



Cloud Volumes ONTAP 9.12.1 Release Notes

Cloud Volumes ONTAP release notes

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Cloud Volumes ONTAP 9.12.1 Release Notes

What's new in Cloud Volumes ONTAP 9.12.1

Cloud Volumes ONTAP 9.12.1 includes new enhancements.

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

9.12.1 P14 (29 August 2024)

The 9.12.1 P14 patch is now available for Cloud Volumes ONTAP for all cloud providers. BlueXP will prompt you to upgrade your existing systems to this patch release.

[View the list of bugs fixed in the P14 patch](#) (NetApp Support Site login required).

9.12.1 P13 (8 August 2024)

The 9.12.1 P13 patch is now available for Cloud Volumes ONTAP for all cloud providers. BlueXP will prompt you to upgrade your existing systems to this patch release.

[View the list of bugs fixed in the P13 patch](#) (NetApp Support Site login required).

9.12.1 P12 (22 May 2024)

The 9.12.1 P12 patch is now available for Cloud Volumes ONTAP for all cloud providers. BlueXP will prompt you to upgrade your existing systems to this patch release.

[View the list of bugs fixed in the P12 patch](#) (NetApp Support Site login required).

9.12.1 P11 (22 April 2024)

The 9.12.1 P11 patch is now available for Cloud Volumes ONTAP for all cloud providers. BlueXP 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).

9.12.1 P10 (22 April 2024)

The 9.12.1 P10 patch is now available for Cloud Volumes ONTAP for all cloud providers. BlueXP 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).

9.12.1 P9 (5 February 2024)

The 9.12.1 P9 patch is now available for Cloud Volumes ONTAP for all cloud providers. BlueXP 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).

9.12.1 P8 (8 December 2023)

The 9.12.1 P8 patch is now available for Cloud Volumes ONTAP for all cloud providers. BlueXP 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).

9.12.1 GA (9 February 2023)

The General Availability (GA) release of Cloud Volumes ONTAP 9.12.1 is now available in AWS, Azure, and Google Cloud. The GA release includes bug fixes.

9.12.1 RC1 (8 December 2022)

Cloud Volumes ONTAP 9.12.1 Release Candidate 1 is now available in AWS, Azure, and Google Cloud. This release includes the following new features and enhancements.

ONTAP S3 license in GCP

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

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

NVMe-TCP support in Cloud Volumes ONTAP

NVMe-TCP is supported for cloud providers if you are using Cloud Volumes ONTAP version 9.12.1 or newer. BlueXP does not provide any management capabilities for NVMe-TCP.

For more information on configuring NVMe through ONTAP, see [Configure a storage VM for NVMe](#).

Azure HA in a single availability zone with shared managed disks

You can now deploy a Cloud Volumes ONTAP HA configuration using Microsoft Azure locally redundant storage (LRS) running on top of shared managed disks. Locally redundant storage replicates your data three times within a single data center in the same region.

For more information about the HA configuration architecture and components, see [High-availability pairs in Azure](#).

When you deploy a new HA pair in Azure in a single availability zone, you will now be using LRS shared managed disks rather than page blobs for storage. There's no change to the Working Environment wizard. You simply need to choose a Single Availability Zone to use this new configuration. For details, see [Launching a Cloud Volumes ONTAP HA pair in Azure](#).

Azure HA in multiple availability zones with shared managed disks

You can now deploy a Cloud Volumes ONTAP HA configuration using Azure multiple availability zones within a region. The new configuration protects against data center failure and maintains application availability with the use of Azure zone-redundant storage (ZRS) shared managed disks. This feature is currently available only in the West US 2, West Europe, North Europe, and France Central regions.

For more information about the HA configuration architecture and components, see [High-availability pairs in Azure](#).

To use this new configuration, see [Launching a Cloud Volumes ONTAP HA pair in Azure](#).

To learn more about zone-redundant storage for managed disks, refer to [Microsoft Azure's documentation](#).

Upgrade notes

Read through these notes to learn more about upgrading to this release.

How to upgrade

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

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

Supported upgrade path

You can upgrade to Cloud Volumes ONTAP 9.12.1 from the 9.12.0 and 9.11.1 releases. BlueXP will prompt you to upgrade eligible Cloud Volumes ONTAP systems to this release.

Required version of the Connector

The BlueXP Connector must be running version 3.9.24 or later to deploy new Cloud Volumes ONTAP 9.12.1 systems and to upgrade existing systems to 9.12.1.



Automatic upgrades of the Connector are enabled by default so you should be running the latest version.

Downtime

- 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.

Upgrades in AWS with c4, m4, and r4 EC2 instance types

In AWS, the c4, m4, and r4 EC2 instance types are no longer supported with new Cloud Volumes ONTAP deployments. If you have an existing system that's running on a c4, m4, or r4 instance type, you must change to an instance type in the c5, m5, or r5 instance family. If you can't change the instance type, you need to enable enhanced networking before upgrading.

[Learn how to upgrade in AWS with c4, m4, and r4 EC2 instance types.](#)

[Learn how to change the EC2 instance type for Cloud Volumes ONTAP.](#)

Refer to [NetApp Support](#) to learn more about the end of availability and support for these instance types.

Licensing for Cloud Volumes ONTAP

Cloud Volumes ONTAP offers different licensing options that enable you to choose a consumption model that meets your needs.

The following licensing options are available for new customers.

Capacity-based licensing packages

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

Capacity-based licensing is available in the form of a *package*. When you deploy a Cloud Volumes ONTAP system, you can choose from several licensing packages based on your business needs.

Keystone Flex Subscription

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

Charging is based on the size of your committed capacity for one or more Cloud Volumes ONTAP HA pairs in your Keystone Flex Subscription.

The previous by-node licensing model remains available for existing customers who have already purchased a license or who have an active marketplace subscription.

[Learn more about these licensing options](#)

Supported configurations

Supported configurations 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 | Capacity-based license | PAYGO Explore | PAYGO Standard | PAYGO Premium | Node-based BYOL |
|--|--|------------------------|---------------|----------------|----------------------|----------------------------------|
| Maximum system capacity (disks + object storage) ¹ | 500 GiB | 2 PiB ² | 2 TiB | 10 TiB | 368 TiB ² | 368 TiB per license 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 TiB 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 size. But if you have a configuration that supports the Amazon EBS Elastic Volumes feature, then an aggregate can contain up to 8 disks. [Learn more about support for Elastic Volumes](#)

| General Purpose SSDs (gp3 and gp2) | Provisioned IOPS SSDs (io1) | Throughput Optimized HDDs (st1) |
|--|--|--|
| <ul style="list-style-type: none">• 100 GiB• 500 GiB• 1 TiB• 2 TiB• 4 TiB• 6 TiB• 8 TiB• 16 TiB | <ul style="list-style-type: none">• 100 GiB• 500 GiB• 1 TiB• 2 TiB• 4 TiB• 6 TiB• 8 TiB• 16 TiB | <ul style="list-style-type: none">• 500 GiB• 1 TiB• 2 TiB• 4 TiB• 6 TiB• 8 TiB• 16 TiB |

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 | | | | | | | |

| | | | | | | | |
|---------|--------------------------|-----------------|-----|---------------|-----------|-----------|--------------------|
| | | | | supported | | | |
| | r5.12xlarge ³ | 48 | 384 | Not supported | 10 | 9,500 | Supported |
| License | Supported | vCPU | RAM | Flash | Network | EBS | High write |
| | instance | 48 ⁴ | 384 | Supported | bandwidth | bandwidth | Speed ⁷ |
| | ge | | | | (Gbps) | (Mbps) | Supported |
| | m6id.32xlarge | 48 ⁴ | 512 | Supported | 50 | 40,000 | 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 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 BYOL | Capacity-based license |
|---|---|--|--|---|---|---|
| Maximum system capacity (disks + object storage) | 500 GiB | 2 TiB ¹ | 10 TiB | 368 TiB | 368 TiB per license | 2 PiB |
| Supported virtual machine types | <ul style="list-style-type: none"> • DS4_v2 • DS5_v2 • DS13_v2 • DS14_v2 • DS15_v2 • E4s_v3 • E8s_v3 • E32s_v3 ³ • E48s_v3 ³ • E64is_v3 ³ • E4ds_v4 ³ • E8ds_v4 ³ • E32ds_v4 ³ • E48ds_v4 ³ • E80ids_v4 ³ • L8s_v3 ² • L16s_v3 ^{2,4} • L32s_v3 ^{2,4} | <ul style="list-style-type: none"> • E4s_v3 • E4ds_v4 ³ | <ul style="list-style-type: none"> • DS4_v2 • DS13_v2 • E8s_v3 • E8ds_v4 ³ • L8s_v3 ² | <ul style="list-style-type: none"> • DS5_v2 • DS14_v2 • DS15_v2 • E32s_v3 ³ • E48s_v3 ³ • E64is_v3 ³ • E32ds_v4 ³ • E48ds_v4 ³ • E80ids_v4 ³ | <ul style="list-style-type: none"> • DS4_v2 • DS5_v2 • DS13_v2 • DS14_v2 • DS15_v2 • E4s_v3 • E8s_v3 • E32s_v3 ³ • E48s_v3 ³ • E64is_v3 ³ • E4ds_v4 ³ • E8ds_v4 ³ • E32ds_v4 ³ • E48ds_v4 ³ • E80ids_v4 ³ • L8s_v3 ² • L16s_v3 ^{2,4} • L32s_v3 ^{2,4} | <ul style="list-style-type: none"> • DS4_v2 • DS5_v2 • DS13_v2 • DS14_v2 • DS15_v2 • E4s_v3 • E8s_v3 • E32s_v3 ³ • E48s_v3 ³ • E64is_v3 ³ • E4ds_v4 ³ • E8ds_v4 ³ • E32ds_v4 ³ • E48ds_v4 ³ • E80ids_v4 ³ • L8s_v3 ² • L16s_v3 ^{2,4} • L32s_v3 ^{2,4} |
| Supported disk types ⁴ | 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 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. [Learn more.](#)
3. These VM types use an [Ultra SSD](#) for VNVram, which provides better write performance.

If you choose any of these VM types when you deploy a new Cloud Volumes ONTAP system, you can't change to another VM type that *doesn't* use an Ultra SSD for VNV RAM. For example, you can't change from E8ds_v4 to E8s_v3, but you can change from E8ds_v4 to E32ds_v4 because both of those VM types use Ultra SSDs.

Conversely, if you deployed Cloud Volumes ONTAP using any other VM type, you won't be able to change to a VM type that uses an Ultra SSD for VNV RAM. For example, you can't change from E8s_v3 to E8ds_v4.

- High write speed is supported with all instance types when using a single node system. You can enable high write speed from BlueXP during deployment or any time after. [Learn more about choosing a write speed.](#)
- Enhanced write performance is enabled when using SSDs.
- For Azure region support, see [Cloud Volumes Global Regions](#).
- 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.

HA pairs with page blob

| | Freemium | PAYGO Standard | PAYGO Premium | Node-based BYOL | Capacity-based license |
|---|--|---|---|--|--|
| Maximum system capacity (disks + object storage) | 500 GiB | 10 TiB | 368 TiB | 368 TiB per license | 2 PiB |
| 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 E8ds_v4 ³ E32ds_v4 ^{1,3} E48ds_v4 ^{1,3} E80ids_v4 ^{1,2,3} | <ul style="list-style-type: none"> DS4_v2 DS13_v2 E8s_v3 E8ds_v4 ³ | <ul style="list-style-type: none"> DS5_v2 ¹ DS14_v2 ¹ DS15_v2 ¹ E48s_v3 ¹ E32ds_v4 ^{1,3} E48ds_v4 ^{1,3} E80ids_v4 ^{1,2,3} | <ul style="list-style-type: none"> DS4_v2 DS5_v2 ¹ DS13_v2 DS14_v2 ¹ DS15_v2 ¹ E8s_v3 E48s_v3 ¹ E8ds_v4 ³ E32ds_v4 ^{1,3} E48ds_v4 ^{1,3} E80ids_v4 ^{1,2,3} | <ul style="list-style-type: none"> DS4_v2 DS5_v2 ¹ DS13_v2 DS14_v2 ¹ DS15_v2 ¹ E8s_v3 E48s_v3 ¹ E8ds_v4 ³ E32ds_v4 ^{1,3} E48ds_v4 ^{1,3} E80ids_v4 ^{1,2,3} |
| Supported disk types | Page blobs | | | | |

Notes:

1. Cloud Volumes ONTAP supports high write speed with these VM types when using an HA pair. You can enable high write speed from BlueXP during deployment or any time after. [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. These VM types are only supported in deployments of Cloud Volumes ONTAP 9.11.1 or earlier.

HA pairs with shared managed disks

| | Freemium | PAYGO Standard | PAYGO Premium | Node-based BYOL | Capacity-based license |
|---|--|--|--|--|--|
| Maximum system capacity (disks + object storage) | 500 GiB | 10 TiB | 368 TiB | 368 TiB per license | 2 PiB |
| Supported virtual machine types | <ul style="list-style-type: none"> • E8ds_v4 ⁴ • E32ds_v4 ^{1,4} • E48ds_v4 ^{1,4} • E80ids_v4 ^{1,2,4} • L16s_v3 ^{1,3,5} • L32s_v3 ^{1,3,5} | <ul style="list-style-type: none"> • E8ds_v4 ⁴ | <ul style="list-style-type: none"> • E32ds_v4 ^{1,4} • E48ds_v4 ^{1,4} • E80ids_v4 ^{1,2,4} • L16s_v3 ^{1,3,5} • L32s_v3 ^{1,3,5} | <ul style="list-style-type: none"> • E8ds_v4 ⁴ • E32ds_v4 ^{1,4} • E48ds_v4 ^{1,4} • E80ids_v4 ^{1,2,4} • L16s_v3 ^{1,3,5} • L32s_v3 ^{1,3,5} | <ul style="list-style-type: none"> • E8ds_v4 ⁴ • E32ds_v4 ^{1,4} • E48ds_v4 ^{1,4} • E80ids_v4 ^{1,2,4} • L16s_v3 ^{1,3,5} • L32s_v3 ^{1,3,5} |
| Supported disk types | Managed disks | | | | |

Notes:

1. Cloud Volumes ONTAP supports high write speed with these VM types when using an HA pair. You can enable high write speed from BlueXP during deployment or any time after. [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. These VM types are only supported for HA pairs in a single availability zone configuration running on shared managed disks.
4. These VM types are supported for HA pairs in single availability zone and multiple availability zone configurations running on shared managed disks.
5. 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. [Learn more.](#)

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 GiB• 1 TiB• 2 TiB• 4 TiB• 8 TiB• 16 TiB• 32 TiB | <ul style="list-style-type: none">• 100 GiB• 500 GiB• 1 TiB• 2 TiB• 4 TiB• 8 TiB• 16 TiB• 32 TiB | <ul style="list-style-type: none">• 100 GiB• 500 GiB• 1 TiB• 2 TiB• 4 TiB• 8 TiB• 16 TiB• 32 TiB |

HA pairs

HA pairs use managed disks. (Page blobs are supported with HA pairs deployed before the 9.12.1 release.)

The following disk sizes are supported:

- 500 GiB
- 1 TiB
- 2 TiB
- 4 TiB
- 8 TiB

Supported configurations in Google Cloud

Several Cloud Volumes ONTAP configurations are supported in Google Cloud.

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 BYOL | Capacity-based license |
|--|---|---|--|--|---|---|
| Maximum system capacity (disks + object storage) ¹ | 500 GB | 2 TB ² | 10 TB | 368 TB | 368 TB per license | 2 PiB |
| Supported machine types ³ | <ul style="list-style-type: none"> • n1-standard-8 • n1-standard-32 • n2-standard-4 • n2-standard-8 • n2-standard-16 • 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-16 • n2-standard-32 | <ul style="list-style-type: none"> • n1-standard-8 • n1-standard-32 • n2-standard-4 • n2-standard-8 • n2-standard-16 • n2-standard-32 | <ul style="list-style-type: none"> • n1-standard-8 • n1-standard-32 • n2-standard-4 • n2-standard-8 • n2-standard-16 • 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 Google Cloud.](#)

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 BlueXP 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 Google Cloud, 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 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, BlueXP 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 GiB |
| PAYGO Explore | 2 TiB (data tiering is not supported with Explore) |
| PAYGO Standard | 10 TiB |
| PAYGO Premium | 368 TiB |
| Node-based license | 2 PiB (requires multiple licenses) |
| Capacity-based license | 2 PiB |

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 TiB 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 TiB disk on node A, BlueXP also allocates an 8 TiB disk on node B that is used for mirrored data. While 16 TiB of capacity was provisioned, only 8 TiB counts against the license limit.

Aggregate limits

Cloud Volumes ONTAP uses EBS 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 ² | <ul style="list-style-type: none"> • 96 TiB of raw capacity • 128 TiB of raw capacity with Elastic Volumes ³ |
| Disks per aggregate ⁴ | <ul style="list-style-type: none"> • 1-6 • 1-8 with Elastic Volumes 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 maximum aggregate size is based on the disks that comprise the aggregate. The limit does not include object storage used for data tiering.
3. If you have a configuration that supports the Amazon EBS Elastic Volumes feature, then an aggregate can contain up to 8 disks, which provides up to 128 TiB of capacity. The Amazon EBS Elastic Volumes feature is enabled by default on *new* Cloud Volumes ONTAP 9.11.0 or later systems when using gp3 or io1 disks.
[Learn more about support for Elastic Volumes](#)
4. All disks in an aggregate must be the same size.

Disk and tiering limits by EC2 instance

Capacity limits are different depending on the EC2 instance type family that you use and whether you're using a single node system or an HA pair.

The following notes provide details about the numbers that you'll see in the tables below:

- The disk limits are specific to disks that contain user data.

The limits do not include the boot disk and root disk.

- A maximum system capacity is listed when using disks alone and when using disks and cold data tiering to object storage.
- Cloud Volumes ONTAP uses EBS volumes as disks, with a maximum disk size of 16 TiB.

Limits for capacity-based licensing

The following disk limits apply to Cloud Volumes ONTAP systems that use a capacity-based licensing package.
[Learn about Cloud Volumes ONTAP licensing options](#)

Single node

| Instance | 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 TiB | 2 PiB |
| <ul style="list-style-type: none"> • m5dn.24xlarge • m6id.32xlarge | 19 ¹ | 304 TiB | 2 PiB |

1. This instance type has more local NVMe disks than other instance types, which means a smaller number of data disks are supported.

HA pairs

| Instance | 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 TiB | 2 PiB |
| <ul style="list-style-type: none"> • m5dn.24xlarge • m6id.32xlarge | 16 ¹ | 256 TiB | 2 PiB |

1. This instance type has more local NVMe disks than other instance types, which means a smaller number of data disks are supported.

Limits for node-based licensing

The following disk limits apply to Cloud Volumes ONTAP systems that use node-based licensing, which is the previous generation licensing model that enabled you to license Cloud Volumes ONTAP by node. Node-based licensing is still available for existing customers.

You can purchase multiple node-based licenses for a Cloud Volumes ONTAP BYOL single node or HA pair system to allocate more than 368 TiB of capacity, up to the maximum tested and supported system capacity limit of 2 PiB. Be aware that disk limits can prevent you from reaching the capacity limit by using disks alone. You can go beyond the disk limit by [tiering inactive data to object storage](#). [Learn how to add additional system licenses to Cloud Volumes ONTAP](#). Though Cloud Volumes ONTAP supports up to the maximum tested and supported system capacity of 2 PiB, crossing the 2 PiB limit results in an unsupported system configuration.

AWS Secret Cloud and Top Secret Cloud regions support purchases of multiple node-based licenses starting with Cloud Volumes ONTAP 9.12.1.

Single node with PAYGO Premium

| Instance | 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 TiB | 368 TiB |

| Instance | Max disks per node | Max system capacity with disks alone | Max system capacity with disks and data tiering |
|--|--------------------|--------------------------------------|---|
| <ul style="list-style-type: none"> • m5dn.24xlarge • m6id.32xlarge | 19 ² | 304 TiB | 368 TiB |

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.
2. This instance type has more local NVMe disks than other instance types, which means a smaller number of data disks are supported.

Single node with BYOL

| Instance | 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 TiB | 368 TiB | 336 TiB | 2 PiB |
| <ul style="list-style-type: none"> • m5dn.24xlarge • m6id.32xlarge | 19 ² | 304 TiB | 368 TiB | 304 TiB | 2 PiB |

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.
2. This instance type has more local NVMe disks than other instance types, which means a smaller number of data disks are supported.

HA pairs with PAYGO Premium

| Instance | 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 TiB | 368 TiB |
| <ul style="list-style-type: none"> • m5dn.24xlarge • m6id.32xlarge | 16 ² | 256 TiB | 368 TiB |

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.
2. This instance type has more local NVMe disks than other instance types, which means a smaller number of data disks are supported.

HA pairs with BYOL

| Instance | 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 TiB | 368 TiB | 288 TiB | 2 PiB |
| <ul style="list-style-type: none"> • m5dn.24xlarge • m6id.32xlarge | 16 ² | 256 TiB | 368 TiB | 256 TiB | 2 PiB |

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.
2. This instance type has more local NVMe disks than other instance types, which means a smaller number of data disks are supported.

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 | Storage VM limit |
|--|---|
| Freemium | 24 storage VMs total ^{1,2} |
| Capacity-based PAYGO or BYOL ³ | 24 storage VMs total ^{1,2} |
| Node-based PAYGO | <ul style="list-style-type: none"> • 1 storage VM for serving data • 1 storage VM for disaster recovery |
| Node-based BYOL ⁴ | <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 TiB minimum capacity charge per storage VM. For example, if you create two storage VMs and each has 2 TiB of provisioned capacity, you'll be charged a total of 8 TiB.
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 | *.xlarge | 15 | 9 | 10 | 5 |
| | *.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 | *.xlarge | 15 | 10 | 11 | 5 |
| | *.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 | *.xlarge | 15 | 12 | 13 | 13 |
| | *.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 BlueXP 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 ² | 128 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 ³ | 300 TiB |
| 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.
2. Beginning with ONTAP 9.12.1P2, the limit is 128 TB. In ONTAP 9.11.1 and earlier versions, the limit is 16 TB.
3. FlexVol volume creation up to the maximum size of 300 TiB is supported using System Manager starting from Cloud Volumes ONTAP 9.12.1 P2.

iSCSI storage limits

| iSCSI storage | Parameter | Limit |
|-----------------------|----------------------------|--------|
| LUNs | Maximum per node | 1,024 |
| | Maximum number of LUN maps | 1,024 |
| | Maximum size | 16 TiB |
| | 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 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, BlueXP displays an action required message and no longer allows you to add additional disks.

| License | Maximum system capacity (disks + object storage) |
|----------------|--|
| Freemium | 500 GiB |
| PAYGO Explore | 2 TiB (data tiering is not supported with Explore) |
| PAYGO Standard | 10 TiB |

| License | Maximum system capacity (disks + object storage) |
|------------------------|--|
| PAYGO Premium | 368 TiB |
| Node-based license | 2 PiB (requires multiple licenses) |
| Capacity-based license | 2 PiB |

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 TiB of capacity between both nodes.

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 TiB of raw capacity for single node ² 352 TiB of raw capacity for single node with PAYGO 96 TiB of raw capacity for HA pairs with page blob 384 TiB of raw capacity for HA pairs with managed disks |
| 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 TiB.
3. All disks in an aggregate must be the same size.

Disk and tiering limits by VM size

Capacity limits are different depending on the VM size that you use and whether you're using a single node system or an HA pair.

The following notes provide details about the numbers that you'll see in the tables below:

- The disk limits are specific to disks that contain user data.

The limits do not include the root disk, core disk, and VNV RAM.

- A maximum system capacity is listed when using disks alone and when using disks and cold data tiering to object storage.

- Single node and HA systems which use managed disks have a maximum of 32 TiB per disk. The number of supported disks varies by VM size.
- HA systems which use page blobs have a maximum of 8 TiB per page blob. The number of supported disks varies by VM size.
- The 896 TiB disk-based limit that's listed for single node systems with certain VM sizes is the *tested* limit.

Limits for capacity-based licensing

The following disk limits apply to Cloud Volumes ONTAP systems that use a capacity-based licensing package. [Learn about Cloud Volumes ONTAP licensing options](#)

Single node

| VM size | Max data disks per node | Max system capacity with disks alone | Max system capacity with disks and data tiering |
|-----------|-------------------------|--------------------------------------|---|
| DS4_v2 | 29 | 896 TiB | 2 PiB |
| DS5_v2 | 61 | 896 TiB | 2 PiB |
| DS13_v2 | 29 | 896 TiB | 2 PiB |
| DS14_v2 | 61 | 896 TiB | 2 PiB |
| DS15_v2 | 61 | 896 TiB | 2 PiB |
| E4s_v3 | 5 | 160 TiB | 2 PiB |
| E8s_v3 | 13 | 416 TiB | 2 PiB |
| E32s_v3 | 29 | 896 TiB | 2 PiB |
| E48s_v3 | 29 | 896 TiB | 2 PiB |
| E64is_v3 | 29 | 896 TiB | 2 PiB |
| E4ds_v4 | 5 | 160 TiB | 2 PiB |
| E8ds_v4 | 13 | 416 TiB | 2 PiB |
| E32ds_v4 | 29 | 896 TiB | 2 PiB |
| E48ds_v4 | 29 | 896 TiB | 2 PiB |
| E80ids_v4 | 61 | 896 TiB | 2 PiB |
| L8s_v3 | 12 | 384 TiB | 2 PiB |
| L16s_v3 | 28 | 896 TiB | 2 PiB |
| L32s_v3 | 28 | 896 TiB | 2 PiB |

HA pairs in a single availability zone with page blobs

| VM size | Max data disks for an HA pair | Max system capacity with disks alone | Max system capacity with disks and data tiering |
|-----------|-------------------------------|--------------------------------------|---|
| DS4_v2 | 29 | 232 TiB | 2 PiB |
| DS5_v2 | 61 | 488 TiB | 2 PiB |
| DS13_v2 | 29 | 232 TiB | 2 PiB |
| DS14_v2 | 61 | 488 TiB | 2 PiB |
| DS15_v2 | 61 | 488 TiB | 2 PiB |
| E8s_v3 | 13 | 104 TiB | 2 PiB |
| E48s_v3 | 29 | 232 TiB | 2 PiB |
| E8ds_v4 | 13 | 104 TiB | 2 PiB |
| E32ds_v4 | 29 | 232 TiB | 2 PiB |
| E48ds_v4 | 29 | 232 TiB | 2 PiB |
| E80ids_v4 | 61 | 488 TiB | 2 PiB |

HA pairs in a single availability zone with shared managed disks

| VM size | Max data disks for an HA pair | Max system capacity with disks alone | Max system capacity with disks and data tiering |
|-----------|-------------------------------|--------------------------------------|---|
| E8ds_v4 | 12 | 384 TiB | 2 PiB |
| E32ds_v4 | 28 | 896 TiB | 2 PiB |
| E48ds_v4 | 28 | 896 TiB | 2 PiB |
| E80ids_v4 | 28 | 896 TiB | 2 PiB |
| L16s_v3 | 28 | 896 TiB | 2 PiB |
| L32s_v3 | 28 | 896 TiB | 2 PiB |

HA pairs in multiple availability zones with shared managed disks

| VM size | Max data disks for an HA pair | Max system capacity with disks alone | Max system capacity with disks and data tiering |
|----------|-------------------------------|--------------------------------------|---|
| E8ds_v4 | 12 | 384 TiB | 2 PiB |
| E32ds_v4 | 28 | 896 TiB | 2 PiB |

| VM size | Max data disks for an HA pair | Max system capacity with disks alone | Max system capacity with disks and data tiering |
|-----------|-------------------------------|--------------------------------------|---|
| E48ds_v4 | 28 | 896 TiB | 2 PiB |
| E80ids_v4 | 28 | 896 TiB | 2 PiB |

Limits for node-based licensing

The following disk limits apply to Cloud Volumes ONTAP systems that use node-based licensing, which is the previous generation licensing model that enabled you to license Cloud Volumes ONTAP by node. Node-based licensing is still available for existing customers.

You can purchase multiple node-based licenses for a Cloud Volumes ONTAP BYOL single node or HA pair system to allocate more than 368 TiB of capacity, up to the maximum tested and supported system capacity limit of 2 PiB. Be aware that disk limits can prevent you from reaching the capacity limit by using disks alone. You can go beyond the disk limit by [tiering inactive data to object storage](#). [Learn how to add additional system licenses to Cloud Volumes ONTAP](#). Though Cloud Volumes ONTAP supports up to the maximum tested and supported system capacity of 2 PiB, crossing the 2 PiB limit results in an unsupported system configuration.

Single node

Single node has two node-based licensing options: PAYGO Premium and BYOL.

Single node with PAYGO Premium

| 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 TiB | 368 TiB |
| DS14_v2 | 61 | 368 TiB | 368 TiB |
| DS15_v2 | 61 | 368 TiB | 368 TiB |
| E32s_v3 | 29 | 368 TiB | 368 TiB |
| E48s_v3 | 29 | 368 TiB | 368 TiB |
| E64is_v3 | 29 | 368 TiB | 368 TiB |
| E32ds_v4 | 29 | 368 TiB | 368 TiB |
| E48ds_v4 | 29 | 368 TiB | 368 TiB |
| E80ids_v4 | 61 | 368 TiB | 368 TiB |

Single node with BYOL

| 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 TiB | 368 TiB | 896 TiB | 2 PiB |
| DS5_v2 | 61 | 368 TiB | 368 TiB | 896 TiB | 2 PiB |
| DS13_v2 | 29 | 368 TiB | 368 TiB | 896 TiB | 2 PiB |
| DS14_v2 | 61 | 368 TiB | 368 TiB | 896 TiB | 2 PiB |
| DS15_v2 | 61 | 368 TiB | 368 TiB | 896 TiB | 2 PiB |
| L8s_v2 | 13 | 368 TiB | 368 TiB | 416 TiB | 2 PiB |
| E4s_v3 | 5 | 160 TiB | 368 TiB | 160 TiB | 2 PiB |
| E8s_v3 | 13 | 368 TiB | 368 TiB | 416 TiB | 2 PiB |
| E32s_v3 | 29 | 368 TiB | 368 TiB | 896 TiB | 2 PiB |
| E48s_v3 | 29 | 368 TiB | 368 TiB | 896 TiB | 2 PiB |
| E64is_v3 | 29 | 368 TiB | 368 TiB | 896 TiB | 2 PiB |
| E4ds_v4 | 5 | 160 TiB | 368 TiB | 160 TiB | 2 PiB |
| E8ds_v4 | 13 | 368 TiB | 368 TiB | 416 TiB | 2 PiB |
| E32ds_v4 | 29 | 368 TiB | 368 TiB | 896 TiB | 2 PiB |
| E48ds_v4 | 29 | 368 TiB | 368 TiB | 896 TiB | 2 PiB |
| E80ids_v4 | 61 | 368 TiB | 368 TiB | 896 TiB | 2 PiB |

HA pairs

HA pairs have two configuration types: page blob and multiple availability zone. Each configuration has two node-based licensing options: PAYGO Premium and BYOL.

PAYGO Premium: HA pairs in single availability zone with page blobs

| VM size | Max data disks for an HA pair | Max system capacity with disks alone | Max system capacity with disks and data tiering |
|----------------|--------------------------------------|---|--|
| DS5_v2 | 61 | 368 TiB | 368 TiB |
| DS14_v2 | 61 | 368 TiB | 368 TiB |
| DS15_v2 | 61 | 368 TiB | 368 TiB |
| E8s_v3 | 13 | 104 TiB | 368 TiB |
| E48s_v3 | 29 | 232 TiB | 368 TiB |
| E32ds_v4 | 29 | 232 TiB | 368 TiB |
| E48ds_v4 | 29 | 232 TiB | 368 TiB |
| E80ids_v4 | 61 | 368 TiB | 368 TiB |

PAYGO Premium: HA pairs in a multiple availability zone configuration with shared managed disks

| VM size | Max data disks for an HA pair | Max system capacity with disks alone | Max system capacity with disks and data tiering |
|----------------|--------------------------------------|---|--|
| E32ds_v4 | 28 | 368 TiB | 368 TiB |
| E48ds_v4 | 28 | 368 TiB | 368 TiB |
| E80ids_v4 | 28 | 368 TiB | 368 TiB |

BYOL: HA pairs in single availability zone with page blobs

| VM size | Max data disks for an HA pair | 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 | 232 TiB | 368 TiB | 232 TiB | 2 PiB |
| DS5_v2 | 61 | 368 TiB | 368 TiB | 488 TiB | 2 PiB |
| DS13_v2 | 29 | 232 TiB | 368 TiB | 232 TiB | 2 PiB |
| DS14_v2 | 61 | 368 TiB | 368 TiB | 488 TiB | 2 PiB |
| DS15_v2 | 61 | 368 TiB | 368 TiB | 488 TiB | 2 PiB |
| E8s_v3 | 13 | 104 TiB | 368 TiB | 104 TiB | 2 PiB |
| E48s_v3 | 29 | 232 TiB | 368 TiB | 232 TiB | 2 PiB |
| E8ds_v4 | 13 | 104 TiB | 368 TiB | 104 TiB | 2 PiB |
| E32ds_v4 | 29 | 232 TiB | 368 TiB | 232 TiB | 2 PiB |
| E48ds_v4 | 29 | 232 TiB | 368 TiB | 232 TiB | 2 PiB |
| E80ids_v4 | 61 | 368 TiB | 368 TiB | 488 TiB | 2 PiB |

BYOL: HA pairs in a multiple availability zone configuration with shared managed disks

| VM size | Max data disks for an HA pair | Max system capacity with one license | | Max system capacity with multiple licenses | |
|-----------|-------------------------------|--------------------------------------|----------------------|--|----------------------|
| | | Disks alone | Disks + data tiering | Disks alone | Disks + data tiering |
| E8ds_v4 | 12 | 368 TiB | 368 TiB | 368 TiB | 2 PiB |
| E32ds_v4 | 28 | 368 TiB | 368 TiB | 368 TiB | 2 PiB |
| E48ds_v4 | 28 | 368 TiB | 368 TiB | 368 TiB | 2 PiB |
| E80ids_v4 | 28 | 368 TiB | 368 TiB | 368 TiB | 2 PiB |

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

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 TiB minimum capacity charge per storage VM. For example, if you create two storage VMs and each has 2 TiB of provisioned capacity, you'll be charged a total of 8 TiB.
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 ² | 128 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 ³ | 300 TiB |
| 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.

2. Beginning with ONTAP 9.12.1P2, the limit is 128 TB. In ONTAP 9.11.1 and earlier versions, the limit is 16 TB.
3. FlexVol volume creation up to the maximum size of 300 TiB is supported using System Manager starting from Cloud Volumes ONTAP 9.12.1 P2.

iSCSI storage limits

| iSCSI storage | Parameter | Limit |
|-----------------------|----------------------------|--------|
| LUNs | Maximum per node | 1,024 |
| | Maximum number of LUN maps | 1,024 |
| | Maximum size | 16 TiB |
| | 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 in Google Cloud

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, BlueXP 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 |

| License | Maximum system capacity (disks + object storage) |
|------------------------|--|
| PAYGO Premium | 368 TB |
| Node-based license | 2 PiB (requires multiple licenses) |
| Capacity-based license | 2 PiB |

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, BlueXP also allocates an 8 TB disk on node B that is used for mirrored data. While 16 TB of capacity was provisioned, only 8 TB counts against the license limit.

Aggregate 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.

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, root disk, or NVRAM.

| Parameter | Limit |
|---|---|
| Maximum data disks | <ul style="list-style-type: none">• 124 for single node systems• 123 per node for HA pairs |
| Maximum disk size | 64 TB |
| Maximum system capacity with disks alone | 256 TB ¹ |
| Maximum system capacity with disks and cold data tiering to a Google Cloud Storage bucket | Depends on the license. Refer to the maximum system capacity limits above. |

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

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 |
|---|--|
| Freemium | 24 storage VMs total ¹ |
| Capacity-based PAYGO or BYOL ² | 24 storage VMs total ¹ |
| Node-based BYOL ³ | 24 storage VMs total ¹ |
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| 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

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 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 Google Cloud.

Maximum concurrent replication operations

The maximum number of concurrent SnapMirror or SnapVault transfers for Cloud Volumes ONTAP is 100 per node, regardless of the instance type or machine type.

Cloud provider snapshots must not be used for your backup and recovery plans

You shouldn't use your cloud provider's snapshots as part of your backup and recovery plan for Cloud Volumes ONTAP data. You should always use ONTAP Snapshot copies or third-party backup solutions to back up and restore data hosted on Cloud Volumes ONTAP.

[Learn how to use the Cloud Backup service to back up and restore ONTAP data.](#)



ONTAP consistency points in the WAFL file system determine data consistency. Only ONTAP can quiesce the WAFL file system to make a crash-consistent backup.

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 BlueXP

Upgrades of Cloud Volumes ONTAP must be completed from BlueXP. 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 BlueXP creates and manages can impact system stability and BlueXP's ability to manage the system.

Disks and aggregates must be managed from BlueXP

All disks and aggregates must be created and deleted directly from BlueXP. 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
- Anti-ransomware
- Disk maintenance center
- Disk sanitization
- FabricPool mirroring
- Fibre Channel (FC)
- Flash Pools
- Infinite Volumes
- Interface groups
- Intranode LIF failover
- MetroCluster
- Multi-admin verification

Enabling multi-admin verification on Cloud Volumes ONTAP will result in an unsupported configuration.

- ONTAP S3 in Google Cloud (the S3 protocol is supported in Azure and AWS)
- RAID4, RAID-DP, RAID-TEC (RAID0 is supported)
- Service Processor
- SnapLock Compliance and Enterprise modes (only Cloud WORM is supported)
- SnapMirror Synchronous
- VLANs

Known limitations 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 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 up to Cloud Volumes ONTAP 9.12.0. When you deploy or upgrade to Cloud Volumes ONTAP 9.12.1, you don't need to disable compression.

You can choose no storage efficiency when creating a volume from BlueXP, 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 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 in all cloud providers](#).

Flash Cache limitations

Some VM types include 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 up to Cloud Volumes ONTAP 9.12.0. When you deploy or upgrade to Cloud Volumes ONTAP 9.12.1, you don't need to disable compression.

You can choose no storage efficiency when creating a volume from BlueXP, 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

HA pairs aren't supported in some regions.

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

Known limitations in Google Cloud

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

Limitation with packet mirroring

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

Cloud Volumes ONTAP can't operate properly if packet mirroring is enabled.

Google Private Service Connect limitations

If you leverage [Google Private Service Connect](#) within the VPC that you are deploying Cloud Volumes ONTAP into, you will need to implement DNS records that forward traffic to the required [BlueXP API Endpoints](#).

Tiering data from Cloud Volumes ONTAP into a Google Cloud Storage bucket is not currently supported with Private Service Connect.

Cloud provider integrations

This page describes how NetApp works with cloud providers to resolve issues that might arise.

Collaborative support best practices

NetApp is committed to provide support to Licensee and will use commercially reasonable efforts to resolve technical support issues for Cloud Volumes ONTAP when reported by the Licensee. NetApp and the applicable cloud provider don't have any direct support obligations to each other's licensed software or infrastructure.

NetApp has implemented tools aimed to connect with applicable cloud providers on customer technical issues that may be a result of the applicable cloud provider services. However, the best way to maintain a seamless support flow is for customers to (i) maintain a current support contract with both NetApp and the applicable cloud provider and (ii) coordinate joint escalation meetings with both NetApp and the applicable cloud provider when technical issues arise and the customer needs clarity on which products or services are causing those technical issues.

Azure maintenance events

Microsoft schedules and programmatically announces maintenance events on its Azure virtual machine (VM) infrastructure that may affect Cloud Volumes ONTAP VMs. These events are announced 15 minutes prior to the maintenance window.

Special handling of the maintenance events is supported for Cloud Volumes ONTAP high availability (HA) pairs. To maintain application health, we perform a preventive takeover to prioritize stability, as any loss of connectivity of more than 15 seconds will disable failover capabilities.

When the maintenance window is announced, the partner node of the targeted node will perform a takeover. When the maintenance is complete, a giveback will be initiated. After the giveback, the HA pair is expected to return to a healthy state. If this doesn't occur, contact NetApp Support for assistance. Note that maintenance events are targeted at one of the VMs in an HA pair at a time, and typically both nodes are targeted in a relatively short period of time.

CIFS/SMB clients that use Cloud Volumes ONTAP non-continuously available CIFS shares will experience a loss of session both when a takeover occurs, and when the aggregate that the session is using is given back to the aggregate's home node. This is a limitation imposed by the CIFS/SMB protocol itself. Customers may wish to use third-party products to avoid issues that may arise from takeover and giveback. For further assistance, contact NetApp Support.

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- [Notice for the Cloud Volumes ONTAP 9.12.1 mediator in AWS](#)
- [Notice for the Cloud Volumes ONTAP 9.12.1 mediator in Google Cloud](#)
- [Notice for ONTAP](#)

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