9.5 Release Notes

Cloud Volumes ONTAP

NetApp
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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	• m5.2xlarge • r5.xlarge	• m5.4xlarge • r5.2xlarge	• 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	• m4.xlarge • m5.xlarge	• m4.2xlarge • m5.2xlarge • r4.xlarge • r5.xlarge	• c4.4xlarge • c4.8xlarge • c5d.4xlarge* • c5d.9xlarge* • m4.4xlarge • m5.4xlarge • r4.2xlarge • r5.2xlarge • r5d.2xlarge*	• 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.

8. 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	• DS4_v2 • DS13_v2	• DS5_v2 • DS14_v2	• 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.

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	• DS4_v2 • DS13_v2	• DS5_v2 • DS14_v2	• 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.