



# Cloud Volumes ONTAP documentation

## Cloud Volumes ONTAP

NetApp  
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# Cloud Volumes ONTAP documentation

# Release notes

## What's new in Cloud Volumes ONTAP

Learn what's new with Cloud Volumes ONTAP management in the NetApp Console.

The enhancements described on this page are specific to managing Cloud Volumes ONTAP through the Console. To learn what's new with the Cloud Volumes ONTAP software itself, [go to the Cloud Volumes ONTAP Release Notes](#).

### 26 February 2026

#### Support for Google Infrastructure Manager for private mode deployments

Cloud Volumes ONTAP 9.16.1 and later now support [Google Cloud Infrastructure Manager](#) (IM) instead of [Cloud Deployment Manager](#) (DM) for new private mode deployments in Google Cloud. Google will deprecate Deployment Manager as an infrastructure service in the near future for the more advanced Infrastructure Manager.

Beginning February 25, 2026, Cloud Volumes ONTAP uses Infrastructure Manager for new and existing private mode deployments. This table explains the basic workflows for you:

Scenario	Action	New APIs for the agent	New permissions for the agent	New Google Cloud APIs for Cloud Volumes ONTAP	Doc resources
Existing agent and existing deployment in private mode	Upgrade to the latest version of NetApp Console agent by downloading the installer from the NetApp Support Site and then manually installing the agent on your host, so that it can use Infrastructure Manager APIs. Thereafter, convert the existing Cloud Volumes ONTAP systems to use Infrastructure Manager.	<ul style="list-style-type: none"> <li>• Cloud Infrastructure Manager API</li> <li>• Cloud Quotas API</li> <li>• Cloud Build API</li> </ul>	<p>All the permissions listed for the Console release on:</p> <ul style="list-style-type: none"> <li>• <a href="#">8 December 2025</a></li> <li>• <a href="#">09 February 2026</a></li> <li>• <code>cloudbuild.workerpools.get</code></li> <li>• <code>cloudbuild.workerpools.get</code></li> </ul>	<ul style="list-style-type: none"> <li>• <a href="https://cloudbuild.googleapis.com/v1">https://cloudbuild.googleapis.com/v1</a></li> <li>• <a href="https://www.googleapis.com/upload/storage/v1">https://www.googleapis.com/upload/storage/v1</a></li> <li>• <a href="https://config.googleapis.com/v1">https://config.googleapis.com/v1</a></li> </ul>	<ul style="list-style-type: none"> <li>• <a href="#">Configure existing Cloud Volumes ONTAP deployments for Google Cloud Infrastructure Manager</a></li> </ul>
New agent and new deployment	Create a new agent and deploy a new Cloud Volumes ONTAP system in private mode.				<ul style="list-style-type: none"> <li>• <a href="#">Create a Console agent from Google Cloud</a></li> <li>• <a href="#">Quick start for private mode deployments</a></li> </ul>

In private mode deployments, you need a few configuration changes for Cloud Volumes ONTAP to start using Infrastructure Manager. Refer to [Infrastructure Manager configuration for private mode deployments](#).

#### Related links

- [NetApp Console Agent 4.2.0 Release Notes](#)
- [Permissions required for Google Cloud Infrastructure Manager](#)

## 19 February 2026

### New regions supported in Azure

You can now deploy Cloud Volumes ONTAP 9.12.1 GA and later in single and multiple availability zones in Azure in the following regions. This includes support for both single-node and high-availability (HA) deployments.

- Japan West (japanwest)
- Indonesia Central (indonesiacentral)

For a list of all regions, refer to the [Global Regions Map under Azure](#).

## 17 February 2026

### Cloud Volumes ONTAP support for next generation Google Cloud VMs

With 9.18.1, NetApp transitions new Cloud Volumes ONTAP deployments off N2 VMs to the next generation Google Cloud C3 series VMs for a faster and more scalable experience. You can now take advantage of C3 series VMs while deploying Cloud Volumes ONTAP 9.18.1 and later in Google Cloud. The C3 series machines offer improved performance and higher capacity limits by using Google Virtual NIC (gVNIC) and Hyperdisk Balanced disks that ensure dynamic performance for intensive workloads.



For now, Cloud Volumes ONTAP supports the C3 series only in single-node deployments.

If your Cloud Volumes ONTAP system runs 9.18.1 or later, the preconfigured packages that you use for easy single node deployments automatically use C3 VMs, while enabling you to customize the IOPS and throughput parameters based on your workload needs. Similarly, while creating aggregates, you can add Hyperdisk Balanced disks to achieve better performance and scalability in Google Cloud. Additionally, you can select the LSSD variants of the C3 series machines for default Flash Cache support.

You can't change the disk type for C3 VMs when adding volumes to aggregates because C3 supports only Hyperdisk Balanced disks. Similarly, when replicating a system with N2 VM types to a C3 VM, the disk type is set by default to Hyperdisk Balanced.

[Supported configurations for Cloud Volumes ONTAP in Google Cloud](#)

[Google documents: C3 machine series](#)

### VNet security for Cloud Volumes ONTAP in Azure

Cloud Volumes ONTAP 9.18.1 and later deployments in Azure single and multiple availability zones support Azure Virtual Network (VNet) encryption as part of its layered security strategy to protect data in transit. Cloud Volumes ONTAP leverages Azure's native Datagram Transport Layer Security (DTLS) protocol to secure communication between ONTAP nodes, management interfaces, and other Azure services, preventing

interception and unauthorized access. This network-level encryption complements ONTAP's built-in storage and data-at-rest protections to deliver end-to-end security of your data.

[Networking for Azure VNet encryption](#)

## 12 February 2026

### Support for Ebdsv5 and E104ids\_v5 VMs in Azure

Beginning with Cloud Volumes ONTAP 9.18.1, you can deploy Ebdsv5 and E104ids\_v5 VMs for single-node and high-availability (HA) deployments and upgrades.

Ebdsv5 VMs within the Eb family of Azure virtual machines are optimized for higher remote storage performance. You can use these VMs for memory-intensive and I/O-heavy enterprise workloads, such as relational databases, in-memory analytics, and other demanding business-critical applications.

E104ids\_v5 is an isolated VM instance that helps you better handle scheduled maintenance windows. Compared to E80ids\_v4, it offers much higher disk throughput and IOPS, along with better overall network performance.

[Supported configurations for Cloud Volumes ONTAP in Azure](#)

[Azure documentation: Edsv5 sizes series](#)

## 10 February 2026

### Cloud Volumes ONTAP 9.18.1 GA

You can now use the NetApp Console to deploy and manage the General Availability (GA) version of Cloud Volumes ONTAP 9.18.1 in AWS, Azure, and Google Cloud.

[Learn more about this release of Cloud Volumes ONTAP.](#)

## 9 February 2026

### Support for Google Cloud Infrastructure Manager

Cloud Volumes ONTAP 9.16.1 and later now support [Google Cloud Infrastructure Manager](#) (IM) instead of [Cloud Deployment Manager](#) (DM) for new deployments in Google Cloud. Google will deprecate Deployment Manager as an infrastructure service in the near future for the more advanced Infrastructure Manager.

Beginning February 09, 2026, Cloud Volumes ONTAP uses Infrastructure Manager for new and existing deployments. This table explains a few workflows for you:

Scenario	Action	New APIs for the agent	New permissions for the agent	New Google Cloud APIs for Cloud Volumes ONTAP	Doc resources
Existing agent and existing Cloud Volumes ONTAP deployment	Add new APIs and permissions to the existing agent and convert the existing Cloud Volumes ONTAP system.	<ul style="list-style-type: none"> <li>• Cloud Infrastructure Manager API</li> <li>• Cloud Quotas API</li> </ul>	All the permissions listed for the Console release on: <ul style="list-style-type: none"> <li>• <a href="#">8 December 2025</a></li> <li>• <a href="#">09 February 2026</a></li> </ul>	<a href="https://www.googleapis.com/upload/storage/v1">https://www.googleapis.com/upload/storage/v1</a> <a href="https://config.googleapis.com/v1">https://config.googleapis.com/v1</a>	<a href="#">Configure existing Cloud Volumes ONTAP deployments for Google Cloud Infrastructure Manager</a>
Existing agent and new Cloud Volumes ONTAP deployment	Add new APIs and permissions to the existing agent and deploy a new Cloud Volumes ONTAP system.	<ul style="list-style-type: none"> <li>• Cloud Infrastructure Manager API</li> <li>• Cloud Quotas API</li> </ul>	All the permissions listed for the Console release on: <ul style="list-style-type: none"> <li>• <a href="#">8 December 2025</a></li> <li>• <a href="#">09 February 2026</a></li> </ul>	All the steps for new deployment	<a href="#">Getting started with Cloud Volumes ONTAP in Google Cloud</a>

Scenario	Action	New APIs for the agent	New permissions for the agent	New Google Cloud APIs for Cloud Volumes ONTAP	Doc resources
New agent and new deployment	Create a new agent and deploy a new Cloud Volumes ONTAP system.				<ul style="list-style-type: none"> <li>• <a href="#">Create a Console agent from Google Cloud</a></li> <li>• <a href="#">Getting started with Cloud Volumes ONTAP in Google Cloud</a></li> </ul>

Now, deploy Cloud Volumes ONTAP to automatically use Infrastructure Manager or switch your existing deployments in Deployment Manager to Infrastructure Manager by running a conversion tool. The conversion is a one-time process, after which your systems will start using Infrastructure Manager. Refer to [Configure existing Cloud Volumes ONTAP deployments for Google Cloud Infrastructure Manager](#) for instructions on running the conversion tool.

Cloud Volumes ONTAP systems that use Infrastructure Manager use Google Cloud Storage buckets to store data and records in the zone of the first deployment to store deployment records, which are reused for subsequent deployments. You might incur extra costs for these buckets, but do not edit or delete the buckets or their content:

- `gs://netapp-cvo-infrastructure-manager-<project id>`: for ONTAP versions and SVM Terraform Templates used for new Cloud Volumes ONTAP deployments. Inside this, the `dm-to-im-convert` bucket contains the Cloud Volumes ONTAP Terraform files.
- `<gcp project number>-<region>-blueprint-config`: for storing Google Cloud Terraform artifacts.

**Related links**

- [Getting started with Cloud Volumes ONTAP in Google Cloud](#)
- [NetApp Console Agent 4.2.0 Release Notes](#)
- [Permissions required for Google Cloud Infrastructure Manager](#)

## 12 January 2026

### Preferred billing option for Cloud Volumes ONTAP

You can now select a preferred billing option for calculating your Cloud Volumes ONTAP usage and overages. Since the limited availability of the Bring Your Own Licenses (BYOL) licensing model on June 25, 2025, NetApp has added preferred charging methods in the **Licensing and Subscriptions** section of the NetApp Console. You can use either your annual marketplace subscription for billing and overages or the existing BYOL model as the preferred option. This gives you the flexibility to choose the charging method that best fits your organization's financial strategy and usage patterns.

[Billing preferences and overages.](#)

## 10 December 2025

### Ability to enhance performance of Premium SSD v2 disks in Azure

You can now enhance the performance of Premium SSD v2 Managed Disks in Azure by modifying the IOPS and throughput parameters. Using this capability, you can optimize the storage performance of your systems based on your workload requirements.

[Manage Premium SSD v2 disk performance for Cloud Volumes ONTAP in Azure.](#)

### Overage charging for Essentials licenses simplified

For Cloud Volumes ONTAP marketplace annual contracts/private offers, overage calculations for Essentials licenses is now aligned with Bring Your Own License (BYOL) packages. Previously, overages were billed at hourly marketplace rates for the exact Essentials package. Now, if your marketplace annual contract includes multiple Essentials packages, the NetApp Console charges overages for an Essentials package against the available capacity of a higher-priced Essentials package in your subscription. This simplifies overage calculations for Essentials packages and ensures a smooth transition from BYOL licensing to a subscription-based model.

[How overages are charged for Essentials licenses](#)

### Support for Azure Edsv6 sizes series

Beginning with Cloud Volumes ONTAP 9.17.1, you can deploy Azure Edsv6 series VMs through the NetApp Console for new Cloud Volumes ONTAP instances. Cloud Volumes ONTAP 9.17.1 and later will support only Generation 2 VMs for new deployments. These Generation 2 machines are compatible with the latest technologies, such as Unified Extensible Firmware Interface (UEFI), Azure Boost systems, and NVMe. They are ideal for memory-intensive systems and applications that need fast, local storage, such as database servers and analytics engines.

[Supported configurations for Cloud Volumes ONTAP in Azure](#)

## 10 November 2025

### Enhanced NVMe-TCP Support

Earlier, when deploying Cloud Volumes ONTAP instances over NVMe-TCP, you would have to manually obtain and apply NVMe licenses before deployment. With this update, Cloud Volumes ONTAP now automatically installs the required NVMe licenses during deployment, simplifying the setup process.

For existing NVMe-TCP deployments that lack licenses, Cloud Volumes ONTAP applies the licenses automatically. You must restart the system for the licenses to take effect.

For more information, see [Supported client protocols for Cloud Volumes ONTAP: NVMe-TCP](#).

## 17 October 2025

### Cloud Volumes ONTAP in Azure now limited to latest supported versions

Cloud Volumes ONTAP deployments and upgrades in Azure through the NetApp Console are now restricted to the latest supported versions. This ensures compatibility with the latest generation hardware supported by Microsoft and provides the newest features and security enhancements. The Console will prompt you to upgrade to the supported versions.

For more details, refer to:

- Deployment: [Supported ONTAP versions for Cloud Volumes ONTAP deployments](#)
- Upgrade: [Supported upgrade paths for Azure](#)

## 06 October 2025

### BlueXP is now NetApp Console

The NetApp Console, built on the enhanced and restructured BlueXP foundation, provides centralized management of NetApp storage and NetApp Data Services across on-premises and cloud environments at enterprise grade—delivering real-time insights, faster workflows, and simplified administration, that is highly secure and compliant.

For details on what has changed, see the [NetApp Console release notes](#).

### Simplified Cloud Volumes ONTAP deployment in AWS

You can now deploy Cloud Volumes ONTAP in AWS using a quick deployment method for both single-node and high-availability (HA) configurations. This streamlined process reduces the number of steps compared to the advanced method, automatically sets default values on a single page, and minimizes navigation, making deployment faster and easier.

For more information, refer to [Deploy Cloud Volumes ONTAP in AWS using quick deployment](#).

## 04 September 2025

### Cloud Volumes ONTAP 9.17.1 RC

You can now use BlueXP to deploy and manage the Release Candidate 1 of Cloud Volumes ONTAP 9.17.1 in Azure and Google Cloud. However, this version is not available for deployment and upgrade in AWS.

[Learn more about this release of Cloud Volumes ONTAP](#).

## 11 August 2025

### End of availability of Optimized licenses

Beginning on August 11, 2025, the Cloud Volumes ONTAP Optimized license will be deprecated and will no

longer be available for purchase or renewal in the Azure and Google Cloud marketplaces for pay-as-you-go (PAYGO) subscriptions. If you have an existing annual contract with an Optimized license, you can continue to use the license until the end of your contract. When your Optimized license expires, you can opt for Cloud Volumes ONTAP Essentials or Professional licenses in BlueXP.

However, the ability to add or renew Optimized licenses will be available through the APIs.

For information about licensing packages, refer to [Licensing for Cloud Volumes ONTAP](#).

For information about switching to a different charging method, refer to [Manage capacity-based licensing](#).

## 14 July 2025

### Support for transparent proxy

BlueXP now supports transparent proxy servers in addition to the existing explicit proxy connections. When creating or modifying the BlueXP Connector, you can configure a transparent proxy server to securely manage network traffic to and from Cloud Volumes ONTAP.

For more information about the use of proxy servers in Cloud Volumes ONTAP, refer to:

- [Network configurations to support Connector proxy in AWS](#)
- [Network configurations to support Connector proxy in Azure](#)
- [Network configurations to support Connector proxy in Google Cloud](#)

### New VM type supported for Cloud Volumes ONTAP in Azure

Beginning with Cloud Volumes ONTAP 9.13.1, L8s\_v3 is supported as a VM type in Azure single and multiple availability zones, for both new and existing high-availability (HA) pair deployments.

For more information, refer to [Supported configurations in Azure](#).

## 25 June 2025

### Restricted availability of BYOL licensing for Cloud Volumes ONTAP

Beginning June 25, 2025, NetApp has restricted the bring your own license (BYOL) licensing model for Cloud Volumes ONTAP. The restriction applies to all customers and Cloud Volumes ONTAP deployments in AWS, Azure, and Google Cloud. The only exemptions are the U.S. Public Sector customers and China region deployments.

NetApp support and services will continue until your BYOL contract expires, but your expired licenses will not be renewed or extended. When your BYOL licenses expire, you must replace them with capacity-based licenses purchased through your cloud marketplace subscriptions. A capacity-based licensing model through hyperscaler marketplaces streamlines the licensing experience and delivers greater business benefits. Contact your NetApp accounts team or customer success representatives to discuss your options of conversion.

For more information, refer to this customer communiqué: [CPC-00661: Changes to Cloud Volumes ONTAP BYOL Policy](#).

## 29 May 2025

### Private mode deployments enabled for Cloud Volumes ONTAP 9.15.1

You can now deploy Cloud Volumes ONTAP 9.15.1 in private mode in AWS, Azure, and Google Cloud. Private mode is enabled for both single-node and high-availability (HA) deployments of Cloud Volumes ONTAP 9.15.1.

For more information about private mode deployments refer to [Learn about BlueXP deployment modes](#).

## 12 May 2025

### Discovery of deployments made through the Azure marketplace in BlueXP

BlueXP now has the capability of discovering the Cloud Volumes ONTAP systems deployed directly through the Azure marketplace. This means that you can now add and manage these systems as working environments in BlueXP, just like any other Cloud Volumes ONTAP system.

[Deploy Cloud Volumes ONTAP from the Azure marketplace](#)

## 16 April 2025

### New regions supported in Azure

You can now deploy Cloud Volumes ONTAP 9.12.1 GA and later in single and multiple availability zones in Azure in the following regions. This includes support for both single-node and high-availability (HA) deployments.

- Spain Central
- Mexico Central

For a list of all regions, refer to the [Global Regions Map under Azure](#).

## 14 April 2025

### Storage VM creation automated through the APIs in Google Cloud

You can now use the BlueXP APIs to automate the storage VM creation in Google Cloud. You have been using this feature in Cloud Volumes ONTAP high-availability (HA) configurations, and now you can also use it in single node deployments. By using the BlueXP APIs, you can easily create, rename, and delete additional data-serving storage VMs in your Google Cloud environment, without the need to manually configure the required network interfaces, LIFs, and management LIFs. This automation simplifies the process of managing storage VMs.

[Manage data-serving storage VMs for Cloud Volumes ONTAP in Google Cloud](#)

## 03 April 2025

### Support for China regions for Cloud Volumes ONTAP 9.13.1 in AWS

You can now deploy Cloud Volumes ONTAP 9.13.1 in AWS in China regions. This includes support for both single-node and high-availability (HA) deployments. Only licenses purchased directly from NetApp are supported.

For regional availability, refer to the [Global Regions Maps for Cloud Volumes ONTAP](#).

## 28 March 2025

### Private mode deployments enabled for Cloud Volumes ONTAP 9.14.1

You can now deploy Cloud Volumes ONTAP 9.14.1 in private mode in AWS, Azure, and Google Cloud. Private mode is enabled for both single-node and high-availability (HA) deployments of Cloud Volumes ONTAP 9.14.1.

For more information about private mode deployments refer to [Learn about BlueXP deployment modes](#).

## 12 March 2025

### New regions supported for multiple availability zone deployments in Azure

The following regions now support HA multiple availability zone deployments in Azure for Cloud Volumes ONTAP 9.12.1 GA and later:

- Central US
- US Gov Virginia (US Government Region - Virginia)

For a list of all regions, refer to the [Global Regions Map under Azure](#).

## 10 March 2025

### Storage VM creation automated through the APIs in Azure

You can now use the BlueXP APIs to create, rename, and delete additional data-serving storage VMs for Cloud Volumes ONTAP in Azure. Using the APIs automates the process of storage VM creation, including the configuration of the required network interfaces, LIFs, and a management LIF, if you need to use a storage VM for management purposes.

[Manage data-serving storage VMs for Cloud Volumes ONTAP in Azure](#)

## 06 March 2025

### Cloud Volumes ONTAP 9.16.1 GA

You can now use BlueXP to deploy and manage the Cloud Volumes ONTAP 9.16.1 General Availability release in Azure and Google Cloud. However, this version is not available for deployment and upgrade in AWS.

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

## 03 March 2025

### Support for New Zealand North region in Azure

The New Zealand North region is now supported in Azure for single node and high-availability (HA) configurations of Cloud Volumes ONTAP 9.12.1 GA and later. Note that the Lsv3 instance type is not supported in this region.

For a list of all supported regions, refer to the [Global Regions Map under Azure](#).

## 18 February 2025

### Introducing Azure marketplace direct deployment

You can now take advantage of Azure marketplace direct deployment to easily and quickly deploy Cloud Volumes ONTAP directly from the Azure marketplace. Using this streamlined method, you can explore the core features and capabilities of Cloud Volumes ONTAP in your environment without the need to set up the BlueXP Connector or meet other onboarding criteria required for deploying Cloud Volumes ONTAP through BlueXP.

- [Learn about Cloud Volumes ONTAP deployment options in Azure](#)
- [Deploy Cloud Volumes ONTAP from the Azure marketplace](#)

## 10 February 2025

### User authentication enabled for accessing System Manager from BlueXP

As a BlueXP administrator, you can now activate authentication for ONTAP users accessing ONTAP System Manager from BlueXP. You can enable this option by editing the BlueXP Connector settings. This option is available for standard and private modes.

[Administer Cloud Volumes ONTAP using System Manager.](#)

### BlueXP Advanced View renamed to System Manager

The option for advanced management of Cloud Volumes ONTAP from BlueXP through ONTAP System Manager has been renamed from **Advanced View** to **System Manager**.

[Administer Cloud Volumes ONTAP using System Manager.](#)

### Introducing a simpler way to manage licenses with the BlueXP digital wallet

Now, you can experience simplified management of Cloud Volumes ONTAP licenses by using improved navigation points within the BlueXP digital wallet:

- Access your Cloud Volumes ONTAP license information easily through the **Administration > Licenses and subscriptions > Overview/Direct Licenses** tabs.
- Click **View** on the Cloud Volume ONTAP panel in the **Overview** tab to gain a comprehensive understanding of your capacity-based licenses. This advanced view offers detailed insight into your licenses and subscriptions.
- If you prefer the previous interface, you can click the **Switch to legacy view** button to view license details by type and modify charging methods for your licenses.

[Manage capacity-based licenses.](#)

## 09 December 2024

### List of supported VMs updated for Azure to align with the best practices

The DS\_v2 and Es\_v3 machine families are no longer available for selection on BlueXP when deploying new instances of Cloud Volumes ONTAP in Azure. These families will be retained and supported only in older, existing systems. New deployments of Cloud Volumes ONTAP are supported in Azure only from the 9.12.1 release. We recommend that you switch to either Es\_v4 or any other series compatible with Cloud Volumes ONTAP 9.12.1 and later. The DS\_v2 and Es\_v3 series machines, however, will be available for new

deployments made through the API.

[Supported configurations in Azure](#)

## 11 November 2024

### End of availability for node-based licenses

NetApp has planned the end of availability (EOA) and end of support (EOS) of Cloud Volumes ONTAP node-based licensing. Beginning with 11 November, 2024, the limited availability of node-based licenses has been terminated. The support for node-based licensing ends on 31 December, 2024. After the EOA of your node-based licenses, you should transition to capacity-based licensing by using the BlueXP license conversion tool.

For annual or longer-term commitments, NetApp recommends that you contact your NetApp representative prior to the EOA date or license expiration date to ensure that the prerequisites for the transition are in place. If you don't have a long-term contract for a Cloud Volumes ONTAP node and run your system against an on-demand pay-as-you-go (PAYGO) subscription, it is important to plan your conversion before the EOS date. For both long-term contracts and PAYGO subscriptions, you can use the BlueXP license conversion tool for a seamless conversion.

[End of availability of node-based licenses](#)

[Convert a Cloud Volumes ONTAP node-based license to a capacity-based license](#)

### Removal of node-based deployments from BlueXP

The option to deploy Cloud Volumes ONTAP systems by using node-based licenses is deprecated on BlueXP. Except for a few special cases, you cannot use node-based licenses for Cloud Volumes ONTAP deployments for any cloud provider.

NetApp recognizes the following unique licensing requirements in compliance with contractual obligations and operational needs, and will continue to support node-based licenses in these situations:

- U.S. Public Sector customers
- Deployments in private mode
- China region deployments of Cloud Volumes ONTAP in AWS
- If you have a valid, non-expired by-node bring your own license (BYOL license)

[End of availability of node-based licenses](#)

### Addition of a cold tier for Cloud Volumes ONTAP data on Azure Blob storage

BlueXP now enables you to select a cold tier to store the inactive capacity tier data on Azure Blob storage. Adding the cold tier to the existing hot and cool tiers provides you with a more affordable storage option and improved cost efficiency.

[Data tiering in Azure](#)

### Option to restrict public access to storage account for Azure

You now have the option to restrict public access to your storage account for Cloud Volumes ONTAP systems in Azure. By disabling access, you can secure your private IP address from exposure even within the same VNet, should there be a need to comply with your organization's security policies. This option also disables data tiering for your Cloud Volumes ONTAP systems, and is applicable to both single node and high-availability

pairs.

[Security group rules.](#)

## **WORM enablement after deploying Cloud Volumes ONTAP**

You now have the ability to activate write once, read many (WORM) storage on an existing Cloud Volumes ONTAP system using BlueXP. This functionality provides you with the flexibility of enabling WORM on a working environment, even if WORM was not enabled on it during its creation. Once enabled, you cannot disable WORM.

[Enabling WORM on a Cloud Volumes ONTAP working environment](#)

## **25 October 2024**

### **List of supported VMs updated for Google Cloud to align with the best practices**

The n1 series machines are no longer available for selection on BlueXP when deploying new instances of Cloud Volumes ONTAP in Google Cloud. The n1 series machines will be retained and supported only in older, existing systems. New deployments of Cloud Volumes ONTAP are supported in Google Cloud only from the 9.8 release. We recommend that you switch to the n2 series machine types that are compatible with Cloud Volumes ONTAP 9.8 and later. The n1 series machines, however, will be available for new deployments performed through the API.

[Supported configurations in Google Cloud.](#)

### **Local Zones support for Amazon Web Services in private mode**

BlueXP now supports AWS Local Zones for Cloud Volumes ONTAP high availability (HA) deployments in private mode. The support that was earlier limited to only standard mode has now been extended to include private mode.



AWS Local Zones are not supported when using BlueXP in restricted mode.

For more information on AWS Local Zones with HA Deployments, refer to [AWS Local Zones](#).

## **07 October 2024**

### **Enhanced user experience in version selection for upgrade**

Beginning with this release, when you try to upgrade Cloud Volumes ONTAP using the BlueXP notification, you will receive guidance on the default, latest, and compatible versions to use. Also, now you can select the latest patch or major version compatible with your Cloud Volumes ONTAP instance, or manually enter a version for upgrade.

[Upgrade Cloud Volumes ONTAP software](#)

## **09 September 2024**

### **WORM and ARP functionalities are no longer chargeable**

The built-in data protection and security features of WORM (Write Once Read Many) and ARP (Autonomous Ransomware Protection) will be offered with Cloud Volumes ONTAP licenses at no extra cost. The new pricing

model applies to both new and existing BYOL and PAYGO/marketplace subscriptions of AWS, Azure, and Google Cloud. Both capacity-based and node-based licenses will contain ARP and WORM for all configurations, including single node and high-availability (HA) pairs, at no additional cost.

The simplified pricing brings you these benefits:

- Accounts that currently include WORM and ARP will no longer incur charges for these features. Going forward, your billing will only have charges for capacity usage, as it was before this change. WORM and ARP will no longer be included in your future bills.
- If your current accounts do not include these features, you can now opt for WORM and ARP at no additional cost.
- All Cloud Volumes ONTAP offerings for any new accounts will exclude charges for WORM and ARP.

Learn more about these features:

- [Enable NetApp ransomware protection solutions for Cloud Volumes ONTAP](#)
- [WORM storage](#)

## 23 August 2024

### Canada West region now supported in AWS

The Canada West region is now supported in AWS for Cloud Volumes ONTAP 9.12.1 GA and later.

For a list of all regions, see the [Global Regions Map under AWS](#).

## 22 August 2024

### Cloud Volumes ONTAP 9.15.1 GA

BlueXP can now deploy and manage Cloud Volumes ONTAP 9.15.1 General Availability release in AWS, Azure, and Google Cloud.

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

## 08 August 2024

### Edge Cache licensing packages deprecated

Edge Cache capacity-based licensing packages will no longer be available for future deployments of Cloud Volumes ONTAP. However, you can use the API to avail this functionality.

### Minimum version support for Flash Cache in Azure

The minimum Cloud Volumes ONTAP version required for configuring Flash Cache in Azure is 9.13.1 GA. You can only use ONTAP 9.13.1 GA and later versions for deploying Flash Cache on Cloud Volumes ONTAP systems in Azure.

For supported configurations, see [Supported configurations in Azure](#).

## Free trials for marketplace subscriptions deprecated

The 30-day automatic free trial or evaluation license for pay-as-you-go subscriptions in cloud provider's marketplace will no longer be available in Cloud Volumes ONTAP. The charging for any type of marketplace subscription (PAYGO or annual contract) will be activated from the first use, without any free trial period.

## 10 June 2024

### Cloud Volumes ONTAP 9.15.0

BlueXP can now deploy and manage the Cloud Volumes ONTAP 9.15.0 in AWS, Azure, and Google Cloud.

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

## 17 May 2024

### Amazon Web Services Local Zones support

Support for AWS Local Zones is now available for Cloud Volumes ONTAP HA deployments. AWS Local Zones are an infrastructure deployment where storage, compute, database, and other select AWS services are located close to large cities and industry areas.



AWS Local Zones are supported when using BlueXP in standard mode. At this time, AWS Local Zones are not supported when using BlueXP in restricted mode or private mode.

For more information on AWS Local Zones with HA Deployments, refer to [AWS Local Zones](#).

## 23 April 2024

### New regions supported for multiple availability zone deployments in Azure

The following regions now support HA multiple availability zone deployments in Azure for Cloud Volumes ONTAP 9.12.1 GA and later:

- Germany West Central
- Poland Central
- West US 3
- Israel Central
- Italy North
- Canada Central

For a list of all regions, refer to the [Global Regions Map under Azure](#).

### Johannesburg region now supported in Google Cloud

The Johannesburg region (`africa-south1` region) is now supported in Google Cloud for Cloud Volumes ONTAP 9.12.1 GA and later.

For a list of all regions, refer to the [Global Regions Map under Google Cloud](#).

## Volume templates and tags no longer supported

You can no longer create a volume from a template or edit a volume's tags. These actions were associated with the BlueXP remediation service, which is no longer available.

## 08 March 2024

### Amazon Instant Metadata Service v2 support

In AWS, Cloud Volumes ONTAP, the Mediator, and the Connector now support Amazon Instant Metadata Service v2 (IMDSv2) for all functions. IMDSv2 provides enhanced protection against vulnerabilities. Only IMDSv1 was previously supported.

If required by your security policies, you can configure your EC2 instances to use IMDSv2. For instructions, refer to [BlueXP setup and administration documentation for managing existing Connectors](#).

## 05 March 2024

### Cloud Volumes ONTAP 9.14.1 GA

BlueXP can now deploy and manage Cloud Volumes ONTAP 9.14.1 General Availability release in AWS, Azure, and Google Cloud.

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

## 02 February 2024

### Support for Edv5-series VMs in Azure

Cloud Volumes ONTAP now supports the following Edv5-series VMs starting with the 9.14.1 release.

- E4ds\_v5
- E8ds\_v5
- E20s\_v5
- E32ds\_v5
- E48ds\_v5
- E64ds\_v5

[Supported configurations in Azure](#)

## 16 January 2024

### Patch releases in BlueXP

Patch releases are available in BlueXP only for the latest three versions of Cloud Volumes ONTAP.

[Upgrade Cloud Volumes ONTAP](#)

## 08 January 2024

## New VMs for Azure multiple availability zones

Starting from Cloud Volumes ONTAP 9.13.1, the following VM types support Azure multiple availability zones for new and existing high-availability pair deployments:

- L16s\_v3
- L32s\_v3
- L48s\_v3
- L64s\_v3

[Supported configurations in Azure](#)

## 06 December 2023

### Cloud Volumes ONTAP 9.14.1 RC1

BlueXP can now deploy and manage Cloud Volumes ONTAP 9.14.1 in AWS, Azure, and Google Cloud.

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

### 300 TiB FlexVol volume max limit

You can now create a FlexVol volume up to the maximum size of 300 TiB with System Manager and the ONTAP CLI starting from Cloud Volumes ONTAP 9.12.1 P2 and 9.13.0 P2, and in BlueXP starting from Cloud Volumes ONTAP 9.13.1.

- [Storage limits in AWS](#)
- [Storage limits in Azure](#)
- [Storage limits in Google Cloud](#)

## 05 December 2023

The following changes were introduced.

### New region support in Azure

#### Single availability zone region support

The following regions now support highly-available single availability zone deployments in Azure for Cloud Volumes ONTAP 9.12.1 GA and later:

- Tel Aviv
- Milan

#### Multiple availability zone region support

The following regions now support highly-available multiple availability zone deployments in Azure for Cloud Volumes ONTAP 9.12.1 GA and later:

- Central India
- Norway East
- Switzerland North

- South Africa North
- United Arab Emirates North

For a list of all regions, refer to the [Global Regions Map under Azure](#).

## 10 November 2023

The following change was introduced with the 3.9.35 release of the Connector.

### **Berlin region now supported in Google Cloud**

The Berlin region is now supported in Google Cloud for Cloud Volumes ONTAP 9.12.1 GA and later.

For a list of all regions, refer to the [Global Regions Map under Google Cloud](#).

## 08 November 2023

The following change was introduced with the 3.9.35 release of the Connector.

### **Tel Aviv region now supported in AWS**

The Tel Aviv region is now supported in AWS for Cloud Volumes ONTAP 9.12.1 GA and later.

For a list of all regions, refer to the [Global Regions Map under AWS](#).

## 01 November 2023

The following change was introduced with the 3.9.34 release of the Connector.

### **Saudi Arabia region now supported in Google Cloud**

The Saudi Arabia region is now supported in Google Cloud for Cloud Volumes ONTAP and the Connector for Cloud Volumes ONTAP 9.12.1 GA and later.

For a list of all regions, refer to the [Global Regions Map under Google Cloud](#).

## 23 October 2023

The following change was introduced with the 3.9.34 release of the Connector.

### **New regions supported for HA multiple availability zone deployments in Azure**

The following regions in Azure now support highly-available multiple availability zone deployments for Cloud Volumes ONTAP 9.12.1 GA and later:

- Australia East
- East Asia
- France Central
- North Europe
- Qatar Central
- Sweden Central

- West Europe
- West US 2

For a list of all regions that support multiple availability zones, refer to the [Global Regions Map under Azure](#).

## 06 October 2023

The following change was introduced with the 3.9.34 release of the Connector.

### Cloud Volumes ONTAP 9.14.0

BlueXP can now deploy and manage the Cloud Volumes ONTAP 9.14.0 General Availability release in AWS, Azure, and Google Cloud.

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

## 10 September 2023

The following change was introduced with the 3.9.33 release of the Connector.

### Support for Lsv3-series VMs in Azure

The L48s\_v3 and L64s\_v3 instance types are now supported with Cloud Volumes ONTAP in Azure for single node and high-availability pair deployments with shared managed disks in single and multiple availability zones, starting with the 9.13.1 release. These instance types support Flash Cache.

[View supported configurations for Cloud Volumes ONTAP in Azure](#)  
[View storage limits for Cloud Volumes ONTAP in Azure](#)

## 30 July 2023

The following changes were introduced with the 3.9.32 release of the Connector.

### Flash Cache and high write speed support in Google Cloud

Flash Cache and high write speed can be enabled separately in Google Cloud for Cloud Volumes ONTAP 9.13.1 and later. High write speed is available on all supported instance types. Flash Cache is supported on the following instance types:

- n2-standard-16
- n2-standard-32
- n2-standard-48
- n2-standard-64

You can use these features separately or together on both single node and high-availability pair deployments.

[Launch Cloud Volumes ONTAP in Google Cloud](#)

### Usage reports enhancements

Various improvements to the displayed information within the usage reports are now available. The following are enhancements to the usage reports:

- The TiB unit is now included in the name of columns.
- A new "node(s)" field for serial numbers is now included.
- A new "Workload Type" column is now included under the Storage VMs usage report.
- Working environment names now included in Storage VMs and Volume usage reports.
- Volume type "file" is now labeled "Primary (Read/Write)".
- Volume type "secondary" is now labeled "Secondary (DP)".

For more information on usage reports, refer to [Download usage reports](#).

## 26 July 2023

The following changes were introduced with the 3.9.31 release of the Connector.

### Cloud Volumes ONTAP 9.13.1 GA

BlueXP can now deploy and manage the Cloud Volumes ONTAP 9.13.1 General Availability release in AWS, Azure, and Google Cloud.

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

## 02 July 2023

The following changes were introduced with the 3.9.31 release of the Connector.

### Support for HA multiple availability zone deployments in Azure

The Japan East and Korea Central in Azure now supports HA multiple availability zone deployments for Cloud Volumes ONTAP 9.12.1 GA and later.

For a list of all regions that support multiple availability zones, refer to the [Global Regions Map under Azure](#).

### Autonomous Ransomware Protection support

Autonomous Ransomware Protection (ARP) is now supported on Cloud Volumes ONTAP. ARP support is available on Cloud Volumes ONTAP version 9.12.1 and higher.

To learn more about ARP with Cloud Volumes ONTAP, refer to [Autonomous Ransomware Protection](#).

## 26 June 2023

The following change was introduced with the 3.9.30 release of the Connector.

### Cloud Volumes ONTAP 9.13.1 RC1

BlueXP can now deploy and manage Cloud Volumes ONTAP 9.13.1 in AWS, Azure, and Google Cloud.

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

## 04 June 2023

The following change was introduced with the 3.9.30 release of the Connector.

## Cloud Volumes ONTAP upgrade version selector update

Through the Upgrade Cloud Volumes ONTAP page, you can now choose to upgrade to the latest available version of Cloud Volumes ONTAP or an older version.

To learn more about upgrading Cloud Volumes ONTAP through BlueXP, refer to [Upgrade Cloud Volumes ONTAP](#).

## 07 May 2023

The following changes were introduced with the 3.9.29 release of the Connector.

### Qatar region now supported in Google Cloud

The Qatar region is now supported in Google Cloud for Cloud Volumes ONTAP and the Connector for Cloud Volumes ONTAP 9.12.1 GA and later.

### Sweden Central region now supported in Azure

The Sweden Central region is now supported in Azure for Cloud Volumes ONTAP and the Connector for Cloud Volumes ONTAP 9.12.1 GA and later.

### Support for HA multiple availability zone deployments in Azure Australia East

The Australia East region in Azure now supports HA multiple availability zone deployments for Cloud Volumes ONTAP 9.12.1 GA and later.

### Charging usage breakdown

Now you can find out what you're being charged for when you're subscribed to capacity-based licenses. The following types of usage reports are available for download from the digital wallet in BlueXP. The usage reports provide capacity details of your subscriptions and tell you how you're being charged for the resources in your Cloud Volumes ONTAP subscriptions. The downloadable reports can be easily shared with others.

- Cloud Volumes ONTAP package usage
- High-level usage
- Storage VMs usage
- Volumes usage

For more information, refer to [Manage capacity-based licenses](#).

### Notification now displays when accessing BlueXP without a marketplace subscription

A notification now displays whenever you access Cloud Volumes ONTAP in BlueXP without a marketplace subscription. The notification states "a marketplace subscription for this working environment is required to be compliant with Cloud Volumes ONTAP terms and conditions."

### New permissions added to AWS IAM policy for HA mediators

These new AWS permissions have been added to the IAM policy for HA mediators in Cloud Volumes ONTAP high-availability (HA) environments:

- sts:AssumeRole

- ec2:DescribeSubnets

## 04 April 2023

### Support for China regions for AWS

Starting with Cloud Volumes ONTAP 9.12.1 GA, China regions are now supported in AWS as follows.

- Single-node systems are supported.
- Licenses purchased directly from NetApp are supported.

For regional availability, refer to the [Global Regions Maps for Cloud Volumes ONTAP](#).

## 3 April 2023

The following changes were introduced with the 3.9.28 release of the Connector.

### Turin region now supported in Google Cloud

The Turin region is now supported in Google Cloud for Cloud Volumes ONTAP and the Connector for Cloud Volumes ONTAP 9.12.1 GA and later.

### BlueXP digital wallet enhancement

The BlueXP digital wallet now shows the licensed capacity that you purchased with marketplace private offers.

[Learn how to view the consumed capacity in your account.](#)

### Support for comments during volume creation

This release enables you to make comments when creating an Cloud Volumes ONTAP FlexGroup volume or FlexVol volume when using the API.

### BlueXP user interface redesign for Cloud Volumes ONTAP Overview, Volumes, and Aggregates pages

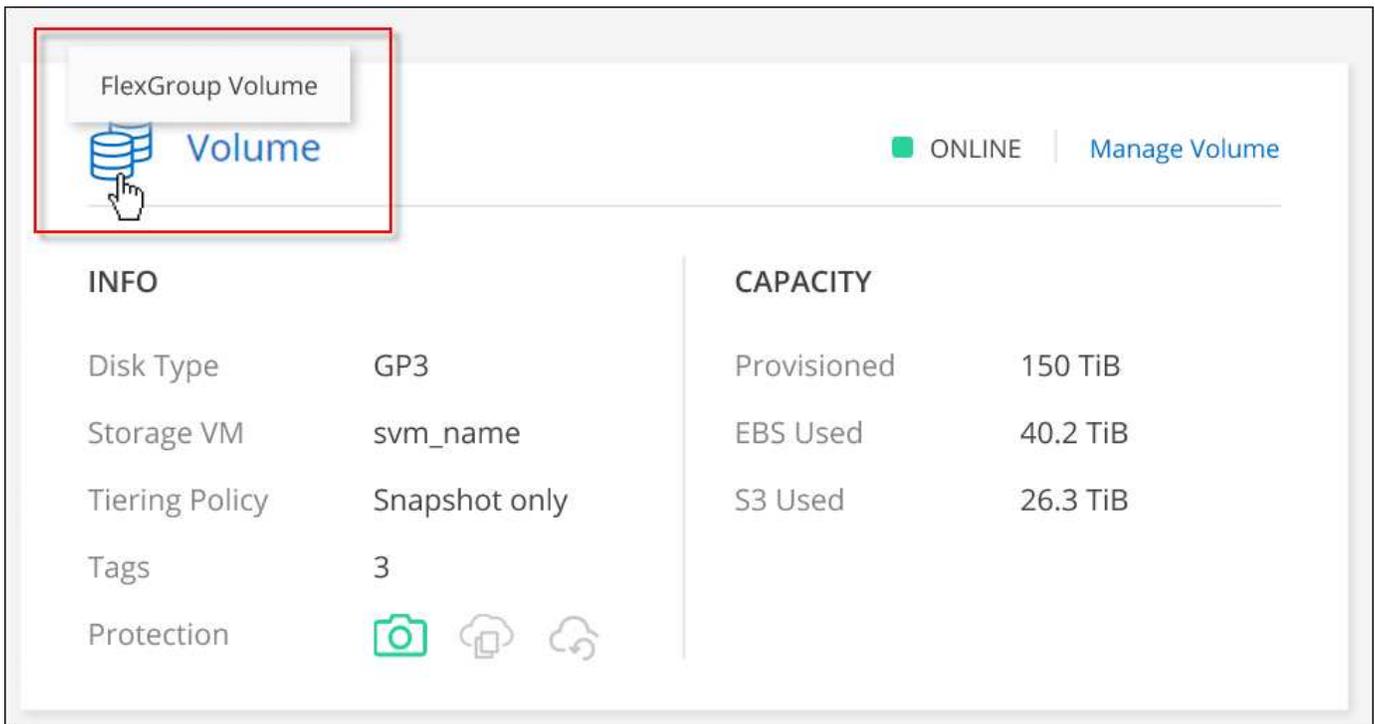
BlueXP now has a redesigned user interface for Cloud Volumes ONTAP Overview, Volumes, and Aggregates pages. The tile-based design presents more comprehensive information in each tile for a better user experience.

### FlexGroup Volumes viewable through Cloud Volumes ONTAP

FlexGroup volumes created through ONTAP System Manager or the ONTAP CLI directly are now viewable through the redesigned Volumes tile in BlueXP. Identical to the information provided for FlexVol volumes, BlueXP provides detailed information for created FlexGroup volumes through a dedicated Volumes tile.



Currently, you can only view existing FlexGroup volumes under BlueXP. The ability to create FlexGroup volumes in BlueXP is not available but planned for a future release.



[Learn more about viewing created FlexGroup volumes.](#)

## 13 March 2023

### Support for China regions in Azure

China North 3 region is now supported for single node deployments of Cloud Volumes ONTAP 9.12.1 GA and 9.13.0 GA in Azure. Only licenses purchased directly from NetApp (BYOL licenses) are supported in these regions.



Fresh deployments of Cloud Volumes ONTAP in China regions are supported only in 9.12.1 GA and 9.13.0 GA. You can upgrade these versions to later patches and releases of Cloud Volumes ONTAP. If you want to deploy later Cloud Volumes ONTAP versions in China regions, contact NetApp Support.

For regional availability, refer to the [Global Regions Maps for Cloud Volumes ONTAP](#).

## 05 March 2023

The following changes were introduced with the 3.9.27 release of the Connector.

### Cloud Volumes ONTAP 9.13.0

BlueXP can now deploy and manage Cloud Volumes ONTAP 9.13.0 in AWS, Azure, and Google Cloud.

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

### 16 TiB and 32 Tib support in Azure

Cloud Volumes ONTAP now supports 16 TiB and 32 TiB disk sizes for high-availability deployments running on managed disks in Azure.

Learn more about [supported disk sizes in Azure](#).

## **MTEKM license**

The Multi-tenant Encryption Key Management (MTEKM) license is now included with new and existing Cloud Volumes ONTAP systems running version 9.12.1 GA or later.

Multi-tenant external key management enables individual storage VMs (SVMs) to maintain their own keys through a KMIP server when using NetApp Volume Encryption.

[Learn how to encrypt volumes with NetApp encryption solutions.](#)

## **Support for environments without internet**

Cloud Volumes ONTAP is now supported in any cloud environment that has complete isolation from the internet. Only node-based licensing (BYOL) is supported in these environments. Capacity-based licensing is not supported. To get started, manually install the Connector software, log in to the BlueXP console that's running on the Connector, add your BYOL license to the BlueXP digital wallet, and then deploy Cloud Volumes ONTAP.

- [Install the Connector in a location without internet access](#)
- [Access the BlueXP console on the Connector](#)
- [Add an unassigned license](#)

## **Flash Cache and high write speed in Google Cloud**

Support for Flash Cache, high write speed, and a high maximum transmission unit (MTU) of 8,896 bytes is now available for select instances with the Cloud Volumes ONTAP 9.13.0 release.

Learn more about [supported configurations by license for Google Cloud](#).

## **05 February 2023**

The following changes were introduced with the 3.9.26 release of the Connector.

### **Placement group creation in AWS**

A new configuration setting is now available for placement group creation with AWS HA single availability zone (AZ) deployments. Now you can choose to bypass failed placement group creations and allow AWS HA single AZ deployments to complete successfully.

For detailed information on how to configure the placement group creation setting, refer to [Configure placement group creation for AWS HA Single AZ](#).

### **Private DNS zone configuration update**

A new configuration setting is now available so that you can avoid creating a link between a private DNS zone and a virtual network when using Azure Private Links. Creation is enabled by default.

[Provide BlueXP with details about your Azure Private DNS](#)

## **WORM storage and data tiering**

You can now enable both data tiering and WORM storage together when you create a Cloud Volumes ONTAP 9.8 system or later. Enabling data tiering with WORM storage allows you to tier the data to an object store in the cloud.

[Learn about WORM storage.](#)

## **1 January 2023**

The following changes were introduced with the 3.9.25 release of the Connector.

### **Licensing packages available in Google Cloud**

Optimized and Edge Cache capacity-based licensing packages are available for Cloud Volumes ONTAP in the Google Cloud Marketplace as a pay-as-you-go offering or as an annual contract.

Refer to [Cloud Volumes ONTAP licensing](#).

### **Default configuration for Cloud Volumes ONTAP**

The Multi-tenant Encryption Key Management (MTEKM) license is no longer included in new Cloud Volumes ONTAP deployments.

For more information on the ONTAP feature licenses automatically installed with Cloud Volumes ONTAP, refer to [Default Configuration for Cloud Volumes ONTAP](#).

## **15 December 2022**

### **Cloud Volumes ONTAP 9.12.0**

BlueXP can now deploy and manage Cloud Volumes ONTAP 9.12.0 in AWS and Google Cloud.

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

## **08 December 2022**

### **Cloud Volumes ONTAP 9.12.1**

BlueXP can now deploy and manage Cloud Volumes ONTAP 9.12.1, which includes support for new features and additional cloud provider regions.

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

## **04 December 2022**

The following changes were introduced with the 3.9.24 release of the Connector.

### **WORM + Cloud Backup now available during Cloud Volumes ONTAP creation**

The ability to activate both write once, read many (WORM) and Cloud Backup features is now available during the Cloud Volumes ONTAP creation process.

## Israel region now supported in Google Cloud

The Israel region is now supported in Google Cloud for Cloud Volumes ONTAP and the Connector for Cloud Volumes ONTAP 9.11.1 P3 and later.

## 15 November 2022

The following changes were introduced with the 3.9.23 release of the Connector.

### ONTAP S3 license in Google Cloud

An ONTAP S3 license is now included on new and existing Cloud Volumes ONTAP systems running version 9.12.1 or later in Google Cloud Platform.

[ONTAP documentation: Learn how to configure and manage S3 object storage services](#)

## 06 November 2022

The following changes were introduced with the 3.9.23 release of the Connector.

### Moving resource groups in Azure

You can now move a working environment from one resource group to a different resource group in Azure within the same Azure subscription.

For more information, refer to [Moving resource groups](#).

### NDMP-copy certification

NDMP-copy is now certified for use with Cloud Volume ONTAP.

For information on how to configure and use NDMP, refer to the [ONTAP documentation: NDMP configuration overview](#).

### Managed disk encryption support for Azure

A new Azure permission has been added that now allows you to encrypt all managed disks upon creation.

For more information on this new functionality, refer to [Set up Cloud Volumes ONTAP to use a customer-managed key in Azure](#).

## 18 September 2022

The following changes were introduced with the 3.9.22 release of the Connector.

### Digital Wallet enhancements

- The Digital Wallet now shows a summary of the Optimized I/O licensing package and the provisioned WORM capacity for Cloud Volumes ONTAP systems across your account.

These details can help you better understand how you're being charged and whether you need to purchase additional capacity.

[Learn how to view the consumed capacity in your account.](#)

- You can now change from one charging method to the Optimized charging method.

[Learn how to change charging methods.](#)

## Optimize cost and performance

You can now optimize the cost and performance of a Cloud Volumes ONTAP system directly from the Canvas.

After you select a working environment, you can choose the **Optimize Cost & Performance** option to change the instance type for Cloud Volumes ONTAP. Choosing a smaller-sized instance can help you reduce costs, while changing to a larger-sized instance can help you optimize performance.

[A screenshot of the Optimize Cost & Performance option that's available from the Canvas after you select a Cloud Volumes ONTAP system.]

## AutoSupport notifications

BlueXP will now generate a notification if a Cloud Volumes ONTAP system is unable to send AutoSupport messages. The notification includes a link to instructions that you can use to troubleshoot networking issues.

## 31 July 2022

The following changes were introduced with the 3.9.21 release of the Connector.

### MTEKM license

The Multi-tenant Encryption Key Management (MTEKM) license is now included with new and existing Cloud Volumes ONTAP systems running version 9.11.1 or later.

Multi-tenant external key management enables individual storage VMs (SVMs) to maintain their own keys through a KMIP server when using NetApp Volume Encryption.

[Learn how to encrypt volumes with NetApp encryption solutions.](#)

### Proxy server

BlueXP now automatically configures your Cloud Volumes ONTAP systems to use the Connector as a proxy server, if an outbound internet connection isn't available to send AutoSupport messages.

AutoSupport proactively monitors the health of your system and sends messages to NetApp technical support.

The only requirement is to ensure that the Connector's security group allows *inbound* connections over port 3128. You'll need to open this port after you deploy the Connector.

### Change charging method

You can now change the charging method for a Cloud Volumes ONTAP system that uses capacity-based licensing. For example, if you deployed a Cloud Volumes ONTAP system with the Essentials package, you can change it to the Professional package if your business needs changed. This feature is available from the Digital Wallet.

[Learn how to change charging methods.](#)

## Security group enhancement

When you create a Cloud Volumes ONTAP working environment, the user interface now enables you to choose whether you want the predefined security group to allow traffic within the selected network only (recommended) or all networks.

[A screenshot that shows the Allow Traffic Within option that's available in the working environment wizard when selecting a security group.]

## 18 July 2022

### New licensing packages in Azure

Two new capacity-based licensing packages are available for Cloud Volumes ONTAP in Azure when you pay through an Azure Marketplace subscription:

- **Optimized:** Pay for provisioned capacity and I/O operations separately
- **Edge Cache:** Licensing for [Cloud Volumes Edge Cache](#)

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

## 3 July 2022

The following changes were introduced with the 3.9.20 release of the Connector.

### Digital Wallet

The Digital Wallet now shows you the total consumed capacity in your account and the consumed capacity by licensing package. This can help you understand how you're being charged and whether you need to purchase additional capacity.

[A screenshot that shows the Digital Wallet page for capacity-based licenses. The page provides an overview of the consumed capacity in your account and then breaks down the consumed capacity by licensing package.]

### Elastic Volumes enhancement

BlueXP now supports the Amazon EBS Elastic Volumes feature when creating a Cloud Volumes ONTAP working environment from the user interface. The Elastic Volumes feature is enabled by default when using gp3 or io1 disks. You can choose the initial capacity based on your storage needs and revise it after Cloud Volumes ONTAP is deployed.

[Learn more about support for Elastic Volumes in AWS.](#)

### ONTAP S3 license in AWS

An ONTAP S3 license is now included on new and existing Cloud Volumes ONTAP systems running version 9.11.0 or later in AWS.

[ONTAP documentation: Learn how to configure and manage S3 object storage services](#)

### New Azure Cloud region support

Starting with the 9.10.1 release, Cloud Volumes ONTAP is now supported in the Azure West US 3 region.

[View the full list of supported regions for Cloud Volumes ONTAP](#)

## ONTAP S3 license in Azure

An ONTAP S3 license is now included on new and existing Cloud Volumes ONTAP systems running version 9.9.1 or later in Azure.

[ONTAP documentation: Learn how to configure and manage S3 object storage services](#)

## 07 June 2022

The following changes were introduced with the 3.9.19 release of the Connector.

### Cloud Volumes ONTAP 9.11.1

BlueXP can now deploy and manage Cloud Volumes ONTAP 9.11.1, which includes support for new features and additional cloud provider regions.

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

### New Advanced View

If you need to perform advanced management of Cloud Volumes ONTAP, you can do so using ONTAP System Manager, which is a management interface that's provided with an ONTAP system. We have included the System Manager interface directly inside BlueXP so that you don't need to leave BlueXP for advanced management.

This Advanced View is available as a Preview with Cloud Volumes ONTAP 9.10.0 and later. We plan to refine this experience and add enhancements in upcoming releases. Please send us feedback by using the in-product chat.

[Learn more about the Advanced View.](#)

### Support for Amazon EBS Elastic Volumes

Support for the Amazon EBS Elastic Volumes feature with a Cloud Volumes ONTAP aggregate provides better performance and additional capacity, while enabling BlueXP to automatically increase the underlying disk capacity as needed.

Support for Elastic Volumes is available starting with *new* Cloud Volumes ONTAP 9.11.0 systems and with gp3 and io1 EBS disk types.

[Learn more about support for Elastic Volumes.](#)

Note that support for Elastic Volumes requires new AWS permissions for the Connector:

```
"ec2:DescribeVolumesModifications",  
"ec2:ModifyVolume"
```

Be sure to provide these permissions to each set of AWS credentials that you've added to BlueXP. [View the latest Connector policy for AWS.](#)

## Support for deploying HA pairs in shared AWS subnets

Cloud Volumes ONTAP 9.11.1 includes support for AWS VPC sharing. This release of the Connector enables you to deploy an HA pair in an AWS shared subnet when using the API.

[Learn how to deploy an HA pair in a shared subnet.](#)

## Limited network access when using service endpoints

BlueXP now limits network access when using a VNet service endpoint for connections between Cloud Volumes ONTAP and storage accounts. BlueXP uses a service endpoint if you disable Azure Private Link connections.

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

## Support for creating storage VMs in Google Cloud

Multiple storage VMs are now supported with Cloud Volumes ONTAP in Google Cloud, starting with the 9.11.1 release. Starting with this release of the Connector, BlueXP enables you to create storage VMs on Cloud Volumes ONTAP HA pairs in Google Cloud by using the API.

Support for creating storage VMs requires new Google Cloud permissions for the Connector:

- `compute.instanceGroups.get`
- `compute.addresses.get`

Note that you must use the ONTAP CLI or System Manager to create a storage VM on a single-node system.

- [Learn more about storage VM limits in Google Cloud](#)
- [Learn how to create data-serving storage VMs for Cloud Volumes ONTAP in Google Cloud](#)

## 02 May 2022

The following changes were introduced with the 3.9.18 release of the Connector.

### Cloud Volumes ONTAP 9.11.0

BlueXP can now deploy and manage Cloud Volumes ONTAP 9.11.0.

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

### Enhancement to mediator upgrades

When BlueXP upgrades the mediator for an HA pair, it now validates that a new mediator image is available before it deletes the boot disk. This change ensures that the mediator can continue to operate successfully if the upgrade process is unsuccessful.

### K8s tab has been removed

The K8s tab was deprecated in a previous release, and has now been removed.

## Annual contract in Azure

The Essentials and Professional packages are now available in Azure through an annual contract. You can contact your NetApp sales representative to purchase an annual contract. The contract is available as a private offer in the Azure Marketplace.

After NetApp shares the private offer with you, you can select the annual plan when you subscribe from the Azure Marketplace during working environment creation.

[Learn more about licensing.](#)

## S3 Glacier Instant Retrieval

You can now store tiered data in the Amazon Simple Storage Service (Amazon S3) Glacier Instant Retrieval storage class.

[Learn how to change the storage class for tiered data.](#)

## New AWS permissions required for the Connector

The following permissions are now required to create an AWS spread placement group when deploying an HA pair in a single Availability Zone (AZ):

```
"ec2:DescribePlacementGroups",  
"iam:GetRolePolicy"
```

These permissions are now required to optimize how BlueXP creates the placement group.

Be sure to provide these permissions to each set of AWS credentials that you've added to BlueXP. [View the latest Connector policy for AWS.](#)

## New Google Cloud region support

Cloud Volumes ONTAP is now supported in the following Google Cloud regions starting with the 9.10.1 release:

- Delhi (asia-south2)
- Melbourne (australia-southeast2)
- Milan (europe-west8) - single node only
- Santiago (southamerica-west1) - single node only

[View the full list of supported regions for Cloud Volumes ONTAP](#)

## Support for n2-standard-16 in Google Cloud

The n2-standard-16 machine type is now supported with Cloud Volumes ONTAP in Google Cloud, starting with the 9.10.1 release.

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

## Enhancements to Google Cloud firewall policies

- When you create a Cloud Volumes ONTAP HA pair in Google Cloud, BlueXP will now display all existing firewall policies in a VPC.

Previously, BlueXP wouldn't display any policies in VPC-1, VPC-2, or VPC-3 that didn't have a target tag.

- When you create a Cloud Volumes ONTAP single-node system in Google Cloud, you can now choose whether you want the predefined firewall policy to allow traffic within the selected VPC only (recommended) or all VPCs.

## Enhancement to Google Cloud service accounts

When you select the Google Cloud service account to use with Cloud Volumes ONTAP, BlueXP now displays the email address that's associated with each service account. Viewing the email address can make it easier to distinguish between service accounts that share the same name.

[A screenshot of the service account field]

## 3 April 2022

### System Manager link has been removed

We have removed the System Manager link that was previously available from within a Cloud Volumes ONTAP working environment.

You can still connect to System Manager by entering the cluster management IP address in a web browser that has a connection to the Cloud Volumes ONTAP system. [Learn more about connecting to System Manager.](#)

### Charging for WORM storage

Now that the introductory special rate has expired, you will now be charged for using WORM storage. Charging is hourly, according to the total provisioned capacity of WORM volumes. This applies to new and existing Cloud Volumes ONTAP systems.

[Learn about pricing for WORM storage.](#)

## 27 February 2022

The following changes were introduced with the 3.9.16 release of the Connector.

### Redesigned volume wizard

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.](#)

## 09 February 2022

### Marketplace updates

- The Essentials package and Professional package are now available in all cloud provider 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, BlueXP will prompt you to subscribe when you create a new working environment.

- By-node licensing from all cloud provider 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.](#)

## 06 February 2022

### Exchange unassigned licenses

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.](#)

## 30 January 2022

The following changes were introduced with the 3.9.15 release of the Connector.

### Redesigned licensing selection

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.

### Digital Wallet update

We updated the **Digital Wallet** by consolidating Cloud Volumes ONTAP licenses in a single tab.

## 02 January 2022

The following changes were introduced with the 3.9.14 release of the Connector.

### Support for additional Azure VM types

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

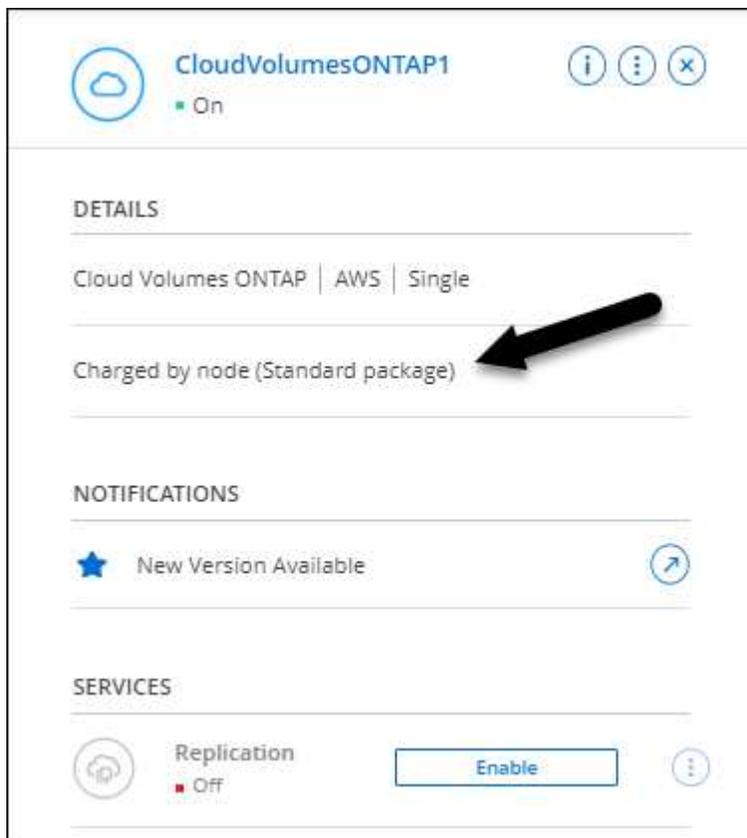
Go to the [Cloud Volumes ONTAP Release Notes](#) for more details about supported configurations.

### FlexClone charging update

If you use a [capacity-based license](#) for Cloud Volumes ONTAP, you are no longer charged for the capacity used by FlexClone volumes.

### Charging method now displayed

BlueXP now shows the charging method for each Cloud Volumes ONTAP working environment in the right panel of the Canvas.



### Choose your user name

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

Password

Confirm Password

### Volume creation enhancements

We made a few enhancements to volume creation:

- We redesigned the create volume wizard for ease of use.
- You can now choose a custom export policy for NFS.

✓ Details, Protection & Tags   2 Protocol   3 Disk Type   4 Usage Profile & Tiering Policy   5 Review

Volumes Protocol

Select the volume's protocol:    NFS Protocol    CIFS Protocol    iSCSI Protocol

Access Control

 ▼

Export Policy (1 rule defined)

[Manage volume's export policy](#)

## 28 November 2021

The following changes were introduced with the 3.9.13 release of the Connector.

### Cloud Volumes ONTAP 9.10.1

BlueXP can now deploy and manage Cloud Volumes ONTAP 9.10.1.

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

## NetApp Keystone Subscriptions

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

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

- [Learn more about NetApp Keystone Subscriptions.](#)
- [Learn how to get started with Keystone Subscriptions in BlueXP.](#)

## New AWS region support

Cloud Volumes ONTAP is now supported in the AWS Asia Pacific (Osaka) region (ap-northeast-3).

## Port reduction

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.

## 04 October 2021

The following changes were introduced with the 3.9.11 release of the Connector.

### Cloud Volumes ONTAP 9.10.0

BlueXP can now deploy and manage Cloud Volumes ONTAP 9.10.0.

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

### Reduced deployment time

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.

## 02 September 2021

The following changes were introduced with the 3.9.10 release of the Connector.

### Customer-managed encryption 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 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 BlueXP, use the API to create a Cloud Volumes ONTAP working environment that uses the key.

[Learn more about these steps.](#)

## 07 July 2021

The following changes were introduced with the 3.9.8 release of the Connector.

### New charging methods

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 multiple 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:

### 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)

---

### WORM storage available for general use

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.](#)

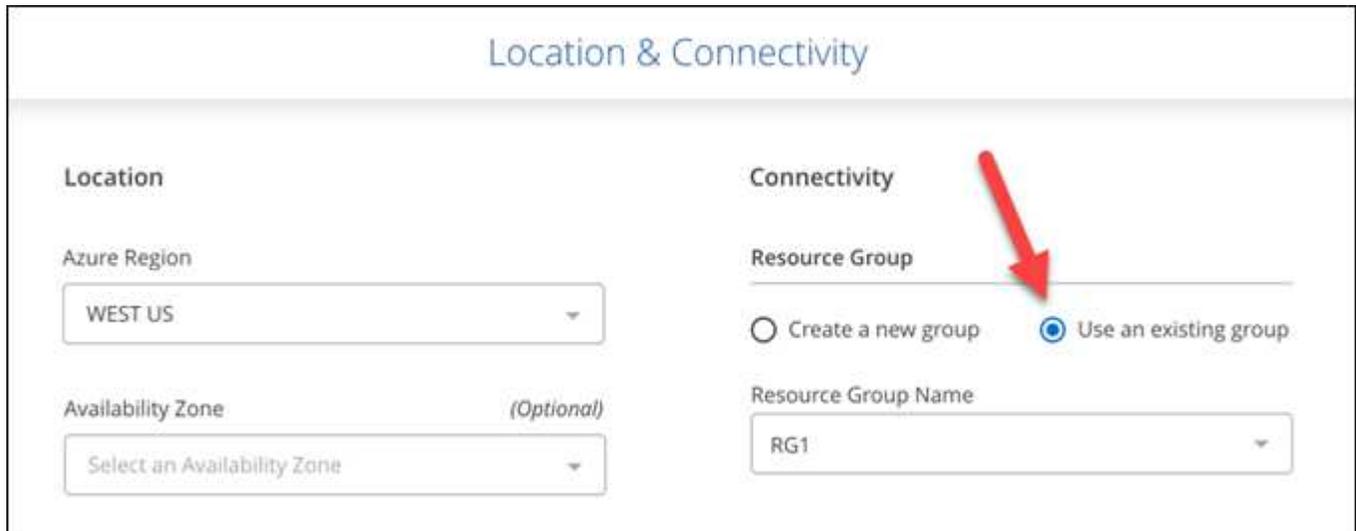
## Support for m5dn.24xlarge in AWS

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.](#)

## Select existing Azure resource groups

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.



The screenshot shows the 'Location & Connectivity' configuration page. Under 'Location', 'Azure Region' is 'WEST US' and 'Availability Zone' is 'Select an Availability Zone'. Under 'Connectivity', the 'Resource Group' section has two radio buttons: 'Create a new group' and 'Use an existing group'. A red arrow points to the 'Use an existing group' radio button. Below it, 'Resource Group Name' is 'RG1'.

The following permissions enable BlueXP 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 BlueXP. [View the latest Connector policy for Azure.](#)

## Blob public access now disabled in Azure

As a security enhancement, BlueXP now disables **Blob public access** when creating a storage account for Cloud Volumes ONTAP.

## Azure Private Link enhancement

By default, BlueXP 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.](#)

## Balanced persistent disks 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.

## custom-4-16384 no longer supported in Google Cloud

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 Google Cloud.](#)

## 30 May 2021

The following changes were introduced with the 3.9.7 release of the Connector.

### New Professional Package 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-premises 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.

### Tags on EBS volumes in AWS

BlueXP 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.

### Minimum cooling period for auto tiering policy

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.](#)

### Enhancement to custom export policies

When you create a new NFS volume, BlueXP now displays custom export policies in ascending order, making it easier for you to find the export policy that you need.

### Deletion of old cloud snapshots

BlueXP 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 Connector policy for Azure.](#)

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

## 24 May 2021

### Cloud Volumes ONTAP 9.9.1

BlueXP can now deploy and manage Cloud Volumes ONTAP 9.9.1.

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

## 11 Apr 2021

The following changes were introduced with the 3.9.5 release of the Connector.

### Logical space reporting

BlueXP 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.

### Support for gp3 disks 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.

[Size your system in AWS.](#)

### Cold HDD disks no longer supported in AWS

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

### TLS 1.2 for Azure storage accounts

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

## 08 Mar 2021

The following changes were introduced with the 3.9.4 release of the Connector.

### Cloud Volumes ONTAP 9.9.0

BlueXP can now deploy and manage Cloud Volumes ONTAP 9.9.0.

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

## Support for the AWS C2S environment

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

[Deploy Cloud Volumes ONTAP in AWS Secret Cloud or AWS Top Secret Cloud.](#)

## AWS encryption with customer-managed CMKs

BlueXP 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.](#)

## Support for Azure DoD

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

## IP address reduction 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.](#)

## Shared VPC support 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.](#)

## 04 January 2021

The following changes were introduced with the 3.9.2 release of the Connector.

### 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 BlueXP 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

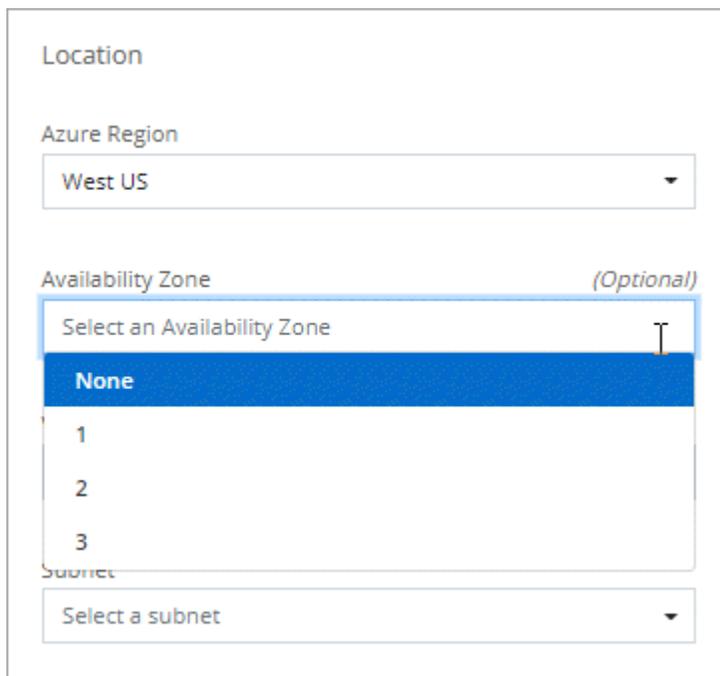
### Ultra SSD VNV RAM in supported Azure regions

Cloud Volumes ONTAP can now use an Ultra SSD as VNV RAM when you use the E32s\_v3 VM type with a single-node system [in any supported Azure region](#).

VNV RAM provides better write performance.

### 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, BlueXP will select one for you.



The screenshot shows a configuration form for an Azure resource. It includes a 'Location' section with an 'Azure Region' dropdown set to 'West US'. Below that is an 'Availability Zone' section, labeled '(Optional)', with a dropdown menu open. The dropdown menu shows 'None' selected, with options '1', '2', and '3' visible below it. At the bottom of the form, there is a 'Subnet' dropdown menu set to 'Select a subnet'.

### Larger disks in Google Cloud

Cloud Volumes ONTAP now supports 64 TB disks in Google Cloud.



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

### New machine types in Google Cloud

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

**03 Nov 2020**

The following changes were introduced with the 3.9.0 release of the Connector.

### **Azure Private Link for Cloud Volumes ONTAP**

By default, BlueXP 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](#)

## **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.

These limitations are specific to Cloud Volumes ONTAP management in the NetApp Console. To view limitations with the Cloud Volumes ONTAP software itself, [go to the Cloud Volumes ONTAP Release Notes](#).

### **Console doesn't support FlexGroup volumes creation**

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



The ability to create FlexGroup volumes in the Console is planned for a future release.

### **Console doesn't support S3 with Cloud Volumes ONTAP**

While Cloud Volumes ONTAP supports S3 as an option for scale-out storage, the Console 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 [ONTAP S3 Configuration Power Guide](#).

[Learn more about Cloud Volumes ONTAP support for ONTAP S3 and other client protocols.](#)

### **Console doesn't support disaster recovery for storage VMs**

The Console doesn't provide any setup or orchestration support for storage VM (SVM) disaster recovery. You must use ONTAP System Manager or the ONTAP CLI.

[Learn more about SVM disaster recovery.](#)

## **Cloud Volumes ONTAP Release Notes**

The Release Notes for Cloud Volumes ONTAP provide release-specific information. What's new in the release, supported configurations, storage limits, and any known limitations or issues that can affect product functionality.

[Go to the Cloud Volumes ONTAP Release Notes](#)

# Get started

## 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 NetApp Backup and Recovery to deliver backup and restore capabilities for protection, and long-term archive of your cloud data.

[Learn more about Backup and Recovery](#)

- 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.

[Learn more about SnapCenter](#)

- Data security

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

- Privacy compliance controls

Integration with NetApp Data Classification helps you understand data context and identify sensitive data.

[Learn more about Data Classification](#)



Licenses for ONTAP features are included with Cloud Volumes ONTAP.

[View supported Cloud Volumes ONTAP configurations](#)

## Supported ONTAP versions for Cloud Volumes ONTAP deployments

The NetApp Console enables you to choose from several different ONTAP versions when you add a Cloud Volumes ONTAP system.

Cloud Volumes ONTAP versions other than those listed here are not available for new deployments. The patch or the generic (General Availability) version in a release here represents the base version available for deployment. For details about the available patches, refer to the [versioned release notes](#) for each release.

For information on upgrade, refer to [Supported upgrade paths](#).

### Google Cloud

#### Single node

- 9.18.1
- 9.17.1 P1
- 9.16.1
- 9.15.1
- 9.15.0 P1
- 9.14.1
- 9.14.1
- 9.14.0
- 9.13.1
- 9.12.1
- 9.12.1
- 9.12.0 P1
- 9.11.1 P3
- 9.10.1
- 9.9.1 P6
- 9.8
- 9.7 P5

#### HA pair

- 9.18.1
- 9.17.1 P1
- 9.16.1
- 9.15.1
- 9.15.0 P1
- 9.14.1

- 9.14.1
- 9.14.0
- 9.13.1
- 9.12.1
- 9.12.1
- 9.12.0 P1
- 9.11.1 P3
- 9.10.1
- 9.9.1 P6
- 9.8

## Get started in Google Cloud

### Quick start for Cloud Volumes ONTAP in Google Cloud

Get started with Cloud Volumes ONTAP in Google Cloud in a few steps.

1

#### Create a Console agent

If you don't have a [Console agent](#) yet, you need to create one. [Learn how to create a Console agent in Google Cloud](#)

Note that if you want to deploy Cloud Volumes ONTAP in a subnet where no internet access is available, then you need to manually install the Console agent and access the NetApp Console that's running on that Console agent. [Learn how to manually install the Console agent in a location without internet access](#)

2

#### Plan your configuration

The Console 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

- Ensure that your VPC and subnets will support connectivity between the Console agent and Cloud Volumes ONTAP.
- If you plan to enable data tiering, [configure the Cloud Volumes ONTAP subnet for Private Google Access](#).
- If you're deploying an HA pair, ensure that you have four VPCs, each with their own subnet.
- If you're using a shared VPC, provide the *Compute Network User* role to the Console agent service account.
- Enable outbound internet access from the target VPC for NetApp AutoSupport.

This step isn't required if you're deploying Cloud Volumes ONTAP in a location where no internet access is available.

[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 [NetApp Backup and Recovery](#) 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 Google Cloud APIs in your project.](#) [These APIs](#), which you might have already enabled as part of creating the Console agent, are required to deploy Cloud Volumes ONTAP in Google Cloud.

6

#### Launch Cloud Volumes ONTAP using the Console

Click **Add System**, 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 Console agent](#)
- [Installing the Console agent software on a Linux host](#)
- [Google Cloud permissions for the Console agent](#)

## Plan 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.

#### Choose a Cloud Volumes ONTAP 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](#)
- [Learn how to set up licensing](#)

#### Choose a supported region

Cloud Volumes ONTAP is supported in most Google Cloud regions. [View the full list of supported regions.](#)

## Choose a supported machine type

Cloud Volumes ONTAP supports several machine types, depending on the license type that you choose.

[Supported configurations for Cloud Volumes ONTAP in Google Cloud](#)

## Understand 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 Google Cloud](#)

## Size your system in Google Cloud

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](#)

### Disk types

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, refer to the [Google Cloud documentation: Zonal Persistent disks \(Standard and SSD\)](#).

### Disk size

You need to choose an initial disk size when you deploy a Cloud Volumes ONTAP system. After that you can let the NetApp Console 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](#)

### View default system disks

In addition to the storage for user data, the Console 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: Cloud Quotas overview](#)

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 Console agent also requires a system disk. [View details about the Console agent's default configuration.](#)

### Collect networking information

When you deploy Cloud Volumes ONTAP in Google Cloud, 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

Google Cloud information	Your value
Region	
Zone	
VPC network	
Subnet	
Firewall policy (if using your own)	

#### Network information for an HA pair in multiple zones

Google Cloud 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	

Google Cloud information	Your value
Firewall policy (if using your own)	

### Network information for an HA pair in a single zone

Google Cloud information	Your value
Region	
Zone	
VPC-0 and subnet	
VPC-1 and subnet	
VPC-2 and subnet	
VPC-3 and subnet	
Firewall policy (if using your own)	

### Choose a write speed

The Console 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.](#)

### Choose 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 the Console, 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 Google Cloud networking for Cloud Volumes ONTAP

The NetApp Console 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.

If you want to deploy an HA pair, you should [learn how HA pairs work in Google Cloud](#).

## Requirements for Cloud Volumes ONTAP

The following requirements must be met in Google Cloud.

### Requirements specific to single-node systems

If you want to deploy a single-node system, ensure that your networking meets the following requirements.

#### One VPC

One Virtual Private Cloud (VPC) is required for a single-node system.

#### Private IP addresses

For a single-node system in Google Cloud, the Console allocates private IP addresses to the following:

- Node
- Cluster
- Storage VM
- Data NAS LIF
- Data iSCSI LIF

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.

### Requirements specific to HA pairs

If you want to deploy an HA pair, ensure that your networking meets the following requirements.

#### One or multiple zones

You can ensure the high availability of your data by deploying an HA configuration across multiple or in a single zone. The Console prompts 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.

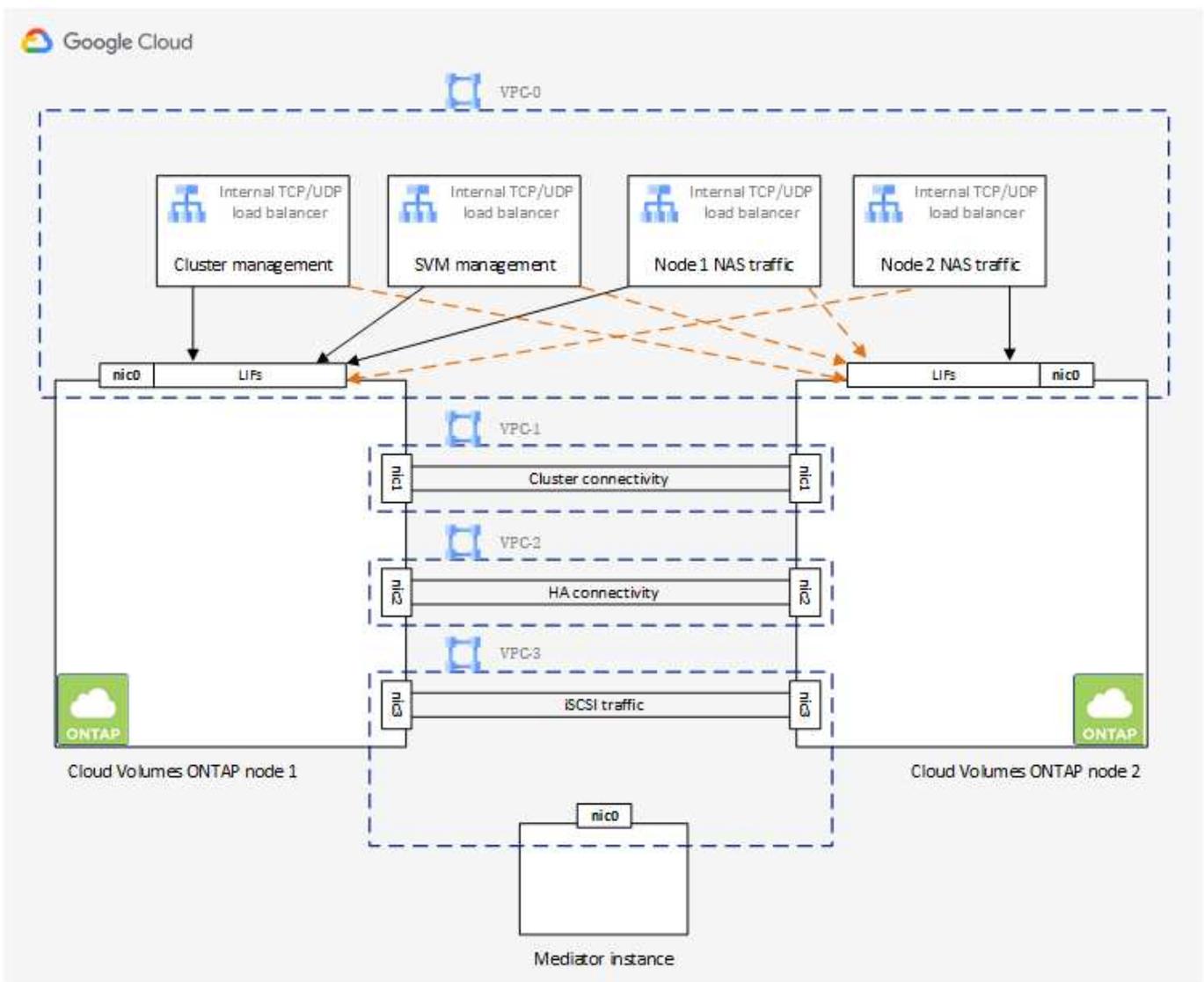
This deployment model does lower your costs because there are no data egress charges between zones.

### Four Virtual Private Clouds

Four Virtual Private Clouds (VPCs) are required for an HA configuration. Four VPCs are required because Google Cloud requires that each network interface resides in a separate VPC network.

The Console prompts 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

A private subnet is required for each VPC.

If you place the Console agent 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.

## Private IP addresses

The Console automatically allocates the required number of private IP addresses to Cloud Volumes ONTAP in Google Cloud. You need to make sure that your networking has enough private addresses available.

The number of LIFs allocated 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. An SVM management LIF is required for management tools like SnapCenter.

### • Single node

The Console allocates 4 IP addresses to a single-node system:

- Node management LIF
- Cluster management LIF
- iSCSI data LIF



An iSCSI LIF provides client access over the iSCSI protocol and is used by the system for other important networking workflows. These LIFs are required and should not be deleted.

- NAS LIF

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
```

### • HA pair

The Console allocates 12-13 IP addresses to an HA pair:

- 2 Node management LIFs (e0a)
- 1 Cluster management LIF (e0a)
- 2 iSCSI LIFs (e0a)



An iSCSI LIF provides client access over the iSCSI protocol and is used by the system for other important networking workflows. These LIFs are required and should not be deleted.

- 1 or 2 NAS LIFs (e0a)
- 2 Cluster LIFs (e0b)
- 2 HA Interconnect IP addresses (e0c)
- 2 RSM iSCSI IP addresses (e0d)

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
```

## Internal load balancers

The Console 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.

## Shared VPCs

Cloud Volumes ONTAP and the Console agent 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 Console agent and Cloud Volumes ONTAP virtual machine instances in a *service project*.

[Google Cloud documentation: Shared VPC overview.](#)

[Review the required shared VPC permissions covered in Console agent deployment](#)

## Packet mirroring in VPCs

[Packet mirroring](#) must be disabled in the Google Cloud subnet in which you deploy Cloud Volumes ONTAP.

## Outbound internet access

Cloud Volumes ONTAP systems require outbound internet access for accessing external endpoints for various functions. Cloud Volumes ONTAP can't operate properly if these endpoints are blocked in environments with strict security requirements.

The Console agent also contacts several endpoints for day-to-day operations. For information about the endpoints, refer to [View endpoints contacted from the Console agent](#) and [Prepare networking for using the Console](#).

## Cloud Volumes ONTAP endpoints

Cloud Volumes ONTAP uses these endpoints to communicate with various services.

Endpoints	Applicable for	Purpose	Deployment mode	Impact if endpoint is not available
<a href="https://netapp-cloud-account.auth0.com">https://netapp-cloud-account.auth0.com</a>	Authentication	Used for authentication in the Console.	Standard and restricted modes.	User authentication fails and the following services remain unavailable: <ul style="list-style-type: none"><li>• Cloud Volumes ONTAP services</li><li>• ONTAP services</li><li>• Protocols and proxy services</li></ul>
<a href="https://api.bluexp.netapp.com/tenancy">https://api.bluexp.netapp.com/tenancy</a>	Tenancy	Used to retrieve Cloud Volumes ONTAP resource from the Console to authorize resources and users.	Standard and restricted modes.	Cloud Volumes ONTAP resources and the users are not authorized.
<a href="https://mysupport.netapp.com/aods/asupmessage">https://mysupport.netapp.com/aods/asupmessage</a> <a href="https://mysupport.netapp.com/asupprod/post/1.0/postAsup">https://mysupport.netapp.com/asupprod/post/1.0/postAsup</a>	AutoSupport	Used to send AutoSupport telemetry data to NetApp support.	Standard and restricted modes.	AutoSupport information remains undelivered.

Endpoints	Applicable for	Purpose	Deployment mode	Impact if endpoint is not available
<a href="https://cloudbuild.googleapis.com/v1">https://cloudbuild.googleapis.com/v1</a> (for only private mode deployments) <a href="https://cloudkms.googleapis.com/v1">https://cloudkms.googleapis.com/v1</a> <a href="https://cloudresourcemanager.googleapis.com/v1/projects">https://cloudresourcemanager.googleapis.com/v1/projects</a> <a href="https://compute.googleapis.com/compute/v1">https://compute.googleapis.com/compute/v1</a> <a href="https://www.googleapis.com/compute/beta">https://www.googleapis.com/compute/beta</a> <a href="https://www.googleapis.com/compute/v1/projects/">https://www.googleapis.com/compute/v1/projects/</a> <a href="https://www.googleapis.com/deploymentmanager/v2/projects">https://www.googleapis.com/deploymentmanager/v2/projects</a> <a href="https://www.googleapis.com/storage/v1">https://www.googleapis.com/storage/v1</a> <a href="https://www.googleapis.com/upload/storage/v1">https://www.googleapis.com/upload/storage/v1</a> <a href="https://config.googleapis.com/v1">https://config.googleapis.com/v1</a> <a href="https://iam.googleapis.com/v1">https://iam.googleapis.com/v1</a> <a href="https://storage.googleapis.com/storage/v1">https://storage.googleapis.com/storage/v1</a>	Google Cloud (Commercial use).	Communication with Google Cloud services.	Standard, restricted, and private modes.	Cloud Volumes ONTAP cannot communicate with Google Cloud service to perform specific operations for the Console in Google Cloud.

### Connections to ONTAP systems in other networks

To replicate data between a Cloud Volumes ONTAP system in Google Cloud and ONTAP systems in other networks, you must have a VPN connection between the VPC and the other network—for example, your corporate network.

[Google Cloud documentation: Cloud VPN overview.](#)

### Firewall rules

The Console creates Google Cloud 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 to use your own firewall rules.

The firewall rules for Cloud Volumes ONTAP requires both inbound and outbound rules. If you're deploying an HA configuration, these are the firewall rules for Cloud Volumes ONTAP in VPC-0.

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.
- 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.](#)



Looking for information about the Console agent? [View firewall rules for the Console agent](#)

## Inbound rules

When you add a Cloud Volumes ONTAP system, you can choose the source filter for the predefined firewall policy during deployment:

- **Selected VPC only:** the source filter for inbound traffic is the subnet range of the VPC for the Cloud Volumes ONTAP system and the subnet range of the VPC where the Console agent resides. This is the recommended option.
- **All VPCs:** the source filter for inbound traffic is the 0.0.0.0/0 IP range.

If you use your own firewall policy, 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 the [Google Cloud documentation: Load Balancer Firewall Rules](#).

Protocol	Port	Purpose
All ICMP	All	Pinging the instance
HTTP	80	HTTP access to the ONTAP System Manager web console using the IP address of the cluster management LIF
HTTPS	443	Connectivity with the Console agent and HTTPS access to the ONTAP 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 Cloud Volumes ONTAP clusters use the following ports for regulating nodes traffic.



The source is the interface (IP address) of 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	mysupport.netapp.com	AutoSupport (HTTPS is the default)
	HTTP	80	Node management LIF	mysupport.netapp.com	AutoSupport (only if the transport protocol is changed from HTTPS to HTTP)
	TCP	3128	Node management LIF	Console agent	Sending AutoSupport messages through a proxy server on the Console agent, if an outbound internet connection isn't available
Configuration backups	HTTP	80	Node management LIF	http://<console-agent-IP-address>/occm/offboxconfig	Send configuration backups to the Console agent. <a href="#">ONTAP documentation</a>
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	1860-18699	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	11104	Intercluster LIF	ONTAP intercluster LIFs	Management of intercluster communication sessions for SnapMirror
	TCP	11105	Intercluster LIF	ONTAP intercluster LIFs	SnapMirror data transfer
Syslog	UDP	514	Node management LIF	Syslog server	Syslog forward messages

## Rules for VPC-1, VPC-2, and VPC-3

In Google Cloud, 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 created for the instances in VPC-1, VPC-2, and VPC-3 enable 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).



To enable high write speed for new Google Cloud HA pair deployments, a maximum transmission unit (MTU) of at least 8,896 bytes is required for VPC-1, VPC-2, and VPC-3. If you choose to upgrade existing VPC-1, VPC-2, and VPC-3 to an MTU of 8,896 bytes, you must shutdown all existing HA systems using these VPCs during the configuration process.

### Infrastructure Manager configuration for private mode deployments

If you want to deploy Cloud Volumes ONTAP 9.16.1 or later in private mode, you need to make a few configuration changes so that Cloud Volumes ONTAP can use Google Cloud Infrastructure Manager as the deployment service instead of Deployment Manager, which Google will eventually deprecate.

#### Before you begin

- Ensure that your Cloud Volumes ONTAP system is 9.16.1 or later. If it isn't, upgrade your system. Refer to [Upgrade Cloud Volumes ONTAP](#) for instructions.
- Ensure that the Google Cloud APIs are enabled. Refer to [Enable Google Cloud APIs](#).
- Ensure that the Cloud Build API is enabled. Refer to [Enable the Cloud Build API here](#).
- Verify that the Console agent's service account has all standard permissions. Additionally, ensure that the service account has the `cloudbuild.workerpools.get` and `cloudbuild.workerpools.list` permissions. Refer to [Google Cloud permissions for the Console agent](#).

#### Steps

1. Create a private worker pool with this configuration in the same region as the Cloud Volumes ONTAP deployments. For information about creating a private worker pool, refer to [Google Cloud documentation: Create and manage private pools](#) and [Google Cloud Build pricing](#).

The worker pool must have the following configuration:

- Machine type: e2-medium
- Disk size: 100 GB
- Assign external IP: False
- Network: Default or a private.
- The subnet configured to access [Google APIs](#). Perform these steps to ensure that the subnet can access Google APIs:
  - a. Ensure "Private Google Access" is turned on for the subnet.
  - b. Go to **VPC Network level > Private Service Access Tab > Allocated IP ranges for services**.
  - c. Select **Allocate IP range** and allocate the internal IP range for the private connection to the Google Compute Service.
  - d. On **Private connection to services**, select **Create Connection**.

- e. Select **Connected service producer = Google Cloud Platform**.
  - f. Assign the allocation for the private connection IP range you created in the previous step.
2. Deploy this worker pool and keep it running for Cloud Volumes ONTAP management. Google Cloud uses this worker pool to run all Terraform operations in an isolated environment.
  3. When deploying Cloud Volumes ONTAP in private mode, select the name of this worker pool in the **GCP Worker Pool** field. Refer to [Launch Cloud Volumes ONTAP in Google Cloud](#) for instructions.

## Requirements for the Console agent

If you haven't created a Console agent yet, you should review networking requirements.

- [View networking requirements for the Console agent](#)
- [Firewall rules in Google Cloud](#)

## Network configurations to support Console agent proxy

You can use the proxy servers configured for the Console agent to enable outbound internet access from Cloud Volumes ONTAP. The Console supports two types of proxies:

- **Explicit proxy:** The outbound traffic from Cloud Volumes ONTAP uses the HTTP address of the proxy server specified during the Console agent proxy configuration. The Console agent administrator might also have configured user credentials and root CA certificates for additional authentication. If a root CA certificate is available for the explicit proxy, make sure to obtain and upload the same certificate to your Cloud Volumes ONTAP system using the [ONTAP CLI: security certificate install](#) command.
- **Transparent proxy:** The network is configured to automatically route outbound traffic from Cloud Volumes ONTAP through the Console agent proxy. When setting up a transparent proxy, the Console agent administrator needs to provide only a root CA certificate for connectivity from Cloud Volumes ONTAP, not the HTTP address of the proxy server. Make sure that you obtain and upload the same root CA certificate to your Cloud Volumes ONTAP system using the [ONTAP CLI: security certificate install](#) command.

For information about configuring proxy servers for the Console agent, refer to the [Configure a Console agent to use a proxy server](#).

## Configure network tags for Cloud Volumes ONTAP in Google Cloud

During the transparent proxy configuration of the Console agent, the administrator adds a network tag for Google Cloud. You need to obtain and manually add the same network tag for your Cloud Volumes ONTAP configuration. This tag is necessary for the proxy server to function correctly.

1. In the Google Cloud Console, locate your Cloud Volumes ONTAP system.
2. Go to **Details > Networking > Network tags**.
3. Add the tag used for the Console agent and save the configuration.

## Related topics

- [Verify AutoSupport setup for Cloud Volumes ONTAP](#)
- [Learn about ONTAP internal ports](#).

## Set up VPC Service Controls to deploy Cloud Volumes ONTAP in Google Cloud

When choosing to lock down your Google Cloud environment with VPC Service Controls, you should understand how NetApp Console and Cloud Volumes ONTAP interact with the

Google Cloud APIs, as well as how to configure your service perimeter to deploy the Console 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

The Console communicates 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 Console agent.

Depending on the deployment style of the Console agent, certain exceptions may have to be made for your service perimeter.

### Images

Both Cloud Volumes ONTAP and the Console use images from a project within Google Cloud that is managed by NetApp. This can affect the deployment of the Console agent 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 Console agent 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 Console agent and Cloud Volumes ONTAP.

#### Deploying a Console agent

The user who deploys a Console agent needs to be able to reference an image hosted in the projectId `netapp-cloudmanager` and the project number `14190056516`.

#### Deploying Cloud Volumes ONTAP

- The Console 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 [Google Cloud VPC Service Controls Policy Documentation](#).

To set the policies that the Console 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

### 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
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 Console agent and for Cloud Volumes ONTAP.

## Create a Google Cloud service account for Cloud Volumes ONTAP

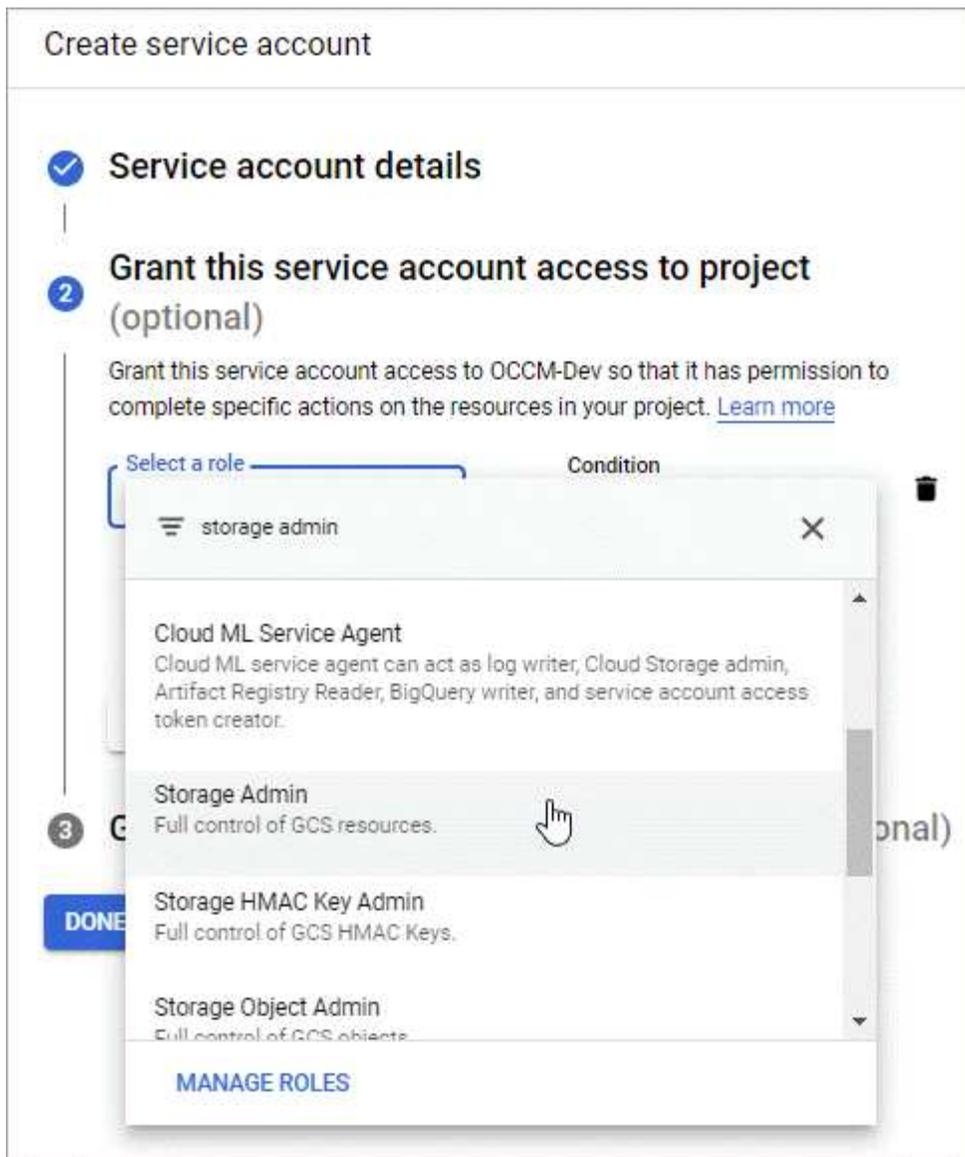
Cloud Volumes ONTAP requires a Google Cloud service account for two purposes. The first is when you enable [data tiering](#) to tier cold data to low-cost object storage in Google Cloud. The second is when you enable the [NetApp Backup and Recovery](#) to back up volumes to low-cost object storage.

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.



- c. **Grant users access to this service account:** Add the Console agent 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 Backup and Recovery.

### 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 system.

## Details and Credentials

default-project Google Cloud Project	gcp-sub2 Marketplace Subscription	<input type="button" value="Edit Project"/>
---	--------------------------------------	---

### Details

Working Environment Name (Cluster Name)

Service Account

---

Service Account Name

+ Add Labels Optional Field | Up to four labels

### Credentials

User Name

Password

Confirm Password

## 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 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.

### Steps

1. Ensure that the Console agent service account has the correct permissions at the project level, in the project where the key is stored.

The permissions are provided in the [the service account permissions 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.useToEncrypt`
- `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, the NetApp Console 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 system.

### Example

```
"gcpEncryptionParameters": {  
  "key": "projects/project-1/locations/us-east4/keyRings/keyring-  
1/cryptoKeys/generatedkey1"  
}
```

Refer to the [NetApp Console automation docs](#) for more details about using the "GcpEncryption" parameter.

## Set up licensing for Cloud Volumes ONTAP in Google Cloud

After you decide which licensing option you want to use with Cloud Volumes ONTAP, a few steps are required before you can choose that licensing option when creating a new system.

### Freemium

Select the Freemium offering to use Cloud Volumes ONTAP free of charge with up to 500 GiB of provisioned capacity. [Learn more about the Freemium offering.](#)

### Steps

1. From the left navigation menu, select **Storage > Management**.
2. On the **Systems** page, click **Add System** and follow the steps in the NetApp Console.
  - a. On the **Details and Credentials** page, click **Edit Credentials > Add Subscription** and then follow the prompts to subscribe to the pay-as-you-go offering in the Google Cloud Marketplace.

You won't be charged through the marketplace subscription unless you exceed 500 GiB of provisioned capacity, at which time the system is automatically converted to the [Essentials package](#).

b. After you return to the Console, select **Freemium** when you reach the charging methods page.

Select Charging Method		
<input type="radio"/>	Professional	By capacity
<input type="radio"/>	Essential	By capacity
<input checked="" type="radio"/>	Freemium (Up to 500 GiB)	By capacity
<input type="radio"/>	Per Node	By node

[View step-by-step instructions to launch Cloud Volumes ONTAP in Google Cloud.](#)

### Capacity-based license

Capacity-based licensing enables you to pay for Cloud Volumes ONTAP per TiB of capacity. Capacity-based licensing is available in the form of a *package*: the Essentials or Professional package.

The Essentials and Professional packages are available with the following consumption models or purchase options:

- A license (bring your own license (BYOL)) purchased from NetApp
- An hourly, pay-as-you-go (PAYGO) subscription from the Google Cloud Marketplace
- An annual contract

[Learn more about capacity-based licensing.](#)

The following sections describe how to get started with each of these consumption models.

#### BYOL

Pay upfront by purchasing a license (BYOL) from NetApp to deploy Cloud Volumes ONTAP systems in any cloud provider.



NetApp has restricted the purchase, extension, and renewal of BYOL licensing. For more information, refer to [Restricted availability of BYOL licensing for Cloud Volumes ONTAP](#).

#### Steps

1. [Contact NetApp Sales to obtain a license](#)
2. [Add your NetApp Support Site account to the NetApp Console](#)

The Console automatically queries NetApp's licensing service to obtain details about the licenses associated with your NetApp Support Site account. If there are no errors, the Console adds the licenses.

Your license must be available from the Console before you can use it with Cloud Volumes ONTAP. If

needed, you can [manually add the license to the Console](#).

3. On the **Systems** page, click **Add System** and follow the steps.
  - a. On the **Details and Credentials** page, click **Edit Credentials > Add Subscription** and then follow the prompts to subscribe to the pay-as-you-go offering in the Google Cloud Marketplace.

The license that you purchased from NetApp is always charged first, but you'll be charged from the hourly rate in the marketplace if you exceed your licensed capacity or if the term of your license expires.

- b. After you return to the Console, select a capacity-based package when you reach the charging methods page.

Select Charging Method		
<input checked="" type="radio"/>	Professional	By capacity
<input type="radio"/>	Essential	By capacity
<input type="radio"/>	Freemium (Up to 500 GiB)	By capacity
<input type="radio"/>	Per Node	By node

[View step-by-step instructions to launch Cloud Volumes ONTAP in Google Cloud.](#)

### PAYGO subscription

Pay hourly by subscribing to the offer from your cloud provider's marketplace.

When you create a Cloud Volumes ONTAP system, the Console prompts you to subscribe to the agreement that's available in the Google Cloud Marketplace. That subscription is then associated with the system for charging. You can use that same subscription for additional systems.

### Steps

1. From the left navigation menu, select **Storage > Management**.
2. On the **Systems** page, click **Add System** and follow the steps.
  - a. On the **Details and Credentials** page, click **Edit Credentials > Add Subscription** and then follow the prompts to subscribe to the pay-as-you-go offering in the Google Cloud Marketplace.
  - b. After you return to the Console, select a capacity-based package when you reach the charging methods page.

### Select Charging Method

<input checked="" type="radio"/> Professional	<span style="background-color: #0070c0; color: white; padding: 2px 5px;">By capacity</span> <span style="font-size: 1em;">▼</span>
<input type="radio"/> Essential	<span style="background-color: #0070c0; color: white; padding: 2px 5px;">By capacity</span> <span style="font-size: 1em;">▼</span>
<input type="radio"/> Freemium (Up to 500 GiB)	<span style="background-color: #0070c0; color: white; padding: 2px 5px;">By capacity</span> <span style="font-size: 1em;">▼</span>
<input type="radio"/> Per Node	<span style="background-color: #800080; color: white; padding: 2px 5px;">By node</span> <span style="font-size: 1em;">▼</span>

[View step-by-step instructions to launch Cloud Volumes ONTAP in Google Cloud.](#)



You can manage the Google Cloud Marketplace subscriptions associated with your accounts from the Settings > Credentials page. [Learn how to manage your Google Cloud credentials and subscriptions](#)

#### Annual contract

Pay for Cloud Volumes ONTAP annually by purchasing an annual contract.

#### Steps

1. Contact your NetApp sales representative to purchase an annual contract.

The contract is available as a *private* offer in the Google Cloud Marketplace.

After NetApp shares the private offer with you, you can select the annual plan when you subscribe from the Google Cloud Marketplace during system creation.

2. On the **Systems** page, click **Add System** and follow the steps.
  - a. On the **Details and Credentials** page, click **Edit Credentials > Add Subscription** and then follow the prompts to subscribe to the annual plan in the Google Cloud Marketplace.
  - b. In Google Cloud, select the annual plan that was shared with your account and then click **Subscribe**.
  - c. After you return to the Console, select a capacity-based package when you reach the charging methods page.

Select Charging Method

<input checked="" type="radio"/> Professional	By capacity	∨
<input type="radio"/> Essential	By capacity	∨
<input type="radio"/> Freemium (Up to 500 GiB)	By capacity	∨
<input type="radio"/> Per Node	By node	∨

[View step-by-step instructions to launch Cloud Volumes ONTAP in Google Cloud.](#)

### Keystone Subscription

A Keystone Subscription is a pay-as-you-grow subscription-based service. [Learn more about NetApp Keystone Subscriptions.](#)

#### Steps

1. If you don't have a subscription yet, [contact NetApp](#)
2. [Contact NetApp](#) to authorize your the Console user account with one or more Keystone Subscriptions.
3. After NetApp authorizes your account, [link your subscriptions for use with Cloud Volumes ONTAP.](#)
4. On the **Systems** page, click **Add System** and follow the steps.
  - a. Select the Keystone Subscription charging method when prompted to choose a charging method.

### Select Charging Method

Keystone
By capacity
^

Storage management

Charged against your NetApp credit

Keystone Subscription

A-AMRITA1
▼

---

Professional
By capacity
▼

---

Essential
By capacity
▼

---

Freemium (Up to 500 GiB)
By capacity
▼

---

Per Node
By node
▼

[View step-by-step instructions to launch Cloud Volumes ONTAP in Google Cloud.](#)

### Node-based license

A node-based license is the previous generation license for Cloud Volumes ONTAP. A node-based license could be procured from NetApp (BYOL) and is available for license renewals, only in specific cases. For information, refer to:

- [End of availability for node-based licenses](#)
- [End of availability of node-based licenses](#)
- [Convert a node-based license to a capacity-based license](#)

### Launch Cloud Volumes ONTAP in Google Cloud

You can launch Cloud Volumes ONTAP in a single-node configuration or as an HA pair in Google Cloud.

#### Before you begin

You need the following before you begin.

- A NetApp Console agent that's up and running.
  - You should have a [Console agent that is associated with your system](#).
  - You should be prepared to leave the Console agent running at all times.

- The service account associated with the Console agent [should have the required permissions](#)
- An understanding of the configuration that you want to use.

You should have prepared by choosing a configuration and by obtaining Google Cloud networking information from your administrator. For details, refer to [Planning your Cloud Volumes ONTAP configuration](#).

- An understanding of what's required to set up licensing for Cloud Volumes ONTAP.

[Learn how to set up licensing.](#)

- 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

## Launch a single-node system in Google Cloud

Create a system in the NetApp Console to launch Cloud Volumes ONTAP in Google Cloud.

### Steps

1. From the left navigation menu, select **Storage > Management**.
2. On the **Systems** page, click **Add System** and follow the prompts.
3. **Choose a Location**: Select **Google Cloud** and **Cloud Volumes ONTAP**.
4. If you're prompted, [create a Console agent](#).
5. **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
System Name	The Console uses the system name to name both the Cloud Volumes ONTAP system and the Google Cloud 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="#">NetApp Backup and Recovery</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> .

Field	Description
Add Labels	<p>Labels are metadata for your Google Cloud resources. The Console adds the labels to the Cloud Volumes ONTAP system and Google Cloud resources associated with the system.</p> <p>You can add up to four labels from the user interface when creating a system, and then you can add more after it's created. Note that the API does not limit you to four labels when creating a system.</p> <p>For information about labels, refer to the <a href="#">Google Cloud Documentation: Labeling Resources</a>.</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 ONTAP System Manager or the ONTAP 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 of the Console.</p> <p>If you don't see any additional projects in the drop-down list, then you haven't yet associated the 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 role that you use for the Console to that project. You'll need to repeat this step for each project.</p> <div style="border-left: 1px solid #ccc; padding-left: 10px; margin-top: 10px;">  This is the service account that you set up for the Console, <a href="#">as described on this page</a>. </div> <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 Google Cloud project that's associated with a subscription to Cloud Volumes ONTAP from the Google Cloud marketplace. Refer to <a href="#">Associating a marketplace subscription with Google Cloud credentials</a>.</p>

6. **Services:** Select the services that you want to use on this system. In order to select Backup and Recovery, or to use NetApp Cloud Tiering, you must have specified the Service Account in step 3.



If you would like to utilize WORM and data tiering, you must disable Backup and Recovery and deploy a Cloud Volumes ONTAP system with version 9.8 or above.

7. **Location & Connectivity:** Select the Google Cloud region and zone for your system, choose a firewall policy, and confirm network connectivity to Google Cloud storage for data tiering.

The following table describes fields for which you might need guidance:

Field	Description
Connectivity verification	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 <a href="#">Google Cloud Documentation: Configuring Private Google Access</a> .
Generated firewall policy	If you let the Console generate the firewall policy for you, you need to choose how you'll allow traffic: <ul style="list-style-type: none"> <li>• If you choose <b>Selected VPC only</b>, the source filter for inbound traffic is the subnet range of the selected VPC and the subnet range of the VPC where the Console agent resides. This is the recommended option.</li> <li>• If you choose <b>All VPCs</b>, the source filter for inbound traffic is the 0.0.0.0/0 IP range.</li> </ul>
Use existing firewall policy	If you use an existing firewall policy, ensure that it includes the required rules: <a href="#">Learn about firewall rules for Cloud Volumes ONTAP</a>

- 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 licensing options for Cloud Volumes ONTAP](#)
  - [Learn how to set up licensing](#)
- 9. Preconfigured Packages:** Select one of the packages to quickly deploy a Cloud Volumes ONTAP system, or click **Create my own configuration**. The preconfigured packages vary with the selected Cloud Volumes ONTAP version. For example, for Cloud Volumes ONTAP 9.18.1 and later, the Console shows packages with C3 VMs, including Hyperdisk Balanced disks. You can modify the configurations, such as IOPS and throughput parameters, based on your workload needs.

If you choose one of the packages, you only need to specify a volume and then review and approve the configuration.

- 10. Licensing:** Change the Cloud Volumes ONTAP version as needed and select a machine type.



If a newer Release Candidate, General Availability, or patch release is available for a selected version, then the Console updates the system to that version when creating it. For example, the update occurs if you select Cloud Volumes ONTAP 9.13.1 and 9.13.1 P4 is available. The update does not occur from one release to another— for example, from 9.13 to 9.14.

- 11. 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 the Console 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, refer to [Size your system in Google Cloud](#).

- 12. Flash Cache, Write Speed & WORM:**

- a. Enable **Flash Cache** or choose **Normal** or **High** write speed if you need.

Learn more about [Flash Cache](#) and [write speed](#).



High write speed and a higher maximum transmission unit (MTU) of 8,896 bytes are available through the **High** write speed option. In addition, the higher MTU of 8,896 requires the selection of VPC-1, VPC-2 and VPC-3 for the deployment. For more information on VPC-1, VPC-2, and VPC-3, refer to [Rules for VPC-1, VPC-2, and VPC-3](#).

- b. Activate write once, read many (WORM) storage, if desired.

WORM can't be enabled if data tiering was enabled for Cloud Volumes ONTAP versions 9.7 and below. Reverting or downgrading to Cloud Volumes ONTAP 9.8 is blocked after enabling WORM and tiering.

[Learn more about WORM storage](#).

- c. If you activate WORM storage, select the retention period.

13. **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 Google Cloud account (required for Cloud Volumes ONTAP 9.6).

Note the following:

- The Console 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 Console agent service account as a user of the tiering service account, otherwise, you can't select it from the Console.
- For help with adding a Google Cloud account, refer to [Setting up and adding Google Cloud 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 Google Cloud Console.

[Learn more about data tiering](#).

14. **Create Volume:** Enter details for the new volume or click **Skip**.

[Learn about supported client protocols and versions](#).

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, the Console enters a value that provides access to all instances in the subnet.

Field	Description
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, the Console 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>.</p>

The following image shows the first page of the volume creation wizard:

**Volume Details & Protection**

Volume Name i

Storage VM (SVM)

Volume Size i Unit

Snapshot Policy  
  
 default policy i

15. **CIFS Setup:** If you chose the CIFS protocol, set up a CIFS server.

Field	Description
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> <p>If you're configuring Google Managed Active Directory, AD can be accessed by default with the 169.254.169.254 IP address.</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>To configure Google Managed Microsoft AD as the AD server for Cloud Volumes ONTAP, enter <b>OU=Computers,OU=Cloud</b> in this field.</p> <p><a href="#">Google Cloud Documentation: Organizational Units in Google Managed Microsoft AD</a></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	<p>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. For information, refer to the <a href="#">NetApp Console automation docs</a> for details.</p> <p>Note that you can configure an NTP server only when creating a CIFS server. It's not configurable after you create the CIFS server.</p>

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, refer to [Choose a volume usage profile](#), [Data tiering overview](#), and [KB: What Inline Storage Efficiency features are supported with CVO?](#)

17. **Review & Approve:** Review and confirm your selections.
- Review details about the configuration.
  - Click **More information** to review details about support and the Google Cloud resources that the Console will purchase.
  - Select the **I understand...** check boxes.
  - Click **Go**.

## Result

The Console deploys the Cloud Volumes ONTAP system. You can track the progress on the **Audit** page.

If you experience any issues deploying the Cloud Volumes ONTAP system, review the failure message. You can also select the system 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 ONTAP System Manager or the ONTAP CLI.

Quotas enable you to restrict or track the disk space and number of files used by a user, group, or qtree.



After the deployment process completes, do not modify the system-generated Cloud Volumes ONTAP configurations in the Google Cloud portal, such as the system tags, and the labels set in the Google Cloud resources. Any changes made to these configurations may lead to unexpected behavior or data loss.

### Launch an HA pair in Google Cloud

Create a system in the Console to launch Cloud Volumes ONTAP in Google Cloud.

#### Steps

1. From the left navigation menu, select **Storage > Management**.
2. On the **Systems** page, click **Storage > System** and follow the prompts.
3. **Choose a Location:** Select **Google Cloud** and **Cloud Volumes ONTAP HA**.
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
System Name	The Console uses the system name to name both the Cloud Volumes ONTAP system and the Google Cloud 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="#">NetApp Cloud Tiering</a> or <a href="#">Backup and Recovery</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	Labels are metadata for your Google Cloud resources. The Console adds the labels to the Cloud Volumes ONTAP system and Google Cloud resources associated with the system.  You can add up to four labels from the user interface when creating a system, and then you can add more after it's created. Note that the API does not limit you to four labels when creating a system.  For information about labels, refer to <a href="#">Google Cloud Documentation: Labeling Resources</a> .

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 ONTAP System Manager or the ONTAP CLI. Keep the default <i>admin</i> user name or change it to a custom user name.
Edit Project	<p>Select the project where you want Cloud Volumes ONTAP to reside.</p> <p>If you don't see any additional projects in the drop-down list, then you haven't yet associated the 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 role that you use for the Console 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 the Console, <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 Google Cloud project that's associated with a subscription to Cloud Volumes ONTAP from the Google Cloud Marketplace. Refer to <a href="#">Associating a marketplace subscription with Google Cloud credentials</a>.</p>

- Services:** Select the services that you want to use on this system. To select Backup and Recovery, or to use NetApp Cloud Tiering, you must have specified the Service Account in step 3.



If you would like to utilize WORM and data tiering, you must disable Backup and Recovery and deploy a Cloud Volumes ONTAP system with version 9.8 or above.

- HA Deployment Models:** Choose multiple zones (recommended) or a single zone for the HA configuration. Then select a region and zone.

[Learn more about HA deployment models.](#)

- 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.](#)

The following table describes fields for which you might need guidance:

Field	Description
Generated policy	<p>If you let the Console generate the firewall policy for you, you need to choose how you'll allow traffic:</p> <ul style="list-style-type: none"> <li>• If you choose <b>Selected VPC only</b>, the source filter for inbound traffic is the subnet range of the selected VPC and the subnet range of the VPC where the Console agent resides. This is the recommended option.</li> <li>• If you choose <b>All VPCs</b>, the source filter for inbound traffic is the 0.0.0.0/0 IP range.</li> </ul>
Use existing	<p>If you use an existing firewall policy, ensure that it includes the required rules. <a href="#">Learn about firewall rules for Cloud Volumes ONTAP.</a></p>

- 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 licensing options for Cloud Volumes ONTAP.](#)
  - [Learn how to set up licensing.](#)
- 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.

- Licensing:** Change the Cloud Volumes ONTAP version as needed and select a machine type.



If a newer Release Candidate, General Availability, or patch release is available for the selected version, then the Console updates the system to that version when creating it. For example, the update occurs if you select Cloud Volumes ONTAP 9.13.1 and 9.13.1 P4 is available. The update does not occur from one release to another—for example, from 9.13 to 9.14.

- 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 the Console 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, refer to [Size your system in Google Cloud.](#)

- Flash Cache, Write Speed & WORM:**
  - Enable **Flash Cache** or choose **Normal** or **High** write speed if you need.

Learn more about [Flash Cache](#) and [write speed](#).



High write speed and a higher maximum transmission unit (MTU) of 8,896 bytes are available through the **High** write speed option with the n2-standard-16, n2-standard-32, n2-standard-48, and n2-standard-64 instance types. In addition, the higher MTU of 8,896 requires the selection of VPC-1, VPC-2 and VPC-3 for the deployment. High write speed and an MTU of 8,896 are feature-dependent and cannot be disabled individually within a configured instance. For more information on VPC-1, VPC-2, and VPC-3, refer to [Rules for VPC-1, VPC-2, and VPC-3](#).

b. Activate write once, read many (WORM) storage, if desired.

WORM can't be enabled if data tiering was enabled for Cloud Volumes ONTAP versions 9.7 and below. Reverting or downgrading to Cloud Volumes ONTAP 9.8 is blocked after enabling WORM and tiering.

[Learn more about WORM storage.](#)

c. If you activate WORM storage, select the retention period.

13. **Data Tiering in Google Cloud:** 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:

- The Console 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 Console agent service account as a user of the tiering service account, otherwise, you can't select it from the Console.
- 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 Google Cloud Console.

[Learn more about data tiering.](#)

14. **Create Volume:** Enter details for the new volume or click **Skip**.

[Learn about supported client protocols and versions.](#)

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, the Console 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.

Field	Description
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, the Console 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>.</p>

The following image shows the first page of the volume creation wizard:

The screenshot shows the 'Volume Details & Protection' configuration page. It contains the following fields:

- Volume Name:** A text input field containing 'ABDcv5689' with an information icon to its right.
- Storage VM (SVM):** A dropdown menu showing 'svm\_c...CVO1' with a downward arrow.
- Volume Size:** A text input field containing '100'.
- Unit:** A dropdown menu showing 'GIB' with a downward arrow.
- Snapshot Policy:** A dropdown menu showing 'default' with a downward arrow. Below this dropdown is the text 'default policy' followed by an information icon.

15. **CIFS Setup:** If you chose the CIFS protocol, set up a CIFS server.

Field	Description
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> <p>If you're configuring Google Managed Active Directory, AD can be accessed by default with the 169.254.169.254 IP address.</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>To configure Google Managed Microsoft AD as the AD server for Cloud Volumes ONTAP, enter <b>OU=Computers,OU=Cloud</b> in this field.</p> <p><a href="#">Google Cloud Documentation: Organizational Units in Google Managed Microsoft AD</a></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	<p>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. Refer to the <a href="#">NetApp Console automation docs</a> for details.</p> <p>Note that you can configure an NTP server only when creating a CIFS server. It's not configurable after you create the CIFS server.</p>

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, refer to [Choose a volume usage profile](#), [Data tiering overview](#), and [KB: What Inline Storage Efficiency features are supported with CVO?](#)

17. **Review & Approve:** Review and confirm your selections.
- Review details about the configuration.
  - Click **More information** to review details about support and the Google Cloud resources that the Console will purchase.
  - Select the **I understand...** check boxes.
  - Click **Go**.

## Result

The Console deploys the Cloud Volumes ONTAP system. You can track the progress on the **Audit** page.

If you experience any issues deploying the Cloud Volumes ONTAP system, review the failure message. You can also select the system 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 ONTAP System Manager or the ONTAP CLI.

Quotas enable you to restrict or track the disk space and number of files used by a user, group, or qtree.



After the deployment process completes, do not modify the system-generated Cloud Volumes ONTAP configurations in the Google Cloud portal, such as the system tags, and the labels set in the Google Cloud resources. Any changes made to these configurations may lead to unexpected behavior or data loss.

#### Related links

- [Planning your Cloud Volumes ONTAP configuration in Google Cloud](#)

## Google Cloud Platform Image Verification

### Learn how Google Cloud image is verified in Cloud Volumes ONTAP

Google Cloud image verification complies with enhanced NetApp security requirements. Changes have been made to the script generating the images to sign the image along the way using private keys specifically generated for this task. You can verify the integrity of the Google Cloud image by using the signed digest and public certificate for Google Cloud which can be downloaded via [NSS](#) for a specific release.



Google Cloud image verification is supported on Cloud Volumes ONTAP software version 9.13.0 or greater.

### Convert Google Cloud image to raw format for Cloud Volumes ONTAP

The image being used to deploy new instances, upgrades, or being used in existing images will be shared with the clients through [the NetApp Support Site \(NSS\)](#). The signed digest, and the certificates will be available to download through the NSS portal. Make sure you are downloading the digest and certificates for the right release corresponding to the image shared by NetApp Support. For instance, 9.13.0 images will have a 9.13.0 signed digest and certificates available on NSS.

#### Why is this step needed?

The images from Google Cloud cannot be downloaded directly. In order to verify the image against the signed digest and the certificates, you need to have a mechanism to compare the two files and download the image. To do so, you must export/convert the image into a disk.raw format and save the results in a storage bucket in Google Cloud. The disk.raw file is tarred and gzipped in the process.

The user/service-account will need privileges to perform the following:

- Access to Google storage bucket
- Write to Google Storage bucket
- Create cloud build jobs (used during export process)
- Access to the desired image
- Create export image tasks

To verify the image, it must be converted to a disk.raw format and then downloaded.

#### **Use Google Cloud command line to export Google Cloud image**

The preferred way to export an image to Cloud Storage is to use the [gcloud compute images export command](#). This command takes the provided image and converts it to a disk.raw file which gets tarred and gzipped. The generated file is saved at the destination URL and can then be downloaded for verification.

The user/account must have privileges to access and write to the desired bucket, export the image, and cloud builds (used by Google to export the image) to execute this operation.

#### **Export Google Cloud image using gcloud**

## Click to display

```
$ gcloud compute images export \  
  --destination-uri DESTINATION_URI \  
  --image IMAGE_NAME  
  
# For our example:  
$ gcloud compute images export \  
  --destination-uri gs://vsa-dev-bucket1/example-user-exportimage-  
gcp-demo \  
  --image example-user-20230120115139  
  
## DEMO ##  
# Step 1 - Optional: Checking access and listing objects in the  
destination bucket  
$ gsutil ls gs://example-user-export-image-bucket/  
  
# Step 2 - Exporting the desired image to the bucket  
$ gcloud compute images export --image example-user-export-image-demo  
--destination-uri gs://example-user-export-image-bucket/export-  
demo.tar.gz  
Created [https://cloudbuild.googleapis.com/v1/projects/example-demo-  
project/locations/us-central1/builds/xxxxxxxxxxxxx].  
Logs are available at [https://console.cloud.google.com/cloud-  
build/builds;region=us-central1/xxxxxxxxxxxxx?project=xxxxxxxxxxxxx].  
[image-export]: 2023-01-25T18:13:48Z Fetching image "example-user-  
export-image-demo" from project "example-demo-project".  
[image-export]: 2023-01-25T18:13:49Z Validating workflow  
[image-export]: 2023-01-25T18:13:49Z Validating step "setup-disks"  
[image-export]: 2023-01-25T18:13:49Z Validating step "image-export-  
export-disk"  
[image-export.image-export-export-disk]: 2023-01-25T18:13:49Z  
Validating step "setup-disks"  
[image-export.image-export-export-disk]: 2023-01-25T18:13:49Z  
Validating step "run-image-export-export-disk"  
[image-export.image-export-export-disk]: 2023-01-25T18:13:50Z  
Validating step "wait-for-inst-image-export-export-disk"  
[image-export.image-export-export-disk]: 2023-01-25T18:13:50Z  
Validating step "copy-image-object"  
[image-export.image-export-export-disk]: 2023-01-25T18:13:50Z  
Validating step "delete-inst"  
[image-export]: 2023-01-25T18:13:51Z Validation Complete  
[image-export]: 2023-01-25T18:13:51Z Workflow Project: example-demo-  
project  
[image-export]: 2023-01-25T18:13:51Z Workflow Zone: us-central1-c
```

```
[image-export]: 2023-01-25T18:13:51Z Workflow GCSPath: gs://example-
demo-project-example-bkt-us/
[image-export]: 2023-01-25T18:13:51Z Example scratch path:
https://console.cloud.google.com/storage/browser/example-demo-project-
example-bkt-us/example-image-export-20230125-18:13:49-r88px
[image-export]: 2023-01-25T18:13:51Z Uploading sources
[image-export]: 2023-01-25T18:13:51Z Running workflow
[image-export]: 2023-01-25T18:13:51Z Running step "setup-disks"
(CreateDisks)
[image-export.setup-disks]: 2023-01-25T18:13:51Z CreateDisks: Creating
disk "disk-image-export-image-export-r88px".
[image-export]: 2023-01-25T18:14:02Z Step "setup-disks" (CreateDisks)
successfully finished.
[image-export]: 2023-01-25T18:14:02Z Running step "image-export-export-
disk" (IncludeWorkflow)
[image-export.image-export-export-disk]: 2023-01-25T18:14:02Z Running
step "setup-disks" (CreateDisks)
[image-export.image-export-export-disk.setup-disks]: 2023-01-
25T18:14:02Z CreateDisks: Creating disk "disk-image-export-export-disk-
image-export-image-export--r88px".
[image-export.image-export-export-disk]: 2023-01-25T18:14:02Z Step
"setup-disks" (CreateDisks) successfully finished.
[image-export.image-export-export-disk]: 2023-01-25T18:14:02Z Running
step "run-image-export-export-disk" (CreateInstances)
[image-export.image-export-export-disk.run-image-export-export-disk]:
2023-01-25T18:14:02Z CreateInstances: Creating instance "inst-image-
export-export-disk-image-export-image-export--r88px".
[image-export.image-export-export-disk]: 2023-01-25T18:14:08Z Step
"run-image-export-export-disk" (CreateInstances) successfully finished.
[image-export.image-export-export-disk.run-image-export-export-disk]:
2023-01-25T18:14:08Z CreateInstances: Streaming instance "inst-image-
export-export-disk-image-export-image-export--r88px" serial port 1
output to https://storage.cloud.google.com/example-demo-project-
example-bkt-us/example-image-export-20230125-18:13:49-r88px/logs/inst-
image-export-export-disk-image-export-image-export--r88px-serial-
port1.log
[image-export.image-export-export-disk]: 2023-01-25T18:14:08Z Running
step "wait-for-inst-image-export-export-disk" (WaitForInstancesSignal)
[image-export.image-export-export-disk.wait-for-inst-image-export-
export-disk]: 2023-01-25T18:14:08Z WaitForInstancesSignal: Instance
"inst-image-export-export-disk-image-export-image-export--r88px":
watching serial port 1, SuccessMatch: "ExportSuccess", FailureMatch:
["ExportFailed:"] (this is not an error), StatusMatch: "GCEExport:".
[image-export.image-export-export-disk.wait-for-inst-image-export-
export-disk]: 2023-01-25T18:14:29Z WaitForInstancesSignal: Instance
"inst-image-export-export-disk-image-export-image-export--r88px":
```

```
StatusMatch found: "GCEExport: <serial-output key:'source-size-gb'  
value:'10'>"  
[image-export.image-export-export-disk.wait-for-inst-image-export-  
export-disk]: 2023-01-25T18:14:29Z WaitForInstancesSignal: Instance  
"inst-image-export-export-disk-image-export-image-export--r88px":  
StatusMatch found: "GCEExport: Running export tool."  
[image-export.image-export-export-disk.wait-for-inst-image-export-  
export-disk]: 2023-01-25T18:14:29Z WaitForInstancesSignal: Instance  
"inst-image-export-export-disk-image-export-image-export--r88px":  
StatusMatch found: "GCEExport: Disk /dev/sdb is 10 GiB, compressed size  
will most likely be much smaller."  
[image-export.image-export-export-disk.wait-for-inst-image-export-  
export-disk]: 2023-01-25T18:14:29Z WaitForInstancesSignal: Instance  
"inst-image-export-export-disk-image-export-image-export--r88px":  
StatusMatch found: "GCEExport: Beginning export process..."  
[image-export.image-export-export-disk.wait-for-inst-image-export-  
export-disk]: 2023-01-25T18:14:29Z WaitForInstancesSignal: Instance  
"inst-image-export-export-disk-image-export-image-export--r88px":  
StatusMatch found: "GCEExport: Copying \"/dev/sdb\" to gs://example-  
demo-project-example-bkt-us/example-image-export-20230125-18:13:49-  
r88px/outs/image-export-export-disk.tar.gz."  
[image-export.image-export-export-disk.wait-for-inst-image-export-  
export-disk]: 2023-01-25T18:14:29Z WaitForInstancesSignal: Instance  
"inst-image-export-export-disk-image-export-image-export--r88px":  
StatusMatch found: "GCEExport: Using \"/root/upload\" as the buffer  
prefix, 1.0 GiB as the buffer size, and 4 as the number of workers."  
[image-export.image-export-export-disk.wait-for-inst-image-export-  
export-disk]: 2023-01-25T18:14:29Z WaitForInstancesSignal: Instance  
"inst-image-export-export-disk-image-export-image-export--r88px":  
StatusMatch found: "GCEExport: Creating gzipped image of \"/dev/sdb\"."  
[image-export.image-export-export-disk.wait-for-inst-image-export-  
export-disk]: 2023-01-25T18:14:29Z WaitForInstancesSignal: Instance  
"inst-image-export-export-disk-image-export-image-export--r88px":  
StatusMatch found: "GCEExport: Read 1.0 GiB of 10 GiB (212 MiB/sec),  
total written size: 992 MiB (198 MiB/sec)"  
[image-export.image-export-export-disk.wait-for-inst-image-export-  
export-disk]: 2023-01-25T18:14:59Z WaitForInstancesSignal: Instance  
"inst-image-export-export-disk-image-export-image-export--r88px":  
StatusMatch found: "GCEExport: Read 8.0 GiB of 10 GiB (237 MiB/sec),  
total written size: 1.5 GiB (17 MiB/sec)"  
[image-export.image-export-export-disk.wait-for-inst-image-export-  
export-disk]: 2023-01-25T18:15:19Z WaitForInstancesSignal: Instance  
"inst-image-export-export-disk-image-export-image-export--r88px":  
StatusMatch found: "GCEExport: Finished creating gzipped image of  
\"/dev/sdb\" in 48.956433327s [213 MiB/s] with a compression ratio of  
6."
```

```

[image-export.image-export-export-disk.wait-for-inst-image-export-export-disk]: 2023-01-25T18:15:19Z WaitForInstancesSignal: Instance "inst-image-export-export-disk-image-export-image-export--r88px": StatusMatch found: "GCEExport: Finished export in 48.957347731s"
[image-export.image-export-export-disk.wait-for-inst-image-export-export-disk]: 2023-01-25T18:15:19Z WaitForInstancesSignal: Instance "inst-image-export-export-disk-image-export-image-export--r88px": StatusMatch found: "GCEExport: <serial-output key:'target-size-gb' value:'2'>"
[image-export.image-export-export-disk.wait-for-inst-image-export-export-disk]: 2023-01-25T18:15:19Z WaitForInstancesSignal: Instance "inst-image-export-export-disk-image-export-image-export--r88px": SuccessMatch found "ExportSuccess"
[image-export.image-export-export-disk]: 2023-01-25T18:15:19Z Step "wait-for-inst-image-export-export-disk" (WaitForInstancesSignal) successfully finished.
[image-export.image-export-export-disk]: 2023-01-25T18:15:19Z Running step "copy-image-object" (CopyGCSObjects)
[image-export.image-export-export-disk]: 2023-01-25T18:15:19Z Running step "delete-inst" (DeleteResources)
[image-export.image-export-export-disk.delete-inst]: 2023-01-25T18:15:19Z DeleteResources: Deleting instance "inst-image-export-export-disk".
[image-export.image-export-export-disk]: 2023-01-25T18:15:19Z Step "copy-image-object" (CopyGCSObjects) successfully finished.
[image-export.image-export-export-disk]: 2023-01-25T18:15:34Z Step "delete-inst" (DeleteResources) successfully finished.
[image-export]: 2023-01-25T18:15:34Z Step "image-export-export-disk" (IncludeWorkflow) successfully finished.
[image-export]: 2023-01-25T18:15:34Z Serial-output value -> source-size-gb:10
[image-export]: 2023-01-25T18:15:34Z Serial-output value -> target-size-gb:2
[image-export]: 2023-01-25T18:15:34Z Workflow "image-export" cleaning up (this may take up to 2 minutes).
[image-export]: 2023-01-25T18:15:35Z Workflow "image-export" finished cleanup.

# Step 3 - Validating the image was successfully exported
$ gsutil ls gs://example-user-export-image-bucket/
gs://example-user-export-image-bucket/export-demo.tar.gz

# Step 4 - Download the exported image
$ gcloud storage cp gs://BUCKET_NAME/OBJECT_NAME SAVE_TO_LOCATION

```

```
$ gcloud storage cp gs://example-user-export-image-bucket/export-  
demo.tar.gz CVO_GCP_Signed_Digest.tar.gz  
Copying gs://example-user-export-image-bucket/export-demo.tar.gz to  
file://CVO_GCP_Signed_Digest.tar.gz  
Completed files 1/1 | 1.5GiB/1.5GiB | 185.0MiB/s
```

```
Average throughput: 213.3MiB/s
```

```
$ ls -l  
total 1565036  
-rw-r--r-- 1 example-user example-user 1602589949 Jan 25 18:44  
CVO_GCP_Signed_Digest.tar.gz
```

## Extract zipped files

```
# Extracting files from the digest  
$ tar -xf CVO_GCP_Signed_Digest.tar.gz
```



For more information on how to export an image through Google Cloud, refer to the [Google Cloud doc on Exporting an image](#).

## Image signature verification

### Google Cloud image signature verification for Cloud Volumes ONTAP

To verify the exported Google Cloud signed image, you must download the image digest file from the NSS to validate the disk.raw file and digest file contents.

### Signed image verification workflow summary

The following is an overview of the Google Cloud signed image verification workflow process.

- From the [NSS](#), download the Google Cloud archive containing the following files:
  - Signed digest (.sig)
  - Certificate containing the public key (.pem)
  - Certificate chain (.pem)

# Cloud Volumes ONTAP 9.15.0P1

Date Posted : 17-May-2024

## Cloud Volumes ONTAP

### Non-Restricted Countries

If you are upgrading to ONTAP 9.15.0P1, and you are in "Non-restricted Countries", please download the image with NetApp Volume Encryption.

DOWNLOAD 9150P1\_V\_IMAGE.TGZ [2.58 GB]

[View and download checksums](#)

DOWNLOAD 9150P1\_V\_IMAGE.TGZ.PEM [451 B]

[View and download checksums](#)

DOWNLOAD 9150P1\_V\_IMAGE.TGZ.SIG [256 B]

[View and download checksums](#)

## Cloud Volumes ONTAP

### Restricted Countries

If you are unsure whether your company complied with all applicable legal requirements on encryption technology, download the image without NetApp Volume Encryption.

DOWNLOAD 9150P1\_V\_NODAR\_IMAGE.TGZ [2.58 GB]

[View and download checksums](#)

DOWNLOAD 9150P1\_V\_NODAR\_IMAGE.TGZ.PEM [451 B]

[View and download checksums](#)

DOWNLOAD 9150P1\_V\_NODAR\_IMAGE.TGZ.SIG [256 B]

[View and download checksums](#)

## Cloud Volumes ONTAP

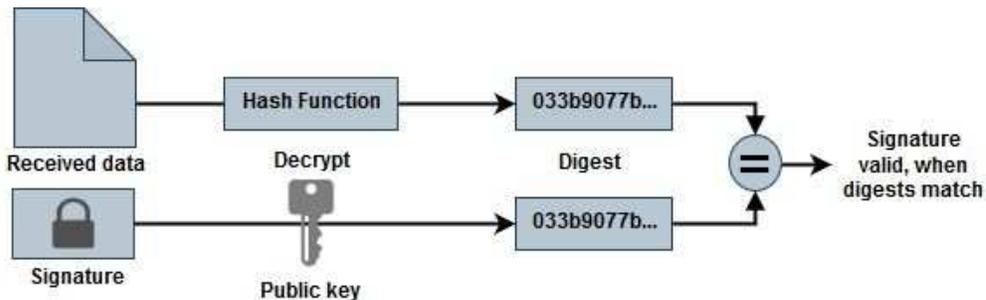
DOWNLOAD GCP-9-15-0P1\_PKG.TAR.GZ [7.49 KB]

[View and download checksums](#)

DOWNLOAD AZURE-9-15-0P1\_PKG.TAR.GZ [7.64 KB]

[View and download checksums](#)

- Download the converted disk.raw file
- Validate the certificate using the certificate chain
- Validate the signed digest using the certificate contain the public key
  - Decrypt the signed digest using the public key to extract the digest of the image file
  - Create a digest of the downloaded disk.raw file
  - Compare the two digest file for validation



Verify the Google Cloud image disk.raw file for Cloud Volumes ONTAP using OpenSSL

You can verify the Google Cloud downloaded disk.raw file against the digest file contents available through the [NSS](#) using OpenSSL.



The OpenSSL commands to validate the image are compatible with Linux, macOS, and Windows machines.

## Steps

1. Verify the certificate using OpenSSL.

## Click to display

```
# Step 1 - Optional, but recommended: Verify the certificate using
OpenSSL

# Step 1.1 - Copy the Certificate and certificate chain to a
directory
$ openssl version
LibreSSL 3.3.6
$ ls -l
total 48
-rw-r--r--@ 1 example-user  engr  8537 Jan 19 15:42 Certificate-
Chain-GCP-CVO-20230119-0XXXXX.pem
-rw-r--r--@ 1 example-user  engr  2365 Jan 19 15:42 Certificate-GCP-
CVO-20230119-0XXXXX.pem

# Step 1.2 - Get the OSCP URL
$ oscp_url=$(openssl x509 -noout -ocsp_uri -in <Certificate-
Chain.pem>)
$ oscp_url=$(openssl x509 -noout -ocsp_uri -in Certificate-Chain-
GCP-CVO-20230119-0XXXXX.pem)
$ echo $oscp_url
http://ocsp.entrust.net

# Step 1.3 - Generate an OSCP request for the certificate
$ openssl ocsf -issuer <Certificate-Chain.pem> -CAfile <Certificate-
Chain.pem> -cert <Certificate.pem> -reqout <request.der>
$ openssl ocsf -issuer Certificate-Chain-GCP-CVO-20230119-0XXXXX.pem
-CAfile Certificate-Chain-GCP-CVO-20230119-0XXXXX.pem -cert
Certificate-GCP-CVO-20230119-0XXXXX.pem -reqout req.der

# Step 1.4 - Optional: Check the new file "req.der" has been
generated
$ ls -l
total 56
-rw-r--r--@ 1 example-user  engr  8537 Jan 19 15:42 Certificate-
Chain-GCP-CVO-20230119-0XXXXX.pem
-rw-r--r--@ 1 example-user  engr  2365 Jan 19 15:42 Certificate-GCP-
CVO-20230119-0XXXXX.pem
-rw-r--r--  1 example-user  engr   120 Jan 19 16:50 req.der

# Step 1.5 - Connect to the OSCP Manager using openssl to send the
OCSP request
$ openssl ocsf -issuer <Certificate-Chain.pem> -CAfile <Certificate-
Chain.pem> -cert <Certificate.pem> -url ${ocsp_url} -resp_text
-respout <response.der>
```

```
$ openssl ocspl -issuer Certificate-Chain-GCP-CVO-20230119-0XXXXX.pem
-CAfile Certificate-Chain-GCP-CVO-20230119-0XXXXX.pem -cert
Certificate-GCP-CVO-20230119-0XXXXX.pem -url ${ocsp_url} -resp_text
-respout resp.der
```

OCSP Response Data:

OCSP Response Status: successful (0x0)

Response Type: Basic OCSP Response

Version: 1 (0x0)

Responder Id: C = US, O = "Entrust, Inc.", CN = Entrust Extended  
Validation Code Signing CA - EVCS2

Produced At: Jan 19 15:14:00 2023 GMT

Responses:

Certificate ID:

Hash Algorithm: sha1

Issuer Name Hash: 69FA640329AB84E27220FE0927647B8194B91F2A

Issuer Key Hash: CE894F8251AA15A28462CA312361D261F8F8FE78

Serial Number: 5994B3D01D26D594BD1D0FA7098C6FF5

Cert Status: good

This Update: Jan 19 15:00:00 2023 GMT

Next Update: Jan 26 14:59:59 2023 GMT

Signature Algorithm: sha512WithRSAEncryption

0b:b6:61:e4:03:5f:98:6f:10:1c:9a:f7:5f:6f:c7:e3:f4:72:  
f2:30:f4:86:88:9a:b9:ba:1e:d6:f6:47:af:dc:ea:e4:cd:31:  
af:e3:7a:20:35:9e:60:db:28:9c:7f:2e:17:7b:a5:11:40:4f:  
1e:72:f7:f8:ef:e3:23:43:1b:bb:28:1a:6f:c6:9c:c5:0c:14:  
d3:5d:bd:9b:6b:28:fb:94:5e:8a:ef:40:20:72:a4:41:df:55:  
cf:f3:db:1b:39:e0:30:63:c9:c7:1f:38:7e:7f:ec:f4:25:7b:  
1e:95:4c:70:6c:83:17:c3:db:b2:47:e1:38:53:ee:0a:55:c0:  
15:6a:82:20:b2:ea:59:eb:9c:ea:7e:97:aa:50:d7:bc:28:60:  
8c:d4:21:92:1c:13:19:b4:e0:66:cb:59:ed:2e:f8:dc:7b:49:  
e3:40:f2:b6:dc:d7:2d:2e:dd:21:82:07:bb:3a:55:99:f7:59:  
5d:4a:4d:ca:e7:8f:1c:d3:9a:3f:17:7b:7a:c4:57:b2:57:a8:  
b4:c0:a5:02:bd:59:9c:50:32:ff:16:b1:65:3a:9c:8c:70:3b:  
9e:be:bc:4f:f9:86:97:b1:62:3c:b2:a9:46:08:be:6b:1b:3c:  
24:14:59:28:c6:ae:e8:d5:64:b2:f8:cc:28:24:5c:b2:c8:d8:  
5a:af:9d:55:48:96:f6:3e:c6:bf:a6:0c:a4:c0:ab:d6:57:03:  
2b:72:43:b0:6a:9f:52:ef:43:bb:14:6a:ce:66:cc:6c:4e:66:  
17:20:a3:64:e0:c6:d1:82:0a:d7:41:8a:cc:17:fd:21:b5:c6:  
d2:3a:af:55:2e:2a:b8:c7:21:41:69:e1:44:ab:a1:dd:df:6d:  
15:99:90:cc:a0:74:1e:e5:2e:07:3f:50:e6:72:a6:b9:ae:fc:  
44:15:eb:81:3d:1a:f8:17:b6:0b:ff:05:76:9d:30:06:40:72:  
cf:d5:c4:6f:8b:c9:14:76:09:6b:3d:6a:70:2c:5a:c4:51:92:  
e5:cd:84:b6:f9:d9:d5:bc:8d:72:b7:7c:13:9c:41:89:a8:97:  
6f:4a:11:5f:8f:b6:c9:b5:df:00:7e:97:20:e7:29:2e:2b:12:  
77:dc:e2:63:48:87:42:49:1d:fc:d0:94:a8:8d:18:f9:07:85:

```

e4:d0:3e:9a:4a:d7:d5:d0:02:51:c3:51:1c:73:12:96:2d:75:
22:83:a6:70:5a:4a:2b:f2:98:d9:ae:1b:57:53:3d:3b:58:82:
38:fc:fa:cb:57:43:3f:3e:7e:e0:6d:5b:d6:fc:67:7e:07:7e:
fb:a3:76:43:26:8f:d1:42:d6:a6:33:4e:9e:e0:a0:51:b4:c4:
bc:e3:10:0d:bf:23:6c:4b
WARNING: no nonce in response
Response Verify OK
Certificate-GCP-CVO-20230119-0XXXXX.pem: good
  This Update: Jan 19 15:00:00 2023 GMT
  Next Update: Jan 26 14:59:59 2023 GMT

# Step 1.5 - Optional: Check the response file "response.der" has
been generated. Verify its contents.
$ ls -l
total 64
-rw-r--r--@ 1 example-user  engr  8537 Jan 19 15:42 Certificate-
Chain-GCP-CVO-20230119-0XXXXX.pem
-rw-r--r--@ 1 example-user  engr  2365 Jan 19 15:42 Certificate-GCP-
CVO-20230119-0XXXXX.pem
-rw-r--r--  1 example-user  engr   120 Jan 19 16:50 req.der
-rw-r--r--  1 example-user  engr   806 Jan 19 16:51 resp.der

# Step 1.6 - Verify the chain of trust and expiration dates against
the local host
$ openssl version -d
OPENSSLDIR: "/private/etc/ssl"
$ OPENSSLDIR=$(openssl version -d | cut -d '"' -f2)
$ echo $OPENSSLDIR
/private/etc/ssl

$ openssl verify -untrusted <Certificate-Chain.pem> -CApath <OpenSSL
dir> <Certificate.pem>
$ openssl verify -untrusted Certificate-Chain-GCP-CVO-20230119-
0XXXXX.pem -CApath ${OPENSSLDIR} Certificate-GCP-CVO-20230119-
0XXXXX.pem
Certificate-GCP-CVO-20230119-0XXXXX.pem: OK

```

2. Place the downloaded disk.raw file, the signature, and certificates in a directory.
3. Extract the public key from the certificate using OpenSSL.
4. Decrypt the signature using the extracted public key and verify the contents of the downloaded disk.raw file.

## Click to display

```
# Step 1 - Place the downloaded disk.raw, the signature and the
certificates in a directory
$ ls -l
-rw-r--r--@ 1 example-user  staff  Jan 19 15:42 Certificate-Chain-
GCP-CVO-20230119-0XXXXX.pem
-rw-r--r--@ 1 example-user  staff  Jan 19 15:42 Certificate-GCP-CVO-
20230119-0XXXXX.pem
-rw-r--r--@ 1 example-user  staff  Jan 19 15:42 GCP_CVO_20230119-
XXXXXX_digest.sig
-rw-r--r--@ 1 example-user  staff  Jan 19 16:39 disk.raw

# Step 2 - Extract the public key from the certificate
$ openssl x509 -pubkey -noout -in (certificate.pem) >
(public_key.pem)
$ openssl x509 -pubkey -noout -in Certificate-GCP-CVO-20230119-
0XXXXX.pem > CVO-GCP-pubkey.pem

$ ls -l
-rw-r--r--@ 1 example-user  staff  Jan 19 15:42 Certificate-Chain-
GCP-CVO-20230119-0XXXXX.pem
-rw-r--r--@ 1 example-user  staff  Jan 19 15:42 Certificate-GCP-CVO-
20230119-0XXXXX.pem
-rw-r--r--@ 1 example-user  staff  Jan 19 17:02 CVO-GCP-pubkey.pem
-rw-r--r--@ 1 example-user  staff  Jan 19 15:42 GCP_CVO_20230119-
XXXXXX_digest.sig
-rw-r--r--@ 1 example-user  staff  Jan 19 16:39 disk.raw

# Step 3 - Decrypt the signature using the extracted public key and
verify the contents of the downloaded disk.raw
$ openssl dgst -verify (public_key) -keyform PEM -sha256 -signature
(signed digest) -binary (downloaded or obtained disk.raw)
$ openssl dgst -verify CVO-GCP-pubkey.pem -keyform PEM -sha256
-signature GCP_CVO_20230119-XXXXXX_digest.sig -binary disk.raw
Verified OK

# A failed response would look like this
$ openssl dgst -verify CVO-GCP-pubkey.pem -keyform PEM -sha256
-signature GCP_CVO_20230119-XXXXXX_digest.sig -binary
../sample_file.txt
Verification Failure
```

# Use Cloud Volumes ONTAP

## License management

### Manage capacity-based licensing for Cloud Volumes ONTAP

Manage your capacity-based licenses from the NetApp Console to ensure that your NetApp account has enough capacity for your Cloud Volumes ONTAP systems.

*Capacity-based licenses* enable you to pay for Cloud Volumes ONTAP per TiB of capacity.

You can manage capacity-based Cloud Volumes ONTAP licenses from the NetApp Console.



While the actual usage and metering for the products and services managed in the Console are always calculated in GiB and TiB, the terms GB/GiB and TB/TiB are used interchangeably. This is reflected in the Cloud Marketplace listings, price quotes, listing descriptions, and in other supporting documentation

[Learn more about Cloud Volumes ONTAP licenses.](#)

### How licenses are added to NetApp Console

After you purchase a license from your NetApp sales representative, NetApp will send you an email with the serial number and additional licensing details.

In the meantime, the Console automatically queries NetApp's licensing service to obtain details about the licenses associated with your NetApp Support Site account. If there are no errors, it adds the licenses.

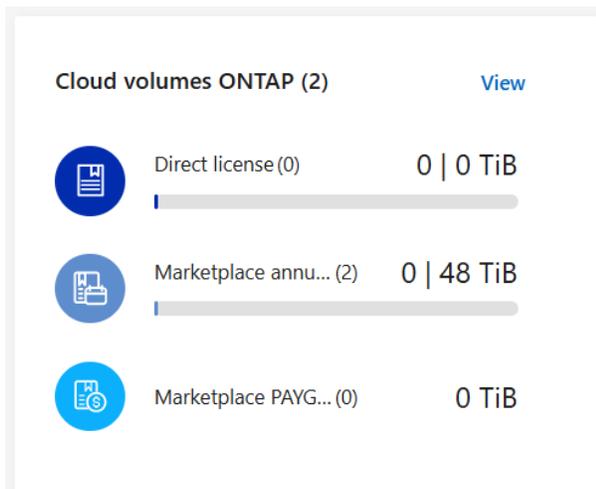
If the Console can't add the license, you'll need to manually add them. For example, if the Console agent is installed at a location that doesn't have internet access, you'll need to add the licenses yourself. [Learn how to add purchased licenses to your account.](#)

### View the consumed capacity in your account

The Console shows you the total consumed capacity in your account and the consumed capacity by licensing package. This can help you understand how you're being charged and whether you need to purchase additional capacity.

#### Steps

1. From the left navigation pane, select **Administration > Licenses and subscriptions**.
2. On the **Overview** tab, the Cloud Volumes ONTAP tile displays the current capacity provisioned for your account.



- *Direct license* is the total provisioned capacity of all Cloud Volumes ONTAP systems in your NetApp account. The charging is based on each volume's provisioned size, regardless of local, used, stored, or effective space within the volume.
- *Annual contract* is the total licensed capacity (bring your own license (BYOL) or Marketplace Contract) that you purchased from NetApp.
- *PAYGO* is the total provisioned capacity using cloud marketplace subscriptions. Charging via PAYGO is used only if the consumed capacity is higher than the licensed capacity or if there is no BYOL license available in the Console.

3. Select **View** to see the consumed capacity for each of your licensing packages.
4. Select the **Licenses** tab to see details for each package license that you have purchased.

To better understand the capacities that display for the Essentials package, you should be familiar with how charging works. [Learn about charging for the Essentials package.](#)

5. Select the **Subscriptions** tab to see the consumed capacity by license consumption model. This tab includes both PAYGO and annual contract licenses.

You'll only see the subscriptions that are associated with the organization that you are that you're currently viewing.

6. As you view the information about your subscriptions, you can interact with the details in the table. Expand a row to view more details.
  - Select  to choose which columns appear in the table. Note that the Term and Auto Renew columns don't appear by default. The Auto Renew column displays renewal information for Azure contracts only.

## Viewing package details

You can view details about the capacity used per package by switching to legacy mode on the Cloud Volumes ONTAP page.

1. From the left navigation pane, select **Administration > Licenses and subscriptions**.
2. On the **Overview** tab, the Cloud Volumes ONTAP tile displays the current capacity provisioned for your account.
3. Select **View** to see the provisioned capacity for each of your licensing packages.

#### 4. Select **Switch to advanced view**.

Overview > Cloud Volumes ONTAP

Cloud Volumes ONTAP

[Usage report](#) [Switch to advanced View](#)

Marketplace annual con... (2) 0 | 48 TiB | Marketplace PAYGO (0) 0 TiB | Direct license (0) 0 | 0 TiB

Subscriptions (2) Licenses (0)

Cloud Volumes ONTAP subscriptions (2)

Provider	Name	Type	Start date	End date	Status	
	DWdemoAnnualSmall123	Annual Contract	Jan 22, 2025	Jan 21, 2026	Subscribed	⋮
	cvo_team_bycap_bynode_annual	Annual Contract	Mar 12, 2025	Mar 11, 2026	Subscribed	⋮

#### 5. View the details of the package you want to see.

Overview > Cloud Volumes ONTAP

Cloud Volumes ONTAP

[Switch to standard View](#)

Cloud Volumes ONTAP Packages Summary [Usage report](#)

0 TiB Total consumed capacity | 48 TiB Total precommitted capacity | 0 TiB Total PAYGO

Essentials Secondary Single Node

0 TiB Consumed Capacity	6 TiB Precommitted capacity	0 TiB PAYGO
BYOL	0 TiB	
Marketplace Contracts	6 TiB	

Professional

0 TiB Consumed Capacity	6 TiB Precommitted capacity	0 TiB PAYGO
BYOL	0 TiB	
Marketplace Contracts	6 TiB	

### Change charging methods

Capacity-based licensing is available in the form of a *package*. When you create a Cloud Volumes ONTAP system, you can choose from several licensing packages based on your business needs. If your needs change after you create the system, you can change the package at any time. For example, you might change from the Essentials package to the Professional package.

[Learn more about capacity-based licensing packages.](#)

#### About this task

- Changing the charging method doesn't affect whether you're charged through a license purchased from NetApp (BYOL) or from your cloud provider's marketplace pay-as-you-go (PAYGO) subscription.

The Console always attempts to charge against a license first. If a license isn't available, it charges against

a marketplace subscription. You don't have to convert a BYOL subscription to marketplace subscription or vice versa.

- If you have a private offer or contract from your cloud provider's marketplace, changing to a charging method that's not included in your contract will result in charging against BYOL (if you purchased a license from NetApp) or PAYGO.

## Steps

1. From the left navigation pane, select **Administration > Licenses and subscriptions**.
2. Select the **Overview** tab.
3. On the Cloud Volumes ONTAP tile, select **View**.
4. Select **Switch to advanced view**.

The screenshot shows the 'Cloud Volumes ONTAP' overview page. At the top, there are three summary cards: 'Marketplace annual con... (2)' with 0 | 48 TiB, 'Marketplace PAYGO (0)' with 0 TiB, and 'Direct license (0)' with 0 | 0 TiB. Below these is a 'Subscriptions (2)' section with a table of two subscriptions. The table has columns for Provider, Name, Type, Start date, End date, and Status. Both subscriptions are 'Annual Contract' and 'Subscribed'.

Provider	Name	Type	Start date	End date	Status
	DWdemoAnnualSmall123	Annual Contract	Jan 22, 2025	Jan 21, 2026	Subscribed
	cvo_team_bycap_bynode_annual	Annual Contract	Mar 12, 2025	Mar 11, 2026	Subscribed

5. Scroll down to the **Capacity-based license** table and select **Change charging method**.

The screenshot shows the 'Cloud Volumes ONTAP licenses (0)' page. A 'Change charging method' button is highlighted with a red box. Below the button is a table with columns for Serial number, Package type, Package sub-type, Type, and Consumed capacity. The table is currently empty, displaying 'No licenses'.

Serial number	Package type	Package sub-type	Type	Consumed capacity
No licenses				

6. On the **Change charging method** pop-up, select a Cloud Volumes ONTAP system, choose the new charging method, and then confirm your understanding that changing the package type will affect service charges.
7. Select **Change charging method**.

## Download usage reports

You can download four usage reports from the Console. These usage reports provide capacity details of your subscriptions and tell you how you're being charged for the resources in your Cloud Volumes ONTAP subscriptions. The downloadable reports capture data at a point in time and can be easily shared with others.



The following reports are available for download. Capacity values shown are in TiB.

- **High-level usage:** This report includes the following information:
  - Total consumed capacity
  - Total precommitted capacity
  - Total BYOL capacity
  - Total Marketplace contracts capacity
  - Total PAYGO capacity
- **Cloud Volumes ONTAP package usage:** This report includes the following information for each package:
  - Total consumed capacity
  - Total precommitted capacity
  - Total BYOL capacity
  - Total Marketplace contracts capacity
  - Total PAYGO capacity
- **Storage VMs usage:** This report shows how charged capacity is broken down across Cloud Volumes ONTAP systems and storage virtual machines (SVMs). This information is only available in the report. It contains the following information:
  - System ID and name (appears as the UUID)
  - Cloud
  - NetApp account ID
  - System configuration
  - SVM name
  - Provisioned capacity
  - Charged capacity roundup
  - Marketplace billing term
  - Cloud Volumes ONTAP package or feature
  - Charging SaaS Marketplace subscription name
  - Charging SaaS Marketplace subscription ID
  - Workload type

- **Volumes usage:** This report shows how charged capacity is broken down by volumes in a Cloud Volumes ONTAP system. This information is not available on any screen in the Console. It includes the following information:
  - System ID and name (appears as the UUID)
  - SVN name
  - Volume ID
  - Volume type
  - Volume provisioned capacity



FlexClone volumes aren't included in this report because these types of volumes don't incur charges.

### Steps

1. From the left navigation pane, select **Administration > Licenses and subscriptions**.
2. On the **Overview** tab, select **View** from the Cloud Volumes ONTAP tile.
3. Select **Usage report**.

The usage report downloads.

4. Open the downloaded file to access the reports.

## Manage Keystone subscriptions for Cloud Volumes ONTAP through NetApp Console

Manage your Keystone subscriptions in the NetApp Console by enabling subscriptions for use with Cloud Volumes ONTAP and by requesting changes to the committed capacity for your subscription's service levels. Requesting additional capacity for a service level provides more storage for Cloud Volumes ONTAP systems.

NetApp Keystone is a flexible pay-as-you-grow subscription-based service that delivers a hybrid cloud experience for customers who prefer OpEx to CapEx or leasing.

[Learn more about Keystone](#)

### Authorize your account

Before you can use and manage Keystone subscriptions in the Console, you need to contact NetApp to authorize your Console account with your Keystone subscriptions.

### Steps

1. From the NetApp Console menu, select **Administration > Licenses and subscriptions**.
2. Select **Keystone Subscriptions**.
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 account to access the subscriptions.

4. Come back to the **Keystone Subscriptions** tab to view your subscriptions.

## Link a subscription

After NetApp authorizes your account, you can link Keystone 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. From the NetApp Console menu, select **Administration > Licenses and subscriptions**.
2. Select **Keystone Subscriptions**.
3. For the subscription that you want to link, click **...** and select **Link**.

### Result

The subscription is now linked to your Console organization or account and available to select when creating a Cloud Volumes ONTAP working environment.

## Request more or less committed capacity

If you want to change the committed capacity for your subscription's service levels, you can send a request to NetApp directly from the Console. Requesting additional capacity for a service level provides more storage for Cloud Volumes ONTAP systems.

### Steps

1. From the NetApp Console menu, select **Administration > Licenses and subscriptions**.
2. Select **Keystone Subscriptions**.
3. For the subscription that you want to adjust the capacity, click **...** and select **View detail and edit**.
4. Enter the requested committed capacity for one or more subscriptions.
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.

## Monitor usage

The Digital Advisor dashboard enables you to monitor Keystone subscription usage and generate reports.

[Learn more about monitoring subscription usage](#)

## Unlink a subscription

If you no longer want to use a Keystone subscription with the Console, 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. From the NetApp Console menu, select **Administration > Licenses and subscriptions**.
2. Select **Keystone**.
3. For the subscription that you want to unlink, click **...** and select **Unlink**.

### Result

The subscription is unlinked from your Console organization or account and no longer available to select when creating a Cloud Volumes ONTAP working environment.

## Manage node-based licensing for Cloud Volumes ONTAP

Manage node-based licenses in the NetApp Console to ensure that each Cloud Volumes ONTAP system has a valid license with the required capacity.

*Node-based licenses* are the previous generation licensing model (and not available for new customers):

- Bring your own license (BYOL) licenses purchased from NetApp
- Hourly pay-as-you-go (PAYGO) subscriptions from your cloud provider's marketplace

You can manage node-based Cloud Volumes ONTAP licenses licenses from the NetApp Console.

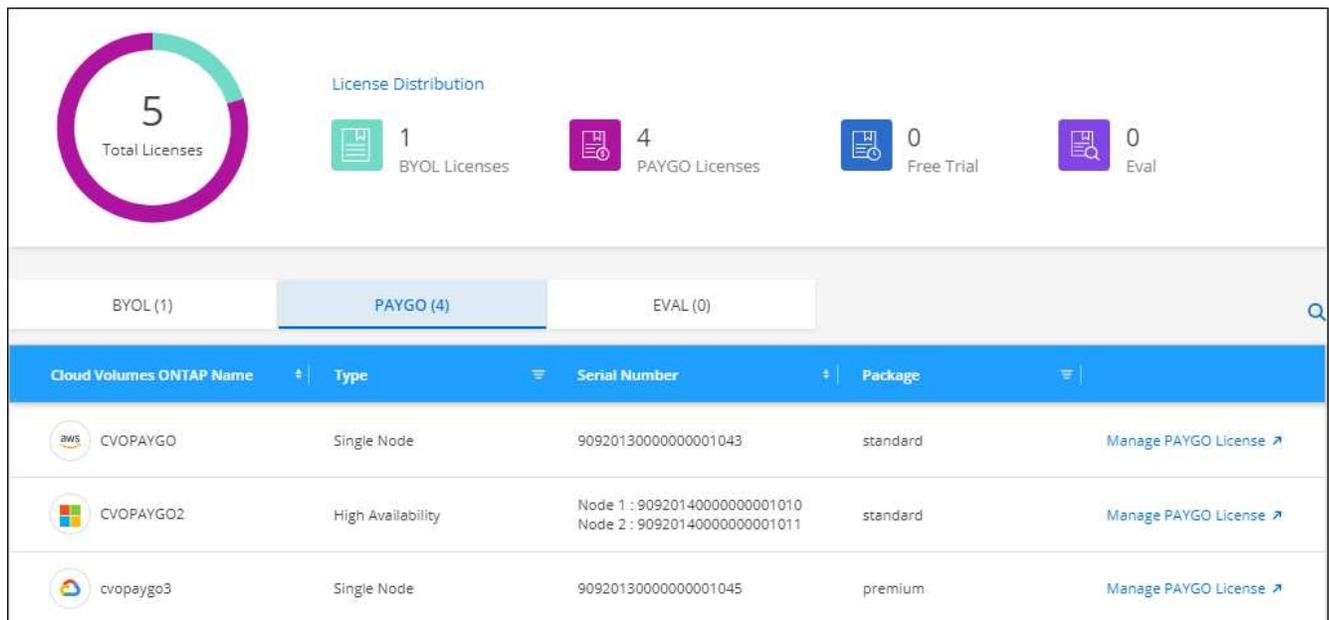
[Learn more about Cloud Volumes ONTAP licenses.](#)

### Manage PAYGO licenses

The Licenses and subscriptions menu enables you to view details about each of your PAYGO Cloud Volumes ONTAP systems, including the serial number and PAYGO license type.

#### Steps

1. From the left navigation pane, select **Administration > Licenses and subscriptions**.
2. Select the **Overview** tab.
3. On the Cloud Volumes ONTAP tile, select **View**.
4. Select **Node Based Licenses** from the drop-down.
5. Click **PAYGO**.
6. View details in the table about each of your PAYGO licenses.



The screenshot displays the 'License Distribution' section of the NetApp console. It features a donut chart showing 5 total licenses, with a breakdown: 1 BYOL License, 4 PAYGO Licenses, 0 Free Trial, and 0 Eval. Below the chart is a filter bar with tabs for BYOL (1), PAYGO (4), and EVAL (0). The main table lists three PAYGO licenses with columns for Cloud Volumes ONTAP Name, Type, Serial Number, and Package. Each row includes a 'Manage PAYGO License' link.

Cloud Volumes ONTAP Name	Type	Serial Number	Package	
aws CVOPAYGO	Single Node	90920130000000001043	standard	<a href="#">Manage PAYGO License</a>
CVOPAYGO2	High Availability	Node 1 : 909201400000000001010 Node 2 : 909201400000000001011	standard	<a href="#">Manage PAYGO License</a>
cvopaygo3	Single Node	909201300000000001045	premium	<a href="#">Manage PAYGO License</a>

7. If needed, click **Manage PAYGO License** to change the PAYGO license or to change the instance type.

### Manage BYOL licenses

Manage licenses that you purchased directly from NetApp by adding and removing system licenses and extra

capacity licenses.



NetApp has restricted the purchase, extension, and renewal of BYOL licensing. For more information, refer to [Restricted availability of BYOL licensing for Cloud Volumes ONTAP](#).

### Add unassigned licenses

Add a node-based license to the Console so that you can select the license when you create a new Cloud Volumes ONTAP system. The Console identifies these licenses as *unassigned*.

#### Steps

1. From the left navigation pane, select **Administration > Licenses and subscriptions**.
2. Select the **Overview** tab.
3. On the Cloud Volumes ONTAP tile, select **View**.
4. Select **Node Based Licenses** from the drop-down.
5. Click **Unassigned**.
6. Click **Add Unassigned Licenses**.
7. 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.

8. Click **Add License**.

#### Result

The Console adds the license. 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 **Licenses and subscriptions**.

### 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 NetApp Backup and Recovery license, a NetApp Data Classification license, or a NetApp 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 direct license
- Licensing for a Cloud Volumes ONTAP single node is converted to a 32 TiB direct license

The converted license has the same expiration date as the Cloud Volumes ONTAP license.

[View walkthrough of how to exchange node-based licenses.](#)

#### Steps

1. From the left navigation pane, select **Administration > Licenses and subscriptions**.
2. Select the **Overview** tab.
3. On the Cloud Volumes ONTAP tile, select **View**.
4. Select **Node Based Licenses** from the drop-down.

5. Click **Unassigned**.
6. Click **Exchange License**.

Serial Number	Type	Cloud Provider	License Expiry	Status	
012345678901234567890	Single Node	All Providers	April 20, 2022	Unassigned	Exchange License ▾
012345678901234567891	Single Node	 Azure	April 20, 2022	Unassigned	Exchange License ▾
012345678901234567892	Single Node	 AWS	January 1, 2022	Exchanged to Cloud Tiering on August 1, 2021	

7. Select the service that you'd like to exchange the license with.
8. If you're prompted, select an additional license for the HA pair.
9. Read the legal consent and click **Agree**.

### Result

The Console 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, the Console 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.

### 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

## License Generator

The following fields are pre-populated based on the NetApp SSO login provided.  
To download the corresponding NetApp license file, re-enter your SSO password along with the correct Product Line and Product Serial number.

First Name	<input type="text" value="Ben"/>
Last Name	<input type="text"/>
Company	<input type="text" value="Network Appliance, Inc"/>
Email Address	<input type="text"/>
Username	<input type="text"/>

Product Line\*

- ONTAP Select - Standard
- ONTAP Select - Premium
- ONTAP Select - Premium XL
- Cloud Volumes ONTAP for AWS (single node)
- Cloud Volumes ONTAP for AWS (HA)
- Cloud Volumes ONTAP for GCP (single node or HA)
- Cloud Volumes ONTAP for Microsoft Azure (single node)
- Cloud Volumes ONTAP for Microsoft Azure (HA)
- Service Level Manager - SLO Advanced
- StorageGRID Webscale
- StorageGRID WhiteBox
- SnapCenter Standard (capacity-based)

Not only is protecting your data required by

I have read NetApp's new **Global Data** may use my personal data.

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, the Console automatically obtains the new license from NetApp and installs it on the Cloud Volumes ONTAP system. If the Console can't access the license file over the secure internet connection, you can obtain the file yourself and then manually upload the file.

### Steps

1. From the left navigation pane, select **Administration > Licenses and subscriptions**.
2. Select the **Overview** tab.
3. On the Cloud Volumes ONTAP tile, select **View**.
4. Select **Node Based Licenses** from the drop-down.
5. In the **BYOL** tab, expand the details for a Cloud Volumes ONTAP system.
6. Click the action menu next to the system license and select **Update License**.
7. Upload the license file (or files if you have an HA pair).
8. Click **Update License**.

### Result

The Console 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 the Console. After you purchase the license, you can apply it to a Cloud Volumes ONTAP system.

### Steps

1. From the left navigation pane, select **Administration > Licenses and subscriptions**.
2. Select the **Overview** tab.
3. On the Cloud Volumes ONTAP tile, select **View**.
4. Select **Node Based Licenses** from the drop-down.
5. In the **BYOL** tab, expand the details for a Cloud Volumes ONTAP system.
6. Click **Add Capacity License**.
7. Enter the serial number or upload the license file (or files if you have an HA pair).
8. 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 the Console.

### Steps

1. From the left navigation pane, select **Administration > Licenses and subscriptions**.
2. Select the **Overview** tab.
3. On the Cloud Volumes ONTAP tile, select **View**.
4. Select **Node Based Licenses** from the drop-down.
5. In the **BYOL** tab, expand the details for a Cloud Volumes ONTAP system.
6. Click the action menu next to the capacity license and select **Update License**.
7. Upload the license file (or files if you have an HA pair).
8. 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. From the left navigation pane, select **Administration > Licenses and subscriptions**.
2. Select the **Overview** tab.
3. On the Cloud Volumes ONTAP tile, select **View**.

4. Select **Node Based Licenses** from the drop-down.
5. In the **BYOL** tab, expand the details for a Cloud Volumes ONTAP system.
6. Click the action menu next to the capacity license and select **Remove License**.
7. Click **Remove**.

## Change between PAYGO and BYOL

Converting a system from PAYGO by-node licensing to BYOL by-node licensing (and vice versa) isn't supported. If you want to switch between a pay-as-you-go subscription and a BYOL subscription, then you need to deploy a new system and replicate data from the existing system to the new system.

### Steps

1. Create a new Cloud Volumes ONTAP system.
2. Set up a one-time data replication between the systems for each volume that you need to replicate.

[Learn how to replicate data between systems](#)

3. Terminate the Cloud Volumes ONTAP system that you no longer need by deleting the original system.

[Learn how to delete a Cloud Volumes ONTAP system.](#)

### Related links

<https://docs.netapp.com/us-en/storage-management-cloud-volumes-ontap/gcp/concept-licensing.html#end-of-availability-of-node-based-licenses> End of availability of node-based licenses  
[Convert node-based licenses to capacity based](#)

## Volume and LUN administration

### Create a FlexVol volume on a Cloud Volumes ONTAP system

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 the NetApp Console.

You have several ways to create a new volume:

- Specify details for a new volume and let the Console handle the underlying data aggregates for you. [Learn more](#)
- Create a volume on a data aggregate of your choice. [Learn more](#)
- Create a volume on the second node in an HA configuration. [Learn more](#)

### Before you begin

A few notes about volume provisioning:

- When you create an iSCSI volume, the Console 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 ONTAP System Manager or the ONTAP CLI.

## Create a volume

The most common way to create a volume is to specify the type of volume that you need and then let the Console handle 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. From the left navigation menu, select **Storage > Management**.
2. On the **Systems** page, double-click the name of the Cloud Volumes ONTAP system on which you want to provision a FlexVol volume.

You can create a volume by letting the Console 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

Select the Volumes tab, and click **Add Volume**.

The screenshot shows the 'Volumes' tab selected in a console interface. At the top, there are three tabs: 'Overview', 'Volumes' (which is active), and 'Aggregates'. Below the tabs is a 'Volumes Summary' section with four cards: '1 Volume', '10 GiB Provisioned Capacity', '0.01 GiB Used & Reserved Capacity', and '0 GiB Tiered Data'. Below this is a 'Volume (1)' section with a search icon, a list icon, and an 'Add Volume' button. A single volume 'v456' is listed with a status of 'Online' and a 'Manage Volume' link.

### Specific aggregate

1. On the **Aggregates** tab, go to the required the aggregate and click the **...** icon.
2. Select **Add Volume**.

### Aggregate (1)

The screenshot shows the 'Aggregate (1)' page for 'aggr1'. The aggregate is in an 'Online' state. A context menu is open over the '...' icon, with 'Add Volume' selected. The page is divided into two columns: 'INFO' and 'Capacity'. The 'INFO' column lists 'Disk Type: Premium SSD v2', 'Disks: 1', 'Volumes: 2', and 'Blob Tiering: Enabled'. The 'Capacity' column lists 'Disk Used' and 'Blob Used'. The context menu options are 'View aggregate details', 'Add Volume', 'Add Azure Disks', and 'Delete'.

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 Name	The identifiable name you can enter for the new volume.
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.
Storage VM (SVM)	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. You can specify the Storage VM for the new volume.
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, the Console prompts you to set up CIFS connectivity after you click **Next**.

[Learn about supported client protocols and versions.](#)

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, the Console 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.

If you're configuring Google Managed Active Directory, AD can be accessed by default with the 169.254.169.254 IP address.

### 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 Google Managed Microsoft AD as the AD server for Cloud Volumes ONTAP, enter **OU=Computers,OU=Cloud** in this field.

[Google Cloud Documentation: Organizational Units in Google Managed Microsoft AD](#)

### 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. For information, refer to the [NetApp Console automation docs](#).

Note that you can configure an NTP server only when creating a CIFS server. It's not configurable after you create the CIFS server.

### 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, the Console 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 Google Cloud](#)
- 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

The Console creates the volume on the Cloud Volumes ONTAP system.

### Create a volume on the second node in an HA configuration

By default, the Console 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. From the left navigation menu, select **Storage > Management**.
2. On the **Systems** page, double-click the name of the Cloud Volumes ONTAP system on which you want to manage aggregates.
3. On the Aggregates tab, click **Add Aggregate**, and create the aggregate.

The screenshot displays the 'Aggregates Summary' section with four metrics: Total Aggregates (1), Aggregates with Tiering (1), Aggregates without Tiering (0), and Allocated Disks (1). Below this is a table for 'Aggregate (1)' showing details for 'aggr1'. The aggregate is 'Online' and has the following specifications:

INFO		Capacity	
Disk Type	Premium SSD v2	Provisioned size	907.18 GiB
Disks	1	Disk Used	1.15 GiB
Volumes	2	Blob Used	0 GiB
Blob Tiering	Enabled		

4. For Home Node, choose the second node in the HA pair.
5. After the Console creates the aggregate, select it and then click **Create volume**.
6. Enter details for the new volume, and then click **Create**.

## Result

The Console creates the volume on the second node in the HA pair.

## 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 ONTAP System Manager or the ONTAP CLI. Quotas enable you to restrict or track the disk space and number of files used by a user, group, or qtree.

## Manage volumes on Cloud Volumes ONTAP systems

You can manage volumes and CIFS servers in the NetApp Console. You can also move volumes to avoid capacity issues.

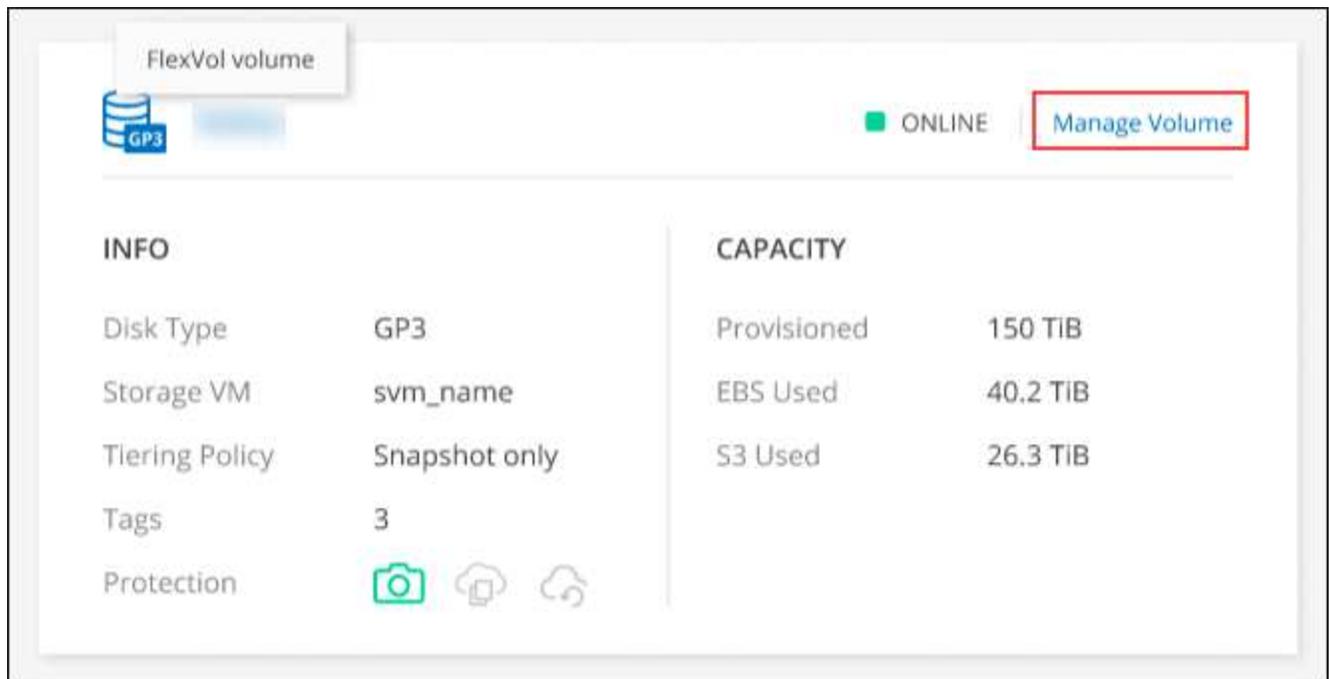
You can manage volumes in the NetApp Console Standard View or through ONTAP System Manager that is included within the Console for advanced volume management. The Standard View provides a limited set of options to modify your volumes. System Manager provides advanced level of management, such as cloning, resizing, changing settings for anti-ransomware, analytics, protection, and activity tracking, and moving volumes across tiers. For information, refer to [Administer Cloud Volumes ONTAP using System Manager](#).

## Manage volumes

By using the Standard View of the Console, you can manage volumes according to your storage needs. You can view, edit, clone, restore, and delete volumes.

### Steps

1. From the left navigation menu, select **Storage > Management**.
2. On the **Systems** page, double-click the Cloud Volumes ONTAP system on which you want to manage volumes.
3. Select the **Volumes** tab.



4. On the required volume tile, click **Manage volume**.

Task	Action
View information about a volume	Under Volume Actions in the Manage volumes panel, click <b>View volume details</b> .
Get the NFS mount command	<ol style="list-style-type: none"><li>a. Under Volume Actions in the Manage volumes panel, click <b>Mount Command</b>.</li><li>b. Click <b>Copy</b>.</li></ol>

Task	Action
Clone a volume	<p>a. Under Volume Actions in the Manage volumes panel, click <b>Clone the volume</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, refer to the <a href="#">ONTAP 9 Logical Storage Management Guide</a>.</p>
Edit a volume (read-write volumes only)	<p>a. Under Volume Actions in the Manage volumes panel, click <b>Edit volume settings</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>Apply</b>.</p> <div data-bbox="609 829 665 892" style="border: 1px solid #ccc; border-radius: 50%; width: 30px; height: 30px; display: flex; align-items: center; justify-content: center; margin: 10px 0;"> <span style="font-size: 18px; font-weight: bold;">i</span> </div> <p style="margin-left: 40px;">If you need custom Snapshot policies, you can create them by using ONTAP System Manager.</p>
Delete a volume	<p>a. Under Volume Actions in the Manage volumes panel, click <b>Delete the volume</b>.</p> <p>b. Under the Delete Volume window, enter the name of the volume you want to delete.</p> <p>c. Click <b>Delete</b> again to confirm.</p>
Create a Snapshot copy on demand	<p>a. Under Protection Actions in the Manage Volumes panel, click <b>Create a Snapshot copy</b>.</p> <p>b. Change the name, if needed, and then click <b>Create</b>.</p>
Restore data from a Snapshot copy to a new volume	<p>a. Under Protection Actions in the Manage Volumes panel, 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>
Change the underlying disk type	<p>a. Under Advanced Actions in the Manage Volumes panel, click <b>Change Disk Type</b>.</p> <p>b. Select the disk type, and then click <b>Change</b>.</p> <div data-bbox="609 1753 665 1816" style="border: 1px solid #ccc; border-radius: 50%; width: 30px; height: 30px; display: flex; align-items: center; justify-content: center; margin: 10px 0;"> <span style="font-size: 18px; font-weight: bold;">i</span> </div> <p style="margin-left: 40px;">The Console 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	<ol style="list-style-type: none"> <li>a. Under Advanced Actions in the Manage Volumes panel, click <b>Change Tiering Policy</b>.</li> <li>b. Select a different policy and click <b>Change</b>.</li> </ol> <div style="border-left: 1px solid #ccc; padding-left: 10px; margin-top: 10px;">  <p>The Console 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> </div>
Delete a volume	<ol style="list-style-type: none"> <li>a. Select a volume, and then click <b>Delete</b>.</li> <li>b. Type the name of the volume in the dialog.</li> <li>c. Click <b>Delete</b> again to confirm.</li> </ol>

## Resize 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 the Console agent's settings.

If you need to resize your volume, you can do it from ONTAP System Manager in the Console.

### Steps

1. Click the System Manager view to resize a volume through ONTAP System Manager. Refer to [How to get started](#).
2. From the left navigation menu, select **Storage > Volumes**.
3. From the list of volumes, identify the one that you should resize.
4. Click the options icon .
5. Select **Resize**.
6. On the **Resize Volume** screen, edit the capacity and Snapshot reserve percentage as required. You can compare the existing, available space with the modified capacity.
7. Click **Save**.

## Resize volume ✕

CAPACITY

25
⇅

GiB
▼

SNAPSHOT RESERVE %

1
⇅

<b>Existing</b>	<b>New</b>
DATA SPACE	DATA SPACE
<b>20 GiB</b>	<b>24.75 GiB</b>
SNAPSHOT RESERVE	SNAPSHOT RESERVE
<b>0 Bytes</b>	<b>256 MiB</b>

Cancel
Save

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 information.

### Modify 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 **Overview** tab of the Cloud Volumes ONTAP system, click the **Feature** tab under the right-side panel.
2. Under the CIFS Setup field, click the **pencil icon** to display the CIFS Setup window.
3. Specify settings for the CIFS server:

Task	Action
Select Storage VM (SVM)	Selecting the Cloud Volume ONTAP storage virtual machine (SVM) displays its configured CIFS information.
Active Directory Domain to join	The FQDN of the Active Directory (AD) domain that you want the CIFS server to join.

Task	Action
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.
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> <p>If you're configuring Google Managed Active Directory, AD can be accessed by default with the 169.254.169.254 IP address.</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.
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> <ul style="list-style-type: none"> <li>To configure Google Managed Microsoft AD as the AD server for Cloud Volumes ONTAP, enter <b>OU=Computers,OU=Cloud</b> in this field.</li> </ul> <p><a href="#">Google Cloud Documentation: Organizational Units in Google Managed Microsoft AD</a></p>

4. Click **Set**.

### Result

Cloud Volumes ONTAP updates the CIFS server with the changes.

### Move a volume

Move volumes for capacity utilization, improved performance, and to satisfy service-level agreements.

You can move a volume in ONTAP 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 ONTAP System Manager or the ONTAP CLI to move the volumes to the aggregate.

In most situations, you can use System Manager to move volumes.

For instructions, refer to the [ONTAP 9 Volume Move Express Guide](#).

### Move a volume when Console displays an Action Required message

The Console 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.



The Console 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 capacity issues.](#)
2. Based on your analysis, move volumes to avoid capacity issues:
  - [Move volumes to another system to avoid capacity issues.](#)
  - [Move volumes to another aggregate to avoid capacity issues.](#)

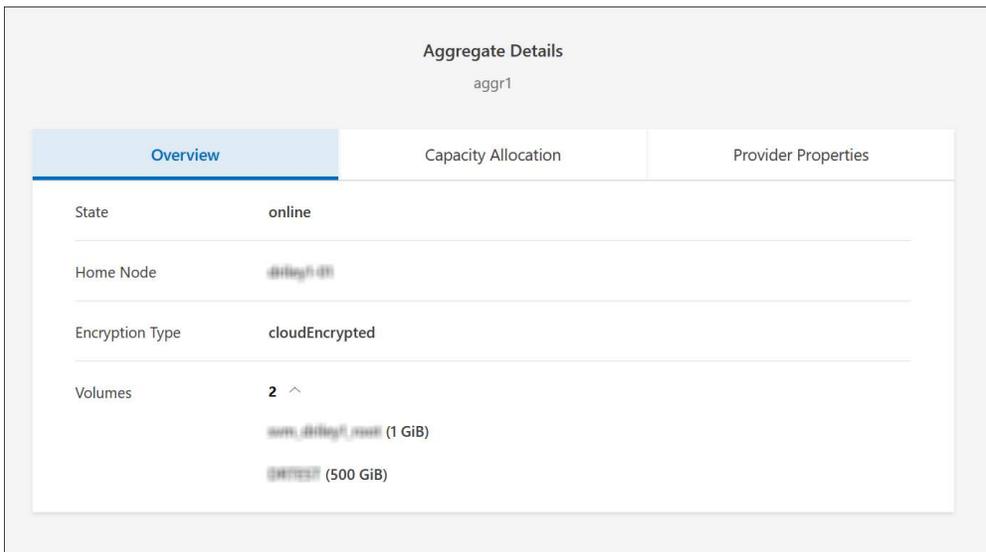
## Identify how to correct capacity issues

If the Console 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 Cloud Volumes ONTAP system, click the **Aggregates tab**.
  - b. On the aggregate tile, click the **...** icon and then click **View aggregate details**.
  - c. Under the **Overview** tab of the **Aggregate Details** screen, 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 information, refer to [Move 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 information, refer to [Move volumes to another aggregate to avoid capacity issues](#).

- c. Move two or more volumes to another system that has space.

For information, refer to [Move volumes to another aggregate to avoid capacity issues](#).

### Move 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, the Console 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 system to the target system to perform a one-time data replication of the volume.

For information, refer to [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 information, refer to [Managing data replication schedules and relationships](#).

4. Configure the volume for data access.

For information about configuring a destination volume for data access, refer to the [ONTAP 9 Volume Disaster Recovery Express Guide](#).

5. Delete the original volume.

For information, refer to [Manage volumes](#).

### Move volumes to another aggregate to avoid capacity issues

You can move one or more volumes to another aggregate to avoid capacity issues.

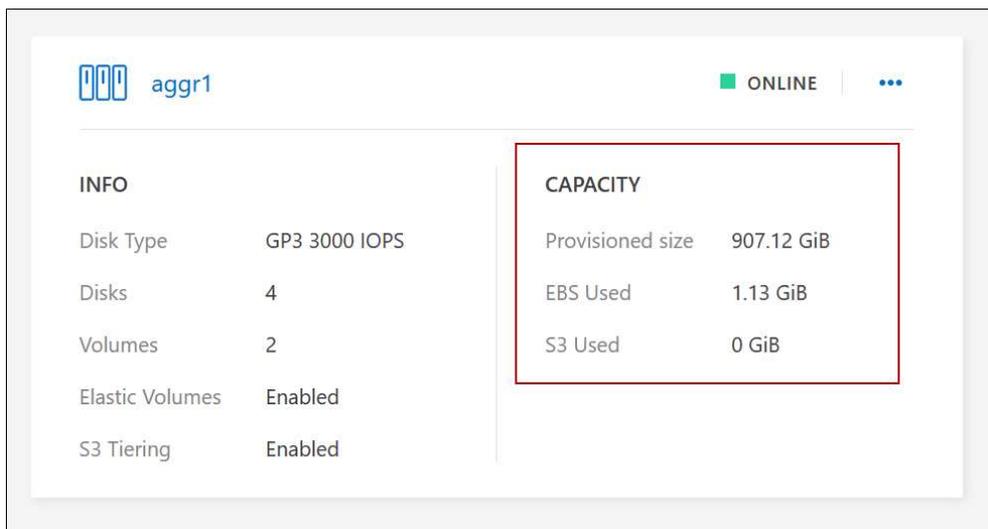
#### About this task

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, the Console 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. On Cloud Volumes ONTAP system, click the **Aggregates tab**.
  - b. On the required aggregate tile, click the **...** icon and then **View aggregate details** to view the available capacity (provisioned size minus used aggregate capacity).



2. If needed, add disks to an existing aggregate:
  - a. Select the aggregate, then click the **...** icon > **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 information, refer to [Creating aggregates](#).

4. Use ONTAP System Manager or the ONTAP CLI to move the volumes to the aggregate.
5. In most situations, you can use System Manager to move volumes.

For instructions, refer to 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.
- One of the aggregates 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.

### View FlexGroup Volumes

You can view FlexGroup volumes created through ONTAP System Manager or the ONTAP CLI directly through the Volumes tab in the Console. You can see detailed information for the FlexGroup volumes through a dedicated **Volumes** tile, where you can identify each FlexGroup volume group through the icon's hover text. Additionally, you can identify and sort FlexGroup volumes under the volumes list view through the Volume Style column.

INFO		CAPACITY	
Disk Type	GP3	Provisioned	150 TiB
Storage VM	svm_name	EBS Used	40.2 TiB
Tiering Policy	Snapshot only	S3 Used	26.3 TiB
Tags	3		
Protection			



Currently, you can only view existing FlexGroup volumes under the Console. You can't create FlexGroup volumes in the Console.

## Tier inactive Cloud Volumes ONTAP data to a 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, refer to [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 are good to go. [Learn more](#).

2

### Ensure connectivity between Cloud Volumes ONTAP and object storage

- For Google Cloud, 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 should be enabled on an aggregate to enable it 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

The NetApp Console prompts you to choose a tiering policy when you create, modify, or replicate a volume.

- [Tier data from read-write volumes](#)
- [Tier data from 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 an object store for the capacity tier. The Console does that for you.
- You don't need to enable data tiering at the system level.



The Console creates an object store for cold data when it creates the system, [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.

### Support in Google Cloud

- Data tiering is supported in Google Cloud beginning with Cloud Volumes ONTAP 9.6.

- The performance tier can be either SSD persistent disks, balanced persistent disks, or standard persistent disks.
- The inactive data is tiered to Google Cloud Storage. Tiering to other providers is not supported.

### Feature interoperability

- 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 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](#).
- A service account must be attached to Cloud Volumes ONTAP.

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

You're prompted to select this service account when you create a Cloud Volumes ONTAP system.

If you don't select a service account during deployment, you'll need to shut down Cloud Volumes ONTAP, go to the Google Cloud Console, and then attach the service account to the Cloud Volumes ONTAP instances. You can then enable data tiering as described in the next section.

- 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.](#)

#### Enable data tiering after implementing the requirements

The Console 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 through the API or ONTAP System Manager, which creates the object store.



The ability to enable tiering through the Console will be available in a future Cloud Volumes ONTAP release.

#### Ensure 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

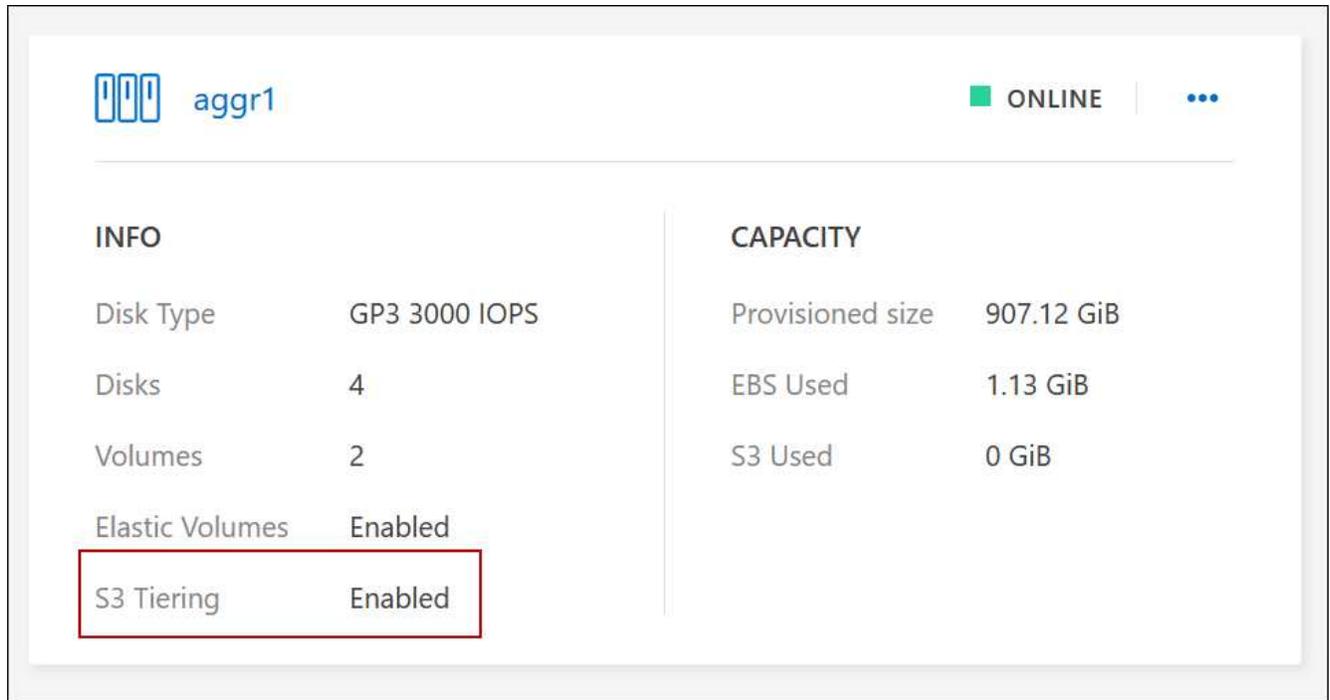
If you're enabling data tiering on a new volume, then you don't need to worry about enabling data tiering on an aggregate. The Console creates the volume on an existing aggregate that has tiering enabled, or it creates a new aggregate for the volume if a data tiering-enabled aggregate doesn't already exist.

- **Existing volumes**

To enable data tiering on an existing volume, ensure it is enabled on the underlying aggregate. If data tiering isn't enabled on the existing aggregate, then you'll need to use ONTAP System Manager to attach an existing aggregate to the object store.

**Steps to confirm whether tiering is enabled on an aggregate**

1. From the left navigation menu, select **Storage > Management**.
2. Open the Cloud Volumes ONTAP system.
3. Select the **Aggregates** tab and check if tiering is enabled or disabled on the aggregate.



**Steps to enable tiering on an aggregate**

1. In ONTAP 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.

**Tier 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**

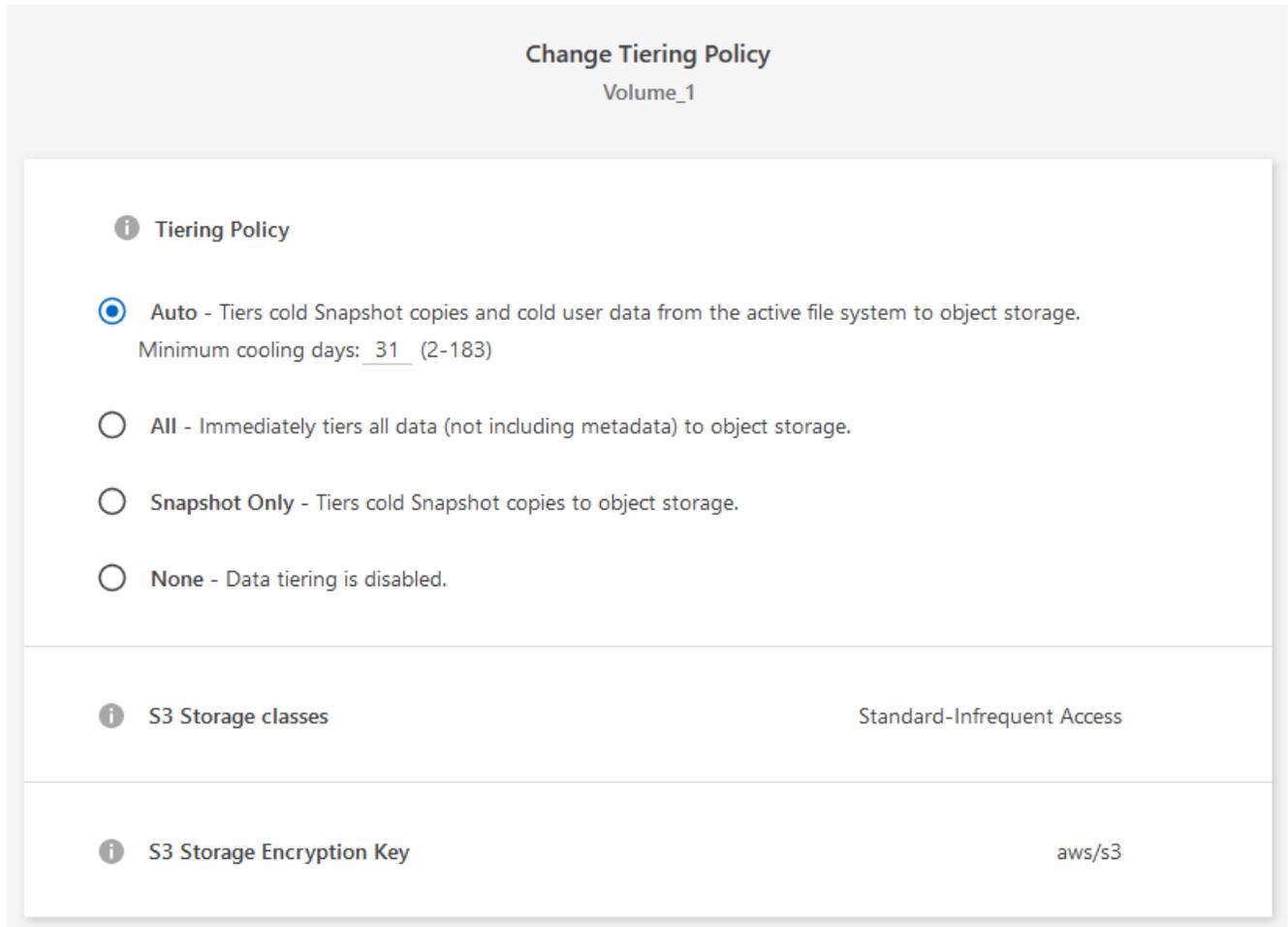
1. In the **Volumes** tab under the system, create a new volume or change the tier of an existing volume:

Task	Action
Create a new volume	Click <b>Add New Volume</b> .
Modify an existing volume	Select the desired volume tile, click <b>Manage volume</b> to access the Manage Volumes right-side panel, and then click <b>Advanced actions</b> and <b>Change tiering policy</b> under the right panel.

2. Select a tiering policy.

For a description of these policies, refer to [Data tiering overview](#).

### Example



The Console creates a new aggregate for the volume if a data tiering-enabled aggregate does not already exist.

### Tier data from data protection volumes

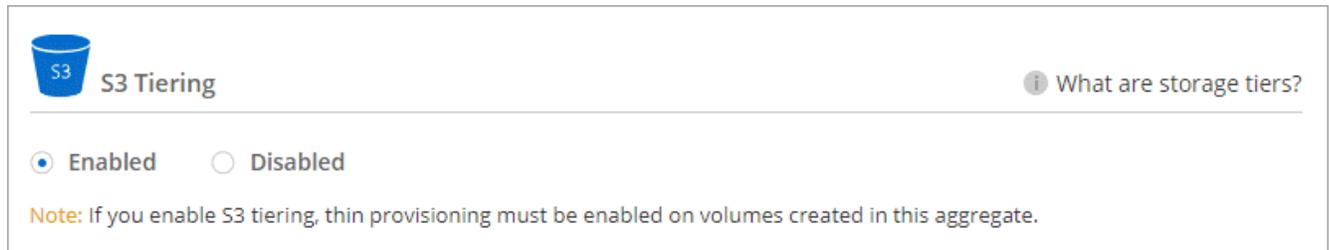
Cloud Volumes ONTAP can tier data from a data protection volume to a capacity tier. If you activate the destination volume, the data gradually moves to the performance tier as it is read.

### Steps

1. From the left navigation menu, select **Storage > Management**.

2. On the **Systems** page, select the Cloud Volumes ONTAP system that contains the source volume, and then drag it to the system to which you want to replicate the volume.
3. Follow the prompts until you reach the tiering page and enable data tiering to object storage.

### Example



For help with replicating data, refer to [Replicating data to and from the cloud](#).

### Change 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, refer to [Data tiering overview](#).

### Steps

1. On the Cloud Volumes ONTAP system, click the menu icon and then click **Storage Classes** or **Blob Storage Tiering**.
2. Choose a storage class and then click **Save**.

### Change 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. The Console can then purchase additional disks for you when additional capacity is required (up until you reach the disk limit for the aggregate).



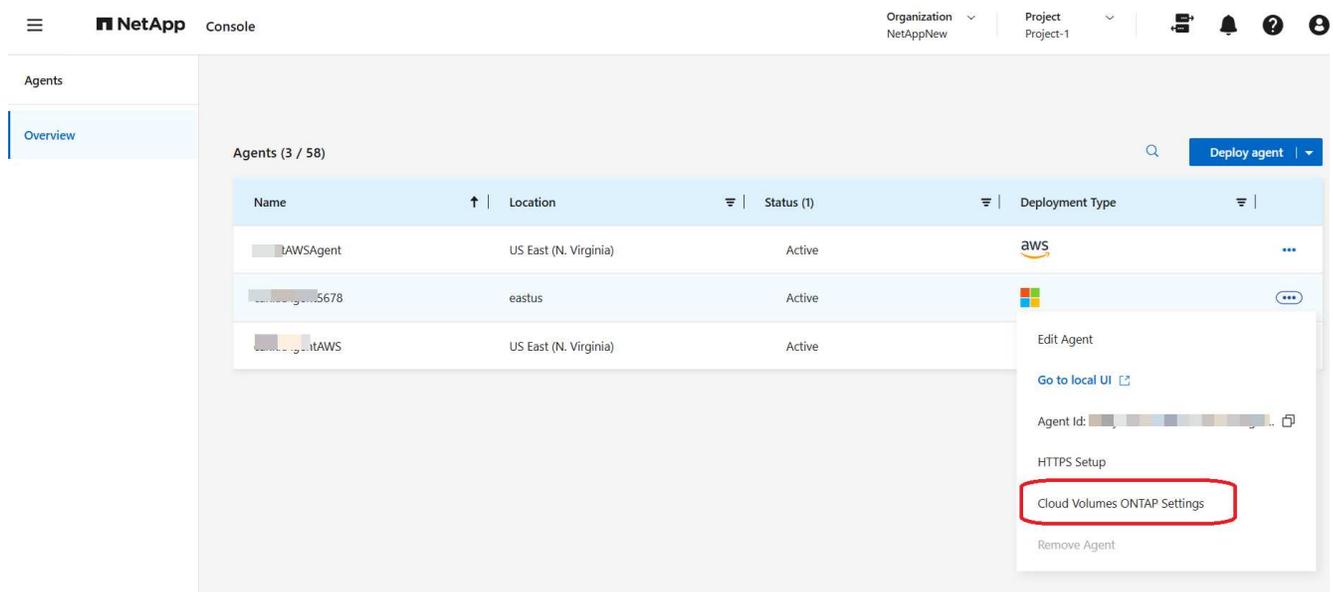
If there isn't sufficient space, then Cloud Volumes ONTAP can't move the data and you might experience performance degradation. Any change should be done with caution. If you're unsure, reach out to NetApp Support for guidance.

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.

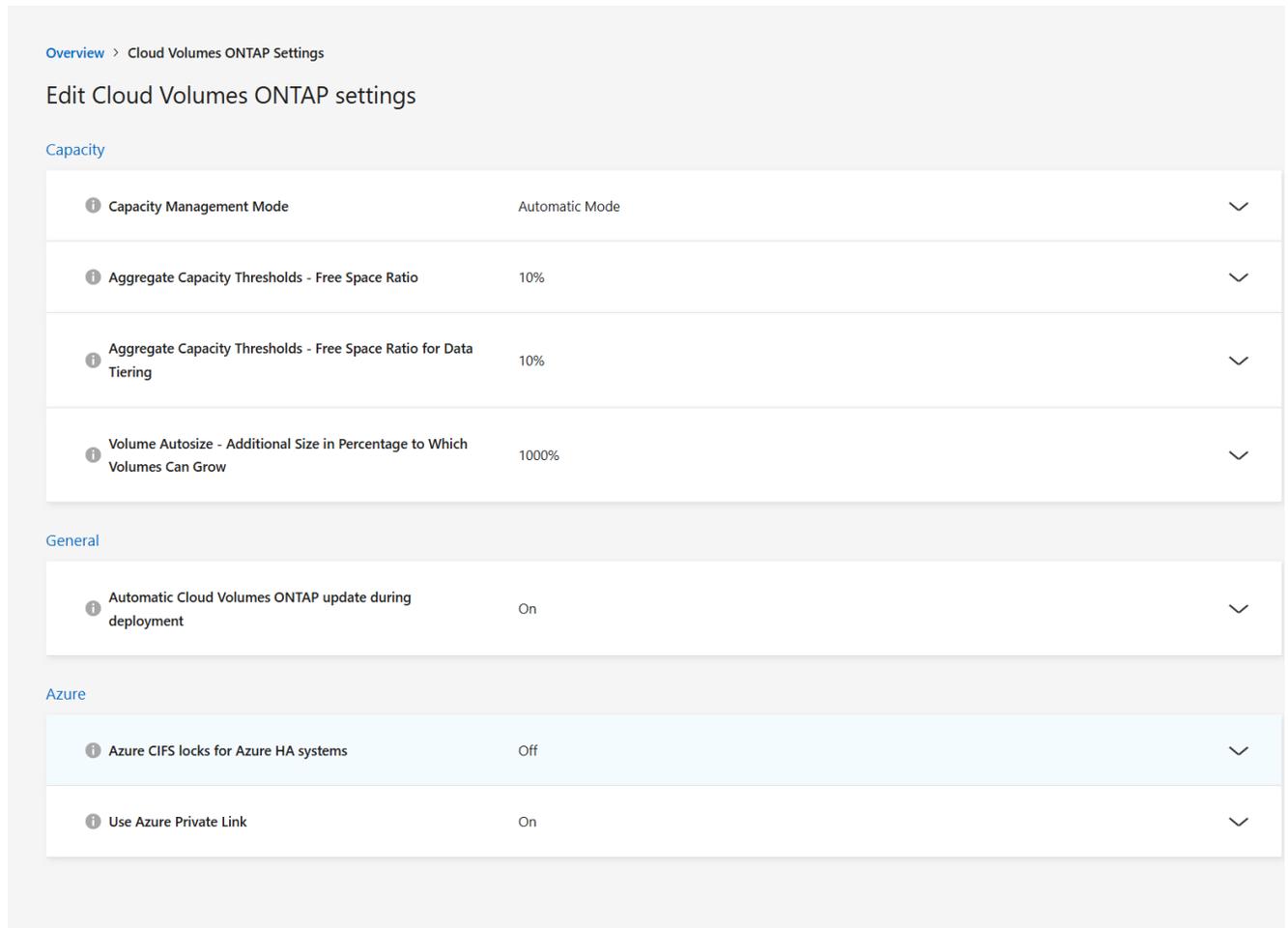
### Steps

1. From the left navigation pane, go to **Administration > Agents**.

2. Click the **...** icon for the Console agent that manages your Cloud Volumes ONTAP system.
3. Select **Cloud Volumes ONTAP Settings**.



4. Under **Capacity**, click **Aggregate Capacity Thresholds - Free Space Ratio for Data Tiering**.



5. Change the free space ratio based on your requirements and click **Save**.

## Change 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 ONTAP CLI and 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.

## Remove an S3 bucket on decommissioning a system

You can delete an S3 bucket with the data tiered from a Cloud Volumes ONTAP system when you decommission the environment.

You can delete the S3 bucket only if:

- The Cloud Volume ONTAP system is deleted from the Console.
- All objects are deleted from the bucket and the S3 bucket is empty.

When you decommission a Cloud Volumes ONTAP system, the S3 bucket that was created for the environment is not deleted automatically. Instead, it remains in an orphaned state to prevent any accidental data loss. You can delete the objects in the bucket, then remove the S3 bucket itself, or keep it for later use. Refer to [ONTAP CLI: vsverver object-store-server bucket delete](#).

## Connect to a LUN on Cloud Volumes ONTAP from your host system

When you create an iSCSI volume, the NetApp Console 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:

- The Console's automatic capacity management doesn't apply to LUNs. When it creates a LUN, it disables the autogrow feature.
- You can create additional LUNs from ONTAP System Manager or the ONTAP CLI.

### Steps

1. From the left navigation menu, select **Storage > Management**.
2. On the **Systems** page, double-click the Cloud Volumes ONTAP system on which you want to manage volumes.
3. In the system, select the **Volumes** tab.
4. Go to the required volume tile and then select **Manage volume** to access the Manage Volumes panel on

the right.

5. Click **Target iQN**.
6. Click **Copy** to copy the iQN name.
7. 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](#)
  - [ONTAP SAN host configuration](#)

## Accelerate data access with FlexCache volumes on a Cloud Volumes ONTAP system

A FlexCache volume is a storage volume that caches SMB and 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.

NetApp Console provides management of FlexCache volumes with the [NetApp Volume Caching](#).

You can also 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](#)



## Work with FlexCache when the origin is encrypted

When configuring FlexCache on a Cloud Volumes ONTAP system where the origin volume is encrypted, additional steps are required, to ensure that the FlexCache volume can properly access and cache the encrypted data.

### Before you begin

1. **Encryption setup:** Ensure that the source volume is fully encrypted and operational. For Cloud Volumes ONTAP systems, this involves integrating with cloud-specific key management services. For Google Cloud, it is Google Cloud Key Management Service. For information, refer to [Manage keys with Google's Cloud Key Management Service](#).
2. **Key management services:** Before creating a FlexCache volume, verify that the key management services are configured correctly on the Cloud Volumes ONTAP system. This configuration is essential for the FlexCache volume to decrypt the data from the origin volume.
3. **Licensing:** Confirm that a valid FlexCache license is available and activated on the Cloud Volumes ONTAP system.
4. **ONTAP version:** Ensure that the ONTAP version of your Cloud Volumes ONTAP system supports FlexCache with encrypted volumes. Refer to the latest [ONTAP release notes](#) or compatibility matrix for more information.
5. **Network Configuration:** Ensure that the network configuration allows for seamless communication between the origin volume and the FlexCache volume. This includes proper routing and DNS resolution in a cloud environment.

### Steps

Create a FlexCache volume on your Cloud Volumes ONTAP system with an encrypted source volume. For detailed steps and additional considerations, refer to the following sections:

- [FlexCache Volumes for Faster Data Access Power Guide](#)
- [Creating FlexCache volumes in System Manager](#)

## Aggregate administration

### Create an aggregate for Cloud Volumes ONTAP systems

You can create aggregates yourself or let the NetApp Console 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.



All disks and aggregates must be created and deleted directly from the Console. 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.

### Steps

1. From the left navigation menu, select **Storage > Management**.
2. On the **Systems** page, double-click the name of the Cloud Volumes ONTAP system on which you want to manage aggregates.

3. On the Aggregates tab, click **Add Aggregate** and then specify details for the aggregate.

#### Google Cloud

For help with disk type and disk size, refer to [Plan your Cloud Volumes ONTAP configuration in Google Cloud](#).

4. Click **Add**, and then click **Approve and Purchase**.

## Manage aggregates for Cloud Volumes ONTAP clusters

Manage aggregates yourself by adding disks, viewing information about the aggregates, and by deleting them.



All disks and aggregates must be created and deleted directly from the NetApp Console. 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.

### 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 ONTAP System Manager.

### Steps

1. From the left navigation menu, select **Storage > Management**.
2. On the **Systems** page, double-click the Cloud Volumes ONTAP system on which you want to manage aggregates.
3. From the system details, click the **Aggregates** tab.
4. For the required aggregate, click the **...** icon for the management actions.

aggr1 ■ ONLINE ⋮

INFO		CAPACITY	
Disk Type	GP3 3000 IOPS	Provisioned size	907.12 GiB
Disks	4	EBS Used	1.13 GiB
Volumes	2	S3 Used	0 GiB
Elastic Volumes	Enabled		
S3 Tiering	Enabled		

5. Manage your aggregates from the available options in the ⋮ menu.



For adding disks to an aggregate, all disks in the aggregate must be of the same size.

## Manage the Cloud Volumes ONTAP aggregate capacity on a Console agent

Each Console agent has settings that determines how it manages aggregate capacity for Cloud Volumes ONTAP.

These settings affect all Cloud Volumes ONTAP systems managed by a Console agent. If you have another Console agent, it can be configured differently.

### Required permissions

You need the organization or account admin privileges of the NetApp Console to modify Cloud Volumes ONTAP Settings.

### Steps

1. From the left navigation pane, go to **Administration > Agents**.
2. Click the ⋮ icon for the Console agent that manages your Cloud Volumes ONTAP system.
3. Select **Cloud Volumes ONTAP Settings**.

NetApp Console

Organization: NetAppNew | Project: Project-1

Agents (3 / 58)

Name	Location	Status (1)	Deployment Type
AWSSAgent	US East (N. Virginia)	Active	aws
Agent-5678	eastus	Active	Windows
AWSSAgent	US East (N. Virginia)	Active	aws

Deploy agent

- Edit Agent
- Go to local UI
- Agent Id: [ID]
- HTTPS Setup
- Cloud Volumes ONTAP Settings**
- Remove Agent

4. Under **Capacity**, modify any of the following settings:

Overview > Cloud Volumes ONTAP Settings

### Edit Cloud Volumes ONTAP settings

Capacity

- Capacity Management Mode: Automatic Mode
- Aggregate Capacity Thresholds - Free Space Ratio: 10%
- Aggregate Capacity Thresholds - Free Space Ratio for Data Tiering: 10%
- Volume Autosize - Additional Size in Percentage to Which Volumes Can Grow: 1000%

General

- Automatic Cloud Volumes ONTAP update during deployment: On

Azure

- Azure CIFS locks for Azure HA systems: Off
- Use Azure Private Link: On

### Capacity Management Mode

Choose whether the Console should notify you of storage capacity decisions or whether it should automatically manage capacity requirements for you.

[Learn how Capacity Management Mode works.](#)

## Aggregate Capacity Threshold - Free Space Ratio

This ratio is a key parameter in capacity management decisions, and understanding its impact is essential regardless of whether you are in an automatic or manual mode of capacity management. It is recommended to set this threshold with consideration of your specific storage needs and anticipated growth to maintain a balance between resource utilization and cost.

In the manual mode, if the free space ratio on an aggregate drops below the specified threshold, it triggers a notification, alerting you that you should take actions to address the low free space ratio. It is important to monitor these notifications and manually manage the aggregate capacity to avoid service disruption and ensure optimal performance.

The free space ratio is calculated as follows:

$(\text{aggregate capacity} - \text{total used capacity on the aggregate}) / \text{aggregate capacity}$

Refer to [Automatic capacity management](#) to learn how capacity is automatically managed in Cloud Volumes ONTAP.

## Aggregate Capacity Thresholds - Free Space Ratio for Data Tiering

Defines how much free space is required on the performance tier (disks) when tiering data to a capacity tier (object storage).

The ratio is important for disaster recovery scenarios. As data is read from the capacity tier, Cloud Volumes ONTAP moves data to the performance tier to provide better performance. If there isn't sufficient space, then Cloud Volumes ONTAP can't move the data.

5. Click **Save**.

# Storage VM administration

## Manage storage VMs for Cloud Volumes ONTAP

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 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

The NetApp Console supports any additional storage VMs that you create from ONTAP System Manager or the ONTAP CLI.

For example, the following image shows how you can choose a storage VM when you create a volume.

### Details & Protection

Storage VM Name ?

svm\_name1 ▼

Volume Name Size (GiB) ?

Snapshot Policy

default ▼

? Default Policy

And the following image shows how you can choose a storage VM when replicating a volume to another system.

Destination Volume Name

volume\_copy

Destination Storage VM Name

svm\_name1 ▼

Destination Aggregate

Automatically select the best aggregate ▼

#### Modify the name of the default storage VM

The Console automatically names the single storage VM that it creates for Cloud Volumes ONTAP. From ONTAP System Manager, the ONTAP CLI, or API, 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.

## Manage data-serving storage VMs for Cloud Volumes ONTAP in Google Cloud

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 and manage additional data-serving storage VMs in Google Cloud, you should use the APIs. This is because the APIs automate the process of creating the storage VMs and configuring the required network interfaces. When creating the storage VMs, the NetApp Console configures the required LIF services, as well as an iSCSI LIF that's required for outbound SMB/CIFS communications from the storage VM.

For information about running Cloud Volumes ONTAP API calls, refer to [Your first API call](#).

### Supported number of storage VMs

Beginning with Cloud Volumes ONTAP 9.11.1, based on your license, multiple storage VMs are supported with specific configurations. Refer to the [Cloud Volumes ONTAP Release Notes](#) to verify the supported number of storage VMs for your version of Cloud Volumes ONTAP.

All versions of Cloud Volumes ONTAP prior to 9.11.1 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.

### Create a storage VM

Based on your configuration and license type, you can create multiple storage VMs on a single-node system or in a high-availability (HA) configuration by using the APIs.

#### About this task

When you create storage VMs using the APIs, along with configuring the required network interfaces, the Console also modifies the `default-data-files` policies on the data storage VMs by removing the following services from the NAS data LIF and adding them to the iSCSI data LIF that's used for outbound management connections:

- `data-fpolicy-client`
- `management-ad-client`
- `management-dns-client`
- `management-ldap-client`
- `management-nis-client`

#### Before you begin

The Console agent requires specific permissions to create storage VMs for Cloud Volumes ONTAP HA pairs. The required permissions are included in [the policies provided by NetApp](#).

#### single-node system

Use the following API call to create a storage VM on a single-node system.

```
POST /gcp/vsa/working-environments/{workingEnvironmentId}/svm
```

Include the following parameters in the request body:

```
{ "svmName": "NewSvmName"
  "svmPassword": "optional value, the API takes the cluster password if
not provided"
  "mgmtLif": "optional value, to create an additional management LIF, if
you want to use the storage VM for management purposes" }
```

## HA pair

Use the following API call to create a storage VM on an HA pair:

POST /gcp/ha/working-environments/{workingEnvironmentId}/svm/

Include the following parameters in the request body:

```
{ "svmName": "NewSvmName"
  "svmPassword": "optional value, the API takes the cluster password if
not provided"
}
```

## Manage storage VMs

Using the APIs, you can rename and delete storage VMs in both single node and HA configurations.

### Before you begin

The Console agent requires specific permissions to manage storage VMs for Cloud Volumes ONTAP HA pairs. The required permissions are included in [the policies provided by NetApp](#).

### Rename a storage VM

To rename a storage VM, you should provide the names of the existing storage VM and new storage VM as parameters.

### Steps

- Use the following API call to rename a storage VM on a single-node system:

PUT /gcp/vsa/working-environments/{workingEnvironmentId}/svm

Include the following parameters in the request body:

```
{
  "svmNewName": "NewSvmName",
  "svmName": "OldSvmName"
}
```

- Use the following API call to rename a storage VM on an HA pair:

```
PUT /gcp/ha/working-environments/{workingEnvironmentId}/svm
```

Include the following parameters in the request body:

```
{
  "svmNewName": "NewSvmName",
  "svmName": "OldSvmName"
}
```

### Delete a storage VM

In a single node or HA configuration, you can remove a storage VM if it doesn't have any active volumes.

#### Steps

- Use the following API call to delete a storage VM on a single-node system:

```
DELETE /gcp/vsa/working-environments/{workingEnvironmentId}/svm/{svmName}
```

- Use the following API call to delete a storage VM on an HA pair:

```
DELETE /gcp/ha/working-environments/{workingEnvironmentId}/svm/{svmName}
```

#### Related information

- [Prepare to use the API](#)
- [Cloud Volumes ONTAP workflows](#)
- [Get required identifiers](#)
- [Use the REST APIs for the NetApp Console](#)

## Set up storage VM disaster recovery for Cloud Volumes ONTAP

The NetApp Console does not offer setup or orchestration support for storage VM (SVM) disaster recovery. To perform these tasks, use ONTAP System Manager or the ONTAP CLI.

If you set up SnapMirror SVM replication between two Cloud Volumes ONTAP systems, the replication must be between two HA pair systems or two single-node systems. You can't set up SnapMirror SVM replication between an HA pair and a single-node system.

Refer to the following documents for the ONTAP CLI instructions.

- [SVM Disaster Recovery Preparation Express Guide](#)
- [SVM Disaster Recovery Express Guide](#)

## Security and data encryption

## Encrypt volumes on Cloud Volumes ONTAP 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 your cloud provider's key vault to protect ONTAP encryption keys:

- Google Cloud Key Management Service

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.

### Before you begin

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 the Console](#)
- [Register pay-as-you-go systems](#)



The NetApp Console 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.
  - Google Cloud: [Google Cloud Key Management Service](#)

## Manage Cloud Volumes ONTAP encryption keys with Google Cloud KMS

You can use [Google Cloud Platform's Key Management Service \(Cloud KMS\)](#) to protect your Cloud Volumes ONTAP encryption keys in a Google Cloud Platform-deployed application.

Key management with Cloud KMS can be enabled with the ONTAP CLI or the ONTAP REST API.

When using Cloud KMS, be aware that by default a data SVM's LIF is used to communicate with the cloud key management endpoint. A node management network is used to communicate with the cloud provider's authentication services (oauth2.googleapis.com). If the cluster network is not configured correctly, the cluster will not properly utilize the key management service.

## Before you begin

- Your system should be running Cloud Volumes ONTAP 9.10.1 or later
- You must use a data SVM. Cloud KMS can be configured only on a data SVM.
- You must be a cluster or SVM administrator
- Volume Encryption (VE) license should be installed on the SVM
- Beginning with Cloud Volumes ONTAP 9.12.1 GA, the multi-tenant Encryption Key Management (MTEKM) license should also be installed
- An active Google Cloud Platform subscription is required

## Configuration

### Google Cloud

1. In your Google Cloud environment, [create a symmetric GCP key ring and key](#).
2. Assign a custom role to the Cloud KMS key and Cloud Volumes ONTAP service account.
  - a. Create the custom role:

```
gcloud iam roles create kmsCustomRole
  --project=<project_id>
  --title=<kms_custom_role_name>
  --description=<custom_role_description>

  --permissions=cloudkms.cryptoKeyVersions.get,cloudkms.cryptoKeyVersions.list,cloudkms.cryptoKeyVersions.useToDecrypt,cloudkms.cryptoKeyVersions.useToEncrypt,cloudkms.cryptoKeys.get,cloudkms.keyRings.get,cloudkms.locations.get,cloudkms.locations.list,resourceManager.projects.get
  --stage=GA
```

- b. Assign the custom role you created:

```
gcloud kms keys add-iam-policy-binding key_name --keyring key_ring_name
  --location key_location --member serviceAccount:service_account_Name_
  --role projects/customer_project_id/roles/kmsCustomRole
```



If you are on Cloud Volumes ONTAP 9.13.0 or later, you don't need to create a custom role. You can assign the predefined `cloudkms.cryptoKeyEncrypterDecrypter` role.

3. Download service account JSON key:

```
gcloud iam service-accounts keys create key-file --iam-account=sa-name
  @project-id.iam.gserviceaccount.com
```

### Cloud Volumes ONTAP

1. Connect to the cluster management LIF with your preferred SSH client.
2. Switch to the advanced privilege level:

```
set -privilege advanced
```

3. Create a DNS for the data SVM.

```
dns create -domains c.<project>.internal -name-servers server_address -vserver SVM_name
```

4. Create CMEK entry:

```
security key-manager external gcp enable -vserver SVM_name -project-id project -key-ring-name key_ring_name -key-ring-location key_ring_location -key-name key_name
```

5. When prompted, enter the service account JSON key from your GCP account.

6. Confirm the enabled process succeeded:

```
security key-manager external gcp check -vserver svm_name
```

7. OPTIONAL: Create a volume to test encryption `vol create volume_name -aggregate aggregate -vserver vserver_name -size 10G`

## Troubleshoot

If you need to troubleshoot, you can tail the raw REST API logs in the final two steps above:

1. `set d`
2. `systemshell -node node -command tail -f /mroot/etc/log/mlog/kmip2_client.log`

## Enable NetApp ransomware protection solutions for Cloud Volumes ONTAP

Ransomware attacks can cost a business time, resources, and reputation. The NetApp Console enables you to implement two NetApp solutions for ransomware: Protection from common ransomware file extensions and Autonomous Ransomware Protection (ARP). These solutions provide effective tools for visibility, detection, and remediation.

### Protection from common ransomware file extensions

Available on the Console, the Ransomware Protection setting allows you to utilize the ONTAP FPolicy functionality to guard against common ransomware file extension types.

### Steps

1. On the **Systems** page, double-click the name of the Cloud Volumes ONTAP system you configure to use ransomware protection.
2. On the Overview tab, click the Features panel and then click the pencil icon next to **Ransomware Protection**.

Information	Features
System Tags	3 Tags 
Scheduled Downtime	Off 
Blob Access Tiering	Hot 
Instance Type	Standard_E8ds_v4 
Charging Method	Capacity-based 
Write Speed	<i>Not Supported</i> 
Ransomware Protection	Off 
Support Registration	Not Registered 
WORM	Disabled 
CIFS Setup	

3. 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



This scope is created 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**

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

## Autonomous Ransomware Protection

Cloud Volumes ONTAP supports the Autonomous Ransomware Protection (ARP) feature, which performs analyses on workloads to proactively detect and warn about abnormal activity that might indicate a ransomware attack.

Separate from the file extension protections provided through the [ransomware protection setting](#), the ARP feature uses workload analysis to alert the user on potential attacks based on detected “abnormal activity”. Both the ransomware protection setting and the ARP feature can be used in conjunction for comprehensive ransomware protection.

The ARP feature is available for use with bring your own license (BYOL) and marketplace subscriptions for your licenses at no additional cost.

ARP-enabled volumes have a designated state of "Learning mode" or "Active".

Configuration of ARP for volumes is performed through ONTAP System Manager and ONTAP CLI.

For more information on how to enable ARP with ONTAP System Manager and the ONTAP CLI, refer to the [ONTAP documentation: Enable Autonomous Ransomware Protection](#).

## Autonomous Ransomware Protection

0 TiB

Protected Capacity

100 TiB

Precommitted capacity

0 TiB

PAYGO

BYOL

100 TiB

Marketplace Contracts

0 TiB

## Create tamperproof Snapshot copies of WORM files on Cloud Volumes ONTAP

You can create tamperproof Snapshot copies of write once, read many (WORM) files on a Cloud Volumes ONTAP system and retain the snapshots in unmodified form for a specific retention period. This functionality is powered by the SnapLock technology, and provides an additional layer of data protection and compliance.

### Before you begin

Ensure that the volume that you use for creating Snapshot copies is a SnapLock volume. For information about enabling SnapLock protection on volumes, refer to the [ONTAP documentation: Configure SnapLock](#).

### Steps

1. Create Snapshot copies from the SnapLock volume. For information about creating Snapshot copies by using the CLI or System Manager, refer to the [ONTAP documentation: Manage local Snapshot copies overview](#).

The Snapshot copies inherit the WORM properties of the volume, making them tamperproof. The underlying SnapLock technology ensures that a snapshot remains protected from edit and deletion until the specified retention period has elapsed.

2. You can modify the retention period if there's a need to edit these snapshots. For information, refer to the [ONTAP documentation: Set the retention time](#).



Even though a Snapshot copy is protected for a specific retention period, the source volume can be deleted by a cluster administrator, as WORM storage in Cloud Volumes ONTAP operates under a "trusted storage administrator" model. Additionally, a trusted cloud administrator can delete the WORM data by operating on the cloud storage resources.

### Related links

- For more information about WORM, refer to [Learn about WORM storage on Cloud Volumes ONTAP](#).

- For information about charging of SnapLock volumes, refer to [Licensing and charging in Cloud Volumes ONTAP](#).

## System administration

### Upgrade Cloud Volumes ONTAP

Upgrade Cloud Volumes ONTAP from the NetApp Console to gain access to the latest new features and enhancements. You should prepare Cloud Volumes ONTAP systems before you upgrade the software.

#### Upgrade overview

You should be aware of the following before you start the Cloud Volumes ONTAP upgrade process.

#### Upgrade from Console only

You should not upgrade Cloud Volumes ONTAP by using ONTAP System Manager or the ONTAP CLI, but only the Console. Otherwise, it might impact system stability.

The Console provides two ways to upgrade Cloud Volumes ONTAP:

- By following upgrade notifications that appear on the system
- By placing the upgrade image at an HTTPS location and then providing the Console with the URL

#### Supported upgrade paths

The Cloud Volumes ONTAP version you can upgrade to depends on the version you are currently running. Each generic or patch version in a release in the following tables represents the base version available for upgrade. For details about the available patches, refer to the [versioned release notes](#) for each release.

#### Supported upgrade paths for Google Cloud

Current version	Versions that you can directly upgrade to
9.17.1 P1	9.18.1
9.16.1	9.17.1 P1
9.15.1	9.16.1
9.15.0	9.15.1
9.14.1	9.15.1
	9.15.0
9.14.0	9.14.1
9.13.1	9.14.1
	9.14.0
9.13.0	9.13.1

<b>Current version</b>	<b>Versions that you can directly upgrade to</b>
9.12.1	9.13.1
	9.13.0
9.12.0	9.12.1
9.11.1	9.12.1
	9.12.0
9.11.0	9.11.1
9.10.1	9.11.1
	9.11.0
9.10.0	9.10.1
9.9.1	9.10.1
	9.10.0
9.9.0	9.9.1
9.8	9.9.1
9.7	9.8
9.6	9.7
9.5	9.6
9.4	9.5
9.3	9.4
9.2	9.3
9.1	9.2
9.0	9.1
8.3	9.0

Note the following:

- The supported upgrade paths for Cloud Volumes ONTAP are different than they are for an on-premises ONTAP cluster.
- If you upgrade by following the notifications that appear in a system, the Console will prompt you to upgrade to a release that follows these supported upgrade paths.
- If you upgrade by placing an upgrade image at an HTTPS location, be sure to follow these supported upgrade paths.
- In some cases, you might need to upgrade a few times to reach your target release.

For example, if you're running version 9.8 and you want to upgrade to 9.10.1, you first need to upgrade to version 9.9.1 and then to 9.10.1.

## Patch releases

Starting in January 2024, patch upgrades are only available if there's a patch release for the three latest versions of Cloud Volumes ONTAP. Patch versions are occasionally available for deployment, when the RC or GA version isn't available for deployment.

We use the latest GA release to determine the three latest versions to display in the Console. For example, if the current GA release is 9.13.1, patches for 9.11.1-9.13.1 appear in the Console.

For patch versions 9.11.1 or below, you will need to use a manual upgrade procedure by [downloading the ONTAP image](#).

As a general rule for patch releases, you can upgrade from a lower patch version to any higher patch version in the same or the next Cloud Volumes ONTAP release.

Here are a couple of examples:

- 9.13.0 → 9.13.1 P15
- 9.12.1 → 9.13.1 P2

## Reverting or downgrading

Reverting or downgrading Cloud Volumes ONTAP to a previous release is not supported.

## Support registration

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 pay-as-you-go (PAYGO) and bring your own license (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 the Console when a new version is available. But you will need to register the system before you can upgrade the software.

## Upgrades of the HA mediator

The Console also updates the mediator instance as needed during the Cloud Volumes ONTAP upgrade process.

## Upgrades in AWS with c4, m4, and r4 EC2 instance types

Cloud Volumes ONTAP no longer supports the c4, m4, and r4 EC2 instance types. You can upgrade existing deployments to Cloud Volumes ONTAP versions 9.8-9.12.1 with these instance types. Before you upgrade we recommend that you [change the instance type](#). If you can't change the instance type, you need to [enable enhanced networking](#) before you upgrade. Read the following sections to learn more about changing the instance type and enabling enhanced networking.

In Cloud Volumes ONTAP running versions 9.13.0 and above, you cannot upgrade with c4, m4, and r4 EC2 instance types. In this case, you need to reduce the number of disks and then [change the instance type](#) or deploy a new HA-pair configuration with the c5, m5, and r5 EC2 instance types and migrate the data.

## Change the instance type

c4, m4, and r4 EC2 instance types allow for more disks per node than the c5, m5, and r5 EC2 instance types. If the disk count per node for the c4, m4, or r4 EC2 instance you're running is below the max disk allowance

per node for c5, m5, and r5 instances, you can change the EC2 instance type to c5, m5, or r5.

[Check disk and tiering limits by EC2 instance](#)  
[Change the EC2 instance type for Cloud Volumes ONTAP](#)

If you can't change the instance type, follow the steps in [Enable enhanced networking](#).

### Enable enhanced networking

To upgrade to Cloud Volumes ONTAP versions 9.8 and later, you must enable *enhanced networking* on the cluster running the c4, m4, or r4 instance type. To enable ENA, refer to the Knowledge Base article "[How to enable Enhanced networking like SR-IOV or ENA on AWS Cloud Volumes ONTAP instances](#)".

### Prepare to upgrade

Before performing an upgrade, you must verify that your systems are ready and make any required configuration changes.

- [Plan for downtime](#)
- [Verify that automatic giveback is still enabled](#)
- [Suspend SnapMirror transfers](#)
- [Verify that aggregates are online](#)
- [Verify that all LIFs are on home ports](#)

### Plan 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.

In many cases, 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.

Session-oriented protocols might cause adverse effects on clients and applications in certain areas during upgrades. For details, refer to the [ONTAP documentation](#)

### Verify 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 documentation: Commands for configuring automatic giveback](#)

### Suspend 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 NetApp Backup and Recovery 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 ONTAP System Manager for version 9.3 and later.

## Steps

1. Log in to System Manager from the destination system.

You can log in to System Manager by pointing your web browser to the IP address of the cluster management LIF. You can find the IP address in the Cloud Volumes ONTAP system.



The computer from which you are accessing the Console must have a network connection to Cloud Volumes ONTAP. For example, you might need to log in to the Console from a jump host that's in your cloud provider network.

2. Click **Protection > Relationships**.
3. Select the relationship and click **Operations > Quiesce**.

### Verify 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 ONTAP System Manager for version 9.3 and later.

## Steps

1. On the Cloud Volumes ONTAP system, click the **Aggregates** tab.
2. On the required aggregate tile, click the **...** icon, and then select **View Aggregate details**.

The screenshot shows the 'Aggregate Details' page for an aggregate named 'aggr1'. The page has three tabs: 'Overview' (selected), 'Capacity Allocation', and 'Provider Properties'. The 'Overview' tab displays the following information:

Property	Value
State	online
Home Node	aggr1@10.10.10.10
Encryption Type	cloudEncrypted
Volumes	2

3. If the aggregate is offline, use ONTAP System Manager to bring the aggregate online:
  - a. Click **Storage > Aggregates & Disks > Aggregates**.
  - b. Select the aggregate, and then click **More Actions > Status > Online**.

## Verify that all LIFs are on home ports

Before you upgrade, all LIFs must be on home ports. Refer to the ONTAP documentation to [verify that all LIFs are on home ports](#).

If an upgrade failure error occurs, consult the Knowledge Base (KB) article [Cloud Volumes ONTAP upgrade fails](#).

## Upgrade Cloud Volumes ONTAP

The Console notifies you when a new version is available for upgrade. You can start the upgrade process from this notification. For more information, see [Upgrade from Console notifications](#).

Another way to perform software upgrades by using an image on an external URL. This option is helpful if the Console can't access the S3 bucket to upgrade the software or if you were provided with a patch. For more information, see [Upgrade from an image available at a URL](#).

### Upgrade from Console notifications

The Console displays a notification in Cloud Volumes ONTAP working environments when a new version of Cloud Volumes ONTAP is available:



Before you can upgrade Cloud Volumes ONTAP through the notifications, you must have a NetApp Support Site account.

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.

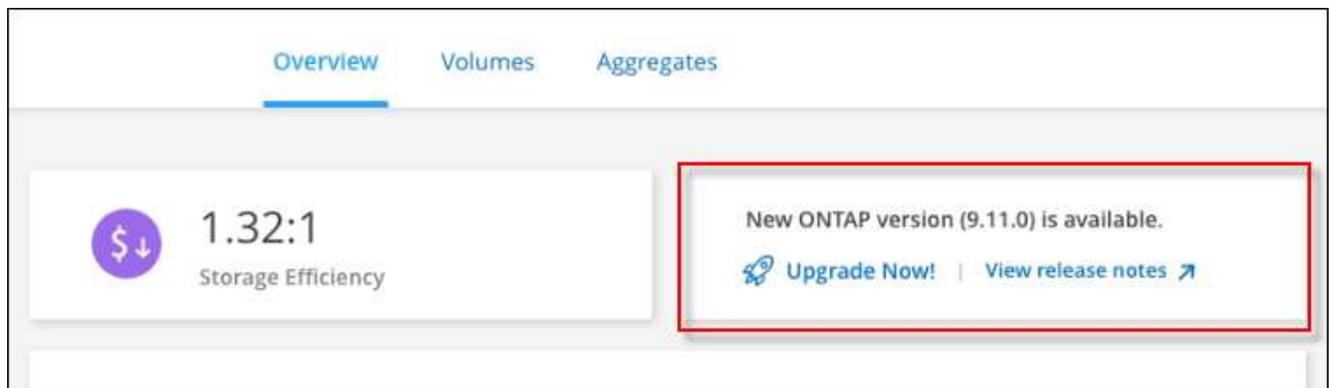
### Before you begin

Operations such as volume or aggregate creation must not be in progress on the Cloud Volumes ONTAP system.

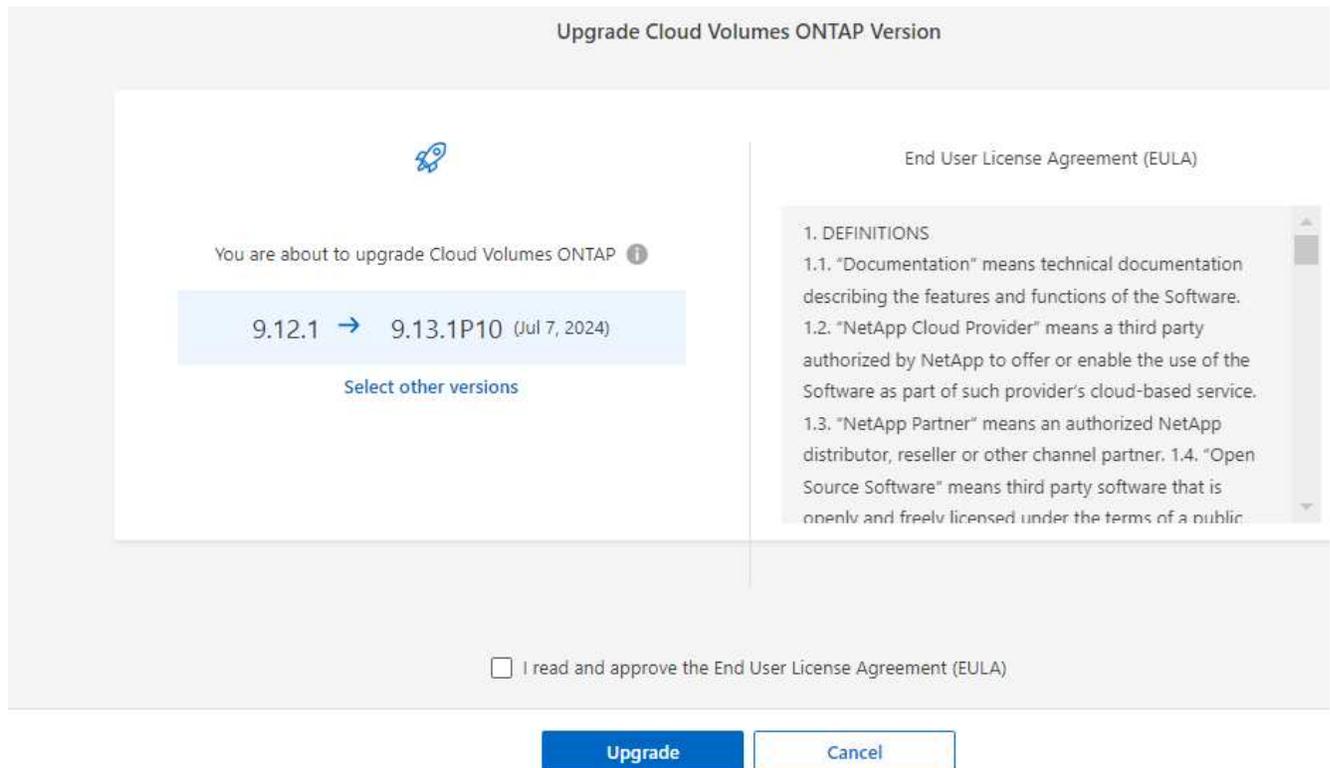
### Steps

1. From the left navigation menu, select **Storage > Management**.
2. Select a Cloud Volumes ONTAP system.

A notification appears in the Overview tab if a new version is available:



3. If you want to upgrade the installed version of Cloud Volumes ONTAP, click **Upgrade Now!** By default, you see the latest, compatible version for upgrade.



If you want to upgrade to another version, click **Select other versions**. You see the latest Cloud Volumes ONTAP versions listed that are also compatible with the installed version on your system.

For example, the installed version on your system is 9.12.1P3, and the following compatible versions are available:

- 9.12.1P4 to 9.12.1P14
- 9.13.1 and 9.13.1P1

You see 9.13.1P1 as the default version for upgrade, and 9.12.1P13, 9.13.1P14, 9.13.1, and 9.13.1P1 as the other available versions.

4. Optionally, you can click **All versions** to enter another version that you want to upgrade to (say, the next patch of the installed version). For a compatible upgrade path of your current Cloud Volumes ONTAP version, refer to [Supported upgrade paths](#).

5. Click **Save**, and then **Apply**.

Select the ONTAP version you want to upgrade to:

Version	Date
<input type="radio"/> 9.12.1P14	Aug 22, 2024
<input type="radio"/> 9.12.1P13	Jul 7, 2024
<input type="radio"/> 9.13.1P10	Jul 7, 2024
<input type="radio"/> 9.13.1P9	May 9, 2024

All versions ^

Write the version you want to upgrade to:

Save Cancel

Apply Cancel

6. In the Upgrade Cloud Volumes ONTAP page, read the EULA, and then select **I read and approve the EULA**.
7. Select **Upgrade**.
8. To view the progress, on the Cloud Volumes ONTAP system, select **Audit**.

### Result

The Console starts the software upgrade. You can perform actions on the system when the software update is complete.

### After you finish

If you suspended SnapMirror transfers, use System Manager to resume the transfers.

### Upgrade from an image available at a URL

You can place the Cloud Volumes ONTAP software image on the Console agent or on an HTTP server and then initiate the software upgrade from the Console. You might use this option if the Console can't access the S3 bucket to upgrade the software.

### Before you begin

- Operations such as volume or aggregate creation must not be in progress on the Cloud Volumes ONTAP

system.

- If you use HTTPS to host ONTAP images, the upgrade can fail due to SSL authentication issues, which are caused by missing certificates. The workaround is to generate and install a CA-signed certificate to be used for authentication between ONTAP and the Console.

Go to the NetApp Knowledge Base to view step-by-step instructions:

[NetApp KB: How to configure the Console as an HTTPS server to host upgrade images](#)

## Steps

1. Optional: Set up an HTTP server that can host the Cloud Volumes ONTAP software image.

If you have a VPN connection to the virtual network, you can place the Cloud Volumes ONTAP software image on an HTTP server in your own network. Otherwise, you must place the file on an HTTP server in the cloud.

2. If you use your own security group for Cloud Volumes ONTAP, ensure that the outbound rules allow HTTP connections so Cloud Volumes ONTAP can access the software image.



The predefined Cloud Volumes ONTAP security group allows outbound HTTP connections by default.

3. Obtain the software image from [the NetApp Support Site](#).
4. Copy the software image to a directory on the Console agent or on an HTTP server from which the file will be served.

Two paths are available. The correct path depends on your Console agent version.

- `/opt/application/netapp/cloudmanager/docker_occm/data/ontap/images/`

- `/opt/application/netapp/cloudmanager/ontap/images/`

5. On the system, click the **...** icon, and then click **Update Cloud Volumes ONTAP**.
6. On the Update Cloud Volumes ONTAP version page, enter the URL, and then click **Change Image**.

If you copied the software image to the Console agent in the path shown above, you would enter the following URL:

`http://<Console_agent_private-IP-address>/ontap/images/<image-file-name>`



In the URL, **image-file-name** must follow the format "cot.image.9.13.1P2.tgz".

7. Click **Proceed** to confirm.

## Result

The Console starts the software update. You can perform actions on the system once the software update is complete.

## After you finish

If you suspended SnapMirror transfers, use System Manager to resume the transfers.

## Fix download failures when using a Google Cloud NAT gateway

The Console agent 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. You must use the APIs to complete this step.

### 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.](#)

## Register Cloud Volumes ONTAP pay-as-you-go systems

Support from NetApp is included with Cloud Volumes ONTAP pay-as-you-go (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 the NetApp Console 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 the Console, go to **Account Settings** and add it now.

[Learn how to add NetApp Support Site accounts.](#)

2. On the **Systems** page, double-click the name of the system you want to register..
3. On the Overview tab, click the Features panel and then click the pencil icon next to **Support Registration**.

Information	Features
System Tags	3 Tags 
Scheduled Downtime	Off 
Blob Access Tiering	Hot 
Instance Type	Standard_E8ds_v4 
Charging Method	Capacity-based 
Write Speed	<i>Not Supported</i> 
Ransomware Protection	Off 
Support Registration	Not Registered 
WORM	Disabled 
CIFS Setup	

4. Select a NetApp Support Site account and click **Register**.

### Result

The system is registered with NetApp.

## Convert a Cloud Volumes ONTAP node-based license to a capacity-based license

After the end of availability (EOA) of your node-based licenses, you should transition to capacity-based licensing by using the license conversion tool in the NetApp Console.

For annual or longer-term commitments, NetApp recommends that you contact your NetApp representative prior to the EOA date (11 November, 2024) or license expiration date to ensure that the prerequisites for the transition are in place. If you don't have a long-term contract for a Cloud Volumes ONTAP node and run your system against an on-demand pay-as-you-go (PAYGO) subscription, it is important to plan your conversion before the end of support (EOS) on 31 December, 2024. In both the cases, you should ensure that your system fulfills the requirements before you use the license conversion tool in the NetApp Console for a seamless transition.

For information about the EOA and EOS, refer to [End of availability of node-based licenses](#).

### About this task

- When you use the license conversion tool, the transition from node-based to capacity-based licensing model is carried out in place and online that eliminates the need for any data migration or provisioning of additional cloud resources.

- It is a non-disruptive operation, and no service disruption or application downtime occurs.
- The account and application data in your Cloud Volumes ONTAP system remains intact.
- The underlying cloud resources remain unaffected post conversion.
- The license conversion tool supports all deployment types, such as single node, high availability (HA) in single availability zone (AZ), HA in multiple AZ, bring your own license (BYOL), and PAYGO.
- The tool supports all node-based licenses as the source and all capacity-based licenses as the destination. For example, if you have a PAYGO Standard node-based license, you can convert it to any capacity-based license purchased through the marketplace. NetApp has restricted the purchase, extension, and renewal of BYOL licensing. For more information, refer to [Restricted availability of BYOL licensing for Cloud Volumes ONTAP](#).
- The conversion is supported for all cloud providers, AWS, Azure, and Google Cloud.
- Post conversion, the serial number of the node-based license will be replaced by a capacity-based format. This is done as a part of the conversion, and is reflected on your NetApp Support Site (NSS) account.
- When you transition to the capacity-based model, your data continues to be retained in the same location as the node-based licensing. This approach guarantees no disruption in data placement, and upholds data sovereignty principles throughout the transition.

### Before your begin

- You should have an NSS account with customer access or administrator access.
- Your NSS account should be registered with the user credentials you used for accessing the Console.
- The Cloud Volumes ONTAP system should be linked to the NSS account with customer access or administrator access.
- You should have a valid capacity-based license in place, either a BYOL license or marketplace subscription.
- A capacity-based license should be available in your account. This license can be a marketplace subscription or a BYOL/private offer package available under **Licenses and subscriptions** in the Console.
- Understand the following criteria before selecting a destination package:
  - If the account has a capacity-based BYOL license, the destination package selected should align with the account's BYOL capacity-based licenses:
    - When `Professional` is selected as the destination package, the account should have a BYOL license with a Professional package:
    - When `Essentials` is selected as the destination package, the account should have a BYOL license with the Essentials package.
  - If the destination package does not align with the account's BYOL license availability, it implies that the capacity-based license might not include the selected package. In this case, you will be charged through your marketplace subscription.
  - If there is no capacity-based BYOL license but only a marketplace subscription, you should ensure that the selected package is included in your capacity-based marketplace subscription.
  - If there is not enough capacity in your existing capacity-based license, and if you have a marketplace subscription to charge for the additional capacity usage, you will be charged for the additional capacity through your marketplace subscription.
  - If there is not enough capacity in your existing capacity-based license, and you don't have a marketplace subscription to charge for the additional capacity usage, the conversion cannot occur. You should add a marketplace subscription to charge the additional capacity or extend the available capacity to your current license.

- If the destination package does not align with the account's BYOL license availability and also if there is not enough capacity in your existing capacity-based license, then you will be charged through your marketplace subscription.



If any of these requirements is not fulfilled, the license conversion does not happen. In specific cases, the license might be converted, but cannot be used. Click the information icon to identify the issues and take corrective actions.

## Steps

1. On the **Systems** page, double-click the name of the system for which you want to modify the license type.
2. On the Overview tab, click the Features panel.
3. Check the pencil icon next to **Charging method**. If the charging method for your system is `Node Based`, you can convert it to by-capacity charging.



The icon is disabled if your Cloud Volumes ONTAP system is already charged by capacity, or if any of the requirements is not fulfilled.

4. On the **Convert Node-based licenses to Capacity-based** screen, verify the system name and source license details.
5. Select the destination package for converting the existing license:
  - Essentials. The default value is `Essentials`.
  - Professional
6. If you have a BYOL license, you can select the checkbox to delete the node-based license from the Console after the conversion is complete. If the conversion is still in progress, selecting this checkbox will not remove the license from the Console. This option is not available for marketplace subscriptions.
7. Select the check box to confirm that you understand the implications of the change, and then click **Proceed**.

## After you finish

View the new license serial number and verify the changes in the **Licenses and subscriptions** menu of the Console.

## Pricing in different hyperscalars

For details on pricing, go to the [NetApp Console website](#).

For information about private offers in specific hyperscalars, write to:

- AWS - [awspo@netapp.com](mailto:awspo@netapp.com)
- Azure - [azurepo@netapp.com](mailto:azurepo@netapp.com)
- Google Cloud - [gcppo@netapp.com](mailto:gcppo@netapp.com)

## Start and stop a Cloud Volumes ONTAP system

You can stop and start Cloud Volumes ONTAP from the NetApp Console 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 the Console 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, the Console postpones the shutdown if an active data transfer is in progress.

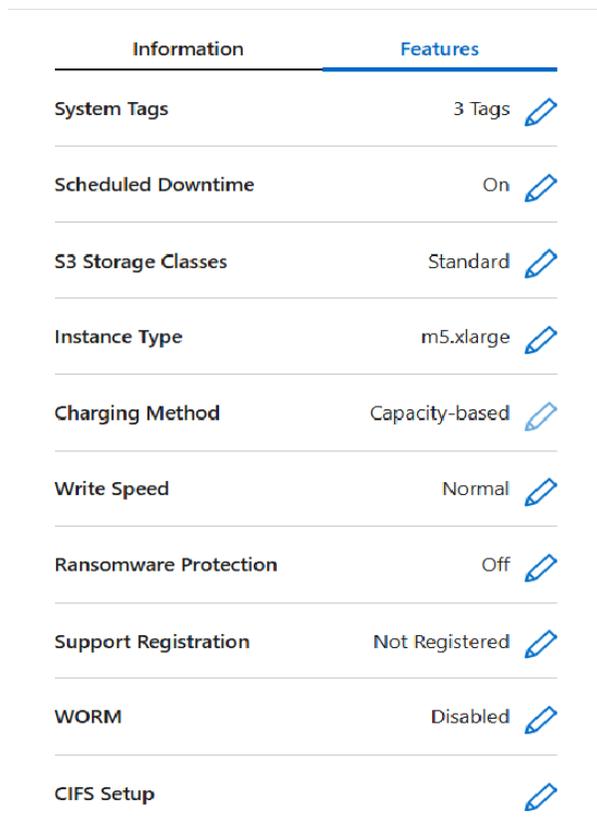
It shuts down the system after the transfer is complete.

- 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

1. On the **Systems** page, double-click the Cloud Volumes ONTAP system.
2. On the Overview tab, click the Features panel and then click the pencil icon next to **Scheduled Downtime**.



Information	Features
System Tags	3 Tags 
Scheduled Downtime	On 
S3 Storage Classes	Standard 
Instance Type	m5.xlarge 
Charging Method	Capacity-based 
Write Speed	Normal 
Ransomware Protection	Off 
Support Registration	Not Registered 
WORM	Disabled 
CIFS Setup	

3. Specify the shutdown schedule:
  - a. Choose whether you want to shut down the system every day, every weekday, every weekend, or any combination of the three options.
  - b. 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 the Console to shut down the system every Saturday at 20:00 P.M. (8:00 PM) for 12 hours. The Console restarts the system every Monday at 12:00 a.m.

### Schedule Downtime

Console Time Zone: 13:48 UTC

Select when to turn off your system:

<b>Turn off every day</b> Sun, Mon, Tue, Wed, Thu, Fri, Sat	at	20	:	00	for	12	hours (1-24)
Turn off every weekdays Mon, Tue, Wed, Thu, Fri	at	20	:	00	for	12	hours (1-24)
Turn off every weekend Sat	at	08	:	00	for	48	hours (1-48)

4. Click **Save**.

## Result

The schedule is saved. The corresponding Scheduled Downtime line item under the Features panel displays 'On'.

## 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, the Console 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, the Console shuts down both nodes.

## Steps

1. From the system, 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 **Systems** page.

 Snapshots are created automatically upon reboot.

## Synchronize Cloud Volumes ONTAP system time using the NTP server

To ensure accurate time synchronization, you must set up a Network Time Protocol (NTP) server for your Cloud Volumes ONTAP systems. Make sure to configure an NTP server for your Cloud Volumes ONTAP systems on all cloud providers to maintain consistent time synchronization within your network.

 If you don't configure an NTP server, you might experience service disruptions and inaccurate time synchronization.

You can specify an NTP server using:

- [The NetApp Console API](#).
- The ONTAP CLI command `cluster time-service ntp server create`.

### Related links

- Knowledge base (KB) article: [How does a CVO cluster use NTP?](#)
- [Prepare to use the API](#)
- [Cloud Volumes ONTAP workflows](#)
- [Get required identifiers](#)
- [Use the REST APIs for NetApp Console](#)

## Modify system write speed

You can choose a normal or high write speed for Cloud Volumes ONTAP in the NetApp Console. 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 and some HA pair configurations. View supported configurations in the [Cloud Volumes ONTAP Release Notes](#)

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. On the **Systems** page, double-click the name of the system you configure to the write speed.
2. On the Overview tab, click the Features panel and then click the pencil icon next to **Write Speed**.
3. Select **Normal** or **High**.

If you choose High, then you'll need to read the "I understand..." statement and confirm by checking the box.



The **High** write speed option is supported with Cloud Volumes ONTAP HA pairs in Google Cloud starting with version 9.13.0.

4. Click **Save**, review the confirmation message, and then click **Approve**.

## Change the Cloud Volumes ONTAP cluster admin password

Cloud Volumes ONTAP includes a cluster admin account. You can change the password for this account from NetApp Console, if needed.



You should not change the password for the admin account through ONTAP System Manager or the ONTAP CLI. The password will not be reflected in the Console. As a result, the Console cannot monitor the instance properly.

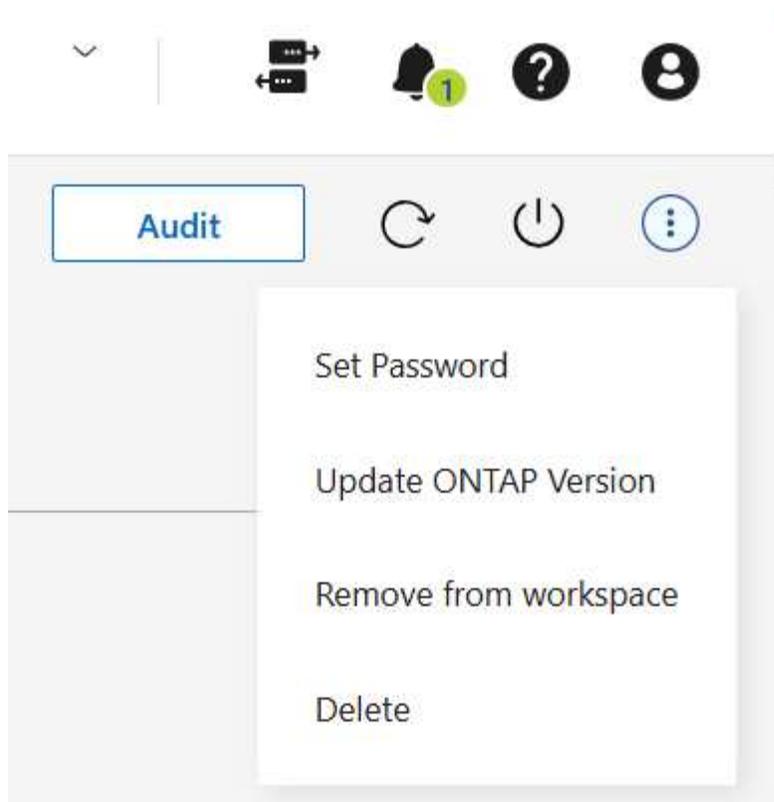
### About this task

The password must observe a few rules. The new password:

- Shouldn't contain the word `admin`
- Must be between eight and 50 characters in length
- Must contain at least one English letter and one digit
- Shouldn't contain these special characters: / ( ) { } [ ] # : % " ? \

### Steps

1. On the **Systems** page, double-click the name of the Cloud Volumes ONTAP system.
2. On the upper right of the Console, click the **...** icon, and select **Set password**.



## Add, remove, or delete systems

### Add an existing Cloud Volumes ONTAP system to NetApp Console

You can discover and add existing Cloud Volumes ONTAP systems to the NetApp Console for centralized management. When you onboard a system with an account, the system is registered with that account. In environments with multiple accounts or organizations, you can only discover and manage systems registered with your Console login account.

When working with system registrations, ensure that all actions are performed within the same organization and account where the systems were originally onboarded. For example, you can move a Cloud Volumes ONTAP system to a new Console agent when the migration stays within the same organization.



You can't discover, view, or manage systems that are registered with a different account or organization.

### Before you begin

You must know the password for the Cloud Volumes ONTAP admin user account.

### Steps

1. From the left navigation menu, select **Storage > Management**.
2. On the **System** page, click **Add System**.
3. Select the cloud provider in which the system resides.
4. Choose the type of Cloud Volumes ONTAP system to add.

5. Click the link to discover an existing system.
6. On the Region page, select a region. You can see the systems that are running in the selected region.



Cloud Volumes ONTAP systems are represented as instances on this page. From the list, you can select only those instances that are registered with the current account.

7. On the Credentials page, enter the password for the Cloud Volumes ONTAP admin user, and then select **Go**.

### Result

The Console adds the Cloud Volumes ONTAP systems to the **Systems** page.

### Remove a Cloud Volumes ONTAP system from NetApp Console

You can remove a Cloud Volumes ONTAP system to move it to another system or to troubleshoot discovery issues.

#### About this task

Removing a Cloud Volumes ONTAP system removes it from the NetApp Console. It does not delete the Cloud Volumes ONTAP system. You can later rediscover the system if you need.

#### Steps

1. On the **Systems** page, double-click on the system you want to remove.
2. On the upper right of the Console, click the **...** icon, and select **Remove from workspace**.
3. In the **Remove from workspace** window, click **Remove**.

### Result

The Console removes the system. Users can rediscover the deleted system from the **Systems** page at any time.

### Delete a Cloud Volumes ONTAP system from NetApp Console

You should always delete Cloud Volumes ONTAP systems from the NetApp Console, rather than from your cloud provider's application. 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 Cloud Volumes ONTAP system from the Console to release the license.

When you delete a system, the Console terminates Cloud Volumes ONTAP instances and deletes disks and snapshots.



Other resources, such as backups managed by NetApp Backup and Recovery, and instances for NetApp Data Classification, are not deleted when you delete a system. You'll need to manually delete them. If you don't, then you'll continue to incur charges for these resources.

When the Console 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 Backup and Recovery on the system, determine whether the backed up data is still required and then [delete the backups, if necessary](#).

Backup and Recovery is independent from Cloud Volumes ONTAP by design. Backup and Recovery 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 Data Classification on this system and no other systems use this service, then you need to delete the instance for the service.

[Learn more about the Data Classification instance](#).

3. Delete the Cloud Volumes ONTAP system.
  - a. On the **Systems** page, double-click the name of the Cloud Volumes ONTAP system that you want to delete.
  - b. On the upper right of the Console, click the **☰** icon, and select **Delete**.
  - c. Type the name of the system you want to delete, and then click **Delete**. It can take up to five minutes to delete a system.



Backup and Recovery is free only for Cloud Volumes ONTAP Professional licenses. This free benefit does not apply to deleted environments. If backed up copies of the Cloud Volumes ONTAP environment are retained in a Backup and Recovery instance, you will be charged for the backed up copies until they are deleted.

## Google Cloud administration

### Change the Google Cloud machine type for Cloud Volumes ONTAP

You can choose from several machine types when you launch Cloud Volumes ONTAP in Google Cloud. 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 machine type can affect Google Cloud service charges.
- The operation restarts Cloud Volumes ONTAP.

For single-node systems, I/O is interrupted.

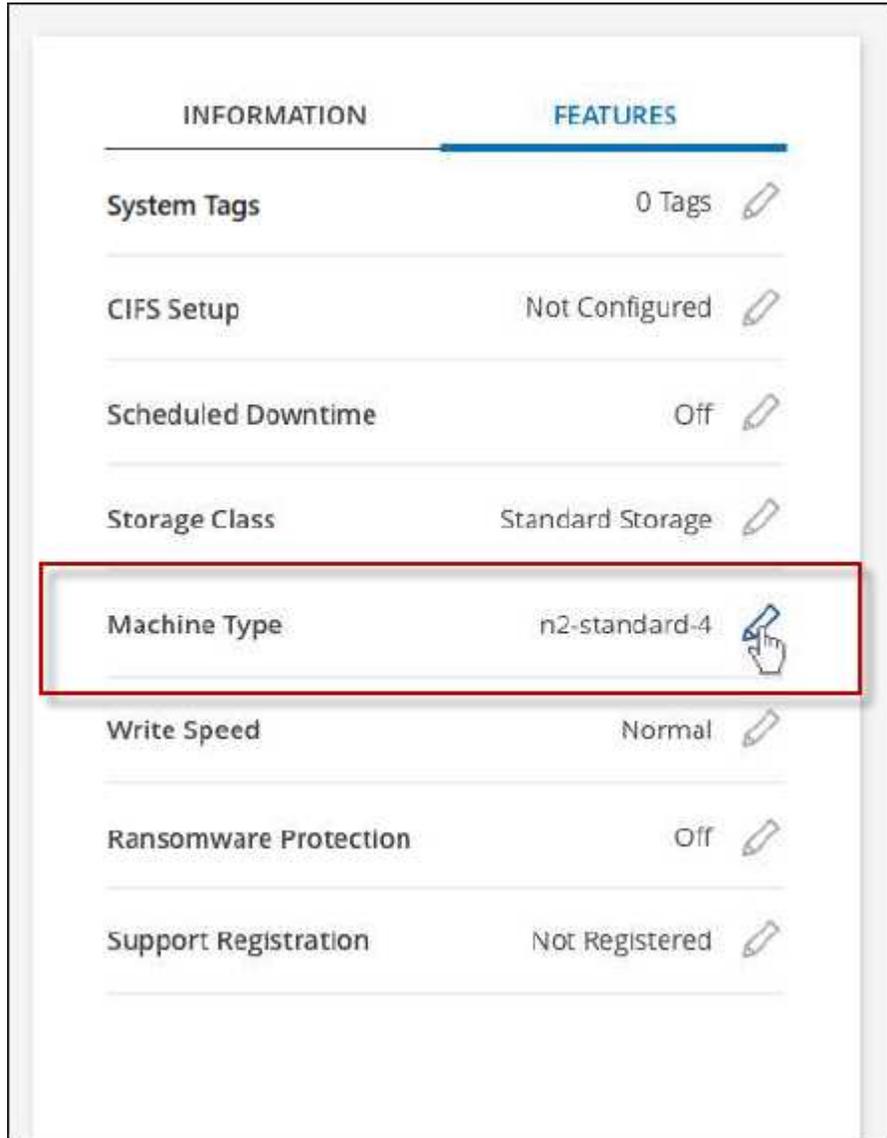
For HA pairs, the change is nondisruptive. HA pairs continue to serve data.



The NetApp Console changes one node at a time by initiating takeover and waiting for give back. NetApp's Quality Assurance team tested both writing and reading files during this process and didn't see any issues on the client side. As connections changed, some retries were observed on the I/O level, but the application layer overcame the rewiring of NFS/CIFS connections.

## Steps

1. On the **Systems** page, select the system.
2. On the Overview tab, click the Features panel and then click the pencil icon next to **Machine type**.



If you are using a node-based pay-as-you-go (PAYGO) license, you can optionally choose a different license and machine type by clicking the pencil icon next to **License type**.

1. Choose an machine type, select the check box to confirm that you understand the implications of the change, and then click **Change**.

## Result

Cloud Volumes ONTAP reboots with the new configuration.

## Convert existing Cloud Volumes ONTAP deployments to Infrastructure Manager

Beginning on February 09, 2026, new Cloud Volumes ONTAP deployments in Google Cloud can use Google Cloud Infrastructure Manager. Google is about to deprecate Google Cloud Deployment Manager in favor of Infrastructure Manager. Therefore, you

need to manually run a transition tool to convert your existing Cloud Volumes ONTAP deployments from Deployment Manager to Infrastructure Manager. This is a one-time process, after which your systems will automatically start using Infrastructure Manager.

### About this task

The transition tool is available in the [NetApp Support site](#), and creates the following artifacts:

- Terraform artifacts, saved in `conversion_output/deployment_name`.
- Summary of the conversion, saved in `conversion_output/batch_summary_<deployment_name>_<timestamp>.json`.
- Debug logs, saved in the `<gcp project number>-<region>-blueprint-config/<cvo name>` directory. You need these logs for troubleshooting. The `<gcp project number>-<region>-blueprint-config` bucket stores the Terraform logs.

Cloud Volumes ONTAP systems using Infrastructure Manager store data and records in Google Cloud Storage buckets. You might incur extra costs for these buckets, but do not edit or delete the buckets or their content:



- `gs://netapp-cvo-infrastructure-manager-<project id>`: for ONTAP versions and SVM Terraform Templates used for new Cloud Volumes ONTAP deployments. Inside this, the `dm-to-im-convert` bucket contains the Cloud Volumes ONTAP Terraform files.
- `<gcp project number>-<region>-blueprint-config`: for storing Google Cloud Terraform artifacts.

### Before you begin

- Ensure that your Cloud Volumes ONTAP system is 9.16.1 or later.
- Ensure that none of the Cloud Volumes ONTAP resources or their properties have been manually edited from the Google Cloud Console.
- Ensure that the Google Cloud APIs are enabled. Refer to [Enable Google Cloud APIs](#). Ensure that along with the other APIs, you enable the Google Cloud Quotas API.
- Verify that the NetApp Console agent's service account has all required permissions. Refer to [Google Cloud permissions for the Console agent](#).

#### For private mode deployments, ensure these additional prerequisites:

- Ensure that you have the latest Console agent version. Download the product installer from the NetApp Support Site and then manually install the agent on your host so that the agent can use Infrastructure Manager APIs.
- If you are running the tool in a private mode, ensure that along with the other APIs, you have enabled the Cloud Build API. [Enable Google Cloud APIs](#).
- Ensure that you have completed the network configurations and created the worker pool for private mode deployments. Refer to [Infrastructure Manager configuration for private mode deployments](#).

- The conversion tool uses the following domains. Enable them on port 443 in your network:

Domain	Port	Protocol	Direction	Purpose
cloudresourcemanager.googleapis.com	443	TCP	EGRESS	Project validation
deploymentmanager.googleapis.com	443	TCP	EGRESS	Deployment discovery
config.googleapis.com	443	TCP	EGRESS	Infrastructure Manager API
storage.googleapis.com	443	TCP	EGRESS	GCS bucket operations
iam.googleapis.com	443	TCP	EGRESS	Service account validation
compute.googleapis.com	443	TCP	EGRESS	Compute API calls used by Google Cloud and Terraform Import and Plan
cloudbuild.googleapis.com	443	TCP	EGRESS	Build operations only required for private mode
openidconnect.googleapis.com	443	TCP	EGRESS	Authentication
oauth2.googleapis.com	443	TCP	EGRESS	OAuth2 token exchange
registry.terraform.io	443	TCP	EGRESS	Terraform provider registry
releases.hashicorp.com	443	TCP	EGRESS	Terraform binary downloads
apt.releases.hashicorp.com	443	TCP	EGRESS	HashiCorp APT repository
us-central1-docker.pkg.dev	443	TCP	EGRESS	GCP Artifact Registry
metadata.google.internal	80	HTTP	Internal	VM metadata & auth tokens
pypi.org	443	TCP	EGRESS	Python package index
files.pythonhosted.org	443	TCP	EGRESS	Python package downloads
checkpoint-api.hashicorp.com	443	TCP	EGRESS	Terraform version check
download.docker.com	443	TCP	EGRESS	Docker APT repository
security.ubuntu.com	80/443	TCP	EGRESS	Ubuntu security updates

Domain	Port	Protocol	Direction	Purpose
*.gce.archive.ubuntu.com	80	TCP	EGRESS	Ubuntu package mirror

### Prepare the environment for running the tool

Run these steps before running the tool.

### Steps

1. Create a role and attach it to a service account:
  - a. Create a YAML file with the following permissions:

```
title: NetApp Dm TO IM Convert Solution
description: Permissions for the service account associated with the
VM where the tool will run.
stage: GA
includedPermissions:
- compute.addresses.get
- compute.disks.get
- compute.forwardingRules.get
- compute.healthChecks.get
- compute.instanceGroups.get
- compute.instances.get
- compute.regionBackendServices.get
- config.deployments.create
- config.deployments.get
- config.deployments.getLock
- config.deployments.lock
- config.deployments.unlock
- config.deployments.update
- config.deployments.delete
- config.deployments.updateState
- config.operations.get
- deploymentmanager.deployments.get
- deploymentmanager.deployments.list
- deploymentmanager.manifests.get
- iam.serviceAccounts.get
- storage.buckets.create
- storage.objects.create
- storage.objects.delete
- storage.objects.get
- storage.objects.list
```

## Include additional permission for private mode deployments

If you are running the tool in a private mode, add the `cloudbuild.workerpools.get` permission also to the YAML file.

- b. Create a custom role in Google Cloud with the permissions defined in the YAML file.  

```
gcloud iam roles create dmtoim_convert_tool_role --project=PROJECT_ID \
--file=YAML_FILE_PATH
```

For more information, refer to [Creating and managing custom roles](#).
  - c. Attach the custom role to the service account that you'll use to create the VM.
  - d. Add the `roles/iam.serviceAccountUser` role to this service account. Refer to [Service accounts overview](#).
2. Create a VM with the following configurations. You run the tool on this VM.
    - Machine Type: Google Compute Engine machine type e2-medium
    - OS: Based on your requirement, select either of these images:
      - Ubuntu 25.10 AMD64 Minimal (image: ubuntu-minimal-2510-amd64)
      - SUSE Linux Enterprise Server 15 SP7 x86\_64
    - Networking: Firewall allowing HTTP and HTTPs
    - Disk Size: 20GB
    - Security: Service accounts: the service account you created
    - Security: Access Scope - access set for each API:
      - Cloud Platform: Enabled
      - Compute Engine: Read only
      - Storage: Read only (default)
      - Google Cloud Logging (previously Stackdriver Logging) API: Write only (default)
      - Stackdriver Monitoring (now part of Google Cloud Operations) API: Write only (default)
      - Service Management: Read only (default)
      - Service Control: Enabled (default)
      - Google Cloud Trace (previously Stackdriver Trace): Write only (default)
  3. Connect to the newly created VM using SSH: 

```
gcloud compute ssh dmtoim-convert-executor-vm
--zone <region where VM is deployed>
```
  4. Download the conversion tool from the [NetApp Support site](#) by using your NSS credentials: 

```
wget
<download link from NetApp Support site>
```
  5. Extract the downloaded TAR file: 

```
unzip <downloaded file name>
```

## Ubuntu

### 1. Download and install these prerequisite packages:

- Docker: 28.2.2 build 28.2.2-0ubuntu1 or later
- Terraform: 1.14.1 or later
- Python: 3.13.7, python3-pip, python3 venv

```
sudo apt-get update
sudo apt-get install python3-pip python3-venv -y
wget -O - https://apt.releases.hashicorp.com/gpg | sudo gpg
--dearmor -o /usr/share/keyrings/hashicorp-archive-keyring.gpg
echo "deb [arch=$(dpkg --print-architecture) signed-
by=/usr/share/keyrings/hashicorp-archive-keyring.gpg]
https://apt.releases.hashicorp.com noble main" | sudo tee
/etc/apt/sources.list.d/hashicorp.list
sudo apt update && sudo apt install terraform
sudo apt-get install -y docker.io
sudo systemctl start docker
```

Google Cloud CLI `gcloud` is preinstalled on the VM.

## SUSE Linux Enterprise Server

1. Set up Python: `sudo update-alternatives --install /usr/bin/python3 python3 /usr/bin/python3.11 2`
2. Install pip3 for installing the package: `python3.11 -m ensurepip --upgrade`
3. Install Terraform:

```
wget
https://releases.hashicorp.com/terraform/1.7.4/terraform_1.7.4_linux
_amd64.zip
unzip terraform_1.7.4_linux_amd64.zip
sudo mv terraform /usr/local/bin/
rm terraform_1.7.4_linux_amd64.zip
```

4. Install Google Cloud SDK (gcloud)

```
curl https://sdk.cloud.google.com | bash
exec -l $SHELL
```

## Run the conversion tool

These steps are for both Ubuntu and SUSE Linux Enterprise Server for running the conversion tool.

### Steps

1. Add the current user to the Docker group, so that the tool can use Docker without `sudo` privileges.

```
sudo usermod -aG docker $USER
newgrp docker
```

2. Install the conversion tool:

```
cd <folder where you extracted the tool>
./install.sh
```

This installs the tool in an isolated environment, `dmconvert-venv`, and verifies that all required software packages are installed.

3. Enter the environment where the tool is installed: `source dmconvert-venv/bin/activate`
4. Run the conversion tool as a non-`sudo` user. Ensure that you use the same service account as the Console agent's service account, and that the service account has all the [necessary permissions for Google Cloud Infrastructure Manager](#).

```
dmconvert \
--project-id=<the Google Cloud project ID for the Cloud Volumes ONTAP
deployment> \
--cvo-name=<Cloud Volumes ONTAP system name> \
--service-account=<the service account attached to the Console agent>
```

### Run the tool in private mode deployments

Specify the `--worker-pool` parameter to run the tool in private mode deployments. For worker pool configuration, refer to [Infrastructure Manager configuration for private mode deployments](#).

```
dmconvert \
--project-id=<the Google Cloud project ID for the Cloud Volumes
ONTAP deployment> \
--cvo-name=<Cloud Volumes ONTAP system name> \
--service-account=<the service account attached to the Console
agent> \
--worker-pool=<worker pool name>
```

### After you finish

The tool displays a list of all Cloud Volumes ONTAP systems and SVM details. When it finishes running, you can see the statuses of all the converted systems. Each converted system appears in the Google Console under Infrastructure Manager in a `<system-name-imdeploy>` format, indicating that the Console now uses Infrastructure Manager APIs to manage that Cloud Volumes ONTAP system.



Post conversion, do not delete the deployment object for Deployment Manager in the Google Cloud Console. This deployment object contains information that you might need to roll back the converted system.

If you need to roll back the conversion, you must use the same VM. If you have converted all systems and do not need to roll back to Deployment Manager, you can delete the VM.

### Roll back the conversion

If you don't want to continue with the conversion, you can roll back to Deployment Manager by following these steps:

#### Steps

1. On the same [VM that you created for running the tool](#), run this command:

```
dmconvert \  
--project-id=<the Google Cloud project ID for the Cloud Volumes ONTAP  
deployment> \  
--cvo-name=<Cloud Volumes ONTAP system name> \  
--service-account=<the service account attached to the Console agent> \  
--rollback
```

2. Wait till the rollback is complete.

#### Related links

- [NetApp Console Agent 4.2.0 Release Notes](#)
- [Permissions required for Google Cloud Infrastructure Manager](#)

## Administer Cloud Volumes ONTAP using System Manager

Advanced storage management capabilities in Cloud Volumes ONTAP are available through ONTAP System Manager, a management interface provided with ONTAP systems. You can access System Manager directly from the NetApp Console.

#### Features

You can perform various storage management functions using ONTAP System Manager in the Console. The following list includes some of those functionalities, though this list is not exhaustive:

- Advanced storage management: Manage consistency groups, shares, qtrees, quotas, and Storage VMs.
- Volume move: [Move a volume to a different aggregate](#).
- Networking management: Manage IPspaces, network interfaces, portsets, and ethernet ports.
- Manage FlexGroup volumes: You can create and manage FlexGroup volumes only through System

Manager. The Console does not support FlexGroup volume creation.

- Events and jobs: View event logs, system alerts, jobs, and audit logs.
- Advanced data protection: Protect storage VMs, LUNs, and consistency groups.
- Host management: Set up SAN initiator groups and NFS clients.
- ONTAP S3 object storage management: ONTAP S3 storage management capabilities in Cloud Volumes ONTAP are available only in System Manager, and not in the Console.

## Supported configurations

- Advanced storage management through ONTAP System Manager is available in Cloud Volumes ONTAP 9.10.0 and later in standard cloud regions.
- System Manager integration is not supported in GovCloud regions or in regions that have no outbound internet access.

## Limitations

A few features that appear in the System Manager interface are not supported with Cloud Volumes ONTAP:

- NetApp Cloud Tiering: Cloud Volumes ONTAP does not support Cloud Tiering. You should set up tiering of data to object storage directly from the Standard View when creating volumes.
- Tiers: Aggregate management (including local tiers and cloud tiers) is not supported from System Manager. You must manage aggregates directly from the Standard View.
- Firmware upgrades: Cloud Volumes ONTAP does not support automatic firmware updates from the **Cluster > Settings** page of the System Manager.
- Role-based access control: Role-based access control from System Manager is not supported.
- SMB Continuous Availability (CA): Cloud Volumes ONTAP does not support [continuously available SMB shares](#) for nondisruptive operations.

## Configure authentication for accessing System Manager

As an administrator, you can activate authentication for users accessing ONTAP System Manager from the Console. You can determine the right level of access permissions based on the ONTAP user roles, and enable or disable authentication as needed. If you enable authentication, then users need to enter their ONTAP user credentials every time they access System Manager from the Console or when the page is reloaded, because the Console doesn't store the credentials internally. If you disable authentication, users can access System Manager using the admin credentials.



This setting is applicable for each Console agent for the ONTAP users in your organization or account, irrespective of the Cloud Volumes ONTAP system.

## Required permissions

You need to be assigned the organization or account admin privileges to modify the Console agent settings for Cloud Volumes ONTAP user authentication.

## Steps

1. From the left navigation pane, go to **Administration > Agents**.
2. Click the **...** icon for the required Console agent and select **Edit Console agent**.
3. Under **Force user credentials**, select the **Enable/Disable** check box. By default, authentication is disabled.



If you set this value to **Enable**, authentication is reset, and you have to modify any existing workflows to accommodate this change.

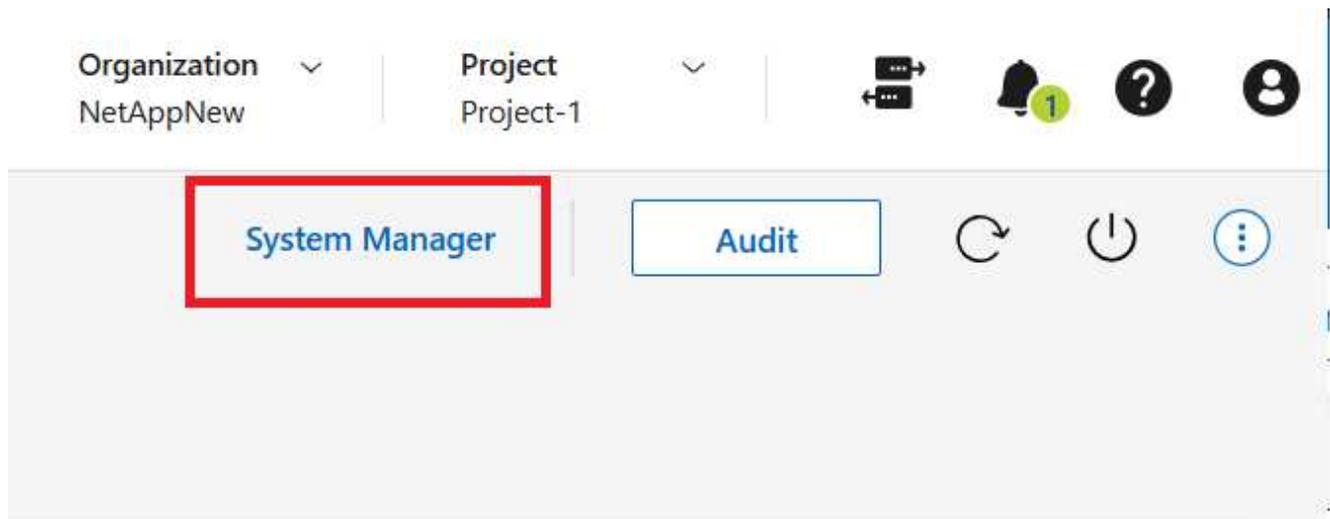
4. Click **Save**.

## Get started with System Manager

You can access ONTAP System Manager from a Cloud Volumes ONTAP system.

### Steps

1. From the left navigation menu, select **Storage > Management**.
2. On the **Systems** page, double click the required Cloud Volumes ONTAP system.
3. Click **System Manager**.



4. If prompted, enter your ONTAP user credentials and click **Login**.
5. If a confirmation message appears, read through it and click **Close**.

Use System Manager to manage your Cloud Volumes ONTAP system. You can click **Go back** to return to the Console.

## Help with using System Manager

If you need help using System Manager with Cloud Volumes ONTAP, you can refer to the [ONTAP documentation](#) for step-by-step instructions. Here are a few ONTAP documentation links that might help:

- [ONTAP roles, applications, and authentication](#)
- [Use System Manager to access a cluster.](#)
- [Volume and LUN management](#)
- [Network management](#)
- [Data protection](#)
- [Create continuously available SMB shares](#)

## Administer Cloud Volumes ONTAP from the 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 SSH from a jump host that's in your cloud provider network.

### Steps

1. In the NetApp Console, identify the IP address of the cluster management interface:
  - a. From the left navigation menu, select **Storage > Management**.
  - b. On the **Systems** page, select the Cloud Volumes ONTAP system.
  - c. 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:



3. At the login prompt, enter the password for the admin account.

### Example

```
Password: *****  
COT2::>
```

## System health and events

### Verify AutoSupport setup for Cloud Volumes ONTAP

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. It's best to verify that AutoSupport can send these messages.

The only required configuration step is to ensure that Cloud Volumes ONTAP has outbound internet

connectivity. For details, refer to the networking requirements for your cloud provider.

## AutoSupport requirements

Cloud Volumes ONTAP nodes require outbound internet access for NetApp AutoSupport, which proactively monitors the health of your system and sends messages to NetApp technical support.

Routing and firewall policies must allow HTTPS traffic to the following endpoints so Cloud Volumes ONTAP can send AutoSupport messages:

- <https://mysupport.netapp.com/aods/asupmessage>
- <https://mysupport.netapp.com/asupprod/post/1.0/postAsup>

If an outbound internet connection isn't available to send AutoSupport messages, the NetApp Console automatically configures your Cloud Volumes ONTAP systems to use the Console agent as a proxy server. The only requirement is to ensure that the Console agent's security group allows *inbound* connections over port 3128. You'll need to open this port after you deploy the Console agent.

If you defined strict outbound rules for Cloud Volumes ONTAP, then you'll also need to ensure that the Cloud Volumes ONTAP security group allows *outbound* connections over port 3128.



If you're using an HA pair, the HA mediator doesn't require outbound internet access.

After you've verified that outbound internet access is available, you can test AutoSupport to ensure that it can send messages. For instructions, refer to the [ONTAP documentation: Set up AutoSupport](#).

## Troubleshoot your AutoSupport configuration

If an outbound connection isn't available and the Console can't configure your Cloud Volumes ONTAP system to use the Console agent as a proxy server, you'll receive a notification from the Console that your system is unable to send AutoSupport messages. Follow these steps to address this issue.

### Steps

1. Connect securely (using SSH) to the Cloud Volumes ONTAP system to use the ONTAP CLI.

[Learn how to SSH to Cloud Volumes ONTAP.](#)

2. Check the detailed status of the AutoSupport subsystem:

```
autosupport check show-details
```

The response looks like this:

```
Category: smtp
  Component: mail-server
  Status: failed
  Detail: SMTP connectivity check failed for destination:
        mailhost. Error: Could not resolve host -
'mailhost'
  Corrective Action: Check the hostname of the SMTP server

Category: http-https
  Component: http-put-destination
  Status: ok
  Detail: Successfully connected to:
        <https://support.netapp.com/put/AsupPut/>.

  Component: http-post-destination
  Status: ok
  Detail: Successfully connected to:
https://support.netapp.com/asupprod/post/1.0/postAsup.

Category: on-demand
  Component: ondemand-server
  Status: ok
  Detail: Successfully connected to:
        https://support.netapp.com/aods/asupmessage.

Category: configuration
  Component: configuration
  Status: ok
  Detail: No configuration issues found.
5 entries were displayed.
```

If the status of the http-https category is OK it means that AutoSupport is configured properly and messages can be sent.

3. If not, verify the proxy URL for each Cloud Volumes ONTAP node:

```
autosupport show -fields proxy-url
```

4. If the proxy URL parameter is empty, configure Cloud Volumes ONTAP to use the Console agent as a proxy:

```
autosupport modify -proxy-url http://<console agent private ip>:3128
```

5. Verify the AutoSupport status again:

```
autosupport check show-details
```

6. If the status is still failed, validate that there is connectivity between Cloud Volumes ONTAP and the Console agent over port 3128.
7. If the status is still failed after verification, SSH to the Console agent.

[Learn more about Connecting to the Linux VM for the Console agent](#)

8. Go to `/opt/application/netapp/cloudmanager/docker_occm/data/`.
9. Open the proxy configuration file `squid.conf`. This is the structure of the file:

```
http_port 3128
acl netapp_support dst support.netapp.com
http_access allow netapp_support
request_header_max_size 21 KB
reply_header_max_size 21 KB
http_access deny all
httpd_suppress_version_string on
```

10. If your file doesn't have an entry for the CIDR block of the Cloud Volumes ONTAP system, add a new entry and allow access:

```
acl cvonet src <cidr>

http_access allow cvonet
```

Here's an example:

```
http_port 3128
acl netapp_support dst support.netapp.com
acl cvonet src <cidr>
http_access allow netapp_support
http_access allow cvonet
request_header_max_size 21 KB
reply_header_max_size 21 KB
http_access deny all
httpd_suppress_version_string on
```

11. After editing the config file, restart the proxy container as `sudo`. Then, depending on whether you're using Docker or Podman, run these commands:

For Docker, run `docker restart squid`.

If you are using Podman, run `podman restart squid`.

12. Go back to the ONTAP CLI and verify that Cloud Volumes ONTAP can send AutoSupport messages:

```
autosupport check show-details
```

**Related links**

- [Networking requirements for Cloud Volumes ONTAP in AWS](#)
- [Networking requirements for Cloud Volumes ONTAP in Azure](#)
- [Networking requirements for Cloud Volumes ONTAP in Google Cloud](#)

**Configure EMS for Cloud Volumes ONTAP systems**

The Event Management System (EMS) collects and displays information about events that occur on 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.

You can configure EMS using the CLI. For instructions, refer to the [ONTAP documentation: EMS configuration overview](#).

# Concepts

## Licensing

### Licensing for Cloud Volumes ONTAP

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.

#### Capacity-based licensing

Pay for multiple Cloud Volumes ONTAP systems in your NetApp account by provisioned capacity. Includes the ability to purchase add-on cloud data services. For more information about consumption models or purchase options in capacity-based licenses, refer to [Learn more about capacity-based licenses](#).

#### Keystone Subscription

A pay-as-you-grow subscription-based service that delivers a seamless hybrid cloud experience for High Availability (HA) pairs.

The following sections provide more details about each of these options.



Support is not available for the use of licensed features without a license.

#### Capacity-based licensing

Capacity-based licensing packages enable 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 from several licensing packages based on your business needs.



While the actual usage and metering for the products and services managed in the NetApp Console are always calculated in GiB and TiB, the terms GB/GiB and TB/TiB are used interchangeably. This is reflected in the Cloud marketplace listings, price quotes, listing descriptions, and in other supporting documentation.

#### Packages

The following capacity-based packages are available for Cloud Volumes ONTAP. For more information about capacity-based license packages, refer to [Learn more about capacity-based licenses](#).

For a list of supported VM types with the following capacity-based packages, refer to:

- [Supported configurations in Google Cloud](#)

## Freemium

Provides all Cloud Volumes ONTAP features free of charge from NetApp (cloud provider charges still apply). A Freemium package has these characteristics:

- 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, for any cloud provider.
- If the provisioned capacity for a Cloud Volumes ONTAP system exceeds 500 GiB, the Console converts the system to an Essentials package.

As soon as a system is converted to the Essentials package, [minimum charging](#) applies to it.

A Cloud Volumes ONTAP system that has been converted into an Essentials package cannot be switched back to Freemium even if the provisioned capacity is reduced to less than 500 GiB. Other systems with less than 500 GiB of provisioned capacity stay on Freemium (as long as they were deployed using the Freemium offering).

## Essentials

You can pay by capacity in a number of different configurations:

- 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

Pay by capacity for any type of Cloud Volumes ONTAP configuration with unlimited backups.

- Provides licensing for any Cloud Volumes ONTAP configuration

Single node or HA with capacity charging for primary and secondary volumes at the same rate

- Includes unlimited volume backups using NetApp Backup and Recovery, but only for Cloud Volumes ONTAP systems that use the Professional package.



A pay-as-you-go (PAYGO) subscription is required for Backup and Recovery, however no charges will be incurred for using this service. For more information on setting up licensing for Backup and Recovery, refer to [Set up licensing for Backup and Recovery](#).

- Add on any of NetApp's cloud data services at extra cost

## Availability of capacity-based licenses

The availability of the PAYGO and BYOL licenses for Cloud Volumes ONTAP systems requires the Console agent to be up and running.

[Learn about Console agents.](#)



NetApp has restricted the purchase, extension, and renewal of BYOL licensing. For more information, refer to [Restricted availability of BYOL licensing for Cloud Volumes ONTAPP.](#)

## How to get started

Learn how to get started with capacity-based licensing:

- [Set up licensing for Cloud Volumes ONTAP in Google Cloud](#)

## Keystone 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 Subscription.

The provisioned capacity for each volume is aggregated and compared to the committed capacity on your Keystone Subscription periodically, and any overages are charged as burst on your Keystone Subscription.

[Learn more about NetApp Keystone.](#)

## Supported configurations

Keystone Subscriptions are supported with HA pairs. This licensing option isn't supported with single-node systems at this time.

## Capacity limit

In the capacity-based licensing model, each Cloud Volumes ONTAP system supports tiering to object storage, and the total tiered capacity can scale up to the cloud provider's bucket limit. Although the license does not impose capacity restrictions, follow the [FabricPool Best Practices](#) to ensure optimal performance, reliability, and cost efficiency when configuring and managing tiering.

For information about the capacity limits of each cloud provider, refer to their documentation:

- [AWS documentation](#)
- [Azure documentation for managed disks](#) and [Azure documentation for blob storage](#)
- [Google Cloud documentation](#)

## How to get started

Learn how to get started with a Keystone Subscription:

- [Set up licensing for 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. By-node charging has been replaced with the by-capacity charging methods described above.

NetApp has planned the end of availability (EOA) and support (EOS) of node-based licensing. After the EOA and EOS, node-based licenses will need to be converted to capacity-based licenses.

For information, refer to [Customer communique: CPC-00589](#).

### End of availability of node-based licenses

Beginning on 11 November, 2024, the limited availability of node-based licenses has been terminated. The support for node-based licensing ends on 31 December, 2024.

If you have a valid node-based contract that extends beyond the EOA date, you can continue to use the license until the contract expires. Once the contract expires, it will be necessary to transition to the capacity-based licensing model. If you don't have a long-term contract for a Cloud Volumes ONTAP node, it is important to plan your conversion before the EOS date.

Learn more about each license type and the impact of EOA on it from this table:

License type	Impact after EOA
Valid node-based license purchased through bring your own license (BYOL)	License remains valid till expiration. Existing unused node-based licenses can be used for deploying new Cloud Volumes ONTAP systems.
Expired node-based license purchased through BYOL	You won't be entitled to deploy new Cloud Volumes ONTAP systems using this license. The existing systems might continue to work, but you won't receive any support or updates for your systems post the EOS date.
Valid node-based license with PAYGO subscription	Will cease to receive NetApp support post the EOS date, until you transition to a capacity-based license.

### Exclusions

NetApp recognizes that certain situations require special consideration, and EOA and EOS of node-based licensing will not apply to the following cases:

- U.S. Public Sector customers
- Deployments in private mode
- China region deployments of Cloud Volumes ONTAP in AWS

For these particular scenarios, NetApp will offer support to address the unique licensing requirements in compliance with contractual obligations and operational needs.



Even in these scenarios, new node-based licenses and license renewals are valid for a maximum of one year from the date of approval.

## License conversion

The Console enables a seamless conversion of node-based licenses to capacity based through the license conversion tool. For information about EOA of node-based licensing, refer to [End of availability of node-based licenses](#).

Before transitioning, it is good to familiarize yourself with the difference between the two licensing models. Node-based licensing includes fixed capacity for each ONTAP instance, which can restrict flexibility. Capacity-based licensing, on the other hand, allows for a shared pool of storage across multiple instances, offering enhanced flexibility, optimizing resource utilization, and reducing the potential for financial penalties when redistributing workloads. Capacity-based charging seamlessly adjusts to changing storage requirements.

To know how you can perform this conversion, refer to [Convert a Cloud Volumes ONTAP node-based license to capacity-based license](#).



Conversion of a system from capacity-based to node-based licensing is not supported.

## Learn more about capacity-based licenses for Cloud Volumes ONTAP

You should be familiar with the charging and capacity usage for capacity-based licenses.

### Consumption models or license purchase options

Capacity-based licensing packages are available with the following consumption models or purchase options:

- **BYOL:** Bring your own license (BYOL). A license purchased from NetApp that can be used to deploy Cloud Volumes ONTAP in any cloud provider.



NetApp has restricted the purchase, extension, and renewal of BYOL licensing. For more information, refer to [Restricted availability of BYOL licensing for Cloud Volumes ONTAP](#).

- **PAYGO:** A pay-as-you-go (PAYGO) subscription is an hourly subscription from your cloud provider's marketplace.
- **Annual:** An annual contract 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. NetApp has restricted BYOL licensing. When your BYOL licenses expire, you are required to replace them with cloud marketplace subscriptions.

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.
- Only single-node systems with BYOL are supported in China regions. China region deployments are exempt from BYOL licensing restrictions.

## Changing of license packages

After deployment, you can change the package for a Cloud Volumes ONTAP system that uses capacity-based licensing. For example, if you deployed a Cloud Volumes ONTAP system with the Essentials package, you can change it to the Professional package if your business needs changed.

[Learn how to change charging methods.](#)

For information about converting node-based licenses to capacity-based, see

## How you are charged for supported storage types and packages

Charging in Cloud Volumes ONTAP is based on a number of factors, such as packages and volume types. Capacity-based licensing packages are available with Cloud Volumes ONTAP 9.7 and later.

For details about pricing, go to the [NetApp Console website](#).

### Storage VMs

- There are no extra licensing costs for additional data-serving storage VMs (SVMs), but there is a 4 TiB minimum capacity charge per data-serving SVM.
- Disaster recovery SVMs are charged according to the provisioned capacity.

### HA pairs

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.

### FlexClone and FlexCache volumes

- 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.

### Read/write volumes

If you create or use a writable (read/write) volume, it is considered a primary volume and is charged for the provisioned capacity based on the minimum charge per storage VM (SVM). Examples include FlexVol read/write volumes, SnapLock audit volumes, and CIFS/NFS audit volumes. All user-created data volumes are charged per your subscription and package type. ONTAP internal volumes that are automatically created and cannot store data, such as SVM root volumes, are not charged.

### Essentials packages

With the Essentials package, you're billed by the deployment type (HA or single node) and the volume type (primary or secondary). Pricing from high to low is in the following order: *Essentials Primary HA*, *Essentials Primary Single Node*, *Essentials Secondary HA*, and *Essentials Secondary Single Node*. Alternately, when you purchase a marketplace contract or accept a private offer, capacity charges are the same for any deployment or volume type.

Licensing is based entirely on the volume type created within Cloud Volumes ONTAP systems:

- Essentials Single Node: Read/write volumes created on a Cloud Volumes ONTAP system using one ONTAP node only.

- Essentials HA: Read/write volumes using two ONTAP nodes that can fail over to each other for non-disruptive data access.
- Essentials Secondary Single Node: Data Protection (DP) type volumes (typically SnapMirror or SnapVault destination volumes that are read-only) created on a Cloud Volumes ONTAP system using one ONTAP node only.



If a read-only/DP volume becomes a primary volume, the Console considers it as primary data and the charging costs are calculated based on the time the volume was in read/write mode. When the volume is again made read-only/DP, it considers the volume as secondary data again and charges accordingly using the best matching license in the Console.

- Essentials Secondary HA: Data Protection (DP) type volumes (typically SnapMirror or SnapVault destination volumes that are read-only) created on a Cloud Volumes ONTAP system using two ONTAP nodes that can fail over to each other for non-disruptive data access.

### Capacity limit

In the capacity-based licensing model, each Cloud Volumes ONTAP system supports tiering to object storage, and the total tiered capacity can scale up to the cloud provider's bucket limit. Although the license does not impose capacity restrictions, follow the [FabricPool Best Practices](#) to ensure optimal performance, reliability, and cost efficiency when configuring and managing tiering.

For information about the capacity limits of each cloud provider, refer to their documentation:

- [AWS documentation](#)
- [Azure documentation for managed disks](#) and [Azure documentation for blob storage](#)
- [Google Cloud documentation](#)

### Max number of systems

With capacity-based licensing, the maximum number of Cloud Volumes ONTAP systems is limited to 24 per NetApp Console organization. A *system* is a Cloud Volumes ONTAP HA pair, a Cloud Volumes ONTAP single-node system, or any additional storage VMs that you create. The default storage VM does not count against the limit. This limit applies to all licensing models.

For example, let's say you have three systems:

- A single node Cloud Volumes ONTAP system with one storage VM (this is the default storage VM that's created when you deploy Cloud Volumes ONTAP)

This system counts as one system.

- A single node Cloud Volumes ONTAP system with two storage VMs (the default storage VM, plus one additional storage VM that you created)

This system counts as two systems: one for the single-node system and one for the additional storage VM.

- A Cloud Volumes ONTAP HA pair with three storage VMs (the default storage VM, plus two additional storage VMs that you created)

This system counts as three systems: one for the HA pair and two for the additional storage VMs.

That's six systems in total. You would then have room for an additional 14 systems in your organization.

If you have a large deployment that requires more than 24 systems, contact your accounts representative or sales team.

[Learn about storage limits for AWS, Azure, and Google Cloud.](#)

### Minimum charge

There is a 4 TiB minimum charge for each data-serving storage VM that has at least one primary (read-write) volume. If the sum of the primary volumes is less than 4 TiB, then the Console applies the 4 TiB minimum charge to that storage VM.

If you haven't provisioned any volumes yet, then the minimum charge doesn't apply.

For the Essentials package, the 4 TiB minimum capacity charge doesn't apply to storage VMs that contain secondary (data protection) volumes only. For example, if you have a storage VM with 1 TiB of secondary data, then you're charged just for that 1 TiB of data. With the Professional package type, the minimum capacity charging of 4 TiB applies regardless of the volume type.

### Billing preferences and overages

You can choose how you want to be charged in the **Licenses and subscriptions** section in the Console. Overages occur when your usage exceeds the capacity specified in your license package or annual subscription.

- **NetApp licenses first:** In this model, your usage is first charged against the capacity of your license package (BYOL). If you exceed your license capacity, overages are charged based on your annual marketplace subscription or marketplace on-demand hourly rates (PAYGO). If your BYOL license expires, you must transition to a capacity-based licensing model through the cloud marketplaces. For information, refer to [Convert a Cloud Volumes ONTAP node-based license to a capacity-based license](#).
- **Marketplace subscriptions only:** In this model, your usage is first charged against your annual marketplace subscription. Any additional usage is charged at marketplace on-demand hourly rates (PAYGO). Any unused license capacity is disregarded for billing.

For more information about billing preferences, refer to [Learn about billing preferences for licenses and subscriptions](#).

### How overages are charged for Essentials licenses

If you purchase an Essentials license from NetApp (BYOL) and you exceed the licensed capacity for a specific Essentials package, the Console charges overages against a higher-priced Essentials license (if you have one with available capacity). The Console first uses the available capacity that you've paid for before charging against the marketplace. If there is no available capacity with your BYOL license, the exceeded capacity is charged at marketplace on-demand hourly rates (PAYGO) and added to your monthly bill.

Similarly, if you have an annual marketplace contract or a private offer with multiple Essentials packages, and your usage exceeds the committed capacity for a deployment and volume type of a specific package, the Console charges overages against a higher-priced Essentials package based on its available capacity. After that capacity is exhausted, the remaining overage is billed at marketplace on-demand (PAYGO) hourly rates and added to your monthly bill.

For information about Essentials licenses charging, refer to [Essentials packages](#).

Here's an example. Let's say you have the following licenses for the Essentials package:

- A 500 TiB *Essentials Secondary HA* license that has 500 TiB of committed capacity
- A 500 TiB *Essentials Single Node* license that only has 100 TiB of committed capacity

Another 50 TiB is provisioned on an HA pair with secondary volumes. Instead of charging that 50 TiB to PAYGO, the Console charges the 50 TiB overage against the *Essentials Single Node* license. That license is priced higher than *Essentials Secondary HA*, but it's making use of a license you have already purchased, and it will not add costs to your monthly bill.

In **Administration > Licenses and subscriptions**, you can see 50 TiB charged against the *Essentials Single Node* license.

Here's another example. Let's say you have the following licenses for the Essentials package:

- A 500 TiB *Essentials Secondary HA* license that has 500 TiB of committed capacity
- A 500 TiB *Essentials Single Node* license that only has 100 TiB of committed capacity

Another 100 TiB is provisioned on an HA pair with primary volumes. The license you purchased doesn't have *Essentials Primary HA* committed capacity. The *Essentials Primary HA* license is priced higher than both the *Essentials Primary Single Node* and *Essentials Secondary HA* licenses.

In this example, the Console charges overages at the marketplace rate for the additional 100 TiB. The overage charges will appear on your monthly bill.

## Storage

### Supported client protocols for Cloud Volumes ONTAP

Cloud Volumes ONTAP supports the iSCSI, NFS, SMB, NVMe-TCP, and S3 client protocols.

#### iSCSI

iSCSI is a block protocol that can run on standard Ethernet networks. Most client operating systems offer a software initiator that runs over a standard Ethernet port.

#### NFS

NFS is the traditional file access protocol for UNIX and LINUX systems. Clients can access files in ONTAP volumes using the NFSv3, NFSv4, and NFSv4.1 protocols. You can control file access using UNIX-style permissions, NTFS-style permissions, or a mix of both.

Clients can access the same files using both NFS and SMB protocols.

#### SMB

SMB is the traditional file access protocol for Windows systems. Clients can access files in ONTAP volumes using the SMB 2.0, SMB 2.1, SMB 3.0, and SMB 3.1.1 protocols. Just like with NFS, a mix of permission styles are supported.

#### S3

Cloud Volumes ONTAP supports S3 as an option for scale-out storage. S3 protocol support enables you to

configure S3 client access to objects contained in a bucket in a storage VM (SVM).

[ONTAP documentation: Learn how S3 multiprotocol works.](#)

[ONTAP documentation: Learn how to configure and manage S3 object storage services in ONTAP.](#)

## NVMe-TCP

Beginning with ONTAP version 9.12.1, NVMe-TCP is supported for all cloud providers. Cloud Volumes ONTAP supports NVMe-TCP as a block protocol for storage VMs (SVMs) during deployment, and installs the required NVMe licenses automatically.

NetApp Console does not provide any management capabilities for NVMe-TCP.

For more information on configuring NVMe through ONTAP, refer to the [ONTAP documentation: Configure a storage VM for NVMe.](#)

## Disks and aggregates used for Cloud Volumes ONTAP clusters

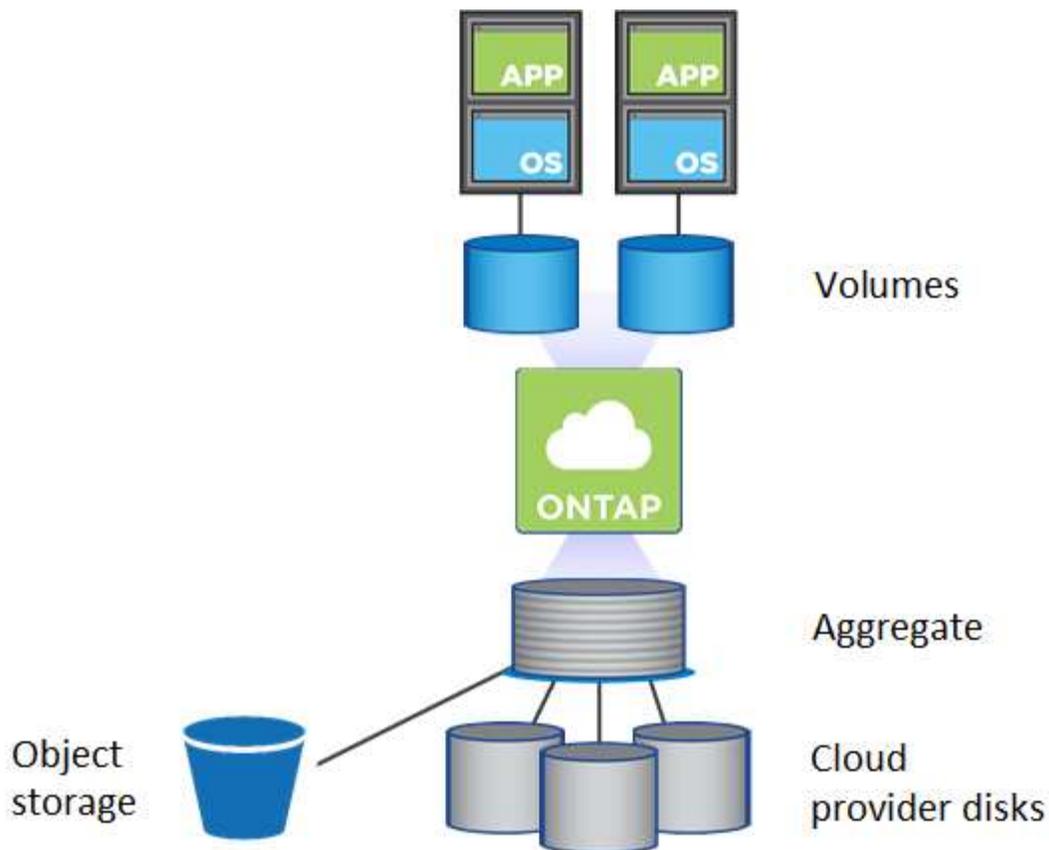
Understanding how Cloud Volumes ONTAP uses cloud storage can help you understand your storage costs.



You must create and delete all disks and aggregates from the NetApp Console. 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 the Console creates a 500 GiB aggregate, the usable capacity is 442.94 GiB.

## Google Cloud storage

In Google Cloud, 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 [low-cost object storage](#).

## Related links

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

## RAID type

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

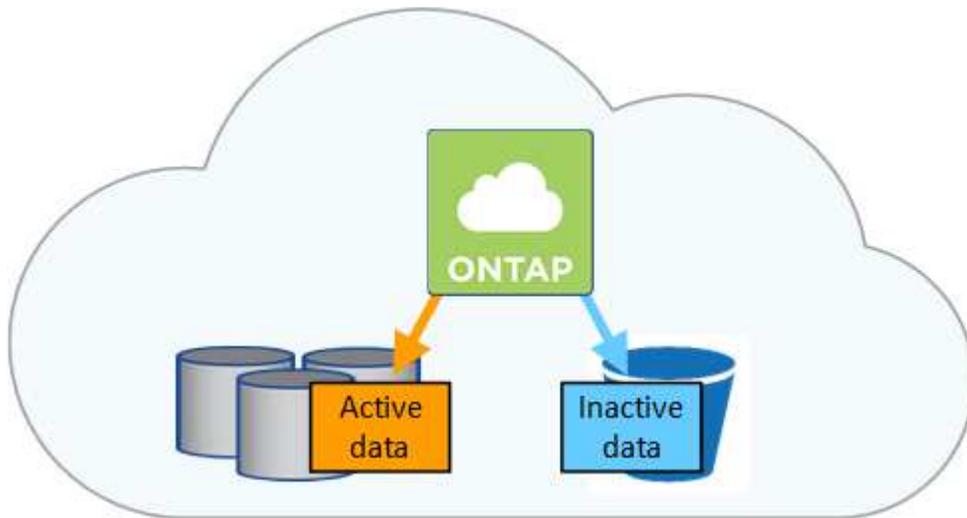
## Hot spares

RAID0 doesn't support the use of hot spares for redundancy.

Creating unused disks (hot spares) attached to a Cloud Volumes ONTAP instance is an unnecessary expense and may prevent provisioning additional space as needed. Therefore, it's not recommended.

## Learn about data tiering with Cloud Volumes ONTAP in AWS, Azure, or Google Cloud

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.



Data tiering is powered by FabricPool technology. Cloud Volumes ONTAP provides data tiering for all Cloud Volumes ONTAP clusters without an additional license. When you enable data tiering, data tiered to object storage incurs charges. Refer to your cloud provider's documentation for details about object storage costs.

### Data tiering in Google Cloud

When you enable data tiering in Google Cloud, 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.

The Console creates a bucket for each system and names it *fabric-pool-cluster unique identifier*. A different bucket is not created for each volume.

When the Console creates the bucket, it uses the following default settings:

- Location type: Region

- Storage class: Standard
- Public access: Subject to object ACLs
- Access control: Fine-grained
- Protection: None
- Data encryption: Google-managed key

## 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, subsequent inactive data moves directly to the class that you selected.



Any existing inactive data will maintain the default storage class when you change the storage class. To change the storage class for existing inactive data, you must perform the designation manually.

The access costs are higher if you do access the data, so take that into consideration before you change the storage class. To learn more, refer to the [Google Cloud documentation: Storage classes](#).

You can select a storage tier when you create the system and you can change it any time afterwards. For details about changing the storage class, refer to [Tier 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](#).

The Console 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.

## Replication

When you replicate a volume, you can choose whether to tier the data to object storage. If you do, the Console applies the **Backup** policy to the data protection volume. Starting with Cloud Volumes ONTAP 9.6, the **All** tiering policy replaces the backup policy. When a replication relationship is deleted, the destination volume retains the tiering policy that was in effect during replication.

### 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, refer to [Tier inactive data to low-cost object storage](#).

## Cloud Volumes ONTAP storage management

The NetApp Console provides simplified and advanced management of Cloud Volumes ONTAP storage.



You must create and delete all disks and aggregates directly from the Console. 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

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

### Simplified provisioning

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

When you create a volume, the Console 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.

The Console 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.

### Advanced allocation

You can also manage aggregates. [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 organization or account admin can configure the Console to notify you of storage capacity decisions or whether to automatically manage capacity requirements for you.

This behavior is determined by the *Capacity Management Mode* on a Console agent. The Capacity Management Mode affects all Cloud Volumes ONTAP systems managed by that Console agent. If you have another Console agent, it can be configured differently.

### Automatic capacity management

The Capacity Management Mode is set to automatic by default. In this mode, the Console checks the free space ratio every 15 minutes to determine if the free space ratio falls below the specified threshold. If more capacity is needed, it initiates purchase of new disks, deletes unused collections of disks (aggregates), moves volumes between aggregates as required, and attempts to prevent disk failure.

The following examples illustrate how this mode works:

- If an aggregate reaches the capacity threshold and it has room for more disks, the Console automatically purchases new disks for that aggregate so volumes can continue to grow.
- If an aggregate reaches the capacity threshold and it can't support any additional disks, the Console automatically moves a volume from that aggregate to an aggregate with available capacity or to a new

aggregate.

If the Console 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 the cloud provider in this scenario.

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

## Management of LUNs with automatic capacity management

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

### Manual capacity management

If the organization or account admin sets the **Capacity Management Mode** to manual, the Console informs you to take appropriate actions for capacity decisions. The same examples described in the automatic mode apply to the manual mode, but it is up to you to accept the actions.

#### Learn more

[Learn how to modify the capacity management mode.](#)

## Write speed

NetApp Console enables you to choose normal or high write speed for most Cloud Volumes ONTAP configurations. 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.

### 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.

### Google Cloud

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

If you use an HA pair, Cloud Volumes ONTAP supports high write speed with several VM types, starting with the 9.13.0 release. Go to the [Cloud Volumes ONTAP Release Notes](#) to view the VM types that support high write speed.

[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 add a new Cloud Volumes ONTAP system and you can [change the write speed for an existing system](#).

### What to expect if data loss occurs

If data loss occurs due to high write speed, the Event Management System (EMS) reports the following two events:

- Cloud Volumes ONTAP 9.12.1 or later

```
NOTICE nv.data.loss.possible: An unexpected shutdown occurred while in high write speed mode, which possibly caused a loss of data.
```

- Cloud Volumes ONTAP 9.11.0 to 9.11.1

```
DEBUG nv.check.failed: NVRAM check failed with error "NVRAM disabled due to dirty shutdown with High Write Speed mode"
```

```
ERROR wafl.root.content.changed: Contents of the root volume '' might have changed. Verify that all recent configuration changes are still in effect..
```

- Cloud Volumes ONTAP 9.8 to 9.10.1

```
DEBUG nv.check.failed: NVRAM check failed with error "NVRAM disabled due to dirty shutdown"
```

```
ERROR wafl.root.content.changed: Contents of the root volume '' might have changed. Verify that all recent configuration changes are still in effect.
```

When this happens, Cloud Volumes ONTAP should be able to boot up and continue to serve data without user intervention.

### 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 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 configurations

Flash Cache is supported with specific Cloud Volumes ONTAP configurations. View supported configurations in the [Cloud Volumes ONTAP Release Notes](#)

## Limitations

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

## Related topics

- [Supported configurations for Cloud Volumes ONTAP in AWS](#)
- [Supported configurations for Cloud Volumes ONTAP in Azure](#)
- [Supported configurations for Cloud Volumes ONTAP in Google Cloud](#)

## Learn about WORM storage on Cloud Volumes ONTAP

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.

The WORM feature is available for use with bring your own license (BYOL) and marketplace subscriptions for your licenses at no additional cost. Contact your NetApp sales representative to add WORM to your current license.

### How WORM storage works

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

How you activate WORM storage depends on the Cloud Volumes ONTAP version that you're using.

#### Version 9.10.1 and later

Beginning with Cloud Volumes ONTAP 9.10.1, you have the option to enable or disable WORM at the volume level.

When you add a Cloud Volumes ONTAP system, you're prompted to enable or disable WORM storage:

- If you enable WORM storage when adding a system, every volume that you create from the NetApp Console has WORM enabled. But you can use ONTAP System Manager or the ONTAP CLI to create volumes that have WORM disabled.
- If you disable WORM storage when adding a system, every volume that you create from the Console, ONTAP System Manager, or the ONTAP CLI has WORM disabled.

#### Version 9.10.0 and earlier

You can activate WORM storage on a Cloud Volumes ONTAP system when you add a new system. Every

volume that you create from the Console has WORM enabled. You can't disable WORM storage on individual volumes.

## 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 the [ONTAP documentation on SnapLock](#).

## Enabling WORM on a Cloud Volumes ONTAP system

You can enable WORM storage when creating a Cloud Volumes ONTAP system on the Console. You can also enable WORM on a system if WORM is not enabled on it during creation. After you enable it, you cannot disable WORM.

### About this task

- WORM is supported on ONTAP 9.10.1 and later.
- WORM with backup is supported on ONTAP 9.11.1 and later.

### Steps

1. On the **Systems** page, double-click the name of the system on which you want to enable WORM.
2. On the Overview tab, click the Features panel and then click the pencil icon next to **WORM**.

If WORM is already enabled on the system, the pencil icon is disabled.

3. On the **WORM** page, set the retention period for the cluster Compliance Clock.

For more information, refer to the [ONTAP documentation: Initialize the Compliance Clock](#).

4. Click **Set**.

### After you finish

You can verify the status of **WORM** on the Features panel.

After WORM is enabled, the SnapLock license is automatically installed on the cluster. You can view the SnapLock license on ONTAP System Manager.

## Deleting WORM files

You can delete WORM files during the retention period using the privileged delete feature.

For instructions, refer to the [ONTAP documentation](#).

## WORM and data tiering

When you create a new Cloud Volumes ONTAP 9.8 system or later, you can enable both data tiering and WORM storage together. Enabling data tiering with WORM storage allows you to tier the data to an object store in the cloud.

You should understand the following about enabling both data tiering and WORM storage:

- Data that is tiered to object storage doesn't include the ONTAP WORM functionality. To ensure end-to-end WORM capability, you'll need to set up the bucket permissions correctly.
- The data that is tiered to object storage doesn't carry the WORM functionality, which means technically anyone with full access to buckets and containers can go and delete the objects tiered by ONTAP.
- Reverting or downgrading to Cloud Volumes ONTAP 9.8 is blocked after enabling WORM and tiering.

## 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 expiration date by removing or editing cloud storage directly from the cloud provider.

## Related link

- [Create tamperproof Snapshot copies for WORM storage](#)
- [Licensing and charging in Cloud Volumes ONTAP](#)

# High-availability pairs

## Learn about Cloud Volumes ONTAP HA pairs in Google Cloud

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

### HA components

Cloud Volumes ONTAP HA configurations in Google Cloud 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.
- One zone or three zones (recommended).

If you choose three zones, the two nodes and mediator are in separate Google Cloud zones.

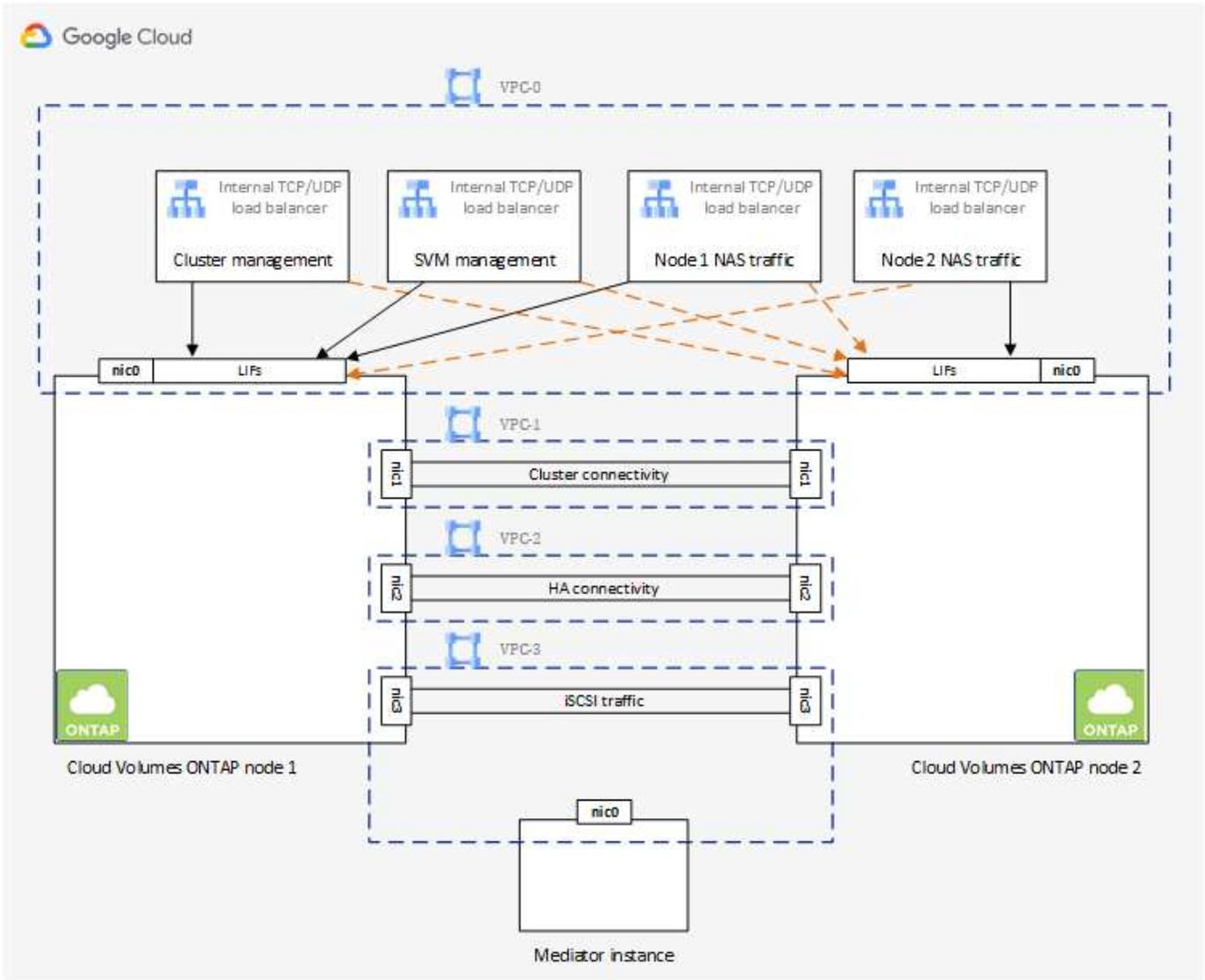
- Four Virtual Private Clouds (VPCs).

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:



**Mediator**

Here are some key details about the mediator instance in Google Cloud:

**Instance type**

e2-micro (an f1-micro instance was previously used)

**Disks**

Two standard persistent disks that are 10 GiB each

**Operating system**

Debian 11



For Cloud Volumes ONTAP 9.10.0 and earlier, Debian 10 was installed on the mediator.

**Upgrades**

When you upgrade Cloud Volumes ONTAP, the NetApp Console also updates the mediator instance as needed.

## Access to the instance

For Debian, the default cloud user is `admin`. Google Cloud creates and adds a certificates for the `admin` user when SSH access is requested through the Google Cloud Console or `gcloud` command line. You can specify `sudo` to gain root privileges.

## Third-party agents

Third-party agents or VM extensions are not supported on the mediator instance.

## 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 120 seconds.

In the event of an outage, data should be available in 120 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, the Console 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, the Console 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, refer to [Performance](#).

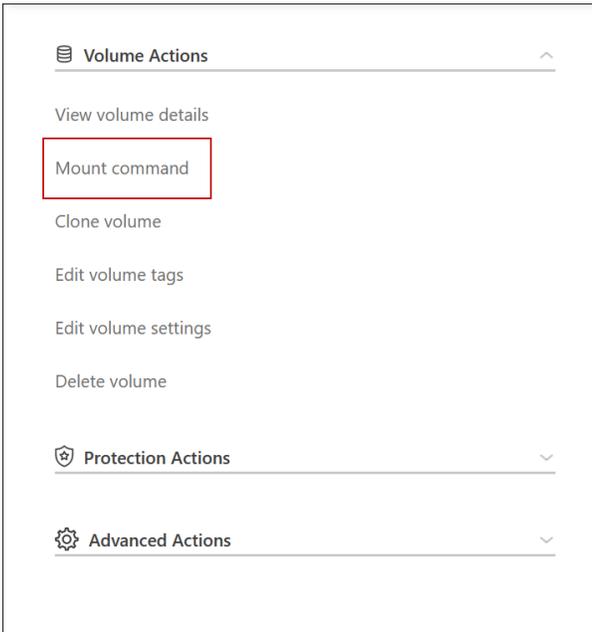
## Client access to storage

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, refer to ONTAP documentation.

You can locate the correct IP address from the Console by selecting the volume and clicking **Mount Command**.



### Related links

- [Learn about networking requirements](#)
- [Learn how to get started in GCP](#)

## Operations unavailable when a node in Cloud Volumes ONTAP HA pair is offline

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 in storage giveback is complete.



When a node in an HA pair is unavailable, the state of the system in the NetApp Console is *Degraded*.

The following actions are unavailable from 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 system changes back to normal.

# Learn about Cloud Volumes ONTAP data encryption and ransomware protection

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)
- Google Cloud Platform default encryption

You can use NetApp encryption solutions with native encryption from your cloud provider, which encrypts 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.

Cloud Volumes ONTAP supports both NVE and NAE with external key management services (EKMs) provided by AWS, Azure, and Google Cloud, including third-party solutions, such as Fortanix. Unlike ONTAP, for Cloud Volumes ONTAP, encryption keys are generated at the cloud provider's side, not in ONTAP. Cloud Volumes ONTAP doesn't support [Onboard Key Manager](#).

Cloud Volumes ONTAP uses the standard Key Management Interoperability Protocol (KMIP) services that ONTAP uses. For more information about the supported services, refer to the [Interoperability Matrix Tool](#).

If you use NVE, you have the option to use your cloud provider's key vault to protect ONTAP encryption keys:

- Google Cloud Key Management Service

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 have 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 [Encrypt volumes with NetApp encryption solutions](#).

## 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 the Console 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, refer to the [NetApp Interoperability Matrix](#).

For information about how to configure and manage the antivirus functionality on ONTAP systems, refer to the [ONTAP 9 Antivirus Configuration Guide](#).

## Ransomware protection

Ransomware attacks can cost a business time, resources, and reputation. The Console enables you to implement the NetApp solution for ransomware, which provides effective tools for visibility, detection, and remediation.

- The Console 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.

- The Console 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.](#)

# Learn about performance monitoring for Cloud Volumes ONTAP workloads

You can review performance results to help you decide which workloads are appropriate for Cloud Volumes ONTAP.

## Performance technical reports

- 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.

For information, refer to the [NetApp knowledgebase article about how to monitor ONTAP CPU utilization using the CLI](#)

## License management for node-based BYOL

Each Cloud Volumes ONTAP system that has a node-based bring your own license (BYOL) must have a system license installed with an active subscription. The NetApp Console simplifies the process by managing licenses for you and by displaying a warning before they expire.



A node-based license is the previous generation license for Cloud Volumes ONTAP. A node-based license could be procured from NetApp (BYOL) and is available for license renewals, only in specific cases.

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

[Learn more about how to manage node-based licenses.](#)

## BYOL system licenses

Node-based licenses could be procured from NetApp. The number of licenses that you can purchase for a single-node system or HA pair is unlimited.



NetApp has restricted the purchase, extension, and renewal of BYOL licensing. For more information, refer to [Restricted availability of BYOL licensing for Cloud Volumes ONTAPP](#).

A node-based license provides up to 368 TiB of capacity for a single node or HA pair. You might have purchased multiple licenses for a Cloud Volumes ONTAP BYOL system to allocate more than 368 TiB of capacity. For example, you might have two licenses to allocate up to 736 TiB of capacity to Cloud Volumes ONTAP. Or you could have four licenses to get up to 1.4 PiB.

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, the Console prompts you for the serial number of your license and your NetApp Support Site account. The Console 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 the Console.](#)

If the Console can't access the license file over the secure internet connection, you can [obtain the file yourself and then manually upload the file to the Console](#).

## License expiration

The Console 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 system to review the message.

The Console includes a license expiration warning in the Cloud Volumes ONTAP report that's emailed to you, if you are an organization or 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

If you renew a node-based BYOL subscription by contacting a NetApp representative, the Console automatically obtains the new license from NetApp and installs it on the Cloud Volumes ONTAP system.

If the Console can't access the license file over the secure internet connection, you can [obtain the file yourself and then manually upload the file to the Console](#).

## 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.

## Learn how AutoSupport and Digital Advisor are used for Cloud Volumes ONTAP

The AutoSupport component of ONTAP collects telemetry and sends it for analysis. Active IQ Digital Advisor (also known as Digital Advisor) analyzes the data from AutoSupport and provides proactive care and optimization. Using artificial intelligence, Digital Advisor can identify potential problems and help you resolve them before they impact your business.

Digital Advisor 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 Digital Advisor 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 Digital Advisor:

- Plan upgrades.

Digital Advisor 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 Digital Advisor 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.

Digital Advisor 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.

Digital Advisor displays complete inventory and software and hardware configuration information. See when service contracts are expiring and renew them to ensure you remain supported.

### Related links

- [NetApp Documentation: Digital Advisor](#)
- [Launch Digital Advisor](#)
- [SupportEdge Services](#)

## Supported default configurations 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.

## Default setup

- The NetApp Console creates one data-serving storage VM when it deploys Cloud Volumes ONTAP. Some configurations support additional storage VMs. [Learn more about managing storage VMs.](#)

Beginning with the 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. For information about inline storage efficiency features, refer to the knowledge base article [KB: What Inline Storage Efficiency features are supported with CVO?](#)

- The Console automatically installs the following ONTAP feature licenses on Cloud Volumes ONTAP:
  - CIFS
  - FlexCache
  - FlexClone
  - iSCSI
  - Multi-tenant Encryption Key Management (MTEKM), starting with Cloud Volumes ONTAP 9.12.1 GA
  - NetApp Volume Encryption (only for bring your own license (BYOL) or registered pay-as-you-go (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 Google Cloud
  - A node management LIF

In Google Cloud, 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 cloud provider 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 Console agent using HTTP.

The backups are accessible from `http://ipaddress/occm/offboxconfig/` where *ipaddress* is the IP address of the host of the Console agent.

You can use the backups for reconfiguring your Cloud Volumes ONTAP system. For more information about configuration backups, refer to the [ONTAP documentation](#).

- The Console sets a few volume attributes differently than other management tools (ONTAP System

Manager or the ONTAP CLI, for example).

The following table lists the volume attributes set differently from the defaults:

Attribute	Value that the Console configures
Autosize mode	grow
Maximum autosize	1,000 percent  The organization or account admin can modify this value from the Settings page.
Security style	NTFS for CIFS volumes UNIX for NFS volumes
Space guarantee style	none
UNIX permissions (NFS only)	777

For information about these attributes, refer to [ONTAP \*volume create\* man page](#).

## Internal disks for system data

In addition to the storage for user data, the Console also purchases cloud storage for system data.

### 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



Snapshots are created automatically upon reboot.

- Boot and root disks are encrypted by default.

### 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

- One 10 GiB Standard persistent disk for mediator boot data
- Snapshots for boot and root data



Snapshots are created automatically upon reboot.

- Boot and root disks are encrypted by default.

### **Where the disks reside**

Storage layout:

- 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.

# Knowledge and support

## Register for support

Support registration is required to receive technical support specific to the NetApp Console and its storage solutions and data services. Support registration is also required to enable key workflows for Cloud Volumes ONTAP systems.

Registering for support does not enable NetApp support for a cloud provider file service. For technical support related to a cloud provider file service, its infrastructure, or any solution using the service, refer to "Getting help" in the documentation for that product.

- [Amazon FSx for ONTAP](#)
- [Azure NetApp Files](#)
- [Google Cloud NetApp Volumes](#)

## Support registration overview

There are two forms of registration to activate support entitlement:

- Registering your NetApp Console account serial number (your 20 digit 960xxxxxxx serial number located on the Support Resources page in the Console).

This serves as your single support subscription ID for any service within the Console. Each Console account must be registered.

- Registering the Cloud Volumes ONTAP serial numbers associated with a subscription in your cloud provider's marketplace (these are 20 digit 909201xxxxxxx serial numbers).

These serial numbers are commonly referred to as *PAYGO serial numbers* and get generated by the NetApp Console at the time of Cloud Volumes ONTAP deployment.

Registering both types of serial numbers enables capabilities like opening support tickets and automatic case generation. Registration is completed by adding NetApp Support Site (NSS) accounts to the Console as described below.

## Register NetApp Console for NetApp support

To register for support and activate support entitlement, one user in your NetApp Console account must associate a NetApp Support Site account with their Console login. How you register for NetApp support depends on whether you already have a NetApp Support Site (NSS) account.

### Existing customer with an NSS account

If you're a NetApp customer with an NSS account, you simply need to register for support through the Console.

#### Steps

1. Select **Administration > Credentials**.
2. Select **User Credentials**.

3. Select **Add NSS credentials** and follow the NetApp Support Site (NSS) authentication prompt.
4. To confirm that the registration process was successful, select the Help icon, and select **Support**.

The **Resources** page should show that your Console account is registered for support.

Note that other Console users will not see this same support registration status if they have not associated a NetApp Support Site account with their login. However, that doesn't mean that your account is not registered for support. As long as one user in the organization has followed these steps, then your account has been registered.

### Existing customer but no NSS account

If you're an existing NetApp customer with existing licenses and serial numbers but *no* NSS account, you need to create an NSS account and associate it with your Console login.

#### Steps

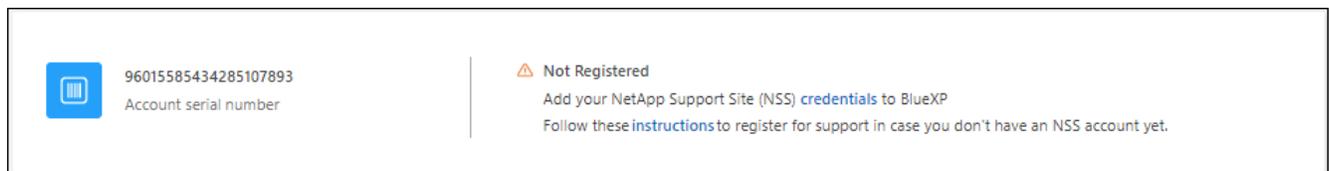
1. Create a NetApp Support Site account by completing the [NetApp Support Site User Registration form](#)
  - a. Be sure to select the appropriate User Level, which is typically **NetApp Customer/End User**.
  - b. Be sure to copy the Console account serial number (960xxxx) used above for the serial number field. This will speed up the account processing.
2. Associate your new NSS account with your Console login by completing the steps under [Existing customer with an NSS account](#).

### Brand new to NetApp

If you are brand new to NetApp and you don't have an NSS account, follow each step below.

#### Steps

1. In the upper right of the Console, select the Help icon, and select **Support**.
2. Locate your account ID serial number from the Support Registration page.



3. Navigate to [NetApp's support registration site](#) and select **I am not a registered NetApp Customer**.
4. Fill out the mandatory fields (those with red asterisks).
5. In the **Product Line** field, select **Cloud Manager** and then select your applicable billing provider.
6. Copy your account serial number from step 2 above, complete the security check, and then confirm that you read NetApp's Global Data Privacy Policy.

An email is immediately sent to the mailbox provided to finalize this secure transaction. Be sure to check your spam folders if the validation email doesn't arrive in few minutes.

7. Confirm the action from within the email.

Confirming submits your request to NetApp and recommends that you create a NetApp Support Site account.

8. Create a NetApp Support Site account by completing the [NetApp Support Site User Registration form](#)
  - a. Be sure to select the appropriate User Level, which is typically **NetApp Customer/End User**.
  - b. Be sure to copy the account serial number (960xxxx) used above for the serial number field. This will speed up processing.

### After you finish

NetApp should reach out to you during this process. This is a one-time onboarding exercise for new users.

Once you have your NetApp Support Site account, associate the account with your Console login by completing the steps under [Existing customer with an NSS account](#).

## Associate NSS credentials for Cloud Volumes ONTAP support

Associating NetApp Support Site credentials with your Console account is required to enable the following key workflows for Cloud Volumes ONTAP:

- Registering pay-as-you-go Cloud Volumes ONTAP systems for support

Providing your NSS account is required to activate support for your system and to gain access to NetApp technical support resources.

- Deploying Cloud Volumes ONTAP when you bring your own license (BYOL)

Providing your NSS account is required so that the Console can upload your license key and to enable the subscription for the term that you purchased. This includes automatic updates for term renewals.

- Upgrading Cloud Volumes ONTAP software to the latest release

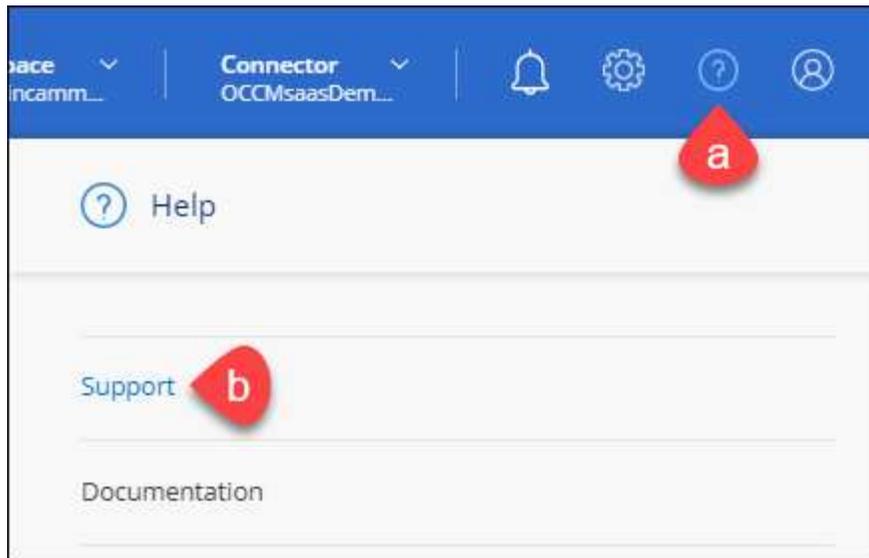
Associating NSS credentials with your NetApp Console account is different than the NSS account that is associated with a Console user login.

These NSS credentials are associated with your specific Console account ID. Users who belong to the Console organization can access these credentials from **Support > NSS Management**.

- If you have a customer-level account, you can add one or more NSS accounts.
- If you have a partner or reseller account, you can add one or more NSS accounts, but they can't be added alongside customer-level accounts.

### Steps

1. In the upper right of the Console, select the Help icon, and select **Support**.



2. Select **NSS Management > Add NSS Account**.
3. When you're prompted, select **Continue** to be redirected to a Microsoft login page.

NetApp uses Microsoft Entra ID as the identity provider for authentication services specific to support and licensing.

4. At the login page, provide your NetApp Support Site registered email address and password to perform the authentication process.

These actions enable the Console to use your NSS account for things like license downloads, software upgrade verification, and future support registrations.

Note the following:

- The NSS account must be a customer-level account (not a guest or temp account). You can have multiple customer-level NSS accounts.
- There can be only one NSS account if that account is a partner-level account. If you try to add customer-level NSS accounts and a partner-level account exists, you'll get the following error message:

"The NSS customer type is not allowed for this account as there are already NSS Users of different type."

The same is true if you have pre-existing customer-level NSS accounts and try to add a partner-level account.

- Upon successful login, NetApp will store the NSS user name.

This is a system-generated ID that maps to your email. On the **NSS Management** page, you can display your email from the **...** menu.

- If you ever need to refresh your login credential tokens, there is also an **Update Credentials** option in the **...** menu.

Using this option prompts you to log in again. Note that the token for these accounts expire after 90 days. A notification will be posted to alert you of this.

# Get help

NetApp provides support for NetApp Console and its cloud services in a variety of ways. Extensive free self-support options are available 24/7, such as knowledge base (KB) articles and a community forum. Your support registration includes remote technical support via web ticketing.

## Get support for a cloud provider file service

For technical support related to a cloud provider file service, its infrastructure, or any solution using the service, refer to the documentation for that product.

- [Amazon FSx for ONTAP](#)
- [Azure NetApp Files](#)
- [Google Cloud NetApp Volumes](#)

To receive technical support specific to NetApp and its storage solutions and data services, use the support options described below.

## Use self-support options

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

- **Documentation**

The NetApp Console documentation that you're currently viewing.

- **Knowledge base**

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

- **Communities**

Join the NetApp Console community to follow ongoing discussions or create new ones.

## Create a case with NetApp support

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

### Before you get started

- To use the **Create a Case** capability, you must first associate your NetApp Support Site credentials with your Console login. [Learn how to manage credentials associated with your Console login.](#)
- If you're opening a case for an ONTAP system that has a serial number, then your NSS account must be associated with the serial number for that system.

### Steps

1. In NetApp Console, select **Help > Support**.
2. On the **Resources** page, choose one of the available options under Technical Support:

- a. Select **Call Us** if you'd like to speak with someone on the phone. You'll be directed to a page on netapp.com that lists the phone numbers that you can call.
- b. Select **Create a Case** to open a ticket with a NetApp Support specialist:
  - **Service:** Select the service that the issue is associated with. For example, **NetApp Console** when specific to a technical support issue with workflows or functionality within the Console.
  - **System:** If applicable to storage, select **Cloud Volumes ONTAP** or **On-Prem** and then the associated working environment.

The list of systems are within scope of the Console organization, and Console agent you have selected in the top banner.

- **Case Priority:** Choose the priority for the case, which can be Low, Medium, High, or Critical.

To learn more details about these priorities, hover your mouse over the information icon next to the field name.

- **Issue Description:** Provide a detailed description of your problem, including any applicable error messages or troubleshooting steps that you performed.
- **Additional Email Addresses:** Enter additional email addresses if you'd like to make someone else aware of this issue.
- **Attachment (Optional):** Upload up to five attachments, one at a time.

Attachments are limited to 25 MB per file. The following file extensions are supported: txt, log, pdf, jpg/jpeg, rtf, doc/docx, xls/xlsx, and csv.

ntapitdemo 

NetApp Support Site Account

---

Service Working Environment

Select Select

Case Priority 

Low - General guidance

Issue Description

Provide detailed description of problem, applicable error messages and troubleshooting steps taken.

Additional Email Addresses (Optional) 

Type here

Attachment (Optional) Upload 

No files selected  

### After you finish

A pop-up will appear with your support case number. A NetApp Support specialist will review your case and get back to you soon.

For a history of your support cases, you can select **Settings > Timeline** and look for actions named "create support case." A button to the far right lets you expand the action to see details.

It's possible that you might encounter the following error message when trying to create a case:

"You are not authorized to Create a Case against the selected service"

This error could mean that the NSS account and the company of record it's associated with is not the same company of record for the NetApp Console account serial number (ie. 960xxxx) or the working environment serial number. You can seek assistance using one of the following options:

- Submit a non-technical case at <https://mysupport.netapp.com/site/help>

## Manage your support cases

You can view and manage active and resolved support cases directly from the Console. You can manage the

cases associated with your NSS account and with your company.

Note the following:

- The case management dashboard at the top of the page offers two views:
  - The view on the left shows the total cases opened in the past 3 months by the user NSS account you provided.
  - The view on the right shows the total cases opened in the past 3 months at your company level based on your user NSS account.

The results in the table reflect the cases related to the view that you selected.

- You can add or remove columns of interest and you can filter the contents of columns like Priority and Status. Other columns provide just sorting capabilities.

View the steps below for more details.

- At a per-case level, we offer the ability to update case notes or close a case that is not already in Closed or Pending Closed status.

## Steps

1. In the NetApp Console, select **Help > Support**.
2. Select **Case Management** and if you're prompted, add your NSS account to the Console.

The **Case management** page shows open cases related to the NSS account that is associated with your Console user account. This is the same NSS account that appears at the top of the **NSS management** page.

3. Optionally modify the information that displays in the table:
  - Under **Organization's cases**, select **View** to view all cases associated with your company.
  - Modify the date range by choosing an exact date range or by choosing a different time frame.
  - Filter the contents of the columns.
  - Change the columns that appear in the table by selecting  and then choosing the columns that you'd like to display.
4. Manage an existing case by selecting **...** and selecting one of the available options:
  - **View case**: View full details about a specific case.
  - **Update case notes**: Provide additional details about your problem or select **Upload files** to attach up to a maximum of five files.

Attachments are limited to 25 MB per file. The following file extensions are supported: txt, log, pdf, jpg/jpeg, rtf, doc/docx, xls/xlsx, and csv.

- **Close case**: Provide details about why you're closing the case and select **Close case**.

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