



NetApp Cloud Volumes ONTAP Release Notes

Cloud Volumes ONTAP

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NetApp 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.

These release notes are specific to Cloud Volumes ONTAP. View the [ONTAP Release Notes](#) to identify new features, known problems, and limitations for ONTAP software in general.

If you need documentation that describes how to deploy and manage Cloud Volumes ONTAP, then you should refer to [Cloud Manager documentation](#).

9.9.1 Release Notes

What's new in Cloud Volumes ONTAP 9.9.1

Cloud Volumes ONTAP 9.9.1 includes several new features and enhancements.

Additional features and enhancements are also introduced in the latest versions of Cloud Manager. See the [Cloud Manager Release Notes](#) for details.

9.9.1 GA (21 July 2021)

The General Availability (GA) release of Cloud Volumes ONTAP 9.9.1 is now available. The GA release includes bug fixes.

Cloud Manager will prompt you to upgrade existing systems that are running any of the following versions: 9.9.1 Release Candidate, 9.9.0, or 9.8.

9.9.1 update (7 July 2021)

The following changes were introduced with the Cloud Manager 3.9.8 release.

- 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 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 *Essential* 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 GB of allocated capacity per system and there's no support contract. You can have up to 10 Freemium systems.

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

- In AWS, Cloud Volumes ONTAP now supports the m5dn.24xlarge instance type with the following charging methods: PAYGO Premium, capacity-based licenses (BYOL), and node-based licenses (BYOL).
- In Google Cloud, Cloud Volumes ONTAP now supports Balanced persistent disks (pd-balanced). These SSDs balance performance and cost by providing lower IOPS per GB.
- The custom-4-16384 machine type is no longer supported with new Cloud Volumes ONTAP systems in Google Cloud.

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.

[Learn more about what's new in Cloud Manager.](#)

9.9.1 update (3 June 2021)

The recent Cloud Manager 3.9.7 release introduced support for a new Professional Package that enables you to bundle Cloud Volumes ONTAP and Cloud Backup Service by using an annual contract from the AWS Marketplace.

[Learn more about this licensing option.](#)

9.9.1 Release Candidate (24 May 2021)

The Cloud Volumes ONTAP 9.9.1 Release Candidate is now available in AWS, Azure, and Google Cloud Platform.

In addition to the features introduced with [ONTAP 9.9.1](#), this release of Cloud Volumes ONTAP includes the following:

- [ONTAP S3 support in Azure](#)
- [Enhanced performance in AWS with high write speed](#)
- [io2 boot disk in AWS](#)

ONTAP S3 support in Azure

You can now provide S3 object storage from Cloud Volumes ONTAP in Azure. Cloud Volumes ONTAP for Microsoft Azure supports S3 as an option for scale-out storage, in addition to classic file-based protocols like NFS and SMB.

Note the following:

- The main use case for ONTAP S3 with Cloud Volumes ONTAP is a general purpose object store.
- At this time, the S3 protocol is not supported with Cloud Volumes ONTAP in AWS or in Google Cloud.
- Cloud Manager doesn't provide any management capabilities for the ONTAP S3 feature.

Using the CLI is the best practice to configure S3 client access from Cloud Volumes ONTAP. For details, refer to the [S3 Configuration Power Guide](#).

Enhanced performance in AWS with high write speed

We have enhanced the throughput performance of Cloud Volumes ONTAP when [high write speed](#) is enabled on a supported instance type.

io2 boot disk in AWS

In AWS, the boot disk for a new Cloud Volumes ONTAP system is now a provisioned IOPS SSD (io2) volume. io2 volumes provide more reliability than io1 volumes, which were previously used for boot disks.

Required version of the Cloud Manager Connector

The Cloud Manager Connector must be running version 3.9.6 or later to deploy new Cloud Volumes ONTAP 9.9.1 systems and to upgrade existing systems to 9.9.1.

Upgrade notes

- Upgrades of Cloud Volumes ONTAP must be completed from Cloud Manager. You should not upgrade Cloud Volumes ONTAP by using System Manager or the CLI. Doing so can impact system stability.
- You can upgrade to Cloud Volumes ONTAP 9.9.1 from the 9.9.0 release and from the 9.8 release. Cloud Manager will prompt you to upgrade your existing Cloud Volumes ONTAP 9.9.0 and 9.8 systems to the 9.9.1 release.

[Learn how to upgrade when Cloud Manager notifies you.](#)

- The upgrade of a single node system takes the system offline for up to 25 minutes, during which I/O is interrupted.
- Upgrading an HA pair is nondisruptive and I/O is uninterrupted. During this nondisruptive upgrade process, each node is upgraded in tandem to continue serving I/O to clients.

c4, m4, and r4 instance types

Starting with the 9.8 release, c4, m4, and r4 instance types aren't supported with new Cloud Volumes ONTAP systems. If you have an existing Cloud Volumes ONTAP system that's running on a c4, m4, or r4 instance type, you can still upgrade to this release.

We recommend changing to an instance type in the c5, m5, or r5 instance family.

Licensing for Cloud Volumes ONTAP 9.9.1

Several licensing options are available for Cloud Volumes ONTAP. Each option enables you to choose a configuration that meets your needs.

Licensing overview

The following table provides an overview of the licensing options for Cloud Volumes ONTAP.

Beyond these licensing options, you can also choose the *Freemium* offering to get started with Cloud Volumes ONTAP without purchasing a license or contract.

Charging method	Highlights	Support	Max system capacity
Capacity-based license: Essential package	<ul style="list-style-type: none">• Pay per TiB of capacity for one or more Cloud Volumes ONTAP systems• Provides a la carte licensing for Cloud Volumes ONTAP:<ul style="list-style-type: none">◦ A single node or HA system◦ File and block storage or secondary data (DR)• Available by bringing your own license (BYOL) purchased from NetApp	Included	2 PB

Charging method	Highlights	Support	Max system capacity
Capacity-based license: Professional package	<ul style="list-style-type: none"> Pay per TiB of capacity for one or more Cloud Volumes ONTAP systems Provides licensing for any Cloud Volumes ONTAP configuration (single node or HA with any storage type) Includes volume backups using the Cloud Backup Service (only for volumes charged against this license) Available through an AWS Marketplace annual contract or by bringing your own license (BYOL) purchased from NetApp 	Included	2 PB
PAYGO by node	<ul style="list-style-type: none"> Pay-as-you-go by the hour through a marketplace subscription from your cloud provider Charging is per Cloud Volumes ONTAP node Available in three licensing options: Explore, Standard, and Premium 	Included, but you must activate support	<ul style="list-style-type: none"> Explore: 2 TB Standard: 10 TB Premium: 368 TB
Node-based license	<ul style="list-style-type: none"> Single node or HA license with term-based options Available by bringing your own license (BYOL) purchased from NetApp 	Included	368 TB per license

The following sections provide more details about each of these options.

Freemium offering

- A new offering that provides all Cloud Volumes ONTAP features free of charge from NetApp (cloud provider charges still apply).
- No license or contract is needed.
- Support is not included.
- You're limited to 500 GB of allocated capacity per Cloud Volumes ONTAP system.
- You can use up to 10 Cloud Volumes ONTAP systems with the Freemium offering per NetApp account.
- If the allocated capacity for a Cloud Volumes ONTAP system exceeds 500 GB, Cloud Manager converts the system to the Essential package (which is a capacity-based license) and charging starts.

Any other systems that have less than 500 GB of allocated capacity stay on the Freemium offering (as long as they were deployed using the Freemium offering).

To get started with the Freemium offering, create a new Cloud Volumes ONTAP working environment and select **Freemium** when prompted to choose a charging method.

Capacity-based licenses

Capacity-based licensing enables you to pay for Cloud Volumes ONTAP per TiB of capacity. The license is associated with your NetApp account and enables you to charge multiple systems against the license, as long as enough capacity is available through the license.

For example, you could purchase a single 20 TB license, deploy four Cloud Volumes ONTAP systems, and then allocate a 5 TB volume to each system, for a total of 20 TB.

Unlike the by-node charging method where a license is purchased per Cloud Volumes ONTAP system, a capacity-based license is issued to a NetApp account. The capacity is then 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 the following packages: Essential or Professional.

This licensing method is available for Cloud Volumes ONTAP 9.7 and later.



For each package, there is a minimum allocated capacity charge of 4 TB. Any Cloud Volumes ONTAP instance that has less than 4 TB of allocated capacity will be charged at a rate of 4 TB.

Essential package

- Provides a la carte licensing for Cloud Volumes ONTAP:
 - A single node or HA system
 - File and block storage or secondary data for disaster recovery (DR)
- This package is available as a license (BYOL) purchased from NetApp.
- Support is included for the length of the subscription term.
- Conversions to another licensing option isn't supported.
- Each individual Cloud Volumes ONTAP system supports up to 2 PB of capacity through disks and tiering to object storage.

Professional package

- Provides licensing for any Cloud Volumes ONTAP configuration (single node or HA with any storage type).
- Includes volume backups using the Cloud Backup Service (only for volumes charged against this license).
- This package is available as an annual contract from the AWS Marketplace or as a license (BYOL) purchased from NetApp.

If you have an AWS Marketplace contract, *all* Cloud Volumes ONTAP systems that you deploy are charged against that contract. You can't mix and match a Marketplace contract with BYOL.

- Support is included for the length of the subscription term.
- Conversions to another licensing option isn't supported.
- Each individual Cloud Volumes ONTAP system supports up to 2 PB of capacity through disks and tiering to object storage.

To get started with a capacity-based license, [Contact NetApp Sales](#) and then [add your license to Cloud](#)

Manager.

PAYGO by node

- Requires a subscription from a cloud provider's marketplace for pay-as-you-go pricing at an hourly rate.
- Charging is per Cloud Volumes ONTAP node.
- Offers Cloud Volumes ONTAP in three different licensing options: Explore, Standard, and Premium. Each license provides support for different amounts of storage and compute.
- A 30-day free trial is available for the first Cloud Volumes ONTAP system that you deploy in a cloud provider. [Learn more about 30-day free trials.](#)
 - There are no hourly software charges, but cloud provider infrastructure charges still apply (compute, storage, and networking).
 - When the free trial ends, you'll be charged hourly according to the selected license, as long as you subscribed. If you haven't subscribed, the system shuts down.

Cloud Manager prompts you to subscribe to your cloud provider's marketplace when you create a Cloud Volumes ONTAP system.

- Conversions to another licensing option isn't supported.
- Basic technical support is offered, but you must [register and activate the NetApp serial number associated with your system.](#)

You can view pricing details from your cloud provider's marketplace:

- [AWS Marketplace](#)
- [Azure Marketplace](#)
- [Google Cloud Platform Marketplace](#)

To get started with PAYGO, create a Cloud Volumes ONTAP working environment and subscribe to your cloud provider's marketplace when prompted.

Node-based licenses

- Single node or HA license with term-based subscription options like 12 months, 24 months, and more.
- Available by bringing your own license (BYOL) purchased from NetApp.
- Each Cloud Volumes ONTAP system supports up to 368 TB of capacity per license.
- Conversions to another licensing option isn't supported.

If you want to transition to capacity-based licensing, you can purchase a license, deploy a new Cloud Volumes ONTAP system, and then replicate the data to that new system.

To get started with a node-based license, [Contact NetApp Sales](#) and then [add your license to Cloud Manager](#).

Supported configurations

Supported configurations for Cloud Volumes ONTAP 9.9.1 in AWS

Several Cloud Volumes ONTAP configurations are supported in AWS.

Supported number of nodes

Cloud Volumes ONTAP is available in AWS as a single node system and as a high-availability (HA) pair of nodes for fault tolerance and nondisruptive operations.

Upgrading a single node system to an HA pair is not supported. If you want to switch between a single node system and an HA pair, then you need to deploy a new system and replicate data from the existing system to the new system.

Supported storage

Cloud Volumes ONTAP supports several types of EBS disks, and S3 object storage for data tiering. The maximum storage capacity is determined by the license that you choose.

Storage support by license

Each license supports a different maximum system capacity. The maximum system capacity includes disk-based storage plus object storage used for data tiering. NetApp doesn't support exceeding this limit.

	Freemium	PAYGO Explore	PAYGO Standard	PAYGO Premium	Node-based license	Capacity-based license
Maximum system capacity (disks + object storage)¹	500 GB	2 TB	10 TB	368 TB ²	368 TB per license ²	2 PB ²
Supported disk types	<ul style="list-style-type: none">General Purpose SSD (gp3 and gp2)³Provisioned IOPS SSD (io1)³Throughput Optimized HDD (st1)⁴					
Cold data tiering to S3	Supported	Not supported	Supported			

- For an HA pair, the capacity limit is for the entire HA pair. It's not per node. For example, if you use the Premium license, you can have up to 368 TB of capacity between both nodes.
- For some configurations, disk limits prevent you from reaching the capacity limit by using disks alone. In those cases, you can reach the capacity limit by [tiering inactive data to object storage](#). For information about disk limits, refer to [storage limits](#).
- Enhanced write performance is enabled when using SSDs with all Cloud Volumes ONTAP configurations, except for PAYGO Explore.
- Tiering data to object storage is not recommended when using Throughput Optimized HDDs (st1).

Supported disk sizes

In AWS, an aggregate can contain up to 6 disks that are all the same type and size.

General Purpose SSDs (gp3 and gp2)	Provisioned IOPS SSDs (io1)	Throughput Optimized HDDs (st1)
• 100 GB	• 100 GB	• 500 GB
• 500 GB	• 500 GB	• 1 TB
• 1 TB	• 1 TB	• 2 TB
• 2 TB	• 2 TB	• 4 TB
• 4 TB	• 4 TB	• 6 TB
• 6 TB	• 6 TB	• 8 TB
• 8 TB	• 8 TB	• 16 TB
• 16 TB	• 16 TB	

Supported EC2 compute

Each Cloud Volumes ONTAP license supports different EC2 instance types. For your convenience, the table below shows the vCPU, RAM, and bandwidth for each supported instance type. [You should refer to AWS for the latest and complete details about EC2 instance types.](#)

The bandwidths shown in the table below match the documented AWS limits for each instance type. These limits don't completely align with what Cloud Volumes ONTAP can provide. For the expected performance, refer to [NetApp Technical Report 4383: Performance Characterization of Cloud Volumes ONTAP in Amazon Web Services with Application Workloads](#).

License	Supported instance	vCPU	RAM	Flash Cache ¹	Network bandwidth (Gbps)	EBS bandwidth (Mbps)	High write speed ²
Explore or any other license	m5.xlarge	4	16	Not supported	Up to 10	Up to 4,750	Supported (single node only)
Standard or any other license	r5.xlarge	4	32	Not supported	Up to 10	Up to 4,750	Supported (single node only)
	m5a.2xlarge	8	32	Not supported	Up to 10	Up to 2,880	Supported
	m5.2xlarge	8	32	Not supported	Up to 10	Up to 4,750	Supported

License	Supported instance	vCPU	RAM	Flash Cache ¹	Network bandwidth (Gbps)	EBS bandwidth (Mbps)	High write speed ²
Premium or any other license	m5n.2xlarge	8	32	Not supported	Up to 25	Up to 4,750	Supported
	r5.2xlarge	8	64	Not supported	Up to 10	Up to 4,750	Supported
	r5d.2xlarge	8	64	Supported	Up to 10	Up to 4,750	Supported
	c5d.4xlarge	16	32	Supported	Up to 10	4,570	Supported
	m5.4xlarge	16	64	Not supported	Up to 10	4,750	Supported
	m5d.8xlarge	32	128	Supported	10	6,800	Supported
	r5.8xlarge	32	256	Not supported	10	6,800	Supported
	c5.9xlarge	36	72	Not supported	10	9,500	Supported
	c5d.9xlarge	36	72	Supported	10	9,500	Supported
	c5n.9xlarge	36	96	Not supported	50	9,500	Supported
	c5a.12xlarge	48 ⁴	96	Not supported	12	4,750	Supported
	c5.18xlarge	48 ⁴	144	Not supported	25	19,000	Supported
	c5d.18xlarge	48 ⁴	144	Supported	25	19,000	Supported
	m5d.12xlarge	48	192	Supported	12	9,500	Supported
	c5n.18xlarge	48 ⁴	192	Not supported	100	19,000	Supported
	m5a.16xlarge	48 ⁴	256	Not supported	12	9,500	Supported
	m5.16xlarge	48 ⁴	256	Not supported	20	13,600	Supported
	r5.12xlarge ³	48	384	Not supported	10	9,500	Supported
	m5dn.24xlarge	48 ⁴	384	Supported	100	19,000	Supported

- Some instance types include local NVMe storage, which Cloud Volumes ONTAP uses as *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. Compression must be disabled on all volumes to take advantage of the Flash Cache performance improvements. [Learn more about Flash Cache](#).

- Cloud Volumes ONTAP supports high write speed with most instance types when using an HA pair. High write speed is supported with all instance types when using a single node system. [Learn more about choosing a write speed](#).
- The r5.12xlarge instance type has a known limitation with supportability. If a node unexpectedly reboots due to a panic, the system might not collect core files used to troubleshoot and root cause the problem. The customer accepts the risks and limited support terms and bears all support responsibility if this condition occurs. This limitation affects newly deployed HA pairs and HA pairs upgraded from 9.8. The limitation does not affect newly deployed single node systems.
- While these EC2 instance types support more than 48 vCPUs, Cloud Volumes ONTAP supports up to 48 vCPUs.
- When you choose an EC2 instance type, you can specify whether it is a shared instance or a dedicated instance.
- Cloud Volumes ONTAP can run on either a Reserved or On-demand EC2 instance. Solutions that use other instance types aren't supported.

Supported regions

For AWS region support, see [Cloud Volumes Global Regions](#).

Supported configurations for Cloud Volumes ONTAP 9.9.1 in Azure

Several Cloud Volumes ONTAP configurations are supported in Azure.

Supported configurations by license

Cloud Volumes ONTAP is available in Azure as a single node system and as a high-availability (HA) pair of nodes for fault tolerance and nondisruptive operations.

Upgrading a single node system to an HA pair is not supported. If you want to switch between a single node system and an HA pair, then you need to deploy a new system and replicate data from the existing system to the new system.

Single node systems

You can choose from the following configurations when deploying Cloud Volumes ONTAP as a single-node system in Azure:

	Freemium	PAYGO Explore	PAYGO Standard	PAYGO Premium	Node-based license	Capacity-based license
Maximum system capacity (disks + object storage)	500 GB	2 TB ¹	10 TB	368 TB	368 TB per license	2 PB

	Freemium	PAYGO Explore	PAYGO Standard	PAYGO Premium	Node-based license	Capacity-based license
Supported virtual machine types	<ul style="list-style-type: none"> • DS3_v2 • DS4_v2 • DS5_v2 • DS13_v2 • DS14_v2 • DS15_v2 • E4s_v3 • E8s_v3 • E32s_v3 ² • E48s_v3 ² • E64is_v3 ² • E80ids_v4 ³ • L8s_v2 ⁴ 	<ul style="list-style-type: none"> • DS3_v2 • E4s_v3 	<ul style="list-style-type: none"> • DS4_v2 • DS13_v2 • E8s_v3 	<ul style="list-style-type: none"> • DS5_v2 • DS14_v2 • DS15_v2 • E32s_v3 ² • E48s_v3 ² • E64is_v3 ² • E80ids_v4 ³ 	<ul style="list-style-type: none"> • DS3_v2 • DS4_v2 • DS5_v2 • DS13_v2 • DS14_v2 • DS15_v2 • E4s_v3 • E8s_v3 • E32s_v3 ² • E48s_v3 ² • E64is_v3 ² • E80ids_v4 ³ • L8s_v2 ⁴ 	<ul style="list-style-type: none"> • DS3_v2 • DS4_v2 • DS5_v2 • DS13_v2 • DS14_v2 • DS15_v2 • E4s_v3 • E8s_v3 • E32s_v3 ² • E48s_v3 ² • E64is_v3 ² • E80ids_v4 ³ • L8s_v2 ⁴
Supported disk types ⁵	Standard HDD Managed Disks, Standard SSD Managed Disks, and Premium SSD Managed Disks					

Notes:

1. Data tiering to Azure Blob storage isn't supported with PAYGO Explore.
2. This VM type uses an [Ultra SSD](#) for VNVVRAM, which provides better write performance.
3. This VM is recommended only when Azure maintenance control is needed. It's not recommended for any other use case due to the higher pricing.
4. This VM type includes local NVMe storage, which Cloud Volumes ONTAP uses as *Flash Cache*. Flash Cache speeds access to data through real-time intelligent caching of recently read user data and NetApp metadata. It is effective for random read-intensive workloads, including databases, email, and file services. Compression must be disabled on all volumes to take advantage of the Flash Cache performance improvements. [Learn more](#).
5. Enhanced write performance is enabled when using SSDs, but not when using the DS3_v2 virtual machine type.
6. For Azure region support, see [Cloud Volumes Global Regions](#).
7. Cloud Volumes ONTAP can run on either a Reserved or On-demand VM instance from your cloud provider. Solutions that use other VM instance types aren't supported.

HA pairs

You can choose from the following configurations when deploying Cloud Volumes ONTAP as an HA pair in Azure.

	Freemium	PAYGO Standard	PAYGO Premium	Node-based license	Capacity-based license
Maximum system capacity (disks + object storage)	500 GB	10 TB	368 TB	368 TB per license	2 PB
Supported virtual machine types	<ul style="list-style-type: none"> • DS4_v2 • DS5_v2 ¹ • DS13_v2 • DS14_v2 • DS15_v2 ¹ • E8s_v3 • E48s_v3 ¹ • E80ids_v4 ² 	<ul style="list-style-type: none"> • DS4_v2 • DS13_v2 	<ul style="list-style-type: none"> • DS5_v2 ¹ • DS14_v2 ¹ • DS15_v2 ¹ • E8s_v3 • E48s_v3 ¹ • E80ids_v4 ² 	<ul style="list-style-type: none"> • DS4_v2 • DS13_v2 • DS14_v2 ¹ • DS15_v2 ¹ • E8s_v3 • E48s_v3 ¹ • E80ids_v4 ² 	<ul style="list-style-type: none"> • DS4_v2 • DS5_v2 ¹ • DS13_v2 • DS14_v2 ¹ • DS15_v2 ¹ • E8s_v3 • E48s_v3 ¹ • E80ids_v4 ²
Supported disk types	Premium page blobs				

Notes:

1. Cloud Volumes ONTAP supports high write speed with these VM types when using an HA pair. High write speed is supported with all instance types when using a single node system. [Learn more about choosing a write speed](#).
2. This VM is recommended only when Azure maintenance control is needed. It's not recommended for any other use case due to the higher pricing.
3. PAYGO Explore isn't supported with HA pairs in Azure.
4. For Azure region support, see [Cloud Volumes Global Regions](#).
5. Cloud Volumes ONTAP can run on either a Reserved or On-demand VM instance from your cloud provider. Solutions that use other VM instance types aren't supported.

Supported disk sizes

In Azure, an aggregate can contain up to 12 disks that are all the same type and size.

Single node systems

Single node systems use Azure Managed Disks. The following disk sizes are supported:

Premium SSD	Standard SSD	Standard HDD
• 500 GB	• 100 GB	• 100 GB
• 1 TB	• 500 GB	• 500 GB
• 2 TB	• 1 TB	• 1 TB
• 4 TB	• 2 TB	• 2 TB
• 8 TB	• 4 TB	• 4 TB
• 16 TB	• 8 TB	• 8 TB
• 32 TB	• 16 TB	• 16 TB
	• 32 TB	• 32 TB

HA pairs

HA pairs use Premium page blobs. The following disk sizes are supported:

- 500 GB
- 1 TB
- 2 TB
- 4 TB
- 8 TB

Supported configurations for Cloud Volumes ONTAP 9.9.1 in GCP

Several Cloud Volumes ONTAP configurations are supported in GCP.

Supported configurations by license

Cloud Volumes ONTAP is available in Google Cloud Platform as a single node system and as a high-availability (HA) pair of nodes for fault tolerance and nondisruptive operations.

Upgrading a single node system to an HA pair isn't supported. If you want to switch between a single node system and an HA pair, then you need to deploy a new system and replicate data from the existing system to the new system.

	Freemium	PAYGO Explore	PAYGO Standard	PAYGO Premium	Node-based license	Capacity-based license
Maximum system capacity (disks + object storage)¹	500 GB	2 TB ²	10 TB	368 TB	368 TB per license	2 PB

	Freemium	PAYGO Explore	PAYGO Standard	PAYGO Premium	Node-based license	Capacity-based license
Supported machine types ³	<ul style="list-style-type: none"> • n1-standard-8 • n1-standard-32 • n2-standard-4 • n2-standard-8 • n2-standard-32 	<ul style="list-style-type: none"> • n2-standard-4 	<ul style="list-style-type: none"> • n1-standard-8 • n2-standard-8 	<ul style="list-style-type: none"> • n1-standard-32 • n2-standard-32 	<ul style="list-style-type: none"> • n1-standard-8 • n1-standard-32 • n2-standard-4 • n2-standard-8 • n2-standard-32 	<ul style="list-style-type: none"> • n1-standard-8 • n1-standard-32 • n2-standard-4 • n2-standard-8 • n2-standard-32
Supported disk types ⁴	Zonal persistent disks (SSD, balanced, and standard)					

Notes:

1. Disk limits can prevent you from reaching the maximum system capacity limit by using disks alone. You can reach the capacity limit by [tiering inactive data to object storage](#).

[Learn more about disk limits in GCP](#).

2. Data tiering to Google Cloud Storage isn't supported with PAYGO Explore.
3. 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.

4. Enhanced write performance is enabled when using SSDs.
5. The Cloud Manager interface shows an additional supported machine type for Standard and BYOL: n1-highmem-4. However, this machine type isn't meant for production environments. We've made it available for a specific lab environment only.
6. For Google Cloud Platform region support, see [Cloud Volumes Global Regions](#).
7. Cloud Volumes ONTAP can run on either a Reserved or On-demand VM instance from your cloud provider. Solutions that use other VM instance types aren't supported.

Supported disk sizes

In GCP, an aggregate can contain up to 6 disks that are all the same type and size. The following disk sizes are supported:

- 100 GB

- 500 GB
- 1 TB
- 2 TB
- 4 TB
- 8 TB
- 16 TB
- 64 TB

Storage limits

Storage limits for Cloud Volumes ONTAP 9.9.1 in AWS

Cloud Volumes ONTAP has storage configuration limits to provide reliable operations. For best performance, do not configure your system at the maximum values.

Maximum system capacity by license

The maximum system capacity for a Cloud Volumes ONTAP system is determined by its license. The maximum system capacity includes disk-based storage plus object storage used for data tiering.

NetApp doesn't support exceeding the system capacity limit. If you reach the licensed capacity limit, Cloud Manager displays an action required message and no longer allows you to add additional disks.

For some configurations, disk limits prevent you from reaching the capacity limit by using disks alone. In those cases, you can reach the capacity limit by [tiering inactive data to object storage](#). Refer to capacity and disk limits below for more details.

License	Maximum system capacity (disks + object storage)
Freemium	500 GB
PAYGO Explore	2 TB (data tiering is not supported with Explore)
PAYGO Standard	10 TB
PAYGO Premium	368 TB
Node-based license	368 TB per license
Capacity-based license	2 PB

For HA, is the license capacity limit per node or for the entire HA pair?

The capacity limit is for the entire HA pair. It is not per node. For example, if you use the Premium license, you can have up to 368 TB of capacity between both nodes.

For an HA system in AWS, does mirrored data count against the capacity limit?

No, it doesn't. Data in an AWS HA pair is synchronously mirrored between the nodes so that the data is available in the event of failure. For example, if you purchase an 8 TB disk on node A, Cloud Manager also allocates an 8 TB disk on node B that is used for mirrored data. While 16 TB of capacity was provisioned, only 8 TB counts against the license limit.

Disk and tiering limits by EC2 instance

Cloud Volumes ONTAP uses EBS volumes as disks, with a maximum disk size of 16 TB. The sections below show disk and tiering limits by EC2 instance family because many EC2 instance types have different disk limits. Disk limits are also different between single node systems and HA pairs.

Note the following:

- c4, m4, and r4 instance types are not supported with new Cloud Volumes ONTAP 9.9.1 systems. However, we're still showing disk limits for these instance types because you can upgrade a system to the 9.9.1 release when running on one of these instance types.
- The disk limits below are specific to disks that contain user data. The limits do not include the boot disk and root disk.
- You can now purchase multiple node-based licenses for a Cloud Volumes ONTAP BYOL system to allocate more than 368 TB of capacity. The number of licenses that you can purchase for a single node system or HA pair is unlimited. 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](#). [Learn how to add additional system licenses to Cloud Volumes ONTAP](#).

Single node with a Premium license

Instance family	Max disks per node	Max system capacity with disks alone	Max system capacity with disks and data tiering
c5, m5, and r5 instances	21 ¹	336 TB	368 TB
c4, m4, and r4 instances	34	368 TB	368 TB

1. 21 data disks is the limit for *new* deployments of Cloud Volumes ONTAP. If you upgrade a system that was created with version 9.7 or earlier, then the system continues to support 22 disks. One less data disk is supported on new systems that use these instance types because of the addition of a core disk starting with the 9.8 release.

Single node with node-based licensing

Instance family	Max disks per node	Max system capacity with one license		Max system capacity with multiple licenses	
		Disks alone	Disks + data tiering	Disks alone	Disks + data tiering
c5, m5, and r5 instances	21 ¹	336 TB	368 TB	336 TB	368 TB x each license
c4, m4, and r4 instances	34	368 TB	368 TB	544 TB	368 TB x each license

- 21 data disks is the limit for *new* deployments of Cloud Volumes ONTAP. If you upgrade a system that was created with version 9.7 or earlier, then the system continues to support 22 disks. One less data disk is supported on new systems that use these instance types because of the addition of a core disk starting with the 9.8 release.

Single node with capacity-based licensing

Instance family	Max disks per node	Max system capacity with disks alone	Max system capacity with disks and data tiering
c5, m5, and r5 instances	21	336 TB	2 PB

HA pairs with a Premium license

Instance family	Max disks per node	Max system capacity with disks alone	Max system capacity with disks and data tiering
c5, m5, and r5 instances	18 ¹	288 TB	368 TB
c4, m4, and r4 instances	31	368 TB	368 TB

- 18 data disks is the limit for *new* deployments of Cloud Volumes ONTAP. If you upgrade a system that was created with version 9.7 or earlier, then the system continues to support 19 disks. One less data disk is supported on new systems that use these instance types because of the addition of a core disk starting with the 9.8 release.

HA pairs with node-based licensing

Instance family	Max disks per node	Max system capacity with one license		Max system capacity with multiple licenses	
		Disks alone	Disks + data tiering	Disks alone	Disks + data tiering
c5, m5, and r5 instances	18 ¹	288 TB	368 TB	288 TB	368 TB x each license
c4, m4, and r4 instances	31	368 TB	368 TB	496 TB	368 TB x each license

- 18 data disks is the limit for *new* deployments of Cloud Volumes ONTAP. If you upgrade a system that was created with version 9.7 or earlier, then the system continues to support 19 disks. One less data disk is supported on new systems that use these instance types because of the addition of a core disk starting with the 9.8 release.

HA pairs with capacity-based licensing

Instance family	Max disks per node	Max system capacity with disks alone	Max system capacity with disks and data tiering
c5, m5, and r5 instances	18	288 TB	2 PB

Aggregate limits

Cloud Volumes ONTAP uses AWS volumes as disks and groups them into *aggregates*. Aggregates provide storage to volumes.

Parameter	Limit
Maximum number of aggregates	Single node: Same as the disk limit HA pairs: 18 in a node ¹
Maximum aggregate size	96 TB of raw capacity ²
Disks per aggregate	1-6 ³
Maximum number of RAID groups per aggregate	1

Notes:

1. It's not possible to create 18 aggregates on both nodes in an HA pair because doing so would exceed the data disk limit.
2. The aggregate capacity limit is based on the disks that comprise the aggregate. The limit does not include object storage used for data tiering.
3. All disks in an aggregate must be the same size.

Storage VM limits

Some configurations enable you to create additional storage VMs (SVMs) for Cloud Volumes ONTAP.

[Learn how to create additional storage VMs.](#)

License type	Instance family	Storage VM limit
PAYGO	c4, m4, and r4	<ul style="list-style-type: none">• 1 storage VM for serving data• 1 storage VM for disaster recovery
	c5, m5, and r5	<ul style="list-style-type: none">• 1 storage VM for serving data• 1 storage VM for disaster recovery
Freemium	c5, m5, and r5	<ul style="list-style-type: none">• 24 storage VMs total ^{1,2}
Capacity-based license ³	c5, m5, and r5	<ul style="list-style-type: none">• 24 storage VMs total ^{1,2}
Node-based BYOL ⁴	c4, m4, and r4	<ul style="list-style-type: none">• 1 storage VM for serving data• 1 storage VM for disaster recovery
	c5, m5, and r5	<ul style="list-style-type: none">• 24 storage VMs total ^{1,2}

1. The limit can be lower, depending on the EC2 instance type that you use. The limits per instance are listed in the section below.
2. These 24 storage VMs can serve data or be configured for disaster recovery (DR).

- For capacity-based licensing, there are no extra licensing costs for additional storage VMs, but there is a 4 TB minimum capacity charge per storage VM. For example, if you create two storage VMs and each has 2 TB of provisioned capacity, you'll be charged a total of 8 TB.
- For node-based BYOL, an add-on license is required for each additional *data-serving* storage VM beyond the first storage VM that comes with Cloud Volumes ONTAP by default. Contact your account team to obtain a storage VM add-on license.

Storage VMs that you configure for disaster recovery (DR) don't require an add-on license (they are free of charge), but they do count against the storage VM limit. For example, if you have 12 data-serving storage VMs and 12 storage VMs configured for disaster recovery, then you've reached the limit and can't create any additional storage VMs.

Storage VM limit by EC2 instance type

When you create an additional storage VM, you need to allocate private IP addresses to port e0a. The table below identifies the maximum number of private IPs per interface, as well as the number of IP addresses that are available on port e0a after Cloud Volumes ONTAP has been deployed. The number of available IP addresses directly affects the maximum number of storage VMs for that configuration.

The instances listed below are for the c5, m5, and r5 instance families.

Configuration	Instance type	Max private IPs per interface	IPs remaining after deployment ¹	Max storage VMs without a mgmt LIF ^{2,3}	Max storage VMs with a mgmt LIF ^{2,3}
Single node	*.2xlarge	15	9	10	5
	*.4xlarge	30	24	24	12
	*.8xlarge	30	24	24	12
	*.9xlarge	30	24	24	12
	*.12xlarge	30	24	24	12
	*.16xlarge	50	44	24	12
	*.18xlarge	50	44	24	12
	*.24xlarge	50	44	24	12
HA pair in single AZ	*.2xlarge	15	10	11	5
	*.4xlarge	30	25	24	12
	*.8xlarge	30	25	24	12
	*.9xlarge	30	25	24	12
	*.12xlarge	30	25	24	12
	*.16xlarge	50	45	24	12
	*.18xlarge	50	45	24	12
	*.24xlarge	50	44	24	12

Configuration	Instance type	Max private IPs per interface	IPs remaining after deployment ¹	Max storage VMs without a mgmt LIF ^{2,3}	Max storage VMs with a mgmt LIF ^{2,3}
HA pair in multi AZs	*.2xlarge	15	12	13	13
	*.4xlarge	30	27	24	24
	*.8xlarge	30	27	24	24
	*.9xlarge	30	27	24	24
	*.12xlarge	30	27	24	24
	*.16xlarge	50	47	24	24
	*.18xlarge	50	47	24	24
	*.24xlarge	50	44	24	12

1. This number indicates how many *remaining* private IP addresses are available on port e0a after Cloud Volumes ONTAP is deployed and set up. For example, a *.2xlarge system supports a maximum of 15 IP addresses per network interface. When an HA pair is deployed in a single AZ, 5 private IP addresses are allocated to port e0a. As a result, an HA pair that uses a *.2xlarge instance type has 10 private IP addresses remaining for additional storage VMs.
2. The number listed in these columns includes the initial storage VM that Cloud Manager creates by default. For example, if 24 is listed in this column, it means that you can create 23 additional storage VMs for a total of 24.
3. A management LIF for the storage VM is optional. A management LIF provides a connection to management tools like SnapCenter.

Because it requires a private IP address, it will limit the number of additional storage VMs that you can create. The only exception is an HA pair in multiple AZs. In that case, the IP address for the management LIF is a *floating* IP address so it doesn't count against the *private* IP limit.

File and volume limits

Logical storage	Parameter	Limit
Files	Maximum size	16 TB
	Maximum per volume	Volume size dependent, up to 2 billion
FlexClone volumes	Hierarchical clone depth ¹	499
FlexVol volumes	Maximum per node	500
	Minimum size	20 MB
	Maximum size	Dependent on the size of the aggregate
Qtrees	Maximum per FlexVol volume	4,995
Snapshot copies	Maximum per FlexVol volume	1,023

1. Hierarchical clone depth is the maximum depth of a nested hierarchy of FlexClone volumes that can be created from a single FlexVol volume.

iSCSI storage limits

iSCSI storage	Parameter	Limit
LUNs	Maximum per node	1,024
	Maximum number of LUN maps	1,024
	Maximum size	16 TB
	Maximum per volume	512
igroups	Maximum per node	256
Initiators	Maximum per node	512
	Maximum per igroup	128
iSCSI sessions	Maximum per node	1,024
LIFs	Maximum per port	32
	Maximum per portset	32
Portsets	Maximum per node	256

Storage limits for Cloud Volumes ONTAP 9.9.1 in Azure

Cloud Volumes ONTAP has storage configuration limits to provide reliable operations. For best performance, do not configure your system at the maximum values.

Maximum system capacity by license

The maximum system capacity for a Cloud Volumes ONTAP system is determined by its license. The maximum system capacity includes disk-based storage plus object storage used for data tiering.

NetApp doesn't support exceeding the system capacity limit. If you reach the licensed capacity limit, Cloud Manager displays an action required message and no longer allows you to add additional disks.

License	Maximum system capacity (disks + object storage)
Freemium	500 GB
PAYGO Explore	2 TB (data tiering is not supported with Explore)
PAYGO Standard	10 TB
PAYGO Premium	368 TB
Node-based license	368 TB per license
Capacity-based license	2 PB

For HA, is the license capacity limit per node or for the entire HA pair?

The capacity limit is for the entire HA pair. It is not per node. For example, if you use the Premium license, you can have up to 368 TB of capacity between both nodes.

Disk and tiering limits by VM size

The disk limits below are specific to disks that contain user data. The limits do not include the root disk, core disk, and VNV RAM.

The tables below show the maximum system capacity by VM size with disks alone, and with disks and cold data tiering to object storage.

- Single node systems can use Standard HDD Managed Disks, Standard SSD Managed Disks, and Premium SSD Managed Disks, with up to 32 TB per disk. The number of supported disks varies by VM size.
- HA systems use Premium page blobs as disks, with up to 8 TB per page blob. The number of supported disks varies by VM size.



You can purchase multiple node-based licenses for a Cloud Volumes ONTAP BYOL system to allocate more than 368 TB of capacity. The number of licenses that you can purchase for a single node system or HA pair is unlimited. 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](#). Learn how to add additional system licenses to Cloud Volumes ONTAP.

Single node with a Premium license

VM size	Max data disks per node	Max system capacity with disks alone	Max system capacity with disks and data tiering
DS5_v2	61	368 TB	368 TB
DS14_v2	61	368 TB	368 TB
DS15_v2	61	368 TB	368 TB
E32s_v3	29	368 TB	368 TB
E48s_v3	29	368 TB	368 TB
E64is_v3	29	368 TB	368 TB
E80ids_v4	29	368 TB	368 TB

Single node with node-based licensing



For some VM types, you'll need several BYOL licenses to reach the max system capacity listed below. For example, you'd need 6 BYOL licenses to reach 1.95 PB with DS5_v2.

VM size	Max data disks per node	Max system capacity with one license		Max system capacity with multiple licenses	
		Disks alone	Disks + data tiering	Disks alone	Disks + data tiering
DS3_v2	13	368 TB	368 TB	416 TB	368 TB x each license
DS4_v2	29	368 TB	368 TB	928 TB	368 TB x each license
DS5_v2	61	368 TB	368 TB	1.95 PB	368 TB x each license
DS13_v2	29	368 TB	368 TB	928 TB	368 TB x each license
DS14_v2	61	368 TB	368 TB	1.95 PB	368 TB x each license
DS15_v2	61	368 TB	368 TB	1.95 PB	368 TB x each license
E4s_v3	5	160 TB	368 TB	160 TB	368 TB x each license
E8s_v3	13	368 TB	368 TB	416 TB	368 TB x each license
E32s_v3	29	368 TB	368 TB	928 TB	368 TB x each license
E48s_v3	29	368 TB	368 TB	928 TB	368 TB x each license
E64is_v3	29	368 TB	368 TB	928 TB	368 TB x each license
E80ids_v4	29	368 TB	368 TB	928 TB	368 TB x each license
L8s_v2	13	368 TB	368 TB	416 TB	368 TB x each license

Single node with capacity-based licensing

VM size	Max data disks per node	Max system capacity with disks alone	Max system capacity with disks and data tiering
DS3_v2	13	416 TB	2 PB
DS4_v2	29	928 TB	2 PB
DS5_v2	61	1.95 TB	2 PB
DS13_v2	29	928 TB	2 PB
DS14_v2	61	1.95 TB	2 PB
DS15_v2	61	1.95 TB	2 PB

VM size	Max data disks per node	Max system capacity with disks alone	Max system capacity with disks and data tiering
E4s_v3	5	160 TB	2 PB
E8s_v3	13	416 TB	2 PB
E32s_v3	29	928 TB	2 PB
E48s_v3	29	928 TB	2 PB
E64is_v3	29	928 TB	2 PB
E80ids_v4	29	928 TB	2 PB
L8s_v2	13	416 TB	2 PB

HA pairs with a Premium license

VM size	Max data disks per node	Max system capacity with disks alone	Max system capacity with disks and data tiering
DS5_v2	61	368 TB	368 TB
DS14_v2	61	368 TB	368 TB
DS15_v2	61	368 TB	368 TB
E8s_v3	13	208 TB	368 TB
E48s_v3	29	368 TB	368 TB
E80ids_v4	29	368 TB	368 TB

HA pairs with node-based licensing



For some VM types, you'll need several BYOL licenses to reach the max system capacity listed below. For example, you'd need 3 BYOL licenses to reach 976 TB with DS5_v2.

VM size	Max data disks per node	Max system capacity with one license		Max system capacity with multiple licenses	
		Disks alone	Disks + data tiering	Disks alone	Disks + data tiering
DS4_v2	29	368 TB	368 TB	464 TB	368 TB x each license
DS5_v2	61	368 TB	368 TB	976 TB	368 TB x each license
DS13_v2	29	368 TB	368 TB	464 TB	368 TB x each license
DS14_v2	61	368 TB	368 TB	976 TB	368 TB x each license

VM size	Max data disks per node	Max system capacity with one license		Max system capacity with multiple licenses	
DS15_v2	61	368 TB	368 TB	976 TB	368 TB x each license
E8s_v3	13	208 TB	368 TB	208 TB	368 TB x each license
E48s_v3	29	368 TB	368 TB	464 TB	368 TB x each license
E80ids_v4	29	368 TB	368 TB	464 TB	368 TB x each license

HA pairs with capacity-based licensing

VM size	Max data disks per node	Max system capacity with disks alone	Max system capacity with disks and data tiering
DS4_v2	29	464 TB	2 PB
DS5_v2	61	976 TB	2 PB
DS13_v2	29	464 TB	2 PB
DS14_v2	61	976 TB	2 PB
DS15_v2	61	976 TB	2 PB
E8s_v3	13	208 TB	2 PB
E48s_v3	29	464 TB	2 PB
E80ids_v4	29	464 TB	2 PB

Aggregate limits

Cloud Volumes ONTAP uses Azure storage as disks and groups them into *aggregates*. Aggregates provide storage to volumes.

Parameter	Limit
Maximum number of aggregates	Same as the disk limit
Maximum aggregate size ¹	384 TB of raw capacity for single node ² 352 TB of raw capacity for single node with PAYGO 96 TB of raw capacity for HA pairs
Disks per aggregate	1-12 ³
Maximum number of RAID groups per aggregate	1

Notes:

1. The aggregate capacity limit is based on the disks that comprise the aggregate. The limit does not include

- object storage used for data tiering.
2. If using node-based licensing, two BYOL licenses are required to reach 384 TB.
 3. All disks in an aggregate must be the same size.

Storage VM limits

Some configurations enable you to create additional storage VMs (SVMs) for Cloud Volumes ONTAP.

These are the tested limits. While it is theoretically possible to configure additional storage VMs, it's not supported.

[Learn how to create additional storage VMs.](#)

License type	Storage VM limit
PAYGO	<ul style="list-style-type: none"> • 1 storage VM for serving data • 1 storage VM for disaster recovery
Freemium	24 storage VMs total ^{1,2}
Capacity-based license ³	24 storage VMs total ^{1,2}
Node-based BYOL ⁴	24 storage VMs total ^{1,2}

1. These 24 storage VMs can serve data or be configured for disaster recovery (DR).
2. Each storage VM can have up to three LIFs where two are data LIFs and one is an SVM management LIF.
3. For capacity-based licensing, there are no extra licensing costs for additional storage VMs, but there is a 4 TB minimum capacity charge per storage VM. For example, if you create two storage VMs and each has 2 TB of provisioned capacity, you'll be charged a total of 8 TB.
4. For node-based BYOL, an add-on license is required for each additional *data-serving* storage VM beyond the first storage VM that comes with Cloud Volumes ONTAP by default. Contact your account team to obtain a storage VM add-on license.

Storage VMs that you configure for disaster recovery (DR) don't require an add-on license (they are free of charge), but they do count against the storage VM limit. For example, if you have 12 data-serving storage VMs and 12 storage VMs configured for disaster recovery, then you've reached the limit and can't create any additional storage VMs.

File and volume limits

Logical storage	Parameter	Limit
Files	Maximum size	16 TB
	Maximum per volume	Volume size dependent, up to 2 billion
FlexClone volumes	Hierarchical clone depth ²	499

Logical storage	Parameter	Limit
FlexVol volumes	Maximum per node	500
	Minimum size	20 MB
	Maximum size	Azure HA: Dependent on the size of the aggregate ³ Azure single node: 100 TB
Qtrees	Maximum per FlexVol volume	4,995
Snapshot copies	Maximum per FlexVol volume	1,023

Notes:

- Cloud Manager does not provide any setup or orchestration support for SVM disaster recovery. It also does not support storage-related tasks on an additional SVM. You must use System Manager or the CLI for SVM disaster recovery.
 - [SVM Disaster Recovery Preparation Express Guide](#)
 - [SVM Disaster Recovery Express Guide](#)
- Hierarchical clone depth is the maximum depth of a nested hierarchy of FlexClone volumes that can be created from a single FlexVol volume.
- Less than 100 TB is supported for this configuration because aggregates on HA pairs are limited to 96 TB of *raw* capacity.

iSCSI storage limits

iSCSI storage	Parameter	Limit
LUNs	Maximum per node	1,024
	Maximum number of LUN maps	1,024
	Maximum size	16 TB
	Maximum per volume	512
igroups	Maximum per node	256
Initiators	Maximum per node	512
	Maximum per igroup	128
iSCSI sessions	Maximum per node	1,024
LIFs	Maximum per port	32
	Maximum per portset	32
Portsets	Maximum per node	256

Storage limits for Cloud Volumes ONTAP 9.9.1 in GCP

Cloud Volumes ONTAP has storage configuration limits to provide reliable operations. For best performance, do not configure your system at the maximum values.

Maximum system capacity by license

The maximum system capacity for a Cloud Volumes ONTAP system is determined by its license. The maximum system capacity includes disk-based storage plus object storage used for data tiering.

NetApp doesn't support exceeding the system capacity limit. If you reach the licensed capacity limit, Cloud Manager displays an action required message and no longer allows you to add additional disks.

For some configurations, disk limits prevent you from reaching the capacity limit by using disks alone. You can reach the capacity limit by [tiering inactive data to object storage](#). Refer to the disk limits below for more details.

License	Maximum system capacity (disks + object storage)
Freemium	500 GB
PAYGO Explore	2 TB (data tiering is not supported with Explore)
PAYGO Standard	10 TB
PAYGO Premium	368 TB
Node-based license	368 TB per license
Capacity-based license	2 PB

For an HA pair, is the licensed capacity limit per node or for the entire HA pair?

The capacity limit is for the entire HA pair. It is not per node. For example, if you use the Premium license, you can have up to 368 TB of capacity between both nodes.

For an HA pair, does mirrored data count against the licensed capacity limit?

No, it doesn't. Data in an HA pair is synchronously mirrored between the nodes so that the data is available in the event of failure in Google Cloud. For example, if you purchase an 8 TB disk on node A, Cloud Manager also allocates an 8 TB disk on node B that is used for mirrored data. While 16 TB of capacity was provisioned, only 8 TB counts against the license limit.

Disk and tiering limits

The table below shows the maximum system capacity with disks alone, and with disks and cold data tiering to object storage. The disk limits are specific to disks that contain user data. The limits do not include the boot disk and root disk.

Parameter	Limit
Maximum data disks	<ul style="list-style-type: none">• 124 for single node systems• 123 per node for HA pairs
Maximum disk size	64 TB

Parameter	Limit
Maximum system capacity with disks alone	256 TB ¹
Maximum system capacity with disks and cold data tiering to a Google Cloud Storage bucket	Depends on the license. See the table above.

¹ This limit is defined by virtual machine limits in Google Cloud Platform.

Aggregate limits

Cloud Volumes ONTAP groups Google Cloud Platform disks into *aggregates*. Aggregates provide storage to volumes.

Parameter	Limit
Maximum number of data aggregates ¹	<ul style="list-style-type: none"> • 99 for single node • 64 for an entire HA pair
Maximum aggregate size	256 TB of raw capacity ²
Disks per aggregate	1-6 ³
Maximum number of RAID groups per aggregate	1

Notes:

1. The maximum number of data aggregates doesn't include the root aggregate.
2. The aggregate capacity limit is based on the disks that comprise the aggregate. The limit does not include object storage used for data tiering.
3. All disks in an aggregate must be the same size.

Logical storage limits

Logical storage	Parameter	Limit
Storage virtual machines (SVMs)	Maximum number for Cloud Volumes ONTAP (HA pair or single node)	One data-serving SVM and one destination SVM used for disaster recovery. You can activate the destination SVM for data access if there's an outage on the source SVM. ¹ The one data-serving SVM spans the entire Cloud Volumes ONTAP system (HA pair or single node).
Files	Maximum size	16 TB
	Maximum per volume	Volume size dependent, up to 2 billion
FlexClone volumes	Hierarchical clone depth ²	499

Logical storage	Parameter	Limit
FlexVol volumes	Maximum per node	500
	Minimum size	20 MB
	Maximum size	100 TB
Qtrees	Maximum per FlexVol volume	4,995
Snapshot copies	Maximum per FlexVol volume	1,023

Notes:

- Cloud Manager does not provide any setup or orchestration support for SVM disaster recovery. It also does not support storage-related tasks on an additional SVM. You must use System Manager or the CLI for SVM disaster recovery.
 - [SVM Disaster Recovery Preparation Express Guide](#)
 - [SVM Disaster Recovery Express Guide](#)
- Hierarchical clone depth is the maximum depth of a nested hierarchy of FlexClone volumes that can be created from a single FlexVol volume.

iSCSI storage limits

iSCSI storage	Parameter	Limit
LUNs	Maximum per node	1,024
	Maximum number of LUN maps	1,024
	Maximum size	16 TB
	Maximum per volume	512
igroups	Maximum per node	256
Initiators	Maximum per node	512
	Maximum per igroup	128
iSCSI sessions	Maximum per node	1,024
LIFs	Maximum per port	1
	Maximum per portset	32
Portsets	Maximum per node	256

Known issues for Cloud Volumes ONTAP 9.9.1

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

There are no known issues in this release specific to Cloud Volumes ONTAP.

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

Known limitations

Limitations for Cloud Volumes ONTAP 9.9.1 in all cloud providers

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.

The following limitations apply to Cloud Volumes ONTAP in all cloud providers: AWS, Azure, and GCP.

Cloud Volumes ONTAP supports Reserved and On-demand VM instances

Cloud Volumes ONTAP can run on either a Reserved or On-demand VM instance from your cloud provider. Other types of VM instances aren't supported.

Automatic application resource management solutions shouldn't be used

Automatic application resource management solutions should not manage Cloud Volumes ONTAP systems. Doing so can result in a change to an unsupported configuration. For example, the solution might change Cloud Volumes ONTAP to an unsupported VM instance type.

Software updates must be completed by Cloud Manager

Upgrades of Cloud Volumes ONTAP must be completed from Cloud Manager. You should not upgrade Cloud Volumes ONTAP by using System Manager or the CLI. Doing so can impact system stability.

Cloud Volumes ONTAP deployment must not be modified from your cloud provider's console

Changes to a Cloud Volumes ONTAP configuration from your cloud provider's console results in an unsupported configuration. Any changes to the Cloud Volumes ONTAP resources that Cloud Manager creates and manages can impact system stability and Cloud Manager's ability to manage the system.

Disks and aggregates must be managed from Cloud Manager

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

SnapManager licensing limitation

SnapManager per-server licenses are supported with Cloud Volumes ONTAP. Per-storage system (SnapManager suite) licenses are not supported.

Unsupported ONTAP features

The following features are not supported with Cloud Volumes ONTAP:

- Aggregate-level inline deduplication
- Aggregate-level background deduplication
- Disk maintenance center
- Disk sanitization

- FabricPool mirroring
- Fibre Channel (FC)
- Flash Pools
- Infinite Volumes
- Interface groups
- Intranode LIF failover
- MetroCluster
- ONTAP S3 in AWS and Google Cloud (the S3 protocol is supported in Azure)
- RAID4, RAID-DP, RAID-TEC (RAID0 is supported)
- Service Processor
- SnapLock Compliance mode (Enterprise mode is supported)
- SnapMirror Synchronous
- VLANs

Known limitations for Cloud Volumes ONTAP 9.9.1 in AWS

The following known limitations are specific to Cloud Volumes ONTAP in Amazon Web Services. Be sure to also review [Limitations for Cloud Volumes ONTAP 9.9.1 in all cloud providers](#).

AWS Outpost limitations

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

Flash Cache limitations

C5D and R5D instance types include local NVMe storage, which Cloud Volumes ONTAP uses as *Flash Cache*. Note the following limitations:

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

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

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

False alarms reported by Amazon CloudWatch

Cloud Volumes ONTAP does not release CPUs when idle, so [Amazon CloudWatch](#) can report a high CPU warning for the EC2 instance because it sees 100% usage. You can ignore this alarm. The ONTAP statistics command displays the true usage of the CPUs.

Cloud Volumes ONTAP HA pairs do not support immediate storage giveback

After a node reboots, the partner must sync data before it can return the storage. The time that it takes to resync data depends on the amount of data written by clients while the node was down and the data write speed during the time of giveback.

[Learn how storage works in a Cloud Volumes ONTAP HA pair running in AWS.](#)

Known limitations for Cloud Volumes ONTAP 9.9.1 in Azure

The following known limitations are specific to Cloud Volumes ONTAP in Microsoft Azure. Be sure to also review [Limitations for Cloud Volumes ONTAP 9.9.1 in all cloud providers](#).

Flash Cache limitations

The Standard_L8s_v2 VM type includes local NVMe storage, which Cloud Volumes ONTAP uses as *Flash Cache*. Note the following limitations for Flash Cache:

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

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

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

HA limitations

The following limitations affect Cloud Volumes ONTAP HA pairs in Microsoft Azure:

- NFSv4 isn't supported. NFSv3 is supported.
- HA pairs aren't supported in some regions.

[See the list of supported Azure regions.](#)

Pay-as-you-go not available for CSP partners

If you are a Microsoft Cloud Solution Provider (CSP) partner, you cannot deploy Cloud Volumes ONTAP Explore, Standard, or Premium because pay-as-you-go subscriptions are not available for CSP partners. You must purchase a license and deploy Cloud Volumes ONTAP BYOL.

Known limitations for Cloud Volumes ONTAP 9.9.1 in GCP

There are no known limitations specific to Cloud Volumes ONTAP in Google Cloud Platform. See the [Limitations for Cloud Volumes ONTAP 9.9.1 in all cloud providers](#).

9.9.0 Release Notes

What's new in Cloud Volumes ONTAP 9.9.0

Cloud Volumes ONTAP 9.9.0 includes several new features and enhancements.

Additional features and enhancements are also introduced in the latest versions of Cloud Manager. See the [Cloud Manager Release Notes](#) for details.

Latest update (21 Apr 2021)

In AWS, you can now configure up to 24 storage VMs (SVMs) for disaster recovery (DR). The previous limit was 12 storage VMs used for DR.

[Learn more about storage VM limits.](#)

Latest updates (12 Apr 2021)

A few updates have been made since Cloud Volumes ONTAP 9.9.0 was released.

AWS updates

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

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

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

These EBS disk changes were introduced as part of Cloud Manager 3.9.5.

Azure updates

- New E series VM types are supported:
 - E4s_v3 with single node systems using PAYGO Explore or BYOL
 - E8s_v3 with single node systems using PAYGO Standard or BYOL, and HA pairs using PAYGO Premium or BYOL
 - E64is_v3 with single node systems using PAYGO Premium or BYOL
- Up to 24 storage VMs (SVMs) are supported with Cloud Volumes ONTAP BYOL. Those 24 storage VMs can serve data or be configured for disaster recovery (DR).

The previous limit in the 9.9.0 release was 12 storage VMs used for DR in Azure.

9.9.0 GA (9 Mar 2021)

The 9.9.0 GA release is available in AWS, Azure, and Google Cloud Platform. The release includes the following new features and enhancements.

Improved write performance

This release includes improved write performance for Cloud Volumes ONTAP in all cloud providers and on all configurations.

Support for new EC2 instance types

Cloud Volumes ONTAP is now supported with the following Amazon EC2 instance types:

- m5a.2xlarge with Standard and BYOL
- m5a.16xlarge with Premium and BYOL
- c5a.12xlarge with Premium and BYOL

Learn more about [M5a instances](#) and [C5a instances](#).

[View supported configurations in AWS](#).

Support for 24 storage VMs in Azure

24 storage VMs are now supported with Cloud Volumes ONTAP in Azure when you bring your own license (BYOL). This includes up to 12 storage VMs used for DR.

An add-on license is required for each additional *data-serving* storage VM beyond the first storage VM that comes with Cloud Volumes ONTAP by default. Contact your account team to obtain an SVM add-on license.

Storage VMs that you configure for disaster recovery (DR) don't require an add-on license (they are free of charge), but they do count against the storage VM limit.

[Learn more about storage VM limits in Azure](#).

[Learn how to create data-serving storage VMs for Cloud Volumes ONTAP in Azure](#).

Required version of the Cloud Manager Connector

The Cloud Manager Connector must be running version 3.9.4 or later to deploy new Cloud Volumes ONTAP 9.9.0 systems and to upgrade existing systems to 9.9.0.

Changes introduced with Cloud Manager 3.9.4

The Cloud Manager 3.9.4 release includes a few enhancements for the management of Cloud Volumes ONTAP, including enhancements to AWS KMS support, shared VPC support in Google Cloud, and reduced IPs in Google Cloud.

Go to the [Cloud Manager Release Notes](#) for more details about the 3.9.4 release.

Upgrade notes

- Upgrades of Cloud Volumes ONTAP must be completed from Cloud Manager. You should not upgrade Cloud Volumes ONTAP by using System Manager or the CLI. Doing so can impact system stability.
- You can upgrade to Cloud Volumes ONTAP 9.9.0 from the 9.8 release. Cloud Manager will prompt you to upgrade your existing Cloud Volumes ONTAP 9.8 systems to the 9.9.0 release.

[Learn how to upgrade when Cloud Manager notifies you](#).

- The upgrade of a single node system takes the system offline for up to 25 minutes, during which I/O is interrupted.
- Upgrading an HA pair is nondisruptive and I/O is uninterrupted. During this nondisruptive upgrade process, each node is upgraded in tandem to continue serving I/O to clients.

c4, m4, and r4 instance types

Starting with the 9.8 release, c4, m4, and r4 instance types aren't supported with new Cloud Volumes ONTAP systems. If you have an existing Cloud Volumes ONTAP system that's running on a c4, m4, or r4 instance type, you can still upgrade to this release.

We recommend changing to an instance type in the c5, m5, or r5 instance family.

Licensing for Cloud Volumes ONTAP 9.9.0

Several licensing options are available for Cloud Volumes ONTAP. Each option enables you to choose a configuration that meets your needs.

Licensing overview

The following table provides an overview of the licensing options for Cloud Volumes ONTAP.

Beyond these licensing options, you can also choose the *Freemium* offering to get started with Cloud Volumes ONTAP without purchasing a license or contract.

Charging method	Highlights	Support	Max system capacity
Capacity-based license: Essential package	<ul style="list-style-type: none"> • Pay per TiB of capacity for one or more Cloud Volumes ONTAP systems • Provides a la carte licensing for Cloud Volumes ONTAP: <ul style="list-style-type: none"> ◦ A single node or HA system ◦ File and block storage or secondary data (DR) • Available by bringing your own license (BYOL) purchased from NetApp 	Included	2 PB

Charging method	Highlights	Support	Max system capacity
Capacity-based license: Professional package	<ul style="list-style-type: none"> Pay per TiB of capacity for one or more Cloud Volumes ONTAP systems Provides licensing for any Cloud Volumes ONTAP configuration (single node or HA with any storage type) Includes volume backups using the Cloud Backup Service (only for volumes charged against this license) Available through an AWS Marketplace annual contract or by bringing your own license (BYOL) purchased from NetApp 	Included	2 PB
PAYGO by node	<ul style="list-style-type: none"> Pay-as-you-go by the hour through a marketplace subscription from your cloud provider Charging is per Cloud Volumes ONTAP node Available in three licensing options: Explore, Standard, and Premium 	Included, but you must activate support	<ul style="list-style-type: none"> Explore: 2 TB Standard: 10 TB Premium: 368 TB
Node-based license	<ul style="list-style-type: none"> Single node or HA license with term-based options Available by bringing your own license (BYOL) purchased from NetApp 	Included	368 TB per license

The following sections provide more details about each of these options.

Freemium offering

- A new offering that provides all Cloud Volumes ONTAP features free of charge from NetApp (cloud provider charges still apply).
- No license or contract is needed.
- Support is not included.
- You're limited to 500 GB of allocated capacity per Cloud Volumes ONTAP system.
- You can use up to 10 Cloud Volumes ONTAP systems with the Freemium offering per NetApp account.
- If the allocated capacity for a Cloud Volumes ONTAP system exceeds 500 GB, Cloud Manager converts the system to the Essential package (which is a capacity-based license) and charging starts.

Any other systems that have less than 500 GB of allocated capacity stay on the Freemium offering (as long as they were deployed using the Freemium offering).

To get started with the Freemium offering, create a new Cloud Volumes ONTAP working environment and select **Freemium** when prompted to choose a charging method.

Capacity-based licenses

Capacity-based licensing enables you to pay for Cloud Volumes ONTAP per TiB of capacity. The license is associated with your NetApp account and enables you to charge multiple systems against the license, as long as enough capacity is available through the license.

For example, you could purchase a single 20 TB license, deploy four Cloud Volumes ONTAP systems, and then allocate a 5 TB volume to each system, for a total of 20 TB.

Unlike the by-node charging method where a license is purchased per Cloud Volumes ONTAP system, a capacity-based license is issued to a NetApp account. The capacity is then 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 the following packages: Essential or Professional.

This licensing method is available for Cloud Volumes ONTAP 9.7 and later.



For each package, there is a minimum allocated capacity charge of 4 TB. Any Cloud Volumes ONTAP instance that has less than 4 TB of allocated capacity will be charged at a rate of 4 TB.

Essential package

- Provides a la carte licensing for Cloud Volumes ONTAP:
 - A single node or HA system
 - File and block storage or secondary data for disaster recovery (DR)
- This package is available as a license (BYOL) purchased from NetApp.
- Support is included for the length of the subscription term.
- Conversions to another licensing option isn't supported.
- Each individual Cloud Volumes ONTAP system supports up to 2 PB of capacity through disks and tiering to object storage.

Professional package

- Provides licensing for any Cloud Volumes ONTAP configuration (single node or HA with any storage type).
- Includes volume backups using the Cloud Backup Service (only for volumes charged against this license).
- This package is available as an annual contract from the AWS Marketplace or as a license (BYOL) purchased from NetApp.

If you have an AWS Marketplace contract, *all* Cloud Volumes ONTAP systems that you deploy are charged against that contract. You can't mix and match a Marketplace contract with BYOL.

- Support is included for the length of the subscription term.
- Conversions to another licensing option isn't supported.
- Each individual Cloud Volumes ONTAP system supports up to 2 PB of capacity through disks and tiering to object storage.

To get started with a capacity-based license, [Contact NetApp Sales](#) and then [add your license to Cloud](#)

Manager.

PAYGO by node

- Requires a subscription from a cloud provider's marketplace for pay-as-you-go pricing at an hourly rate.
- Charging is per Cloud Volumes ONTAP node.
- Offers Cloud Volumes ONTAP in three different licensing options: Explore, Standard, and Premium. Each license provides support for different amounts of storage and compute.
- A 30-day free trial is available for the first Cloud Volumes ONTAP system that you deploy in a cloud provider. [Learn more about 30-day free trials.](#)
 - There are no hourly software charges, but cloud provider infrastructure charges still apply (compute, storage, and networking).
 - When the free trial ends, you'll be charged hourly according to the selected license, as long as you subscribed. If you haven't subscribed, the system shuts down.

Cloud Manager prompts you to subscribe to your cloud provider's marketplace when you create a Cloud Volumes ONTAP system.

- Conversions to another licensing option isn't supported.
- Basic technical support is offered, but you must [register and activate the NetApp serial number associated with your system.](#)

You can view pricing details from your cloud provider's marketplace:

- [AWS Marketplace](#)
- [Azure Marketplace](#)
- [Google Cloud Platform Marketplace](#)

To get started with PAYGO, create a Cloud Volumes ONTAP working environment and subscribe to your cloud provider's marketplace when prompted.

Node-based licenses

- Single node or HA license with term-based subscription options like 12 months, 24 months, and more.
- Available by bringing your own license (BYOL) purchased from NetApp.
- Each Cloud Volumes ONTAP system supports up to 368 TB of capacity per license.
- Conversions to another licensing option isn't supported.

If you want to transition to capacity-based licensing, you can purchase a license, deploy a new Cloud Volumes ONTAP system, and then replicate the data to that new system.

To get started with a node-based license, [Contact NetApp Sales](#) and then [add your license to Cloud Manager](#).

Supported configurations

Supported configurations for Cloud Volumes ONTAP 9.9.0 in AWS

Several Cloud Volumes ONTAP configurations are supported in AWS.

Supported number of nodes

Cloud Volumes ONTAP is available in AWS as a single node system and as a high-availability (HA) pair of nodes for fault tolerance and nondisruptive operations.

Upgrading a single node system to an HA pair is not supported. If you want to switch between a single node system and an HA pair, then you need to deploy a new system and replicate data from the existing system to the new system.

Supported storage

Cloud Volumes ONTAP supports several types of EBS disks, and S3 object storage for data tiering. The maximum storage capacity is determined by the license that you choose.

Storage support by license

Each license supports a different maximum system capacity. The maximum system capacity includes disk-based storage plus object storage used for data tiering. NetApp doesn't support exceeding this limit.

	Freemium	PAYGO Explore	PAYGO Standard	PAYGO Premium	Node-based license	Capacity-based license
Maximum system capacity (disks + object storage)¹	500 GB	2 TB	10 TB	368 TB ²	368 TB per license ²	2 PB ²
Supported disk types	<ul style="list-style-type: none">General Purpose SSD (gp3 and gp2)³Provisioned IOPS SSD (io1)³Throughput Optimized HDD (st1)⁴					
Cold data tiering to S3	Supported	Not supported	Supported			

- For an HA pair, the capacity limit is for the entire HA pair. It's not per node. For example, if you use the Premium license, you can have up to 368 TB of capacity between both nodes.
- For some configurations, disk limits prevent you from reaching the capacity limit by using disks alone. In those cases, you can reach the capacity limit by [tiering inactive data to object storage](#). For information about disk limits, refer to [storage limits](#).
- Enhanced write performance is enabled when using SSDs with all Cloud Volumes ONTAP configurations, except for PAYGO Explore.
- Tiering data to object storage is not recommended when using Throughput Optimized HDDs (st1).

Supported disk sizes

In AWS, an aggregate can contain up to 6 disks that are all the same type and size.

General Purpose SSDs (gp3 and gp2)	Provisioned IOPS SSDs (io1)	Throughput Optimized HDDs (st1)
• 100 GB	• 100 GB	• 500 GB
• 500 GB	• 500 GB	• 1 TB
• 1 TB	• 1 TB	• 2 TB
• 2 TB	• 2 TB	• 4 TB
• 4 TB	• 4 TB	• 6 TB
• 6 TB	• 6 TB	• 8 TB
• 8 TB	• 8 TB	• 16 TB
• 16 TB	• 16 TB	

Supported EC2 compute

Each Cloud Volumes ONTAP license supports different EC2 instance types. For your convenience, the table below shows the vCPU, RAM, and bandwidth for each supported instance type. [You should refer to AWS for the latest and complete details about EC2 instance types.](#)

The bandwidths shown in the table below match the documented AWS limits for each instance type. These limits don't completely align with what Cloud Volumes ONTAP can provide. For the expected performance, refer to [NetApp Technical Report 4383: Performance Characterization of Cloud Volumes ONTAP in Amazon Web Services with Application Workloads](#).

License	Supported instance	vCPU	RAM	Flash Cache ¹	Network bandwidth (Gbps)	EBS bandwidth (Mbps)	High write speed ²
Explore or any other license	m5.xlarge	4	16	Not supported	Up to 10	Up to 4,750	Supported (single node only)
Standard or any other license	r5.xlarge	4	32	Not supported	Up to 10	Up to 4,750	Supported (single node only)
	m5a.2xlarge	8	32	Not supported	Up to 10	Up to 2,880	Supported
	m5.2xlarge	8	32	Not supported	Up to 10	Up to 4,750	Supported

License	Supported instance	vCPU	RAM	Flash Cache ¹	Network bandwidth (Gbps)	EBS bandwidth (Mbps)	High write speed ²
Premium or any other license	m5n.2xlarge	8	32	Not supported	Up to 25	Up to 4,750	Supported
	r5.2xlarge	8	64	Not supported	Up to 10	Up to 4,750	Supported
	r5d.2xlarge	8	64	Supported	Up to 10	Up to 4,750	Supported
	c5d.4xlarge	16	32	Supported	Up to 10	4,570	Supported
	m5.4xlarge	16	64	Not supported	Up to 10	4,750	Supported
	m5d.8xlarge	32	128	Supported	10	6,800	Supported
	r5.8xlarge	32	256	Not supported	10	6,800	Supported
	c5.9xlarge	36	72	Not supported	10	9,500	Supported
	c5d.9xlarge	36	72	Supported	10	9,500	Supported
	c5n.9xlarge	36	96	Not supported	50	9,500	Supported
	c5a.12xlarge	48 ⁴	96	Not supported	12	4,750	Supported
	c5.18xlarge	48 ⁴	144	Not supported	25	19,000	Supported
	c5d.18xlarge	48 ⁴	144	Supported	25	19,000	Supported
	m5d.12xlarge	48	192	Supported	12	9,500	Supported
	c5n.18xlarge	48 ⁴	192	Not supported	100	19,000	Supported
	m5a.16xlarge	48 ⁴	256	Not supported	12	9,500	Supported
	m5.16xlarge	48 ⁴	256	Not supported	20	13,600	Supported
	r5.12xlarge ³	48	384	Not supported	10	9,500	Supported

- Some instance types include local NVMe storage, which Cloud Volumes ONTAP uses as *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. Compression must be disabled on all volumes to take advantage of the Flash Cache performance improvements. [Learn more about Flash Cache](#).
- Cloud Volumes ONTAP supports high write speed with most instance types when using an HA pair. High write speed is supported with all instance types when using a single node system. [Learn more about](#)

choosing a write speed.

3. The r5.12xlarge instance type has a known limitation with supportability. If a node unexpectedly reboots due to a panic, the system might not collect core files used to troubleshoot and root cause the problem. The customer accepts the risks and limited support terms and bears all support responsibility if this condition occurs. This limitation affects newly deployed HA pairs and HA pairs upgraded from 9.8. The limitation does not affect newly deployed single node systems.
4. While these EC2 instance types support more than 48 vCPUs, Cloud Volumes ONTAP supports up to 48 vCPUs.
5. When you choose an EC2 instance type, you can specify whether it is a shared instance or a dedicated instance.
6. Cloud Volumes ONTAP can run on either a Reserved or On-demand EC2 instance. Solutions that use other instance types aren't supported.

Supported regions

For AWS region support, see [Cloud Volumes Global Regions](#).

Supported configurations for Cloud Volumes ONTAP 9.9.0 in Azure

Several Cloud Volumes ONTAP configurations are supported in Azure.

Supported configurations by license

Cloud Volumes ONTAP is available in Azure as a single node system and as a high-availability (HA) pair of nodes for fault tolerance and nondisruptive operations.

Upgrading a single node system to an HA pair is not supported. If you want to switch between a single node system and an HA pair, then you need to deploy a new system and replicate data from the existing system to the new system.

Single node systems

You can choose from the following configurations when deploying Cloud Volumes ONTAP as a single-node system in Azure.

	Freemium	PAYGO Explore	PAYGO Standard	PAYGO Premium	Node-based license	Capacity-based license
Maximum system capacity (disks + object storage)	500 GB	2 TB ¹	10 TB	368 TB	368 TB per license	2 PB

	Freemium	PAYGO Explore	PAYGO Standard	PAYGO Premium	Node-based license	Capacity-based license
Supported virtual machine types	<ul style="list-style-type: none"> • DS3_v2 • DS4_v2 • DS5_v2 • DS13_v2 • DS14_v2 • DS15_v2 • E4s_v3 • E8s_v3 • E32s_v3 ² • E48s_v3 ² • E64is_v3 ² • E80ids_v4 ³ • L8s_v2 ⁴ 	<ul style="list-style-type: none"> • DS3_v2 • E4s_v3 	<ul style="list-style-type: none"> • DS4_v2 • DS13_v2 • E8s_v3 	<ul style="list-style-type: none"> • DS5_v2 • DS14_v2 • DS15_v2 • E32s_v3 ² • E48s_v3 ² • E64is_v3 ² • E80ids_v4 ³ 	<ul style="list-style-type: none"> • DS3_v2 • DS4_v2 • DS5_v2 • DS13_v2 • DS14_v2 • DS15_v2 • E4s_v3 • E8s_v3 • E32s_v3 ² • E48s_v3 ² • E64is_v3 ² • E80ids_v4 ³ • L8s_v2 ⁴ 	<ul style="list-style-type: none"> • DS3_v2 • DS4_v2 • DS5_v2 • DS13_v2 • DS14_v2 • DS15_v2 • E4s_v3 • E8s_v3 • E32s_v3 ² • E48s_v3 ² • E64is_v3 ² • E80ids_v4 ³ • L8s_v2 ⁴
Supported disk types ⁵	Standard HDD Managed Disks, Standard SSD Managed Disks, and Premium SSD Managed Disks					

Notes:

1. Data tiering to Azure Blob storage isn't supported with PAYGO Explore.
2. This VM type uses an [Ultra SSD](#) for VNVVRAM, which provides better write performance.
3. This VM is recommended only when Azure maintenance control is needed. It's not recommended for any other use case due to the higher pricing.
4. This VM type includes local NVMe storage, which Cloud Volumes ONTAP uses as *Flash Cache*. Flash Cache speeds access to data through real-time intelligent caching of recently read user data and NetApp metadata. It is effective for random read-intensive workloads, including databases, email, and file services. Compression must be disabled on all volumes to take advantage of the Flash Cache performance improvements. [Learn more](#).
5. Enhanced write performance is enabled when using SSDs, but not when using the DS3_v2 virtual machine type.
6. For Azure region support, see [Cloud Volumes Global Regions](#).
7. Cloud Volumes ONTAP can run on either a Reserved or On-demand VM instance from your cloud provider. Solutions that use other VM instance types aren't supported.

HA pairs

You can choose from the following configurations when deploying Cloud Volumes ONTAP as an HA pair in Azure.

	Freemium	PAYGO Standard	PAYGO Premium	Node-based license	Capacity-based license
Maximum system capacity (disks + object storage)	500 GB	10 TB	368 TB	368 TB per license	2 PB
Supported virtual machine types	<ul style="list-style-type: none"> • DS4_v2 • DS5_v2 ¹ • DS13_v2 • DS14_v2 • DS15_v2 ¹ • E8s_v3 • E48s_v3 ¹ • E80ids_v4 ² 	<ul style="list-style-type: none"> • DS4_v2 • DS13_v2 	<ul style="list-style-type: none"> • DS5_v2 ¹ • DS14_v2 ¹ • DS15_v2 ¹ • E8s_v3 • E48s_v3 ¹ • E80ids_v4 ² 	<ul style="list-style-type: none"> • DS4_v2 • DS13_v2 • DS14_v2 ¹ • DS15_v2 ¹ • E8s_v3 • E48s_v3 ¹ • E80ids_v4 ² 	<ul style="list-style-type: none"> • DS4_v2 • DS5_v2 ¹ • DS13_v2 • DS14_v2 ¹ • DS15_v2 ¹ • E8s_v3 • E48s_v3 ¹ • E80ids_v4 ²
Supported disk types	Premium page blobs				

Notes:

1. Cloud Volumes ONTAP supports high write speed with these VM types when using an HA pair. High write speed is supported with all instance types when using a single node system. [Learn more about choosing a write speed](#).
2. This VM is recommended only when Azure maintenance control is needed. It's not recommended for any other use case due to the higher pricing.
3. PAYGO Explore isn't supported with HA pairs in Azure.
4. For Azure region support, see [Cloud Volumes Global Regions](#).
5. Cloud Volumes ONTAP can run on either a Reserved or On-demand VM instance from your cloud provider. Solutions that use other VM instance types aren't supported.

Supported disk sizes

In Azure, an aggregate can contain up to 12 disks that are all the same type and size.

Single node systems

Single node systems use Azure Managed Disks. The following disk sizes are supported:

Premium SSD	Standard SSD	Standard HDD
• 500 GB	• 100 GB	• 100 GB
• 1 TB	• 500 GB	• 500 GB
• 2 TB	• 1 TB	• 1 TB
• 4 TB	• 2 TB	• 2 TB
• 8 TB	• 4 TB	• 4 TB
• 16 TB	• 8 TB	• 8 TB
• 32 TB	• 16 TB	• 16 TB
	• 32 TB	• 32 TB

HA pairs

HA pairs use Premium page blobs. The following disk sizes are supported:

- 500 GB
- 1 TB
- 2 TB
- 4 TB
- 8 TB

Supported configurations for Cloud Volumes ONTAP 9.9.0 in GCP

Several Cloud Volumes ONTAP configurations are supported in GCP.

Supported configurations by license

Cloud Volumes ONTAP is available in Google Cloud Platform as a single node system and as a high-availability (HA) pair of nodes for fault tolerance and nondisruptive operations.

Upgrading a single node system to an HA pair is not supported. If you want to switch between a single node system and an HA pair, then you need to deploy a new system and replicate data from the existing system to the new system.

	Freemium	PAYGO Explore	PAYGO Standard	PAYGO Premium	Node-based license	Capacity-based license
Maximum system capacity (disks + object storage)¹	500 GB	2 TB ²	10 TB	368 TB	368 TB per license	2 PB

	Freemium	PAYGO Explore	PAYGO Standard	PAYGO Premium	Node-based license	Capacity-based license
Supported machine types ³	<ul style="list-style-type: none"> • n1-standard-8 • n1-standard-32 • n2-standard-4 • n2-standard-8 • n2-standard-32 	<ul style="list-style-type: none"> • n2-standard-4 	<ul style="list-style-type: none"> • n1-standard-8 • n2-standard-8 	<ul style="list-style-type: none"> • n1-standard-32 • n2-standard-32 	<ul style="list-style-type: none"> • n1-standard-8 • n1-standard-32 • n2-standard-4 • n2-standard-8 • n2-standard-32 	<ul style="list-style-type: none"> • n1-standard-8 • n1-standard-32 • n2-standard-4 • n2-standard-8 • n2-standard-32
Supported disk types ⁴	Zonal persistent disks (SSD and standard)					

Notes:

1. Disk limits can prevent you from reaching the maximum system capacity limit by using disks alone. You can reach the capacity limit by [tiering inactive data to object storage](#).

[Learn more about disk limits in GCP](#).

2. Data tiering to Google Cloud Storage isn't supported with PAYGO Explore.
3. 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.

4. Enhanced write performance is enabled when using SSDs.
5. The Cloud Manager interface shows an additional supported machine type for Standard and BYOL: n1-highmem-4. However, this machine type isn't meant for production environments. We've made it available for a specific lab environment only.
6. For Google Cloud Platform region support, see [Cloud Volumes Global Regions](#).
7. Cloud Volumes ONTAP can run on either a Reserved or On-demand VM instance from your cloud provider. Solutions that use other VM instance types aren't supported.

Supported disk sizes

In GCP, an aggregate can contain up to 6 disks that are all the same type and size. The following disk sizes are supported:

- 100 GB

- 500 GB
- 1 TB
- 2 TB
- 4 TB
- 8 TB
- 16 TB
- 64 TB

Storage limits

Storage limits for Cloud Volumes ONTAP 9.9.0 in AWS

Cloud Volumes ONTAP has storage configuration limits to provide reliable operations. For best performance, do not configure your system at the maximum values.

Maximum system capacity by license

The maximum system capacity for a Cloud Volumes ONTAP system is determined by its license. The maximum system capacity includes disk-based storage plus object storage used for data tiering.

NetApp doesn't support exceeding the system capacity limit. If you reach the licensed capacity limit, Cloud Manager displays an action required message and no longer allows you to add additional disks.

For some configurations, disk limits prevent you from reaching the capacity limit by using disks alone. In those cases, you can reach the capacity limit by [tiering inactive data to object storage](#). Refer to capacity and disk limits below for more details.

License	Maximum system capacity (disks + object storage)
Freemium	500 GB
PAYGO Explore	2 TB (data tiering is not supported with Explore)
PAYGO Standard	10 TB
PAYGO Premium	368 TB
Node-based license	368 TB per license
Capacity-based license	2 PB

For HA, is the license capacity limit per node or for the entire HA pair?

The capacity limit is for the entire HA pair. It is not per node. For example, if you use the Premium license, you can have up to 368 TB of capacity between both nodes.

For an HA system in AWS, does mirrored data count against the capacity limit?

No, it doesn't. Data in an AWS HA pair is synchronously mirrored between the nodes so that the data is available in the event of failure. For example, if you purchase an 8 TB disk on node A, Cloud Manager also allocates an 8 TB disk on node B that is used for mirrored data. While 16 TB of capacity was provisioned, only 8 TB counts against the license limit.

Disk and tiering limits by EC2 instance

Cloud Volumes ONTAP uses EBS volumes as disks, with a maximum disk size of 16 TB. The sections below show disk and tiering limits by EC2 instance family because many EC2 instance types have different disk limits. Disk limits are also different between single node systems and HA pairs.

Note the following:

- c4, m4, and r4 instance types are not supported with new Cloud Volumes ONTAP 9.9.0 systems. However, we're still showing disk limits for these instance types because you can upgrade a system to the 9.9.0 release when running on one of these instance types.
- The disk limits below are specific to disks that contain user data. The limits do not include the boot disk and root disk.
- You can now purchase multiple node-based licenses for a Cloud Volumes ONTAP BYOL system to allocate more than 368 TB of capacity. The number of licenses that you can purchase for a single node system or HA pair is unlimited. 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](#). [Learn how to add additional system licenses to Cloud Volumes ONTAP](#).

Single node with a Premium license

Instance family	Max disks per node	Max system capacity with disks alone	Max system capacity with disks and data tiering
c5, m5, and r5 instances	21 ¹	336 TB	368 TB
c4, m4, and r4 instances	34	368 TB	368 TB

1. 21 data disks is the limit for *new* deployments of Cloud Volumes ONTAP. If you upgrade a system that was created with version 9.7 or earlier, then the system continues to support 22 disks. One less data disk is supported on new systems that use these instance types because of the addition of a core disk starting with the 9.8 release.

Single node with node-based licensing

Instance family	Max disks per node	Max system capacity with one license		Max system capacity with multiple licenses	
		Disks alone	Disks + data tiering	Disks alone	Disks + data tiering
c5, m5, and r5 instances	21 ¹	336 TB	368 TB	336 TB	368 TB x each license
c4, m4, and r4 instances	34	368 TB	368 TB	544 TB	368 TB x each license

- 21 data disks is the limit for *new* deployments of Cloud Volumes ONTAP. If you upgrade a system that was created with version 9.7 or earlier, then the system continues to support 22 disks. One less data disk is supported on new systems that use these instance types because of the addition of a core disk starting with the 9.8 release.

Single node with capacity-based licensing

Instance family	Max disks per node	Max system capacity with disks alone	Max system capacity with disks and data tiering
c5, m5, and r5 instances	21	336 TB	2 PB

HA pairs with a Premium license

Instance family	Max disks per node	Max system capacity with disks alone	Max system capacity with disks and data tiering
c5, m5, and r5 instances	18 ¹	288 TB	368 TB
c4, m4, and r4 instances	31	368 TB	368 TB

- 18 data disks is the limit for *new* deployments of Cloud Volumes ONTAP. If you upgrade a system that was created with version 9.7 or earlier, then the system continues to support 19 disks. One less data disk is supported on new systems that use these instance types because of the addition of a core disk starting with the 9.8 release.

HA pairs with node-based licensing

Instance family	Max disks per node	Max system capacity with one license		Max system capacity with multiple licenses	
		Disks alone	Disks + data tiering	Disks alone	Disks + data tiering
c5, m5, and r5 instances	18 ¹	288 TB	368 TB	288 TB	368 TB x each license
c4, m4, and r4 instances	31	368 TB	368 TB	496 TB	368 TB x each license

- 18 data disks is the limit for *new* deployments of Cloud Volumes ONTAP. If you upgrade a system that was created with version 9.7 or earlier, then the system continues to support 19 disks. One less data disk is supported on new systems that use these instance types because of the addition of a core disk starting with the 9.8 release.

HA pairs with capacity-based licensing

Instance family	Max disks per node	Max system capacity with disks alone	Max system capacity with disks and data tiering
c5, m5, and r5 instances	18	288 TB	2 PB

Aggregate limits

Cloud Volumes ONTAP uses AWS volumes as disks and groups them into *aggregates*. Aggregates provide storage to volumes.

Parameter	Limit
Maximum number of aggregates	Single node: Same as the disk limit HA pairs: 18 in a node ¹
Maximum aggregate size	96 TB of raw capacity ²
Disks per aggregate	1-6 ³
Maximum number of RAID groups per aggregate	1

Notes:

1. It's not possible to create 18 aggregates on both nodes in an HA pair because doing so would exceed the data disk limit.
2. The aggregate capacity limit is based on the disks that comprise the aggregate. The limit does not include object storage used for data tiering.
3. All disks in an aggregate must be the same size.

Storage VM limits

Some configurations enable you to create additional storage VMs (SVMs) for Cloud Volumes ONTAP.

[Learn how to create additional storage VMs.](#)

License type	Instance family	Storage VM limit
PAYGO	c4, m4, and r4	<ul style="list-style-type: none">• 1 storage VM for serving data• 1 storage VM for disaster recovery
	c5, m5, and r5	<ul style="list-style-type: none">• 1 storage VM for serving data• 1 storage VM for disaster recovery
Freemium	c5, m5, and r5	<ul style="list-style-type: none">• 24 storage VMs total ^{1,2}
Capacity-based license ³	c5, m5, and r5	<ul style="list-style-type: none">• 24 storage VMs total ^{1,2}
Node-based BYOL ⁴	c4, m4, and r4	<ul style="list-style-type: none">• 1 storage VM for serving data• 1 storage VM for disaster recovery
	c5, m5, and r5	<ul style="list-style-type: none">• 24 storage VMs total ^{1,2}

1. The limit can be lower, depending on the EC2 instance type that you use. The limits per instance are listed in the section below.
2. These 24 storage VMs can serve data or be configured for disaster recovery (DR).

- For capacity-based licensing, there are no extra licensing costs for additional storage VMs, but there is a 4 TB minimum capacity charge per storage VM. For example, if you create two storage VMs and each has 2 TB of provisioned capacity, you'll be charged a total of 8 TB.
- For node-based BYOL, an add-on license is required for each additional *data-serving* storage VM beyond the first storage VM that comes with Cloud Volumes ONTAP by default. Contact your account team to obtain a storage VM add-on license.

Storage VMs that you configure for disaster recovery (DR) don't require an add-on license (they are free of charge), but they do count against the storage VM limit. For example, if you have 12 data-serving storage VMs and 12 storage VMs configured for disaster recovery, then you've reached the limit and can't create any additional storage VMs.

Storage VM limit by EC2 instance type

When you create an additional storage VM, you need to allocate private IP addresses to port e0a. The table below identifies the maximum number of private IPs per interface, as well as the number of IP addresses that are available on port e0a after Cloud Volumes ONTAP has been deployed. The number of available IP addresses directly affects the maximum number of storage VMs for that configuration.

Configuration	Instance type	Max private IPs per interface	IPs remaining after deployment ¹	Max storage VMs without a mgmt LIF ^{2,3}	Max storage VMs with a mgmt LIF ^{2,3}
Single node	*.2xlarge	15	9	10	5
	*.4xlarge	30	24	24	12
	*.8xlarge	30	24	24	12
	*.9xlarge	30	24	24	12
	*.12xlarge	30	24	24	12
	*.16xlarge	50	44	24	12
	*.18xlarge	50	44	24	12
HA pair in single AZ	*.2xlarge	15	10	11	5
	*.4xlarge	30	25	24	12
	*.8xlarge	30	25	24	12
	*.9xlarge	30	25	24	12
	*.12xlarge	30	25	24	12
	*.16xlarge	50	45	24	12
	*.18xlarge	50	45	24	12

Configuration	Instance type	Max private IPs per interface	IPs remaining after deployment ¹	Max storage VMs without a mgmt LIF ^{2,3}	Max storage VMs with a mgmt LIF ^{2,3}
HA pair in multi AZs	*.2xlarge	15	12	13	13
	*.4xlarge	30	27	24	24
	*.8xlarge	30	27	24	24
	*.9xlarge	30	27	24	24
	*.12xlarge	30	27	24	24
	*.16xlarge	50	47	24	24
	*.18xlarge	50	47	24	24

1. This number indicates how many *remaining* private IP addresses are available on port e0a after Cloud Volumes ONTAP is deployed and set up. For example, a *.2xlarge system supports a maximum of 15 IP addresses per network interface. When an HA pair is deployed in a single AZ, 5 private IP addresses are allocated to port e0a. As a result, an HA pair that uses a *.2xlarge instance type has 10 private IP addresses remaining for additional storage VMs.
2. The number listed in these columns includes the initial storage VM that Cloud Manager creates by default. For example, if 24 is listed in this column, it means that you can create 23 additional storage VMs for a total of 24.
3. A management LIF for the storage VM is optional. A management LIF provides a connection to management tools like SnapCenter.

Because it requires a private IP address, it will limit the number of additional storage VMs that you can create. The only exception is an HA pair in multiple AZs. In that case, the IP address for the management LIF is a *floating* IP address so it doesn't count against the *private* IP limit.

File and volume limits

Logical storage	Parameter	Limit
Files	Maximum size	16 TB
	Maximum per volume	Volume size dependent, up to 2 billion
FlexClone volumes	Hierarchical clone depth ¹	499
FlexVol volumes	Maximum per node	500
	Minimum size	20 MB
	Maximum size	Dependent on the size of the aggregate
Qtrees	Maximum per FlexVol volume	4,995
Snapshot copies	Maximum per FlexVol volume	1,023

1. Hierarchical clone depth is the maximum depth of a nested hierarchy of FlexClone volumes that can be created from a single FlexVol volume.

iSCSI storage limits

iSCSI storage	Parameter	Limit
LUNs	Maximum per node	1,024
	Maximum number of LUN maps	1,024
	Maximum size	16 TB
	Maximum per volume	512
igroups	Maximum per node	256
Initiators	Maximum per node	512
	Maximum per igroup	128
iSCSI sessions	Maximum per node	1,024
LIFs	Maximum per port	32
	Maximum per portset	32
Portsets	Maximum per node	256

Storage limits for Cloud Volumes ONTAP 9.9.0 in Azure

Cloud Volumes ONTAP has storage configuration limits to provide reliable operations. For best performance, do not configure your system at the maximum values.

Maximum system capacity by license

The maximum system capacity for a Cloud Volumes ONTAP system is determined by its license. The maximum system capacity includes disk-based storage plus object storage used for data tiering.

NetApp doesn't support exceeding the system capacity limit. If you reach the licensed capacity limit, Cloud Manager displays an action required message and no longer allows you to add additional disks.

License	Maximum system capacity (disks + object storage)
Freemium	500 GB
PAYGO Explore	2 TB (data tiering is not supported with Explore)
PAYGO Standard	10 TB
PAYGO Premium	368 TB
Node-based license	368 TB per license
Capacity-based license	2 PB

For HA, is the license capacity limit per node or for the entire HA pair?

The capacity limit is for the entire HA pair. It is not per node. For example, if you use the Premium license, you can have up to 368 TB of capacity between both nodes.

Disk and tiering limits by VM size

The disk limits below are specific to disks that contain user data. The limits do not include the root disk, core disk, and VNV RAM.

The tables below show the maximum system capacity by VM size with disks alone, and with disks and cold data tiering to object storage.

- Single node systems can use Standard HDD Managed Disks, Standard SSD Managed Disks, and Premium SSD Managed Disks, with up to 32 TB per disk. The number of supported disks varies by VM size.
- HA systems use Premium page blobs as disks, with up to 8 TB per page blob. The number of supported disks varies by VM size.



You can purchase multiple node-based licenses for a Cloud Volumes ONTAP BYOL system to allocate more than 368 TB of capacity. The number of licenses that you can purchase for a single node system or HA pair is unlimited. 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](#). Learn how to add additional system licenses to Cloud Volumes ONTAP.

Single node with a Premium license

VM size	Max data disks per node	Max system capacity with disks alone	Max system capacity with disks and data tiering
DS5_v2	61	368 TB	368 TB
DS14_v2	61	368 TB	368 TB
DS15_v2	61	368 TB	368 TB
E32s_v3	29	368 TB	368 TB
E48s_v3	29	368 TB	368 TB
E64is_v3	29	368 TB	368 TB
E80ids_v4	29	368 TB	368 TB

Single node with node-based licensing



For some VM types, you'll need several BYOL licenses to reach the max system capacity listed below. For example, you'd need 6 BYOL licenses to reach 1.95 PB with DS5_v2.

VM size	Max data disks per node	Max system capacity with one license		Max system capacity with multiple licenses	
		Disks alone	Disks + data tiering	Disks alone	Disks + data tiering
DS3_v2	13	368 TB	368 TB	416 TB	368 TB x each license
DS4_v2	29	368 TB	368 TB	928 TB	368 TB x each license
DS5_v2	61	368 TB	368 TB	1.95 PB	368 TB x each license
DS13_v2	29	368 TB	368 TB	928 TB	368 TB x each license
DS14_v2	61	368 TB	368 TB	1.95 PB	368 TB x each license
DS15_v2	61	368 TB	368 TB	1.95 PB	368 TB x each license
E4s_v3	5	160 TB	368 TB	160 TB	368 TB x each license
E8s_v3	13	368 TB	368 TB	416 TB	368 TB x each license
E32s_v3	29	368 TB	368 TB	928 TB	368 TB x each license
E48s_v3	29	368 TB	368 TB	928 TB	368 TB x each license
E64is_v3	29	368 TB	368 TB	928 TB	368 TB x each license
E80ids_v4	29	368 TB	368 TB	928 TB	368 TB x each license
L8s_v2	13	368 TB	368 TB	416 TB	368 TB x each license

Single node with capacity-based licensing

VM size	Max data disks per node	Max system capacity with disks alone	Max system capacity with disks and data tiering
DS3_v2	13	416 TB	2 PB
DS4_v2	29	928 TB	2 PB
DS5_v2	61	1.95 TB	2 PB
DS13_v2	29	928 TB	2 PB
DS14_v2	61	1.95 TB	2 PB
DS15_v2	61	1.95 TB	2 PB

VM size	Max data disks per node	Max system capacity with disks alone	Max system capacity with disks and data tiering
E4s_v3	5	160 TB	2 PB
E8s_v3	13	416 TB	2 PB
E32s_v3	29	928 TB	2 PB
E48s_v3	29	928 TB	2 PB
E64is_v3	29	928 TB	2 PB
E80ids_v4	29	928 TB	2 PB
L8s_v2	13	416 TB	2 PB

HA pairs with a Premium license

VM size	Max data disks per node	Max system capacity with disks alone	Max system capacity with disks and data tiering
DS5_v2	61	368 TB	368 TB
DS14_v2	61	368 TB	368 TB
DS15_v2	61	368 TB	368 TB
E8s_v3	13	208 TB	368 TB
E48s_v3	29	368 TB	368 TB
E80ids_v4	29	368 TB	368 TB

HA pairs with node-based licensing



For some VM types, you'll need several BYOL licenses to reach the max system capacity listed below. For example, you'd need 3 BYOL licenses to reach 976 TB with DS5_v2.

VM size	Max data disks per node	Max system capacity with one license		Max system capacity with multiple licenses	
		Disks alone	Disks + data tiering	Disks alone	Disks + data tiering
DS4_v2	29	368 TB	368 TB	464 TB	368 TB x each license
DS5_v2	61	368 TB	368 TB	976 TB	368 TB x each license
DS13_v2	29	368 TB	368 TB	464 TB	368 TB x each license
DS14_v2	61	368 TB	368 TB	976 TB	368 TB x each license

VM size	Max data disks per node	Max system capacity with one license		Max system capacity with multiple licenses	
DS15_v2	61	368 TB	368 TB	976 TB	368 TB x each license
E8s_v3	13	208 TB	368 TB	208 TB	368 TB x each license
E48s_v3	29	368 TB	368 TB	464 TB	368 TB x each license
E80ids_v4	29	368 TB	368 TB	464 TB	368 TB x each license

HA pairs with capacity-based licensing

VM size	Max data disks per node	Max system capacity with disks alone	Max system capacity with disks and data tiering
DS4_v2	29	464 TB	2 PB
DS5_v2	61	976 TB	2 PB
DS13_v2	29	464 TB	2 PB
DS14_v2	61	976 TB	2 PB
DS15_v2	61	976 TB	2 PB
E8s_v3	13	208 TB	2 PB
E48s_v3	29	464 TB	2 PB
E80ids_v4	29	464 TB	2 PB

Aggregate limits

Cloud Volumes ONTAP uses Azure storage as disks and groups them into *aggregates*. Aggregates provide storage to volumes.

Parameter	Limit
Maximum number of aggregates	Same as the disk limit
Maximum aggregate size ¹	384 TB of raw capacity for single node ² 352 TB of raw capacity for single node with PAYGO 96 TB of raw capacity for HA pairs
Disks per aggregate	1-12 ³
Maximum number of RAID groups per aggregate	1

Notes:

1. The aggregate capacity limit is based on the disks that comprise the aggregate. The limit does not include

- object storage used for data tiering.
2. If using node-based licensing, two BYOL licenses are required to reach 384 TB.
 3. All disks in an aggregate must be the same size.

Storage VM limits

Some configurations enable you to create additional storage VMs (SVMs) for Cloud Volumes ONTAP.

These are the tested limits. While it is theoretically possible to configure additional storage VMs, it's not supported.

[Learn how to create additional storage VMs.](#)

License type	Storage VM limit
PAYGO	<ul style="list-style-type: none"> • 1 storage VM for serving data • 1 storage VM for disaster recovery
Freemium	24 storage VMs total ^{1,2}
Capacity-based license ³	24 storage VMs total ^{1,2}
Node-based BYOL ⁴	24 storage VMs total ^{1,2}

1. These 24 storage VMs can serve data or be configured for disaster recovery (DR).
2. Each storage VM can have up to three LIFs where two are data LIFs and one is an SVM management LIF.
3. For capacity-based licensing, there are no extra licensing costs for additional storage VMs, but there is a 4 TB minimum capacity charge per storage VM. For example, if you create two storage VMs and each has 2 TB of provisioned capacity, you'll be charged a total of 8 TB.
4. For node-based BYOL, an add-on license is required for each additional *data-serving* storage VM beyond the first storage VM that comes with Cloud Volumes ONTAP by default. Contact your account team to obtain a storage VM add-on license.

Storage VMs that you configure for disaster recovery (DR) don't require an add-on license (they are free of charge), but they do count against the storage VM limit. For example, if you have 12 data-serving storage VMs and 12 storage VMs configured for disaster recovery, then you've reached the limit and can't create any additional storage VMs.

File and volume limits

Logical storage	Parameter	Limit
Files	Maximum size	16 TB
	Maximum per volume	Volume size dependent, up to 2 billion
FlexClone volumes	Hierarchical clone depth ²	499

Logical storage	Parameter	Limit
FlexVol volumes	Maximum per node	500
	Minimum size	20 MB
	Maximum size	Azure HA: Dependent on the size of the aggregate ³ Azure single node: 100 TB
Qtrees	Maximum per FlexVol volume	4,995
Snapshot copies	Maximum per FlexVol volume	1,023

Notes:

- Cloud Manager does not provide any setup or orchestration support for SVM disaster recovery. It also does not support storage-related tasks on an additional SVM. You must use System Manager or the CLI for SVM disaster recovery.
 - [SVM Disaster Recovery Preparation Express Guide](#)
 - [SVM Disaster Recovery Express Guide](#)
- Hierarchical clone depth is the maximum depth of a nested hierarchy of FlexClone volumes that can be created from a single FlexVol volume.
- Less than 100 TB is supported for this configuration because aggregates on HA pairs are limited to 96 TB of *raw* capacity.

iSCSI storage limits

iSCSI storage	Parameter	Limit
LUNs	Maximum per node	1,024
	Maximum number of LUN maps	1,024
	Maximum size	16 TB
	Maximum per volume	512
igroups	Maximum per node	256
Initiators	Maximum per node	512
	Maximum per igroup	128
iSCSI sessions	Maximum per node	1,024
LIFs	Maximum per port	32
	Maximum per portset	32
Portsets	Maximum per node	256

Storage limits for Cloud Volumes ONTAP 9.9.0 in GCP

Cloud Volumes ONTAP has storage configuration limits to provide reliable operations. For best performance, do not configure your system at the maximum values.

Maximum system capacity by license

The maximum system capacity for a Cloud Volumes ONTAP system is determined by its license. The maximum system capacity includes disk-based storage plus object storage used for data tiering.

NetApp doesn't support exceeding the system capacity limit. If you reach the licensed capacity limit, Cloud Manager displays an action required message and no longer allows you to add additional disks.

For some configurations, disk limits prevent you from reaching the capacity limit by using disks alone. You can reach the capacity limit by [tiering inactive data to object storage](#). Refer to the disk limits below for more details.

License	Maximum system capacity (disks + object storage)
Freemium	500 GB
PAYGO Explore	2 TB (data tiering is not supported with Explore)
PAYGO Standard	10 TB
PAYGO Premium	368 TB
Node-based license	368 TB per license
Capacity-based license	2 PB

For an HA pair, is the licensed capacity limit per node or for the entire HA pair?

The capacity limit is for the entire HA pair. It is not per node. For example, if you use the Premium license, you can have up to 368 TB of capacity between both nodes.

For an HA pair, does mirrored data count against the licensed capacity limit?

No, it doesn't. Data in an HA pair is synchronously mirrored between the nodes so that the data is available in the event of failure in Google Cloud. For example, if you purchase an 8 TB disk on node A, Cloud Manager also allocates an 8 TB disk on node B that is used for mirrored data. While 16 TB of capacity was provisioned, only 8 TB counts against the license limit.

Disk and tiering limits

The table below shows the maximum system capacity with disks alone, and with disks and cold data tiering to object storage. The disk limits are specific to disks that contain user data. The limits do not include the boot disk and root disk.

Parameter	Limit
Maximum data disks	<ul style="list-style-type: none">• 124 for single node systems• 123 per node for HA pairs
Maximum disk size	64 TB

Parameter	Limit
Maximum system capacity with disks alone	256 TB ¹
Maximum system capacity with disks and cold data tiering to a Google Cloud Storage bucket	Depends on the license. See the table above.

¹ This limit is defined by virtual machine limits in Google Cloud Platform.

Aggregate limits

Cloud Volumes ONTAP groups Google Cloud Platform disks into *aggregates*. Aggregates provide storage to volumes.

Parameter	Limit
Maximum number of data aggregates ¹	<ul style="list-style-type: none"> • 99 for single node • 64 for an entire HA pair
Maximum aggregate size	256 TB of raw capacity ²
Disks per aggregate	1-6 ³
Maximum number of RAID groups per aggregate	1

Notes:

1. The maximum number of data aggregates doesn't include the root aggregate.
2. The aggregate capacity limit is based on the disks that comprise the aggregate. The limit does not include object storage used for data tiering.
3. All disks in an aggregate must be the same size.

Logical storage limits

Logical storage	Parameter	Limit
Storage virtual machines (SVMs)	Maximum number for Cloud Volumes ONTAP (HA pair or single node)	One data-serving SVM and one destination SVM used for disaster recovery. You can activate the destination SVM for data access if there's an outage on the source SVM. ¹ The one data-serving SVM spans the entire Cloud Volumes ONTAP system (HA pair or single node).
Files	Maximum size	16 TB
	Maximum per volume	Volume size dependent, up to 2 billion
FlexClone volumes	Hierarchical clone depth ²	499

Logical storage	Parameter	Limit
FlexVol volumes	Maximum per node	500
	Minimum size	20 MB
	Maximum size	100 TB
Qtrees	Maximum per FlexVol volume	4,995
Snapshot copies	Maximum per FlexVol volume	1,023

Notes:

- Cloud Manager does not provide any setup or orchestration support for SVM disaster recovery. It also does not support storage-related tasks on an additional SVM. You must use System Manager or the CLI for SVM disaster recovery.
 - [SVM Disaster Recovery Preparation Express Guide](#)
 - [SVM Disaster Recovery Express Guide](#)
- Hierarchical clone depth is the maximum depth of a nested hierarchy of FlexClone volumes that can be created from a single FlexVol volume.

iSCSI storage limits

iSCSI storage	Parameter	Limit
LUNs	Maximum per node	1,024
	Maximum number of LUN maps	1,024
	Maximum size	16 TB
	Maximum per volume	512
igroups	Maximum per node	256
Initiators	Maximum per node	512
	Maximum per igroup	128
iSCSI sessions	Maximum per node	1,024
LIFs	Maximum per port	1
	Maximum per portset	32
Portsets	Maximum per node	256

Known issues for Cloud Volumes ONTAP 9.9.0

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

There are no known issues in this release specific to Cloud Volumes ONTAP.

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

Known limitations

Limitations for Cloud Volumes ONTAP 9.9.0 in all cloud providers

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.

The following limitations apply to Cloud Volumes ONTAP in all cloud providers: AWS, Azure, and GCP.

Cloud Volumes ONTAP supports Reserved and On-demand VM instances

Cloud Volumes ONTAP can run on either a Reserved or On-demand VM instance from your cloud provider. Other types of VM instances aren't supported.

Automatic application resource management solutions shouldn't be used

Automatic application resource management solutions should not manage Cloud Volumes ONTAP systems. Doing so can result in a change to an unsupported configuration. For example, the solution might change Cloud Volumes ONTAP to an unsupported VM instance type.

Software updates must be completed by Cloud Manager

Upgrades of Cloud Volumes ONTAP must be completed from Cloud Manager. You should not upgrade Cloud Volumes ONTAP by using System Manager or the CLI. Doing so can impact system stability.

Cloud Volumes ONTAP deployment must not be modified from your cloud provider's console

Changes to a Cloud Volumes ONTAP configuration from your cloud provider's console results in an unsupported configuration. Any changes to the Cloud Volumes ONTAP resources that Cloud Manager creates and manages can impact system stability and Cloud Manager's ability to manage the system.

Disk and aggregates must be managed from Cloud Manager

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

SnapManager licensing limitation

SnapManager per-server licenses are supported with Cloud Volumes ONTAP. Per-storage system (SnapManager suite) licenses are not supported.

Unsupported ONTAP features

The following features are not supported with Cloud Volumes ONTAP:

- Aggregate-level inline deduplication
- Aggregate-level background deduplication
- Disk maintenance center
- Disk sanitization

- FabricPool mirroring
- Fibre Channel (FC)
- Flash Pools
- Infinite Volumes
- Interface groups
- Intranode LIF failover
- MetroCluster
- ONTAP S3
- RAID4, RAID-DP, RAID-TEC (RAID0 is supported)
- Service Processor
- SnapLock Compliance mode (Enterprise mode is supported)
- SnapMirror Synchronous
- VLANs

Known limitations for Cloud Volumes ONTAP 9.9.0 in AWS

The following known limitations are specific to Cloud Volumes ONTAP in Amazon Web Services. Be sure to also review [Limitations for Cloud Volumes ONTAP 9.9.0 in all cloud providers](#).

AWS Outpost limitations

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

Flash Cache limitations

C5D and R5D instance types include local NVMe storage, which Cloud Volumes ONTAP uses as *Flash Cache*. Note the following limitations:

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

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

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

False alarms reported by Amazon CloudWatch

Cloud Volumes ONTAP does not release CPUs when idle, so [Amazon CloudWatch](#) can report a high CPU warning for the EC2 instance because it sees 100% usage. You can ignore this alarm. The ONTAP statistics command displays the true usage of the CPUs.

Cloud Volumes ONTAP HA pairs do not support immediate storage giveback

After a node reboots, the partner must sync data before it can return the storage. The time that it takes to resync data depends on the amount of data written by clients while the node was down and the data write speed during the time of giveback.

[Learn how storage works in a Cloud Volumes ONTAP HA pair running in AWS.](#)

Known limitations for Cloud Volumes ONTAP 9.9.0 in Azure

The following known limitations are specific to Cloud Volumes ONTAP in Microsoft Azure. Be sure to also review [Limitations for Cloud Volumes ONTAP 9.9.0 in all cloud providers](#).

Flash Cache limitations

The Standard_L8s_v2 VM type includes local NVMe storage, which Cloud Volumes ONTAP uses as *Flash Cache*. Note the following limitations for Flash Cache:

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

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

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

HA limitations

The following limitations affect Cloud Volumes ONTAP HA pairs in Microsoft Azure:

- NFSv4 isn't supported. NFSv3 is supported.
- HA pairs aren't supported in some regions.

[See the list of supported Azure regions.](#)

Pay-as-you-go not available for CSP partners

If you are a Microsoft Cloud Solution Provider (CSP) partner, you cannot deploy Cloud Volumes ONTAP Explore, Standard, or Premium because pay-as-you-go subscriptions are not available for CSP partners. You must purchase a license and deploy Cloud Volumes ONTAP BYOL.

Known limitations for Cloud Volumes ONTAP 9.9.0 in GCP

There are no known limitations specific to Cloud Volumes ONTAP in Google Cloud Platform. See the [Limitations for Cloud Volumes ONTAP 9.9.0 in all cloud providers](#).

9.8 Release Notes

What's new in Cloud Volumes ONTAP 9.8

Cloud Volumes ONTAP 9.8 includes several new features and enhancements.

Additional features and enhancements are also introduced in the latest versions of Cloud Manager. See the [Cloud Manager Release Notes](#) for details.

9.8 GA (5 Jan 2021)

The General Availability (GA) release of Cloud Volumes ONTAP 9.8 is now available. The GA release includes bug fixes. Cloud Manager will prompt you to upgrade existing 9.8 RC1 and 9.7 systems to this release.

Changes introduced with Cloud Manager 3.9.2 (4 Jan 2021)

The Cloud Manager 3.9.2 release includes several enhancements for Cloud Volumes ONTAP, including support for AWS Outposts, larger disks in GCP, and more.

Go to the [Cloud Manager Release Notes](#) for more details about the 3.9.2 release.

E48s_v3 now supported with HA pairs (21 Dec 2020)

The E48s_v3 VM type is now supported with Cloud Volumes ONTAP HA pairs in Microsoft Azure.

Supported EC2 instances (11 Dec 2020)

Starting with the 9.8 release, c4, m4, and r4 EC2 instance types are not supported with new Cloud Volumes ONTAP systems. Changing an existing 9.8 system to one of these instance types isn't supported either.

If you have an existing Cloud Volumes ONTAP 9.7 system that's running on a c4, m4, or r4 instance type, you can still upgrade to the 9.8 release.

9.8 RC1 update (12 Nov 2020)

Similar to single node systems, Cloud Manager now allocates a core disk to new 9.8 HA pair deployments in AWS when you use a C5, M5, or R5 instance type. The core disk expands the ability to switch between supported instance types, enhances the system's ability to collect core files when issues occur, and provides the ability to support larger instance types in the future.

The core disk is a General Purpose SSD (gp2) with 540 GB.



With the addition of this core disk, one less data disk is now supported on systems that use these instance types. [Learn more about storage limits in AWS](#).

9.8 RC1 (8 Nov 2020)

Cloud Volumes ONTAP 9.8 RC1 is now available in AWS, Azure, and Google Cloud Platform. In Azure, 9.8 RC1 is available for upgrades only at this time.

In addition to the features introduced with [ONTAP 9.8](#), this release of Cloud Volumes ONTAP includes the

following:

- [High-availability pairs in Google Cloud](#)
- [Fixes for Azure NIC detach events and maintenance events](#)
- [High write speed with HA pairs in AWS and Azure](#)
- [\[Support for 24 storage VMs in AWS\]](#)
- [Core disk for single node systems in AWS](#)

High-availability pairs in Google Cloud

Cloud Volumes ONTAP high-availability (HA) pairs are now available in Google Cloud.

An HA pair provides enterprise reliability and continuous operations in case of failures in your cloud environment. Similar to Cloud Volumes ONTAP in AWS, an HA pair in Google Cloud includes two Cloud Volumes ONTAP nodes whose data is synchronously mirrored between each other, and a mediator instance that provides a communication channel to assist in storage takeover and giveback.

View [supported configurations](#) and [storage limits](#).

[Learn more about HA pairs in Google Cloud](#).

Fixes for Azure NIC detach events and maintenance events

This release provides several improvements for how Cloud Volumes ONTAP handles Azure freeze events, Azure NIC detach events, and other Azure maintenance activities (for example, Virtual Function Revoke). Cloud Volumes ONTAP is more fault tolerant in this release and will handle Azure events more gracefully, with a reduced likelihood of service disruption or cluster degradation.

High write speed with HA pairs in AWS and Azure

Cloud Volumes ONTAP now supports high write speed with HA pairs in AWS and Azure when using a specific instance or VM type. 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.

Before you choose a write speed, you should understand the differences between the normal and high settings and the risks and recommendations when using high write speed.

[Learn more](#).

Support for up to 24 storage VMs in AWS

Up to 24 storage VMs are now supported with Cloud Volumes ONTAP in AWS when you use a C5, M5, or R5 instance type and bring your own license. Of those 24 storage VMs, up to 12 can be configured for disaster recovery (DR).

The limit can be lower, depending on the EC2 instance type that you use.

An add-on license is required for each additional *data-serving* storage VM beyond the first storage VM that comes with Cloud Volumes ONTAP by default. Contact your account team to obtain an SVM add-on license.

Storage VMs that you configure for disaster recovery (DR) don't require an add-on license (they are free of charge), but they do count against the storage VM limit.

[Learn more about storage VM limits.](#)

[Learn how to create data-serving storage VMs for Cloud Volumes ONTAP in AWS.](#)

Core disk for single node systems in AWS

Cloud Manager now allocates a core disk to new 9.8 single node deployments in AWS when you use a C5, M5, or R5 instance type. The core disk expands the ability to switch between supported instance types, enhances the system's ability to collect core files when issues occur, and provides the ability to support larger instance types in the future.

The core disk is a General Purpose SSD (gp2) with 540 GB.



With the addition of this core disk, one less data disk is now supported on single node systems that use these instance types. [Learn more about storage limits in AWS.](#)

Required version of the Cloud Manager Connector

The Cloud Manager Connector must be running version 3.9.0 or later to deploy new Cloud Volumes ONTAP 9.8 systems and to upgrade existing systems to version 9.8.

Upgrade notes

- Upgrades of Cloud Volumes ONTAP must be completed from Cloud Manager. You should not upgrade Cloud Volumes ONTAP by using System Manager or the CLI. Doing so can impact system stability.
- You can upgrade to Cloud Volumes ONTAP 9.8 from the 9.7 release. Cloud Manager will prompt you to upgrade your existing Cloud Volumes ONTAP 9.7 systems to the 9.8 release.

[Learn how to upgrade when Cloud Manager notifies you.](#)

- The upgrade of a single node system takes the system offline for up to 25 minutes, during which I/O is interrupted.
- Upgrading an HA pair is nondisruptive and I/O is uninterrupted. During this nondisruptive upgrade process, each node is upgraded in tandem to continue serving I/O to clients.

c4, m4, and r4 instance types

Starting with the 9.8 release, c4, m4, and r4 instance types aren't supported with new Cloud Volumes ONTAP systems. If you have an existing Cloud Volumes ONTAP system that's running on a c4, m4, or r4 instance type, you can still upgrade to this release.

We recommend changing to an instance type in the c5, m5, or r5 instance family.

Licensing for Cloud Volumes ONTAP 9.8

Several licensing options are available for Cloud Volumes ONTAP. Each option enables you to choose a configuration that meets your needs.

Licensing overview

The following table provides an overview of the licensing options for Cloud Volumes ONTAP.

Beyond these licensing options, you can also choose the *Freemium* offering to get started with Cloud Volumes ONTAP without purchasing a license or contract.

Charging method	Highlights	Support	Max system capacity
Capacity-based license: Essential package	<ul style="list-style-type: none"> Pay per TiB of capacity for one or more Cloud Volumes ONTAP systems Provides a la carte licensing for Cloud Volumes ONTAP: <ul style="list-style-type: none"> A single node or HA system File and block storage or secondary data (DR) Available by bringing your own license (BYOL) purchased from NetApp 	Included	2 PB
Capacity-based license: Professional package	<ul style="list-style-type: none"> Pay per TiB of capacity for one or more Cloud Volumes ONTAP systems Provides licensing for any Cloud Volumes ONTAP configuration (single node or HA with any storage type) Includes volume backups using the Cloud Backup Service (only for volumes charged against this license) Available through an AWS Marketplace annual contract or by bringing your own license (BYOL) purchased from NetApp 	Included	2 PB
PAYGO by node	<ul style="list-style-type: none"> Pay-as-you-go by the hour through a marketplace subscription from your cloud provider Charging is per Cloud Volumes ONTAP node Available in three licensing options: Explore, Standard, and Premium 	Included, but you must activate support	<ul style="list-style-type: none"> Explore: 2 TB Standard: 10 TB Premium: 368 TB
Node-based license	<ul style="list-style-type: none"> Single node or HA license with term-based options Available by bringing your own license (BYOL) purchased from NetApp 	Included	368 TB per license

The following sections provide more details about each of these options.

Freemium offering

- A new offering that provides all Cloud Volumes ONTAP features free of charge from NetApp (cloud provider charges still apply).

- No license or contract is needed.
- Support is not included.
- You're limited to 500 GB of allocated capacity per Cloud Volumes ONTAP system.
- You can use up to 10 Cloud Volumes ONTAP systems with the Freemium offering per NetApp account.
- If the allocated capacity for a Cloud Volumes ONTAP system exceeds 500 GB, Cloud Manager converts the system to the Essential package (which is a capacity-based license) and charging starts.

Any other systems that have less than 500 GB of allocated capacity stay on the Freemium offering (as long as they were deployed using the Freemium offering).

To get started with the Freemium offering, create a new Cloud Volumes ONTAP working environment and select **Freemium** when prompted to choose a charging method.

Capacity-based licenses

Capacity-based licensing enables you to pay for Cloud Volumes ONTAP per TiB of capacity. The license is associated with your NetApp account and enables you to charge multiple systems against the license, as long as enough capacity is available through the license.

For example, you could purchase a single 20 TB license, deploy four Cloud Volumes ONTAP systems, and then allocate a 5 TB volume to each system, for a total of 20 TB.

Unlike the by-node charging method where a license is purchased per Cloud Volumes ONTAP system, a capacity-based license is issued to a NetApp account. The capacity is then 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 the following packages: Essential or Professional.

This licensing method is available for Cloud Volumes ONTAP 9.7 and later.



For each package, there is a minimum allocated capacity charge of 4 TB. Any Cloud Volumes ONTAP instance that has less than 4 TB of allocated capacity will be charged at a rate of 4 TB.

Essential package

- Provides a la carte licensing for Cloud Volumes ONTAP:
 - A single node or HA system
 - File and block storage or secondary data for disaster recovery (DR)
- This package is available as a license (BYOL) purchased from NetApp.
- Support is included for the length of the subscription term.
- Conversions to another licensing option isn't supported.
- Each individual Cloud Volumes ONTAP system supports up to 2 PB of capacity through disks and tiering to object storage.

Professional package

- Provides licensing for any Cloud Volumes ONTAP configuration (single node or HA with any storage type).

- Includes volume backups using the Cloud Backup Service (only for volumes charged against this license).
- This package is available as an annual contract from the AWS Marketplace or as a license (BYOL) purchased from NetApp.

If you have an AWS Marketplace contract, *all* Cloud Volumes ONTAP systems that you deploy are charged against that contract. You can't mix and match a Marketplace contract with BYOL.

- Support is included for the length of the subscription term.
- Conversions to another licensing option isn't supported.
- Each individual Cloud Volumes ONTAP system supports up to 2 PB of capacity through disks and tiering to object storage.

To get started with a capacity-based license, [Contact NetApp Sales](#) and then [add your license to Cloud Manager](#).

PAYGO by node

- Requires a subscription from a cloud provider's marketplace for pay-as-you-go pricing at an hourly rate.
- Charging is per Cloud Volumes ONTAP node.
- Offers Cloud Volumes ONTAP in three different licensing options: Explore, Standard, and Premium. Each license provides support for different amounts of storage and compute.
- A 30-day free trial is available for the first Cloud Volumes ONTAP system that you deploy in a cloud provider. [Learn more about 30-day free trials](#).
 - There are no hourly software charges, but cloud provider infrastructure charges still apply (compute, storage, and networking).
 - When the free trial ends, you'll be charged hourly according to the selected license, as long as you subscribed. If you haven't subscribed, the system shuts down.

Cloud Manager prompts you to subscribe to your cloud provider's marketplace when you create a Cloud Volumes ONTAP system.

- Conversions to another licensing option isn't supported.
- Basic technical support is offered, but you must [register and activate the NetApp serial number associated with your system](#).

You can view pricing details from your cloud provider's marketplace:

- [AWS Marketplace](#)
- [Azure Marketplace](#)
- [Google Cloud Platform Marketplace](#)

To get started with PAYGO, create a Cloud Volumes ONTAP working environment and subscribe to your cloud provider's marketplace when prompted.

Node-based licenses

- Single node or HA license with term-based subscription options like 12 months, 24 months, and more.
- Available by bringing your own license (BYOL) purchased from NetApp.

- Each Cloud Volumes ONTAP system supports up to 368 TB of capacity per license.
- Conversions to another licensing option isn't supported.

If you want to transition to capacity-based licensing, you can purchase a license, deploy a new Cloud Volumes ONTAP system, and then replicate the data to that new system.

To get started with a node-based license, [Contact NetApp Sales](#) and then [add your license to Cloud Manager](#).

Supported configurations

Supported configurations for Cloud Volumes ONTAP 9.8 in AWS

Several Cloud Volumes ONTAP configurations are supported in AWS.

Supported number of nodes

Cloud Volumes ONTAP is available in AWS as a single node system and as a high-availability (HA) pair of nodes for fault tolerance and nondisruptive operations.

Upgrading a single node system to an HA pair is not supported. If you want to switch between a single node system and an HA pair, then you need to deploy a new system and replicate data from the existing system to the new system.

Supported storage

Cloud Volumes ONTAP supports several types of EBS disks, and S3 object storage for data tiering. The maximum storage capacity is determined by the license that you choose.

Storage support by license

Each license supports a different maximum system capacity. The maximum system capacity includes disk-based storage plus object storage used for data tiering. NetApp doesn't support exceeding this limit.

	Freemium	PAYGO Explore	PAYGO Standard	PAYGO Premium	Node-based license	Capacity-based license
Maximum system capacity (disks + object storage)¹	500 GB	2 TB	10 TB	368 TB ²	368 TB per license ²	2 PB ²
Supported disk types	<ul style="list-style-type: none"> General Purpose SSD (gp3 and gp2)³ Provisioned IOPS SSD (io1)³ Throughput Optimized HDD (st1)⁴ 					
Cold data tiering to S3	Supported	Not supported	Supported			

1. For an HA pair, the capacity limit is for the entire HA pair. It's not per node. For example, if you use the

Premium license, you can have up to 368 TB of capacity between both nodes.

2. For some configurations, disk limits prevent you from reaching the capacity limit by using disks alone. In those cases, you can reach the capacity limit by [tiering inactive data to object storage](#). For information about disk limits, refer to [storage limits](#).
3. Enhanced write performance is enabled when using SSDs with all Cloud Volumes ONTAP configurations, except for PAYGO Explore.
4. Tiering data to object storage is not recommended when using Throughput Optimized HDDs (st1).

Supported disk sizes

In AWS, an aggregate can contain up to 6 disks that are all the same type and size.

General Purpose SSDs (gp3 and gp2)	Provisioned IOPS SSDs (io1)	Throughput Optimized HDDs (st1)
• 100 GB	• 100 GB	• 500 GB
• 500 GB	• 500 GB	• 1 TB
• 1 TB	• 1 TB	• 2 TB
• 2 TB	• 2 TB	• 4 TB
• 4 TB	• 4 TB	• 6 TB
• 6 TB	• 6 TB	• 8 TB
• 8 TB	• 8 TB	• 16 TB
• 16 TB	• 16 TB	

Supported compute

Each Cloud Volumes ONTAP license supports different EC2 instance types. For your convenience, the table below shows the vCPU, RAM, and bandwidth for each supported instance type. [You should refer to AWS for the latest and complete details about EC2 instance types](#).

The bandwidths shown in the table below match the documented AWS limits for each instance type. These limits don't completely align with what Cloud Volumes ONTAP can provide. For the expected performance, refer to [NetApp Technical Report 4383: Performance Characterization of Cloud Volumes ONTAP in Amazon Web Services with Application Workloads](#).

License	Supported instance	vCPU	RAM	Flash Cache ¹	Network bandwidth (Gbps)	EBS bandwidth (Mbps)	High write speed ²
Explore or any other license	m5.xlarge	4	16	Not supported	Up to 10	Up to 4,750	Supported (single node only)
Standard or any other license	r5.xlarge	4	32	Not supported	Up to 10	Up to 4,750	Supported (single node only)
	m5.2xlarge	8	32	Not supported	Up to 10	Up to 4,750	Supported

License	Supported instance	vCPU	RAM	Flash Cache ¹	Network bandwidth (Gbps)	EBS bandwidth (Mbps)	High write speed ²
Premium or any other license	m5n.2xlarge	8	32	Not supported	Up to 25	Up to 4,750	Supported
	r5.2xlarge	8	64	Not supported	Up to 10	Up to 4,750	Supported
	r5d.2xlarge	8	64	Supported	Up to 10	Up to 4,750	Supported
	c5d.4xlarge	16	32	Supported	Up to 10	4,570	Supported
	m5.4xlarge	16	64	Not supported	Up to 10	4,750	Supported
	m5d.8xlarge	32	128	Supported	10	6,800	Supported
	r5.8xlarge	32	256	Not supported	10	6,800	Supported
	c5.9xlarge	36	72	Not supported	10	9,500	Supported
	c5d.9xlarge	36	72	Supported	10	9,500	Supported
	c5n.9xlarge	36	96	Not supported	50	9,500	Supported
	c5.18xlarge	48 ⁴	144	Not supported	25	19,000	Supported
	c5d.18xlarge	48 ⁴	144	Supported	25	19,000	Supported
	m5d.12xlarge	48	192	Supported	12	9,500	Supported
	c5n.18xlarge	48 ⁴	192	Not supported	100	19,000	Supported
	m5.16xlarge	48 ⁴	256	Not supported	20	13,600	Supported
	r5.12xlarge ³	48	384	Not supported	10	9,500	Supported

1. Some instance types include local NVMe storage, which Cloud Volumes ONTAP uses as *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. Compression must be disabled on all volumes to take advantage of the Flash Cache performance improvements. [Learn more about Flash Cache](#).
2. Cloud Volumes ONTAP supports high write speed with most instance types when using an HA pair. High write speed is supported with all instance types when using a single node system. [Learn more about choosing a write speed](#).
3. The r5.12xlarge instance type has a known limitation with supportability. If a node unexpectedly reboots due to a panic, the system might not collect core files used to troubleshoot and root cause the problem. The customer accepts the risks and limited support terms and bears all support responsibility if this condition occurs. This limitation affects newly deployed 9.8 HA pairs and HA pairs upgraded from 9.7. The

limitation does not affect newly deployed single node systems.

4. While these EC2 instance types support more than 48 vCPUs, Cloud Volumes ONTAP supports up to 48 vCPUs.
5. When you choose an EC2 instance type, you can specify whether it is a shared instance or a dedicated instance.
6. Cloud Volumes ONTAP can run on either a Reserved or On-demand EC2 instance. Solutions that use other instance types aren't supported.

Supported regions

For AWS region support, see [Cloud Volumes Global Regions](#).

Supported configurations for Cloud Volumes ONTAP 9.8 in Azure

Several Cloud Volumes ONTAP configurations are supported in Azure.

Supported configurations by license

Cloud Volumes ONTAP is available in Azure as a single node system and as a high-availability (HA) pair of nodes for fault tolerance and nondisruptive operations.

Upgrading a single node system to an HA pair is not supported. If you want to switch between a single node system and an HA pair, then you need to deploy a new system and replicate data from the existing system to the new system.

Single node systems

You can choose from the following configurations when deploying Cloud Volumes ONTAP as a single-node system in Azure:

	Freemium	PAYGO Explore	PAYGO Standard	PAYGO Premium	Node-based license	Capacity-based license
Maximum system capacity (disks + object storage)	500 GB	2 TB ¹	10 TB	368 TB	368 TB per license	2 PB

	Freemium	PAYGO Explore	PAYGO Standard	PAYGO Premium	Node-based license	Capacity-based license
Supported virtual machine types	<ul style="list-style-type: none"> • DS3_v2 • DS4_v2 • DS5_v2 • DS13_v2 • DS14_v2 • DS15_v2 • E32s_v3 ² • E48s_v3 ² • E64is_v3 ² • E80ids_v4 ₃ • L8s_v2 ⁴ 	DS3_v2	<ul style="list-style-type: none"> • DS4_v2 • DS13_v2 	<ul style="list-style-type: none"> • DS5_v2 • DS14_v2 • DS15_v2 • E32s_v3 ² • E48s_v3 ² • E64is_v3 ² • E80ids_v4 ₃ 	<ul style="list-style-type: none"> • DS3_v2 • DS4_v2 • DS5_v2 • DS13_v2 • DS14_v2 • DS15_v2 • E32s_v3 ² • E48s_v3 ² • E64is_v3 ² • E80ids_v4 ₃ • L8s_v2 ⁴ 	<ul style="list-style-type: none"> • DS3_v2 • DS4_v2 • DS5_v2 • DS13_v2 • DS14_v2 • DS15_v2 • E32s_v3 ² • E48s_v3 ² • E64is_v3 ² • E80ids_v4 ₃ • L8s_v2 ⁴
Supported disk types ⁵	Standard HDD Managed Disks, Standard SSD Managed Disks, and Premium SSD Managed Disks					

Notes:

1. Data tiering to Azure Blob storage isn't supported with PAYGO Explore.
2. This VM type uses an [Ultra SSD](#) for VNVRAM, which provides better write performance.
3. This VM is recommended only when Azure maintenance control is needed. It's not recommended for any other use case due to the higher pricing.
4. This VM type includes local NVMe storage, which Cloud Volumes ONTAP uses as *Flash Cache*. Flash Cache speeds access to data through real-time intelligent caching of recently read user data and NetApp metadata. It is effective for random read-intensive workloads, including databases, email, and file services. Compression must be disabled on all volumes to take advantage of the Flash Cache performance improvements. [Learn more](#).
5. Enhanced write performance is enabled when using SSDs, but not when using the DS3_v2 virtual machine type.
6. For Azure region support, see [Cloud Volumes Global Regions](#).
7. Cloud Volumes ONTAP can run on either a Reserved or On-demand VM instance from your cloud provider. Solutions that use other VM instance types aren't supported.

HA pairs

You can choose from the following configurations when deploying Cloud Volumes ONTAP as an HA pair in Azure.

	Freemium	PAYGO Standard	PAYGO Premium	Node-based license	Capacity-based license
Maximum system capacity (disks + object storage)	500 GB	10 TB	368 TB	368 TB per license	2 PB
Supported virtual machine types	<ul style="list-style-type: none"> • DS4_v2 • DS5_v2 ¹ • DS13_v2 • DS14_v2 ¹ • DS15_v2 ¹ • E48s_v3 ¹ • E80ids_v4 ² 	<ul style="list-style-type: none"> • DS4_v2 • DS13_v2 	<ul style="list-style-type: none"> • DS5_v2 ¹ • DS14_v2 ¹ • DS15_v2 ¹ • E48s_v3 ¹ • E80ids_v4 ² 	<ul style="list-style-type: none"> • DS4_v2 • DS5_v2 ¹ • DS13_v2 • DS14_v2 ¹ • DS15_v2 ¹ • E48s_v3 ¹ • E80ids_v4 ² 	<ul style="list-style-type: none"> • DS4_v2 • DS5_v2 ¹ • DS13_v2 • DS14_v2 ¹ • DS15_v2 ¹ • E48s_v3 ¹ • E80ids_v4 ²
Supported disk types	Premium page blobs				

Notes:

1. Cloud Volumes ONTAP supports high write speed with these VM types when using an HA pair. High write speed is supported with all instance types when using a single node system. [Learn more about choosing a write speed.](#)
2. This VM is recommended only when Azure maintenance control is needed. It's not recommended for any other use case due to the higher pricing.
3. PAYGO Explore isn't supported with HA pairs in Azure.
4. For Azure region support, see [Cloud Volumes Global Regions](#).
5. Cloud Volumes ONTAP can run on either a Reserved or On-demand VM instance from your cloud provider. Solutions that use other VM instance types aren't supported.

Supported disk sizes

In Azure, an aggregate can contain up to 12 disks that are all the same type and size.

Single node systems

Single node systems use Azure Managed Disks. The following disk sizes are supported:

Premium SSD	Standard SSD	Standard HDD
• 500 GB	• 100 GB	• 100 GB
• 1 TB	• 500 GB	• 500 GB
• 2 TB	• 1 TB	• 1 TB
• 4 TB	• 2 TB	• 2 TB
• 8 TB	• 4 TB	• 4 TB
• 16 TB	• 8 TB	• 8 TB
• 32 TB	• 16 TB	• 16 TB
	• 32 TB	• 32 TB

HA pairs

HA pairs use Premium page blobs. The following disk sizes are supported:

- 500 GB
- 1 TB
- 2 TB
- 4 TB
- 8 TB

Supported configurations for Cloud Volumes ONTAP 9.8 in GCP

Several Cloud Volumes ONTAP configurations are supported in GCP.

Supported configurations by license

Cloud Volumes ONTAP is available in Google Cloud Platform as a single node system and as a high-availability (HA) pair of nodes for fault tolerance and nondisruptive operations.

Upgrading a single node system to an HA pair is not supported. If you want to switch between a single node system and an HA pair, then you need to deploy a new system and replicate data from the existing system to the new system.

	Freemium	PAYGO Explore	PAYGO Standard	PAYGO Premium	Node-based license	Capacity-based license
Maximum system capacity (disks + object storage)¹	500 GB	2 TB ²	10 TB	368 TB	368 TB per license	2 PB

	Freemium	PAYGO Explore	PAYGO Standard	PAYGO Premium	Node-based license	Capacity-based license
Supported machine types ³	<ul style="list-style-type: none"> • n1-standard-8 • n1-standard-32 • n2-standard-4 • n2-standard-8 • n2-standard-32 	<ul style="list-style-type: none"> • n2-standard-4 	<ul style="list-style-type: none"> • n1-standard-8 • n2-standard-8 	<ul style="list-style-type: none"> • n1-standard-32 • n2-standard-32 	<ul style="list-style-type: none"> • n1-standard-8 • n1-standard-32 • n2-standard-4 • n2-standard-8 • n2-standard-32 	<ul style="list-style-type: none"> • n1-standard-8 • n1-standard-32 • n2-standard-4 • n2-standard-8 • n2-standard-32
Supported disk types ⁴	Zonal persistent disks (SSD and standard)					

Notes:

1. Disk limits can prevent you from reaching the maximum system capacity limit by using disks alone. You can reach the capacity limit by [tiering inactive data to object storage](#).

[Learn more about disk limits in GCP](#).

2. Data tiering to Google Cloud Storage isn't supported with PAYGO Explore.
3. 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.

4. Enhanced write performance is enabled when using SSDs.
5. The Cloud Manager interface shows an additional supported machine type for Standard and BYOL: n1-highmem-4. However, this machine type isn't meant for production environments. We've made it available for a specific lab environment only.
6. For Google Cloud Platform region support, see [Cloud Volumes Global Regions](#).
7. Cloud Volumes ONTAP can run on either a Reserved or On-demand VM instance from your cloud provider. Solutions that use other VM instance types aren't supported.

Supported disk sizes

In GCP, an aggregate can contain up to 6 disks that are all the same type and size. The following disk sizes are supported:

- 100 GB

- 500 GB
- 1 TB
- 2 TB
- 4 TB
- 8 TB
- 16 TB
- 64 TB

Storage limits

Storage limits for Cloud Volumes ONTAP 9.8 in AWS

Cloud Volumes ONTAP has storage configuration limits to provide reliable operations. For best performance, do not configure your system at the maximum values.

Maximum system capacity by license

The maximum system capacity for a Cloud Volumes ONTAP system is determined by its license. The maximum system capacity includes disk-based storage plus object storage used for data tiering. NetApp doesn't support exceeding this limit.

For some HA configurations, disk limits prevent you from reaching the capacity limit by using disks alone. In those cases, you can reach the capacity limit by [tiering inactive data to object storage](#). Refer to capacity and disk limits below for more details.

License	Maximum system capacity (disks + object storage)
Freemium	500 GB
PAYGO Explore	2 TB (data tiering is not supported with Explore)
PAYGO Standard	10 TB
PAYGO Premium	368 TB
Node-based license	368 TB per license
Capacity-based license	2 PB

For HA, is the license capacity limit per node or for the entire HA pair?

The capacity limit is for the entire HA pair. It is not per node. For example, if you use the Premium license, you can have up to 368 TB of capacity between both nodes.

For an HA system in AWS, does mirrored data count against the capacity limit?

No, it doesn't. Data in an AWS HA pair is synchronously mirrored between the nodes so that the data is

available in the event of failure. For example, if you purchase an 8 TB disk on node A, Cloud Manager also allocates an 8 TB disk on node B that is used for mirrored data. While 16 TB of capacity was provisioned, only 8 TB counts against the license limit.

Disk and tiering limits by EC2 instance

Cloud Volumes ONTAP uses EBS volumes as disks, with a maximum disk size of 16 TB. The sections below show disk and tiering limits by EC2 instance family because many EC2 instance types have different disk limits. Disk limits are also different between single node systems and HA pairs.

Note the following:

- c4, m4, and r4 instance types are not supported with new Cloud Volumes ONTAP 9.8 systems. However, we're still showing disk limits for these instance types because you can upgrade a system to the 9.8 release when running on one of these instance types.
- The disk limits below are specific to disks that contain user data. The limits do not include the boot disk and root disk.
- You can now purchase multiple node-based licenses for a Cloud Volumes ONTAP BYOL system to allocate more than 368 TB of capacity. The number of licenses that you can purchase for a single node system or HA pair is unlimited. 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](#). [Learn how to add additional system licenses to Cloud Volumes ONTAP](#).

Single node with a Premium license

Instance family	Max disks per node	Max system capacity with disks alone	Max system capacity with disks and data tiering
c5, m5, and r5 instances	21 ¹	336 TB	368 TB
c4, m4, and r4 instances	34	368 TB	368 TB

1. 21 data disks is the limit for *new* deployments of Cloud Volumes ONTAP. If you upgrade a system that was created with version 9.7 or earlier, then the system continues to support 22 disks. One less data disk is supported on new systems that use these instance types because of the addition of a core disk starting with the 9.8 release.

Single node with node-based licensing

Instance family	Max disks per node	Max system capacity with one license		Max system capacity with multiple licenses	
		Disks alone	Disks + data tiering	Disks alone	Disks + data tiering
c5, m5, and r5 instances	21 ¹	336 TB	368 TB	336 TB	368 TB x each license
c4, m4, and r4 instances	34	368 TB	368 TB	544 TB	368 TB x each license

1. 21 data disks is the limit for *new* deployments of Cloud Volumes ONTAP. If you upgrade a system that was created with version 9.7 or earlier, then the system continues to support 22 disks. One less data disk is

supported on new systems that use these instance types because of the addition of a core disk starting with the 9.8 release.

Single node with capacity-based licensing

Instance family	Max disks per node	Max system capacity with disks alone	Max system capacity with disks and data tiering
c5, m5, and r5 instances	21	336 TB	2 PB

HA pairs with a Premium license

Instance family	Max disks per node	Max system capacity with disks alone	Max system capacity with disks and data tiering
c5, m5, and r5 instances	18 ¹	288 TB	368 TB
c4, m4, and r4 instances	31	368 TB	368 TB

1. 18 data disks is the limit for *new* deployments of Cloud Volumes ONTAP. If you upgrade a system that was created with version 9.7 or earlier, then the system continues to support 19 disks. One less data disk is supported on new systems that use these instance types because of the addition of a core disk starting with the 9.8 release.

HA pairs with node-based licensing

Instance family	Max disks per node	Max system capacity with one license		Max system capacity with multiple licenses	
		Disks alone	Disks + data tiering	Disks alone	Disks + data tiering
c5, m5, and r5 instances	18 ¹	288 TB	368 TB	288 TB	368 TB x each license
c4, m4, and r4 instances	31	368 TB	368 TB	496 TB	368 TB x each license

1. 18 data disks is the limit for *new* deployments of Cloud Volumes ONTAP. If you upgrade a system that was created with version 9.7 or earlier, then the system continues to support 19 disks. One less data disk is supported on new systems that use these instance types because of the addition of a core disk starting with the 9.8 release.

HA pairs with capacity-based licensing

Instance family	Max disks per node	Max system capacity with disks alone	Max system capacity with disks and data tiering
c5, m5, and r5 instances	18	288 TB	2 PB

Aggregate limits

Cloud Volumes ONTAP uses AWS volumes as disks and groups them into *aggregates*. Aggregates provide storage to volumes.

Parameter	Limit
Maximum number of aggregates	Single node: Same as the disk limit HA pairs: 18 in a node ¹
Maximum aggregate size	96 TB of raw capacity ²
Disks per aggregate	1-6 ³
Maximum number of RAID groups per aggregate	1

Notes:

1. It's not possible to create 18 aggregates on both nodes in an HA pair because doing so would exceed the data disk limit.
2. The aggregate capacity limit is based on the disks that comprise the aggregate. The limit does not include object storage used for data tiering.
3. All disks in an aggregate must be the same size.

Storage VM limits

Some configurations enable you to create additional storage VMs (SVMs) for Cloud Volumes ONTAP.

[Learn how to create additional storage VMs.](#)

License type	Instance family	Storage VM limit
PAYGO	c4, m4, and r4	<ul style="list-style-type: none">• 1 storage VM for serving data• 1 storage VM for disaster recovery
	c5, m5, and r5	<ul style="list-style-type: none">• 1 storage VM for serving data• 1 storage VM for disaster recovery
Freemium	c5, m5, and r5	<ul style="list-style-type: none">• 24 storage VMs total ^{1,2}
Capacity-based license ³	c5, m5, and r5	<ul style="list-style-type: none">• 24 storage VMs total ^{1,2}
Node-based BYOL ⁴	c4, m4, and r4	<ul style="list-style-type: none">• 1 storage VM for serving data• 1 storage VM for disaster recovery
	c5, m5, and r5	<ul style="list-style-type: none">• 24 storage VMs total ^{1,2}

1. The limit can be lower, depending on the EC2 instance type that you use. The limits per instance are listed in the section below.
2. These 24 storage VMs can serve data or be configured for disaster recovery (DR).

- For capacity-based licensing, there are no extra licensing costs for additional storage VMs, but there is a 4 TB minimum capacity charge per storage VM. For example, if you create two storage VMs and each has 2 TB of provisioned capacity, you'll be charged a total of 8 TB.
- For node-based BYOL, an add-on license is required for each additional *data-serving* storage VM beyond the first storage VM that comes with Cloud Volumes ONTAP by default. Contact your account team to obtain a storage VM add-on license.

Storage VMs that you configure for disaster recovery (DR) don't require an add-on license (they are free of charge), but they do count against the storage VM limit. For example, if you have 12 data-serving storage VMs and 12 storage VMs configured for disaster recovery, then you've reached the limit and can't create any additional storage VMs.

Storage VM limit by EC2 instance type

When you create an additional storage VM, you need to allocate private IP addresses to port e0a. The table below identifies the maximum number of private IPs per interface, as well as the number of IP addresses that are available on port e0a after Cloud Volumes ONTAP has been deployed. The number of available IP addresses directly affects the maximum number of storage VMs for that configuration.

Configuration	Instance type	Max private IPs per interface	IPs remaining after deployment ¹	Max storage VMs without a mgmt LIF ^{2,3}	Max storage VMs with a mgmt LIF ^{2,3}
Single node	*.2xlarge	15	9	10	5
	*.4xlarge	30	24	24	12
	*.8xlarge	30	24	24	12
	*.9xlarge	30	24	24	12
	*.12xlarge	30	24	24	12
	*.16xlarge	50	44	24	12
	*.18xlarge	50	44	24	12
HA pair in single AZ	*.2xlarge	15	10	11	5
	*.4xlarge	30	25	24	12
	*.8xlarge	30	25	24	12
	*.9xlarge	30	25	24	12
	*.12xlarge	30	25	24	12
	*.16xlarge	50	45	24	12
	*.18xlarge	50	45	24	12

Configuration	Instance type	Max private IPs per interface	IPs remaining after deployment ¹	Max storage VMs without a mgmt LIF ^{2,3}	Max storage VMs with a mgmt LIF ^{2,3}
HA pair in multi AZs	*.2xlarge	15	12	13	13
	*.4xlarge	30	27	24	24
	*.8xlarge	30	27	24	24
	*.9xlarge	30	27	24	24
	*.12xlarge	30	27	24	24
	*.16xlarge	50	47	24	24
	*.18xlarge	50	47	24	24

1. This number indicates how many *remaining* private IP addresses are available on port e0a after Cloud Volumes ONTAP is deployed and set up. For example, a *.2xlarge system supports a maximum of 15 IP addresses per network interface. When an HA pair is deployed in a single AZ, 5 private IP addresses are allocated to port e0a. As a result, an HA pair that uses a *.2xlarge instance type has 10 private IP addresses remaining for additional storage VMs.
2. The number listed in these columns includes the initial storage VM that Cloud Manager creates by default. For example, if 24 is listed in this column, it means that you can create 23 additional storage VMs for a total of 24.
3. A management LIF for the storage VM is optional. A management LIF provides a connection to management tools like SnapCenter.

Because it requires a private IP address, it will limit the number of additional storage VMs that you can create. The only exception is an HA pair in multiple AZs. In that case, the IP address for the management LIF is a *floating* IP address so it doesn't count against the *private* IP limit.

File and volume limits

Logical storage	Parameter	Limit
Files	Maximum size	16 TB
	Maximum per volume	Volume size dependent, up to 2 billion
FlexClone volumes	Hierarchical clone depth ¹	499
FlexVol volumes	Maximum per node	500
	Minimum size	20 MB
	Maximum size	Dependent on the size of the aggregate
Qtrees	Maximum per FlexVol volume	4,995
Snapshot copies	Maximum per FlexVol volume	1,023

1. Hierarchical clone depth is the maximum depth of a nested hierarchy of FlexClone volumes that can be created from a single FlexVol volume.

iSCSI storage limits

iSCSI storage	Parameter	Limit
LUNs	Maximum per node	1,024
	Maximum number of LUN maps	1,024
	Maximum size	16 TB
	Maximum per volume	512
igroups	Maximum per node	256
Initiators	Maximum per node	512
	Maximum per igroup	128
iSCSI sessions	Maximum per node	1,024
LIFs	Maximum per port	32
	Maximum per portset	32
Portsets	Maximum per node	256

Storage limits for Cloud Volumes ONTAP 9.8 in Azure

Cloud Volumes ONTAP has storage configuration limits to provide reliable operations. For best performance, do not configure your system at the maximum values.

Maximum system capacity by license

The maximum system capacity for a Cloud Volumes ONTAP system is determined by its license. The maximum system capacity includes disk-based storage plus object storage used for data tiering. NetApp doesn't support exceeding this limit.

License	Maximum system capacity (disks + object storage)
Freemium	500 GB
PAYGO Explore	2 TB (data tiering is not supported with Explore)
PAYGO Standard	10 TB
PAYGO Premium	368 TB
Node-based license	368 TB per license
Capacity-based license	2 PB

For HA, is the license capacity limit per node or for the entire HA pair?

The capacity limit is for the entire HA pair. It is not per node. For example, if you use the Premium license, you can have up to 368 TB of capacity between both nodes.

Disk and tiering limits by VM size

The disk limits below are specific to disks that contain user data. The limits do not include the root disk, core disk, and VNVRAM.

The tables below show the maximum system capacity by VM size with disks alone, and with disks and cold data tiering to object storage.

- Single node systems can use Standard HDD Managed Disks, Standard SSD Managed Disks, and Premium SSD Managed Disks, with up to 32 TB per disk. The number of supported disks varies by VM size.
- HA systems use Premium page blobs as disks, with up to 8 TB per page blob. The number of supported disks varies by VM size.



You can purchase multiple node-based licenses for a Cloud Volumes ONTAP BYOL system to allocate more than 368 TB of capacity. The number of licenses that you can purchase for a single node system or HA pair is unlimited. 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](#). [Learn how to add additional system licenses to Cloud Volumes ONTAP](#).

Single node with a Premium license

VM size	Max data disks per node	Max system capacity with disks alone	Max system capacity with disks and data tiering
DS5_v2	61	368 TB	368 TB
DS14_v2	61	368 TB	368 TB
DS15_v2	61	368 TB	368 TB
E32s_v3	29	368 TB	368 TB
E48s_v3	29	368 TB	368 TB
E64is_v3	29	368 TB	368 TB
E80ids_v4	29	368 TB	368 TB

Single node with node-based licensing



For some VM types, you'll need several BYOL licenses to reach the max system capacity listed below. For example, you'd need 6 BYOL licenses to reach 1.95 PB with DS5_v2.

VM size	Max data disks per node	Max system capacity with one license		Max system capacity with multiple licenses	
		Disks alone	Disks + data tiering	Disks alone	Disks + data tiering
DS3_v2	13	368 TB	368 TB	416 TB	368 TB x each license

VM size	Max data disks per node	Max system capacity with one license		Max system capacity with multiple licenses	
DS4_v2	29	368 TB	368 TB	928 TB	368 TB x each license
DS5_v2	61	368 TB	368 TB	1.95 PB	368 TB x each license
DS13_v2	29	368 TB	368 TB	928 TB	368 TB x each license
DS14_v2	61	368 TB	368 TB	1.95 PB	368 TB x each license
DS15_v2	61	368 TB	368 TB	1.95 PB	368 TB x each license
E32s_v3	29	368 TB	368 TB	928 TB	368 TB x each license
E48s_v3	29	368 TB	368 TB	928 TB	368 TB x each license
E64is_v3	29	368 TB	368 TB	928 TB	368 TB x each license
E80ids_v4	29	368 TB	368 TB	928 TB	368 TB x each license
L8s_v2	13	368 TB	368 TB	416 TB	368 TB x each license

Single node with capacity-based licensing

VM size	Max data disks per node	Max system capacity with disks alone	Max system capacity with disks and data tiering
DS3_v2	13	416 TB	2 PB
DS4_v2	29	928 TB	2 PB
DS5_v2	61	1.95 TB	2 PB
DS13_v2	29	928 TB	2 PB
DS14_v2	61	1.95 TB	2 PB
DS15_v2	61	1.95 TB	2 PB
E32s_v3	29	928 TB	2 PB
E48s_v3	29	928 TB	2 PB
E80ids_v4	29	928 TB	2 PB
L8s_v2	13	416 TB	2 PB

HA pairs with a Premium license

VM size	Max data disks per node	Max system capacity with disks alone	Max system capacity with disks and data tiering
DS5_v2	61	368 TB	368 TB
DS14_v2	61	368 TB	368 TB
DS15_v2	61	368 TB	368 TB
E48s_v3	29	368 TB	368 TB
E80ids_v4	29	368 TB	368 TB

HA pairs with node-based licensing



For some VM types, you'll need several BYOL licenses to reach the max system capacity listed below. For example, you'd need 3 BYOL licenses to reach 976 TB with DS5_v2.

VM size	Max data disks per node	Max system capacity with one license		Max system capacity with multiple licenses	
		Disks alone	Disks + data tiering	Disks alone	Disks + data tiering
DS4_v2	29	368 TB	368 TB	464 TB	368 TB x each license
DS5_v2	61	368 TB	368 TB	976 TB	368 TB x each license
DS13_v2	29	368 TB	368 TB	464 TB	368 TB x each license
DS14_v2	61	368 TB	368 TB	976 TB	368 TB x each license
DS15_v2	61	368 TB	368 TB	976 TB	368 TB x each license
E48s_v3	29	368 TB	368 TB	464 TB	368 TB x each license
E80ids_v4	29	368 TB	368 TB	464 TB	368 TB x each license

HA pairs with capacity-based licensing

VM size	Max data disks per node	Max system capacity with disks alone	Max system capacity with disks and data tiering
DS5_v2	61	976 TB	2 PB
DS14_v2	61	976 TB	2 PB

VM size	Max data disks per node	Max system capacity with disks alone	Max system capacity with disks and data tiering
DS15_v2	61	976 TB	2 PB
E48s_v3	29	464 TB	2 PB
E80ids_v4	29	464 TB	2 PB

Aggregate limits

Cloud Volumes ONTAP uses Azure storage as disks and groups them into *aggregates*. Aggregates provide storage to volumes.

Parameter	Limit
Maximum number of aggregates	Same as the disk limit
Maximum aggregate size ¹	384 TB of raw capacity for single node ² 352 TB of raw capacity for single node with PAYGO 96 TB of raw capacity for HA pairs
Disks per aggregate	1-12 ³
Maximum number of RAID groups per aggregate	1

Notes:

1. The aggregate capacity limit is based on the disks that comprise the aggregate. The limit does not include object storage used for data tiering.
2. If using node-based licensing, two BYOL licenses are required to reach 384 TB.
3. All disks in an aggregate must be the same size.

Logical storage limits

Logical storage	Parameter	Limit
Storage virtual machines (SVMs)	Maximum number for Cloud Volumes ONTAP (HA pair or single node)	One data-serving SVM and one destination SVM used for disaster recovery. You can activate the destination SVM for data access if there's an outage on the source SVM. ¹ The one data-serving SVM spans the entire Cloud Volumes ONTAP system (HA pair or single node).
Files	Maximum size	16 TB
	Maximum per volume	Volume size dependent, up to 2 billion
FlexClone volumes	Hierarchical clone depth ²	499

Logical storage	Parameter	Limit
FlexVol volumes	Maximum per node	500
	Minimum size	20 MB
	Maximum size	Azure HA: Dependent on the size of the aggregate ³ Azure single node: 100 TB
Qtrees	Maximum per FlexVol volume	4,995
Snapshot copies	Maximum per FlexVol volume	1,023

Notes:

- Cloud Manager does not provide any setup or orchestration support for SVM disaster recovery. It also does not support storage-related tasks on an additional SVM. You must use System Manager or the CLI for SVM disaster recovery.
 - [SVM Disaster Recovery Preparation Express Guide](#)
 - [SVM Disaster Recovery Express Guide](#)
- Hierarchical clone depth is the maximum depth of a nested hierarchy of FlexClone volumes that can be created from a single FlexVol volume.
- Less than 100 TB is supported for this configuration because aggregates on HA pairs are limited to 96 TB of *raw* capacity.

iSCSI storage limits

iSCSI storage	Parameter	Limit
LUNs	Maximum per node	1,024
	Maximum number of LUN maps	1,024
	Maximum size	16 TB
	Maximum per volume	512
igroups	Maximum per node	256
Initiators	Maximum per node	512
	Maximum per igroup	128
iSCSI sessions	Maximum per node	1,024
LIFs	Maximum per port	32
	Maximum per portset	32
Portsets	Maximum per node	256

Storage limits for Cloud Volumes ONTAP 9.8 in GCP

Cloud Volumes ONTAP has storage configuration limits to provide reliable operations. For best performance, do not configure your system at the maximum values.

Maximum system capacity by license

The maximum system capacity for a Cloud Volumes ONTAP system is determined by its license. The maximum system capacity includes disk-based storage plus object storage used for data tiering. NetApp doesn't support exceeding this limit.

For some configurations, disk limits prevent you from reaching the capacity limit by using disks alone. You can reach the capacity limit by [tiering inactive data to object storage](#). Refer to the disk limits below for more details.

License	Maximum system capacity (disks + object storage)
Freemium	500 GB
PAYGO Explore	2 TB (data tiering is not supported with Explore)
PAYGO Standard	10 TB
PAYGO Premium	368 TB
Node-based license	368 TB per license
Capacity-based license	2 PB

For an HA pair, is the licensed capacity limit per node or for the entire HA pair?

The capacity limit is for the entire HA pair. It is not per node. For example, if you use the Premium license, you can have up to 368 TB of capacity between both nodes.

For an HA pair, does mirrored data count against the licensed capacity limit?

No, it doesn't. Data in an HA pair is synchronously mirrored between the nodes so that the data is available in the event of failure in Google Cloud. For example, if you purchase an 8 TB disk on node A, Cloud Manager also allocates an 8 TB disk on node B that is used for mirrored data. While 16 TB of capacity was provisioned, only 8 TB counts against the license limit.

Disk and tiering limits

The table below shows the maximum system capacity with disks alone, and with disks and cold data tiering to object storage. The disk limits are specific to disks that contain user data. The limits do not include the boot disk and root disk.

Parameter	Limit
Maximum data disks	<ul style="list-style-type: none">• 124 for single node systems• 123 per node for HA pairs
Maximum disk size	64 TB
Maximum system capacity with disks alone	256 TB ¹

Parameter	Limit
Maximum system capacity with disks and cold data tiering to a Google Cloud Storage bucket	Depends on the license. See the table above.

¹ This limit is defined by virtual machine limits in Google Cloud Platform.

Aggregate limits

Cloud Volumes ONTAP groups Google Cloud Platform disks into *aggregates*. Aggregates provide storage to volumes.

Parameter	Limit
Maximum number of data aggregates ¹	<ul style="list-style-type: none"> • 99 for single node • 64 for an entire HA pair
Maximum aggregate size	256 TB of raw capacity ²
Disks per aggregate	1-6 ³
Maximum number of RAID groups per aggregate	1

Notes:

1. The maximum number of data aggregates doesn't include the root aggregate.
2. The aggregate capacity limit is based on the disks that comprise the aggregate. The limit does not include object storage used for data tiering.
3. All disks in an aggregate must be the same size.

Logical storage limits

Logical storage	Parameter	Limit
Storage virtual machines (SVMs)	Maximum number for Cloud Volumes ONTAP (HA pair or single node)	One data-serving SVM and one destination SVM used for disaster recovery. You can activate the destination SVM for data access if there's an outage on the source SVM. ¹ The one data-serving SVM spans the entire Cloud Volumes ONTAP system (HA pair or single node).
Files	Maximum size	16 TB
	Maximum per volume	Volume size dependent, up to 2 billion
FlexClone volumes	Hierarchical clone depth ²	499

Logical storage	Parameter	Limit
FlexVol volumes	Maximum per node	500
	Minimum size	20 MB
	Maximum size	100 TB
Qtrees	Maximum per FlexVol volume	4,995
Snapshot copies	Maximum per FlexVol volume	1,023

Notes:

- Cloud Manager does not provide any setup or orchestration support for SVM disaster recovery. It also does not support storage-related tasks on an additional SVM. You must use System Manager or the CLI for SVM disaster recovery.
 - [SVM Disaster Recovery Preparation Express Guide](#)
 - [SVM Disaster Recovery Express Guide](#)
- Hierarchical clone depth is the maximum depth of a nested hierarchy of FlexClone volumes that can be created from a single FlexVol volume.

iSCSI storage limits

iSCSI storage	Parameter	Limit
LUNs	Maximum per node	1,024
	Maximum number of LUN maps	1,024
	Maximum size	16 TB
	Maximum per volume	512
igroups	Maximum per node	256
Initiators	Maximum per node	512
	Maximum per igroup	128
iSCSI sessions	Maximum per node	1,024
LIFs	Maximum per port	1
	Maximum per portset	32
Portsets	Maximum per node	256

Known issues for Cloud Volumes ONTAP 9.8

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

There are no known issues in this release specific to Cloud Volumes ONTAP.

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

Known limitations

Limitations for Cloud Volumes ONTAP 9.8 in all cloud providers

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.

The following limitations apply to Cloud Volumes ONTAP in all cloud providers: AWS, Azure, and GCP.

Cloud Volumes ONTAP supports Reserved and On-demand VM instances

Cloud Volumes ONTAP can run on either a Reserved or On-demand VM instance from your cloud provider. Other types of VM instances aren't supported.

Automatic application resource management solutions shouldn't be used

Automatic application resource management solutions should not manage Cloud Volumes ONTAP systems. Doing so can result in a change to an unsupported configuration. For example, the solution might change Cloud Volumes ONTAP to an unsupported VM instance type.

Software updates must be completed by Cloud Manager

Upgrades of Cloud Volumes ONTAP must be completed from Cloud Manager. You should not upgrade Cloud Volumes ONTAP by using System Manager or the CLI. Doing so can impact system stability.

Cloud Volumes ONTAP deployment must not be modified from your cloud provider's console

Changes to a Cloud Volumes ONTAP configuration from your cloud provider's console results in an unsupported configuration. Any changes to the Cloud Volumes ONTAP resources that Cloud Manager creates and manages can impact system stability and Cloud Manager's ability to manage the system.

Disks and aggregates must be managed from Cloud Manager

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

SnapManager licensing limitation

SnapManager per-server licenses are supported with Cloud Volumes ONTAP. Per-storage system (SnapManager suite) licenses are not supported.

Unsupported ONTAP features

The following features are not supported with Cloud Volumes ONTAP:

- Aggregate-level inline deduplication
- Aggregate-level background deduplication
- Disk maintenance center
- Disk sanitization

- FabricPool mirroring
- Fibre Channel (FC)
- Flash Pools
- Infinite Volumes
- Interface groups
- Intranode LIF failover
- MetroCluster
- ONTAP S3
- RAID4, RAID-DP, RAID-TEC (RAID0 is supported)
- Service Processor
- SnapLock Compliance mode (Enterprise mode is supported)
- SnapMirror Synchronous
- VLANs

Known limitations for Cloud Volumes ONTAP 9.8 in AWS

The following known limitations are specific to Cloud Volumes ONTAP in Amazon Web Services. Be sure to also review [Limitations for Cloud Volumes ONTAP 9.8 in all cloud providers](#).

AWS Outpost limitations

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

Flash Cache limitations

C5D and R5D instance types include local NVMe storage, which Cloud Volumes ONTAP uses as *Flash Cache*. Note the following limitations:

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

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

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

False alarms reported by Amazon CloudWatch

Cloud Volumes ONTAP does not release CPUs when idle, so [Amazon CloudWatch](#) can report a high CPU warning for the EC2 instance because it sees 100% usage. You can ignore this alarm. The ONTAP statistics command displays the true usage of the CPUs.

Cloud Volumes ONTAP HA pairs do not support immediate storage giveback

After a node reboots, the partner must sync data before it can return the storage. The time that it takes to resync data depends on the amount of data written by clients while the node was down and the data write speed during the time of giveback.

[Learn how storage works in a Cloud Volumes ONTAP HA pair running in AWS.](#)

Limitations in the AWS C2S environment

[View limitations for Cloud Volumes ONTAP in AWS C2S.](#)

Known limitations for Cloud Volumes ONTAP 9.8 in Azure

The following known limitations are specific to Cloud Volumes ONTAP in Microsoft Azure. Be sure to also review [Limitations for Cloud Volumes ONTAP 9.8 in all cloud providers](#).

Flash Cache limitations

The Standard_L8s_v2 VM type includes local NVMe storage, which Cloud Volumes ONTAP uses as *Flash Cache*. Note the following limitations for Flash Cache:

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

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

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

HA limitations

The following limitations affect Cloud Volumes ONTAP HA pairs in Microsoft Azure:

- NFSv4 isn't supported. NFSv3 is supported.
- HA pairs aren't supported in some regions.

[See the list of supported Azure regions.](#)

Pay-as-you-go not available for CSP partners

If you are a Microsoft Cloud Solution Provider (CSP) partner, you cannot deploy Cloud Volumes ONTAP Explore, Standard, or Premium because pay-as-you-go subscriptions are not available for CSP partners. You must purchase a license and deploy Cloud Volumes ONTAP BYOL.

Known limitations for Cloud Volumes ONTAP 9.8 in GCP

There are no known limitations specific to Cloud Volumes ONTAP in Google Cloud Platform. See the [Limitations for Cloud Volumes ONTAP 9.8 in all cloud providers](#).

9.7 Release Notes

What's new in Cloud Volumes ONTAP 9.7

Cloud Volumes ONTAP 9.7 includes several new features and enhancements.

Additional features and enhancements are also introduced in the latest versions of Cloud Manager. See the [Cloud Manager Release Notes](#) for details.

9.7 P6 (15 Aug 2020)

The 9.7 P6 patch release for Cloud Volumes ONTAP is now available through Cloud Manager 3.8 and later. Cloud Manager will prompt you to upgrade your existing systems to this patch release. [View the list of bugs fixed in the P6 patch](#) (NetApp Support Site login required).

Multiple BYOL licenses for additional capacity (3 Aug 2020)

You can now purchase multiple licenses for a Cloud Volumes ONTAP BYOL system to allocate more than 368 TB of capacity. For example, you might purchase two licenses to allocate up to 736 TB of capacity to Cloud Volumes ONTAP. Or you could purchase four licenses to get up to 1.4 PB.

The number of licenses that you can purchase for a single node system or HA pair is unlimited.

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 the storage limits in these release notes.

[Learn how to add additional system licenses to Cloud Volumes ONTAP](#).

9.7 P5 in AWS (27 July 2020)

Cloud Volumes ONTAP 9.7 P5 is now available in AWS. This patch release includes bug fixes and support for new EC2 instance types.

[View the list of bugs fixed in the P5 patch](#) (NetApp Support Site login required).

Support for new EC2 instance types

Cloud Volumes ONTAP now supports the following EC2 instance types with the Premium and BYOL licenses:

- c5n.9xlarge
- c5n.18xlarge

9.7 P5 in Azure (20 July 2020)

Cloud Volumes ONTAP 9.7 P5 is now available in Microsoft Azure. This patch release includes bug fixes and support for new VM types.

[View the list of bugs fixed in the P5 patch](#) (NetApp Support Site login required).

Support for new VM types with Ultra SSD VNVVRAM

Cloud Volumes ONTAP now supports the following VM types with single node systems that have a Premium or BYOL license:

- Standard_E32s_v3
- Standard_E48s_v3

The E32s_v3 VM type uses an [Ultra SSD](#) for VNVVRAM, which provides better write performance.

Support for these VM types is currently available in the following regions: US Gov Virginia, South Central US, and West US.

Support for multiple storage VMs in AWS (16 July 2020)

Cloud Volumes ONTAP 9.7 now supports multiple storage VMs (SVMs) in AWS.

Multiple storage VMs are supported with the C5, M5, and R5 instance types when you bring your own license (BYOL). The following number of storage VMs are supported:

- 12 storage VMs with single node systems
- 8 storage VMs with HA pairs

An add-on license is required for each additional *data-serving* storage VM beyond the first storage VM that is configured with Cloud Volumes ONTAP by default. Contact your account team to obtain an SVM add-on license.

Storage VMs that you configure for disaster recovery (DR) don't require an add-on license (they are free of charge), but they do count against the storage VM limit.

For example, if you have 8 data-serving storage VMs on an HA pair, then you've reached the limit and can't create any additional storage VMs. The same is true for another HA pair that has 8 storage VMs configured for disaster recovery—you've reached the limit and can't create any additional storage VMs.

Creating additional storage VMs must be done through System Manager or the CLI.

Germany Sovereign regions in Azure are no longer supported (26 June 2020)

Cloud Volumes ONTAP is no longer supported in the following Azure regions:

- Germany Central (Sovereign)
- Germany Northeast (Sovereign)

NetApp continues to support Cloud Volumes ONTAP in the public Germany regions:

- Germany North (Public)
- Germany West Central (Public)

[See the full list of supported Azure regions.](#)

9.7 P4 (2 June 2020)

The 9.7 P4 patch release for Cloud Volumes ONTAP is now available through Cloud Manager 3.8 and later.

Cloud Manager will prompt you to upgrade your existing systems to this patch release. [View the list of bugs fixed in the P4 patch](#) (NetApp Support Site login required).

9.7 P3 (2 May 2020)

The 9.7 P3 patch release for Cloud Volumes ONTAP is now available through Cloud Manager 3.8 and later. Cloud Manager will prompt you to upgrade your existing systems to this patch release. [View the list of bugs fixed in the P3 patch](#) (NetApp Support Site login required).

9.7 P2 (8 Apr 2020)

The 9.7 P2 patch release for Cloud Volumes ONTAP is now available through Cloud Manager 3.8 and later. Cloud Manager will prompt you to upgrade your existing systems to this patch release. [View the list of bugs fixed in the P2 patch](#) (NetApp Support Site login required).

Increased disk capacity in GCP (13 Mar 2020)

You can now attach up to 256 TB of persistent disks to Cloud Volumes ONTAP when using the Premium or BYOL licenses in Google Cloud. This is up from 64 TB.

Just like before, you can reach the 368 TB maximum system capacity for Premium and BYOL by combining persistent disks with data tiering to object storage.

The maximum number of data disks per system has also increased to 124 disks.

- [Learn more about supported configurations for Cloud Volumes ONTAP in GCP](#)
- [Review storage limits in GCP](#)

9.7 P1 (6 Mar 2020)

The 9.7 P1 patch release for Cloud Volumes ONTAP is now available through Cloud Manager 3.8 and later. Cloud Manager will prompt you to upgrade your existing systems to this patch release. [View the list of bugs fixed in the P1 patch](#) (NetApp Support Site login required).

AWS updates (16 Feb 2020)

We've introduced support for new EC2 instances and a change in the number of supported data disks.

Support for new instances

Several new EC2 instance types are now supported with Cloud Volumes ONTAP 9.7 when using a Premium or BYOL license:

- c5.9xlarge
- c5d.18xlarge ¹
- m5d.8xlarge ¹
- m5d.12xlarge ¹
- m5.16xlarge
- r5.8xlarge
- r5.12xlarge ²

¹ These instance types include local NVMe storage, which Cloud Volumes ONTAP uses as *Flash Cache*. [Learn more](#).

² The r5.12xlarge instance type has a known limitation with supportability. If a node unexpectedly reboots due to a panic, the system might not collect core files used to troubleshoot and root cause the problem. The customer accepts the risks and limited support terms and bears all support responsibility if this condition occurs.

[Learn more about these EC2 instance types](#).

[Learn more about supported 9.7 configurations in AWS](#).

Supported data disks

One less data disk is now supported for c5, m5, and r5 instances. For single node systems, 22 data disks are supported. For HA pairs, 19 data disks are supported per node.

[Learn more about storage limits in AWS](#).

Support for DS15_v2 in Azure (12 Feb 2020)

Cloud Volumes ONTAP is now supported with the DS15_v2 virtual machine type in Azure, on both single node systems and HA pairs.

[Learn more about the DSv2 series](#).

[Learn more about supported 9.7 configurations in Azure](#).

9.7 GA (10 Feb 2020)

The General Availability (GA) release of Cloud Volumes ONTAP 9.7 is now available in AWS and GCP. The GA release includes bug fixes. Cloud Manager will prompt you to upgrade your existing systems to this release.

9.7 D1 for Azure (29 Jan 2020)

Cloud Volumes ONTAP 9.7 D1 is now available in Microsoft Azure.

We discovered an issue with Cloud Volumes ONTAP 9.7 and earlier, where Cloud Volumes ONTAP may not start up successfully in situations where the Azure virtual machine is restarted.

This issue is fixed in 9.7 D1 (and later). We highly recommend upgrading to the latest Cloud Volumes ONTAP version as soon as possible.

If you have any questions, please contact us using the in-product chat or at <https://www.netapp.com/us/contact-us/support.aspx>.

9.7 RC1 (16 Dec 2019)

Cloud Volumes ONTAP 9.7 RC1 is now available in AWS, Azure, and Google Cloud Platform. In addition to the features introduced with [ONTAP 9.7](#), this release of Cloud Volumes ONTAP includes the following:

- [Flash Cache support in Azure](#)
- [Fix for Azure NIC detach events](#)

Flash Cache support in Azure

Cloud Volumes ONTAP now supports the Standard_L8s_v2 VM type with single node, BYOL systems in Azure. This VM type includes local NVMe storage, which Cloud Volumes ONTAP uses as *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.

Deploy new systems using this VM type or modify existing systems to use this VM type and you'll automatically take advantage of Flash Cache.

[Learn more about enabling Flash Cache on Cloud Volumes ONTAP, including a limitation with data compression.](#)

Fix for Azure NIC detach events

This release addresses an issue with Cloud Volumes ONTAP node reboots from Azure NIC detach events. Cloud Volumes ONTAP will handle these events more gracefully and not disrupt service. Cloud Volumes ONTAP HA pairs will still perform a takeover/give back sequence from Azure freeze maintenance events, but there's no subsequent reboot from a NIC detach that might occur during this time.

Upgrade notes

- Upgrades of Cloud Volumes ONTAP must be completed from Cloud Manager. You should not upgrade Cloud Volumes ONTAP by using System Manager or the CLI. Doing so can impact system stability.
- You can upgrade to Cloud Volumes ONTAP 9.7 from the 9.6 release. Cloud Manager will prompt you to upgrade your existing Cloud Volumes ONTAP 9.6 systems to the 9.7 release.

[Learn how to upgrade when Cloud Manager notifies you.](#)

- The upgrade of a single node system takes the system offline for up to 25 minutes, during which I/O is interrupted.
- Upgrading an HA pair is nondisruptive and I/O is uninterrupted. During this nondisruptive upgrade process, each node is upgraded in tandem to continue serving I/O to clients.

Licensing for Cloud Volumes ONTAP 9.7

Several licensing options are available for Cloud Volumes ONTAP. Each option enables you to choose a configuration that meets your needs.

Licensing overview

The following table provides an overview of the licensing options for Cloud Volumes ONTAP.

Beyond these licensing options, you can also choose the *Freemium* offering to get started with Cloud Volumes ONTAP without purchasing a license or contract.

Charging method	Highlights	Support	Max system capacity
Capacity-based license: Essential package	<ul style="list-style-type: none"> • Pay per TiB of capacity for one or more Cloud Volumes ONTAP systems • Provides a la carte licensing for Cloud Volumes ONTAP: <ul style="list-style-type: none"> ◦ A single node or HA system ◦ File and block storage or secondary data (DR) • Available by bringing your own license (BYOL) purchased from NetApp 	Included	2 PB
Capacity-based license: Professional package	<ul style="list-style-type: none"> • Pay per TiB of capacity for one or more Cloud Volumes ONTAP systems • Provides licensing for any Cloud Volumes ONTAP configuration (single node or HA with any storage type) • Includes volume backups using the Cloud Backup Service (only for volumes charged against this license) • Available through an AWS Marketplace annual contract or by bringing your own license (BYOL) purchased from NetApp 	Included	2 PB
PAYGO by node	<ul style="list-style-type: none"> • Pay-as-you-go by the hour through a marketplace subscription from your cloud provider • Charging is per Cloud Volumes ONTAP node • Available in three licensing options: Explore, Standard, and Premium 	Included, but you must activate support	<ul style="list-style-type: none"> • Explore: 2 TB • Standard: 10 TB • Premium: 368 TB
Node-based license	<ul style="list-style-type: none"> • Single node or HA license with term-based options • Available by bringing your own license (BYOL) purchased from NetApp 	Included	368 TB per license

The following sections provide more details about each of these options.

Freemium offering

- A new offering that provides all Cloud Volumes ONTAP features free of charge from NetApp (cloud provider charges still apply).
- No license or contract is needed.
- Support is not included.

- You're limited to 500 GB of allocated capacity per Cloud Volumes ONTAP system.
- You can use up to 10 Cloud Volumes ONTAP systems with the Freemium offering per NetApp account.
- If the allocated capacity for a Cloud Volumes ONTAP system exceeds 500 GB, Cloud Manager converts the system to the Essential package (which is a capacity-based license) and charging starts.

Any other systems that have less than 500 GB of allocated capacity stay on the Freemium offering (as long as they were deployed using the Freemium offering).

To get started with the Freemium offering, create a new Cloud Volumes ONTAP working environment and select **Freemium** when prompted to choose a charging method.

Capacity-based licenses

Capacity-based licensing enables you to pay for Cloud Volumes ONTAP per TiB of capacity. The license is associated with your NetApp account and enables you to charge multiple systems against the license, as long as enough capacity is available through the license.

For example, you could purchase a single 20 TB license, deploy four Cloud Volumes ONTAP systems, and then allocate a 5 TB volume to each system, for a total of 20 TB.

Unlike the by-node charging method where a license is purchased per Cloud Volumes ONTAP system, a capacity-based license is issued to a NetApp account. The capacity is then 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 the following packages: Essential or Professional.

This licensing method is available for Cloud Volumes ONTAP 9.7 and later.



For each package, there is a minimum allocated capacity charge of 4 TB. Any Cloud Volumes ONTAP instance that has less than 4 TB of allocated capacity will be charged at a rate of 4 TB.

Essential package

- Provides a la carte licensing for Cloud Volumes ONTAP:
 - A single node or HA system
 - File and block storage or secondary data for disaster recovery (DR)
- This package is available as a license (BYOL) purchased from NetApp.
- Support is included for the length of the subscription term.
- Conversions to another licensing option isn't supported.
- Each individual Cloud Volumes ONTAP system supports up to 2 PB of capacity through disks and tiering to object storage.

Professional package

- Provides licensing for any Cloud Volumes ONTAP configuration (single node or HA with any storage type).
- Includes volume backups using the Cloud Backup Service (only for volumes charged against this license).

- This package is available as an annual contract from the AWS Marketplace or as a license (BYOL) purchased from NetApp.

If you have an AWS Marketplace contract, *all* Cloud Volumes ONTAP systems that you deploy are charged against that contract. You can't mix and match a Marketplace contract with BYOL.

- Support is included for the length of the subscription term.
- Conversions to another licensing option isn't supported.
- Each individual Cloud Volumes ONTAP system supports up to 2 PB of capacity through disks and tiering to object storage.

To get started with a capacity-based license, [Contact NetApp Sales](#) and then [add your license to Cloud Manager](#).

PAYGO by node

- Requires a subscription from a cloud provider's marketplace for pay-as-you-go pricing at an hourly rate.
- Charging is per Cloud Volumes ONTAP node.
- Offers Cloud Volumes ONTAP in three different licensing options: Explore, Standard, and Premium. Each license provides support for different amounts of storage and compute.
- A 30-day free trial is available for the first Cloud Volumes ONTAP system that you deploy in a cloud provider. [Learn more about 30-day free trials](#).
 - There are no hourly software charges, but cloud provider infrastructure charges still apply (compute, storage, and networking).
 - When the free trial ends, you'll be charged hourly according to the selected license, as long as you subscribed. If you haven't subscribed, the system shuts down.

Cloud Manager prompts you to subscribe to your cloud provider's marketplace when you create a Cloud Volumes ONTAP system.

- Conversions to another licensing option isn't supported.
- Basic technical support is offered, but you must [register and activate the NetApp serial number associated with your system](#).

You can view pricing details from your cloud provider's marketplace:

- [AWS Marketplace](#)
- [Azure Marketplace](#)
- [Google Cloud Platform Marketplace](#)

To get started with PAYGO, create a Cloud Volumes ONTAP working environment and subscribe to your cloud provider's marketplace when prompted.

Node-based licenses

- Single node or HA license with term-based subscription options like 12 months, 24 months, and more.
- Available by bringing your own license (BYOL) purchased from NetApp.
- Each Cloud Volumes ONTAP system supports up to 368 TB of capacity per license.

- Conversions to another licensing option isn't supported.

If you want to transition to capacity-based licensing, you can purchase a license, deploy a new Cloud Volumes ONTAP system, and then replicate the data to that new system.

To get started with a node-based license, [Contact NetApp Sales](#) and then [add your license to Cloud Manager](#).

Supported configurations

Supported configurations for Cloud Volumes ONTAP 9.7 in AWS

Several Cloud Volumes ONTAP configurations are supported in AWS.

Supported configurations by license

Cloud Volumes ONTAP is available in AWS as a single node system and as a high-availability (HA) pair of nodes for fault tolerance and nondisruptive operations.

Upgrading a single node system to an HA pair is not supported. If you want to switch between a single node system and an HA pair, then you need to deploy a new system and replicate data from the existing system to the new system.

	Freemium	PAYGO Explore	PAYGO Standard	PAYGO Premium	Node-based license	Capacity-based license
Maximum system capacity (disks + object storage)	500 GB	2 TB	10 TB	368 TB ¹	368 TB per license ¹	2 PB ¹

	Freemium	PAYGO Explore	PAYGO Standard	PAYGO Premium	Node-based license	Capacity-based license
Supported EC2 instance types ²	<ul style="list-style-type: none"> c4.4xlarge c4.8xlarge c5.9xlarge c5.18xlarge c5d.4xlarge ³ c5d.9xlarge ³ c5d.18xlarge ³ c5n.9xlarge ⁴ c5n.18xlarge ⁴ m4.xlarge m4.2xlarge m4.4xlarge m5.xlarge m5.2xlarge m5.4xlarge m5.16xlarge m5d.8xlarge ³ m5d.12xlarge ³ r4.2xlarge r5.2xlarge r5.8xlarge r5.12xlarge ⁵ 	<ul style="list-style-type: none"> m4.xlarge m5.xlarge 	<ul style="list-style-type: none"> m4.2xlarge m5.2xlarge r4.xlarge r5.xlarge 	<ul style="list-style-type: none"> c4.4xlarge c4.8xlarge c5.9xlarge c5.18xlarge c5d.4xlarge ³ c5d.9xlarge ³ c5d.18xlarge ³ c5n.9xlarge ⁴ c5n.18xlarge ⁴ m4.4xlarge m5.4xlarge m5.16xlarge m5d.8xlarge ³ m5d.12xlarge ³ r4.2xlarge r5.2xlarge r5.8xlarge r5.12xlarge ⁵ r5d.2xlarge ³ 	<ul style="list-style-type: none"> c4.4xlarge c4.8xlarge c5.9xlarge c5.18xlarge c5d.4xlarge ³ c5d.9xlarge ³ c5d.18xlarge ³ c5n.9xlarge ⁴ c5n.18xlarge ⁴ m4.2xlarge m4.4xlarge m5.xlarge m5.2xlarge m5.4xlarge m5.16xlarge m5d.8xlarge ³ m5d.12xlarge ³ r4.xlarge 	<ul style="list-style-type: none"> c4.4xlarge c4.8xlarge c5.9xlarge c5.18xlarge c5d.4xlarge ³ c5d.9xlarge ³ c5d.18xlarge ³ c5n.9xlarge ⁴ c5n.18xlarge ⁴ m4.2xlarge m4.4xlarge m5.xlarge m5.2xlarge m5.4xlarge m5.16xlarge m5d.8xlarge ³ m5d.12xlarge ³ r4.xlarge

	Freemium	PAYGO Explore	PAYGO Standard	PAYGO Premium	Node-based license	Capacity-based license
Supported disk types ⁶	General Purpose SSDs (gp3 and gp2), Provisioned IOPS SSDs (io1), and Throughput Optimized HDDs (st1) ⁷					

- Notes:
- r5.2xlarge
 - r5.8xlarge
 - 1. For some configurations, disk limits prevent you from reaching the capacity limit by using disks alone. In those cases, you can reach the capacity limit by [tiering inactive data to object storage](#). For information about disk limits, refer to [Storage limits](#).
 - 2. When you choose an EC2 instance type, you can specify whether it is a shared instance or a dedicated instance.
 - 3. These instance types include local NVMe storage, which Cloud Volumes ONTAP uses as *Flash Cache*. Flash Cache speeds access to data through real-time intelligent caching of recently read user data and NetApp metadata. It is effective for random read-intensive workloads, including databases, email, and file services. Compression must be disabled on all volumes to take advantage of the Flash Cache performance improvements. [Learn more](#).
 - 4. c5n.9xlarge and c5n.18xlarge are supported starting with 9.7 P5.
 - 5. The r5.12xlarge instance type has a known limitation with supportability. If a node unexpectedly reboots due to a panic, the system might not collect core files used to troubleshoot and root cause the problem. The customer accepts the risks and limited support terms and bears all support responsibility if this condition occurs.
 - 6. Enhanced write performance is enabled when using SSDs with Cloud Volumes ONTAP Standard, Premium, and BYOL.
 - 7. Tiering data to object storage is not recommended when using Throughput Optimized HDDs (st1).
 - 8. For AWS region support, see [Cloud Volumes Global Regions](#).
 - 9. Cloud Volumes ONTAP can run on either a Reserved or On-demand VM instance from your cloud provider. Solutions that use other VM instance types aren't supported.

Supported disk sizes

In AWS, an aggregate can contain up to 6 disks that are all the same type and size.

General Purpose SSD (gp3 and gp2)	Provisioned IOPS SSD (io1)	Throughput Optimized HDD (st1)
<ul style="list-style-type: none"> • 100 GB • 500 GB • 1 TB • 2 TB • 4 TB • 6 TB • 8 TB • 16 TB 	<ul style="list-style-type: none"> • 100 GB • 500 GB • 1 TB • 2 TB • 4 TB • 6 TB • 8 TB • 16 TB 	<ul style="list-style-type: none"> • 500 GB • 1 TB • 2 TB • 4 TB • 6 TB • 8 TB • 16 TB

Supported configurations for Cloud Volumes ONTAP 9.7 in Azure

Several Cloud Volumes ONTAP configurations are supported in Azure.

Supported configurations by license

Cloud Volumes ONTAP is available in Azure as a single node system and as a high-availability (HA) pair of nodes for fault tolerance and nondisruptive operations.

Upgrading a single node system to an HA pair is not supported. If you want to switch between a single node system and an HA pair, then you need to deploy a new system and replicate data from the existing system to the new system.

Single node systems

You can choose from the following configurations when deploying Cloud Volumes ONTAP as a single-node system in Azure:

	Freemium	PAYGO Explore	PAYGO Standard	PAYGO Premium	Node-based license	Capacity-based license
Maximum system capacity (disks + object storage)	500 GB	2 TB ¹	10 TB	368 TB	368 TB per license	2 PB
Supported virtual machine types	<ul style="list-style-type: none">• DS3_v2• DS4_v2• DS5_v2• DS13_v2• DS14_v2• DS15_v2• E32s_v3 ²• E48s_v3 ²• E80ids_v4 ³• L8s_v2 ⁴	DS3_v2	<ul style="list-style-type: none">• DS4_v2• DS13_v2	<ul style="list-style-type: none">• DS5_v2• DS14_v2• DS15_v2• E32s_v3 ²• E48s_v3 ²• E80ids_v4 ³	<ul style="list-style-type: none">• DS3_v2• DS4_v2• DS5_v2• DS13_v2• DS14_v2• DS15_v2• E32s_v3 ²• E48s_v3 ²• E80ids_v4 ³• L8s_v2 ⁴	<ul style="list-style-type: none">• DS3_v2• DS4_v2• DS5_v2• DS13_v2• DS14_v2• DS15_v2• E32s_v3 ²• E48s_v3 ²• E80ids_v4 ³• L8s_v2 ⁴
Supported disk types ⁵	Standard HDD Managed Disks, Standard SSD Managed Disks, and Premium SSD Managed Disks					

Notes:

1. Data tiering to Azure Blob storage isn't supported with PAYGO Explore.
2. This VM type uses an [Ultra SSD](#) for VNVRAM, which provides better write performance.
3. This VM is recommended only when Azure maintenance control is needed. It's not recommended for any

other use case due to the higher pricing.

4. This VM type includes local NVMe storage, which Cloud Volumes ONTAP uses as *Flash Cache*. Flash Cache speeds access to data through real-time intelligent caching of recently read user data and NetApp metadata. It is effective for random read-intensive workloads, including databases, email, and file services. Compression must be disabled on all volumes to take advantage of the Flash Cache performance improvements. [Learn more](#).
5. Enhanced write performance is enabled when using SSDs, but not when using the DS3_v2 virtual machine type.
6. For Azure region support, see [Cloud Volumes Global Regions](#).
7. Cloud Volumes ONTAP can run on either a Reserved or On-demand VM instance from your cloud provider. Solutions that use other VM instance types aren't supported.

HA pairs

You can choose from the following configurations when deploying Cloud Volumes ONTAP as an HA pair in Azure.

	Freemium	PAYGO Standard	PAYGO Premium	Node-based license	Capacity-based license
Maximum system capacity (disks + object storage)	500 GB	10 TB	368 TB	368 TB per license	2 PB
Supported virtual machine types	<ul style="list-style-type: none">• DS4_v2• DS5_v2• DS13_v2• DS14_v2• DS15_v2• E80ids_v4 ¹	<ul style="list-style-type: none">• DS4_v2• DS13_v2	<ul style="list-style-type: none">• DS5_v2• DS14_v2• DS15_v2• E80ids_v4 ¹	<ul style="list-style-type: none">• DS4_v2• DS5_v2• DS13_v2• DS14_v2• DS15_v2• E80ids_v4 ¹	<ul style="list-style-type: none">• DS4_v2• DS5_v2• DS13_v2• DS14_v2• DS15_v2• E80ids_v4 ¹
Supported disk types	Premium page blobs				

Notes:

1. This VM is recommended only when Azure maintenance control is needed. It's not recommended for any other use case due to the higher pricing.
2. PAYGO Explore isn't supported with HA pairs in Azure.
3. For Azure region support, see [Cloud Volumes Global Regions](#).
4. Cloud Volumes ONTAP can run on either a Reserved or On-demand VM instance from your cloud provider. Solutions that use other VM instance types aren't supported.

Supported disk sizes

In Azure, an aggregate can contain up to 12 disks that are all the same type and size.

Single node systems

Single node systems use Azure Managed Disks. The following disk sizes are supported:

Premium SSD	Standard SSD	Standard HDD
<ul style="list-style-type: none">• 500 GB• 1 TB• 2 TB• 4 TB• 8 TB• 16 TB• 32 TB	<ul style="list-style-type: none">• 100 GB• 500 GB• 1 TB• 2 TB• 4 TB• 8 TB• 16 TB• 32 TB	<ul style="list-style-type: none">• 100 GB• 500 GB• 1 TB• 2 TB• 4 TB• 8 TB• 16 TB• 32 TB

HA pairs

HA pairs use Premium page blobs. The following disk sizes are supported:

- 500 GB
- 1 TB
- 2 TB
- 4 TB
- 8 TB

Supported configurations for Cloud Volumes ONTAP 9.7 in GCP

Several Cloud Volumes ONTAP configurations are supported in GCP.

Supported configurations by license

Cloud Volumes ONTAP is available in Google Cloud Platform as a single node system.

	Freemium	PAYGO Explore	PAYGO Standard	PAYGO Premium	Node-based license	Capacity-based license
Maximum system capacity (disks + object storage)¹	500 GB	2 TB ²	10 TB	368 TB	368 TB per license	2 PB

	Freemium	PAYGO Explore	PAYGO Standard	PAYGO Premium	Node-based license	Capacity-based license
Supported machine types ³	<ul style="list-style-type: none"> custom-4-16384 n1-standard-8 n1-standard-32 	custom-4-16384	n1-standard-8	n1-standard-32	<ul style="list-style-type: none"> custom-4-16384 n1-standard-8 n1-standard-32 	<ul style="list-style-type: none"> custom-4-16384 n1-standard-8 n1-standard-32
Supported disk types ⁴	Zonal persistent disks (SSD and standard)					

Notes:

1. Disk limits can prevent you from reaching the maximum system capacity limit by using disks alone. You can reach the capacity limit by [tiering inactive data to object storage](#).

[Learn more about disk limits in GCP](#).

2. Data tiering to Google Cloud Storage isn't supported with PAYGO Explore.
3. 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.

4. Enhanced write performance is enabled when using SSDs.
5. For Google Cloud Platform region support, see [Cloud Volumes Global Regions](#).
6. Cloud Volumes ONTAP can run on either a Reserved or On-demand VM instance from your cloud provider. Solutions that use other VM instance types aren't supported.

Supported disk sizes

In GCP, an aggregate can contain up to 6 disks that are all the same type and size. The following disk sizes are supported:

- 100 GB
- 500 GB
- 1 TB
- 2 TB
- 4 TB
- 8 TB
- 16 TB

Storage limits

Storage limits for Cloud Volumes ONTAP 9.7 in AWS

Cloud Volumes ONTAP has storage configuration limits to provide reliable operations. For best performance, do not configure your system at the maximum values.

Maximum system capacity by license

The maximum system capacity for a Cloud Volumes ONTAP system is determined by its license. The maximum system capacity includes disk-based storage plus object storage used for data tiering. NetApp doesn't support exceeding this limit.

For some HA configurations, disk limits prevent you from reaching the capacity limit by using disks alone. In those cases, you can reach the capacity limit by [tiering inactive data to object storage](#). Refer to capacity and disk limits below for more details.

License	Maximum system capacity (disks + object storage)
Freemium	500 GB
PAYGO Explore	2 TB (data tiering is not supported with Explore)
PAYGO Standard	10 TB
PAYGO Premium	368 TB
Node-based license	368 TB per license
Capacity-based license	2 PB

For HA, is the license capacity limit per node or for the entire HA pair?

The capacity limit is for the entire HA pair. It is not per node. For example, if you use the Premium license, you can have up to 368 TB of capacity between both nodes.

For an HA system in AWS, does mirrored data count against the capacity limit?

No, it doesn't. Data in an AWS HA pair is synchronously mirrored between the nodes so that the data is available in the event of failure. For example, if you purchase an 8 TB disk on node A, Cloud Manager also allocates an 8 TB disk on node B that is used for mirrored data. While 16 TB of capacity was provisioned, only 8 TB counts against the license limit.

Disk and tiering limits by EC2 instance

Cloud Volumes ONTAP uses EBS volumes as disks, with a maximum disk size of 16 TB. The sections below show disk and tiering limits by EC2 instance type because many EC2 instance types have different disk limits. Disk limits are also different between single node systems and HA pairs.

The disk limits below are specific to disks that contain user data. The limits do not include the boot disk and

root disk.



You can now purchase multiple node-based licenses for a Cloud Volumes ONTAP BYOL system to allocate more than 368 TB of capacity. The number of licenses that you can purchase for a single node system or HA pair is unlimited. 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](#). [Learn how to add additional system licenses to Cloud Volumes ONTAP](#).

Single node with a Premium license

Instance family	Max disks per node	Max system capacity with disks alone	Max system capacity with disks and data tiering
c5, m5, and r5 instances	22	352 TB	368 TB
c4, m4, and r4 instances	34	368 TB	368 TB

Single node with node-based licensing

Instance family	Max disks per node	Max system capacity with one license		Max system capacity with multiple licenses	
		Disks alone	Disks + data tiering	Disks alone	Disks + data tiering
c5, m5, and r5 instances	22	352 TB	368 TB	352 TB	368 TB x each license
c4, m4, and r4 instances	34	368 TB	368 TB	544 TB	368 TB x each license

Single node with capacity-based licensing

Instance family	Max disks per node	Max system capacity with disks alone	Max system capacity with disks and data tiering
c5, m5, and r5 instances	22	352 TB	2 PB
c4, m4, and r4 instances	34	544 TB	2 PB

HA pairs with a Premium license

Instance family	Max disks per node	Max system capacity with disks alone	Max system capacity with disks and data tiering
c5, m5, and r5 instances	19	304 TB	368 TB
c4, m4, and r4 instances	31	368 TB	368 TB

HA pairs with node-based licensing

Instance family	Max disks per node	Max system capacity with one license		Max system capacity with multiple licenses	
		Disks alone	Disks + data tiering	Disks alone	Disks + data tiering
c5, m5, and r5 instances	19	304 TB	368 TB	304 TB	368 TB x each license
c4, m4, and r4 instances	31	368 TB	368 TB	496 TB	368 TB x each license

HA pairs with capacity-based licensing

Instance family	Max disks per node	Max system capacity with disks alone	Max system capacity with disks and data tiering
c5, m5, and r5 instances	19	304 TB	2 PB
c4, m4, and r4 instances	31	496 TB	2 PB

Aggregate limits

Cloud Volumes ONTAP uses AWS volumes as disks and groups them into *aggregates*. Aggregates provide storage to volumes.

Parameter	Limit
Maximum number of aggregates	Single node: Same as the disk limit HA pairs: 18 in a node ¹
Maximum aggregate size	96 TB of raw capacity ²
Disks per aggregate	1-6 ³
Maximum number of RAID groups per aggregate	1

Notes:

1. It is not possible to create 19 aggregates on both nodes in an HA pair because doing so would exceed the data disk limit.
2. The aggregate capacity limit is based on the disks that comprise the aggregate. The limit does not include object storage used for data tiering.
3. All disks in an aggregate must be the same size.

Logical storage limits

Logical storage	Parameter	Limit
Storage VMs (SVMs)	Maximum number for Cloud Volumes ONTAP (HA pair or single node)	<p>C5, M5, and R5 instances with BYOL The following number of storage VMs are supported with C5, M5, and R5 instance types when you bring your own license (BYOL):</p> <ul style="list-style-type: none"> • 12 storage VMs with single node systems • 8 storage VMs with HA pairs <p> A storage VM spans the entire Cloud Volumes ONTAP system (HA pair or single node)</p> <p>An add-on license is required for each additional <i>data-serving</i> SVM beyond the first storage VM that comes with Cloud Volumes ONTAP by default. Contact your account team to obtain an SVM add-on license.</p> <p>Storage VMs that you configure for disaster recovery (DR) don't require an add-on license (they are free of charge), but they do count against the storage VM limit.^{1,2}</p> <p>All other configurations One data-serving storage VM and one destination storage VM used for disaster recovery are supported.²</p> <p>A storage VM spans the entire Cloud Volumes ONTAP system (HA pair or single node).</p>
Files	Maximum size	16 TB
	Maximum per volume	Volume size dependent, up to 2 billion
FlexClone volumes	Hierarchical clone depth ³	499
FlexVol volumes	Maximum per node	500
	Minimum size	20 MB
	Maximum size	Dependent on the size of the aggregate
Qtrees	Maximum per FlexVol volume	4,995
Snapshot copies	Maximum per FlexVol volume	1,023

Notes:

1. For example, if you have 8 data-serving storage VMs on an HA pair, then you've reached the limit and can't create any additional storage VMs. The same is true for another HA pair that has 8 storage VMs configured for disaster recovery—you've reached the limit and can't create any additional storage VMs.
2. You can activate a destination storage VM for data access if there's an outage on the source storage VM. Cloud Manager doesn't provide any setup or orchestration support for storage VM disaster recovery. You

must use System Manager or the CLI.

- [SVM Disaster Recovery Preparation Express Guide](#)
- [SVM Disaster Recovery Express Guide](#)

3. Hierarchical clone depth is the maximum depth of a nested hierarchy of FlexClone volumes that can be created from a single FlexVol volume.

iSCSI storage limits

iSCSI storage	Parameter	Limit
LUNs	Maximum per node	1,024
	Maximum number of LUN maps	1,024
	Maximum size	16 TB
	Maximum per volume	512
igroups	Maximum per node	256
Initiators	Maximum per node	512
	Maximum per igroup	128
iSCSI sessions	Maximum per node	1,024
LIFs	Maximum per port	32
	Maximum per portset	32
Portsets	Maximum per node	256

Storage limits for Cloud Volumes ONTAP 9.7 in Azure

Cloud Volumes ONTAP has storage configuration limits to provide reliable operations. For best performance, do not configure your system at the maximum values.

Maximum system capacity by license

The maximum system capacity for a Cloud Volumes ONTAP system is determined by its license. The maximum system capacity includes disk-based storage plus object storage used for data tiering. NetApp doesn't support exceeding this limit.

License	Maximum system capacity (disks + object storage)
Freemium	500 GB
PAYGO Explore	2 TB (data tiering is not supported with Explore)
PAYGO Standard	10 TB
PAYGO Premium	368 TB
Node-based license	368 TB per license

License	Maximum system capacity (disks + object storage)
Capacity-based license	2 PB

For HA, is the license capacity limit per node or for the entire HA pair?

The capacity limit is for the entire HA pair. It is not per node. For example, if you use the Premium license, you can have up to 368 TB of capacity between both nodes.

Disk and tiering limits by VM size

The disk limits below are specific to disks that contain user data. The limits do not include the root disk, core disk, and VNVRAM.



The number of data disks listed in the tables below are as 9.7 P5. In previous 9.7 releases, two additional data disks were supported. Starting in 9.7 P5, Cloud Volumes ONTAP uses an additional disk for core data and another for VNVRAM. This change reduced the number of disks available for data.

The tables below show the maximum system capacity by VM size with disks alone, and with disks and cold data tiering to object storage.

- Single node systems can use Standard HDD Managed Disks, Standard SSD Managed Disks, and Premium SSD Managed Disks, with up to 32 TB per disk. The number of supported disks varies by VM size.
- HA systems use Premium page blobs as disks, with up to 8 TB per page blob. The number of supported disks varies by VM size.



You can purchase multiple node-based licenses for a Cloud Volumes ONTAP BYOL system to allocate more than 368 TB of capacity. The number of licenses that you can purchase for a single node system or HA pair is unlimited. 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](#). [Learn how to add additional system licenses to Cloud Volumes ONTAP](#).

Single node with a Premium license

VM size	Max data disks per node	Max system capacity with disks alone	Max system capacity with disks and data tiering
DS5_v2	61	368 TB	368 TB
DS14_v2	61	368 TB	368 TB
DS15_v2	61	368 TB	368 TB
E32s_v3	29	368 TB	368 TB
E48s_v3	29	368 TB	368 TB
L8s_v2	13	368 TB	368 TB

VM size	Max data disks per node	Max system capacity with disks alone	Max system capacity with disks and data tiering
E80ids_v4	29	368 TB	368 TB

Single node with node-based licensing



For some VM types, you'll need several BYOL licenses to reach the max system capacity listed below. For example, you'd need 6 BYOL licenses to reach 2 PB with DS5_v2.

VM size	Max data disks per node	Max system capacity with one license		Max system capacity with multiple licenses	
		Disks alone	Disks + data tiering	Disks alone	Disks + data tiering
DS3_v2	13	368 TB	368 TB	416 TB	368 TB x each license
DS4_v2	29	368 TB	368 TB	928 TB	368 TB x each license
DS5_v2	61	368 TB	368 TB	1.95 PB	368 TB x each license
DS13_v2	29	368 TB	368 TB	928 TB	368 TB x each license
DS14_v2	61	368 TB	368 TB	1.95 PB	368 TB x each license
DS15_v2	61	368 TB	368 TB	1.95 PB	368 TB x each license
E32s_v3	29	368 TB	368 TB	928 TB	368 TB x each license
E48s_v3	29	368 TB	368 TB	928 TB	368 TB x each license
E80ids_v4	29	368 TB	368 TB	928 TB	368 TB x each license
L8s_v2	13	368 TB	368 TB	416 TB	368 TB x each license

Single node with capacity-based licensing

VM size	Max data disks per node	Max system capacity with disks alone	Max system capacity with disks and data tiering
DS3_v2	13	416 TB	2 PB
DS4_v2	29	928 TB	2 PB

VM size	Max data disks per node	Max system capacity with disks alone	Max system capacity with disks and data tiering
DS5_v2	61	1.95 TB	2 PB
DS13_v2	29	928 TB	2 PB
DS14_v2	61	1.95 TB	2 PB
DS15_v2	61	1.95 TB	2 PB
E32s_v3	29	928 TB	2 PB
E48s_v3	29	928 TB	2 PB
E80ids_v4	29	928 TB	2 PB
L8s_v2	13	416 TB	2 PB

HA pairs with a Premium license

VM size	Max data disks per node	Max system capacity with disks alone	Max system capacity with disks and data tiering
DS5_v2	61	368 TB	368 TB
DS14_v2	61	368 TB	368 TB
DS15_v2	61	368 TB	368 TB
E80ids_v4	29	368 TB	368 TB

HA pairs with node-based licensing



For some VM types, you'll need several BYOL licenses to reach the max system capacity listed below. For example, you'd need 3 BYOL licenses to reach 1 PB with DS5_v2.

VM size	Max data disks per node	Max system capacity with one license		Max system capacity with multiple licenses	
		Disks alone	Disks + data tiering	Disks alone	Disks + data tiering
DS4_v2	29	368 TB	368 TB	464 TB	368 TB x each license
DS5_v2	61	368 TB	368 TB	976 TB	368 TB x each license
DS13_v2	29	368 TB	368 TB	464 TB	368 TB x each license
DS14_v2	61	368 TB	368 TB	976 TB	368 TB x each license

VM size	Max data disks per node	Max system capacity with one license		Max system capacity with multiple licenses	
DS15_v2	61	368 TB	368 TB	976 TB	368 TB x each license
E80ids_v4	29	368 TB	368 TB	464 TB	368 TB x each license

HA pairs with capacity-based licensing

VM size	Max data disks per node	Max system capacity with disks alone	Max system capacity with disks and data tiering
DS5_v2	61	1.95 TB	2 PB
DS14_v2	61	1.95 TB	2 PB
DS15_v2	61	1.95 TB	2 PB
E80ids_v4	29	928 TB	2 PB

Aggregate limits

Cloud Volumes ONTAP uses Azure storage as disks and groups them into *aggregates*. Aggregates provide storage to volumes.

Parameter	Limit
Maximum number of aggregates	Same as the disk limit
Maximum aggregate size ¹	384 TB of raw capacity for single node ² 352 TB of raw capacity for single node with PAYGO 96 TB of raw capacity for HA pairs
Disks per aggregate	1-12 ³
Maximum number of RAID groups per aggregate	1

Notes:

1. The aggregate capacity limit is based on the disks that comprise the aggregate. The limit does not include object storage used for data tiering.
2. If using node-based licensing, two BYOL licenses are required to reach 384 TB.
3. All disks in an aggregate must be the same size.

Logical storage limits

Logical storage	Parameter	Limit
Storage virtual machines (SVMs)	Maximum number for Cloud Volumes ONTAP (HA pair or single node)	One data-serving SVM and one destination SVM used for disaster recovery. You can activate the destination SVM for data access if there's an outage on the source SVM. ¹ The one data-serving SVM spans the entire Cloud Volumes ONTAP system (HA pair or single node).
Files	Maximum size	16 TB
	Maximum per volume	Volume size dependent, up to 2 billion
FlexClone volumes	Hierarchical clone depth ²	499
FlexVol volumes	Maximum per node	500
	Minimum size	20 MB
	Maximum size	Azure HA: Dependent on the size of the aggregate ³ Azure single node: 100 TB
Qtrees	Maximum per FlexVol volume	4,995
Snapshot copies	Maximum per FlexVol volume	1,023

Notes:

- Cloud Manager does not provide any setup or orchestration support for SVM disaster recovery. It also does not support storage-related tasks on an additional SVM. You must use System Manager or the CLI for SVM disaster recovery.
 - [SVM Disaster Recovery Preparation Express Guide](#)
 - [SVM Disaster Recovery Express Guide](#)
- Hierarchical clone depth is the maximum depth of a nested hierarchy of FlexClone volumes that can be created from a single FlexVol volume.
- Less than 100 TB is supported for this configuration because aggregates on HA pairs are limited to 96 TB of *raw* capacity.

iSCSI storage limits

iSCSI storage	Parameter	Limit
LUNs	Maximum per node	1,024
	Maximum number of LUN maps	1,024
	Maximum size	16 TB
	Maximum per volume	512
igroups	Maximum per node	256
Initiators	Maximum per node	512
	Maximum per igroup	128

iSCSI storage	Parameter	Limit
iSCSI sessions	Maximum per node	1,024
LIFs	Maximum per port	32
	Maximum per portset	32
Portsets	Maximum per node	256

Storage limits for Cloud Volumes ONTAP 9.7 in GCP

Cloud Volumes ONTAP has storage configuration limits to provide reliable operations. For best performance, do not configure your system at the maximum values.

Maximum system capacity by license

The maximum system capacity for a Cloud Volumes ONTAP system is determined by its license. The maximum system capacity includes disk-based storage plus object storage used for data tiering. NetApp doesn't support exceeding this limit.

For some configurations, disk limits prevent you from reaching the capacity limit by using disks alone. You can reach the capacity limit by [tiering inactive data to object storage](#). Refer to the disk limits below for more details.

License	Maximum system capacity (disks + object storage)
Freemium	500 GB
PAYGO Explore	2 TB (data tiering is not supported with Explore)
PAYGO Standard	10 TB
PAYGO Premium	368 TB
Node-based license	368 TB per license
Capacity-based license	2 PB

Disk and tiering limits

The table below shows the maximum system capacity with disks alone, and with disks and cold data tiering to object storage. The disk limits are specific to disks that contain user data. The limits do not include the boot disk and root disk.

Parameter	Limit
Maximum disks per system	124
Maximum disk size	16 TB
Maximum system capacity with disks alone	256 TB

Parameter	Limit
Maximum system capacity with disks and cold data tiering to a Google Cloud Storage bucket	Depends on the license. See the table above.

Aggregate limits

Cloud Volumes ONTAP groups Google Cloud Platform disks into *aggregates*. Aggregates provide storage to volumes.

Parameter	Limit
Maximum number of data aggregates	99 ¹
Maximum aggregate size	96 TB of raw capacity ²
Disks per aggregate	1-6 ³
Maximum number of RAID groups per aggregate	1

Notes:

1. The maximum number of data aggregates doesn't include the root aggregate.
2. The aggregate capacity limit is based on the disks that comprise the aggregate. The limit does not include object storage used for data tiering.
3. All disks in an aggregate must be the same size.

Logical storage limits

Logical storage	Parameter	Limit
Storage virtual machines (SVMs)	Maximum number for Cloud Volumes ONTAP	One data-serving SVM and one destination SVM used for disaster recovery. You can activate the destination SVM for data access if there's an outage on the source SVM. ¹ The one data-serving SVM spans the entire Cloud Volumes ONTAP system.
Files	Maximum size	16 TB
	Maximum per volume	Volume size dependent, up to 2 billion
FlexClone volumes	Hierarchical clone depth ²	499
FlexVol volumes	Maximum per node	500
	Minimum size	20 MB
	Maximum size	Dependent on the size of the aggregate
Qtrees	Maximum per FlexVol volume	4,995

Logical storage	Parameter	Limit
Snapshot copies	Maximum per FlexVol volume	1,023

Notes:

1. Cloud Manager does not provide any setup or orchestration support for SVM disaster recovery. It also does not support storage-related tasks on an additional SVM. You must use System Manager or the CLI for SVM disaster recovery.
 - [SVM Disaster Recovery Preparation Express Guide](#)
 - [SVM Disaster Recovery Express Guide](#)
2. Hierarchical clone depth is the maximum depth of a nested hierarchy of FlexClone volumes that can be created from a single FlexVol volume.

iSCSI storage limits

iSCSI storage	Parameter	Limit
LUNs	Maximum per node	1,024
	Maximum number of LUN maps	1,024
	Maximum size	16 TB
	Maximum per volume	512
igroups	Maximum per node	256
Initiators	Maximum per node	512
	Maximum per igroup	128
iSCSI sessions	Maximum per node	1,024
LIFs	Maximum per port	1
	Maximum per portset	32
Portsets	Maximum per node	256

Known issues for Cloud Volumes ONTAP 9.7

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

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

Node halt can fail on HA pairs with multiple SVMs

If you plan to halt or reboot a Cloud Volumes ONTAP node in an HA pair that has multiple storage VMs (SVMs), we recommend that you pre-migrate all logical interfaces (LIFs) to the partner node before shutting down the node.

The following example migrates all data LIFs from the current (local) node:

```
node1::> network interface migrate-all -node local
```

This action expedites the network transition to the partner node and avoids occasional known problems with stopping the node.

If the node can't be stopped because it takes too much time to migrate the LIFs, a retry of the reboot or halt command should make it stop.

Known limitations

Limitations for Cloud Volumes ONTAP 9.7 in all cloud providers

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.

The following limitations apply to Cloud Volumes ONTAP in all cloud providers: AWS, Azure, and GCP.

Cloud Volumes ONTAP supports Reserved and On-demand VM instances

Cloud Volumes ONTAP can run on either a Reserved or On-demand VM instance from your cloud provider. Other types of VM instances aren't supported.

Automatic application resource management solutions shouldn't be used

Automatic application resource management solutions should not manage Cloud Volumes ONTAP systems. Doing so can result in a change to an unsupported configuration. For example, the solution might change Cloud Volumes ONTAP to an unsupported VM instance type.

Software updates must be completed by Cloud Manager

Upgrades of Cloud Volumes ONTAP must be completed from Cloud Manager. You should not upgrade Cloud Volumes ONTAP by using System Manager or the CLI. Doing so can impact system stability.

Cloud Volumes ONTAP deployment must not be modified from your cloud provider's console

Changes to a Cloud Volumes ONTAP configuration from your cloud provider's console results in an unsupported configuration. Any changes to the Cloud Volumes ONTAP resources that Cloud Manager creates and manages can impact system stability and Cloud Manager's ability to manage the system.

Disks and aggregates must be managed from Cloud Manager

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

SnapManager licensing limitation

SnapManager per-server licenses are supported with Cloud Volumes ONTAP. Per-storage system (SnapManager suite) licenses are not supported.

Unsupported ONTAP features

The following features are not supported with Cloud Volumes ONTAP:

- Aggregate-level inline deduplication
- Aggregate-level background deduplication
- Disk maintenance center
- Disk sanitization
- FabricPool mirroring
- Fibre Channel (FC)
- Flash Pools
- Infinite Volumes
- Interface groups
- Intranode LIF failover
- MetroCluster
- RAID4, RAID-DP, RAID-TEC (RAID0 is supported)
- Service Processor
- SnapLock Compliance mode (Enterprise mode is supported)
- SnapMirror Synchronous
- VLANs

Known limitations for Cloud Volumes ONTAP 9.7 in AWS

The following known limitations are specific to Cloud Volumes ONTAP in Amazon Web Services. Be sure to also review [Limitations for Cloud Volumes ONTAP 9.7 in all cloud providers](#).

HA pairs not supported with AWS Outposts

Single node systems are supported with AWS Outposts but HA pairs aren't supported at this time.

Flash Cache limitations

C5D and R5D instance types include local NVMe storage, which Cloud Volumes ONTAP uses as *Flash Cache*. Note the following limitations:

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

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

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

False alarms reported by Amazon CloudWatch

Cloud Volumes ONTAP does not release CPUs when idle, so [Amazon CloudWatch](#) can report a high CPU warning for the EC2 instance because it sees 100% usage. You can ignore this alarm. The ONTAP statistics command displays the true usage of the CPUs.

Cloud Volumes ONTAP HA pairs do not support immediate storage giveback

After a node reboots, the partner must sync data before it can return the storage. The time that it takes to resync data depends on the amount of data written by clients while the node was down and the data write speed during the time of giveback.

[Learn how storage works in a Cloud Volumes ONTAP HA pair running in AWS.](#)

Limitations in the AWS C2S environment

See the [Quick Start Guide for the AWS Commercial Cloud Services Environment](#).

Known limitations for Cloud Volumes ONTAP 9.7 in Azure

The following known limitations are specific to Cloud Volumes ONTAP in Microsoft Azure. Be sure to also review [Limitations for Cloud Volumes ONTAP 9.7 in all cloud providers](#).

Flash Cache limitations

The Standard_L8s_v2 VM type includes local NVMe storage, which Cloud Volumes ONTAP uses as *Flash Cache*. Note the following limitations for Flash Cache:

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

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

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

HA limitations

The following limitations affect Cloud Volumes ONTAP HA pairs in Microsoft Azure:

- NFSv4 isn't supported. NFSv3 is supported.
- HA pairs aren't supported in some regions.

[See the list of supported Azure regions.](#)

Pay-as-you-go not available for CSP partners

If you are a Microsoft Cloud Solution Provider (CSP) partner, you cannot deploy Cloud Volumes ONTAP Explore, Standard, or Premium because pay-as-you-go subscriptions are not available for CSP partners. You must purchase a license and deploy Cloud Volumes ONTAP BYOL.

Known limitations for Cloud Volumes ONTAP 9.7 in GCP

There are no known limitations specific to Cloud Volumes ONTAP in Google Cloud Platform. See the [Limitations for Cloud Volumes ONTAP 9.7 in all cloud providers](#).

9.6 Release Notes

What's new in Cloud Volumes ONTAP 9.6

Cloud Volumes ONTAP 9.6 includes several new features and enhancements.

Additional features and enhancements are also introduced in the latest versions of Cloud Manager. See the [Cloud Manager Release Notes](#) for details.

9.6 P8 (2 June 2020)

The 9.6 P8 patch release for Cloud Volumes ONTAP is now available through Cloud Manager 3.8 and later. Cloud Manager will prompt you to upgrade your existing systems to this patch release. [View the list of bugs fixed in the P8 patch](#) (NetApp Support Site login required).

9.6 P7 (8 Apr 2020)

The 9.6 P7 patch release for Cloud Volumes ONTAP is now available through Cloud Manager 3.8 and later. Cloud Manager will prompt you to upgrade your existing systems to this patch release. [View the list of bugs fixed in the P7 patch](#) (NetApp Support Site login required).

9.6 P6 (6 Mar 2020)

The 9.6 P6 patch release for Cloud Volumes ONTAP is now available through Cloud Manager 3.8 and later. Cloud Manager will prompt you to upgrade your existing systems to this patch release. [View the list of bugs fixed in the P6 patch](#) (NetApp Support Site login required).

AWS updates (16 Feb 2020)

We've introduced support for new EC2 instances and a change in the number of supported data disks.

Support for new instances

A few new EC2 instance types are now supported with Cloud Volumes ONTAP 9.6 when using a Premium or BYOL license:

- c5.9xlarge
- c5d.18xlarge ^{1,2}
- m5d.8xlarge ^{1,2}

¹ These instance types include local NVMe storage, which Cloud Volumes ONTAP uses as *Flash Cache*. [Learn more](#).

² These instance types are supported with 9.6 P3 and later.

[Learn more about these EC2 instance types](#).

[Learn more about supported 9.6 configurations in AWS](#).

Supported data disks

One less data disk is now supported for c5, m5, and r5 instances. For single node systems, 22 data disks are supported. For HA pairs, 19 data disks are supported per node.

[Learn more about storage limits in AWS.](#)

Support for DS15_v2 in Azure (12 Feb 2020)

Cloud Volumes ONTAP is now supported with the DS15_v2 virtual machine type in Azure, on both single node systems and HA pairs.

[Learn more about the DSv2 series.](#)

[Learn more about supported 9.6 configurations in Azure.](#)

9.6 P5 (26 Dec 2019)

The 9.6 P5 patch release for Cloud Volumes ONTAP is now available through Cloud Manager. Cloud Manager will prompt you to upgrade your existing systems to this patch release. [View the list of bugs fixed in the P5 patch](#) (NetApp Support Site login required).

9.6 P4 (14 Nov 2019)

The 9.6 P4 patch release for Cloud Volumes ONTAP is now available through Cloud Manager. Cloud Manager will prompt you to upgrade your existing systems to this patch release. [View the list of bugs fixed in the P4 patch](#) (NetApp Support Site login required).

9.6 P3 (23 Oct 2019)

The 9.6 P3 patch release for Cloud Volumes ONTAP is now available through Cloud Manager. Cloud Manager will prompt you to upgrade existing systems to this patch release. [View the list of bugs fixed in the P3 patch](#) (NetApp Support Site login required).

In addition to bug fixes, this release also enables the following:

- Support for the c5.18xlarge instance type in AWS.
- An increase to the maximum aggregate size on single node systems in Azure: 352 TB of raw capacity is now supported.

The maximum aggregate size for a single node system was previously 200 TB.

Pay-as-you-go subscriptions in the GCP Marketplace (6 Oct 2019)

You can now pay for Cloud Volumes ONTAP as you go by subscribing to Cloud Volumes ONTAP in the Google Cloud Platform Marketplace.

[Google Cloud Platform Marketplace: Cloud Manager for Cloud Volumes ONTAP](#)

General Availability of Cloud Volumes ONTAP in GCP (3 Sept 2019)

Cloud Volumes ONTAP is now generally available in Google Cloud Platform (GCP) when you bring your own license (BYOL). A pay-as-you-go promotion is also available. The promotion offers free licenses for an

unlimited number of systems and will expire at the end of September 2019.

- [Learn how to get started in GCP](#)
- [View supported configurations](#)

9.6 P2 (29 Aug 2019)

The 9.6 P2 patch release for Cloud Volumes ONTAP is now available through Cloud Manager. Cloud Manager will prompt you to upgrade your existing 9.5 and 9.6 systems to this patch release. [View the list of bugs fixed in the P2 patch](#) (NetApp Support Site login required).

9.6 GA (15 July 2019)

The General Availability (GA) release of Cloud Volumes ONTAP 9.6 is now available. The GA release includes bug fixes. Cloud Manager will prompt you to upgrade your existing systems to this release.



Cloud Volumes ONTAP remains in private preview in Google Cloud Platform.

9.6 RC1 (16 June 2019)

Cloud Volumes ONTAP 9.6 RC1 is available in AWS, Azure, and now in Google Cloud Platform. This release includes the following features.

- [Private preview of Cloud Volumes ONTAP in Google Cloud Platform](#)
- [Data tiering with HA pairs in Azure](#)
- [Support for FlexCache volumes](#)
- [Additional ONTAP changes](#)

Private preview of Cloud Volumes ONTAP in Google Cloud Platform

A private preview of Cloud Volumes ONTAP in Google Cloud Platform is now available. Similar to other cloud providers, Cloud Volumes ONTAP for Google Cloud Platform helps you reduce costs, improve performance, and increase availability.

Cloud Volumes ONTAP is available in GCP as a single node system and supports data tiering to object storage.

To join the private preview, send a request to ng-Cloud-Volume-ONTAP-preview@netapp.com.

Data tiering with HA pairs in Azure

Data tiering is now supported with Cloud Volumes ONTAP HA pairs in Microsoft Azure. Data tiering enables automated tiering of inactive data to low-cost Blob storage.

[Learn how to set up data tiering in Cloud Manager.](#)

Support for FlexCache volumes

A FlexCache volume is a storage volume that caches NFS read data from an origin (or source) volume. Subsequent reads to the cached data result in faster access to that data.

You can use FlexCache volumes to speed up access to data or to offload traffic from heavily accessed

volumes. FlexCache volumes help improve performance, especially when clients need to access the same data repeatedly, because the data can be served directly without having to access the origin volume. FlexCache volumes work well for system workloads that are read-intensive.

Cloud Manager does not provide management of FlexCache volumes at this time, but you can use the ONTAP CLI or ONTAP System Manager to create and manage FlexCache volumes:

- [FlexCache Volumes for Faster Data Access Power Guide](#)
- [Creating FlexCache volumes in System Manager](#)

Starting with the 3.7.2 release, Cloud Manager generates a FlexCache license for all new Cloud Volumes ONTAP systems. The license includes a 500 GB usage limit.

Additional ONTAP changes

ONTAP 9.6 includes other changes that Cloud Volumes ONTAP users might be interested in:

- SnapMirror replication now supports TLS 1.2 encryption for communication in-flight
- Data tiering (FabricPool) enhancements include:
 - Volume move support without needing to re-tier cold data
 - SVM disaster recovery support

For more details about the 9.6 release, see the [ONTAP 9 Release Notes](#).

Upgrade notes

- Upgrades of Cloud Volumes ONTAP must be completed from Cloud Manager. You should not upgrade Cloud Volumes ONTAP by using System Manager or the CLI. Doing so can impact system stability.
- You can upgrade to Cloud Volumes ONTAP 9.6 from the 9.5 release.
- The upgrade of a single node system takes the system offline for up to 25 minutes, during which I/O is interrupted.
- Upgrading an HA pair is nondisruptive and I/O is uninterrupted. During this nondisruptive upgrade process, each node is upgraded in tandem to continue serving I/O to clients.

Supported configurations

Supported configurations for Cloud Volumes ONTAP 9.6 in AWS

Cloud Volumes ONTAP is available in AWS in two pricing options: pay-as-you-go and Bring Your Own License (BYOL). For pay-as-you-go, you can choose from three configurations: Explore, Standard, or Premium.

Supported configurations by license

Cloud Volumes ONTAP is available in AWS as a single node system and as a high-availability (HA) pair of nodes for fault tolerance and nondisruptive operations.

Upgrading a single node system to an HA pair is not supported. If you want to switch between a single node system and an HA pair, then you need to deploy a new system and replicate data from the existing system to the new system.

	Explore	Standard	Premium	BYOL
Supported EC2 instance types ¹	<ul style="list-style-type: none"> • m4.xlarge • m5.xlarge 	<ul style="list-style-type: none"> • m4.2xlarge • m5.2xlarge • r4.xlarge • r5.xlarge 	<ul style="list-style-type: none"> • c4.4xlarge • c4.8xlarge • c5.9xlarge • c5.18xlarge • c5d.4xlarge ² • c5d.9xlarge ² • c5d.18xlarge ^{2,3} • m4.4xlarge • m5.4xlarge • m5d.8xlarge ^{2,3} • r4.2xlarge • r5.2xlarge • r5d.2xlarge ² 	<ul style="list-style-type: none"> • c4.4xlarge • c4.8xlarge • c5.9xlarge • c5.18xlarge • c5d.4xlarge ² • c5d.9xlarge ² • c5d.18xlarge ^{2,3} • m4.xlarge • m4.2xlarge • m4.4xlarge • m5.xlarge • m5.2xlarge • m5.4xlarge • m5d.8xlarge ^{2,3} • r4.xlarge • r4.2xlarge • r5.xlarge • r5.2xlarge • r5d.2xlarge ²
Supported disk types ⁴	General Purpose SSDs (gp2) ⁵ , Provisioned IOPS SSDs (io1), and Throughput Optimized HDDs (st1)			
Cold data tiering to S3	Not supported			
Maximum system capacity (disks + object storage)	2 TB	10 TB	368 TB ⁵	368 TB per license ⁵

Notes:

1. When you choose an EC2 instance type, you can specify whether it is a shared instance or a dedicated instance.
2. These instance types include local NVMe storage, which Cloud Volumes ONTAP uses as *Flash Cache*. Flash Cache speeds access to data through real-time intelligent caching of recently read user data and NetApp metadata. It is effective for random read-intensive workloads, including databases, email, and file services. Compression must be disabled on all volumes to take advantage of the Flash Cache performance improvements. [Learn more](#).
3. c5d.18xlarge and m5d.8xlarge are supported starting with Cloud Volumes ONTAP 9.6 P3.
4. Enhanced write performance is enabled when using SSDs with Cloud Volumes ONTAP Standard, Premium, and BYOL.

5. gp3 SSDs are not supported.
6. For some HA configurations, disk limits prevent you from reaching the 368 TB capacity limit by using disks alone. In those cases, you can reach the 368 TB capacity limit by [tiering inactive data to object storage](#). For information about disk limits, refer to [storage limits](#).
7. For AWS region support, see [Cloud Volumes Global Regions](#).

Supported disk sizes

In AWS, an aggregate can contain up to 6 disks that are all the same type and size.

General Purpose SSDs (gp2)	Provisioned IOPS SSDs (io1)	Throughput Optimized HDDs (st1)
• 100 GB	• 100 GB	• 500 GB
• 500 GB	• 500 GB	• 1 TB
• 1 TB	• 1 TB	• 2 TB
• 2 TB	• 2 TB	• 4 TB
• 4 TB	• 4 TB	• 6 TB
• 6 TB	• 6 TB	• 8 TB
• 8 TB	• 8 TB	• 16 TB
• 16 TB	• 16 TB	

Supported configurations for Cloud Volumes ONTAP 9.6 in Azure

Cloud Volumes ONTAP is available in Azure in two pricing options: pay-as-you-go and Bring Your Own License (BYOL). For pay-as-you-go, you can choose from three configurations: Explore, Standard, or Premium.

Supported configurations by license

Cloud Volumes ONTAP is available in Azure as a single node system and as a high-availability (HA) pair of nodes for fault tolerance and nondisruptive operations.

Upgrading a single node system to an HA pair is not supported. If you want to switch between a single node system and an HA pair, then you need to deploy a new system and replicate data from the existing system to the new system.

Single node systems

You can choose from the following configurations when deploying Cloud Volumes ONTAP as a single-node system in Azure:

	Explore	Standard	Premium	BYOL
Supported virtual machine types	DS3_v2	<ul style="list-style-type: none"> • DS4_v2 • DS13_v2 	<ul style="list-style-type: none"> • DS5_v2 • DS14_v2 • DS15_v2 	<ul style="list-style-type: none"> • DS3_v2 • DS4_v2 • DS5_v2 • DS13_v2 • DS14_v2 • DS15_v2
Supported disk types¹	Standard HDD Managed Disks, Standard SSD Managed Disks, and Premium SSD Managed Disks			
Cold data tiering to Blob storage	Not supported	Supported		
Maximum system capacity (disks + object storage)	2 TB	10 TB	368 TB	368 TB per license

Notes:

1. Enhanced write performance is enabled when using SSDs, but not when using the DS3_v2 virtual machine type.
2. For Azure region support, see [Cloud Volumes Global Regions](#).

HA pairs

You can choose from the following configurations when deploying Cloud Volumes ONTAP as an HA pair in Azure:

	Explore	Standard	Premium	BYOL
Supported virtual machine types	Not supported	<ul style="list-style-type: none"> • DS4_v2 • DS13_v2 	<ul style="list-style-type: none"> • DS5_v2 • DS14_v2 • DS15_v2 	<ul style="list-style-type: none"> • DS4_v2 • DS5_v2 • DS13_v2 • DS14_v2 • DS15_v2
Supported disk types	Not supported	Premium page blobs		
Cold data tiering to Blob storage²	Not supported	Supported		
Maximum system capacity (disks + object storage)	Not supported	10 TB	368 TB	368 TB per license

Notes:

1. For Azure region support, see [Cloud Volumes Global Regions](#).

Supported disk sizes

In Azure, an aggregate can contain up to 12 disks that are all the same type and size.

Single node systems

Single node systems use Azure Managed Disks. The following disk sizes are supported:

Premium SSD	Standard SSD	Standard HDD
• 500 GB	• 100 GB	• 100 GB
• 1 TB	• 500 GB	• 500 GB
• 2 TB	• 1 TB	• 1 TB
• 4 TB	• 2 TB	• 2 TB
• 8 TB	• 4 TB	• 4 TB
• 16 TB	• 8 TB	• 8 TB
• 32 TB	• 16 TB	• 16 TB
	• 32 TB	• 32 TB

HA pairs

HA pairs use Premium page blobs. The following disk sizes are supported:

- 500 GB
- 1 TB
- 2 TB
- 4 TB
- 8 TB

Supported configurations for Cloud Volumes ONTAP 9.6 in GCP

Cloud Volumes ONTAP is available in Google Cloud Platform as a single node system. Two pricing options are available: pay as you go and Bring Your Own License (BYOL).

Pay-as-you-go overview

- Offers Cloud Volumes ONTAP in three different licensing options: Explore, Standard, and Premium.
- A 30-day free trial is available for the first Cloud Volumes ONTAP system that you deploy in GCP.
 - There are no hourly software charges, but GCP infrastructure charges still apply (compute, storage, and networking).
 - When the free trial ends, you'll be charged hourly according to the selected license, [as long as you subscribed](#). If you haven't subscribed, the system shuts down.
- Conversions from PAYGO to BYOL aren't currently supported.

- Basic technical support is offered, but you must register and activate the NetApp serial number associated with your system.

[Register pay-as-you-go systems in Cloud Manager](#)

BYOL overview

- Single node license with term-based subscription options like 12 months, 24 months, and more.
- Support is included for the length of the subscription term.
- You can purchase multiple licenses for a Cloud Volumes ONTAP BYOL system to allocate more than 368 TB of capacity.

For example, you might purchase two licenses to allocate up to 736 TB of capacity to Cloud Volumes ONTAP. Or you could purchase four licenses to get up to 1.4 PB.

Supported configurations by license

Cloud Volumes ONTAP is available in Google Cloud Platform as a single node system.

	Explore	Standard	Premium	BYOL
Supported machine types ¹	custom-4-16384	n1-standard-8	n1-standard-32	<ul style="list-style-type: none"> • custom-4-16384 • n1-standard-8 • n1-standard-32
Supported disk types ²	Zonal persistent disks (SSD and standard)			
Cold data tiering to object storage	Not supported	Supported		
Maximum system capacity (disks + object storage)	2 TB	10 TB	368 TB ³	368 TB per license ³

Notes:

1. The custom machine type has 4 vCPUs and 16 GB of memory. For details about standard machine types, refer to [Google Cloud Documentation: Machine Types](#).
2. Enhanced write performance is enabled when using SSDs.
3. Disk limits prevent you from reaching the 368 TB capacity limit by using disks alone. You can reach the 368 TB capacity limit by [tiering inactive data to object storage](#).

[Learn more about disk limits in GCP](#).

4. For Google Cloud Platform region support, see [Cloud Volumes Global Regions](#).

Supported disk sizes

In GCP, an aggregate can contain up to 6 disks that are all the same type and size. The following disk sizes

are supported:

- 100 GB
- 500 GB
- 1 TB
- 2 TB
- 4 TB
- 8 TB
- 16 TB

Storage limits

Storage limits for Cloud Volumes ONTAP 9.6 in AWS

Cloud Volumes ONTAP has storage configuration limits to provide reliable operations. For best performance, do not configure your system at the maximum values.

Maximum system capacity by license

The maximum system capacity for a Cloud Volumes ONTAP system is determined by its license. The maximum system capacity includes disk-based storage plus object storage used for data tiering. NetApp doesn't support exceeding this limit.

For some HA configurations, disk limits prevent you from reaching the 368 TB capacity limit by using disks alone. In those cases, you can reach the 368 TB capacity limit by [tiering inactive data to object storage](#). Refer to capacity and disk limits below for more details.

License	Maximum system capacity (disks + object storage)
Explore	2 TB (data tiering is not supported with Explore)
Standard	10 TB
Premium	368 TB
BYOL	368 TB per license

For HA, is the license capacity limit per node or for the entire HA pair?

The capacity limit is for the entire HA pair. It is not per node. For example, if you use the Premium license, you can have up to 368 TB of capacity between both nodes.

For an HA system in AWS, does mirrored data count against the capacity limit?

No, it doesn't. Data in an AWS HA pair is synchronously mirrored between the nodes so that the data is available in the event of failure. For example, if you purchase an 8 TB disk on node A, Cloud Manager also allocates an 8 TB disk on node B that is used for mirrored data. While 16 TB of capacity was provisioned, only 8 TB counts against the license limit.

Disk and tiering limits by EC2 instance

Cloud Volumes ONTAP uses EBS volumes as disks, with a maximum disk size of 16 TB. The sections below show disk and tiering limits by EC2 instance type because many EC2 instance types have different disk limits. Disk limits are also different between single node systems and HA pairs.

The disk limits below are specific to disks that contain user data. The limits do not include the boot disk and root disk.

Disk limits are shown by instance for Premium and BYOL licenses only because disk limits can't be reached with Explore or Standard licenses.

Single node with a Premium license

Instance type	Max disks per node	Max system capacity with disks alone	Max system capacity with disks and data tiering
c4.4xlarge	34	368 TB	368 TB
c4.8xlarge	34	368 TB	368 TB
c5.9xlarge	22	352 TB	368 TB
c5.18xlarge	22	352 TB	368 TB
c5d.4xlarge	22	352 TB	368 TB
c5d.9xlarge	22	352 TB	368 TB
c5d.18xlarge	22	352 TB	368 TB
m4.4xlarge	34	368 TB	368 TB
m5.4xlarge	22	352 TB	368 TB
m5d.8xlarge	22	352 TB	368 TB
r4.2xlarge	34	368 TB	368 TB
r5.2xlarge	22	352 TB	368 TB
r5d.2xlarge	22	352 TB	368 TB

Single node with one or more BYOL licenses

Instance type	Max disks per node	Max system capacity with one license		Max system capacity with multiple licenses	
		Disks alone	Disks + data tiering	Disks alone	Disks + data tiering
c4.4xlarge	34	368 TB	368 TB	544 TB	368 TB x each license

Instance type	Max disks per node	Max system capacity with one license		Max system capacity with multiple licenses	
c4.8xlarge	34	368 TB	368 TB	544 TB	368 TB x each license
c5.9xlarge	22	352 TB	368 TB	352 TB	368 TB x each license
c5.18xlarge	22	352 TB	368 TB	352 TB	368 TB x each license
c5d.4xlarge	22	352 TB	368 TB	352 TB	368 TB x each license
c5d.9xlarge	22	352 TB	368 TB	352 TB	368 TB x each license
c5d.18xlarge	22	352 TB	368 TB	352 TB	368 TB x each license
m4.xlarge	34	368 TB	368 TB	544 TB	368 TB x each license
m4.2xlarge	34	368 TB	368 TB	544 TB	368 TB x each license
m4.4xlarge	34	368 TB	368 TB	544 TB	368 TB x each license
m5.xlarge	22	352 TB	368 TB	352 TB	368 TB x each license
m5.2xlarge	22	352 TB	368 TB	352 TB	368 TB x each license
m5.4xlarge	22	352 TB	368 TB	352 TB	368 TB x each license
m5d.8xlarge	22	352 TB	368 TB	352 TB	368 TB x each license
r4.xlarge	34	368 TB	368 TB	544 TB	368 TB x each license
r4.2xlarge	34	368 TB	368 TB	544 TB	368 TB x each license
r5.xlarge	22	352 TB	368 TB	352 TB	368 TB x each license
r5.2xlarge	22	352 TB	368 TB	352 TB	368 TB x each license
r5d.2xlarge	22	352 TB	368 TB	352 TB	368 TB x each license

HA pairs with a Premium license

Instance type	Max disks per node	Max system capacity with disks alone	Max system capacity with disks and data tiering
c4.4xlarge	31	368 TB	368 TB
c4.8xlarge	31	368 TB	368 TB
c5.9xlarge	19	304 TB	368 TB
c5.18xlarge	19	304 TB	368 TB
c5d.4xlarge	19	304 TB	368 TB
c5d.9xlarge	19	304 TB	368 TB
c5d.18xlarge	19	304 TB	368 TB
m4.4xlarge	31	368 TB	368 TB
m5.4xlarge	19	304 TB	368 TB
m5d.8xlarge	19	304 TB	368 TB
r4.2xlarge	31	368 TB	368 TB
r5.2xlarge	19	304 TB	368 TB
r5d.2xlarge	19	304 TB	368 TB

HA pairs with one or more BYOL licenses

Instance type	Max disks per node	Max system capacity with one license		Max system capacity with multiple licenses	
		Disks alone	Disks + data tiering	Disks alone	Disks + data tiering
c4.4xlarge	31	368 TB	368 TB	496 TB	368 TB x each license
c4.8xlarge	31	368 TB	368 TB	496 TB	368 TB x each license
c5.9xlarge	19	304 TB	368 TB	304 TB	368 TB x each license
c5.18xlarge	19	304 TB	368 TB	304 TB	368 TB x each license
c5d.4xlarge	19	304 TB	368 TB	304 TB	368 TB x each license
c5d.9xlarge	19	304 TB	368 TB	304 TB	368 TB x each license

Instance type	Max disks per node	Max system capacity with one license		Max system capacity with multiple licenses	
c5d.18xlarge	19	304 TB	368 TB	304 TB	368 TB x each license
m4.xlarge	31	368 TB	368 TB	496 TB	368 TB x each license
m4.2xlarge	31	368 TB	368 TB	496 TB	368 TB x each license
m4.4xlarge	31	368 TB	368 TB	496 TB	368 TB x each license
m5.xlarge	19	304 TB	368 TB	304 TB	368 TB x each license
m5.2xlarge	19	304 TB	368 TB	304 TB	368 TB x each license
m5.4xlarge	19	304 TB	368 TB	304 TB	368 TB x each license
m5d.8xlarge	19	304 TB	368 TB	304 TB	368 TB x each license
r4.xlarge	31	368 TB	368 TB	496 TB	368 TB x each license
r4.2xlarge	31	368 TB	368 TB	496 TB	368 TB x each license
r5.xlarge	19	304 TB	368 TB	304 TB	368 TB x each license
r5.2xlarge	19	304 TB	368 TB	304 TB	368 TB x each license
r5d.2xlarge	19	304 TB	368 TB	304 TB	368 TB x each license

Aggregate limits

Cloud Volumes ONTAP uses AWS volumes as disks and groups them into *aggregates*. Aggregates provide storage to volumes.

Parameter	Limit
Maximum number of aggregates	Single node: Same as the disk limit HA pairs: 18 in a node ¹
Maximum aggregate size	96 TB of raw capacity ²
Disks per aggregate	1-6 ³
Maximum number of RAID groups per aggregate	1

Notes:

1. It is not possible to create 18 aggregates on both nodes in an HA pair because doing so would exceed the data disk limit.
2. The aggregate capacity limit is based on the disks that comprise the aggregate. The limit does not include object storage used for data tiering.
3. All disks in an aggregate must be the same size.

Logical storage limits

Logical storage	Parameter	Limit
Storage virtual machines (SVMs)	Maximum number for Cloud Volumes ONTAP (HA pair or single node)	One data-serving SVM and one destination SVM used for disaster recovery. You can activate the destination SVM for data access if there's an outage on the source SVM. ¹ The one data-serving SVM spans the entire Cloud Volumes ONTAP system (HA pair or single node).
Files	Maximum size	16 TB
	Maximum per volume	Volume size dependent, up to 2 billion
FlexClone volumes	Hierarchical clone depth ²	499
FlexVol volumes	Maximum per node	500
	Minimum size	20 MB
	Maximum size	Dependent on the size of the aggregate
Qtrees	Maximum per FlexVol volume	4,995
Snapshot copies	Maximum per FlexVol volume	1,023

Notes:

1. Cloud Manager does not provide any setup or orchestration support for SVM disaster recovery. It also does not support storage-related tasks on an additional SVM. You must use System Manager or the CLI for SVM disaster recovery.
 - [SVM Disaster Recovery Preparation Express Guide](#)
 - [SVM Disaster Recovery Express Guide](#)
2. Hierarchical clone depth is the maximum depth of a nested hierarchy of FlexClone volumes that can be created from a single FlexVol volume.

iSCSI storage limits

iSCSI storage	Parameter	Limit
LUNs	Maximum per node	1,024
	Maximum number of LUN maps	1,024
	Maximum size	16 TB
	Maximum per volume	512
igroups	Maximum per node	256
Initiators	Maximum per node	512
	Maximum per igroup	128
iSCSI sessions	Maximum per node	1,024
LIFs	Maximum per port	32
	Maximum per portset	32
Portsets	Maximum per node	256

Storage limits for Cloud Volumes ONTAP 9.6 in Azure

Cloud Volumes ONTAP has storage configuration limits to provide reliable operations. For best performance, do not configure your system at the maximum values.

Maximum system capacity by license

The maximum system capacity for a Cloud Volumes ONTAP system is determined by its license. The maximum system capacity includes disk-based storage plus object storage used for data tiering. NetApp doesn't support exceeding this limit.

License	Maximum system capacity (disks + object storage)
Explore	2 TB (data tiering is not supported with Explore)
Standard	10 TB
Premium	368 TB
BYOL	368 TB per license

For HA, is the license capacity limit per node or for the entire HA pair?

The capacity limit is for the entire HA pair. It is not per node. For example, if you use the Premium license, you can have up to 368 TB of capacity between both nodes.

Disk and tiering limits by VM size

The disk limits below are specific to disks that contain user data. The limits do not include the boot disk and root disk. The tables below show the maximum system capacity by VM size with disks or alone, and with disks and cold data tiering to object storage.

Disk limits are shown by VM size for Premium and BYOL licenses only because disk limits can't be reached

with Explore or Standard licenses due to system capacity limits.

- Single node systems can use Standard HDD Managed Disks, Standard SSD Managed Disks, and Premium SSD Managed Disks, with up to 32 TB per disk. The number of supported disks varies by VM size.
- HA systems use Premium page blobs as disks, with up to 8 TB per page blob. The number of supported disks varies by VM size.

Single node with a Premium license

VM size	Max disks per node	Max system capacity with disks alone	Max system capacity with disks and data tiering
DS5_v2	63	368 TB	368 TB
DS14_v2	63	368 TB	368 TB
DS15_v2	63	368 TB	368 TB

Single node with one or more BYOL licenses



For some VM types, you'll need several BYOL licenses to reach the max system capacity listed below. For example, you'd need 6 BYOL licenses to reach 2 PB with DS5_v2.

VM size	Max disks per node	Max system capacity with one license		Max system capacity with multiple licenses	
		Disks alone	Disks + data tiering	Disks alone	Disks + data tiering
DS3_v2	15	368 TB	368 TB	480 TB	368 TB x each license
DS4_v2	31	368 TB	368 TB	992 TB	368 TB x each license
DS5_v2	63	368 TB	368 TB	2 PB	368 TB x each license
DS13_v2	31	368 TB	368 TB	992 TB	368 TB x each license
DS14_v2	63	368 TB	368 TB	2 PB	368 TB x each license
DS15_v2	63	368 TB	368 TB	2 PB	368 TB x each license

HA pairs with a Premium license

VM size	Max disks per node	Max system capacity with disks alone	Max system capacity with disks and data tiering
DS5_v2	63	368 TB	368 TB

VM size	Max disks per node	Max system capacity with disks alone	Max system capacity with disks and data tiering
DS14_v2	63	368 TB	368 TB
DS15_v2	63	368 TB	368 TB

HA pairs with one or more BYOL licenses



For some VM types, you'll need several BYOL licenses to reach the max system capacity listed below. For example, you'd need 3 BYOL licenses to reach 1 PB with DS5_v2.

VM size	Max disks per node	Max system capacity with one license		Max system capacity with multiple licenses	
		Disks alone	Disks + data tiering	Disks alone	Disks + data tiering
DS4_v2	31	368 TB	368 TB	496 TB	368 TB x each license
DS5_v2	63	368 TB	368 TB	1 PB	368 TB x each license
DS13_v2	31	368 TB	368 TB	496 TB	368 TB x each license
DS14_v2	63	368 TB	368 TB	1 PB	368 TB x each license
DS15_v2	63	368 TB	368 TB	1 PB	368 TB x each license

Aggregate limits

Cloud Volumes ONTAP uses Azure storage as disks and groups them into *aggregates*. Aggregates provide storage to volumes.

Parameter	Limit
Maximum number of aggregates	Same as the disk limit
Maximum aggregate size	352 TB of raw capacity for single node ^{1, 2} 96 TB of raw capacity for HA pairs ¹
Disks per aggregate	1-12 ³
Maximum number of RAID groups per aggregate	1

Notes:

1. The aggregate capacity limit is based on the disks that comprise the aggregate. The limit does not include object storage used for data tiering.
2. The 352 TB limit is supported starting with 9.6 P3. Releases prior to 9.6 P3 support up to 200 TB of raw capacity in an aggregate on a single node system.

- All disks in an aggregate must be the same size.

Logical storage limits

Logical storage	Parameter	Limit
Storage virtual machines (SVMs)	Maximum number for Cloud Volumes ONTAP (HA pair or single node)	One data-serving SVM and one destination SVM used for disaster recovery. You can activate the destination SVM for data access if there's an outage on the source SVM. ¹ The one data-serving SVM spans the entire Cloud Volumes ONTAP system (HA pair or single node).
Files	Maximum size	16 TB
	Maximum per volume	Volume size dependent, up to 2 billion
FlexClone volumes	Hierarchical clone depth ²	499
FlexVol volumes	Maximum per node	500
	Minimum size	20 MB
	Maximum size	Azure HA: Dependent on the size of the aggregate ³ Azure single node: 100 TB
Qtrees	Maximum per FlexVol volume	4,995
Snapshot copies	Maximum per FlexVol volume	1,023

Notes:

- Cloud Manager does not provide any setup or orchestration support for SVM disaster recovery. It also does not support storage-related tasks on an additional SVM. You must use System Manager or the CLI for SVM disaster recovery.
 - [SVM Disaster Recovery Preparation Express Guide](#)
 - [SVM Disaster Recovery Express Guide](#)
- Hierarchical clone depth is the maximum depth of a nested hierarchy of FlexClone volumes that can be created from a single FlexVol volume.
- Less than 100 TB is supported for this configuration because aggregates on HA pairs are limited to 96 TB of *raw* capacity.

iSCSI storage limits

iSCSI storage	Parameter	Limit
LUNs	Maximum per node	1,024
	Maximum number of LUN maps	1,024
	Maximum size	16 TB
	Maximum per volume	512

iSCSI storage	Parameter	Limit
igroups	Maximum per node	256
Initiators	Maximum per node	512
	Maximum per igroup	128
iSCSI sessions	Maximum per node	1,024
LIFs	Maximum per port	32
	Maximum per portset	32
Portsets	Maximum per node	256

Storage limits for Cloud Volumes ONTAP 9.6 in GCP

Cloud Volumes ONTAP has storage configuration limits to provide reliable operations. For best performance, do not configure your system at the maximum values.

Maximum system capacity by license

The maximum system capacity for a Cloud Volumes ONTAP system is determined by its license. The maximum system capacity includes disk-based storage plus object storage used for data tiering. NetApp doesn't support exceeding this limit.

For the Premium and BYOL licenses, disk limits prevent you from reaching the 368 TB capacity limit by using disks alone. You can reach the 368 TB capacity limit by [tiering inactive data to object storage](#). Refer to the disk limits below for more details.

License	Maximum system capacity (disks + object storage)
Explore	2 TB (data tiering is not supported with Explore)
Standard	10 TB
Premium	368 TB
BYOL	368 TB per license

Disk and tiering limits

The table below shows the maximum system capacity with disks alone, and with disks and cold data tiering to object storage. The disk limits are specific to disks that contain user data. The limits do not include the boot disk and root disk.

Parameter	Limit
Maximum disks per system	16
Maximum disk size	16 TB
Maximum system capacity with disks alone	64 TB

Parameter	Limit
Maximum system capacity with disks and cold data tiering to a Google Cloud Storage bucket	<ul style="list-style-type: none"> Premium: 368 TB BYOL: 368 TB per license

Aggregate limits

Cloud Volumes ONTAP groups Google Cloud Platform disks into *aggregates*. Aggregates provide storage to volumes.

Parameter	Limit
Maximum number of aggregates	16
Maximum aggregate size	64 TB of raw capacity ¹
Disks per aggregate	1-6 ²
Maximum number of RAID groups per aggregate	1

Notes:

1. The aggregate capacity limit is based on the disks that comprise the aggregate. The limit does not include object storage used for data tiering.
2. All disks in an aggregate must be the same size.

Logical storage limits

Logical storage	Parameter	Limit
Storage virtual machines (SVMs)	Maximum number for Cloud Volumes ONTAP	One data-serving SVM and one destination SVM used for disaster recovery. You can activate the destination SVM for data access if there's an outage on the source SVM. ¹ The one data-serving SVM spans the entire Cloud Volumes ONTAP system.
Files	Maximum size	16 TB
	Maximum per volume	Volume size dependent, up to 2 billion
FlexClone volumes	Hierarchical clone depth ²	499
FlexVol volumes	Maximum per node	500
	Minimum size	20 MB
	Maximum size	Dependent on the size of the aggregate
Qtrees	Maximum per FlexVol volume	4,995

Logical storage	Parameter	Limit
Snapshot copies	Maximum per FlexVol volume	1,023

Notes:

1. Cloud Manager does not provide any setup or orchestration support for SVM disaster recovery. It also does not support storage-related tasks on an additional SVM. You must use System Manager or the CLI for SVM disaster recovery.
 - [SVM Disaster Recovery Preparation Express Guide](#)
 - [SVM Disaster Recovery Express Guide](#)
2. Hierarchical clone depth is the maximum depth of a nested hierarchy of FlexClone volumes that can be created from a single FlexVol volume.

iSCSI storage limits

iSCSI storage	Parameter	Limit
LUNs	Maximum per node	1,024
	Maximum number of LUN maps	1,024
	Maximum size	16 TB
	Maximum per volume	512
igroups	Maximum per node	256
Initiators	Maximum per node	512
	Maximum per igroup	128
iSCSI sessions	Maximum per node	1,024
LIFs	Maximum per port	1
	Maximum per portset	32
Portsets	Maximum per node	256

Known issues for Cloud Volumes ONTAP 9.6

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

There are no known issues in this release specific to Cloud Volumes ONTAP.

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

Known limitations

Limitations for Cloud Volumes ONTAP 9.6 in all cloud providers

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.

The following limitations apply to Cloud Volumes ONTAP in all cloud providers: AWS, Azure, and GCP.

Software updates must be completed by Cloud Manager

Upgrades of Cloud Volumes ONTAP must be completed from Cloud Manager. You should not upgrade Cloud Volumes ONTAP by using System Manager or the CLI. Doing so can impact system stability.

Cloud Volumes ONTAP deployment must not be modified from your cloud provider's console

Changes to a Cloud Volumes ONTAP configuration from your cloud provider's console results in an unsupported configuration. Any changes to the Cloud Volumes ONTAP resources that Cloud Manager creates and manages can impact system stability and Cloud Manager's ability to manage the system.

Disks and aggregates must be managed from Cloud Manager

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

SnapManager licensing limitation

SnapManager per-server licenses are supported with Cloud Volumes ONTAP. Per-storage system (SnapManager suite) licenses are not supported.

Unsupported ONTAP features

The following features are not supported with Cloud Volumes ONTAP:

- Aggregate-level inline deduplication
- Aggregate-level background deduplication
- Disk maintenance center
- Disk sanitization
- Fibre Channel (FC)
- Flash Pools
- Infinite Volumes
- Interface groups
- Intranode LIF failover
- MetroCluster
- Multi-tenancy (only one data-serving SVM is supported)
- RAID4, RAID-DP, RAID-TEC (RAID0 is supported)
- Service Processor

- SnapLock Compliance mode (Enterprise mode is supported)
- SnapMirror Synchronous
- VLANs

Known limitations for Cloud Volumes ONTAP 9.6 in AWS

The following known limitations are specific to Cloud Volumes ONTAP in Amazon Web Services. Be sure to also review [Limitations for Cloud Volumes ONTAP 9.6 in all cloud providers](#).

Flash Cache limitations

C5D and R5D instance types include local NVMe storage, which Cloud Volumes ONTAP uses as *Flash Cache*. Note the following limitations:

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

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

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

False alarms reported by Amazon CloudWatch

Cloud Volumes ONTAP does not release CPUs when idle, so [Amazon CloudWatch](#) can report a high CPU warning for the EC2 instance because it sees 100% usage. You can ignore this alarm. The ONTAP statistics command displays the true usage of the CPUs.

Cloud Volumes ONTAP HA pairs do not support immediate storage giveback

After a node reboots, the partner must sync data before it can return the storage. The time that it takes to resync data depends on the amount of data written by clients while the node was down and the data write speed during the time of giveback.

[Learn how storage works in a Cloud Volumes ONTAP HA pair running in AWS](#).

Limitations in the AWS C2S environment

See the [Quick Start Guide for the AWS Commercial Cloud Services Environment](#).

Limitations in AWS GovCloud (US) regions

- Cloud Manager must be deployed in an AWS GovCloud (US) region if you want to launch Cloud Volumes ONTAP instances in any AWS GovCloud (US) region.
- When deployed in an AWS GovCloud (US) region, Cloud Manager cannot discover ONTAP clusters in a NetApp Private Storage for Microsoft Azure configuration or a NetApp Private Storage for SoftLayer configuration.

Known limitations for Cloud Volumes ONTAP 9.6 in Azure

The following known limitations are specific to Cloud Volumes ONTAP in Microsoft Azure.

Be sure to also review [Limitations for Cloud Volumes ONTAP 9.6 in all cloud providers](#).

New deployments aren't supported

New deployments of Cloud Volumes ONTAP 9.6 are no longer supported in Azure. You'll need to deploy Cloud Volumes ONTAP 9.7.

HA limitations

The following limitations affect Cloud Volumes ONTAP HA pairs in Microsoft Azure:

- NFSv4 is not supported. NFSv3 is supported.
- HA pairs are not supported in some regions.

[See the list of supported Azure regions.](#)

Pay-as-you-go not available for CSP partners

If you are a Microsoft Cloud Solution Provider (CSP) partner, you cannot deploy Cloud Volumes ONTAP Explore, Standard, or Premium because pay-as-you-go subscriptions are not available for CSP partners. You must purchase a license and deploy Cloud Volumes ONTAP BYOL.

Known limitations for Cloud Volumes ONTAP 9.6 in GCP

There are no known limitations specific to Cloud Volumes ONTAP in Google Cloud Platform. See the [Limitations for Cloud Volumes ONTAP 9.6 in all cloud providers](#).

9.5 Release Notes

What's new in Cloud Volumes ONTAP 9.5

Cloud Volumes ONTAP 9.5 includes several new features and enhancements.



Additional features and enhancements are also introduced in the latest versions of Cloud Manager. See the [Cloud Manager Release Notes](#) for details.

9.5 P11 (6 Mar 2020)

The 9.5 P11 patch release for Cloud Volumes ONTAP is now available through Cloud Manager 3.8 and later. Cloud Manager will prompt you to upgrade your existing systems to this patch release. [View the list of bugs fixed in the P11 patch](#) (NetApp Support Site login required).

9.5 P10 (12 Jan 2020)

The 9.5 P10 patch release for Cloud Volumes ONTAP is now available through Cloud Manager. Cloud Manager will prompt you to upgrade your existing systems to this patch release. [View the list of bugs fixed in the P10 patch](#) (NetApp Support Site login required).

9.5 P9 patch (17 Nov 2019)

The 9.5 P9 patch release for Cloud Volumes ONTAP is now available through Cloud Manager. Cloud Manager will prompt you to upgrade your existing systems to this patch release. [View the list of bugs fixed in the P9 patch](#) (NetApp Support Site login required).

9.5 P8 patch (6 Oct 2019)

The 9.5 P8 patch release for Cloud Volumes ONTAP is now available. Cloud Manager will prompt you to upgrade your existing systems to this patch release. [View the list of bugs fixed in the P8 patch](#) (NetApp Support Site login required).

9.5 P6 patch (16 July 2019)

The 9.5 P6 patch release for Cloud Volumes ONTAP is now available. Cloud Manager will prompt you to upgrade your existing systems to this patch release. [View the list of bugs fixed in the P6 patch](#) (NetApp Support Site login required).



Cloud Manager prompts you to upgrade to specific ONTAP patch releases that include important fixes for Cloud Volumes ONTAP. That's why you might notice a gap between patch releases in these release notes. We're listing only those patches that Cloud Manager makes available to you.

9.5 P4 patch (16 May 2019)

The 9.5 P4 patch release for Cloud Volumes ONTAP is now available. Cloud Manager will prompt you to upgrade your existing systems to this patch release. [View the list of bugs fixed in the P4 patch](#) (NetApp Support Site login required).

Support for the AWS C2S Environment (2 May 2019)

Cloud Volumes ONTAP 9.5 and Cloud Manager 3.6.4 are now available to the U.S. Intelligence Community (IC) through the AWS Commercial Cloud Services (C2S) environment. You can deploy HA pairs and single node systems in C2S.

[Quick Start Guide for the AWS Commercial Cloud Services Environment](#)

9.5 P3 patch (25 Apr 2019)

The 9.5 P3 patch release for Cloud Volumes ONTAP is now available. [View the list of bugs fixed in the P3 patch](#) (NetApp Support Site login required).

9.5 P2 patch (10 Apr 2019)

The 9.5 P2 patch release for Cloud Volumes ONTAP is now available. This patch includes bug fixes, as well as support for Flash Cache with new AWS EC2 instance types. Cloud Manager will prompt you to upgrade your existing systems to this patch release.

[Click here to see the bugs fixed in the P2 patch](#) (NetApp Support Site login required).

Flash Cache support with new EC2 instance types

The following EC2 instance types are now supported with the Premium and BYOL licenses:

- c5d.4xlarge
- c5d.9xlarge
- r5d.2xlarge

These instance types include local NVMe storage, which Cloud Volumes ONTAP uses as *Flash Cache*. Flash Cache speeds access to data through real-time intelligent caching of recently read user data and NetApp metadata. It is effective for random read-intensive workloads, including databases, email, and file services.

Compression must be disabled on all volumes to take advantage of the Flash Cache performance improvements. You can choose no storage efficiency when creating a volume from Cloud Manager, or you can create a volume and then [disable data compression by using the CLI](#).



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

HA support in the Azure Central US region (25 Mar 2019)

HA pairs are now supported in the Central US region in Azure.

[See the full list of supported Azure regions.](#)

9.5 P1 patch (18 Mar 2019)

The 9.5 P1 patch release for Cloud Volumes ONTAP is now available for all configurations. Cloud Manager will prompt you to upgrade your existing systems to this patch release.

If you have an existing HA pair in Azure, NetApp will contact you to help you apply the P1 patch release.

[Click here to see the bugs fixed in the P1 patch](#) (NetApp Support Site login required).

Cloud Volumes ONTAP HA is now GA in Azure (18 Mar 2019)

With the release of the 9.5 P1 patch, HA pairs in Azure are now Generally Available (GA). A Preview license is no longer required.

The GA release is available in most Azure regions with the exception of the following:

- Central US
- North Central US
- US Gov regions
- West US
- West Central US

Maintenance in these regions can prevent the creation of Cloud Volumes ONTAP and prevent failover from taking place. We plan to support these regions as soon as the maintenance is completed.

[See a full list of supported Azure regions.](#)

9.5 GA for AWS and Azure (4 Feb 2019)

The General Availability (GA) release of Cloud Volumes ONTAP 9.5 is now available in AWS and in Microsoft Azure (for single node systems only in Azure). The GA release includes stability fixes, new and deprecated features in AWS, and a change to system capacity limits.

368 TB capacity limit for all Premium and BYOL configurations

The system capacity limit for Cloud Volumes ONTAP Premium and BYOL is now 368 TB across all configurations: single node and HA in both AWS and Azure.

For some configurations, disk limits prevent you from reaching the 368 TB capacity limit by using disks alone. In those cases, you can reach the 368 TB capacity limit by [tiering inactive data to object storage](#). For example, a single node system in Azure could have 252 TB of disk-based capacity, which would allow up to 116 TB of inactive data in Azure Blob storage.

For information about disk limits, refer to [storage limits](#).

Support for M5 and R5 instances in AWS

Cloud Volumes ONTAP now supports several instance types in the M5 and R5 families:

Explore	Standard	Premium	BYOL
m5.xlarge	<ul style="list-style-type: none">• m5.2xlarge• r5.xlarge	<ul style="list-style-type: none">• m5.4xlarge• r5.2xlarge	<ul style="list-style-type: none">• m5.xlarge• m5.2xlarge• m5.4xlarge• r5.xlarge• r5.2xlarge

These instances use a hypervisor that is based on KVM technology. As a result, the instances support a smaller number of data disks than other instance types: up to 24 data disks for single-node systems and 21

data disks for HA pairs. [Learn about storage limits](#).

Learn more about [M5 instances](#) and [R5 instances](#).

Support for NetApp Volume Encryption in AWS

[NetApp Volume Encryption \(NVE\)](#) is a software-based technology for encrypting data at rest one volume at a time. Data, Snapshot copies, and metadata are encrypted. Access to the data is given by a unique XTS-AES-256 key, one per volume.

At this time, Cloud Volumes ONTAP supports NetApp Volume Encryption with an external key management server. An Onboard Key Manager is not supported. You can find the supported key managers in the [NetApp Interoperability Matrix Tool](#) under the **Key Managers** solution.

You need to set up NetApp Volume Encryption from the CLI. You can then use either the CLI or System Manager to enable encryption on specific volumes. Cloud Manager does not support NetApp Volume Encryption from its user interface and from its APIs.

[Learn how to set up NetApp Volume Encryption](#)



NetApp Volume Encryption is a different encryption technology than Cloud Volumes ONTAP encryption, which encrypted data at the aggregate level and is now deprecated. An upgrade between these two encryption technologies is not possible. See [Deprecated features in AWS](#) for more information.

Deprecated features in AWS

Two features are no longer supported in the 9.5 release.

Cloud Volumes ONTAP aggregate-level encryption now only supports AWS native encryption of disks

Data-at-rest encryption of aggregates using external key managers is no longer supported. If you are currently using this feature and you want to upgrade, you must launch a new 9.5 system and then [replicate data](#) to that system.

Data-at-rest encryption is still supported using other methods. You can encrypt data by using NetApp Volume Encryption or by using the AWS Key Management Service (KMS). [Learn more about encryption of data at rest](#).

c4.2xlarge is no longer supported

The c4.2xlarge instance type is not supported with the 9.5 release. If you are currently using this instance type, you must first [change to a new instance type](#) before you upgrade to the 9.5 release.

9.5 RC1 for Azure (4 Dec 2018)

Cloud Volumes ONTAP 9.5 RC1 is now available in Microsoft Azure. The 9.5 release will be available in AWS at a later date.

Preview of high-availability (HA) pairs in Microsoft Azure

A preview of Cloud Volumes ONTAP HA pairs in Microsoft Azure is now available. An HA pair provides enterprise reliability and continuous operations in case of failures in your cloud environment. Similar to a physical ONTAP cluster, storage in an Azure HA pair is shared between the two nodes.

HA pairs in Azure are available as a preview. You can request a preview license by contacting us at ng-Cloud-Volume-ONTAP-preview@netapp.com.

[Learn more about HA pairs in Azure.](#)

Improved networking performance in Azure

Cloud Volumes ONTAP systems are now enabled with [Accelerated Networking](#) in Azure. Cloud Manager enables Accelerated Networking when you upgrade to 9.5 and when you deploy new 9.5 systems.

Support for new Azure regions

You can now deploy Cloud Volumes ONTAP in the France Central region.

Support for NetApp Volume Encryption in Azure

[NetApp Volume Encryption \(NVE\)](#) is a software-based technology for encrypting data at rest one volume at a time. Data, Snapshot copies, and metadata are encrypted. Access to the data is given by a unique XTS-AES-256 key, one per volume.

At this time, Cloud Volumes ONTAP supports NetApp Volume Encryption with an external key management server. An Onboard Key Manager is not supported. You can find the supported key managers in the [NetApp Interoperability Matrix Tool](#) under the **Key Managers** solution.

You need to set up NetApp Volume Encryption from the CLI. You can then use either the CLI or System Manager to enable encryption on specific volumes. Cloud Manager does not support NetApp Volume Encryption at this time.

[Learn how to set up NetApp Volume Encryption](#)

Upgrade notes

- Upgrades of Cloud Volumes ONTAP must be completed from Cloud Manager. You should not upgrade Cloud Volumes ONTAP by using System Manager or the CLI. Doing so can impact system stability.
- You can upgrade to Cloud Volumes ONTAP 9.5 from the 9.4 release.
- The upgrade of a single node system takes the system offline for up to 25 minutes, during which I/O is interrupted.
- Upgrading an HA pair is nondisruptive and I/O is uninterrupted. During this nondisruptive upgrade process, each node is upgraded in tandem to continue serving I/O to clients.

Supported configurations for Cloud Volumes ONTAP 9.5

Cloud Volumes ONTAP is available in AWS and Azure in two pricing options: pay-as-you-go and Bring Your Own License (BYOL). For pay-as-you-go, you can choose from three configurations: Explore, Standard, or Premium.

Cloud Volumes ONTAP for AWS

In AWS, you can deploy Cloud Volumes ONTAP as a single node system or as an HA pair.

	Explore	Standard	Premium	BYOL
EC2 instance types	<ul style="list-style-type: none"> • m4.xlarge • m5.xlarge 	<ul style="list-style-type: none"> • m4.2xlarge • m5.2xlarge • r4.xlarge • r5.xlarge 	<ul style="list-style-type: none"> • c4.4xlarge • c4.8xlarge • c5d.4xlarge* • c5d.9xlarge* • m4.4xlarge • m5.4xlarge • r4.2xlarge • r5.2xlarge • r5d.2xlarge* 	<ul style="list-style-type: none"> • c4.4xlarge • c4.8xlarge • c5d.4xlarge* • c5d.9xlarge* • m4.xlarge • m4.2xlarge • m4.4xlarge • m5.xlarge • m5.2xlarge • m5.4xlarge • r4.xlarge • r4.2xlarge • r5.xlarge • r5.2xlarge • r5d.2xlarge*
Underlying storage	General Purpose SSDs (gp2), Provisioned IOPS SSDs (io1), and Throughput Optimized HDDs (st1), up to 16 TB per disk			
Maximum system capacity (disks + object storage)	2 TB	10 TB	368 TB	368 TB per license

Notes:

1. The instance types denoted with a * include local NVMe storage, which Cloud Volumes ONTAP uses as *Flash Cache*. Flash Cache speeds access to data through real-time intelligent caching of recently read user data and NetApp metadata. It is effective for random read-intensive workloads, including databases, email, and file services. Compression must be disabled on all volumes to take advantage of the Flash Cache performance improvements. [Learn more](#).
2. For some configurations, disk limits prevent you from reaching the 368 TB capacity limit by using disks alone. In those cases, you can reach the 368 TB capacity limit by [tiering inactive data to object storage](#). For information about disk limits, refer to [storage limits](#).
3. If you enable data tiering, a system's capacity limit stays the same. The capacity limit includes both disks and object storage.
4. Data tiering is supported with Cloud Volumes ONTAP Standard, Premium, and BYOL.
5. When you choose an EC2 instance type, you can specify whether it is a shared instance or a dedicated instance.
6. Cold HDDs are not supported with HA pairs.
7. Enhanced write performance is enabled when using EBS SSDs with Cloud Volumes ONTAP Standard, Premium, and BYOL.

- For AWS region support, see [Cloud Volumes Global Regions](#).

Cloud Volumes ONTAP for Azure

In Azure, you can deploy Cloud Volumes ONTAP as a single node system or as an HA pair.

Single node systems

You can choose from the following configurations when deploying Cloud Volumes ONTAP as a single-node system in Azure:

	Explore	Standard	Premium	BYOL
Virtual machine types	DS3_v2	<ul style="list-style-type: none"> DS4_v2 DS13_v2 	<ul style="list-style-type: none"> DS5_v2 DS14_v2 	<ul style="list-style-type: none"> DS3_v2 DS4_v2 DS5_v2 DS13_v2 DS14_v2
Underlying storage	Standard HDD Managed Disks, Standard SSD Managed Disks, and Premium SSD Managed Disks, up to 32 TB per disk			
Maximum system capacity (disks + object storage)	2 TB	10 TB	368 TB	368 TB per license

Notes:

- If you enable data tiering, a system's capacity limit stays the same. The capacity limit includes both disks and object storage.
- Data tiering is not supported with the DS3_v2 virtual machine type.
- Enhanced write performance is enabled when using Azure Premium Storage disks, but not when using the DS3_v2 virtual machine type.
- For Azure region support, see [Cloud Volumes Global Regions](#).

HA pairs

You can choose from the following configurations when deploying Cloud Volumes ONTAP as an HA pair in Azure:

	Explore	Standard	Premium	BYOL	
Virtual machine types	Not supported	<ul style="list-style-type: none"> DS4_v2 DS13_v2 	<ul style="list-style-type: none"> DS5_v2 DS14_v2 	<ul style="list-style-type: none"> DS4_v2 DS5_v2 DS13_v2 DS14_v2 	
Underlying storage	Not supported	Premium page blobs, up to 8 TB per disk			

	Explore	Standard	Premium	BYOL
Maximum system capacity	Not supported	10 TB	368 TB	368 TB per license

Notes:

1. Data tiering is not supported with HA pairs.
2. For Azure region support, see [Cloud Volumes Global Regions](#).

Storage limits for Cloud Volumes ONTAP 9.5

Cloud Volumes ONTAP has storage configuration limits to provide reliable operations. For best performance, do not configure your system at the maximum values.

Maximum system capacity by license

The maximum system capacity for a Cloud Volumes ONTAP system is determined by its license. The maximum system capacity includes disk-based storage plus object storage used for data tiering. NetApp doesn't support exceeding this limit.

For some configurations, disk limits prevent you from reaching the 368 TB capacity limit by using disks alone. In those cases, you can reach the 368 TB capacity limit by [tiering inactive data to object storage](#). Refer to capacity and disk limits below for more details.

License	Maximum system capacity (disks + object storage)
Explore	2 TB (data tiering is not supported with Explore)
Standard	10 TB
Premium	368 TB
BYOL	368 TB per license

For HA, is the license capacity limit per node or for the entire HA pair?

The capacity limit is for the entire HA pair. It is not per node. For example, if you use the Premium license, you can have up to 368 TB of capacity between both nodes.

For an HA system in AWS, does mirrored data count against the capacity limit?

No, it doesn't. Data in an AWS HA pair is synchronously mirrored between the nodes so that the data is available in the event of failure. For example, if you purchase an 8 TB disk on node A, Cloud Manager also allocates an 8 TB disk on node B that is used for mirrored data. While 16 TB of capacity was provisioned, only 8 TB counts against the license limit.

Capacity and disk limits by AWS EC2 instance

Cloud Volumes ONTAP uses EBS volumes as disks. The disk limits below are specific to disks that contain user data. The limits do not include the boot disk and root disk.

The maximum EBS disk size is 16 TB. The number of supported disks varies by instance type.

The tables below shows the maximum capacity by instance type with just EBS disks, and with disks and tiering to object storage.

Single node with a Premium license

Instance type	Max disks per node	Max system capacity with disks alone	Max system capacity with disks and data tiering
c4.4xlarge	34	368 TB	368 TB
c4.8xlarge	34	368 TB	368 TB
c5d.4xlarge	23	368 TB	368 TB
c5d.9xlarge	23	368 TB	368 TB
m4.4xlarge	34	368 TB	368 TB
m5.4xlarge	23	368 TB	368 TB
r4.2xlarge	34	368 TB	368 TB
r5.2xlarge	23	368 TB	368 TB
r5d.2xlarge	23	368 TB	368 TB

Single node with one or more BYOL licenses

Instance type	Max disks per node	Max system capacity with one license		Max system capacity with multiple licenses	
		Disks alone	Disks + data tiering	Disks alone	Disks + data tiering
c4.4xlarge	34	368 TB	368 TB	544 TB	368 TB x each license
c4.8xlarge	34	368 TB	368 TB	544 TB	368 TB x each license
c5d.4xlarge	23	368 TB	368 TB	368 TB	368 TB x each license
c5d.9xlarge	23	368 TB	368 TB	368 TB	368 TB x each license
m4.xlarge	34	368 TB	368 TB	544 TB	368 TB x each license
m4.2xlarge	34	368 TB	368 TB	544 TB	368 TB x each license
m4.4xlarge	34	368 TB	368 TB	544 TB	368 TB x each license

Instance type	Max disks per node	Max system capacity with one license		Max system capacity with multiple licenses	
m5.xlarge	23	368 TB	368 TB	368 TB	368 TB x each license
m5.2xlarge	23	368 TB	368 TB	368 TB	368 TB x each license
m5.4xlarge	23	368 TB	368 TB	368 TB	368 TB x each license
r4.xlarge	34	368 TB	368 TB	544 TB	368 TB x each license
r4.2xlarge	34	368 TB	368 TB	544 TB	368 TB x each license
r5.xlarge	23	368 TB	368 TB	368 TB	368 TB x each license
r5.2xlarge	23	368 TB	368 TB	368 TB	368 TB x each license
r5d.2xlarge	23	368 TB	368 TB	368 TB	368 TB x each license

HA pairs with a Premium license

Instance type	Max disks per node	Max system capacity with disks alone	Max system capacity with disks and data tiering
c4.4xlarge	31	368 TB	368 TB
c4.8xlarge	31	368 TB	368 TB
c5d.4xlarge	20	320 TB	368 TB
c5d.9xlarge	20	320 TB	368 TB
m4.4xlarge	31	368 TB	368 TB
m5.4xlarge	20	320 TB	368 TB
r4.2xlarge	31	368 TB	368 TB
r5.2xlarge	20	320 TB	368 TB
r5d.2xlarge	20	320 TB	368 TB

HA pairs with one or more BYOL licenses

Instance type	Max disks per node	Max system capacity with one license	Max system capacity with multiple licenses		
		Disks alone	Disks + data tiering	Disks alone	Disks + data tiering

Instance type	Max disks per node	Max system capacity with one license		Max system capacity with multiple licenses	
c4.4xlarge	31	368 TB	368 TB	496 TB	368 TB x each license
c4.8xlarge	31	368 TB	368 TB	496 TB	368 TB x each license
c5d.4xlarge	20	320 TB	368 TB	320 TB	368 TB x each license
c5d.9xlarge	20	320 TB	368 TB	320 TB	368 TB x each license
m4.xlarge	31	368 TB	368 TB	496 TB	368 TB x each license
m4.2xlarge	31	368 TB	368 TB	496 TB	368 TB x each license
m4.4xlarge	31	368 TB	368 TB	496 TB	368 TB x each license
m5.xlarge	20	320 TB	368 TB	320 TB	368 TB x each license
m5.2xlarge	20	320 TB	368 TB	320 TB	368 TB x each license
m5.4xlarge	20	320 TB	368 TB	320 TB	368 TB x each license
r4.xlarge	31	368 TB	368 TB	496 TB	368 TB x each license
r4.2xlarge	31	368 TB	368 TB	496 TB	368 TB x each license
r5.xlarge	20	320 TB	368 TB	320 TB	368 TB x each license
r5.2xlarge	20	320 TB	368 TB	320 TB	368 TB x each license
r5d.2xlarge	20	320 TB	368 TB	320 TB	368 TB x each license

Disk and tiering limits by Azure VM size

The disk limits below are specific to disks that contain user data. The limits do not include the boot disk and root disk. The tables below show the maximum system capacity by VM size with managed disks alone, and with disks and cold data tiering to object storage.

Disk limits are shown by VM size for Premium and BYOL licenses only because disk limits can't be reached with Explore or Standard licenses due to system capacity limits.

- Single node systems can use Standard HDD Managed Disks, Standard SSD Managed Disks, and Premium SSD Managed Disks, with up to 32 TB per disk. The number of supported disks varies by VM size.

- HA systems use Premium page blobs as disks, with up to 8 TB per page blob. The number of supported disks varies by VM size.

Single node with a Premium license

VM size	Max disks per node	Max system capacity with disks alone	Max system capacity with disks and data tiering
DS3_v2	15	368 TB	Tiering not supported
DS4_v2	31	368 TB	368 TB
DS5_v2	63	368 TB	368 TB
DS13_v2	31	368 TB	368 TB
DS14_v2	63	368 TB	368 TB

Single node with one or more BYOL licenses



For some VM types, you'll need several BYOL licenses to reach the max system capacity listed below. For example, you'd need 6 BYOL licenses to reach 2 PB with DS5_v2.

VM size	Max disks per node	Max system capacity with one license		Max system capacity with multiple licenses	
		Disks alone	Disks + data tiering	Disks alone	Disks + data tiering
DS3_v2	15	368 TB	Tiering not supported	480 TB	Tiering not supported
DS4_v2	31	368 TB	368 TB	992 TB	368 TB x each license
DS5_v2	63	368 TB	368 TB	2 PB	368 TB x each license
DS13_v2	31	368 TB	368 TB	992 TB	368 TB x each license
DS14_v2	63	368 TB	368 TB	2 PB	368 TB x each license

HA pairs with a Premium license

VM size	Max disks per node	Max system capacity with disks alone	Max system capacity with disks and data tiering
DS4_v2	31	368 TB	Tiering not supported
DS5_v2	63	368 TB	Tiering not supported
DS13_v2	31	368 TB	Tiering not supported
DS14_v2	63	368 TB	Tiering not supported

VM size	Max disks per node	Max system capacity with disks alone	Max system capacity with disks and data tiering
DS15_v2	63	368 TB	Tiering not supported

HA pairs with one or more BYOL licenses



For some VM types, you'll need several BYOL licenses to reach the max system capacity listed below. For example, you'd need 3 BYOL licenses to reach 1 PB with DS5_v2.

VM size	Max disks per node	Max system capacity with one license		Max system capacity with multiple licenses	
		Disks alone	Disks + data tiering	Disks alone	Disks + data tiering
DS4_v2	31	368 TB	Tiering not supported	496 TB	Tiering not supported
DS5_v2	63	368 TB	Tiering not supported	1 PB	Tiering not supported
DS13_v2	31	368 TB	Tiering not supported	496 TB	Tiering not supported
DS14_v2	63	368 TB	Tiering not supported	1 PB	Tiering not supported
DS15_v2	63	368 TB	Tiering not supported	1 PB	Tiering not supported

Aggregate limits in AWS

Cloud Volumes ONTAP uses AWS volumes as disks and groups them into *aggregates*. Aggregates provide storage to volumes.

Parameter	Limit
Maximum number of aggregates	Single node: Same as the disk limit HA pairs: 18 in a node ¹
Maximum aggregate size	96 TB of raw capacity ²
Disks per aggregate	1-6 ³
Maximum number of RAID groups per aggregate	1

Notes:

1. It is not possible to create 18 aggregates on both nodes in an HA pair because doing so would exceed the data disk limit.
2. The aggregate capacity limit is based on the disks that comprise the aggregate. The limit does not include object storage used for data tiering.
3. All disks in an aggregate must be the same size.

Aggregate limits in Azure

Cloud Volumes ONTAP uses Azure storage as disks and groups them into *aggregates*. Aggregates provide storage to volumes.

Parameter	Limit
Maximum number of aggregates	Same as the disk limit
Maximum aggregate size	200 TB of raw capacity for single node ¹ 96 TB of raw capacity for HA pairs ¹
Disks per aggregate	1-12 ²
Maximum number of RAID groups per aggregate	Single node: 1 HA pairs: 6

Notes:

1. The aggregate capacity limit is based on the disks that comprise the aggregate. The limit does not include object storage used for data tiering.
2. All disks in an aggregate must be the same size.

Logical storage limits

Logical storage	Parameter	Limit
Storage virtual machines (SVMs)	Maximum number for Cloud Volumes ONTAP (HA pair or single node)	One data-serving SVM and one destination SVM used for disaster recovery. You can activate the destination SVM for data access if there's an outage on the source SVM. ¹ The one data-serving SVM spans the entire Cloud Volumes ONTAP system (HA pair or single node).
Files	Maximum size	16 TB
	Maximum per volume	Volume size dependent, up to 2 billion
FlexClone volumes	Hierarchical clone depth ²	499
FlexVol volumes	Maximum per node	500
	Minimum size	20 MB
	Maximum size	AWS: Dependent on the size of the aggregate ³ Azure HA: Dependent on the size of the aggregate ³ Azure single node: 100 TB
Qtrees	Maximum per FlexVol volume	4,995
Snapshot copies	Maximum per FlexVol volume	1,023

Notes:

1. Cloud Manager does not provide any setup or orchestration support for SVM disaster recovery. It also does

not support storage-related tasks on an additional SVM. You must use System Manager or the CLI for SVM disaster recovery.

- [SVM Disaster Recovery Preparation Express Guide](#)
 - [SVM Disaster Recovery Express Guide](#)
2. Hierarchical clone depth is the maximum depth of a nested hierarchy of FlexClone volumes that can be created from a single FlexVol volume.
 3. Less than 100 TB is supported because aggregates for this configuration are limited to 96 TB of *raw* capacity.

iSCSI storage limits

iSCSI storage	Parameter	Limit
LUNs	Maximum per node	1,024
	Maximum number of LUN maps	1,024
	Maximum size	16 TB
	Maximum per volume	512
igroups	Maximum per node	256
Initiators	Maximum per node	512
	Maximum per igroup	128
iSCSI sessions	Maximum per node	1,024
LIFs	Maximum per port	32
	Maximum per portset	32
Portsets	Maximum per node	256

Known issues for Cloud Volumes ONTAP 9.5

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

There are no known issues in this release specific to Cloud Volumes ONTAP.

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

Known limitations for Cloud Volumes ONTAP 9.5

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.

General limitations

The following limitations apply to Cloud Volumes ONTAP in AWS and in Azure.

Software updates must be completed by Cloud Manager

Upgrades of Cloud Volumes ONTAP must be completed from Cloud Manager. You should not upgrade Cloud Volumes ONTAP by using System Manager or the CLI. Doing so can impact system stability.

Cloud Volumes ONTAP deployment must not be modified from your cloud provider's console

Changes to a Cloud Volumes ONTAP configuration from your cloud provider's console results in an unsupported configuration. Any changes to the Cloud Volumes ONTAP resources that Cloud Manager creates and manages can impact system stability and Cloud Manager's ability to manage the system.

Disks and aggregates must be managed from Cloud Manager

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

SnapManager licensing limitation

SnapManager per-server licenses are supported with Cloud Volumes ONTAP. Per-storage system (SnapManager suite) licenses are not supported.

Unsupported ONTAP features

The following features are not supported with Cloud Volumes ONTAP:

- Aggregate-level inline deduplication
- Aggregate-level background deduplication
- Disk maintenance center
- Disk sanitization
- Fibre Channel (FC)
- Flash Pools
- FlexCache
- Infinite Volumes
- Interface groups
- Intranode LIF failover
- MetroCluster
- Multi-tenancy (only one data-serving SVM is supported)
- RAID4, RAID-DP, RAID-TEC (RAID0 is supported)
- Service Processor
- SnapLock Compliance mode (Enterprise mode is supported)
- SnapMirror Synchronous
- VLANs

Known limitations in AWS

The following known limitations affect Cloud Volumes ONTAP in AWS.

Flash Cache limitations

C5D and R5D instance types include local NVMe storage, which Cloud Volumes ONTAP uses as *Flash Cache*. Note the following limitations:

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

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

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

False alarms reported by Amazon CloudWatch

Cloud Volumes ONTAP does not release CPUs when idle, so Amazon CloudWatch can report a high CPU warning for the EC2 instance because it sees 100% usage. You can ignore this alarm. The ONTAP statistics command displays the true usage of the CPUs.

Cloud Volumes ONTAP HA pairs do not support immediate storage giveback

After a node reboots, the partner must sync data before it can return the storage. The time that it takes to resync data depends on the amount of data written by clients while the node was down and the data write speed during the time of giveback.

Limitations in the AWS C2S environment

See the [Quick Start Guide for the AWS Commercial Cloud Services Environment](#).

Limitations in AWS GovCloud (US) regions

- Cloud Manager must be deployed in an AWS GovCloud (US) region if you want to launch Cloud Volumes ONTAP instances in any AWS GovCloud (US) region.
- When deployed in an AWS GovCloud (US) region, Cloud Manager cannot discover ONTAP clusters in a NetApp Private Storage for Microsoft Azure configuration or a NetApp Private Storage for SoftLayer configuration.

Detaching and reattaching EBS volumes is not supported

Detaching an EBS volume from a Cloud Volumes ONTAP instance and then reattaching it to another Cloud Volumes ONTAP instance is not supported. You should use Cloud Manager to replicate data between instances.

Known limitations in Microsoft Azure

The following known limitations affect Cloud Volumes ONTAP in Azure.

New deployments aren't supported

New deployments of Cloud Volumes ONTAP 9.5 are no longer supported in Azure. You'll need to deploy Cloud Volumes ONTAP 9.7.

HA limitations

The following limitations affect Cloud Volumes ONTAP HA pairs in Microsoft Azure:

- Data tiering is not supported.
- NFSv4 is not supported. NFSv3 is supported.
- HA pairs are not supported in some regions.

[See the list of supported Azure regions.](#)

Pay-as-you-go not available for CSP partners

If you are a Microsoft Cloud Solution Provider (CSP) partner, you cannot deploy Cloud Volumes ONTAP Explore, Standard, or Premium because pay-as-you-go subscriptions are not available for CSP partners. You must purchase a license and deploy Cloud Volumes ONTAP BYOL.

9.4 Release Notes

What's new in Cloud Volumes ONTAP 9.4

Cloud Volumes ONTAP 9.4 includes several new features and enhancements.



Additional features and enhancements are also introduced in the latest versions of Cloud Manager. See the [Cloud Manager Release Notes](#) for details.

Support for pay-as-you-go in the AWS GovCloud (US) region

The pay-as-you-go version of Cloud Volumes ONTAP is now supported in the AWS GovCloud (US) region. This is in addition to supporting Cloud Volumes ONTAP BYOL in the GovCloud (US) region.

You can deploy Cloud Volumes ONTAP in the GovCloud (US) region just like any other region. Go to NetApp Cloud Central and launch Cloud Manager in GovCloud (US). Then launch Cloud Volumes ONTAP PAYGO or BYOL by creating a new working environment in Cloud Manager.

Tiering cold data with Cloud Volumes ONTAP Premium and BYOL

The 9.2 release introduced automated data tiering between a performance tier (SSD or HDD) and a capacity tier (an object store). The cold data sent to the capacity tier included Snapshot copies of read-write volumes (the *Snapshot only* tiering policy) or data from destination volumes (the *backup* tiering policy).

With Cloud Volumes ONTAP 9.4 Premium and BYOL, you now have a third option: you can use the *auto* tiering policy to tier cold data blocks in a read-write volume to a capacity tier. The cold data includes not just Snapshot copies but also cold user data from the active file system.

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.

You can choose the tiering policy when you create or edit a volume in Cloud Manager. For details, refer to [Cloud Manager documentation](#).

Data tiering in Microsoft Azure

You can now reduce your Azure storage costs by combining a performance tier for hot data (Premium or Standard managed disks) with a capacity tier for cold data (Azure Blob storage). The same tiering policies that are supported in AWS are also supported in Azure: auto, Snapshot only, and backup.



Data tiering is not supported with the DS3_v2 virtual machine type.

You can choose the tiering policy when you create or edit a volume in Cloud Manager. For details, refer to [Cloud Manager documentation](#).

Data tiering with Provisioned IOPS SSDs

Data tiering is now supported in AWS with Provisioned IOPS SSDs. You can use these SSDs as the performance tier for hot data with Amazon S3 as the capacity tier for cold data.

Improved performance when tiering data

The enhanced write performance that was introduced in the 9.2 and 9.3 releases is now supported with volumes that tier cold data to an object store capacity tier. This applies to volumes created on new SSD aggregates in Cloud Volumes ONTAP 9.4.

Improved performance for multiple workloads in AWS

Cloud Volumes ONTAP now has additional networking bandwidth in AWS, which provides improved performance for systems with multiple workloads. The additional bandwidth is available for the following EC2 instance types when you upgrade to 9.4 and when you launch new 9.4 systems:

- m4.xlarge
- m4.2xlarge
- m4.4xlarge
- c4.4xlarge
- c4.8xlarge

EC2 instance types no longer supported

All versions of Cloud Volumes ONTAP no longer support several EC2 instance types. Existing systems running these instance types will continue to operate normally; however, NetApp strongly recommends changing to a different instance type.

To review pricing differences between instance types and NetApp licenses, go to the AWS Marketplace for [single-node systems](#) and for [HA pairs](#).

Instance type no longer supported	Recommended instance type
c3.2xlarge	m4.xlarge
c4.2xlarge	m4.2xlarge
m3.xlarge	m4.xlarge
m3.2xlarge	m4.2xlarge
r3.xlarge	m4.2xlarge
r3.2xlarge	r4.2xlarge



M3 and R3 instance types are not supported with data tiering and enhanced performance, so moving to the M4 and R4 instance types allows you to take advantage of those Cloud Volumes ONTAP features.

Upgrade notes

- Upgrades of Cloud Volumes ONTAP must be completed from Cloud Manager. You should not upgrade Cloud Volumes ONTAP by using System Manager or the CLI. Doing so can impact system stability.
- You can upgrade to Cloud Volumes ONTAP 9.4 from the 9.3 release.

To understand version requirements, refer to [ONTAP 9 Documentation: Cluster update requirements](#).

- The upgrade of a single node system takes the system offline for up to 25 minutes, during which I/O is interrupted.
- Upgrading an HA pair is nondisruptive and I/O is uninterrupted. During this nondisruptive upgrade process, each node is upgraded in tandem to continue serving I/O to clients.

Supported configurations for Cloud Volumes ONTAP 9.4

Cloud Volumes ONTAP is available in AWS and Azure in two pricing options: pay-as-you-go and Bring Your Own License (BYOL). For pay-as-you-go, you can choose from three configurations: Explore, Standard, or Premium.

Cloud Volumes ONTAP for AWS

In AWS, you can deploy Cloud Volumes ONTAP as a single system or an HA pair.

	Explore	Standard	Premium	BYOL
EC2 instance types	m4.xlarge	<ul style="list-style-type: none"> m4.2xlarge r4.xlarge 	<ul style="list-style-type: none"> c4.4xlarge c4.8xlarge m4.4xlarge r4.2xlarge 	<ul style="list-style-type: none"> c4.4xlarge c4.8xlarge m4.xlarge m4.2xlarge m4.4xlarge r4.xlarge r4.2xlarge
Underlying storage	General Purpose SSDs, Provisioned IOPS SSDs, Throughput Optimized HDDs, and Cold HDDs, up to 16 TB per disk			
Maximum system capacity (disks + object storage)	2 TB	10 TB	368 TB	368 TB per license

Notes:

- If you enable data tiering, a system's capacity limit stays the same. The capacity limit includes both disks and object storage.
- Data tiering is supported with Cloud Volumes ONTAP Standard, Premium, and BYOL.
- When you choose an EC2 instance type, you can specify whether it is a shared instance or a dedicated instance.
- Enhanced write performance is supported when using EBS SSDs with Cloud Volumes ONTAP Standard, Premium, and BYOL.
- For AWS region support, see [Cloud Volumes Global Regions](#).

Cloud Volumes ONTAP for Azure

In Azure, you can deploy Cloud Volumes ONTAP as a single node system.

	Explore	Standard	Premium	BYOL
Virtual machine types	DS3_v2	<ul style="list-style-type: none"> • DS4_v2 • DS13_v2 	<ul style="list-style-type: none"> • DS5_v2 • DS14_v2 	<ul style="list-style-type: none"> • DS3_v2 • DS4_v2 • DS5_v2 • DS13_v2 • DS14_v2
Underlying storage	Standard HDD Managed Disks, Standard SSD Managed Disks, and Premium SSD Managed Disks, up to 32 TB per disk			
Maximum system capacity (disks + object storage)	2 TB	10 TB	368 TB	368 TB per license

Notes:

1. If you enable data tiering, a system's capacity limit stays the same. The capacity limit includes both disks and object storage.
2. Data tiering is not supported with the DS3_v2 virtual machine type.
3. Enhanced write performance is enabled when using Azure Premium Storage disks, but not when using the DS3_v2 virtual machine type.
4. For Azure region support, see [Cloud Volumes Global Regions](#).

Storage limits for Cloud Volumes ONTAP 9.4

Cloud Volumes ONTAP has storage configuration limits to provide reliable operations. For best performance, do not configure your system at the maximum values.

Maximum system capacity by license

The maximum system capacity for a Cloud Volumes ONTAP system is determined by its license. The maximum system capacity includes disk-based storage plus object storage used for data tiering. NetApp doesn't support exceeding this limit.

In Azure, disk limits prevent you from reaching the 368 TB capacity limit by using disks alone. In those cases, you can reach the 368 TB capacity limit by [tiering inactive data to object storage](#). Refer to [capacity and disk limits by Azure VM size](#) for more details.

License	Maximum system capacity (disks + object storage)
Explore	2 TB (data tiering is not supported with Explore)
Standard	10 TB
Premium	368 TB
BYOL	368 TB per license

For HA, is the license capacity limit per node or for the entire HA pair?

The capacity limit is for the entire HA pair. It is not per node. For example, if you use the Premium license, you can have up to 368 TB of capacity between both nodes.

For an HA system in AWS, does mirrored data count against the capacity limit?

No, it doesn't. Data in an AWS HA pair is synchronously mirrored between the nodes so that the data is available in the event of failure. For example, if you purchase an 8 TB disk on node A, Cloud Manager also allocates an 8 TB disk on node B that is used for mirrored data. While 16 TB of capacity was provisioned, only 8 TB counts against the license limit.

Aggregate and disk limits for Cloud Volumes ONTAP in AWS

In Cloud Volumes ONTAP 9.4, all EC2 instance types can reach the 368 TB capacity limit using EBS storage alone, or by using EBS storage and tiering to S3 (both single node and HA).

Physical storage	Parameter	Limit
Aggregates and disks	Maximum number of aggregates	34 for single-node configurations 18 per node in an HA configuration ¹
	Maximum aggregate size	96 TB of raw capacity ²
	Disks per aggregate	1-6 ³
	Maximum disk size	16 TB
	Maximum number of data disks across all aggregates ⁴	34 for single-node configurations 31 per node in an HA configuration
RAID groups	Maximum per aggregate	1

Notes:

1. It is not possible to create 18 aggregates on both nodes in an HA pair because doing so would exceed the data disk limit.
2. The aggregate capacity limit is based on the disks that comprise the aggregate. The limit does not include object storage used for data tiering.
3. All disks in an aggregate must be the same size.
4. The data disk limit is specific to disks that contain user data. The boot disk and root disk for each node are not included in this limit.

Aggregate and disk limits for Cloud Volumes ONTAP in Azure

Physical storage	Parameter	Limit
Aggregates and disks	Maximum number of aggregates	Same as the disk limit
	Maximum aggregate size	200 TB of raw capacity ¹
	Disks per aggregate	1-12 ²
	Maximum disk size	32 TB
	Maximum number of data disks across all aggregates ³	Depends on VM size. See below.
RAID groups	Maximum per aggregate	1

Notes:

1. The aggregate capacity limit is based on the disks that comprise the aggregate. The limit does not include object storage used for data tiering.
2. All disks in an aggregate must be the same size.
3. The data disk limit is specific to disks that contain user data. The boot disk and root disk for each node are not included in this limit.

Capacity and disk limits by Azure VM size

In Azure, single node systems can use Standard HDD Managed Disks, Standard SSD Managed Disks, and Premium SSD Managed Disks, with up to 32 TB per disk. The number of supported disks varies by VM size.

The tables below show the maximum system capacity by VM size with disks alone, and with disks and cold data tiering to object storage.

Disk limits are shown by VM size for Premium and BYOL licenses only because disk limits can't be reached with Explore or Standard licenses due to system capacity limits.

Single node with a Premium license

VM size	Max disks per node	Max system capacity with disks alone	Max system capacity with disks and data tiering
DS3_v2	15	368 TB	Tiering not supported
DS4_v2	31	368 TB	368 TB
DS5_v2	63	368 TB	368 TB
DS13_v2	31	368 TB	368 TB
DS14_v2	63	368 TB	368 TB

Single node with one or more BYOL licenses



For some VM types, you'll need several BYOL licenses to reach the max system capacity listed below. For example, you'd need 6 BYOL licenses to reach 2 PB with DS5_v2.

VM size	Max disks per node	Max system capacity with one license		Max system capacity with multiple licenses	
		Disks alone	Disks + data tiering	Disks alone	Disks + data tiering
DS3_v2	15	368 TB	Tiering not supported	480 TB	Tiering not supported
DS4_v2	31	368 TB	368 TB	992 TB	368 TB x each license
DS5_v2	63	368 TB	368 TB	2 PB	368 TB x each license
DS13_v2	31	368 TB	368 TB	992 TB	368 TB x each license
DS14_v2	63	368 TB	368 TB	2 PB	368 TB x each license

Logical storage limits

Logical storage	Parameter	Limit
Storage virtual machines (SVMs)	Maximum number for Cloud Volumes ONTAP (HA pair or single node)	One data-serving SVM and one destination SVM used for disaster recovery. You can activate the destination SVM for data access if there's an outage on the source SVM. ¹ The one data-serving SVM spans the entire Cloud Volumes ONTAP system (HA pair or single node).
Files	Maximum size	16 TB
	Maximum per volume	Volume size dependent, up to 2 billion
FlexClone volumes	Hierarchical clone depth ²	499
FlexVol volumes	Maximum per node	500
	Minimum size	20 MB
	Maximum size	AWS: Dependent on the size of the aggregate ³ Azure: 100 TB
Qtrees	Maximum per FlexVol volume	4,995
Snapshot copies	Maximum per FlexVol volume	1,023

Notes:

- Cloud Manager does not provide any setup or orchestration support for SVM disaster recovery. It also does not support storage-related tasks on an additional SVM. You must use System Manager or the CLI for SVM disaster recovery.
 - SVM Disaster Recovery Preparation Express Guide

- SVM Disaster Recovery Express Guide
2. Hierarchical clone depth is the maximum depth of a nested hierarchy of FlexClone volumes that can be created from a single FlexVol volume.
 3. Less than 100 TB is supported because aggregates for this configuration are limited to 96 TB of *raw* capacity.

iSCSI storage limits

iSCSI storage	Parameter	Limit
LUNs	Maximum per node	1,024
	Maximum number of LUN maps	1,024
	Maximum size	16 TB
	Maximum per volume	512
igroups	Maximum per node	256
Initiators	Maximum per node	512
	Maximum per igroup	128
iSCSI sessions	Maximum per node	1,024
LIFs	Maximum per port	32
	Maximum per portset	32
Portsets	Maximum per node	256

Known issues for Cloud Volumes ONTAP 9.4

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

There are no known issues in this release specific to Cloud Volumes ONTAP.

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

Known limitations for Cloud Volumes ONTAP 9.4

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.

General limitations

The following limitations apply to Cloud Volumes ONTAP in AWS and in Azure.

Software updates must be completed by Cloud Manager

Upgrades of Cloud Volumes ONTAP must be completed from Cloud Manager. You should not upgrade Cloud Volumes ONTAP by using System Manager or the CLI. Doing so can impact system stability.

Encryption is not supported on boot and root disks

If you enabled an option from your cloud provider that automatically encrypts all new volumes or disks, then you must temporarily disable that option when deploying Cloud Volumes ONTAP. If you don't, then deployment of Cloud Volumes ONTAP will fail. Encryption is not supported on the boot and root disks for the Cloud Volumes ONTAP system.

Cloud Volumes ONTAP deployment must not be modified from your cloud provider's console

Changes to a Cloud Volumes ONTAP configuration from your cloud provider's console results in an unsupported configuration. Any changes to the Cloud Volumes ONTAP resources that Cloud Manager creates and manages can impact system stability and Cloud Manager's ability to manage the system.

Disks and aggregates must be managed from Cloud Manager

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

SnapManager licensing limitation

SnapManager per-server licenses are supported with Cloud Volumes ONTAP. Per-storage system (SnapManager suite) licenses are not supported.

Unsupported ONTAP features

The following features are not supported with Cloud Volumes ONTAP:

- Aggregate-level inline deduplication
- Aggregate-level background deduplication
- Disk maintenance center
- Disk sanitization
- Fibre Channel (FC)
- Flash Pools
- FlexCache
- Infinite Volumes
- Interface groups
- Intranode LIF failover
- MetroCluster
- Multi-tenancy (only one data-serving SVM is supported)
- NetApp Volume Encryption
- RAID4, RAID-DP, RAID-TEC (RAID0 is supported)
- Service Processor
- SnapLock Compliance mode (Enterprise mode is supported)
- SnapMirror Synchronous
- VLANs

Known limitations in AWS

The following known limitations affect Cloud Volumes ONTAP in AWS.

False alarms reported by Amazon CloudWatch

Cloud Volumes ONTAP does not release CPUs when idle, so Amazon CloudWatch can report a high CPU warning for the EC2 instance because it sees 100% usage. You can ignore this alarm. The ONTAP statistics command displays the true usage of the CPUs.

Cloud Volumes ONTAP HA pairs do not support immediate storage giveback

After a node reboots, the partner must sync data before it can return the storage. The time that it takes to resync data depends on the amount of data written by clients while the node was down and the data write speed during the time of giveback.

Limitations with the AWS GovCloud (US) region

- Cloud Manager must be deployed in an AWS GovCloud (US) region if you want to launch Cloud Volumes ONTAP instances in any AWS GovCloud (US) region.
- When deployed in the AWS GovCloud (US) region, Cloud Manager cannot discover ONTAP clusters in a NetApp Private Storage for Microsoft Azure configuration or a NetApp Private Storage for SoftLayer configuration.

Detaching and reattaching EBS volumes is not supported

Detaching an EBS volume from a Cloud Volumes ONTAP instance and then reattaching it to another Cloud Volumes ONTAP instance is not supported. You should use Cloud Manager to replicate data between instances.

Encryption limitations

- LUN move is not supported on systems that have Cloud Volumes ONTAP encryption enabled.
- Cloud Volumes ONTAP sends encryption keys to key managers even for aggregates that it failed to create.

You must manually delete the keys from key managers.

Known limitations in Microsoft Azure

The following known limitations affect Cloud Volumes ONTAP in Azure.

Pay-as-you-go not available for CSP partners

If you are a Microsoft Cloud Solution Provider (CSP) partner, you cannot deploy Cloud Volumes ONTAP Explore, Standard, or Premium because pay-as-you-go subscriptions are not available for CSP partners. You must purchase a license and deploy Cloud Volumes ONTAP BYOL.

9.3 Release Notes

What's new in ONTAP Cloud 9.3

ONTAP Cloud 9.3 includes several new features and enhancements.

ONTAP Cloud HA enhancements in AWS

The 9.3 release addresses the resiliency of ONTAP Cloud HA pairs to tolerate network glitches or transient higher latencies within the AWS ecosystem, and to ensure the availability of customer data during such events.

Support for the EU (Paris) region in AWS

ONTAP Cloud is now supported in the EU (Paris) region in AWS. Based on the supported instance types in this region, the following ONTAP Cloud configurations are available in the EU (Paris) region:

- ONTAP Cloud Standard (r4.xlarge)
- ONTAP Cloud Premium (r4.2xlarge)
- ONTAP Cloud BYOL (r4.xlarge and r4.2xlarge)

Enhanced write performance with Azure Premium disks

Write performance for ONTAP Cloud has been improved in Azure when using Premium Storage disks. The enhancement is supported with ONTAP Cloud Standard, Premium, and BYOL.



Write performance enhancements are not supported when using the DS3_v2 virtual machine type.

Increased capacity limit for ONTAP Cloud Premium and BYOL in Azure

The capacity limit for ONTAP Cloud Premium and ONTAP Cloud BYOL has doubled to 252 TB when using the DS5_v2 or DS14_v2 virtual machine types.



This change is possible due to an increase in the number of disks available per Azure virtual machine. It does not change the maximum capacity per aggregate.

Support for Azure US Gov regions

You can now deploy Cloud Manager and ONTAP Cloud BYOL in the following Azure regions:

- US Gov Arizona
- US Gov Texas
- US Gov Virginia

To deploy Cloud Manager in these regions, you must create a CentOS 7.3 virtual machine from the Azure Marketplace, download the Cloud Manager installer from the NetApp Support Site, and then install the software. After Cloud Manager is running, you can deploy ONTAP Cloud BYOL systems in these regions just like any other region.

Support for SVM disaster recovery

ONTAP Cloud supports one data-serving SVM and one destination SVM used for disaster recovery. You can activate the destination SVM for data access if there's an outage on the source SVM.

SVM disaster recovery is the asynchronous mirroring of SVM data and configuration from a source SVM to a destination SVM. You can quickly activate a destination SVM for data access if the source SVM is no longer available.



Cloud Manager does not provide any setup or orchestration support for SVM disaster recovery. It also does not support storage-related tasks on any additional SVMs. You must use System Manager or the CLI for SVM disaster recovery.

[SVM Disaster Recovery Preparation Express Guide](#)

[SVM Disaster Recovery Express Guide](#)

Upgrade notes

- Upgrades must be completed from Cloud Manager. You should not upgrade ONTAP Cloud by using System Manager or the CLI. Doing so can impact system stability.
- You can upgrade to ONTAP Cloud 9.3 from ONTAP Cloud 9.2.
- The upgrade of a single node system takes the system offline for up to 25 minutes, during which I/O is interrupted.
- Upgrading an HA pair is nondisruptive and I/O is uninterrupted. During this nondisruptive upgrade process, each node is upgraded in tandem to continue serving I/O to clients.

Supported configurations for ONTAP Cloud 9.3

ONTAP Cloud is available in AWS and Azure in two pricing options: pay-as-you-go and Bring Your Own License (BYOL). For pay-as-you-go, you can choose from three configurations: Explore, Standard, or Premium.

ONTAP Cloud for AWS

In AWS, you can deploy ONTAP Cloud as a single system or an HA pair.

	Explore	Standard	Premium	BYOL
EC2 instance types	m4.xlarge	<ul style="list-style-type: none">m4.2xlarger4.xlarge	<ul style="list-style-type: none">c4.4xlargec4.8xlargem4.4xlarger4.2xlarge	<ul style="list-style-type: none">c4.4xlargec4.8xlargem4.xlargem4.2xlargem4.4xlarger4.xlarger4.2xlarge

	Explore	Standard	Premium	BYOL
Underlying storage	General Purpose SSDs, Provisioned IOPS SSDs, Throughput Optimized HDDs, and Cold HDDs, up to 16 TB per disk			
License capacity limit	2 TB	10 TB	368 TB	368 TB per license

Notes:

1. Pay-as-you-go configurations are not supported in GovCloud (US).
2. When you choose an EC2 instance type, you can specify whether it is a shared instance or a dedicated instance.
3. Enhanced write performance is supported when using EBS SSDs with ONTAP Cloud Standard, Premium, and BYOL.
4. Data tiering is supported with ONTAP Cloud Standard, Premium, and BYOL.
5. If you enable data tiering, a system's capacity limit stays the same. The capacity limit includes both disks and object storage.
6. For AWS region support, see [Cloud Volumes Global Regions](#).

ONTAP Cloud for Azure

In Azure, you can deploy ONTAP Cloud as a single node system.

	Explore	Standard	Premium	BYOL
Virtual machine types	DS3_v2	<ul style="list-style-type: none"> • DS4_v2 • DS13_v2 	<ul style="list-style-type: none"> • DS5_v2 • DS14_v2 	<ul style="list-style-type: none"> • DS3_v2 • DS4_v2 • DS5_v2 • DS13_v2 • DS14_v2
Underlying storage	Standard HDD Managed Disks, Standard SSD Managed Disks, and Premium SSD Managed Disks, up to 32 TB per disk			
License capacity limit	2 TB	10 TB	368 TB	368 TB per license

Notes:

1. Enhanced write performance is supported when using Azure Premium Storage disks with ONTAP Cloud Standard, Premium, and BYOL, but not when using the DS3_v2 virtual machine type.
2. For Azure region support, see [Cloud Volumes Global Regions](#).

Storage limits for ONTAP Cloud 9.3

ONTAP Cloud has storage configuration limits to provide reliable operations. For best performance, do not configure your system at the maximum values.

The following sections list limits for aggregates, volumes, LUNs, and related storage objects. Note that the maximum capacity for an ONTAP Cloud system is model specific. ONTAP Cloud configurations that support a lower raw capacity limit cannot reach some of the size and disk limits.

Physical storage limits for ONTAP Cloud in AWS

Physical storage	Parameter	Limit
Aggregates and disks	Maximum number of aggregates	34 for single-node configurations 18 per node in an HA configuration ¹
	Maximum aggregate size	96 TB of raw capacity
	Disks per aggregate	1-6 ²
	Maximum disk size	16 TB
	Maximum number of data disks across all aggregates ³	34 for single-node configurations 31 per node in an HA configuration
RAID groups	Maximum per aggregate	1

Notes:

1. It is not possible to create 18 aggregates on both nodes in an HA pair because doing so would exceed the data disk limit.
2. All disks in an aggregate must be the same size.
3. The data disk limit is specific to disks that contain user data. The boot disk and root disk for each node are not included in this limit.

Physical storage limits for ONTAP Cloud in Azure

Physical storage	Parameter	Limit
Aggregates and disks	Maximum number of aggregates	63
	Maximum aggregate size	200 TB of raw capacity
	Disks per aggregate	1-12 ¹
	Maximum disk size	32 TB
	Maximum number of data disks across all aggregates ²	<ul style="list-style-type: none"> • DS3_v2: 15 • DS4_v2: 31 • DS5_v2: 63 • DS13_v2: 31 • DS14_v2: 63
RAID groups	Maximum per aggregate	1

Notes:

1. All disks in an aggregate must be the same size.
2. The data disk limit is specific to disks that contain user data. The boot disk and root disk for each node are not included in this limit.

Logical storage limits

Logical storage	Parameter	Limit
Storage virtual machines (SVMs)	Maximum number for ONTAP Cloud (HA pair or single node)	One data-serving SVM and one destination SVM used for disaster recovery. You can activate the destination SVM for data access if there's an outage on the source SVM. ¹ The one data-serving SVM spans the entire ONTAP Cloud system (HA pair or single node).
Files	Maximum size	16 TB
	Maximum per volume	Volume size dependent, up to 2 billion
FlexClone volumes	Hierarchical clone depth ²	499
FlexVol volumes	Maximum per node	500
	Minimum size	20 MB
	Maximum size	AWS: Dependent on the size of the aggregate ³ Azure: 100 TB
Qtrees	Maximum per FlexVol volume	4,995
Snapshot copies	Maximum per FlexVol volume	255

Notes:

1. Cloud Manager does not provide any setup or orchestration support for SVM disaster recovery. It also does not support storage-related tasks on an additional SVM. You must use System Manager or the CLI for SVM disaster recovery.
 - [SVM Disaster Recovery Preparation Express Guide](#)
 - [SVM Disaster Recovery Express Guide](#)
2. Hierarchical clone depth is the maximum depth of a nested hierarchy of FlexClone volumes that can be created from a single FlexVol volume.
3. Less than 100 TB is supported because aggregates for this configuration are limited to 96 TB of *raw* capacity.

iSCSI storage limits

iSCSI storage	Parameter	Limit
LUNs	Maximum per node	1,024
	Maximum number of LUN maps	1,024
	Maximum size	16 TB
	Maximum per volume	512
igroups	Maximum per node	256
Initiators	Maximum per node	512
	Maximum per igroup	128
iSCSI sessions	Maximum per node	1,024
LIFs	Maximum per port	32
	Maximum per portset	32
Portsets	Maximum per node	256

Known issues for ONTAP Cloud 9.3

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

There are no known issues in this release specific to ONTAP Cloud.

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

Known limitations for ONTAP Cloud 9.3

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.

General limitations

The following limitations apply to ONTAP Cloud in AWS and in Azure.

Software updates must be completed by Cloud Manager

Upgrades of Cloud Volumes ONTAP must be completed from Cloud Manager. You should not upgrade Cloud Volumes ONTAP by using System Manager or the CLI. Doing so can impact system stability.

Encryption is not supported on boot and root disks

If you enabled an option from your cloud provider that automatically encrypts all new volumes or disks, then you must temporarily disable that option when deploying ONTAP Cloud. If you don't, then deployment of ONTAP Cloud will fail. Encryption is not supported on the boot and root disks for the ONTAP Cloud system.

ONTAP Cloud deployment must not be modified from your cloud provider's console

Changes to an ONTAP Cloud configuration from your cloud provider's console results in an unsupported configuration. Any changes to the ONTAP Cloud resources that Cloud Manager creates and manages can impact system stability and Cloud Manager's ability to manage the system.

Disks and aggregates must be managed from Cloud Manager

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

SnapManager licensing limitation

SnapManager per-server licenses are supported with ONTAP Cloud. Per-storage system (SnapManager suite) licenses are not supported.

Unsupported ONTAP features

The following features are not supported with ONTAP Cloud:

- Aggregate-level inline deduplication
- Aggregate-level background deduplication
- Disk maintenance center
- Disk sanitization
- Fibre Channel (FC)
- Flash Pools
- FlexCache
- FlexGroup volumes
- Infinite Volumes
- Interface groups
- Intranode LIF failover
- MetroCluster
- Multi-tenancy (only one data-serving SVM is supported)
- NetApp Volume Encryption
- RAID4, RAID-DP, RAID-TEC (RAID0 is supported)
- Service Processor
- SnapLock
- SnapMirror Synchronous
- VLANs

Known limitations for ONTAP Cloud in AWS

The following known limitations affect ONTAP Cloud in AWS.

False alarms reported by Amazon CloudWatch

ONTAP Cloud does not release CPUs when idle, so Amazon CloudWatch can report a high CPU warning for the EC2 instance because it sees 100% usage. You can ignore this alarm. The ONTAP statistics command displays the true usage of the CPUs.

ONTAP Cloud HA pairs do not support immediate storage giveback

After a node reboots, the partner must sync data before it can return the storage. The time that it takes to resync data depends on the amount of data written by clients while the node was down and the data write speed during the time of giveback.

Limitations with the AWS GovCloud (US) region

- Cloud Manager must be deployed in an AWS GovCloud (US) region if you want to launch Cloud Volumes ONTAP instances in any AWS GovCloud (US) region.
- The ONTAP Cloud pay-as-you-go AMI is not supported in the AWS GovCloud (US) region.
- When deployed in the AWS GovCloud (US) region, Cloud Manager cannot discover ONTAP clusters in a NetApp Private Storage for Microsoft Azure configuration or a NetApp Private Storage for SoftLayer configuration.

Detaching and reattaching EBS volumes is not supported

Detaching an EBS volume from an ONTAP Cloud instance and then reattaching it to another ONTAP Cloud instance is not supported. You should use Cloud Manager to replicate data between instances.

Encryption limitations

- LUN move is not supported on systems that have ONTAP Cloud encryption enabled.
- ONTAP Cloud sends encryption keys to key managers even for aggregates that it failed to create.

You must manually delete the keys from key managers.

Known limitations for ONTAP Cloud in Azure

The following known limitations affect ONTAP Cloud in Azure.

ONTAP Cloud pay-as-you-go not available for CSP partners

If you are a Microsoft Cloud Solution Provider (CSP) partner, you cannot deploy ONTAP Cloud Explore, Standard, or Premium because pay-as-you-go subscriptions are not available for CSP partners. You must purchase a license and deploy ONTAP Cloud BYOL.

Where to get help and find more information

You can get help and find more information about Cloud Volumes ONTAP through various resources, including videos, forums, and support.

- [Cloud Manager Documentation](#)

Access product documentation for Cloud Manager.

- [Videos for Cloud Manager and Cloud Volumes ONTAP](#)

Watch videos that show you how to deploy and manage Cloud Volumes ONTAP and how to replicate data across your hybrid cloud.

- [ONTAP 9 Documentation Center](#)

Access product documentation for ONTAP, which can help you as you use Cloud Volumes ONTAP.

- Technical reports

- [NetApp Technical Report 4383: Performance Characterization of Cloud Volumes ONTAP in Amazon Web Services with Application Workloads](#)
- [NetApp Technical Report 4671: Performance Characterization of Cloud Volumes ONTAP in Azure with Application Workloads](#)
- [NetApp Technical Report 4816: Performance Characterization of Cloud Volumes ONTAP for Google Cloud](#)

- SVM disaster recovery

SVM disaster recovery is the asynchronous mirroring of SVM data and configuration from a source SVM to a destination SVM. You can quickly activate a destination SVM for data access if the source SVM is no longer available.

- [Cloud Volumes ONTAP 9 SVM Disaster Recovery Preparation Express Guide](#)

Describes how to quickly configure a destination SVM in preparation for disaster recovery.

- [Cloud Volumes ONTAP 9 SVM Disaster Recovery Express Guide](#)

Describes how to quickly activate a destination SVM after a disaster, and then reactivate the source SVM.

- [FlexCache Volumes for Faster Data Access Power Guide](#)

Describes how to create and manage FlexCache volumes in the same cluster or different cluster as the origin volume for accelerating data access.

- [NetApp Community: Hybrid Cloud](#)

Connect with peers, ask questions, exchange ideas, find resources, and share best practices.

- [NetApp Cloud Volumes ONTAP Support](#)

Access support resources to get help and troubleshoot issues with Cloud Volumes ONTAP.

- [NetApp Cloud Central](#)

Find information about additional NetApp products and solutions for the cloud.

- [NetApp Product Documentation](#)

Search NetApp product documentation for instructions, resources, and answers.

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