



9.9.1 Release Notes

Cloud Volumes ONTAP

NetApp
July 30, 2021

This PDF was generated from https://docs.netapp.com/us-en/cloud-volumes-ontap/reference_new_991.html on July 30, 2021. Always check docs.netapp.com for the latest.

Table of Contents

- 9.9.1 Release Notes 1
 - What’s new in Cloud Volumes ONTAP 9.9.1 1
 - Licensing for Cloud Volumes ONTAP 9.9.1 3
 - Supported configurations 6
 - Storage limits 15
 - Known issues for Cloud Volumes ONTAP 9.9.1 30
 - Known limitations 31

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) 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) |
|---|---|---|
| <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 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 |

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 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 9.9.1 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 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 • 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 • DS5_v2 ¹ • 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 |
|--|--|--|
| <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 9.9.1 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 |

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).

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.

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:

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 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](#).

Copyright Information

Copyright © 2021 NetApp, Inc. All rights reserved. Printed in the U.S. No part of this document covered by copyright may be reproduced in any form or by any means-graphic, electronic, or mechanical, including photocopying, recording, taping, or storage in an electronic retrieval system-without prior written permission of the copyright owner.

Software derived from copyrighted NetApp material is subject to the following license and disclaimer:

THIS SOFTWARE IS PROVIDED BY NETAPP "AS IS" AND WITHOUT ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, WHICH ARE HEREBY DISCLAIMED. IN NO EVENT SHALL NETAPP BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

NetApp reserves the right to change any products described herein at any time, and without notice. NetApp assumes no responsibility or liability arising from the use of products described herein, except as expressly agreed to in writing by NetApp. The use or purchase of this product does not convey a license under any patent rights, trademark rights, or any other intellectual property rights of NetApp.

The product described in this manual may be protected by one or more U.S. patents, foreign patents, or pending applications.

RESTRICTED RIGHTS LEGEND: Use, duplication, or disclosure by the government is subject to restrictions as set forth in subparagraph (c)(1)(ii) of the Rights in Technical Data and Computer Software clause at DFARS 252.277-7103 (October 1988) and FAR 52-227-19 (June 1987).

Trademark Information

NETAPP, the NETAPP logo, and the marks listed at <http://www.netapp.com/TM> are trademarks of NetApp, Inc. Other company and product names may be trademarks of their respective owners.