                "fsx:*",
                "ec2:Describe*",
                "ec2:CreateTags",
                "kms:Describe*",
                "kms>List*",
                "iam>CreateServiceLinkedRole"
            ],
            "Resource": "*"
        }
    ]
}

```

3. Copy the Role ARN of the IAM role so that you can paste it in Cloud Manager in the next step.

Result

The IAM role now has the required permissions. [You can now add it to Cloud Manager.](#)

Add the credentials

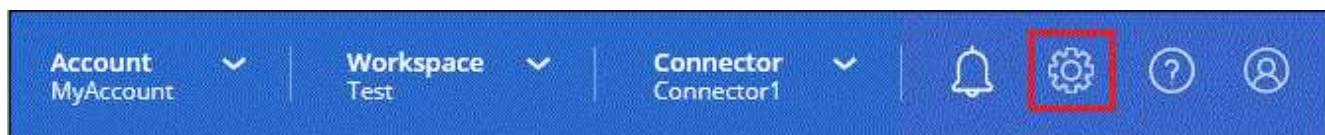
After you provide the IAM role with the required permissions, add the role ARN to Cloud Manager.

Before you get started

If you just created the IAM role, it might take a few minutes until they are available for use. Wait a few minutes before you add the credentials to Cloud Manager.

Steps

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



2. Click **Add Credentials** and follow the steps in the wizard.

- Credentials Location:** Select **Amazon Web Services > Cloud Manager**.
- Define Credentials:** Provide the ARN (Amazon Resource Name) of the IAM role.
- Review:** Confirm the details about the new credentials and click **Add**.

Result

You can now use the credentials when creating an FSx for ONTAP working environment.

Associate an AWS subscription

After you add your AWS credentials to Cloud Manager, you can associate an AWS Marketplace subscription with those credentials. The subscription enables you to pay for Cloud Volumes ONTAP at an hourly rate (PAYGO) or using an annual contract, and to use other NetApp cloud services.

There are two scenarios in which you might associate an AWS Marketplace subscription after you've already added the credentials to Cloud Manager:

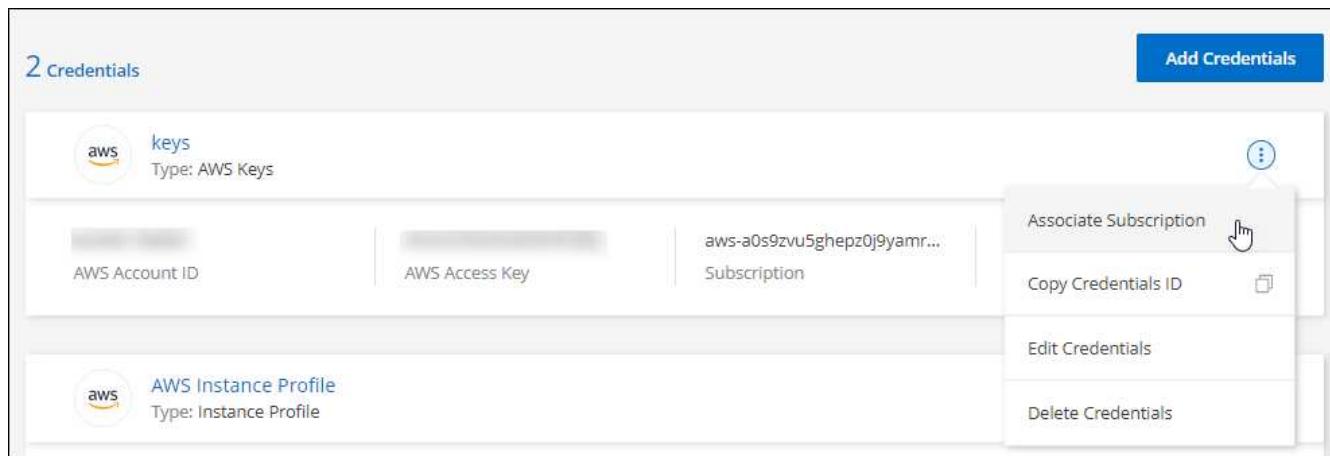
- You didn't associate a subscription when you initially added the credentials to Cloud Manager.
- You want to replace an existing AWS Marketplace subscription with a new subscription.

What you'll need

You need to create a Connector before you can change Cloud Manager settings. [Learn how to create a Connector](#).

Steps

1. In the upper right of the Cloud Manager console, click the Settings icon, and select **Credentials**.
2. Click the action menu for a set of credentials and then select **Associate Subscription**.



3. Select an existing subscription from the down-down list or click **Add Subscription** and follow the steps to create a new subscription.

► https://docs.netapp.com/us-en/occm//media/video_subscribing_aws.mp4 (video)

Edit credentials

Edit your AWS credentials in Cloud Manager by changing the account type (AWS keys or assume role), by editing the name, or by updating the credentials themselves (the keys or the role ARN).



You can't edit the credentials for an instance profile that is associated with a Connector instance.

Steps

1. In the upper right of the Cloud Manager console, click the Settings icon, and select **Credentials**.
2. Click the action menu for a set of credentials and then select **Edit Credentials**.
3. Make the required changes and then click **Apply**.

Deleting credentials

If you no longer need a set of credentials, you can delete them from Cloud Manager. You can only delete credentials that aren't associated with a working environment.



You can't delete the credentials for an instance profile that is associated with a Connector instance.

Steps

1. In the upper right of the Cloud Manager console, click the Settings icon, and select **Credentials**.
2. Click the action menu for a set of credentials and then select **Delete Credentials**.
3. Click **Delete** to confirm.

Azure

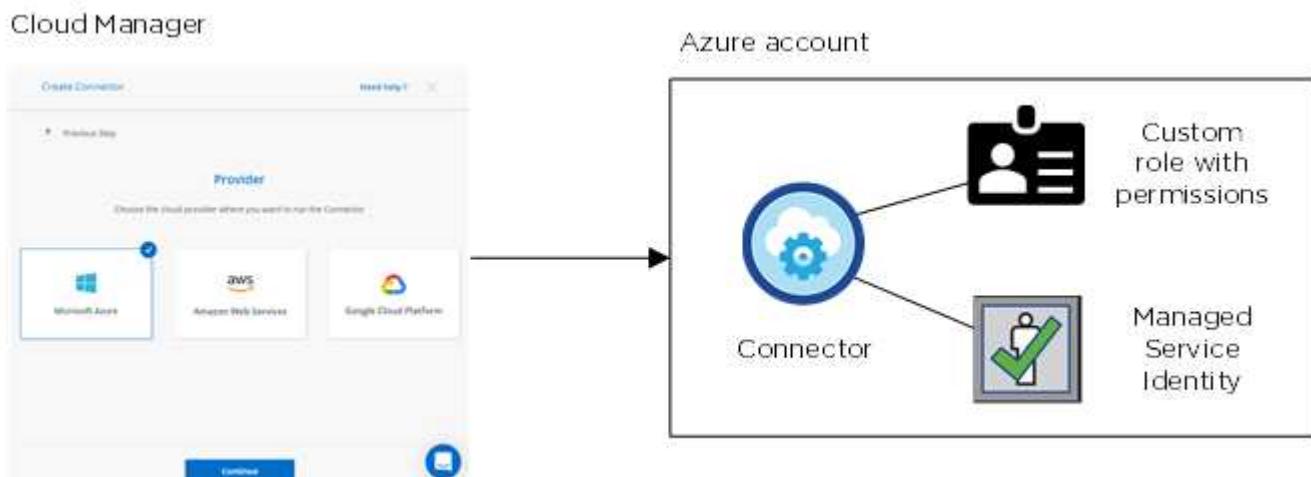
Azure credentials and permissions

Cloud Manager enables you to choose the Azure credentials to use when deploying Cloud Volumes ONTAP. You can deploy all of your Cloud Volumes ONTAP systems using the initial Azure credentials, or you can add additional credentials.

Initial Azure credentials

When you deploy a Connector from Cloud Manager, you need to use an Azure account or service principal that has permissions to deploy the Connector virtual machine. The required permissions are listed in the [Connector deployment policy for Azure](#).

When Cloud Manager deploys the Connector virtual machine in Azure, it enables a [system-assigned managed identity](#) on virtual machine, creates a custom role, and assigns it to the virtual machine. The role provides Cloud Manager with permissions to manage resources and processes within that Azure subscription. [Review how Cloud Manager uses the permissions](#).



Cloud Manager selects these Azure credentials by default when you create a new working environment for Cloud Volumes ONTAP:

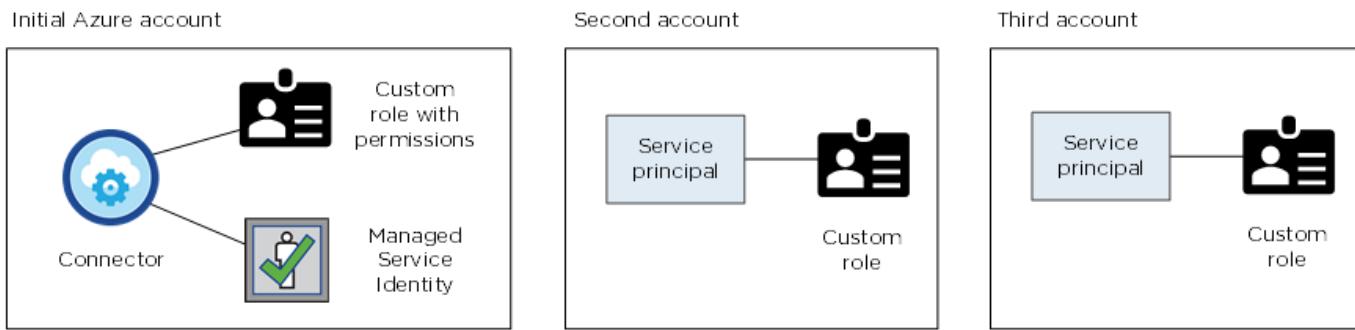
Details & Credentials			
Managed Service Ide...	OCCM QA1	 ⓘ No subscription is associated	Edit Credentials
Credential Name	Azure Subscription	Marketplace Subscription	

Additional Azure subscriptions for a managed identity

The managed identity is associated with the subscription in which you launched the Connector. If you want to select a different Azure subscription, then you need to [associate the managed identity with those subscriptions](#).

Additional Azure credentials

If you want to deploy Cloud Volumes ONTAP using different Azure credentials, then you must grant the required permissions by [creating and setting up a service principal in Azure Active Directory](#) for each Azure account. The following image shows two additional accounts, each set up with a service principal and custom role that provides permissions:



You would then [add the account credentials to Cloud Manager](#) by providing details about the AD service principal.

After you add another set of credentials, you can switch to them when creating a new working environment:

Edit Account & Add Subscription

Credentials

cloud-manager-app | Application ID: 57c42424-88a0-480a.

Managed Service Identity

OCCM QA1 (Default)

What about Marketplace deployments and on-prem deployments?

The sections above describe the recommended deployment method for the Connector, which is from NetApp Cloud Central. You can also deploy a Connector in Azure from the [Azure Marketplace](#), and you can [install the Connector on-premises](#).

If you use the Marketplace, permissions are provided in the same way. You just need to manually create and set up the managed identity for the Connector, and then provide permissions for any additional accounts.

For on-premises deployments, you can't set up a managed identity for the Connector, but you can provide permissions just like you would for additional accounts by using a service principal.

Managing Azure credentials and subscriptions for Cloud Manager

When you create a Cloud Volumes ONTAP system, you need to select the Azure credentials to use with that system. You also need to choose a Marketplace subscription, if you're using pay-as-you-go licensing. Follow the steps on this page if you need to use multiple Azure credentials or multiple Azure Marketplace subscriptions for Cloud Volumes ONTAP.

There are two ways to add additional Azure subscriptions and credentials in Cloud Manager.

1. Associate additional Azure subscriptions with the Azure managed identity.
2. If you want to deploy Cloud Volumes ONTAP using different Azure credentials, grant Azure permissions using a service principal and add its credentials to Cloud Manager.

Associating additional Azure subscriptions with a managed identity

Cloud Manager enables you to choose the Azure credentials and Azure subscription in which you want to deploy Cloud Volumes ONTAP. You can't select a different Azure subscription for the managed identity profile unless you associate the [managed identity](#) with those subscriptions.

About this task

A managed identity is [the initial Azure account](#) when you deploy a Connector from Cloud Manager. When you deployed the Connector, Cloud Manager created the Cloud Manager Operator role and assigned it to the Connector virtual machine.

Steps

1. Log in to the Azure portal.
2. Open the **Subscriptions** service and then select the subscription in which you want to deploy Cloud Volumes ONTAP.
3. Click **Access control (IAM)**.
 - a. Click **Add > Add role assignment** and then add the permissions:
 - Select the **Cloud Manager Operator** role.

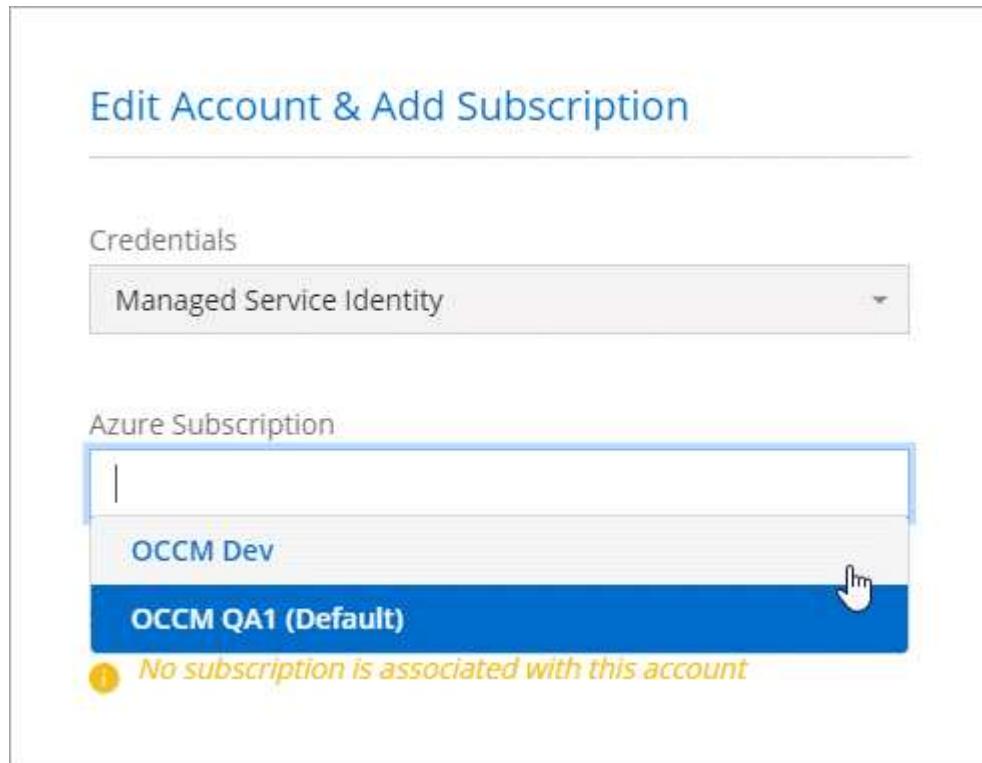


Cloud Manager Operator is the default name provided in the [Cloud Manager policy](#). If you chose a different name for the role, then select that name instead.

- Assign access to a **Virtual Machine**.
 - Select the subscription in which the Connector virtual machine was created.
 - Select the Connector virtual machine.
 - Click **Save**.
4. Repeat these steps for additional subscriptions.

Result

When you create a new working environment, you should now have the ability to select from multiple Azure subscriptions for the managed identity profile.



Adding additional Azure credentials to Cloud Manager

When you deploy a Connector from Cloud Manager, Cloud Manager enables a system-assigned managed identity on the virtual machine that has the required permissions. Cloud Manager selects these Azure credentials by default when you create a new working environment for Cloud Volumes ONTAP.



An initial set of credentials isn't added if you manually installed the Connector software on an existing system. [Learn about Azure credentials and permissions](#).

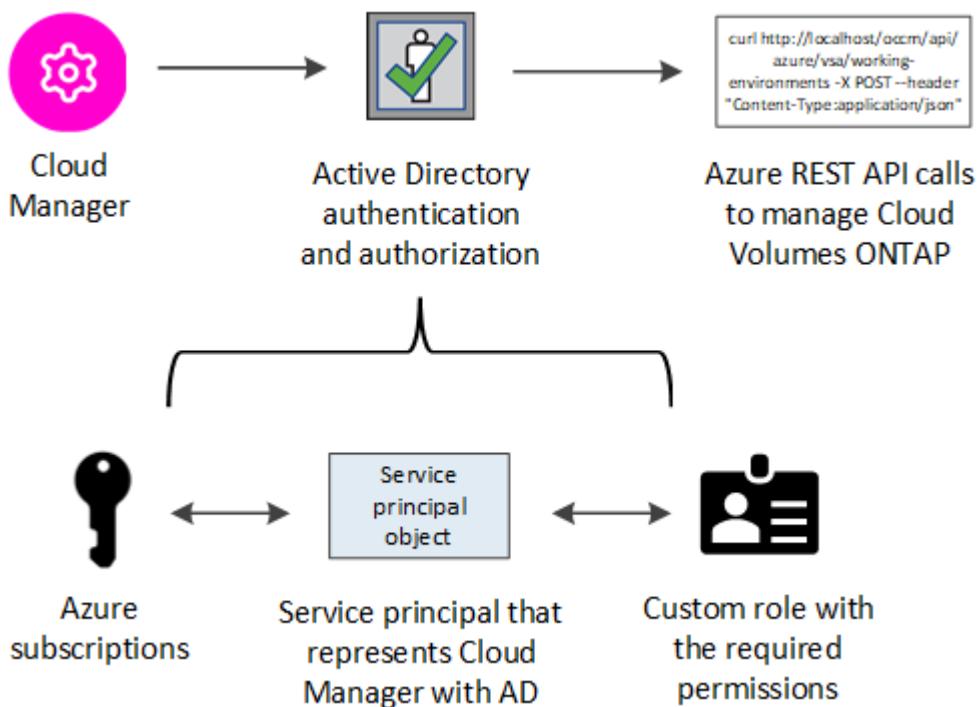
If you want to deploy Cloud Volumes ONTAP using *different* Azure credentials, then you must grant the required permissions by creating and setting up a service principal in Azure Active Directory for each Azure account. You can then add the new credentials to Cloud Manager.

Granting Azure permissions using a service principal

Cloud Manager needs permissions to perform actions in Azure. You can grant the required permissions to an Azure account by creating and setting up a service principal in Azure Active Directory and by obtaining the Azure credentials that Cloud Manager needs.

About this task

The following image depicts how Cloud Manager obtains permissions to perform operations in Azure. A service principal object, which is tied to one or more Azure subscriptions, represents Cloud Manager in Azure Active Directory and is assigned to a custom role that allows the required permissions.



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.](#)

Creating an Azure Active Directory application

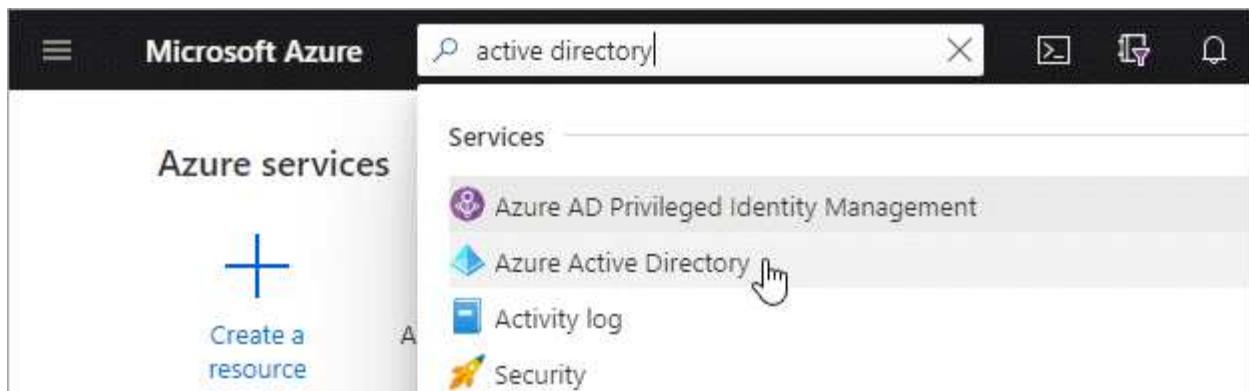
Create an Azure Active Directory (AD) application and service principal that Cloud Manager can use for role-based access control.

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.

Assigning the application to a role

You must bind the service principal to one or more Azure subscriptions and assign it the custom "OnCommand Cloud Manager Operator" role so Cloud Manager has permissions in Azure.

Steps

1. Download the [Cloud Manager Azure policy](#).



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

2. 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

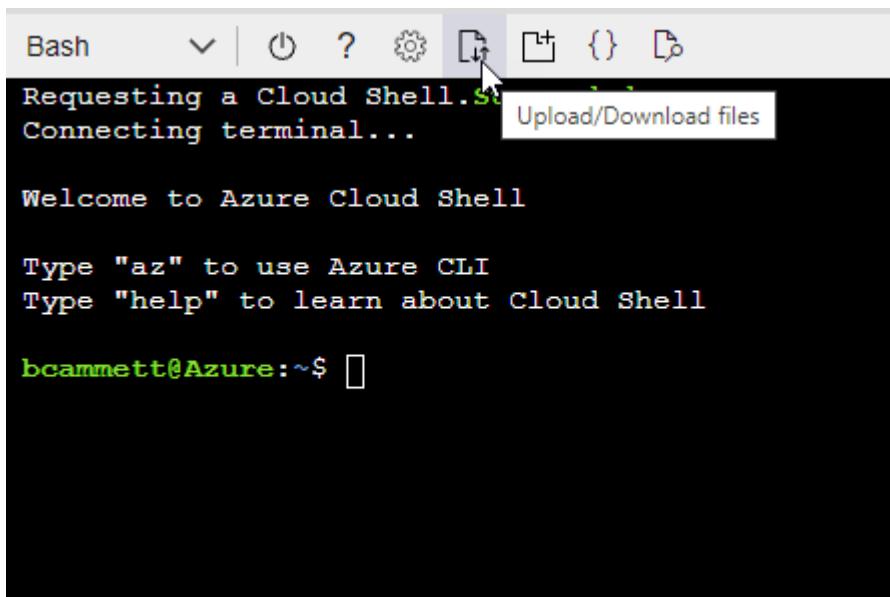
```
"AssignableScopes": [  
  "/subscriptions/d333af45-0d07-4154-943d-c25fbzzzzzz",  
  "/subscriptions/54b91999-b3e6-4599-908e-416e0zzzzzz",  
  "/subscriptions/398e471c-3b42-4ae7-9b59-ce5bbzzzzzz"
```

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.



The screenshot shows the Azure Cloud Shell interface in Bash mode. At the top, there's a toolbar with icons for power, help, settings, and file operations. The central terminal window displays the following text:

```
Bash | ⚡ ? 🛡 { } 🔍
Requesting a Cloud Shell...
Connecting terminal...

Welcome to Azure Cloud Shell

Type "az" to use Azure CLI
Type "help" to learn about Cloud Shell

bcammett@Azure:~$
```

A mouse cursor is hovering over the file upload/download icon in the toolbar, which has a tooltip labeled "Upload/Download files".

c. Enter the following Azure CLI command:

```
az role definition create --role-definition
Policy_for_Cloud_Manager_Azure_3.9.8.json
```

You should now have a custom role called *Cloud Manager Operator*.

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

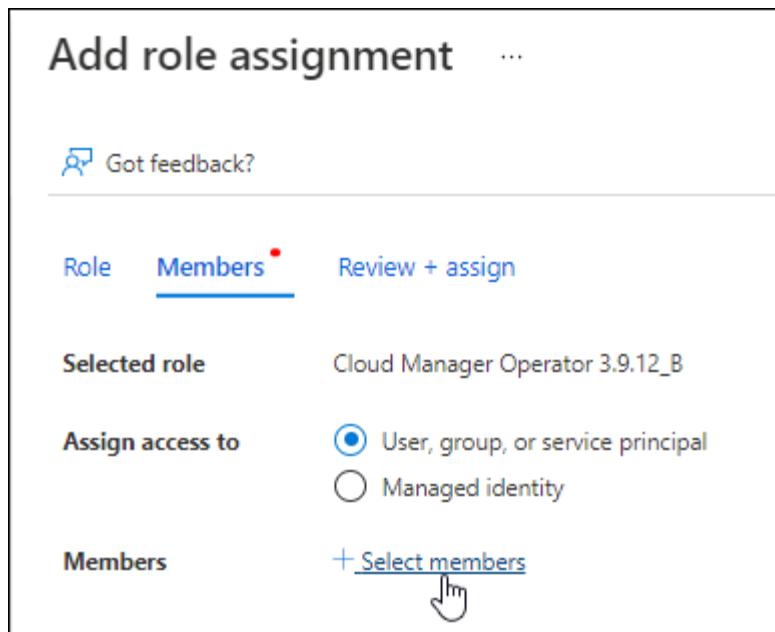
Got feedback?

Role **Members** * Review + assign

Selected role Cloud Manager Operator 3.9.12_B

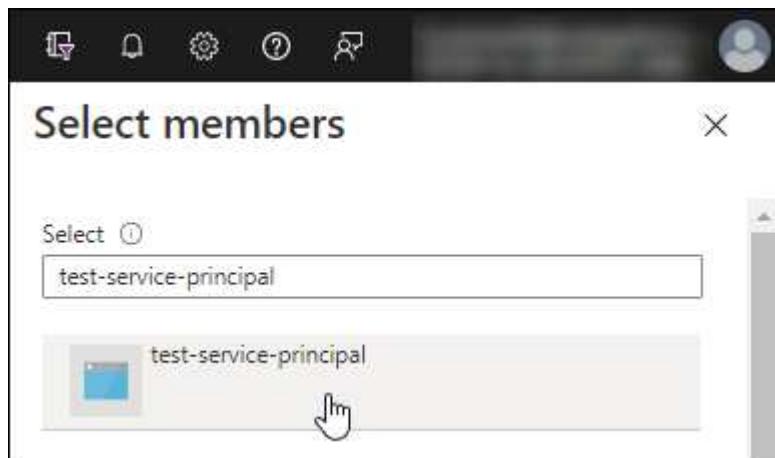
Assign access to User, group, or service principal Managed identity

Members [+ Select members](#)



- Search for the name of the application.

Here's an example:



- Select the application and click **Select**.
 - Click **Next**.
- f. Click **Review + assign**.

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

If you want to deploy Cloud Volumes ONTAP from multiple Azure subscriptions, then you must bind the service principal to each of those subscriptions. Cloud Manager enables you to select the subscription that you want to use when deploying Cloud Volumes ONTAP.

Adding 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

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

Request API permissions

[All APIs](#)



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)	-

Getting the application ID and directory ID

When you add the Azure account to 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**.

The screenshot shows the Azure App Registrations page. At the top, there are 'Delete' and 'Endpoints' buttons. Below that is a message: 'Welcome to the new and improved App registrations. Looking to learn'. The main area displays the following details for a registration named 'test-service-principal':

Display name	: test-service-principal
Application (client) ID	: 73de25f9-99be-4ae0-8b24-538ca787a6b3
Directory (tenant) ID	: 4b0911a0-929b-4715-944b-c03745165b3a
Object ID	: b37489a9-379f-49c2-b27c-e630514106a5

Creating 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.



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 add an Azure account.

Adding the credentials to Cloud Manager

After you provide an Azure account with the required permissions, you can add the credentials for that account to Cloud Manager. Completing this step enables you to launch Cloud Volumes ONTAP using different Azure credentials.

Before you get started

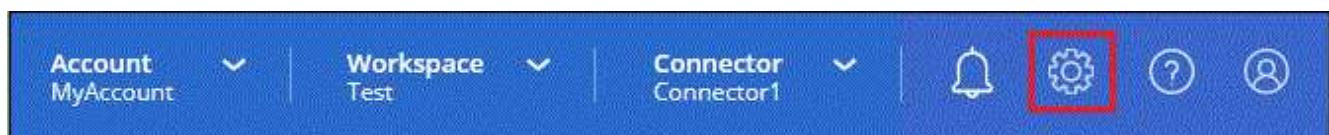
If you just created these credentials in your cloud provider, it might take a few minutes until they are available for use. Wait a few minutes before you add the credentials to Cloud Manager.

What you'll need

You need to create a Connector before you can change Cloud Manager settings. [Learn how](#).

Steps

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



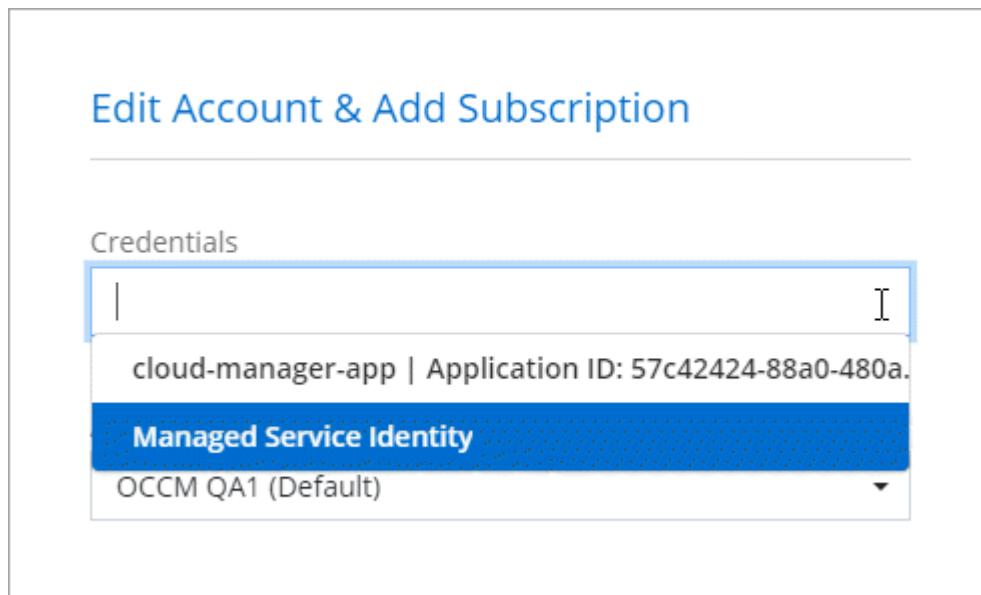
2. Click **Add Credentials** and follow the steps in the wizard.
 - a. **Credentials Location:** Select **Microsoft Azure > Connector**.
 - b. **Define Credentials:** Enter information about the Azure Active Directory service principal that grants the required permissions:
 - Application (client) ID: See [\[Getting the application ID and directory ID\]](#).
 - Directory (tenant) ID: See [\[Getting the application ID and directory ID\]](#).
 - Client Secret: See [Creating a client secret](#).
 - c. **Marketplace Subscription:** Associate a Marketplace subscription with these credentials by subscribing now or by selecting an existing subscription.

To pay for Cloud Volumes ONTAP at an hourly rate (PAYGO), these Azure credentials must be associated with a subscription from the Azure Marketplace.

- d. **Review:** Confirm the details about the new credentials and click **Add**.

Result

You can now switch to different set of credentials from the Details and Credentials page [when creating a new working environment](#):



Manage existing credentials

Manage the Azure credentials that you've already added to Cloud Manager by associating a Marketplace subscription, editing credentials, and deleting them.

Associating an Azure Marketplace subscription to credentials

After you add your Azure credentials to Cloud Manager, you can associate an Azure Marketplace subscription to those credentials. The subscription enables you to create a pay-as-you-go Cloud Volumes ONTAP system, and to use other NetApp cloud services.

There are two scenarios in which you might associate an Azure Marketplace subscription after you've already added the credentials to Cloud Manager:

- You didn't associate a subscription when you initially added the credentials to Cloud Manager.
- You want to replace an existing Azure Marketplace subscription with a new subscription.

What you'll need

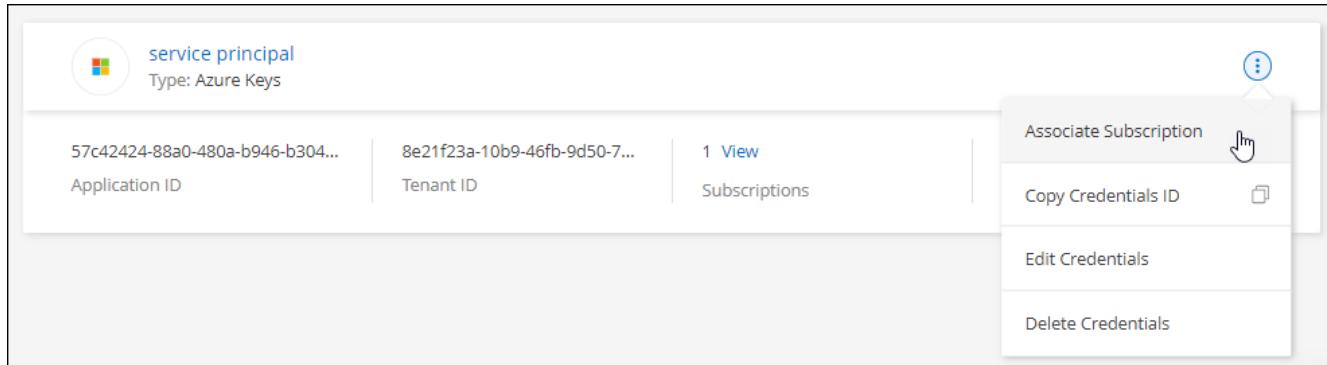
You need to create a Connector before you can change Cloud Manager settings. [Learn how](#).

Steps

1. Select an existing subscription from the down-down list or click **Add Subscription** and follow the steps to create a new subscription.

- ▶ https://docs.netapp.com/us-en/occm//media/video_subscribing_aws.mp4 (video)

2. In the upper right of the Cloud Manager console, click the Settings icon, and select **Credentials**.
3. Click the action menu for a set of credentials and then select **Associate Subscription**.



4. Select a subscription from the down-down list or click **Add Subscription** and follow the steps to create a new subscription.

The following video starts from the context of the working environment wizard, but shows you the same workflow after you click **Add Subscription**:

► https://docs.netapp.com/us-en/occm//media/video_subscribing_azure.mp4 (video)

Editing credentials

Edit your Azure credentials in Cloud Manager by modifying the details about your Azure service credentials. For example, you might need to update the client secret if a new secret was created for the service principal application.

Steps

1. In the upper right of the Cloud Manager console, click the Settings icon, and select **Credentials**.
2. Click the action menu for a set of credentials and then select **Edit Credentials**.
3. Make the required changes and then click **Apply**.

Deleting credentials

If you no longer need a set of credentials, you can delete them from Cloud Manager. You can only delete credentials that aren't associated with a working environment.

Steps

1. In the upper right of the Cloud Manager console, click the Settings icon, and select **Credentials**.
2. Click the action menu for a set of credentials and then select **Delete Credentials**.
3. Click **Delete** to confirm.

GCP

Google Cloud projects, permissions, and accounts

A service account provides Cloud Manager with permissions to deploy and manage Cloud Volumes ONTAP systems that are in the same project as the Connector, or in different projects.

Project and permissions for Cloud Manager

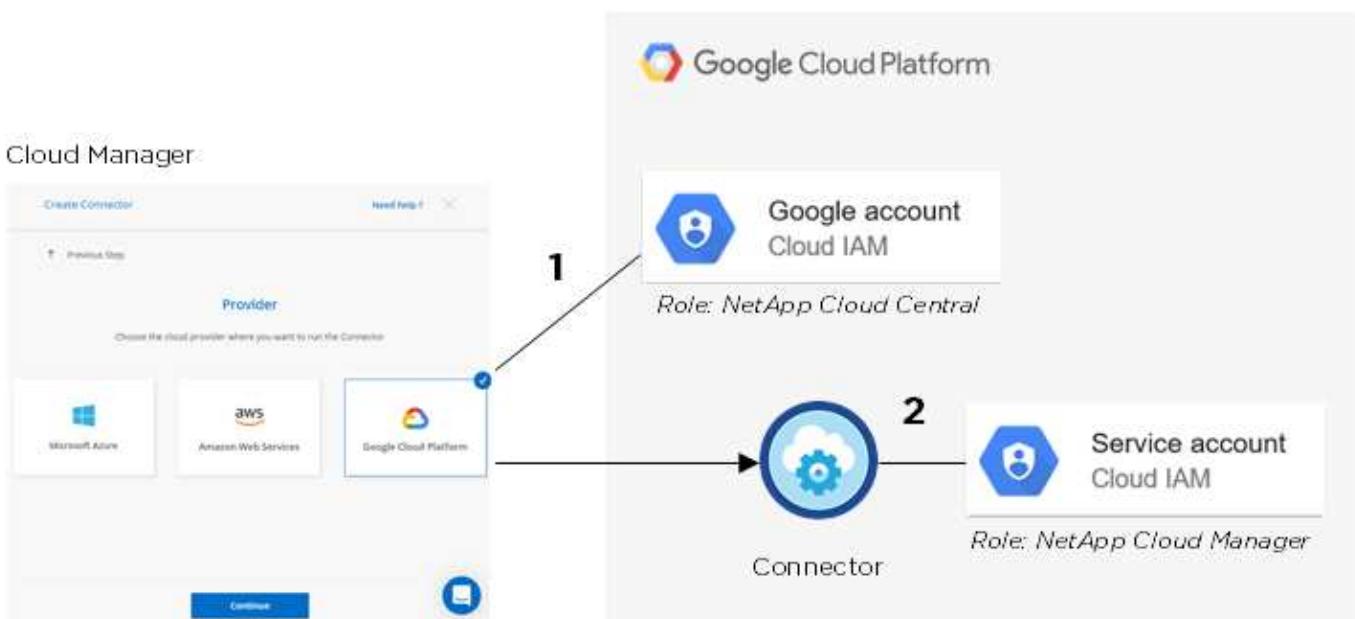
Before you can deploy Cloud Volumes ONTAP in Google Cloud, you must first deploy a Connector in a Google Cloud project. The Connector can't be running on your premises, or in a different cloud provider.

Two sets of permissions must be in place before you deploy a Connector directly from Cloud Manager:

1. You need to deploy a Connector using a Google account that has permissions to launch the Connector VM instance from Cloud Manager.
2. When deploying the Connector, you are prompted to select a [service account](#) for the VM instance. Cloud Manager gets permissions from the service account to create and manage Cloud Volumes ONTAP systems on your behalf. Permissions are provided by attaching a custom role to the service account.

We have set up two YAML files that include the required permissions for the user and the service account. [Learn how to use the YAML files to set up permissions](#).

The following image depicts the permission requirements described in numbers 1 and 2 above:



Project for Cloud Volumes ONTAP

Cloud Volumes ONTAP can reside in the same project as the Connector, or in a different project. To deploy Cloud Volumes ONTAP in a different project, you need to first add the Connector service account and role to that project.

- [Learn how to set up service account \(see step 2\).](#)
- [Learn how to deploy Cloud Volumes ONTAP in GCP and select a project.](#)

Account for data tiering



Cloud Manager requires a GCP account for Cloud Volumes ONTAP 9.6, but not for 9.7 and later. If you want to use data tiering with Cloud Volumes ONTAP 9.7 or later, then follow step 4 in [Getting started with Cloud Volumes ONTAP in Google Cloud Platform](#).

Adding a Google Cloud account to Cloud Manager is required to enable data tiering on a Cloud Volumes ONTAP 9.6 system. Data tiering automatically tiers cold data to low-cost object storage, enabling you to

reclaim space on your primary storage and shrink secondary storage.

When you add the account, you need to provide Cloud Manager with a storage access key for a service account that has Storage Admin permissions. Cloud Manager uses the access keys to set up and manage a Cloud Storage bucket for data tiering.

After you add a Google Cloud account, you can then enable data tiering on individual volumes when you create, modify, or replicate them.

- [Learn how to set up and add GCP accounts to Cloud Manager](#).
- [Learn how to tier inactive data to low-cost object storage](#).

Managing GCP credentials and subscriptions for Cloud Manager

You can manage two types of Google Cloud Platform credentials from Cloud Manager: the credentials that are associated with the Connector VM instance and storage access keys used with a Cloud Volumes ONTAP 9.6 system for [data tiering](#).

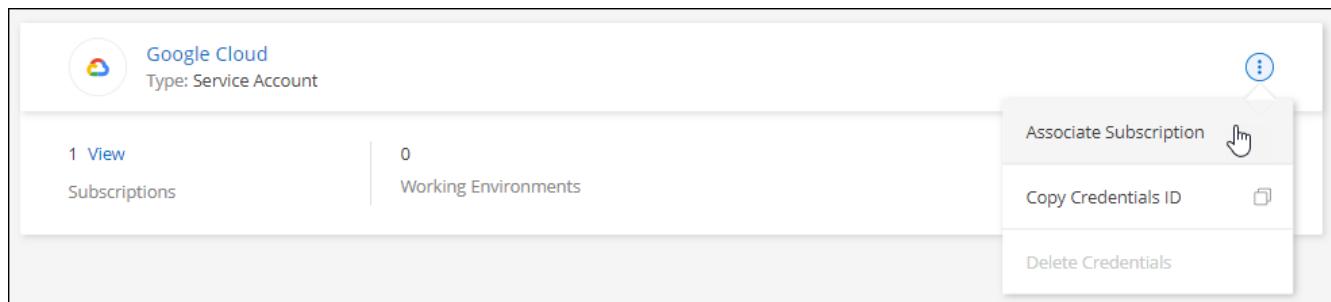
Associating a Marketplace subscription with GCP credentials

When you deploy a Connector in GCP, Cloud Manager creates a default set of credentials that are associated with the Connector VM instance. These are the credentials that Cloud Manager uses to deploy Cloud Volumes ONTAP.

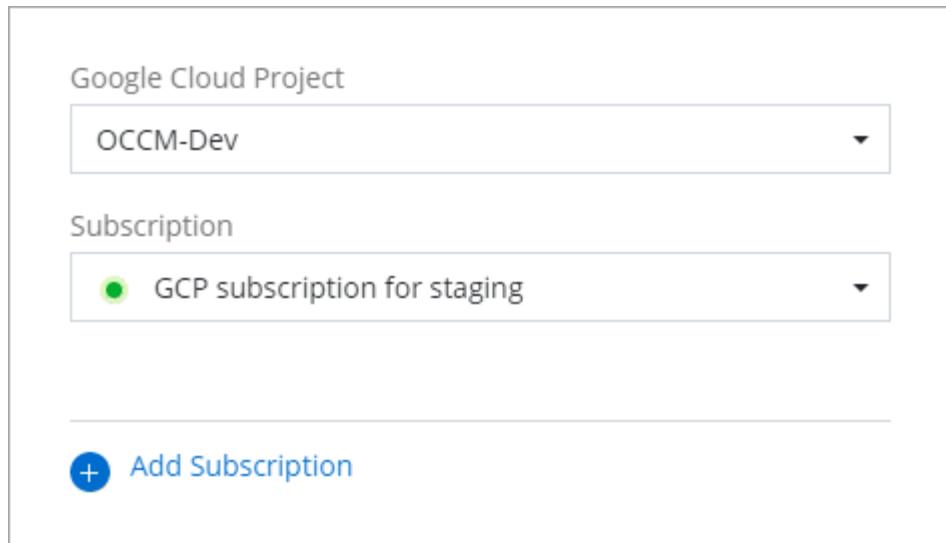
At any time, you can change the Marketplace subscription that's associated with these credentials. The subscription enables you to create a pay-as-you-go Cloud Volumes ONTAP system, and to use other NetApp cloud services.

Steps

1. In the upper right of the Cloud Manager console, click the Settings icon, and select **Credentials**.
2. Click the action menu for a set of credentials and then select **Associate Subscription**.



3. Select a Google Cloud project and subscription from the down-down list.



4. Click **Associate**.
5. If you don't already have a subscription, click **Add Subscription** and follow the steps to create a new subscription below.



Before you complete the following steps, ensure that you have both Billing Admin privileges in your Google Cloud account as well as a NetApp Cloud Central login.

6. Review the subscription steps and click **Continue**.

Add Subscription

Subscription Steps:

1 Cloud Manager

Clicking **Continue** to create your subscription from the Google Cloud Marketplace.

2 Google Cloud Marketplace

Subscribe and then click **Register With NetApp** to configure your account from Cloud Central.

3 Cloud Central

Save your subscription.

4 Cloud Manager

Associate the Marketplace subscription with your Google Cloud project.



[View video instructions](#)

[Continue](#)

[Cancel](#)

7. After you're redirected to the [NetApp Cloud Manager page](#) on the Google Cloud Marketplace, ensure that the correct project is selected at the top navigation menu.



Cloud Manager for Cloud Volumes ONTAP

NetApp, Inc.

Enterprise-grade data management and protection

[SUBSCRIBE](#)[OVERVIEW](#)[PRICING](#)[SUPPORT](#)

Overview

Cloud Volumes ONTAP is a data-management layer that runs natively on Google Cloud infrastructure enabling enhanced control, data protection, mobility and agility for business application data. Get consistent enterprise-grade storage across your hybrid cloud platforms with built-in disaster recovery, backup and ransomware protection. Seamlessly migrate enterprise applications without reengineering. Create company-wide file shares with simultaneous NFS and CIFS/SMB access and iSCSI block storage for GCE instances with scalability up to 368TB. Automate persistent storage provisioning for your Kubernetes clusters. Accelerate CI/CD cycles with instant, zero-capacity data replication. Reduce storage costs by 70% with advanced storage efficiencies. Cloud Manager is the console used to deploy, manage and automate Cloud Volumes ONTAP instances across the hybrid multi-cloud.

[Learn more](#)

Additional details

Type: [APIs & services](#)

Last updated: 3/26/21

Category: [Storage](#)

Runs on: NetApp, Inc. Cloud Servers

8. Click **Subscribe**.

9. Select the appropriate billing account and agree to the terms and conditions.

2. Purchase details

Select a billing account *

3. Terms

Cancellation and change policy

- Usage fee is billed every month.
- You can cancel the service at any time and it will take effect immediately. You will be billed by the amount you used for that month.

Additional terms

I understand this subscription will be automatically renewed at the end of the current term.

I authorize Google LLC and its affiliates ("Google") to share my purchase, usage, operational (e.g., project lifecycle events), support ticket, and account information with NetApp, Inc., its affiliates and subcontractors, for the purposes of providing the service, sales attribution, and technical support. I represent that I have the authority to bind my company.

By deploying the software or accessing the service you are agreeing to comply with the [End User License Agreement](#), [GCP Marketplace Terms of Service](#), and the terms of applicable open source software licenses bundled with the software or service. Please review these terms and licenses carefully for details about any obligations you may have related to the software or service. To the limited extent an open source software license related to the software or service expressly supersedes the GCP Marketplace Terms of Service, that open source software license governs your use of that software or service.

By using this product, you understand that certain account and usage information may be shared with NetApp, Inc. for the purposes of financial accounting, sales attribution, performance analysis, and support. [?](#)

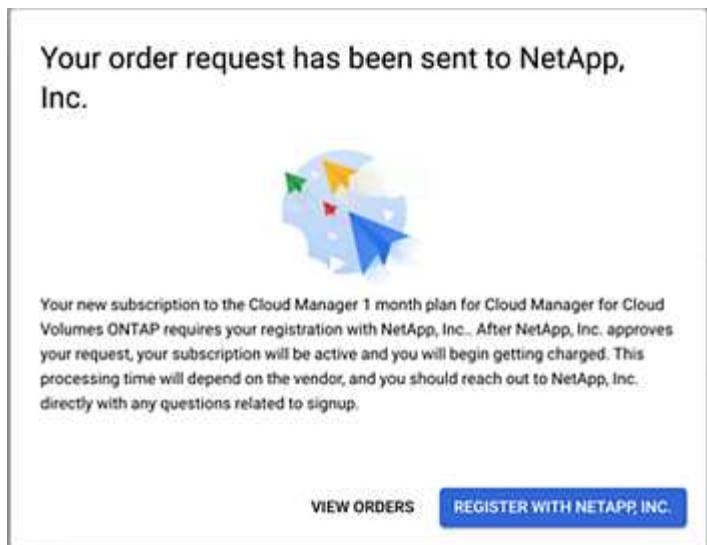
Google is providing this software or service "as-is" and any support for this software or service will be provided by NetApp, Inc. under their terms of service.

SUBSCRIBE

10. Click **Subscribe**.

This step sends your transfer request to NetApp.

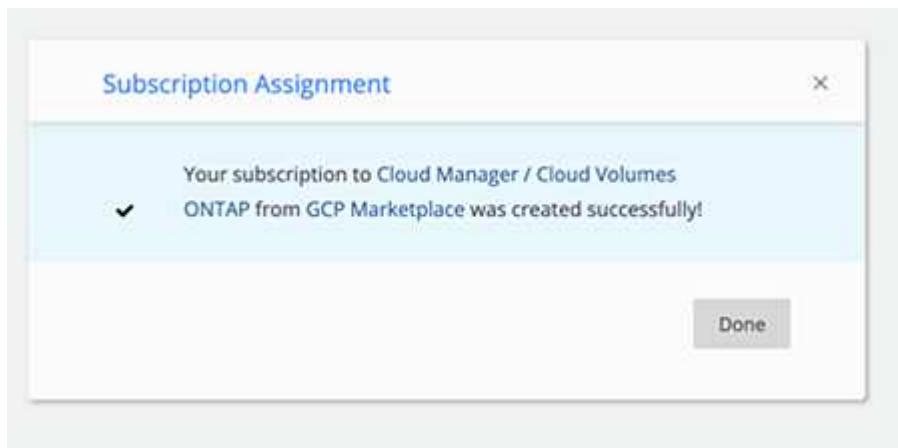
11. On the pop-up dialog box, click **Register with NetApp, Inc.** to be redirected to NetApp Cloud Central.



i This step must be completed to link the GCP subscription to your NetApp account. The process of linking a subscription isn't complete until you are redirected from this page and then sign in to NetApp Cloud Central.

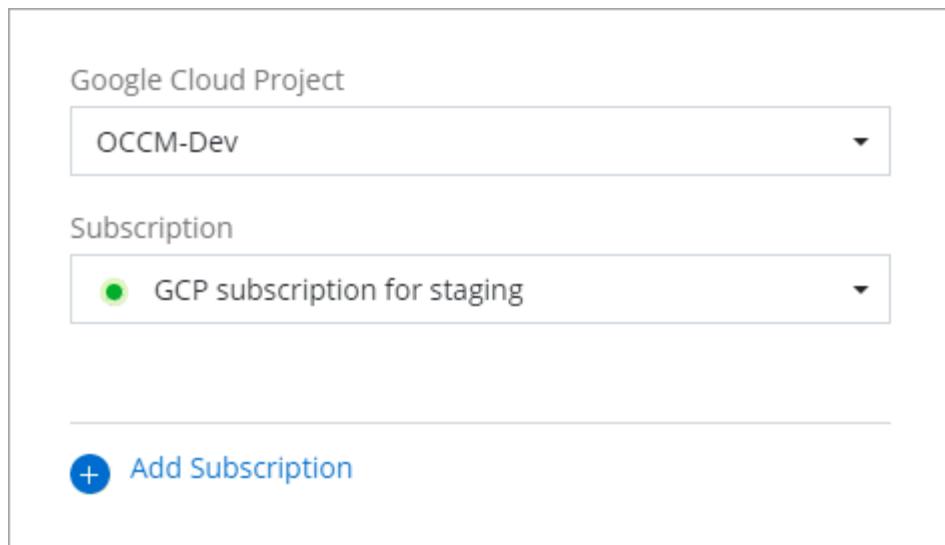
12. After you're redirected to Cloud Central, log in to NetApp Cloud Central or sign up, and then click **Done** to proceed.

The GCP subscription will be linked to all NetApp accounts that your user login is associated with.



i If someone from your organization has already subscribed to the NetApp Cloud Manager subscription from your billing account, then you will be redirected to [the Cloud Volumes ONTAP page on NetApp Cloud Central](#) instead. If this is unexpected, contact your NetApp sales team. Google enables only one subscription per Google billing account.

13. Once this process is complete, navigate back to the Credentials page in Cloud Manager and select this new subscription.



Troubleshooting the Marketplace subscription process

Sometimes subscribing to Cloud Volumes ONTAP through the Google Cloud Marketplace can become fragmented due to incorrect permissions or accidentally not following the redirection to NetApp Cloud Central. If this happens, use the following steps to complete the subscription process.

Steps

1. Navigate to the [NetApp Cloud Manager page on the Google Cloud Marketplace](#) to check on the state of the order. If the page states **Manage on Provider**, scroll down and click **Manage Orders**.

The screenshot shows the 'Pricing' section of the NetApp Cloud Manager page. A green checkmark indicates 'The product was purchased on 12/9/20'. A 'MANAGE ORDERS' button is visible.

- a. If the order shows a green check mark and this is unexpected, somebody else from the organization using the same billing account might already be subscribed. If this is unexpected or you require the details of this subscription, contact your NetApp sales team.

Filter <input type="text"/> Enter property name or value										
Status	Order number	Plan	Discount	Start date	Plan duration	End date	Payment Schedule	Auto-renew	Next plan	⋮
✓	2eebbc...	Cloud Manager	-	10/21/21	1 month	-	Postpay	N/A	N/A	⋮

- b. If the order shows a clock and **Pending** status, go back to the marketplace page and choose **Manage on Provider** to complete the process as documented above.

Filter <input type="text"/> Enter property name or value										
Status	Order number	Plan	Discount	Start date	Plan duration	End date	Payment Schedule	Auto-renew	Next plan	⋮
⌚	d56c66...	Cloud Manager	-	Pending	1 month	Pending	Postpay	N/A	N/A	⋮

Setting up and adding GCP accounts for data tiering with Cloud Volumes ONTAP 9.6

If you want to enable a Cloud Volumes ONTAP 9.6 system for [data tiering](#), you need to provide Cloud Manager with a storage access key for a service account that has Storage Admin permissions. Cloud Manager uses the access keys to set up and manage a Cloud Storage bucket for data tiering.



If you want to use data tiering with Cloud Volumes ONTAP 9.7 or later, then follow step 4 in [Getting started with Cloud Volumes ONTAP in Google Cloud Platform](#).

Setting up a service account and access keys for Google Cloud Storage

A service account enables Cloud Manager to authenticate and access Cloud Storage buckets used for data tiering. The keys are required so that Google Cloud Storage knows who is making the request.

Steps

1. Open the GCP IAM console and [create a service account](#) that has the Storage Admin role.

Create service account

Service account details

Grant this service account access to project (optional)

Select a role Condition

storage admin

Cloud ML Service Agent
Cloud ML service agent can act as log writer, Cloud Storage admin, Artifact Registry Reader, BigQuery writer, and service account access token creator.

Storage Admin
Full control of GCS resources.

Storage HMAC Key Admin
Full control of GCS HMAC Keys.

Storage Object Admin
Full control of GCS objects.

DONE

MANAGE ROLES

2. Go to [GCP Storage Settings](#).

3. If you're prompted, select a project.
4. Click the **Interoperability** tab.
5. If you haven't already done so, click **Enable interoperability access**.
6. Under **Access keys for service accounts**, click **Create a key for a service account**.
7. Select the service account that you created in step 1.

Select a service account

Email	Name	Keys
<input checked="" type="radio"/> data-tiering-for-netapp@top-monitor-250116.iam.gserviceaccount.com	data tiering for netapp	-

[CANCEL](#) [CREATE KEY](#) | [CREATE NEW ACCOUNT](#)

8. Click **Create Key**.
9. Copy the access key and secret.

You'll need to enter this information in Cloud Manager when you add the GCP account for data tiering.

Adding a GCP account to Cloud Manager

Now that you have an access key for a service account, you can add it to Cloud Manager.

What you'll need

You need to create a Connector before you can change Cloud Manager settings. [Learn how](#).

Steps

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



2. Click **Add Credentials** and select **Google Cloud**.
3. Enter the access key and secret for the service account.

The keys enable Cloud Manager to set up a Cloud Storage bucket for data tiering.

4. Confirm that the policy requirements have been met and then click **Create Account**.

What's next?

You can now enable data tiering on individual volumes on a Cloud Volumes ONTAP 9.6 system when you create, modify, or replicate them. For details, see [Tiering inactive data to low-cost object storage](#).

But before you do, be sure that the subnet in which Cloud Volumes ONTAP resides is configured for Private Google Access. For instructions, refer to [Google Cloud Documentation: Configuring Private Google Access](#).

Add and manage NetApp Support Site accounts in Cloud Manager

Provide the credentials for your NetApp Support Site (NSS) accounts to enable key workflows for Cloud Volumes ONTAP and to enable predictive analytics and proactive support through Active IQ.

Overview

Adding your NetApp Support Site account to Cloud Manager is required to enable the following tasks:

- To deploy Cloud Volumes ONTAP when you bring your own license (BYOL)

Providing your NSS account is required so that Cloud Manager can upload your license key and to enable the subscription for the term that you purchased. This includes automatic updates for term renewals.

- To register pay-as-you-go Cloud Volumes ONTAP systems

Providing your NSS account is required to activate support for your system and to gain access to NetApp technical support resources.

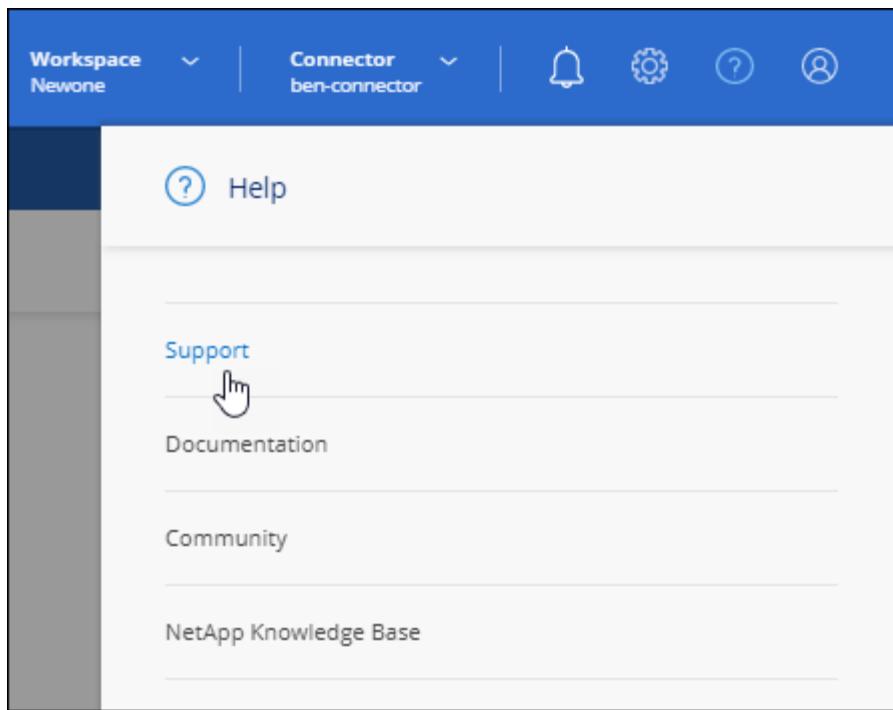
- To upgrade Cloud Volumes ONTAP software to the latest release
- To use Active IQ Digital Advisor from within Cloud Manager

Add an NSS account

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

Steps

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



3. Click **NSS Management > Add NSS Account**.

4. When you're prompted, click **Continue** to be redirected to a Microsoft login page.

NetApp uses Microsoft Azure Active Directory as the identity provider for authentication services specific to support and licensing.

5. At the login page, provide your NetApp Support Site registered email address and password to perform the authentication process.

This action enables Cloud Manager to use your NSS account.

Note the following requirements for the account:

- The account must be a customer-level account (not a guest or temp account).
- If you plan to deploy a node-based BYOL system:
 - The account must be authorized to access the serial numbers of the BYOL systems.
 - If you purchased a secure BYOL subscription, then a secure NSS account is required.

What's next?

Users can now select the account when creating new Cloud Volumes ONTAP systems, when registering existing Cloud Volumes ONTAP systems, and when viewing data in Active IQ.

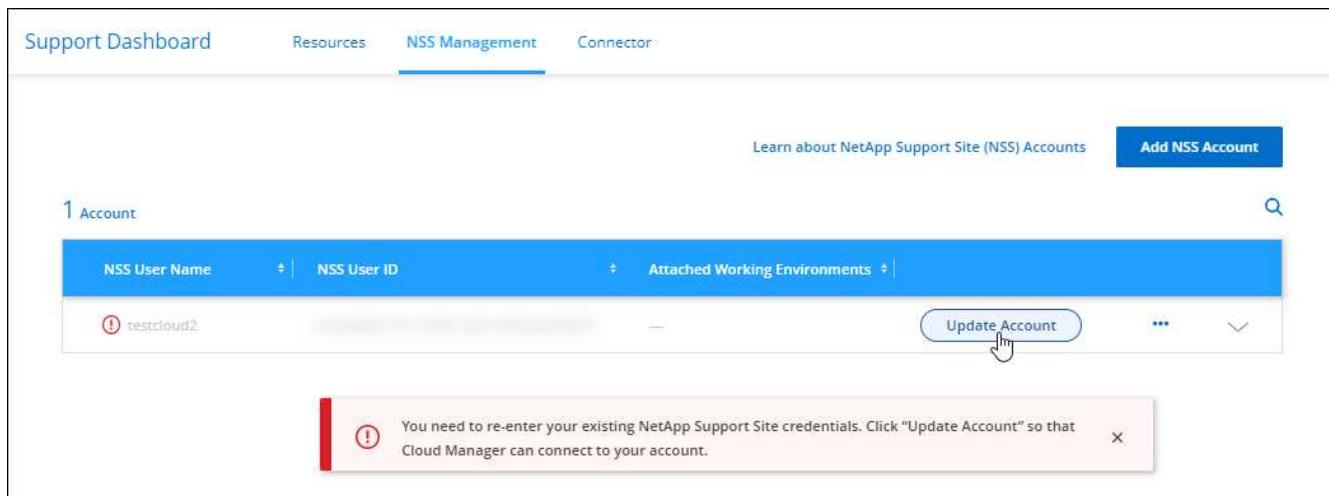
- [Launching Cloud Volumes ONTAP in AWS](#)
- [Launching Cloud Volumes ONTAP in Azure](#)
- [Launching Cloud Volumes ONTAP in GCP](#)
- [Registering pay-as-you-go systems](#)
- [Learn how Cloud Manager manages license files](#)

Update an NSS account for the new authentication method

Starting in November 2021, NetApp now uses Microsoft Azure Active Directory as the identity provider for authentication services specific to support and licensing. As a result of this update, Cloud Manager will prompt you to update the credentials for any existing accounts that you previously added.

Steps

1. If you haven't already done so, [create a Microsoft Azure Active Directory B2C account that will be linked to your current NetApp account](#).
2. In the upper right of the Cloud Manager console, click the Help icon, and select **Support**.
3. Click **NSS Management**.
4. For the NSS account that you want to update, click **Update Account**.



5. When you're prompted, click **Continue** to be redirected to a Microsoft login page.

NetApp uses Microsoft Azure Active Directory as the identity provider for authentication services specific to support and licensing.

6. At the login page, provide your NetApp Support Site registered email address and password to perform the authentication process.

After the process is complete, the account that you updated should now be listed as a *new* account in the table. The *older* version of the account is still listed in the table, along with any existing working environment associations.

7. If existing Cloud Volumes ONTAP working environments are attached to the older version of the account, follow the steps below to [attach those working environments to a different NSS account](#).
8. Go to the older version of the NSS account, click **...** and then select **Delete**.

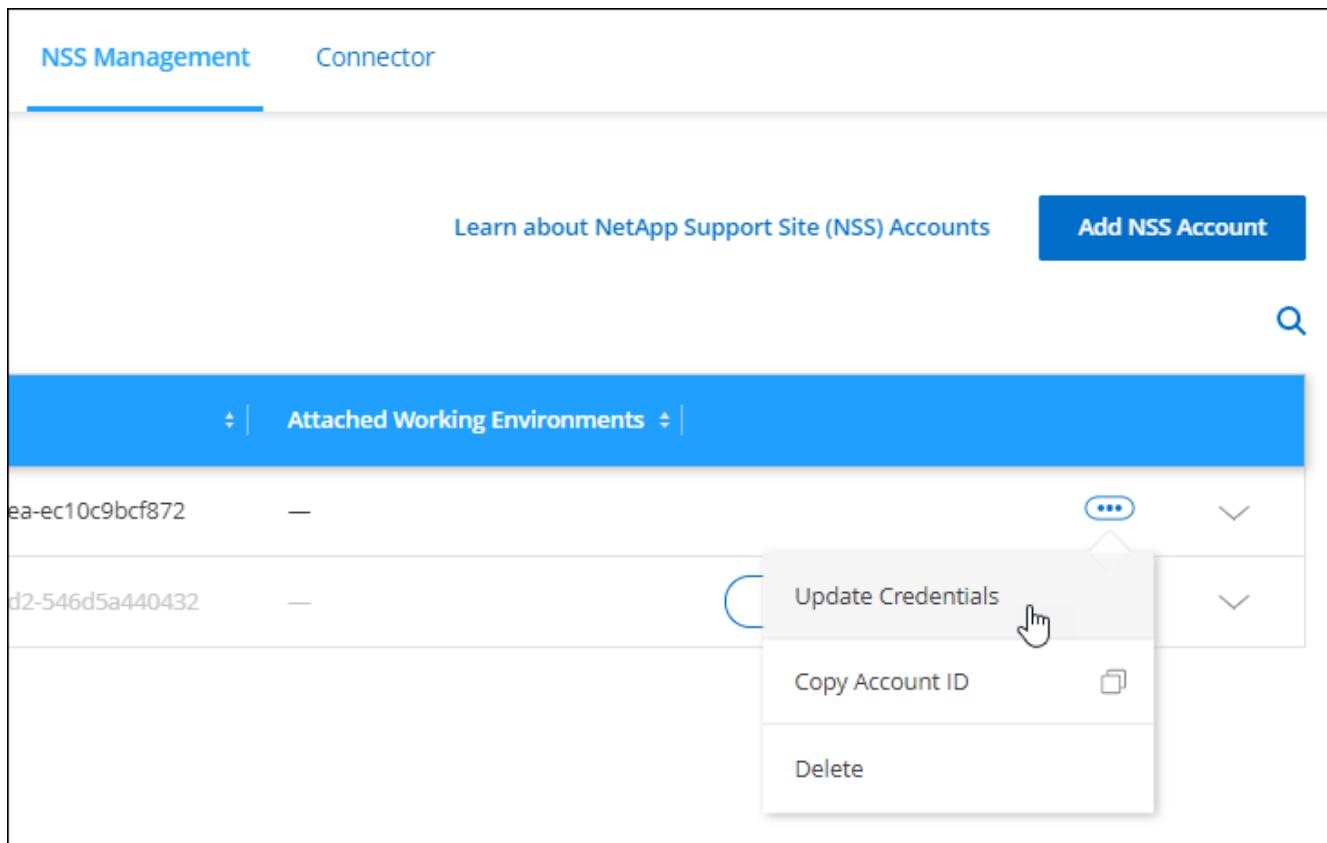
Update NSS credentials

Whenever you change the credentials for your NSS account, you'll need to update them in Cloud Manager.

Steps

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

3. For the NSS account that you want to update, click **...** and then select **Update Credentials**.



4. When you're prompted, click **Continue** to be redirected to a Microsoft login page.

NetApp uses Microsoft Azure Active Directory as the identity provider for authentication services specific to support and licensing.

5. At the login page, provide your NetApp Support Site registered email address and password to perform the authentication process.

Attach a working environment to a different NSS account

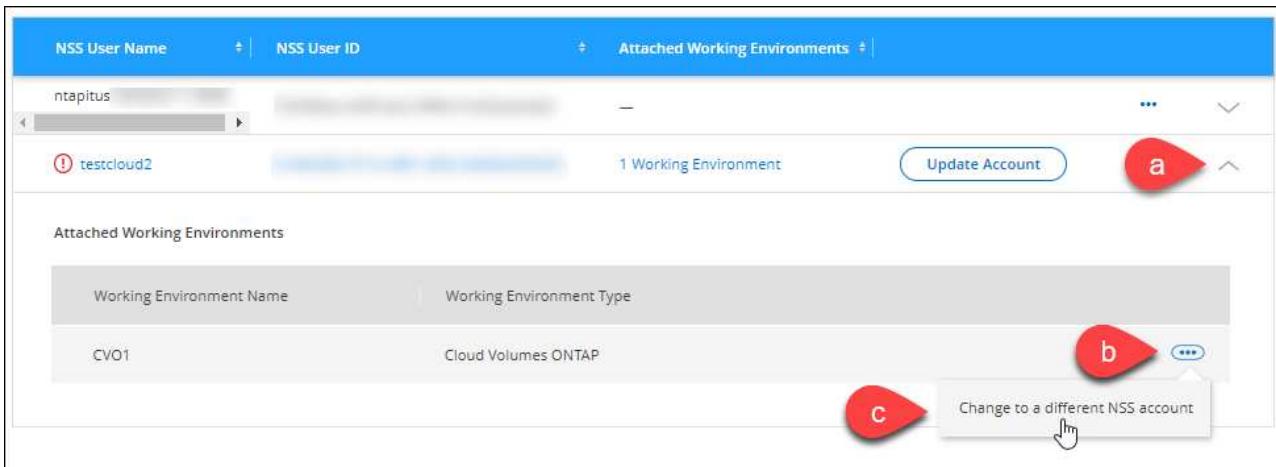
If your organization has multiple NetApp Support Site accounts, you can change which account is associated with a Cloud Volumes ONTAP system.

This feature is only supported with NSS accounts that are configured to use Microsoft Azure AD adopted by NetApp for identity management. Before you can use this feature, you need click **Add NSS Account** or **Update Account**.

Steps

1. In the upper right of the Cloud Manager console, click the Help icon, and select **Support**.
2. Click **NSS Management**.
3. Complete the following steps to change the NSS account:
 - a. Expand the row for the NetApp Support Site account that the working environment is currently associated with.
 - b. For the working environment that you want to change the association for, click **...**

- c. Select **Change to a different NSS account**.



- d. Select the account and then click **Save**.

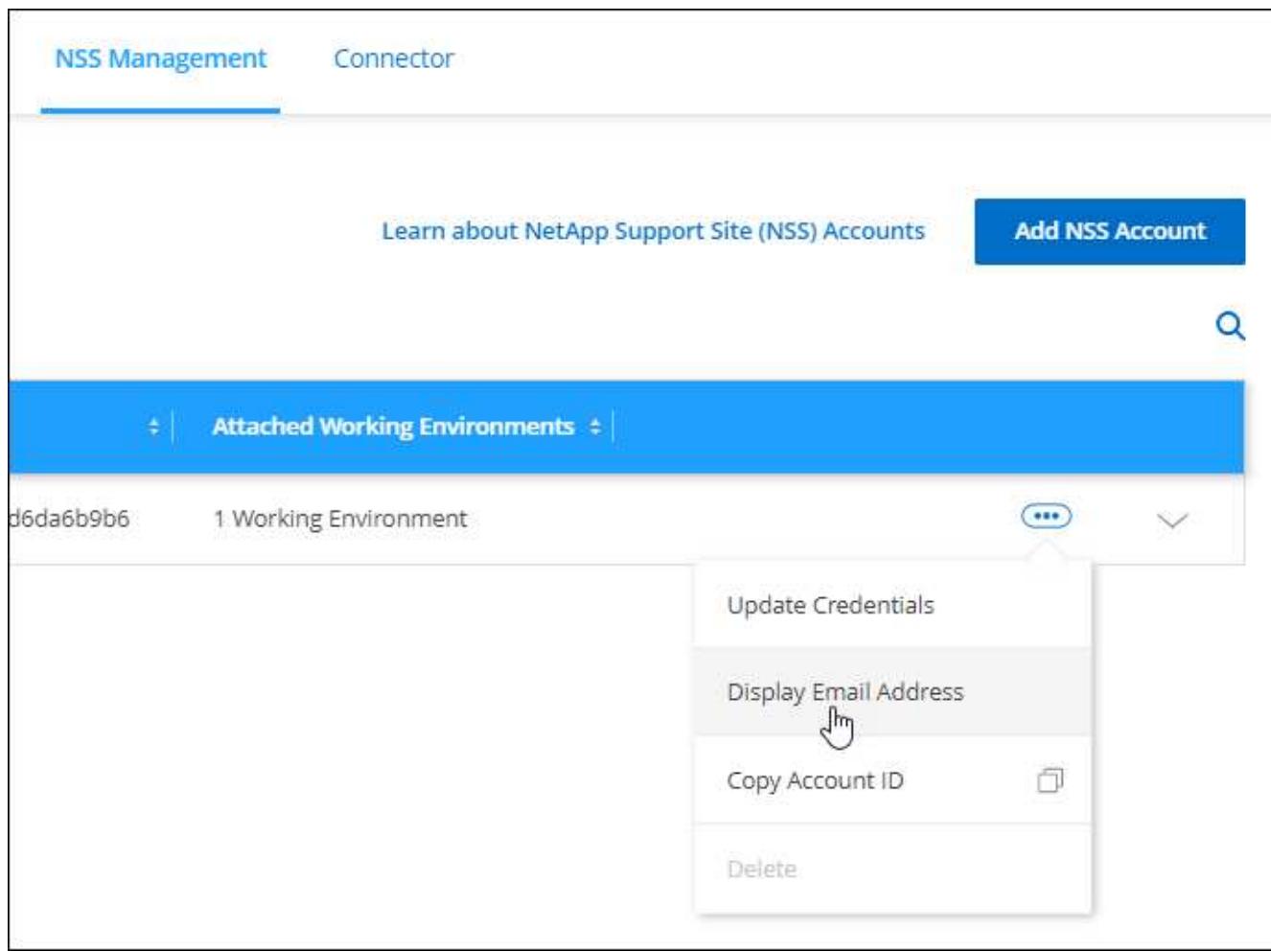
Display the email address for an NSS account

Now that NetApp Support Site accounts use Microsoft Azure Active Directory for authentication services, the NSS user name that displays in Cloud Manager is typically an identifier generated by Azure AD. As a result, you might not immediately know the email address associated with that account. But Cloud Manager has an option to show you the associated email address.

 When you go to the NSS Management page, Cloud Manager generates a token for each account in the table. That token includes information about the associated email address. The token is then removed when you leave the page. The information is never cached, which helps protect your privacy.

Steps

1. In the upper right of the Cloud Manager console, click the Help icon, and select **Support**.
2. Click **NSS Management**.
3. For the NSS account that you want to update, click **...** and then select **Display Email Address**.



Result

Cloud Manager displays the NetApp Support Site user name and the associated email address. You can use the copy button to copy the email address.

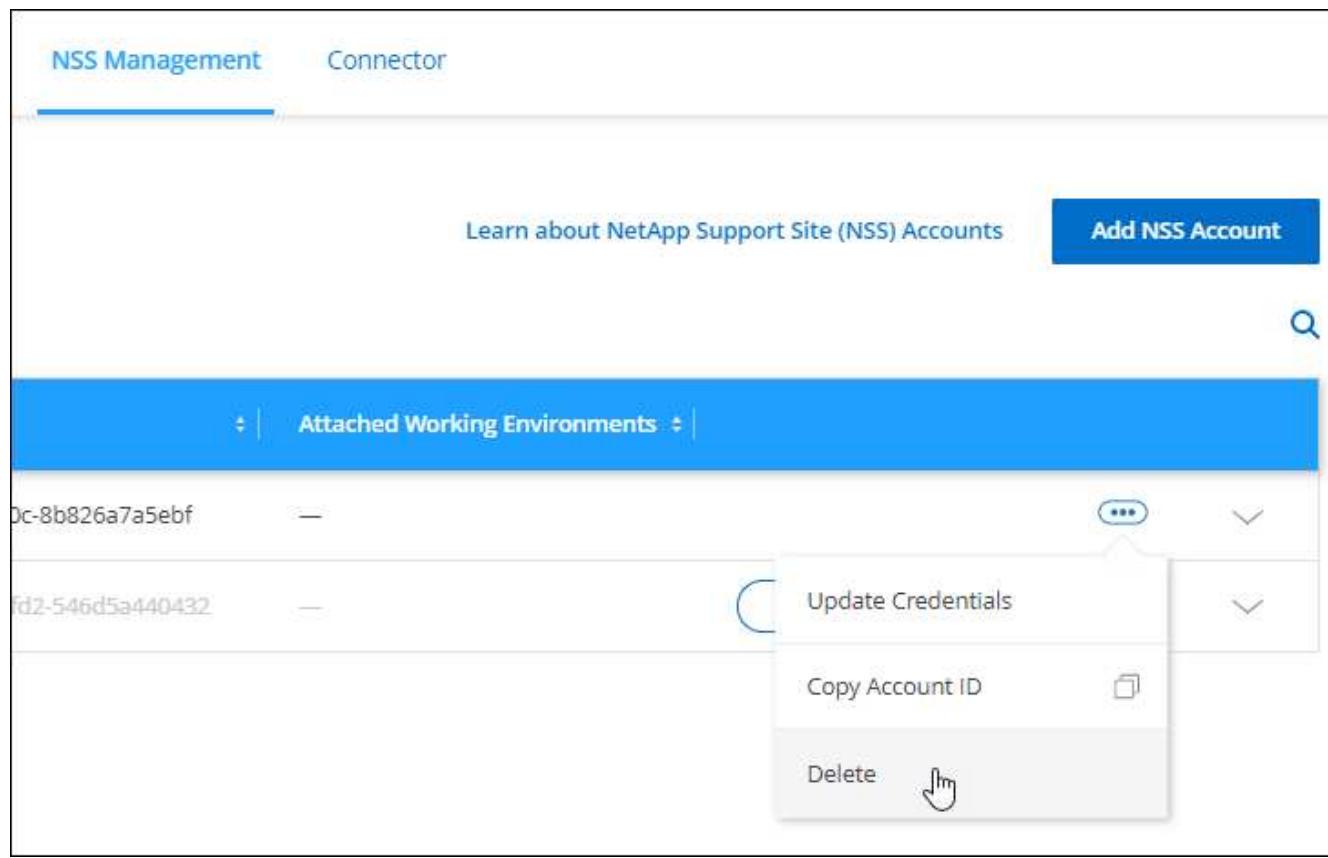
Remove an NSS account

Delete any of the NSS accounts that you no longer want to use with Cloud Manager.

Note that you can't delete an account that is currently associated with a Cloud Volumes ONTAP working environment. You first need to [attach those working environments to a different NSS account](#).

Steps

1. In the upper right of the Cloud Manager console, click the Help icon, and select **Support**.
2. Click **NSS Management**.
3. For the NSS account that you want to delete, click **...** and then select **Delete**.



4. Click **Delete** to confirm.

Managing your account

After you perform initial setup, you can administer your account settings later by managing users, service accounts, workspaces, Connectors, and subscriptions.

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

Managing your account with the Tenancy API

If you want to manage your account settings by sending API requests, then you'll need to use the *Tenancy API*. This API is different than the Cloud Manager API, which you use to create and manage working environments.

[View endpoints for the Tenancy API.](#)

Creating and managing users

The user's in your account can access the manage the resources in your account's workspaces.

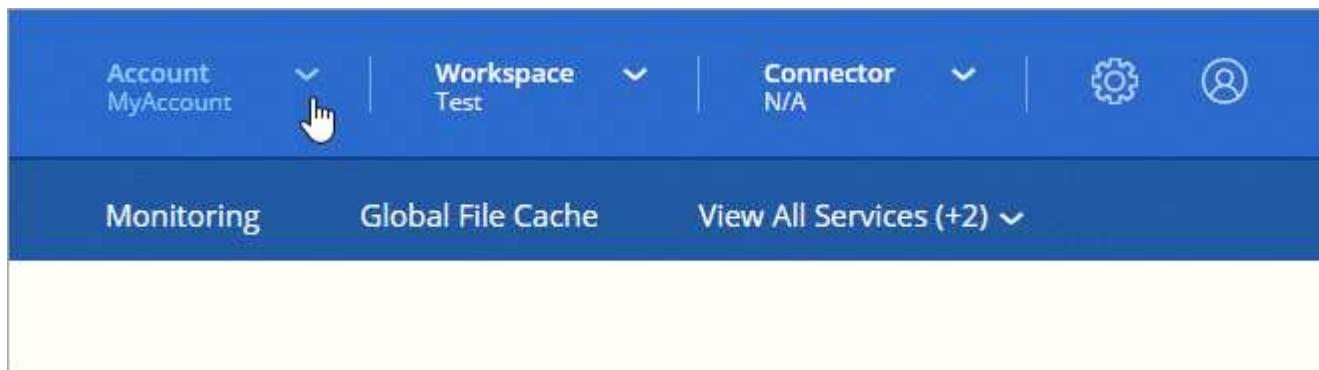
Adding users

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

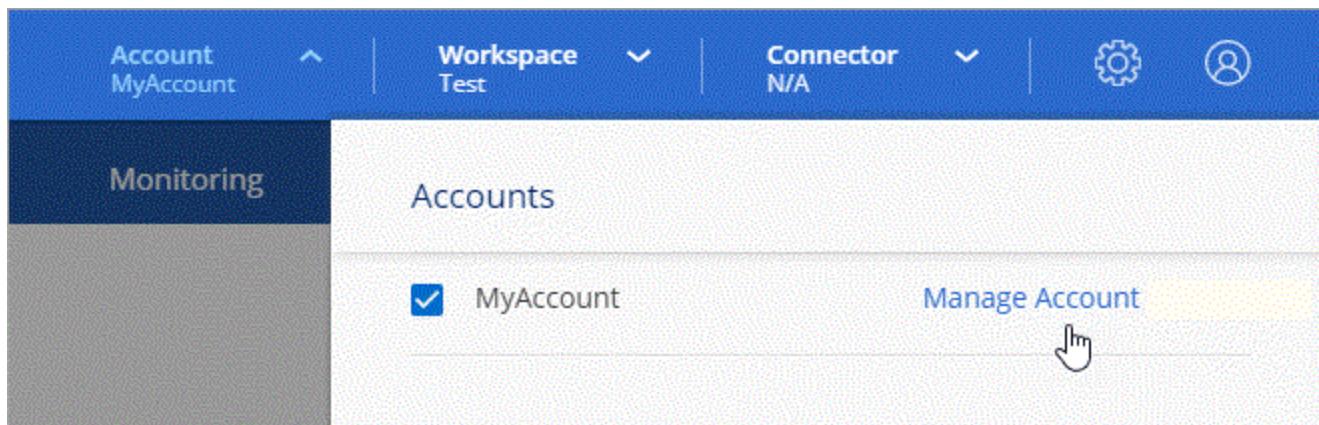
Steps

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.



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

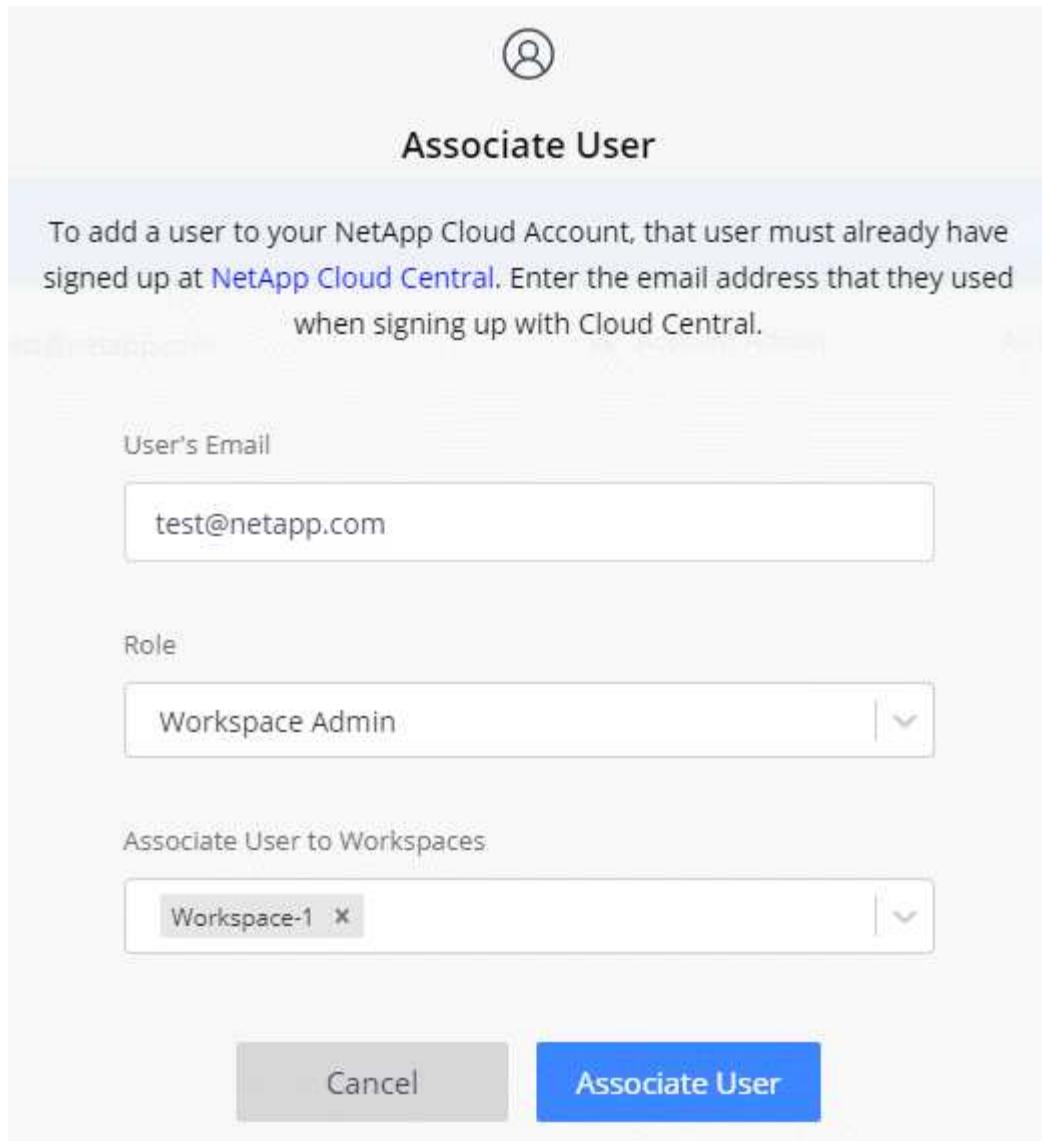


4. From the Members tab, click **Associate User**.

5. 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 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.*

6. If you selected Workspace Admin or Compliance Viewer, select one or more workspaces to associate with that user.



The screenshot shows a 'Associate User' dialog box. At the top is a user icon. Below it is the title 'Associate User'. A descriptive text states: '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.' There is a 'User's Email' input field containing 'test@netapp.com'. A 'Role' dropdown menu is set to 'Workspace Admin'. An 'Associate User to Workspaces' dropdown menu contains 'Workspace-1' with an 'X' button. At the bottom are 'Cancel' and 'Associate User' buttons.

User's Email

test@netapp.com

Role

Workspace Admin

Associate User to Workspaces

Workspace-1 X

Cancel Associate User

7. Click **Associate**.

Result

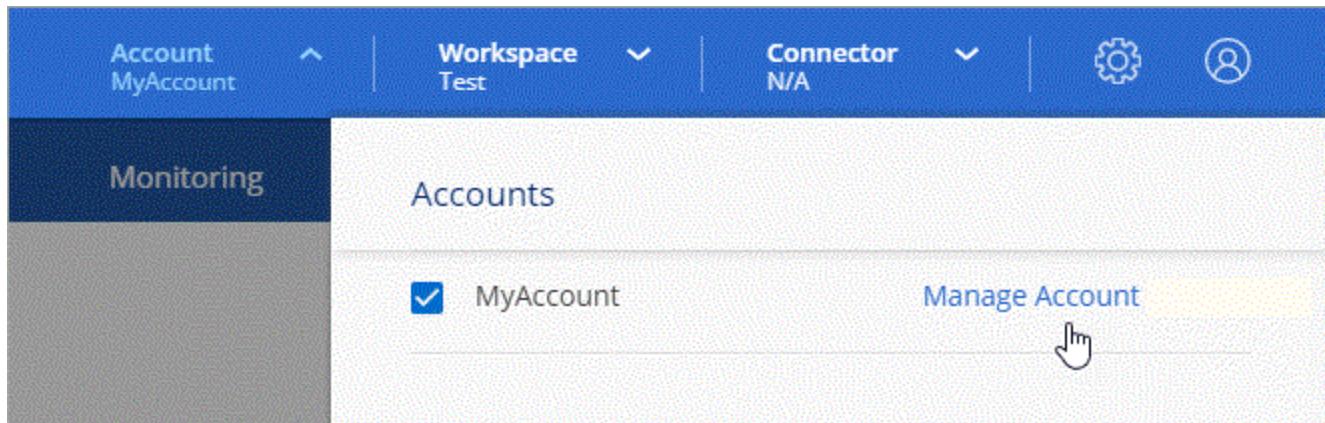
The user should receive an email from NetApp Cloud Central titled "Account Association." The email includes the information needed to access Cloud Manager.

Removing users

Disassociating a user makes it so they can no longer access the resources in a NetApp account.

Steps

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



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

Type	Name	Email	Role	Workspace	Action
👤	Ben	[REDACTED]	⭐ Account Admin	All Workspaces	...
👤	Tom	[REDACTED]	⭐ Account Admin	All Workspaces	...
👤	Ben	[REDACTED]	Workspace Admin	Newone	

- Click **Disassociate User** and click **Disassociate** to confirm.

Result

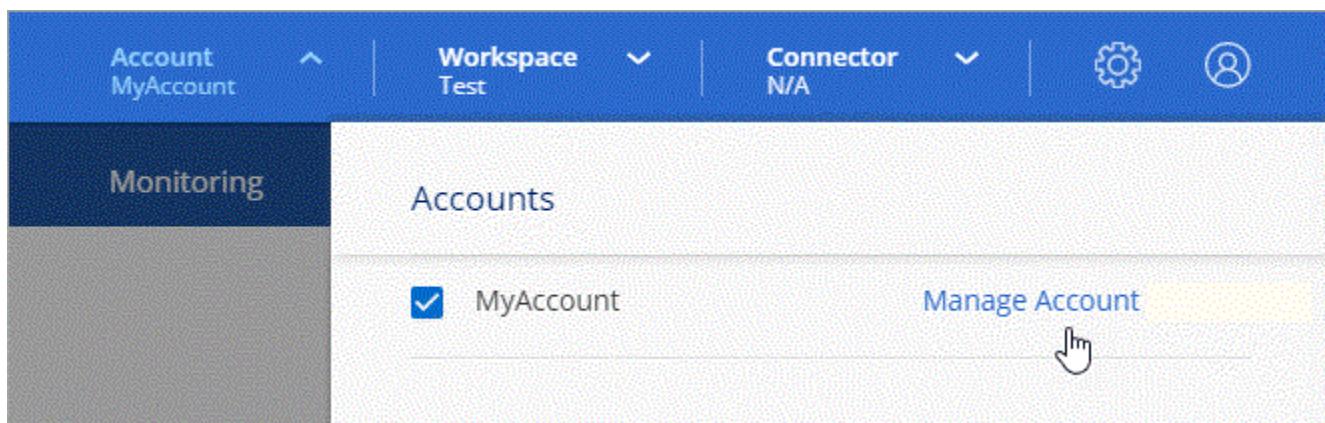
The user can no longer access the resources in this NetApp account.

Managing a Workspace Admin's workspaces

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

Steps

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



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

Type	Name	Email	Role	Workspace
👤	Ben	[REDACTED]	⭐ Account Admin	All Workspaces
👤	Tom	[REDACTED]	⭐ Account Admin	All Workspaces
👤	Ben	[REDACTED]	Workspace Admin	Newone

3. Click **Manage Workspaces**.

4. Select the workspaces to associate with the user 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.

Creating and managing service accounts

A service account acts as a "user" that can make authorized API calls to Cloud Manager for automation purposes. This makes it easier to manage automation because you don't need to build automation scripts based on a real person's user account who can leave the company at any time. And if you're using federation, you can create a token without generating a refresh token from the cloud.

You give permissions to a service account by assigning it a role, just like any other Cloud Manager user. You can also associate the service account with specific workspaces in order to control the working environments (resources) that the service can access.

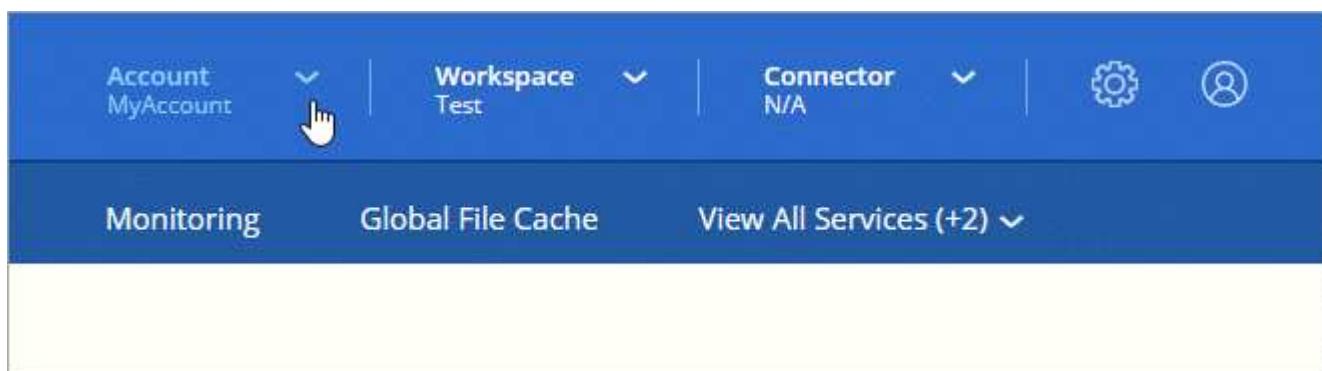
When you create the service account, Cloud Manager enables you to copy or download a client ID and client secret for the service account. This key pair is used for authentication with Cloud Manager.

Creating a service account

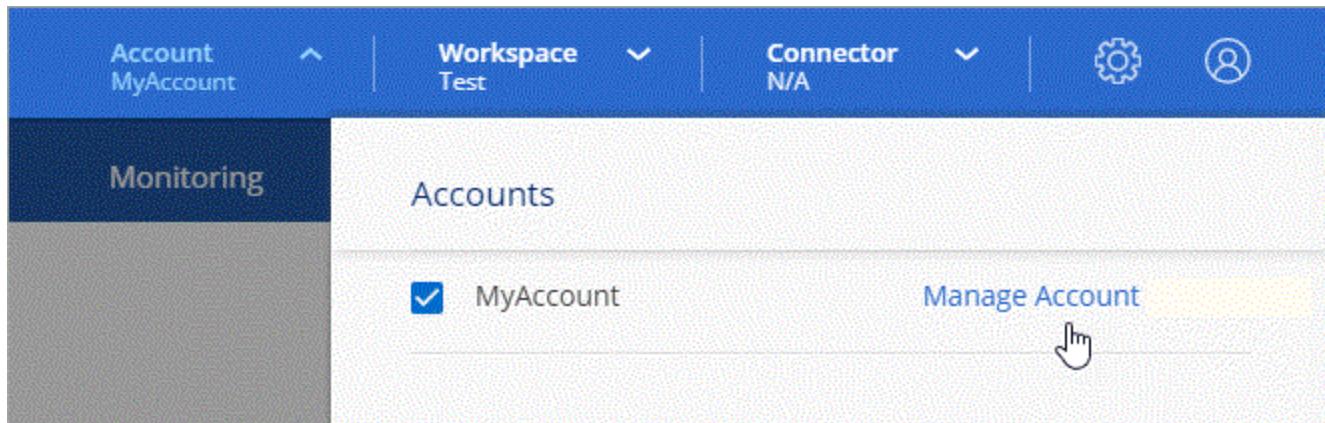
Create as many service accounts as you need to manage the resources in your working environments.

Steps

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



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



3. From the Members tab, click **Create Service Account**.
4. Enter a name and select a role. If you chose a role other than Account Admin, choose the workspace to associate with this service account.
5. Click **Create**.
6. Copy or download the client ID and client secret.

The client secret is visible only once and is not stored anywhere by Cloud Manager. Copy or download the secret and store it safely.

7. Click **Close**.

Obtaining a bearer token for a service account

In order to make API calls to the [Tenancy API](#), you'll need to obtain a bearer token for a service account.

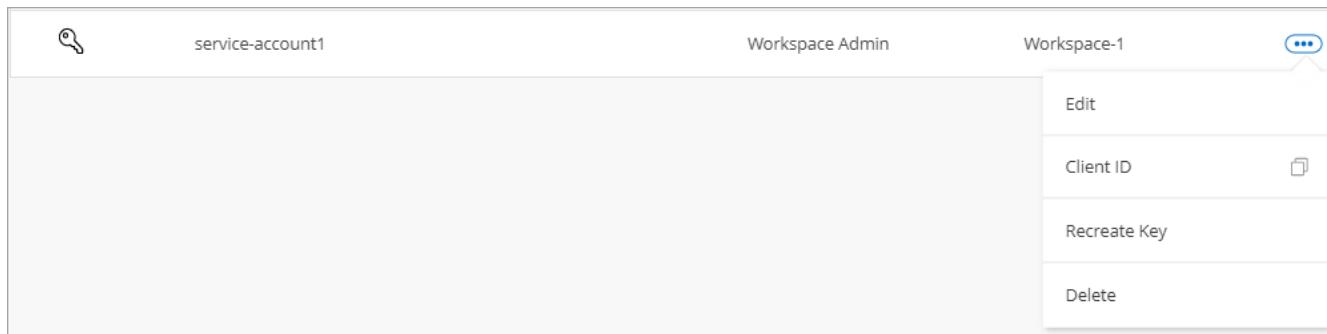
```
curl --location --request POST 'https://netapp-cloud-
account.auth0.com/oauth/token' \
--header 'Content-Type: application/json' \
--data-raw '{
  "grant_type": "client_credentials",
  "client_secret": "<client secret>",
  "audience": "https://api.cloud.netapp.com",
  "client_id": "<client id>"
}'
```

Copying the client ID

You can copy a service account's client ID at any time.

Steps

1. From the Members tab, click the action menu in the row that corresponds to the service account.



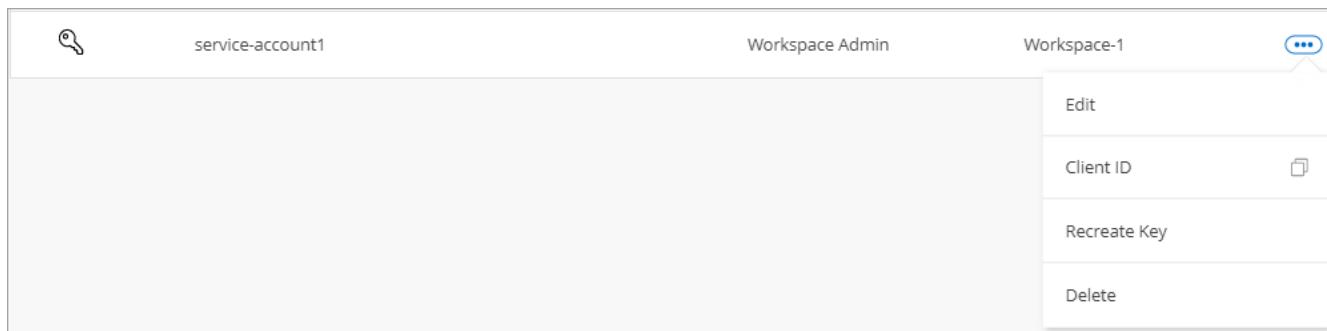
2. Click **Client ID**.
3. The ID is copied to your clipboard.

Recreating keys

Recreating the key will delete the existing key for this service account and then create a new key. You won't be able to use the previous key.

Steps

1. From the Members tab, click the action menu in the row that corresponds to the service account.



2. Click **Recreate Key**.
3. Click **Recreate** to confirm.
4. Copy or download the client ID and client secret.

The client secret is visible only once and is not stored anywhere by Cloud Manager. Copy or download the secret and store it safely.

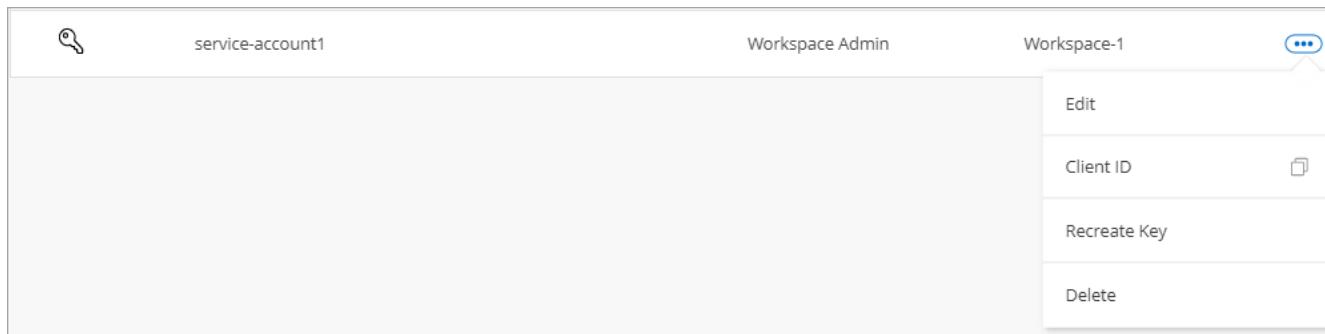
5. Click **Close**.

Deleting a service account

Delete a service account if you no longer need to use it.

Steps

1. From the Members tab, click the action menu in the row that corresponds to the service account.



2. Click **Delete**.
3. Click **Delete** again to confirm.

Managing workspaces

Manage your workspaces by creating, renaming, and deleting them. Note that you can't delete a workspace if it contains any resources. It must be empty.

Steps

1. From the top of Cloud Manager, click the **Account** drop-down and click **Manage Account**.
2. Click **Workspaces**.
3. Choose one of the following options:
 - Click **Add New Workspace** to create a new workspace.
 - Click **Rename** to rename the workspace.
 - Click **Delete** to delete the workspace.

Managing a Connector's workspaces

You need to associate the Connector with workspaces so Workspace Admins can access those workspaces from Cloud Manager.

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 the workspaces to associate with the Connector and click **Apply**.

Managing subscriptions

After you subscribe from a cloud provider's marketplace, each subscription is available from the Account Settings widget. 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 more about subscriptions.](#)

Steps

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

You'll only see the subscriptions that are associated with the account that you're currently viewing.

3. Click the action menu in the row that corresponds to the subscription that you want to manage.

Name	Service	Cloud Provider	Status
QA Subscription	test-service	aws	Unsubscribed
metering service subscription QA !!!!	cloud-volumes-ontap	aws	Subscribed

Rename Subscription
Manage Accounts

4. Choose to rename the subscription or to manage the accounts that are associated with the subscription.

Changing your account name

Change your account name at any time to change it to something meaningful for you.

Steps

1. From the top of Cloud Manager, click the **Account** drop-down and click **Manage Account**.
2. In the **Overview** tab, click the edit icon next to the account name.
3. Type a new account name and click **Save**.

Allowing private previews

Allow private previews in your account to get access to new NetApp cloud services that are made available as a preview in Cloud Manager.

Services in private preview are not guaranteed to behave as expected and might sustain outages and be missing functionality.

Steps

1. From the top of Cloud Manager, click the **Account** drop-down and click **Manage Account**.
2. In the **Overview** tab, enable the **Allow Private Preview** setting.

Allowing third-party services

Allow third-party services in your account to get access to third-party services that are available in Cloud Manager. Third-party services are cloud services similar to the services that NetApp offers, but they're

managed and supported by third-party companies.

Steps

1. From the top of Cloud Manager, click the **Account** drop-down and click **Manage Account**.
2. In the **Overview** tab, enable the **Allow Third Party Services** setting.

Disabling the SaaS platform

We don't recommend disabling the SaaS platform unless you need to in order to comply with your company's security policies. Disabling the SaaS platform limits your ability to use NetApp's integrated cloud services.

The following services aren't available from Cloud Manager if you disable the SaaS platform:

- Cloud Data Sense
- Kubernetes
- Cloud Tiering
- Global File Cache

If you do disable the SaaS platform, you'll need to perform all tasks from [the local user interface that is available on a Connector](#).

This is an irreversible action that will prevent you from using the Cloud Manager SaaS platform. You'll need to perform actions from the local Connector. You won't have the ability to use many of NetApp's integrated cloud services, and re-enabling the SaaS platform will require the help of NetApp support.

Steps

1. From the top of Cloud Manager, click the **Account** drop-down and click **Manage Account**.
2. In the Overview tab, toggle the option to disable use of the SaaS platform.

Monitoring operations in your account

You can monitor the status of the operations that Cloud Manager is performing to see if there are any issues that you need to address. You can view the status in the Notification Center or in the Timeline.

This table provides a comparison of the Notification Center and the Timeline so you can understand what each has to offer.

Notification Center	Timeline
Shows high level status for events and actions	Provides details for each event or action for further investigation
Shows status for the current login session - the information won't appear in the Notification Center after you log off	Retains status for up to the last month
Shows only actions initiated in the user interface	Shows all actions from the UI or APIs

Notification Center	Timeline
Shows user-initiated actions	Shows all actions, whether user-initiated or system-initiated
Filter results by importance	Filter by service, action, user, status, and more

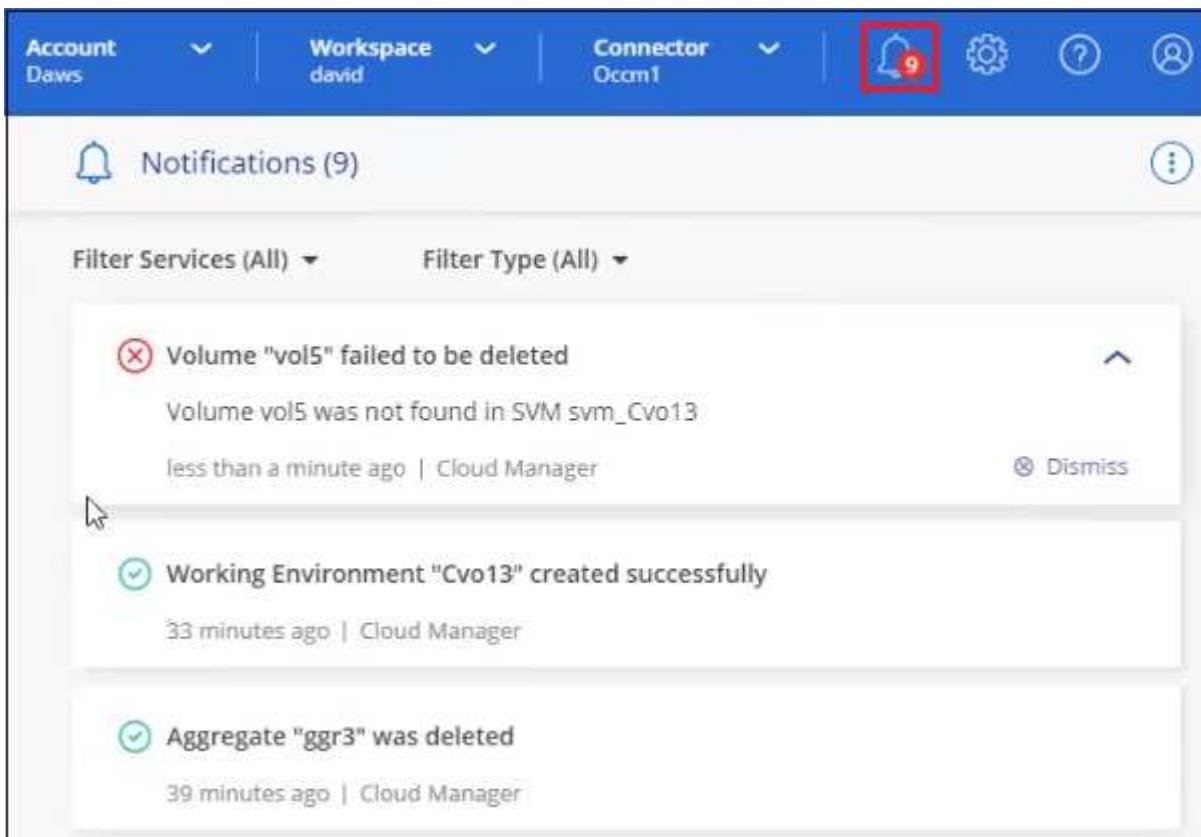
Monitoring operations status using the Notification Center

Notifications are like events where they track the progress of operations that you've initiated in Cloud Manager so you can verify whether the operation was successful, or if it failed. They enable you to view the status for Cloud Manager operations (and cloud services operations in the future) that you initiated during your current login session.

At this time, only notifications for creating and deleting the following Cloud Volumes ONTAP objects are supported:

- working environments
- aggregates
- volumes

You display the notifications by clicking the notification bell () in the menu bar. The color of the little bubble in the bell indicates the highest level severity notification that is active. So if you see a red bubble, it means there's an important notification that you should look at.

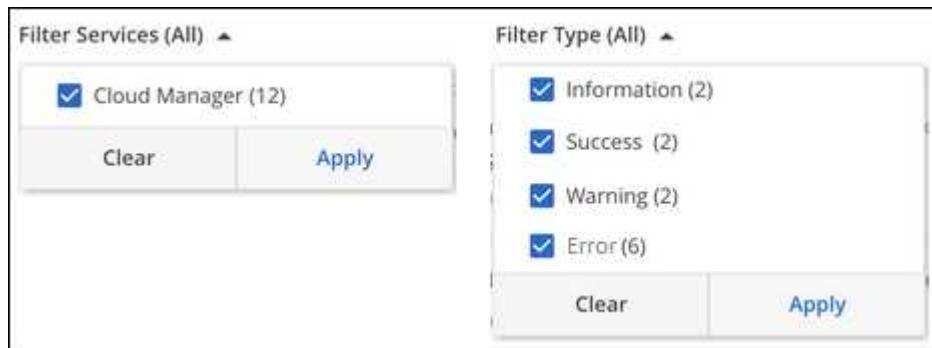


The screenshot shows the Cloud Manager interface with the Notifications panel open. The top navigation bar includes Account (Daws), Workspace (david), Connector (Ocm1), and a Notifications icon (bell with a red bubble containing the number 9, which is highlighted with a red box). The Notifications panel lists three recent operations:

- Volume "vol5" failed to be deleted** (red X icon): Volume vol5 was not found in SVM svm_Cvo13. (less than a minute ago | Cloud Manager) **Dismiss**
- Working Environment "Cvo13" created successfully** (green checkmark icon): 33 minutes ago | Cloud Manager
- Aggregate "ggr3" was deleted** (green checkmark icon): 39 minutes ago | Cloud Manager

Filtering notifications

By default you'll see all notifications. You can filter the notifications that you see in the Notification Center to show only those notifications that are important to you. You can filter by Cloud Manager "Service" and by notification "Type".

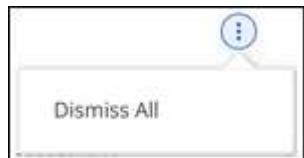


For example, if you want to see only "Error" and "Warning" notifications for Cloud Manager operations, select those entries and you'll see only those types of notifications.

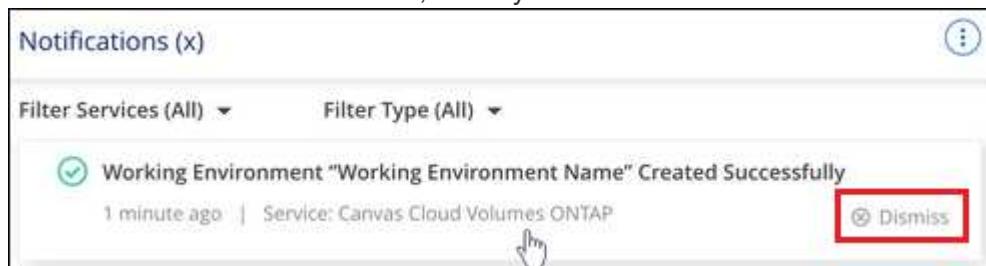
Dismissing notifications

You can remove notifications from the page if you no longer need to see them. You can dismiss all notifications at once, or you can dismiss individual notifications.

To dismiss all notifications, in the Notification Center, click : and select **Dismiss All**.



To dismiss individual notifications, hover your cursor over the notification and click **Dismiss**.



Auditing user activity in your account

The Timeline in Cloud Manager shows the actions that users completed to manage your account. This includes management actions such as associating users, creating workspaces, creating Connectors, and more.

Checking the Timeline can be helpful if you need to identify who performed a specific action, or if you need to identify the status of an action.

Steps

1. Click **All Services > Timeline**.
2. Under the Filters, click **Service**, enable **Tenancy**, and click **Apply**.

Result

The Timeline updates to show your account management actions.

Managing an HTTPS certificate for secure access

By default, Cloud Manager uses a self-signed certificate for HTTPS access to the web console. You can install a certificate signed by a certificate authority (CA), which provides better security protection than a self-signed certificate.

Before you get started

You need to create a Connector before you can change Cloud Manager settings. [Learn how](#).

Installing an HTTPS certificate

Install a certificate signed by a CA for secure access.

Steps

1. In the upper right of the Cloud Manager console, click the Settings icon, and select **HTTPS Setup**.



2. In the HTTPS Setup page, install a certificate by generating a certificate signing request (CSR) or by installing your own CA-signed certificate:

Option	Description
Generate a CSR	<ol style="list-style-type: none">a. Enter the host name or DNS of the Connector host (its Common Name), and then click Generate CSR. Cloud Manager displays a certificate signing request.b. Use the CSR to submit an SSL certificate request to a CA. The certificate must use the Privacy Enhanced Mail (PEM) Base-64 encoded X.509 format.c. Upload the certificate file and then click Install.
Install your own CA-signed certificate	<ol style="list-style-type: none">a. Select Install CA-signed certificate.b. Load both the certificate file and the private key and then click Install. The certificate must use the Privacy Enhanced Mail (PEM) Base-64 encoded X.509 format.

Result

Cloud Manager now uses the CA-signed certificate to provide secure HTTPS access. The following image

shows a Cloud Manager system that is configured for secure access:

The screenshot shows the 'HTTPS Certificate' page. At the top, a green checkmark icon indicates 'HTTPS Setup is active'. Below this, the 'Expiration' date is listed as 'Aug 15, 2029 10:09:01 am'. The 'Issuer' information is 'C=IL, ST=Israel, L=Tel Aviv, O=NetApp, OU=Dev, CN= Localhost, E=Admin@netapp.com'. The 'Subject' information is also 'C=IL, ST=Israel, L=Tel Aviv, O=NetApp, OU=Dev, CN= Localhost, E=Admin@netapp.com'. A blue 'View CSR' button is located at the bottom left of the certificate details.

Renewing the Cloud Manager HTTPS certificate

You should renew the Cloud Manager HTTPS certificate before it expires to ensure secure access to the Cloud Manager web console. If you do not renew the certificate before it expires, a warning appears when users access the web console using HTTPS.

Steps

1. In the upper right of the Cloud Manager console, click the Settings icon, and select **HTTPS Setup**.
Details about the Cloud Manager certificate displays, including the expiration date.
2. Click **Change Certificate** and follow the steps to generate a CSR or install your own CA-signed certificate.

Result

Cloud Manager uses the new CA-signed certificate to provide secure HTTPS access.

Removing Cloud Volumes ONTAP working environments

The Account Admin can remove a Cloud Volumes ONTAP working environment to move it to another system or to troubleshoot discovery issues.

About this task

Removing a Cloud Volumes ONTAP working environment removes it from Cloud Manager. It does not delete the Cloud Volumes ONTAP system. You can later rediscover the working environment.

Removing a working environment from Cloud Manager enables you to do the following:

- Rediscover it in another workspace

- Rediscover it from another Cloud Manager system
- Rediscover it if you had problems during the initial discovery

Steps

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



2. From the Tools page, click **Launch**.
3. Select the Cloud Volumes ONTAP working environment that you want to remove.
4. On the Review and Approve page, click **Go**.

Result

Cloud Manager removes the working environment. Users can rediscover this working environment from the Canvas page at any time.

Configuring a Connector to use an HTTP proxy server

If your corporate policies require you to use a proxy server for all HTTP communication to the internet, then you must configure your Connectors to use that HTTP proxy server. The proxy server can be in the cloud or in your network.

Cloud Manager doesn't support using an HTTPS proxy with the Connector.

Enable a proxy on a Connector

When you configure a Connector to use a proxy server, that Connector and the Cloud Volumes ONTAP systems that it manages (including any HA mediators), all use the proxy server.

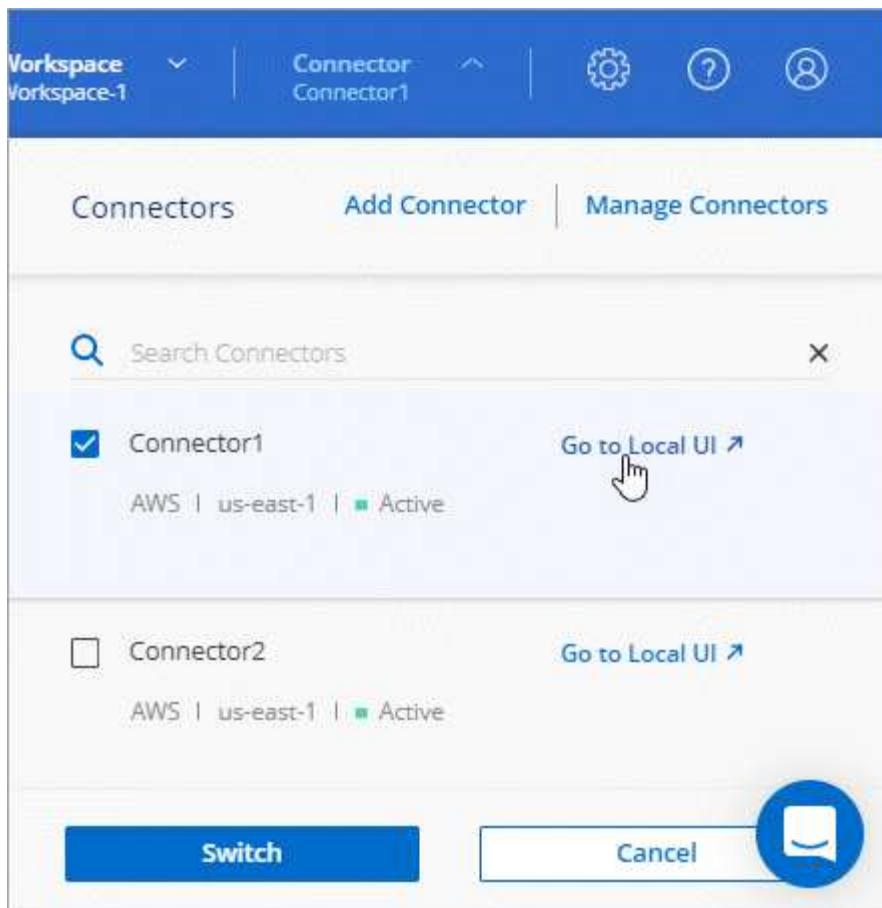
Note that this operation restarts the Connector. Ensure that the Connector isn't performing any operations before you proceed.

Steps

1. [Log in to the Cloud Manager SaaS interface](#) from a machine that has a network connection to the Connector instance.

If the Connector doesn't have a public IP address, you'll need a VPN connection or you'll need to connect from a jump host that's in the same network as the Connector.

2. Click the **Connector** drop-down and then click **Go to local UI** for a specific Connector.



The Cloud Manager interface running on the Connector loads in a new browser tab.

3. In the upper right of the Cloud Manager console, click the Settings icon, and select **Connector Settings**.



4. Under **General**, click **HTTP Proxy Configuration**.
5. Set up the proxy:
 - a. Click **Enable Proxy**.
 - b. Specify the server using the syntax `http://address:port`
 - c. Specify a user name and password if basic authentication is required for the server
 - d. Click **Save**.



Cloud Manager doesn't support passwords that include the @ character.

Result

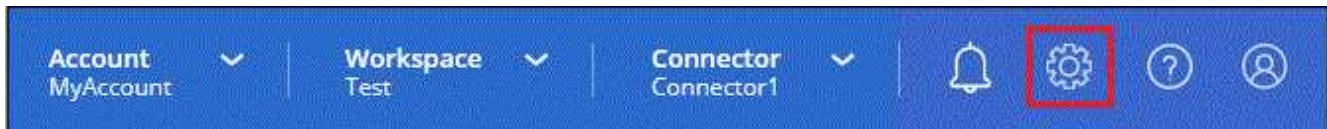
After you specify the proxy server, new Cloud Volumes ONTAP systems are automatically configured to use the proxy server when sending AutoSupport messages. If you didn't specify the proxy server before users create Cloud Volumes ONTAP systems, then they must use System Manager to manually set the proxy server in the AutoSupport options for each system.

Enable direct API traffic

If you configured a proxy server, you can send API calls directly to Cloud Manager without going through the proxy. This option is supported with Connectors that are running in AWS, in Azure, or in Google Cloud.

Steps

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



2. Under **General**, click **Support Direct API Traffic**.
3. Click the checkbox to enable the option and then click **Save**.

Reference

Roles

The Account Admin, Workspace Admin, Compliance Viewer, and SnapCenter Admin roles provide specific permissions to users.

The Compliance Viewer role is for read-only Cloud Data Sense access.

Task	Account Admin	Workspace Admin	Compliance Viewer	SnapCenter Admin
Manage working environments	Yes	Yes	No	No
Enable services on working environments	Yes	Yes	No	No
View data replication status	Yes	Yes	No	No
View the timeline	Yes	Yes	No	No
Switch between workspaces	Yes	Yes	Yes	No
View Data Sense scan results	Yes	Yes	Yes	No
Delete working environments	Yes	No	No	No
Connect Kubernetes clusters to working environments	Yes	No	No	No
Receive the Cloud Volumes ONTAP report	Yes	No	No	No
Create Connectors	Yes	No	No	No

Task	Account Admin	Workspace Admin	Compliance Viewer	SnapCenter Admin
Manage NetApp accounts	Yes	No	No	No
Manage credentials	Yes	No	No	No
Modify Cloud Manager settings	Yes	No	No	No
View and manage the Support Dashboard	Yes	No	No	No
Remove working environments from Cloud Manager	Yes	No	No	No
Install an HTTPS certificate	Yes	No	No	No
Use the SnapCenter Service	Yes	Yes	No	Yes

Related links

- [Setting up workspaces and users in the NetApp account](#)
- [Managing workspaces and users in the NetApp account](#)

How Cloud Manager uses cloud provider permissions

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.

What Cloud Manager does with AWS 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.

Actions	Purpose
"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.
"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.

Actions	Purpose
"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.
"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.

Actions	Purpose
"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.
"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.

What Cloud Manager does with Azure 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.

Actions	Purpose
"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.
"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.

Actions	Purpose
"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.
"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.

Actions	Purpose
"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.
"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.

Actions	Purpose
"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.

What Cloud Manager does with GCP permissions

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

Actions	Purpose
- 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.
- compute.firewalls.create - compute.firewalls.delete - compute.firewalls.get - compute.firewalls.list	To create firewall rules for Cloud Volumes ONTAP.
- compute.globalOperations.get	To get the status of operations.
- compute.images.get - compute.images.getFromFamily - compute.images.list - compute.images.useReadOnly	To get images for VM instances.
- compute.instances.attachDisk - compute.instances.detachDisk	To attach and detach disks to Cloud Volumes ONTAP.
- compute.instances.create - compute.instances.delete	To create and delete Cloud Volumes ONTAP VM instances.
- compute.instances.get	To list VM instances.
- compute.instances.getSerialPortOutput	To get console logs.
- compute.instances.list	To retrieve the list of instances in a zone.
- compute.instances.setDeletionProtection	To set deletion protection on the instance.
- compute.instances.setLabels	To add labels.
- compute.instances.setMachineType - compute.instances.setMinCpuPlatform	To change the machine type for Cloud Volumes ONTAP.

Actions	Purpose
- compute.instances.setMetadata	To add metadata.
- compute.instances.setTags	To add tags for firewall rules.
- compute.instances.start - compute.instances.stop - compute.instances.updateDisplayDevice	To start and stop Cloud Volumes ONTAP.
- compute.machineTypes.get	To get the numbers of cores to check qoutas.
- compute.projects.get	To support multi-projects.
- compute.snapshots.create - compute.snapshots.delete - compute.snapshots.get - compute.snapshots.list - compute.snapshots.setLabels	To create and manage persistent disk snapshots.
- 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.
- 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.
- logging logEntries.list - logging privateLogEntries.list	To get stack log drives.
- resourcemanager projects.get	To support multi-projects.
- 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.

Actions	Purpose
<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.
<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.useExternalIpp - 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.

Automate with the REST API

Automation using the Cloud Manager REST API platform

In addition to the web browser interface, Cloud Manager has a REST API that provides software developers with direct access to the Cloud Manager functionality through the SaaS interface. The Cloud Manager service consists of several distinct components that collectively form an extensible development platform.

To learn more, go to the [Cloud Manager automation docs](#).

Automation resources for infrastructure as code

Use the resources on this page to get help integrating Cloud Manager and Cloud Volumes ONTAP with your [infrastructure as code](#) (IaC).

DevOps teams use a variety of tools to automate the setup of new environments, which allows them to treat infrastructure as code. One such tool is Terraform. We have developed a Terraform provider that DevOps teams can use with Cloud Manager to automate and integrate Cloud Volumes ONTAP with infrastructure as code.

[View the netapp-cloudmanager provider](#).

Related links

- [NetApp Cloud Blog: Using Cloud Manager REST APIs with Federated Access](#)
- [NetApp Cloud Blog: Cloud Automation with Cloud Volumes ONTAP and REST](#)
- [NetApp Cloud Blog: Automated Data Cloning for Cloud-Based Testing of Software Applications](#)
- [NetApp Blog: Infrastructure-As-Code \(IaC\) Accelerated with Ansible + NetApp](#)
- [NetApp thePub: Configuration Management & Automation with Ansible](#)
- [NetApp thePub: Roles for Ansible ONTAP use](#)

Where to get help and find more information

You can get help and find more information about Cloud Manager and Cloud Volumes ONTAP through various resources, including videos, forums, and support.

- [Flex Professional Services for Cloud \(FlexPS\)](#)

Use a subscription-based service to enable ongoing success with NetApp's cloud solutions.

- [NetApp Cloud Volumes ONTAP Support](#)

Access support resources to get help and troubleshoot issues with Cloud Volumes ONTAP.

- [Videos for Cloud Manager and Cloud Volumes ONTAP](#)

Watch videos that show you how to deploy and manage Cloud Volumes ONTAP and how to replicate data across your hybrid cloud.

- [Policies for Cloud Manager](#)

Download JSON files that include the permissions that Cloud Manager needs to perform actions in a cloud provider.

- [Cloud Manager API documentation](#)

Read an overview of the APIs, examples of how to use them, and an API reference.

- [Training for Cloud Volumes ONTAP](#)

- [Cloud Volumes ONTAP Fundamentals](#)
- [Cloud Volumes ONTAP Deployment and Management for Azure](#)
- [Cloud Volumes ONTAP Deployment and Management for AWS](#)

- [Technical reports](#)

- [NetApp Technical Report 4383: Performance Characterization of Cloud Volumes ONTAP in Amazon Web Services with Application Workloads](#)
- [NetApp Technical Report 4671: Performance Characterization of Cloud Volumes ONTAP in Azure with Application Workloads](#)
- [NetApp Technical Report 4816: Performance Characterization of Cloud Volumes ONTAP for Google Cloud](#)

- [SVM disaster recovery](#)

SVM disaster recovery is the asynchronous mirroring of SVM data and configuration from a source SVM to a destination SVM. You can quickly activate a destination SVM for data access if the source SVM is no longer available.

- [Cloud Volumes ONTAP 9 SVM Disaster Recovery Preparation Express Guide](#)

Describes how to quickly configure a destination SVM in preparation for disaster recovery.

- [Cloud Volumes ONTAP 9 SVM Disaster Recovery Express Guide](#)

Describes how to quickly activate a destination SVM after a disaster, and then reactivate the source

SVM.

- [FlexCache Volumes for Faster Data Access Power Guide](#)

Describes how to create and manage FlexCache volumes in the same cluster or different cluster as the origin volume for accelerating data access.

- [Security advisories](#)

Identify known vulnerabilities (CVEs) for NetApp products, including ONTAP. Note that you can remediate security vulnerabilities for Cloud Volumes ONTAP by following ONTAP documentation.

- [ONTAP 9 Documentation Center](#)

Access product documentation for ONTAP, which can help you as you use Cloud Volumes ONTAP.

- [NetApp Community: Cloud Data Services](#)

Connect with peers, ask questions, exchange ideas, find resources, and share best practices.

- [NetApp Cloud Central](#)

Find information about additional NetApp products and solutions for the cloud.

- [NetApp Product Documentation](#)

Search NetApp product documentation for instructions, resources, and answers.

Earlier versions of Cloud Manager documentation

Documentation for previous releases of Cloud Manager is available in case you're not running the latest version.

- [Cloud Manager 3.8](#)
- [Cloud Manager 3.7](#)
- [Cloud Manager 3.6](#)
- [Cloud Manager 3.5](#)
- [Cloud Manager 3.4](#)
- [Cloud Manager 3.3](#)
- [Cloud Manager 3.2](#)

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- [Notice for Cloud Manager 3.9](#)
- [Notice for the Cloud Backup](#)
- [Notice for Single File Restore](#)
- [Notice for Global File Cache](#)
- [Notice for Cloud Sync](#)
- [Notice for Cloud Tiering](#)
- [Notice for Cloud Data Sense](#)
- [Notice for Application Templates](#)

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