



Get started in Amazon Web Services

Cloud Volumes ONTAP

NetApp
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Get started in Amazon Web Services

Quick start for Cloud Volumes ONTAP in AWS

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

1

Create a Console agent

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

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

2

Plan your configuration

The Console offers preconfigured packages that match your workload requirements, or you can create your own configuration. If you choose your own configuration, you should understand the options available to you. [Learn more.](#)

3

Set up your networking

- a. Ensure that your VPC and subnets will support connectivity between the Console agent and Cloud Volumes ONTAP.
- b. Enable outbound internet access from the target VPC for NetApp AutoSupport.

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

- c. Set up a VPC endpoint to the Amazon Simple Storage Service (Amazon S3) service.

A VPC endpoint is required if you want to tier cold data from Cloud Volumes ONTAP to low-cost object storage.

[Learn more about networking requirements.](#)

4

Set up the AWS KMS

If you want to use Amazon encryption with Cloud Volumes ONTAP, then you need to ensure that an active Customer Master Key (CMK) exists. You also need to modify the key policy for each CMK by adding the IAM role that provides permissions to the Console agent as a *key user*. [Learn more.](#)

5

Launch Cloud Volumes ONTAP using the Console

Click **Add System**, select the type of system that you would like to deploy, and complete the steps in the wizard. [Read step-by-step instructions.](#)

Related links

- [Create a Console agent for AWS](#)
- [Create a Console agent from the AWS Marketplace](#)
- [Install and set up a Console agent on premises](#)
- [AWS permissions for the Console agent](#)

Plan your Cloud Volumes ONTAP configuration in AWS

When you deploy Cloud Volumes ONTAP in AWS, you can choose a preconfigured system that matches your workload requirements, or you can create your own configuration. If you choose your own configuration, you should understand the options available to you.

Choose a Cloud Volumes ONTAP license

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

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

Choose a supported region

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

Newer AWS regions must be enabled before you can create and manage resources in those regions. [AWS documentation: Learn how to enable a region.](#)

Choose a supported Local Zone

Selecting a Local Zone is optional. Cloud Volumes ONTAP is supported in some AWS Local Zones including Singapore. Cloud Volumes ONTAP in AWS supports only high availability (HA) mode in a single availability zone. Single node deployments are not supported.



Cloud Volumes ONTAP does not have support for data tiering and cloud tiering in AWS Local Zones. Additionally, Local Zones with instances that have not been qualified for Cloud Volumes ONTAP are not supported. An example of this is Miami, that is not available as a Local Zone, because it has only Gen6 instances that are unsupported and unqualified.

[AWS Documentation: View the full list of Local Zones.](#)

Local Zones must be enabled before you can create and manage resources in those zones.

[AWS Documentation: Getting started with AWS Local Zones.](#)

Choose a supported instance

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

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

Understand storage limits

The raw capacity limit for a Cloud Volumes ONTAP system is tied to the license. Additional limits impact the size of aggregates and volumes. You should be aware of these limits as you plan your configuration.

[Storage limits for Cloud Volumes ONTAP in AWS](#)

Size your system in AWS

Sizing your Cloud Volumes ONTAP system can help you meet requirements for performance and capacity. You should be aware of a few key points when choosing an instance type, disk type, and disk size:

Instance type

- Match your workload requirements to the maximum throughput and IOPS for each EC2 instance type.
- If several users write to the system at the same time, choose an instance type that has enough CPUs to manage the requests.
- If you have an application that is mostly reads, then choose a system with enough RAM.
 - [AWS Documentation: Amazon EC2 Instance Types](#)
 - [AWS Documentation: Amazon EBS-Optimized Instances](#)

EBS disk type

At a high level, the differences between EBS disk types are as follows. To learn more about the use cases for EBS disks, refer to [AWS Documentation: EBS Volume Types](#).

- *General Purpose SSD (gp3)* disks are the lowest-cost SSDs that balance cost and performance for a broad range of workloads. Performance is defined in terms of IOPS and throughput. gp3 disks are supported with Cloud Volumes ONTAP 9.7 and later.

When you select a gp3 disk, the NetApp Console fills in default IOPS and throughput values that provide performance that is equivalent to a gp2 disk based on the selected disk size. You can increase the values to get better performance at a higher cost, but we do not support lower values because it can result in inferior performance. In short, stick with the default values or increase them. Don't lower them. [AWS Documentation: Learn more about gp3 disks and their performance.](#)

Note that Cloud Volumes ONTAP supports the Amazon EBS Elastic Volumes feature with gp3 disks. [Learn more about Elastic Volumes support.](#)

- *General Purpose SSD (gp2)* disks balance cost and performance for a broad range of workloads. Performance is defined in terms of IOPS.
- *Provisioned IOPS SSD (io1)* disks are for critical applications that require the highest performance at a higher cost.

Note that Cloud Volumes ONTAP supports the Amazon EBS Elastic Volumes feature with io1 disks. [Learn more about Elastic Volumes support.](#)

- *Throughput Optimized HDD (st1)* disks are for frequently accessed workloads that require fast and consistent throughput at a lower price.



Data tiering to Amazon Simple Storage Service (Amazon S3) is not supported if your Cloud Volumes ONTAP system is in an AWS Local Zone, because accessing the Amazon S3 buckets outside of the Local Zone involves higher latency and impacts Cloud Volumes ONTAP activities.

EBS disk size

If you choose a configuration that doesn't support the [Amazon EBS Elastic Volumes feature](#), then you need to choose an initial disk size when you launch a Cloud Volumes ONTAP system. After that, you can [let the Console manage a system's capacity for you](#), but if you want to [create aggregates yourself](#), be aware of the following:

- All disks in an aggregate must be the same size.
- The performance of EBS disks is tied to disk size. The size determines the baseline IOPS and maximum burst duration for SSD disks and the baseline and burst throughput for HDD disks.
- Ultimately, you should choose the disk size that gives you the *sustained performance* that you need.
- Even if you do choose larger disks (for example, six 4 TiB disks), you might not get all of the IOPS because the EC2 instance can reach its bandwidth limit.

For more details about EBS disk performance, refer to [AWS Documentation: EBS Volume Types](#).

As noted above, choosing a disk size is not supported with Cloud Volumes ONTAP configurations that support the Amazon EBS Elastic Volumes feature. [Learn more about Elastic Volumes support](#).

View default system disks

In addition to the storage for user data, the Console also purchases cloud storage for Cloud Volumes ONTAP system data (boot data, root data, core data, and NVRAM). For planning purposes, it might help for you to review these details before you deploy Cloud Volumes ONTAP.

[View the default disks for Cloud Volumes ONTAP system data in AWS](#).



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

Prepare to deploy Cloud Volumes ONTAP in an AWS Outpost

If you have an AWS Outpost, you can deploy Cloud Volumes ONTAP in that Outpost by selecting the Outpost VPC during the deployment process. The experience is the same as any other VPC that resides in AWS. Note that you will need to first deploy a Console agent 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

Collect networking information

When you launch Cloud Volumes ONTAP in AWS, you need to specify details about your VPC network. You can use a worksheet to collect the information from your administrator.

Single node or HA pair in a single AZ

AWS information	Your value
Region	
VPC	
Subnet	
Security group (if using your own)	

HA pair in multiple AZs

AWS information	Your value
Region	
VPC	
Security group (if using your own)	
Node 1 availability zone	
Node 1 subnet	
Node 2 availability zone	
Node 2 subnet	
Mediator availability zone	
Mediator subnet	
Key pair for the mediator	
Floating IP address for cluster management port	
Floating IP address for data on node 1	
Floating IP address for data on node 2	
Route tables for floating IP addresses	

Choose a write speed

The Console enables you to choose a write speed setting for Cloud Volumes ONTAP. Before you choose a write speed, you should understand the differences between the normal and high settings and risks and recommendations when using high write speed. [Learn more about write speed.](#)

Choose a volume usage profile

ONTAP includes several storage efficiency features that can reduce the total amount of storage that you need. When you create a volume in the Console, you can choose a profile that enables these features or a profile that disables them. You should learn more about these features to help you decide which profile to use.

NetApp storage efficiency features provide the following benefits:

Thin provisioning

Presents more logical storage to hosts or users than you actually have in your physical storage pool. Instead of preallocating storage space, storage space is allocated dynamically to each volume as data is written.

Deduplication

Improves efficiency by locating identical blocks of data and replacing them with references to a single shared block. This technique reduces storage capacity requirements by eliminating redundant blocks of data that reside in the same volume.

Compression

Reduces the physical capacity required to store data by compressing data within a volume on primary, secondary, and archive storage.

Set up your networking

Set up AWS networking for Cloud Volumes ONTAP

The NetApp Console handles the set up of networking components for Cloud Volumes ONTAP, such as IP addresses, netmasks, and routes. You need to make sure that outbound internet access is available, that enough private IP addresses are available, that the right connections are in place, and more.

General requirements

Ensure that you have fulfilled the following requirements in AWS.

Outbound internet access for Cloud Volumes ONTAP nodes

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

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

Cloud Volumes ONTAP endpoints

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

Endpoints	Applicable for	Purpose	Deployment modes	Impact if endpoint is not available
https://netapp-cloud-account.auth0.com	Authentication	Used for authentication in the Console.	Standard and restricted modes.	User authentication fails and the following services remain unavailable: <ul style="list-style-type: none"> • Cloud Volumes ONTAP services • ONTAP services • Protocols and proxy services
https://api.bluexp.netapp.com/tenancy	Tenancy	Used to retrieve Cloud Volumes ONTAP resource from the Console to authorize resources and users.	Standard and restricted modes.	Cloud Volumes ONTAP resources and the users are not authorized.
https://mysupport.netapp.com/aods/asupmessage https://mysupport.netapp.com/asupprod/post/1.0/postAsup	AutoSupport	Used to send AutoSupport telemetry data to NetApp support.	Standard and restricted modes.	AutoSupport information remains undelivered.
The exact commercial endpoint for AWS service (suffixed with amazonaws.com) depends on the AWS region that you are using. Refer to the AWS documentation for details .	<ul style="list-style-type: none"> • CloudFormation • Elastic Compute Cloud (EC2) • Identity and Access Management (IAM) • Key Management Service (KMS) • Security Token Service (STS) • Amazon Simple Storage Service (S3) 	Communication with AWS services.	Standard and private modes.	Cloud Volumes ONTAP cannot communicate with AWS service to perform specific operations in AWS.

Endpoints	Applicable for	Purpose	Deployment modes	Impact if endpoint is not available
The exact government endpoint for AWS service depends on the AWS region that you are using. The endpoints are suffixed with <code>amazonaws.com</code> and <code>c2s.ic.gov</code> . Refer to AWS SDK and AWS Documentation for more information.	<ul style="list-style-type: none"> • CloudFormation • Elastic Compute Cloud (EC2) • Identity and Access Management (IAM) • Key Management Service (KMS) • Security Token Service (STS) • Simple Storage Service (S3) 	Communication with AWS services.	Restricted mode.	Cloud Volumes ONTAP cannot communicate with AWS service to perform specific operations in AWS.

Outbound internet access for the HA mediator

The HA mediator instance must have an outbound connection to the AWS EC2 service so it can assist with storage failover. To provide the connection, you can add a public IP address, specify a proxy server, or use a manual option.

The manual option can be a NAT gateway or an interface VPC endpoint from the target subnet to the AWS EC2 service. For details about VPC endpoints, refer to the [AWS Documentation: Interface VPC Endpoints \(AWS PrivateLink\)](#).

Network proxy configuration of NetApp Console agent

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

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

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

Private IP addresses

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

The number of LIFs that the Console allocates for Cloud Volumes ONTAP depends on whether you deploy a

single-node system or an HA pair. A LIF is an IP address associated with a physical port.

IP addresses for a single-node system

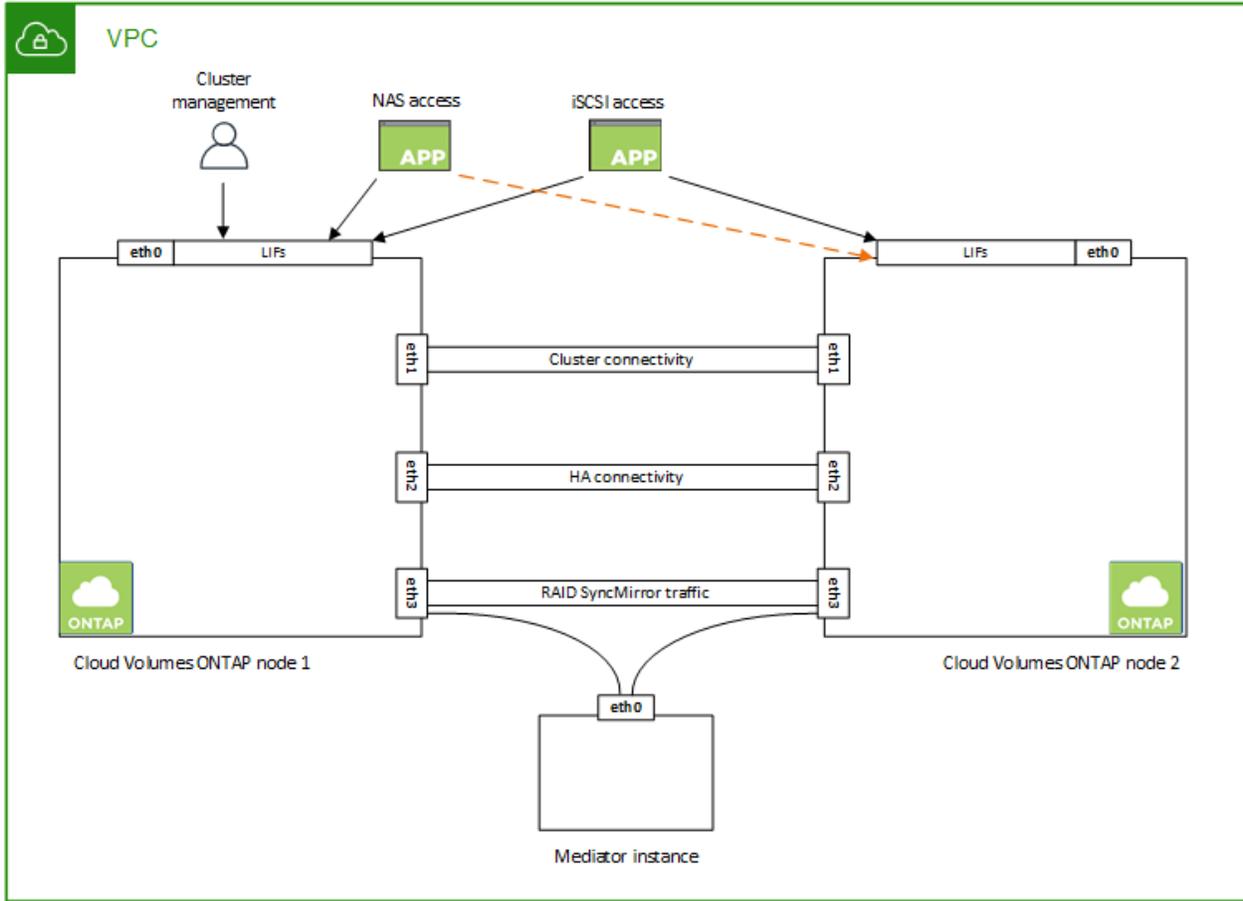
The Console allocates 6 IP addresses to a single-node system.

The following table provides details about the LIFs that are associated with each private IP address.

LIF	Purpose
Cluster management	Administrative management of the entire cluster (HA pair).
Node management	Administrative management of a node.
Intercluster	Cross-cluster communication, backup, and replication.
NAS data	Client access over NAS protocols.
iSCSI data	Client access over the iSCSI protocol. Also used by the system for other important networking workflows. This LIF is required and should not be deleted.
Storage VM management	A storage VM management LIF is used with management tools like SnapCenter.

IP addresses for HA pairs

HA pairs require more IP addresses than a single-node system does. These IP addresses are spread across different ethernet interfaces, as shown in the following image:



The number of private IP addresses required for an HA pair depends on which deployment model you choose. An HA pair deployed in a *single* AWS Availability Zone (AZ) requires 15 private IP addresses, while an HA pair deployed in *multiple* AZs requires 13 private IP addresses.

The following tables provide details about the LIFs that are associated with each private IP address.

Table 1. LIFs for HA pairs in a single AZ

LIF	Interface	Node	Purpose
Cluster management	eth0	node 1	Administrative management of the entire cluster (HA pair).
Node management	eth0	node 1 and node 2	Administrative management of a node.
Intercluster	eth0	node 1 and node 2	Cross-cluster communication, backup, and replication.
NAS data	eth0	node 1	Client access over NAS protocols.
iSCSI data	eth0	node 1 and node 2	Client access over the iSCSI protocol. Also used by the system for other important networking workflows. These LIFs are required and should not be deleted.

LIF	Interface	Node	Purpose
Cluster connectivity	eth1	node 1 and node 2	Enables the nodes to communicate with each other and to move data within the cluster.
HA connectivity	eth2	node 1 and node 2	Communication between the two nodes in case of failover.
RSM iSCSI traffic	eth3	node 1 and node 2	RAID SyncMirror iSCSI traffic, as well as communication between the two Cloud Volumes ONTAP nodes and the mediator.
Mediator	eth0	Mediator	A communication channel between the nodes and the mediator to assist in storage takeover and giveback processes.

Table 2. LIFs for HA pairs in multiple AZs

LIF	Interface	Node	Purpose
Node management	eth0	node 1 and node 2	Administrative management of a node.
Intercluster	eth0	node 1 and node 2	Cross-cluster communication, backup, and replication.
iSCSI data	eth0	node 1 and node 2	Client access over the iSCSI protocol. These LIFs also manage the migration of floating IP addresses between nodes. These LIFs are required and should not be deleted.
Cluster connectivity	eth1	node 1 and node 2	Enables the nodes to communicate with each other and to move data within the cluster.
HA connectivity	eth2	node 1 and node 2	Communication between the two nodes in case of failover.
RSM iSCSI traffic	eth3	node 1 and node 2	RAID SyncMirror iSCSI traffic, as well as communication between the two Cloud Volumes ONTAP nodes and the mediator.
Mediator	eth0	Mediator	A communication channel between the nodes and the mediator to assist in storage takeover and giveback processes.



When deployed in multiple Availability Zones, several LIFs are associated with [floating IP addresses](#), which don't count against the AWS private IP limit.

Security groups

You don't need to create security groups because the Console does that for you. If you need to use your own, refer to [Security group rules](#).



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

Connection for data tiering

If you want to use EBS as a performance tier and Amazon S3 as a capacity tier, you must ensure that Cloud Volumes ONTAP has a connection to S3. The best way to provide that connection is by creating a VPC Endpoint to the S3 service. For instructions, refer to the [AWS Documentation: Creating a Gateway Endpoint](#).

When you create the VPC Endpoint, be sure to select the region, VPC, and route table that corresponds to the Cloud Volumes ONTAP instance. You must also modify the security group to add an outbound HTTPS rule that enables traffic to the S3 endpoint. Otherwise, Cloud Volumes ONTAP cannot connect to the S3 service.

If you experience any issues, refer to the [AWS Support Knowledge Center: Why can't I connect to an S3 bucket using a gateway VPC endpoint?](#)

Connections to ONTAP systems

To replicate data between a Cloud Volumes ONTAP system in AWS and ONTAP systems in other networks, you must have a VPN connection between the AWS VPC and the other network—for example, your corporate network. For instructions, refer to the [AWS Documentation: Setting Up an AWS VPN Connection](#).

DNS and Active Directory for CIFS

If you want to provision CIFS storage, you must set up DNS and Active Directory in AWS or extend your on-premises setup to AWS.

The DNS server must provide name resolution services for the Active Directory environment. You can configure DHCP option sets to use the default EC2 DNS server, which must not be the DNS server used by the Active Directory environment.

For instructions, refer to the [AWS Documentation: Active Directory Domain Services on the AWS Cloud: Quick Start Reference Deployment](#).

VPC sharing

Starting with the 9.11.1 release, Cloud Volumes ONTAP HA pairs are supported in AWS with VPC sharing. VPC sharing enables your organization to share subnets with other AWS accounts. To use this configuration, you must set up your AWS environment and then deploy the HA pair using the API.

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

Requirements for HA pairs in multiple AZs

Additional AWS networking requirements apply to Cloud Volumes ONTAP HA configurations that use multiple Availability Zones (AZs). You should review these requirements before you launch an HA pair because you must enter the networking details in the Console when you add a Cloud Volumes ONTAP system.

To understand how HA pairs work, refer to [High-availability pairs](#).

Availability Zones

This HA deployment model uses multiple AZs to ensure high availability of your data. You should use a dedicated AZ for each Cloud Volumes ONTAP instance and the mediator instance, which provides a communication channel between the HA pair.

A subnet should be available in each Availability Zone.

Floating IP addresses for NAS data and cluster/SVM management

HA configurations in multiple AZs use floating IP addresses that migrate between nodes if failures occur. They are not natively accessible from outside the VPC, unless you [set up an AWS transit gateway](#).

One floating IP address is for cluster management, one is for NFS/CIFS data on node 1, and one is for NFS/CIFS data on node 2. A fourth floating IP address for SVM management is optional.



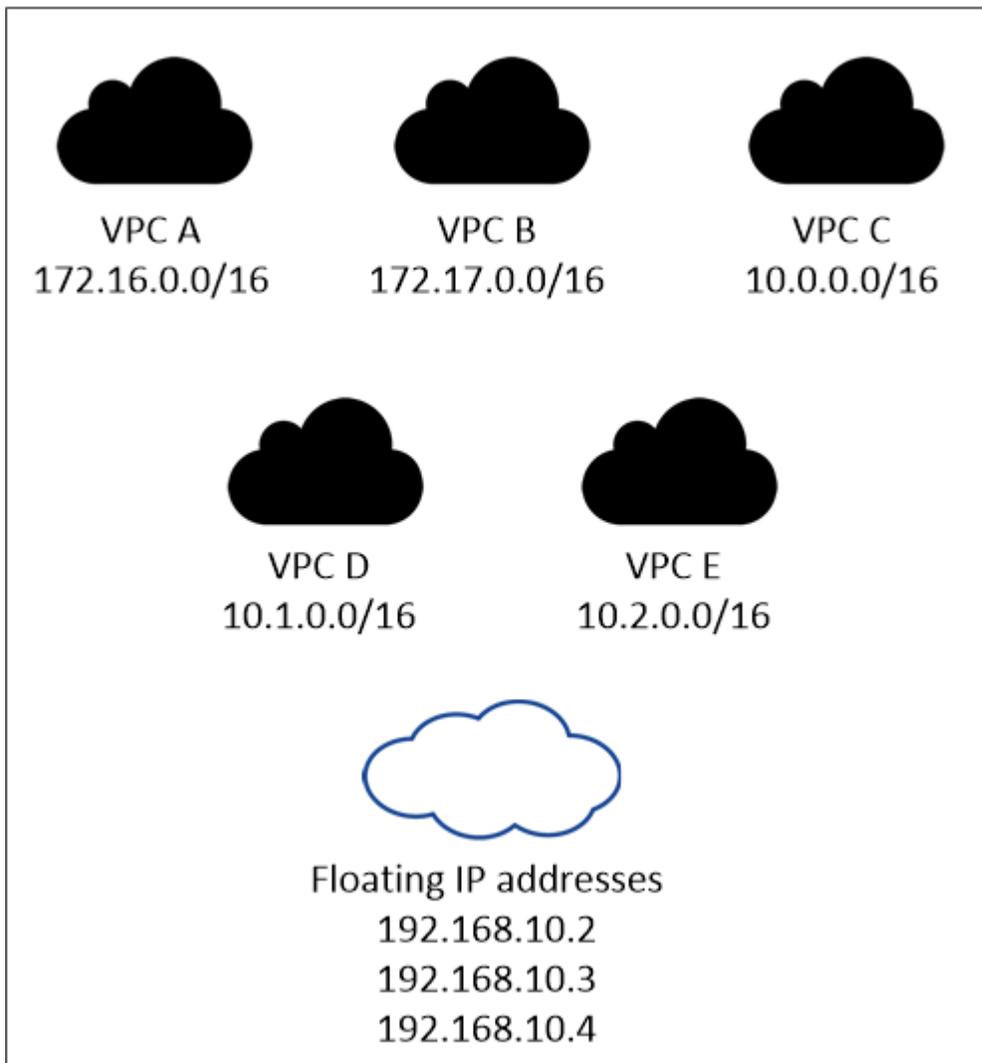
A floating IP address is required for the SVM management LIF if you use SnapDrive for Windows or SnapCenter with the HA pair.

You need to enter the floating IP addresses when you add a Cloud Volumes ONTAP HA system. The Console allocates the IP addresses to the HA pair when it launches the system.

The floating IP addresses must be outside of the CIDR blocks for all VPCs in the AWS region in which you deploy the HA configuration. Think of the floating IP addresses as a logical subnet that's outside of the VPCs in your region.

The following example shows the relationship between floating IP addresses and the VPCs in an AWS region. While the floating IP addresses are outside the CIDR blocks for all VPCs, they're routable to subnets through route tables.

AWS region





The Console automatically creates static IP addresses for iSCSI access and for NAS access from clients outside the VPC. You don't need to meet any requirements for these types of IP addresses.

Transit gateway to enable floating IP access from outside the VPC

If needed, [set up an AWS transit gateway](#) to enable access to an HA pair's floating IP addresses from outside the VPC where the HA pair resides.

Route tables

After you specify the floating IP addresses, you are then prompted to select the route tables that should include routes to the floating IP addresses. This enables client access to the HA pair.

If you have just one route table for the subnets in your VPC (the main route table), then the Console automatically adds the floating IP addresses to that route table. If you have more than one route table, it's very important to select the correct route tables when launching the HA pair. Otherwise, some clients might not have access to Cloud Volumes ONTAP.

For example, you might have two subnets that are associated with different route tables. If you select route table A, but not route table B, then clients in the subnet associated with route table A can access the HA pair, but clients in the subnet associated with route table B can't.

For more information about route tables, refer to the [AWS Documentation: Route Tables](#).

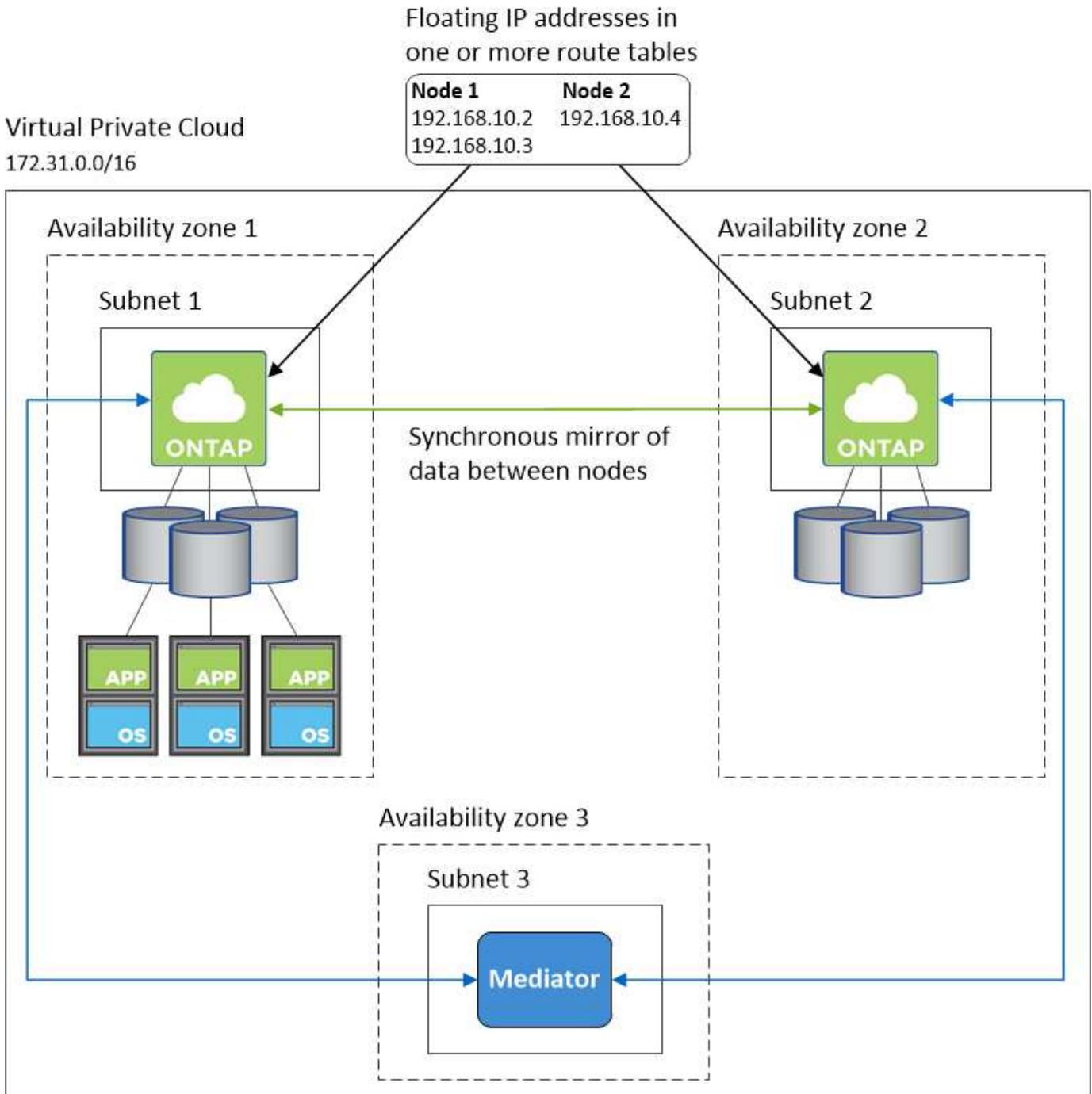
Connection to NetApp management tools

To use NetApp management tools with HA configurations that are in multiple AZs, you have two connection options:

1. Deploy the NetApp management tools in a different VPC and [set up an AWS transit gateway](#). The gateway enables access to the floating IP address for the cluster management interface from outside the VPC.
2. Deploy the NetApp management tools in the same VPC with a similar routing configuration as NAS clients.

Example HA configuration

The following image illustrates the networking components specific to an HA pair in multiple AZs: three Availability Zones, three subnets, floating IP addresses, and a route table.



Requirements for the Console agent

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

- [View networking requirements for the Console agent](#)
- [Security group rules in AWS](#)

Related topics

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

Set up an AWS transit gateway for Cloud Volumes ONTAP HA pairs

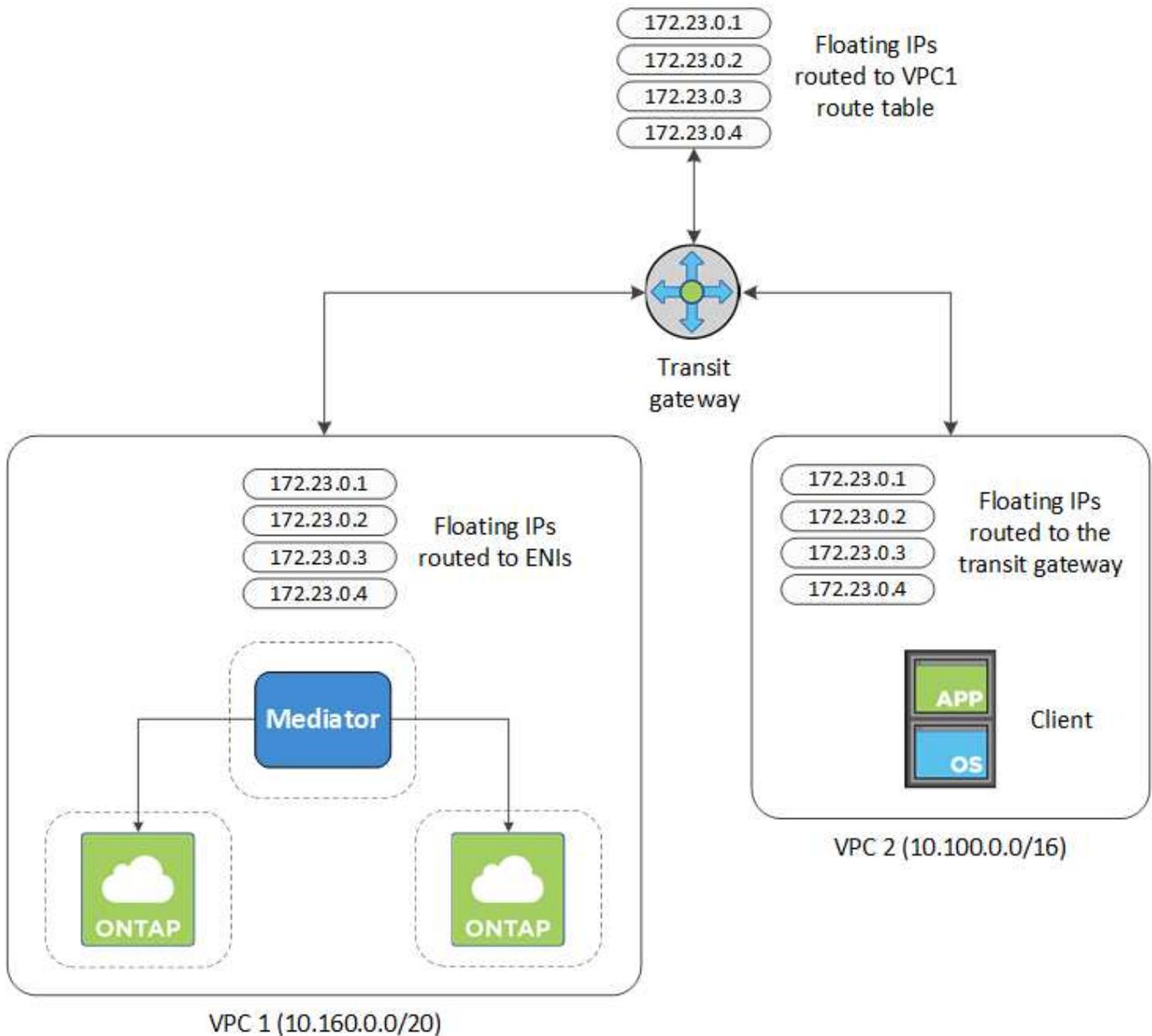
Set up an AWS transit gateway to enable access to an HA pair's [floating IP addresses](#) from outside the VPC where the HA pair resides.

When a Cloud Volumes ONTAP HA configuration is spread across multiple AWS Availability Zones, floating IP addresses are required for NAS data access from within the VPC. These floating IP addresses can migrate between nodes when failures occur, but they are not natively accessible from outside the VPC. Separate private IP addresses provide data access from outside the VPC, but they don't provide automatic failover.

Floating IP addresses are also required for the cluster management interface and the optional SVM management LIF.

If you set up an AWS transit gateway, you enable access to the floating IP addresses from outside the VPC where the HA pair resides. That means NAS clients and NetApp management tools outside the VPC can access the floating IPs.

Here's an example that shows two VPCs connected by a transit gateway. An HA system resides in one VPC, while a client resides in the other. You could then mount a NAS volume on the client using the floating IP address.



The following steps illustrate how to set up a similar configuration.

Steps

1. [Create a transit gateway and attach the VPCs to the gateway.](#)
2. Associate the VPCs with the transit gateway route table.
 - a. In the **VPC** service, click **Transit Gateway Route Tables**.
 - b. Select the route table.
 - c. Click **Associations** and then select **Create association**.
 - d. Choose the attachments (the VPCs) to associate and then click **Create association**.
3. Create routes in the transit gateway's route table by specifying the HA pair's floating IP addresses.

You can find the floating IP addresses on the system information page in the NetApp Console. Here's an example:

NFS & CIFS access from within the VPC using Floating IP

Auto failover

Cluster Management : 172.23.0.1

Data (nfs,cifs) : Node 1: 172.23.0.2 | Node 2: 172.23.0.3

Access

SVM Management : 172.23.0.4

The following sample image shows the route table for the transit gateway. It includes routes to the CIDR blocks of the two VPCs and four floating IP addresses used by Cloud Volumes ONTAP.

Transit Gateway Route Table: tgw-rtb-0ea8ee291c7aeddd3

Details Associations Propagations **Routes** Tags

The table below will return a maximum of 1000 routes. Narrow the filter or use export routes to view more routes.

Create route Replace route Delete route

Filter by attributes or search by keyword

<input type="checkbox"/>	CIDR	Attachment	Resource type	Route type	Route state
<input type="checkbox"/>	10.100.0.0/16	tgw-attach-05e77bd34e2ff91f8 vpc-0b2bc30e0dc8e0db1	VPC2	propagated	active
<input type="checkbox"/>	10.160.0.0/20	tgw-attach-00eba3eac3250d7db vpc-673ae603	VPC1	propagated	active
<input type="checkbox"/>	172.23.0.1/32	tgw-attach-00eba3eac3250d7db vpc-673ae603	VPC	static	active
<input type="checkbox"/>	172.23.0.2/32	tgw-attach-00eba3eac3250d7db vpc-673ae603	VPC	static	active
<input type="checkbox"/>	172.23.0.3/32	tgw-attach-00eba3eac3250d7db vpc-673ae603	VPC	static	active
<input type="checkbox"/>	172.23.0.4/32	tgw-attach-00eba3eac3250d7db vpc-673ae603	VPC	static	active

Floating IP Addresses

4. Modify the route table of VPCs that need to access the floating IP addresses.
 - a. Add route entries to the floating IP addresses.
 - b. Add a route entry to the CIDR block of the VPC where the HA pair resides.

The following sample image shows the route table for VPC 2, which includes routes to VPC 1 and the floating IP addresses.

Route Table: rtb-0569a1bd740ed033f

Summary Routes Subnet Associations Route Propagation Tags

Edit routes

View All routes

Destination	Target	Status	Propagated
10.100.0.0/16	local	active	No
0.0.0.0/0	igw-07250bd01781e67df	active	No
10.160.0.0/20	tgw-015b7c249661ac279	active	No
172.23.0.1/32	tgw-015b7c249661ac279	active	No
172.23.0.2/32	tgw-015b7c249661ac279	active	No
172.23.0.3/32	tgw-015b7c249661ac279	active	No
172.23.0.4/32	tgw-015b7c249661ac279	active	No

VPC1
Floating IP Addresses

- Modify the route table for the HA pair's VPC by adding a route to the VPC that needs access to the floating IP addresses.

This step is important because it completes the routing between the VPCs.

The following sample image shows the route table for VPC 1. It includes a route to the floating IP addresses and to VPC 2, which is where a client resides. The Console automatically added the floating IPs to the route table when it deployed the HA pair.

Summary Routes Subnet Associations Route Propagation Tags

Edit routes

View All routes

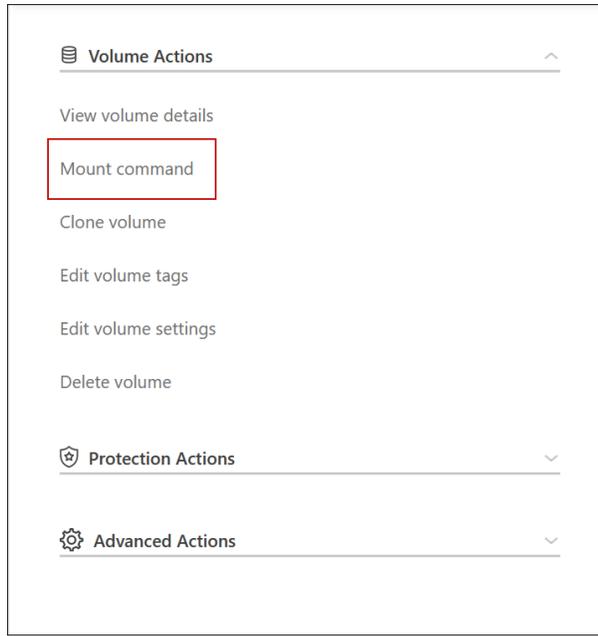
Destination	Target	Status
10.160.0.0/20	local	active
pl-68a54001 (com.amazonaws.us-west-2.s3, 54.231.160.0/19, 52.218.128.0/17, 52.92.32.0/22)	vpce-cb51a0a2	active
0.0.0.0/0	igw-b2182dd7	active
10.60.29.0/25	pcx-589c3331	active
10.100.0.0/16	tgw-015b7c249661ac279	active
10.129.0.0/20	pcx-ff7e1396	active
172.23.0.1/32	eni-0854d4715559c3cdb	active
172.23.0.2/32	eni-0854d4715559c3cdb	active
172.23.0.3/32	eni-0f76681216c3108ed	active
172.23.0.4/32	eni-0854d4715559c3cdb	active

VPC2
Floating IP Addresses

- Update the security groups settings to All traffic for the VPC.
 - Under Virtual Private Cloud, click **Subnets**.
 - Click the **Route table** tab, select the desired environment for one of the floating IP addresses for an HA pair.
 - Click **Security groups**.
 - Select **Edit Inbound Rules**.
 - Click **Add rule**.
 - Under Type, select **All traffic**, and then select the VPC IP address.
 - Click **Save Rules** to apply the changes.
- Mount volumes to clients using the floating IP address.

You can find the correct IP address in the Console through the **Mount Command** option under the Manage

Volumes panel in the Console.



8. If you're mounting an NFS volume, configure the export policy to match the subnet of the client VPC.

[Learn how to edit a volume.](#)

Related links

- [High-availability pairs in AWS](#)
- [Networking requirements for Cloud Volumes ONTAP in AWS](#)

Deploy Cloud Volumes ONTAP HA pairs in an AWS shared subnet

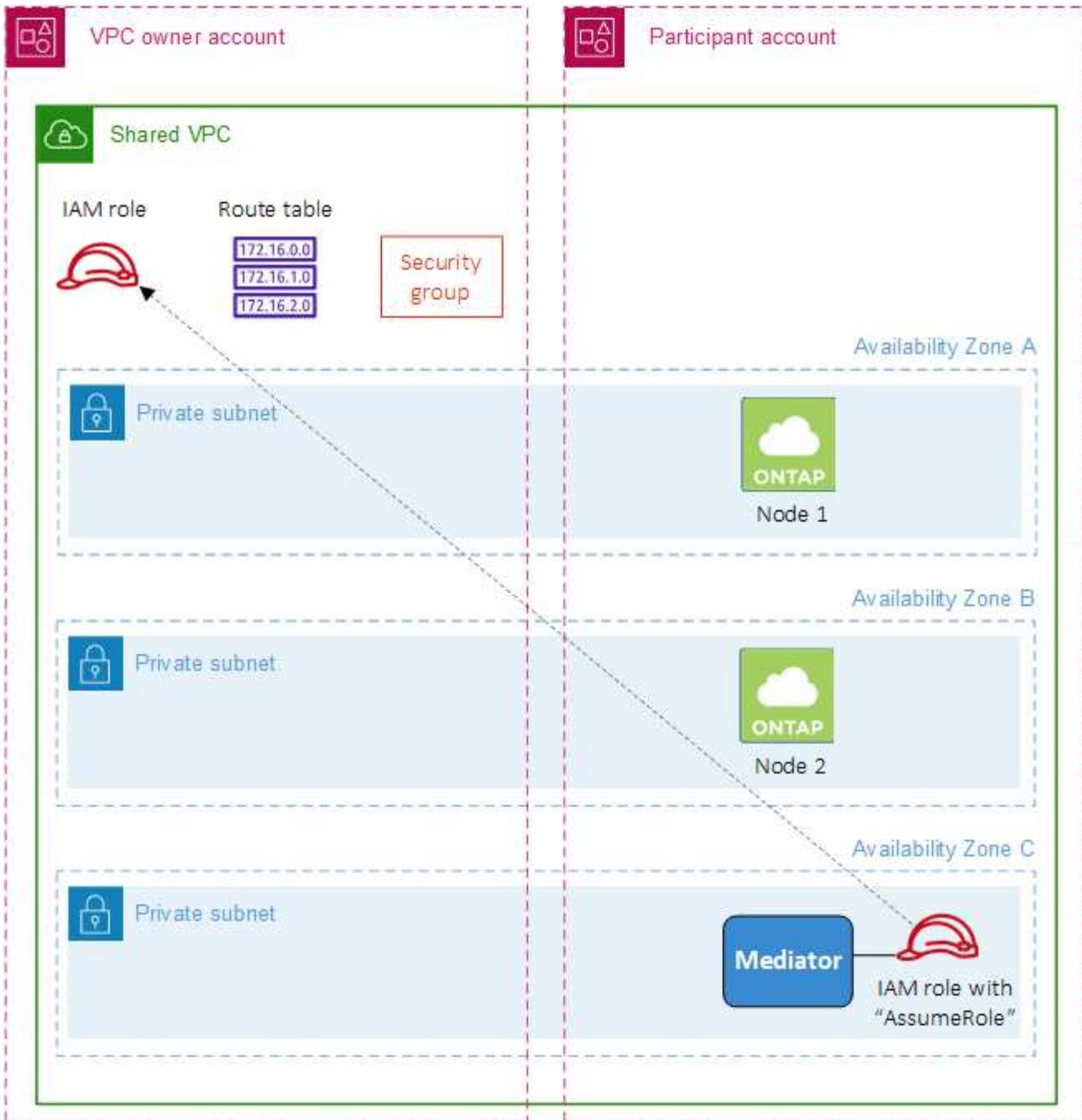
Starting with the 9.11.1 release, Cloud Volumes ONTAP HA pairs are supported in AWS with VPC sharing. VPC sharing enables your organization to share subnets with other AWS accounts. To use this configuration, you must set up your AWS environment and then deploy the HA pair using the API.

With [VPC sharing](#), a Cloud Volumes ONTAP HA configuration is spread across two accounts:

- The VPC owner account, which owns the networking (the VPC, subnets, route tables, and Cloud Volumes ONTAP security group)
- The participant account, where the EC2 instances are deployed in shared subnets (this includes the two HA nodes and the mediator)

In the case of a Cloud Volumes ONTAP HA configuration that is deployed across multiple Availability Zones, the HA mediator needs specific permissions to write to the route tables in the VPC owner account. You need to provide those permissions by setting up an IAM role that the mediator can assume.

The following image shows the components involved this deployment:



As described in the steps below, you'll need to share the subnets with the participant account, and then create the IAM role and security group in the VPC owner account.

When you create the Cloud Volumes ONTAP system, the NetApp Console automatically creates and attaches an IAM role to the mediator. This role assumes the IAM role that you created in the VPC owner account in order to make changes to the route tables associated with the HA pair.

Steps

1. Share the subnets in the VPC owner account with the participant account.

This step is required to deploy the HA pair in shared subnets.

[AWS documentation: Share a subnet](#)

2. In the VPC owner account, create a security group for Cloud Volumes ONTAP.

[Refer to the security group rules for Cloud Volumes ONTAP](#). Note that you don't need to create a security group for the HA mediator. The Console does that for you.

3. In the VPC owner account, create an IAM role that includes the following permissions:

```
    "Action": [
      "ec2:AssignPrivateIpAddresses",
      "ec2:CreateRoute",
      "ec2>DeleteRoute",
      "ec2:DescribeNetworkInterfaces",
      "ec2:DescribeRouteTables",
      "ec2:DescribeVpcs",
      "ec2:ReplaceRoute",
      "ec2:UnassignPrivateIpAddresses"
    ]
```

4. Use the API to create a new Cloud Volumes ONTAP system.

Note that you must specify the following fields:

- "securityGroupId"

The "securityGroupId" field should specify the security group that you created in the VPC owner account (see step 2 above).

- "assumeRoleArn" in the "haParams" object

The "assumeRoleArn" field should include the ARN of the IAM role that you created in the VPC owner account (see step 3 above).

For example:

```
"haParams": {
  "assumeRoleArn":
  "arn:aws:iam::642991768967:role/mediator_role_assume_fromdev"
}
```

[Learn about the Cloud Volumes ONTAP API](#)

Configure placement group creation for Cloud Volumes ONTAP HA pairs in AWS single AZs

Cloud Volumes ONTAP high-availability (HA) deployments in AWS single availability Zone (AZ) can fail and roll back if the creation of the placement group fails. Creation of the placement group also fails and the deployment rolls back if the Cloud Volumes ONTAP node and mediator instance are not available. To avoid this, you can modify the

configuration to allow the deployment to finish even if the placement group creation fails.

On bypassing the rollback process, the Cloud Volumes ONTAP deployment process completes successfully, and notifies you that the placement group creation is incomplete.

Steps

1. Use SSH to connect to the NetApp Console agent host and log in.
2. Navigate to `/opt/application/netapp/cloudmanager/docker_occm/data`.
3. Edit `app.conf` by changing the value of the `rollback-on-placement-group-failure` parameter to `false`. The default value of this parameter is `true`.

```
{
  "occm" : {
    "aws" : {
      "rollback-on-placement-group-failure" : false
    }
  }
}
```

4. Save the file and log off the Console agent. You don't need to restart the Console agent.

AWS security group inbound and outbound rules for Cloud Volumes ONTAP

The NetApp Console creates AWS security groups that include the inbound and outbound rules that Cloud Volumes ONTAP needs to operate successfully. You might want to refer to the ports for testing purposes or if you prefer to use your own security groups.

Rules for Cloud Volumes ONTAP

The security group for Cloud Volumes ONTAP requires both inbound and outbound rules.

Inbound rules

When you add a Cloud Volumes ONTAP system and choose a predefined security group, you can choose to allow traffic within one of the following:

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

Protocol	Port	Purpose
All ICMP	All	Pinging the instance
HTTP	80	HTTP access to the ONTAP System Manager web console using the IP address of the cluster management LIF

Protocol	Port	Purpose
HTTPS	443	Connectivity with the Console agent and HTTPS access to the ONTAP System Manager web console using the IP address of the cluster management LIF
SSH	22	SSH access to the IP address of the cluster management LIF or a node management LIF
TCP	111	Remote procedure call for NFS
TCP	139	NetBIOS service session for CIFS
TCP	161-162	Simple network management protocol
TCP	445	Microsoft SMB/CIFS over TCP with NetBIOS framing
TCP	635	NFS mount
TCP	749	Kerberos
TCP	2049	NFS server daemon
TCP	3260	iSCSI access through the iSCSI data LIF
TCP	4045	NFS lock daemon
TCP	4046	Network status monitor for NFS
TCP	10000	Backup using NDMP
TCP	11104	Management of intercluster communication sessions for SnapMirror
TCP	11105	SnapMirror data transfer using intercluster LIFs
UDP	111	Remote procedure call for NFS
UDP	161-162	Simple network management protocol
UDP	635	NFS mount
UDP	2049	NFS server daemon
UDP	4045	NFS lock daemon
UDP	4046	Network status monitor for NFS
UDP	4049	NFS rquotad protocol

Outbound rules

The predefined security group for Cloud Volumes ONTAP opens all outbound traffic. If that is acceptable, follow the basic outbound rules. If you need more rigid rules, use the advanced outbound rules.

Basic outbound rules

The predefined security group for Cloud Volumes ONTAP includes the following outbound rules.

Protocol	Port	Purpose
All ICMP	All	All outbound traffic
All TCP	All	All outbound traffic
All UDP	All	All outbound traffic

Advanced outbound rules

If you need rigid rules for outbound traffic, you can use the following information to open only those ports that are required for outbound communication by Cloud Volumes ONTAP.



The source is the interface (IP address) on the Cloud Volumes ONTAP system.

Service	Protocol	Port	Source	Destination	Purpose
Active Directory	TCP	88	Node management LIF	Active Directory forest	Kerberos V authentication
	UDP	137	Node management LIF	Active Directory forest	NetBIOS name service
	UDP	138	Node management LIF	Active Directory forest	NetBIOS datagram service
	TCP	139	Node management LIF	Active Directory forest	NetBIOS service session
	TCP & UDP	389	Node management LIF	Active Directory forest	LDAP
	TCP	445	Node management LIF	Active Directory forest	Microsoft SMB/CIFS over TCP with NetBIOS framing
	TCP	464	Node management LIF	Active Directory forest	Kerberos V change & set password (SET_CHANGE)
	UDP	464	Node management LIF	Active Directory forest	Kerberos key administration
	TCP	749	Node management LIF	Active Directory forest	Kerberos V change & set Password (RPCSEC_GSS)
	TCP	88	Data LIF (NFS, CIFS, iSCSI)	Active Directory forest	Kerberos V authentication
	UDP	137	Data LIF (NFS, CIFS)	Active Directory forest	NetBIOS name service
	UDP	138	Data LIF (NFS, CIFS)	Active Directory forest	NetBIOS datagram service
	TCP	139	Data LIF (NFS, CIFS)	Active Directory forest	NetBIOS service session
	TCP & UDP	389	Data LIF (NFS, CIFS)	Active Directory forest	LDAP
	TCP	445	Data LIF (NFS, CIFS)	Active Directory forest	Microsoft SMB/CIFS over TCP with NetBIOS framing
	TCP	464	Data LIF (NFS, CIFS)	Active Directory forest	Kerberos V change & set password (SET_CHANGE)
	UDP	464	Data LIF (NFS, CIFS)	Active Directory forest	Kerberos key administration
	TCP	749	Data LIF (NFS, CIFS)	Active Directory forest	Kerberos V change & set password (RPCSEC_GSS)

Service	Protocol	Port	Source	Destination	Purpose
AutoSupport	HTTPS	443	Node management LIF	mysupport.netapp.com	AutoSupport (HTTPS is the default)
	HTTP	80	Node management LIF	mysupport.netapp.com	AutoSupport (only if the transport protocol is changed from HTTPS to HTTP)
	TCP	3128	Node management LIF	Console agent	Sending AutoSupport messages through a proxy server on the Console agent, if an outbound internet connection isn't available
Backup to S3	TCP	5010	Intercluster LIF	Backup endpoint or restore endpoint	Back up and restore operations for the Backup to S3 feature
Cluster	All traffic	All traffic	All LIFs on one node	All LIFs on the other node	Intercluster communications (Cloud Volumes ONTAP HA only)
	TCP	3000	Node management LIF	HA mediator	ZAPI calls (Cloud Volumes ONTAP HA only)
	ICMP	1	Node management LIF	HA mediator	Keep alive (Cloud Volumes ONTAP HA only)
Configuration backups	HTTP	80	Node management LIF	http://<console-agent-IP-address>/occm/offboxconfig	Send configuration backups to the Console agent. ONTAP documentation
DHCP	UDP	68	Node management LIF	DHCP	DHCP client for first-time setup
DHCPS	UDP	67	Node management LIF	DHCP	DHCP server
DNS	UDP	53	Node management LIF and data LIF (NFS, CIFS)	DNS	DNS
NDMP	TCP	1860-18699	Node management LIF	Destination servers	NDMP copy
SMTP	TCP	25	Node management LIF	Mail server	SMTP alerts, can be used for AutoSupport
SNMP	TCP	161	Node management LIF	Monitor server	Monitoring by SNMP traps
	UDP	161	Node management LIF	Monitor server	Monitoring by SNMP traps
	TCP	162	Node management LIF	Monitor server	Monitoring by SNMP traps
	UDP	162	Node management LIF	Monitor server	Monitoring by SNMP traps

Service	Protocol	Port	Source	Destination	Purpose
SnapMirror	TCP	11104	Intercluster LIF	ONTAP intercluster LIFs	Management of intercluster communication sessions for SnapMirror
	TCP	11105	Intercluster LIF	ONTAP intercluster LIFs	SnapMirror data transfer
Syslog	UDP	514	Node management LIF	Syslog server	Syslog forward messages

Rules for the HA mediator external security group

The predefined external security group for the Cloud Volumes ONTAP HA mediator includes the following inbound and outbound rules.

Inbound rules

The predefined security group for the HA mediator includes the following inbound rule.

Protocol	Port	Source	Purpose
TCP	3000	CIDR of the Console agent	RESTful API access from the Console agent

Outbound rules

The predefined security group for the HA mediator opens all outbound traffic. If that is acceptable, follow the basic outbound rules. If you need more rigid rules, use the advanced outbound rules.

Basic outbound rules

The predefined security group for the HA mediator includes the following outbound rules.

Protocol	Port	Purpose
All TCP	All	All outbound traffic
All UDP	All	All outbound traffic

Advanced outbound rules

If you need rigid rules for outbound traffic, you can use the following information to open only those ports that are required for outbound communication by the HA mediator.

Protocol	Port	Destination	Purpose
HTTP	80	IP address of the Console agent on AWS EC2 instance	Download upgrades for the mediator
HTTPS	443	ec2.amazonaws.com	Assist with storage failover

Protocol	Port	Destination	Purpose
UDP	53	ec2.amazonaws.com	Assist with storage failover



Rather than open ports 443 and 53, you can create an interface VPC endpoint from the target subnet to the AWS EC2 service.

Rules for the HA configuration internal security group

The predefined internal security group for a Cloud Volumes ONTAP HA configuration includes the following rules. This security group enables communication between the HA nodes and between the mediator and the nodes.

The Console always creates this security group. You do not have the option to use your own.

Inbound rules

The predefined security group includes the following inbound rules.

Protocol	Port	Purpose
All traffic	All	Communication between the HA mediator and HA nodes

Outbound rules

The predefined security group includes the following outbound rules.

Protocol	Port	Purpose
All traffic	All	Communication between the HA mediator and HA nodes

Rules for the Console agent

[View security group rules for the Console agent](#)

Set up Cloud Volumes ONTAP to use a customer-managed key in AWS

If you want to use Amazon encryption with Cloud Volumes ONTAP, then you need to set up the AWS Key Management Service (KMS).

Steps

1. Ensure that an active Customer Master Key (CMK) exists.

The CMK can be an AWS-managed CMK or a customer-managed CMK. It can be in the same AWS account as the NetApp Console and Cloud Volumes ONTAP or in a different AWS account.

[AWS Documentation: Customer Master Keys \(CMKs\)](#)

2. Modify the key policy for each CMK by adding the IAM role that provides permissions to the Console as a *key user*.

Adding the Identity and Access Management (IAM) role as a key user gives the Console permissions to use the CMK with Cloud Volumes ONTAP.

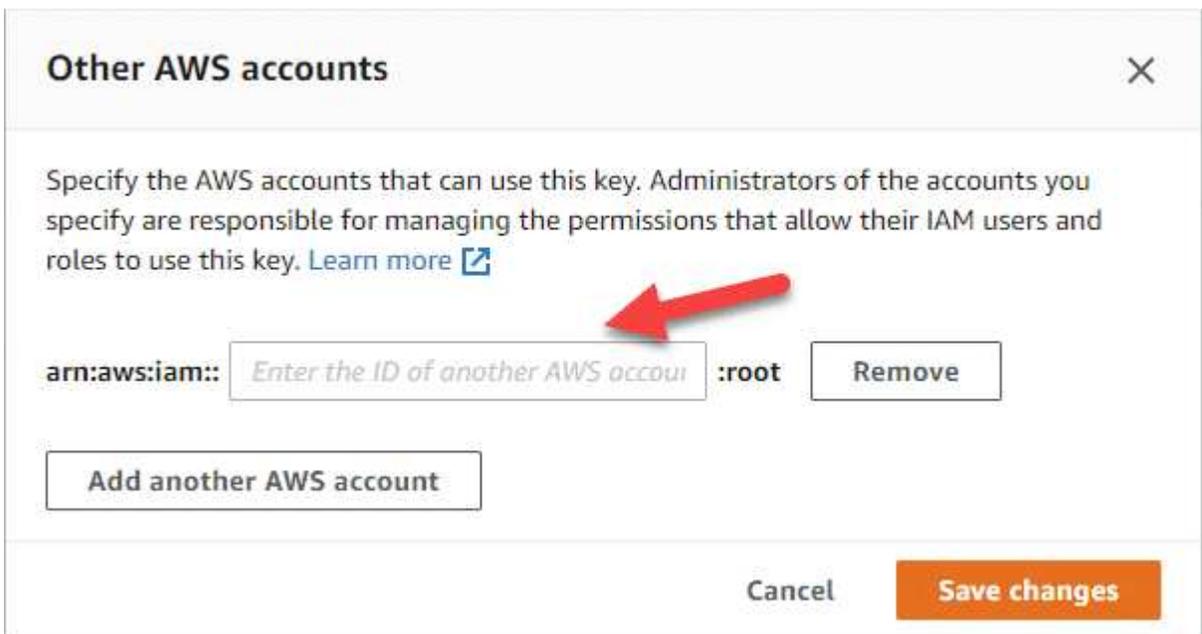
[AWS Documentation: Editing Keys](#)

3. If the CMK is in a different AWS account, complete the following steps:
 - a. Go to the KMS console from the account where the CMK resides.
 - b. Select the key.
 - c. In the **General configuration** pane, copy the ARN of the key.

You'll need to provide the ARN to the Console when you create the Cloud Volumes ONTAP system.

- d. In the **Other AWS accounts** pane, add the AWS account that provides the Console with permissions.

Typically, this is the account where the Console is deployed. If the Console is not installed in AWS, use the account for which you provided AWS access keys to the Console.



- e. Now switch to the AWS account that provides the Console with permissions and open the IAM console.
- f. Create an IAM policy that includes the permissions listed below.
- g. Attach the policy to the IAM role or IAM user that provides permissions to the Console.

The following policy provides the permissions that the Console needs to use the CMK from the external AWS account. Be sure to modify the region and account ID in the "Resource" sections.

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Sid": "AllowUseOfTheKey",
      "Effect": "Allow",
      "Action": [
        "kms:Encrypt",
        "kms:Decrypt",
        "kms:ReEncrypt*",
        "kms:GenerateDataKey*",
        "kms:DescribeKey"
      ],
      "Resource": [
        "arn:aws:kms:us-east-1:externalaccountid:key/externalkeyid"
      ]
    },
    {
      "Sid": "AllowAttachmentOfPersistentResources",
      "Effect": "Allow",
      "Action": [
        "kms:CreateGrant",
        "kms:ListGrants",
        "kms:RevokeGrant"
      ],
      "Resource": [
        "arn:aws:kms:us-east-1:externalaccountid:key/externalaccountid"
      ],
      "Condition": {
        "Bool": {
          "kms:GrantIsForAWSResource": true
        }
      }
    }
  ]
}
```

For additional details about this process, refer to the [AWS Documentation: Allowing users in other accounts to use a KMS key](#).

4. If you are using a customer-managed CMK, modify the key policy for the CMK by adding the Cloud

Volumes ONTAP IAM role as a *key user*.

This step is required if you enabled data tiering on Cloud Volumes ONTAP and want to encrypt the data stored in the Amazon Simple Storage Service (Amazon S3) bucket.

You'll need to perform this step *after* you deploy Cloud Volumes ONTAP because the IAM role is created when you create a Cloud Volumes ONTAP system. (Of course, you do have the option to use an existing Cloud Volumes ONTAP IAM role, so it's possible to perform this step before.)

[AWS Documentation: Editing Keys](#)

Set up AWS IAM roles for Cloud Volumes ONTAP nodes

AWS Identity and Access management (IAM) roles with the required permissions must be attached to each Cloud Volumes ONTAP node. The same is true for the HA mediator. It's easiest to let the NetApp Console create the IAM roles for you, but you can use your own roles.

This task is optional. When you create a Cloud Volumes ONTAP system, the default option is to let the Console create the IAM roles for you. If your business's security policies require you to create the IAM roles yourself, then follow the steps below.



Providing your own IAM role is required in AWS Secret Cloud. [Learn how to deploy Cloud Volumes ONTAP in C2S.](#)

Steps

1. Go to the AWS IAM console.
2. Create IAM policies that include the following permissions:
 - Base policy for Cloud Volumes ONTAP nodes

Standard regions

```
{
  "Version": "2012-10-17",
  "Statement": [{
    "Action": "s3:ListAllMyBuckets",
    "Resource": "arn:aws:s3:::*",
    "Effect": "Allow"
  }, {
    "Action": [
      "s3:ListBucket",
      "s3:GetBucketLocation"
    ],
    "Resource": "arn:aws:s3:::fabric-pool-*",
    "Effect": "Allow"
  }, {
    "Action": [
      "s3:GetObject",
      "s3:PutObject",
      "s3>DeleteObject"
    ],
    "Resource": "arn:aws:s3:::fabric-pool-*",
    "Effect": "Allow"
  }
]
}
```

GovCloud (US) regions

```
{
  "Version": "2012-10-17",
  "Statement": [{
    "Action": "s3:ListAllMyBuckets",
    "Resource": "arn:aws-us-gov:s3:::*",
    "Effect": "Allow"
  }, {
    "Action": [
      "s3:ListBucket",
      "s3:GetBucketLocation"
    ],
    "Resource": "arn:aws-us-gov:s3:::fabric-pool-*",
    "Effect": "Allow"
  }, {
    "Action": [
      "s3:GetObject",
      "s3:PutObject",
      "s3>DeleteObject"
    ],
    "Resource": "arn:aws-us-gov:s3:::fabric-pool-*",
    "Effect": "Allow"
  }]
}
```

Top Secret regions

```
{
  "Version": "2012-10-17",
  "Statement": [{
    "Action": "s3:ListAllMyBuckets",
    "Resource": "arn:aws-iso:s3:::*",
    "Effect": "Allow"
  }, {
    "Action": [
      "s3:ListBucket",
      "s3:GetBucketLocation"
    ],
    "Resource": "arn:aws-iso:s3:::fabric-pool-*",
    "Effect": "Allow"
  }, {
    "Action": [
      "s3:GetObject",
      "s3:PutObject",
      "s3>DeleteObject"
    ],
    "Resource": "arn:aws-iso:s3:::fabric-pool-*",
    "Effect": "Allow"
  }]
}
```

Secret regions

```

{
  "Version": "2012-10-17",
  "Statement": [{
    "Action": "s3:ListAllMyBuckets",
    "Resource": "arn:aws-iso-b:s3:::*",
    "Effect": "Allow"
  }, {
    "Action": [
      "s3:ListBucket",
      "s3:GetBucketLocation"
    ],
    "Resource": "arn:aws-iso-b:s3:::fabric-pool-*",
    "Effect": "Allow"
  }, {
    "Action": [
      "s3:GetObject",
      "s3:PutObject",
      "s3>DeleteObject"
    ],
    "Resource": "arn:aws-iso-b:s3:::fabric-pool-*",
    "Effect": "Allow"
  }]
}

```

- Backup policy for Cloud Volumes ONTAP nodes

If you plan to use NetApp Backup and Recovery with your Cloud Volumes ONTAP systems, the IAM role for the nodes must include the second policy shown below.

Standard regions

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Action": [
        "s3:ListBucket",
        "s3:GetBucketLocation"
      ],
      "Resource": "arn:aws:s3:::netapp-backup*",
      "Effect": "Allow"
    },
    {
      "Action": [
        "s3:GetObject",
        "s3:PutObject",
        "s3:DeleteObject",
        "s3:ListAllMyBuckets",
        "s3:PutObjectTagging",
        "s3:GetObjectTagging",
        "s3:RestoreObject",
        "s3:GetBucketObjectLockConfiguration",
        "s3:GetObjectRetention",
        "s3:PutBucketObjectLockConfiguration",
        "s3:PutObjectRetention"
      ],
      "Resource": "arn:aws:s3:::netapp-backup*/**",
      "Effect": "Allow"
    }
  ]
}
```

GovCloud (US) regions

```

{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Action": [
        "s3:ListBucket",
        "s3:GetBucketLocation"
      ],
      "Resource": "arn:aws-us-gov:s3:::netapp-backup*",
      "Effect": "Allow"
    },
    {
      "Action": [
        "s3:GetObject",
        "s3:PutObject",
        "s3:DeleteObject",
        "s3:ListAllMyBuckets",
        "s3:PutObjectTagging",
        "s3:GetObjectTagging",
        "s3:RestoreObject",
        "s3:GetBucketObjectLockConfiguration",
        "s3:GetObjectRetention",
        "s3:PutBucketObjectLockConfiguration",
        "s3:PutObjectRetention"
      ],
      "Resource": "arn:aws-us-gov:s3:::netapp-backup*/**",
      "Effect": "Allow"
    }
  ]
}

```

Top Secret regions

```

{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Action": [
        "s3:ListBucket",
        "s3:GetBucketLocation"
      ],
      "Resource": "arn:aws-iso:s3:::netapp-backup*",
      "Effect": "Allow"
    },
    {
      "Action": [
        "s3:GetObject",
        "s3:PutObject",
        "s3:DeleteObject",
        "s3:ListAllMyBuckets",
        "s3:PutObjectTagging",
        "s3:GetObjectTagging",
        "s3:RestoreObject",
        "s3:GetBucketObjectLockConfiguration",
        "s3:GetObjectRetention",
        "s3:PutBucketObjectLockConfiguration",
        "s3:PutObjectRetention"
      ],
      "Resource": "arn:aws-iso:s3:::netapp-backup*/**",
      "Effect": "Allow"
    }
  ]
}

```

Secret regions

```

{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Action": [
        "s3:ListBucket",
        "s3:GetBucketLocation"
      ],
      "Resource": "arn:aws-iso-b:s3:::netapp-backup*",
      "Effect": "Allow"
    },
    {
      "Action": [
        "s3:GetObject",
        "s3:PutObject",
        "s3:DeleteObject",
        "s3:ListAllMyBuckets",
        "s3:PutObjectTagging",
        "s3:GetObjectTagging",
        "s3:RestoreObject",
        "s3:GetBucketObjectLockConfiguration",
        "s3:GetObjectRetention",
        "s3:PutBucketObjectLockConfiguration",
        "s3:PutObjectRetention"
      ],
      "Resource": "arn:aws-iso-b:s3:::netapp-backup*/**",
      "Effect": "Allow"
    }
  ]
}

```

- HA mediator

```

{
  "Version": "2012-10-17",
  "Statement": [{
    "Effect": "Allow",
    "Action": [
      "ec2:AssignPrivateIpAddresses",
      "ec2:CreateRoute",
      "ec2>DeleteRoute",
      "ec2:DescribeNetworkInterfaces",
      "ec2:DescribeRouteTables",
      "ec2:DescribeVpcs",
      "ec2:ReplaceRoute",
      "ec2:UnassignPrivateIpAddresses",
      "sts:AssumeRole",
      "ec2:DescribeSubnets"
    ],
    "Resource": "*"
  }
]
}

```

3. Create an IAM role and attach the policies that you created to the role.

Result

You now have IAM roles that you can select when you create a new Cloud Volumes ONTAP system.

More information

- [AWS documentation: Creating IAM policies](#)
- [AWS documentation: Creating IAM roles](#)

Set up licensing for Cloud Volumes ONTAP in AWS

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

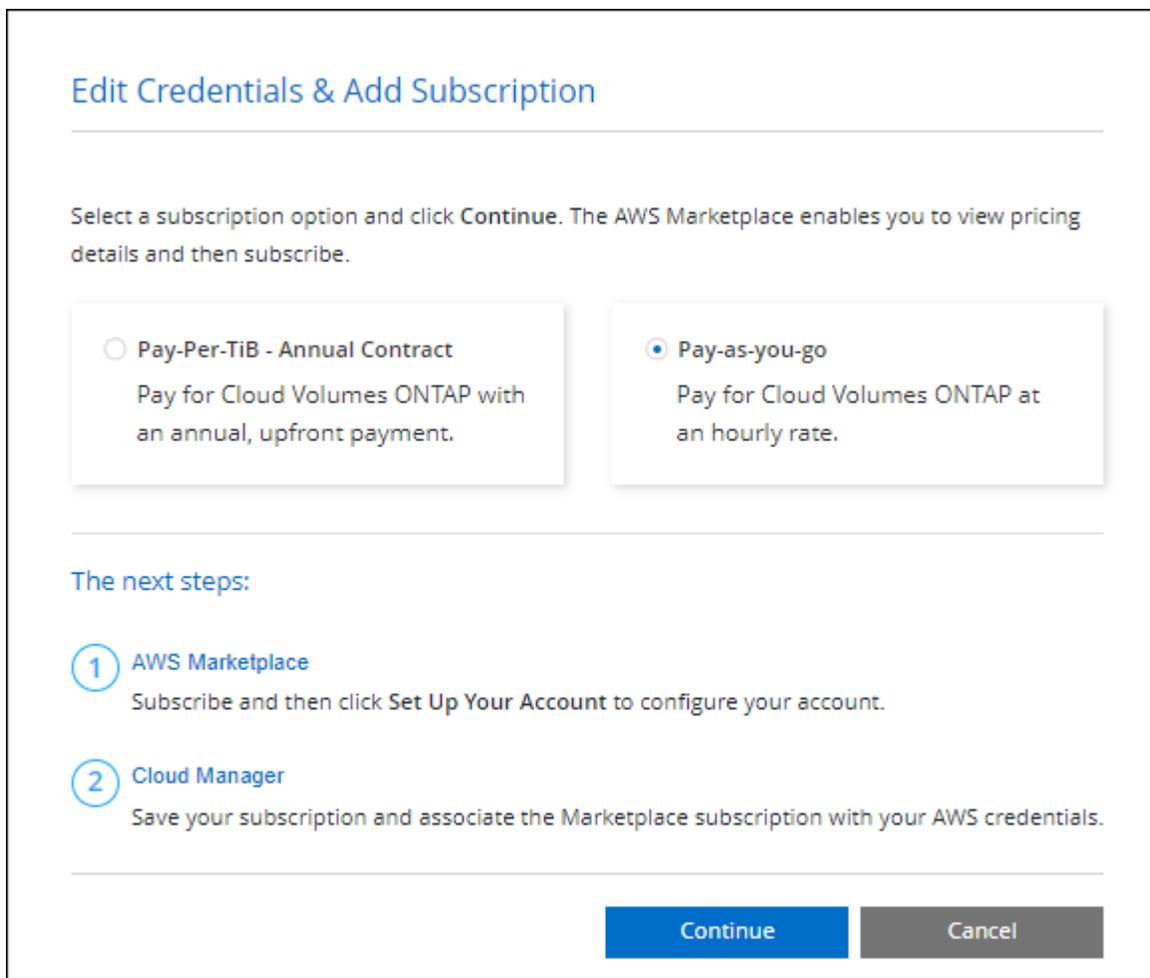
Freemium

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

Steps

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

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



Edit Credentials & Add Subscription

Select a subscription option and click **Continue**. The AWS Marketplace enables you to view pricing details and then subscribe.

Pay-Per-TiB - Annual Contract
Pay for Cloud Volumes ONTAP with an annual, upfront payment.

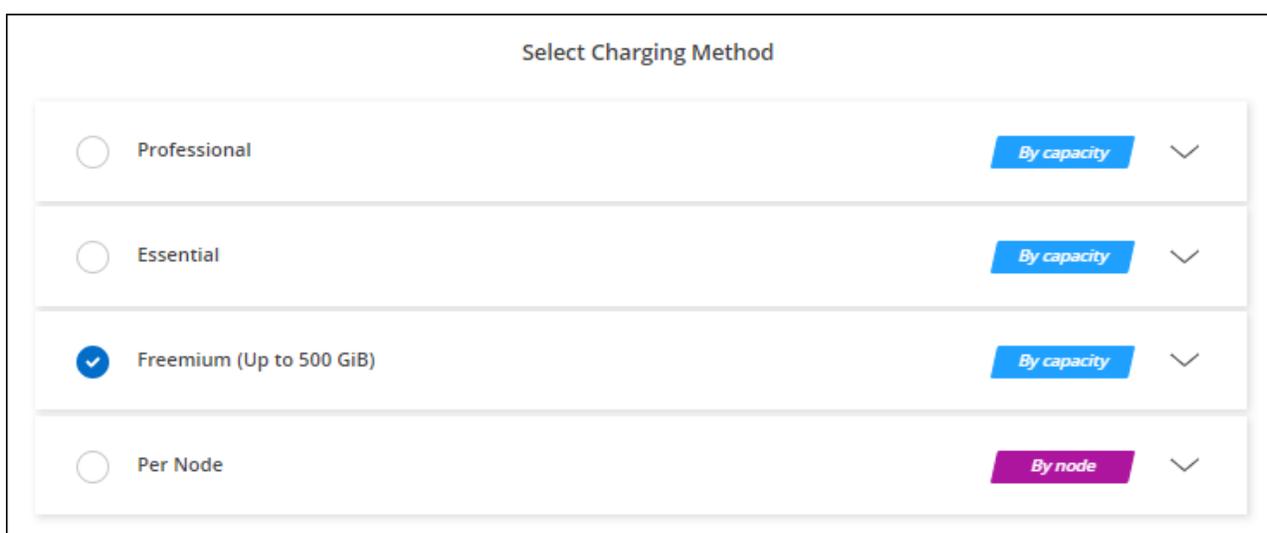
Pay-as-you-go
Pay for Cloud Volumes ONTAP at an hourly rate.

The next steps:

- 1 AWS Marketplace**
Subscribe and then click **Set Up Your Account** to configure your account.
- 2 Cloud Manager**
Save your subscription and associate the Marketplace subscription with your AWS credentials.

Continue **Cancel**

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



Select Charging Method

Professional **By capacity** ▾

Essential **By capacity** ▾

Freemium (Up to 500 GiB) **By capacity** ▾

Per Node **By node** ▾

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

Capacity-based license

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

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

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

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

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

BYOL

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

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

Steps

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

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

Your license must be available from the Console before you can use it with Cloud Volumes ONTAP. If needed, you can [manually add the license to the Console](#).

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

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

Edit Credentials & Add Subscription

Select a subscription option and click **Continue**. The AWS Marketplace enables you to view pricing details and then subscribe.

Pay-Per-TiB - Annual Contract
Pay for Cloud Volumes ONTAP with an annual, upfront payment.

Pay-as-you-go
Pay for Cloud Volumes ONTAP at an hourly rate.

The next steps:

- 1 AWS Marketplace**
Subscribe and then click **Set Up Your Account** to configure your account.
- 2 Cloud Manager**
Save your subscription and associate the Marketplace subscription with your AWS credentials.

Continue **Cancel**

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

Select Charging Method

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

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

PAYGO subscription

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

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

Steps

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

Edit Credentials & Add Subscription

Select a subscription option and click **Continue**. The AWS Marketplace enables you to view pricing details and then subscribe.

Pay-Per-TiB - Annual Contract
Pay for Cloud Volumes ONTAP with an annual, upfront payment.

Pay-as-you-go
Pay for Cloud Volumes ONTAP at an hourly rate.

The next steps:

- 1 **AWS Marketplace**
Subscribe and then click **Set Up Your Account** to configure your account.
- 2 **Cloud Manager**
Save your subscription and associate the Marketplace subscription with your AWS credentials.

Continue **Cancel**

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

Select Charging Method

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

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



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

Annual contract

Pay annually by purchasing an annual contract from your cloud provider's marketplace.

Similar to an hourly subscription, the Console prompts you to subscribe to the annual contract that's available in the AWS Marketplace.

Steps

1. On the **Systems** page, click **Add System** and follow the steps.
 - a. On the **Details and Credentials** page, click **Edit Credentials > Add Subscription** and then follow the prompts to subscribe to the annual contract in the AWS Marketplace.

Edit Credentials & Add Subscription

Select a subscription option and click **Continue**. The AWS Marketplace enables you to view pricing details and then subscribe.

Pay-Per-TiB - Annual Contract

Pay for Cloud Volumes ONTAP with an annual, upfront payment.

Pay-as-you-go

Pay for Cloud Volumes ONTAP at an hourly rate.

The next steps:

1 **AWS Marketplace**

Subscribe and then click **Set Up Your Account** to configure your account.

2 **Cloud Manager**

Save your subscription and associate the Marketplace subscription with your AWS credentials.

Continue

Cancel

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

Select Charging Method

Professional

By capacity



Essential

By capacity



Freemium (Up to 500 GiB)

By capacity



Per Node

By node



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

Keystone Subscription

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

Steps

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

The screenshot shows a 'Select Charging Method' dialog box. The 'Keystone' option is selected, indicated by a blue checkmark. Below the 'Keystone' option, there is a dropdown menu for 'Keystone Subscription' with 'A-AMRITA1' selected. Other options include 'Professional', 'Essential', 'Freemium (Up to 500 GiB)', and 'Per Node'. Each option has a 'By capacity' or 'By node' button and a chevron icon.

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

Node-based license

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

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

Deploy Cloud Volumes ONTAP in AWS using quick deployment

You can deploy Cloud Volumes ONTAP in AWS using a quick deployment method for both single node and high availability (HA) configurations. This simplified process reduces deployment steps compared to the advanced method. It also offers more clarity in the workflow by automatically setting default values on a single page and minimizing navigation.

Before you begin

You need the following to add a Cloud Volumes ONTAP system in AWS from the NetApp Console.

- A Console agent that's up and running.
 - You should have a [Console agent that is associated with your project or workspace](#).
 - [You should be prepared to leave the Console agent running at all times](#).
- An understanding of the configuration that you want to use.

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

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

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

- DNS and Active Directory for CIFS configurations.

For details, refer to [Networking requirements for Cloud Volumes ONTAP in AWS](#).

About this task

Immediately after you create the Cloud Volumes ONTAP system, the NetApp Console launches a test instance in the specified VPC to verify connectivity. If successful, the Console immediately terminates the instance and then starts deploying the system. If the Console cannot verify connectivity, creation of the system fails. The test instance is either a `t2.nano` (for default VPC tenancy) or a `m3.medium` (for dedicated VPC tenancy).

Steps

1. From the left navigation menu, select **Storage > Management**.
2. On the Canvas page, click **Add System** and follow the prompts.
3. Select **Amazon Web Services > Cloud Volumes ONTAP > Add new**. The **Quick create** option is selected by default.



Quick create

Use the recommended and default configuration options. You can change most of these options later.



Advanced create

You set all of the configuration options, including specifying performance, networking, security, backups, and maintenance.

System details

Show API request

Cloud provider account	Instance Profile Account ID: ██████████2	▼
Name	ⓘ Action required	▼
ONTAP Credentials	ⓘ Action required	▼
Tags	0 Tags	▼

Deployment and Configuration

Deployment Type	Single node	▼
Network configuration	US East - N. Virginia VPC name - 172.31.0.0/16 Subnet name - ██████████	▼

Charging and Services

Marketplace subscription	Sub2-ByCapacityByNodePYGO_delete_after_1234	▼
License	Freemium (Up to 500 GiB)	▼
Data services and features	Netapp Backup and Recovery	▼
NetApp Support Site account	No existing account	▼

Summary

Overview	▼
----------	---

Create

Cancel

system details

- Cloud provider account:** The account details are automatically populated based on your selected Console agent. If you have multiple accounts, select the one you want to use. If a Console agent is unavailable, you'll be prompted to [create a Console agent](#).
- Name:** The system name. The Console uses the system (cluster) name to name the Cloud Volumes ONTAP system and the Amazon EC2 instance. It also uses the name as the prefix for the predefined security group, if you select that option.
- ONTAP credentials** These are the credentials for the Cloud Volumes ONTAP cluster administrator account. You can use these credentials to connect to Cloud Volumes ONTAP through ONTAP System Manager or the ONTAP CLI. You can keep the default *admin* user name or change it to a custom user name.
- Tags** AWS tags are metadata for your AWS resources. The Console adds the tags to the Cloud Volumes ONTAP instance and each AWS resource associated with the instance. You can add up to 15 tags from the

user interface when creating a Cloud Volumes ONTAP system, and then you can add more after its created. Note that the API does not limit you to four tags when creating a system. For information about tags, refer to [AWS Documentation: Tagging your Amazon EC2 Resources](#).

Deployment and configuration

1. **Deployment type:** Select the deployment type that you want to use, single node, high availability (HA) in a single availability zone (AZ), or HA in a multiple AZ.
2. **Network configuration:** Enter the network information that you recorded in the [AWS worksheet](#).
 - a. **AWS region:** By default, the region of the associated cloud account that has VPC with subnet resources is selected.
 - b. **VPC:** Enter a VPC for the AWS region with a subnet. If there are no subnets, then the default value for the VPC is selected.
 - c. **Subnet:** You can select a subnet for the VPC only for a single node deployment or HA deployment in a single AZ.

High Availability

If you have selected HA configuration, enter the following information:

HA in single AZ

1. **Mediator Access:** Specify the mediator access information. The mediator is a separate instance that monitors the health of the HA pair and provides quorum in case of a failure. Provide the key pair name to enable the mediator instance to connect to the AWS EC2 service, and select the connection method.

HA in multiple AZ

1. **Availability zones and mediator:** Select the availability zones (AZs) for each node and the mediator and the corresponding subnets where you want to deploy the Cloud Volumes ONTAP HA pair.
2. **Floating IPs:** If you chose multiple AZs, specify the floating IP addresses for the NFS and CIFS services and cluster and SVM management. The IP addresses must be outside of the CIDR block for all VPCs in the region. For additional details, refer to [AWS networking requirements for Cloud Volumes ONTAP HA in multiple AZs](#).
3. **Mediator Access:** Specify the mediator access information. The mediator is a separate instance that monitors the health of the HA pair and provides quorum in case of a failure. Provide the key pair name to enable the mediator instance to connect to the AWS EC2 service, and select the connection method.
4. **Route Tables:** If you chose multiple AZs, select the route tables that include routes to the floating IP addresses. If you have more than one route table, it is important to select the correct route tables. Otherwise, some clients might not have access to the Cloud Volumes ONTAP HA pair. For more information about route tables, refer to the [AWS Documentation: Route Tables](#).

Charging and Services

1. **Marketplace Subscription:** Select the AWS marketplace subscription you want to use with this Cloud Volumes ONTAP system.
2. **License:** Select the license type you want to use with this Cloud Volumes ONTAP system. You can choose from Professional, Essential, and Premium licenses. For information about different licenses, refer to [Learn about Cloud Volumes ONTAP licenses](#).
3. **Data services and features:** Keep the services enabled or disable the services you don't want to use with Cloud Volumes ONTAP.

- [Learn more about NetApp Classification](#)
- [Learn more about NetApp Backup and Recovery](#)
- [Learn about WORM storage on Cloud Volumes ONTAP](#)



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

- **NetApp Support Site account:** If you have multiple accounts, select the one you want to use.

Summary

Check or edit the details you entered, and then click **Create**.



After the deployment process completes, do not modify the system-generated Cloud Volumes ONTAP configurations in the AWS cloud portal, especially the system tags. Any changes made to these configurations may lead to unexpected behavior or data loss.

Related links

- [Planning your Cloud Volumes ONTAP configuration](#)
- [Deploy Cloud Volumes ONTAP in AWS using advanced deployment](#)

Launch Cloud Volumes ONTAP in AWS

You can launch Cloud Volumes ONTAP in a single-system configuration or as an HA pair in AWS. This method provides an advanced deployment experience that offers more configuration options and flexibility than the quick deployment method.

Before you begin

You need the following before you begin.

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

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

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

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

- DNS and Active Directory for CIFS configurations.

For details, refer to [Networking requirements for Cloud Volumes ONTAP in AWS](#).

Launch a single-node Cloud Volumes ONTAP system in AWS

If you want to launch Cloud Volumes ONTAP in AWS, you need to create a new system in the NetApp Console.

About this task

Immediately after you create the system, the Console launches a test instance in the specified VPC to verify connectivity. If successful, the Console immediately terminates the instance and then starts deploying the Cloud Volumes ONTAP system. If the connectivity can't be verified, system creation fails. The test instance is either a `t2.nano` (for default VPC tenancy) or `m3.medium` (for dedicated VPC tenancy).

Steps

1. From the left navigation menu, select **Storage > Management**.
2. On the **Systems** page, click **Add System** and follow the prompts.
3. Select **Amazon Web Services** and **Cloud Volumes ONTAP Single Node**.
4. Select **Advanced create**. Because the **Quick create** mode is selected by default, you might see a message for default values. Click **Continue**.
5. If you're prompted, [create a Console agent](#).
6. **Details and Credentials**: Optionally change the AWS credentials and subscription, enter a system name, add tags if needed, and then enter a password.

Some of the fields in this page are self-explanatory. The following table describes fields for which you might need guidance:

Field	Description
System Name	The Console uses the system name to name both the Cloud Volumes ONTAP system and the Amazon EC2 instance. It also uses the name as the prefix for the predefined security group, if you select that option.
Add tags	<p>AWS tags are metadata for your AWS resources. The Console adds the tags to the Cloud Volumes ONTAP instance and each AWS resource associated with the instance.</p> <p>You can add up to four tags from the user interface when creating a system, and then you can add more after it's created. Note that the API does not limit you to four tags when creating a system.</p> <p>For information about tags, refer to AWS Documentation: Tagging your Amazon EC2 Resources.</p>
User name and password	These are the credentials for the Cloud Volumes ONTAP cluster administrator account. You can use these credentials to connect to Cloud Volumes ONTAP through ONTAP System Manager or the ONTAP CLI. Keep the default <i>admin</i> user name or change it to a custom user name.

Field	Description
Edit Credentials	<p>Choose the AWS credentials associated with the account where you want to deploy this system. You can also associate the AWS marketplace subscription to use with this Cloud Volumes ONTAP system.</p> <p>Click Add Subscription to associate the selected credentials with a new AWS marketplace subscription. The subscription can be for an annual contract or to pay for Cloud Volumes ONTAP at an hourly rate.</p> <p>Learn how to add additional AWS credentials to NetApp Console.</p>

If multiple IAM users work in the same AWS account, then each user needs to subscribe. After the first user subscribes, the AWS marketplace informs subsequent users that they're already subscribed, as shown in the image below. While a subscription is in place for the AWS *account*, each IAM user needs to associate themselves with that subscription. If you see the message shown below, click the **click here** link to go to the Console website and complete the process.



NetApp Cloud Volumes ONTAP (CVO), delivered by ePlus info

You are currently subscribed to this product and will be charged for your accumulated usage at the end of your next billing cycle, based on the costs listed in Pricing information on the right.

Having issues signing up for your product?
If you were unable to complete the set-up process for this software, please [click here](#) to be taken to the product's registration area.

Subscribe

You are already subscribed to this product

Pricing Details

Software Fees

7. **Services:** Keep the services enabled or disable the individual services that you don't want to use with Cloud Volumes ONTAP.

- [Learn more about NetApp Data Classification](#)
- [Learn more about NetApp Backup and Recovery](#)



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

8. **Location & Connectivity:** Enter the network information that you recorded in the [AWS worksheet](#).

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

Field	Description
VPC	If you have an AWS Outpost, you can deploy a single node Cloud Volumes ONTAP system in that Outpost by selecting the Outpost VPC. The experience is the same as any other VPC that resides in AWS.

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

9. **Data Encryption:** Choose no data encryption or AWS-managed encryption.

For AWS-managed encryption, you can choose a different Customer Master Key (CMK) from your account or another AWS account.



You can't change the AWS data encryption method after you create a Cloud Volumes ONTAP system.

[Learn how to set up the AWS KMS for Cloud Volumes ONTAP.](#)

[Learn more about supported encryption technologies.](#)

10. **Charging Methods and NSS Account:** Specify which charging option would you like to use with this system, and then specify a NetApp Support Site account.
- [Learn about licensing options for Cloud Volumes ONTAP.](#)
 - [Learn how to set up licensing.](#)

11. **Cloud Volumes ONTAP Configuration** (annual AWS marketplace contract only): Review the default configuration and click **Continue** or click **Change Configuration** to select your own configuration.

If you keep the default configuration, then you only need to specify a volume and then review and approve the configuration.

12. **Preconfigured Packages:** Select one of the packages to quickly launch Cloud Volumes ONTAP, or click **Change Configuration** to select your own configuration.

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

13. **IAM Role:** It's best to keep the default option to let the Console create the role for you.

If you prefer to use your own policy, it must meet [policy requirements for Cloud Volumes ONTAP nodes.](#)

14. **Licensing:** Change the Cloud Volumes ONTAP version as needed and select an instance type and the instance tenancy.



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

15. **Underlying Storage Resources:** Choose a disk type, configure the underlying storage, and choose whether to keep data tiering enabled.

Note the following:

- The disk type is for the initial volume (and aggregate). You can choose a different disk type for subsequent volumes (and aggregates).
- If you choose a gp3 or io1 disk, the Console uses the Elastic Volumes feature in AWS to automatically increase the underlying storage disk capacity as needed. You can choose the initial capacity based on your storage needs and revise it after Cloud Volumes ONTAP is deployed. [Learn more about support for Elastic Volumes in AWS.](#)
- If you choose a gp2 or st1 disk, you can select a disk size for all disks in the initial aggregate and for any additional aggregates that the Console creates when you use the simple provisioning option. You can create aggregates that use a different disk size by using the advanced allocation option.
- You can choose a specific volume tiering policy when you create or edit a volume.
- If you disable data tiering, you can enable it on subsequent aggregates.

[Learn how data tiering works.](#)

16. **Write Speed & WORM:**

- a. Choose **Normal** or **High** write speed, if desired.

[Learn more about write speed.](#)

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

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

[Learn more about WORM storage.](#)

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

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

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

Some of the fields in this page are self-explanatory. The following table describes fields for which you might need guidance:

Field	Description
Size	The maximum size that you can enter largely depends on whether you enable thin provisioning, which enables you to create a volume that is bigger than the physical storage currently available to it.

Field	Description
Access control (for NFS only)	An export policy defines the clients in the subnet that can access the volume. By default, the Console enters a value that provides access to all instances in the subnet.
Permissions and Users / Groups (for CIFS only)	These fields enable you to control the level of access to a share for users and groups (also called access control lists or ACLs). You can specify local or domain Windows users or groups, or UNIX users or groups. If you specify a domain Windows user name, you must include the user's domain using the format domain\username.
Snapshot Policy	A Snapshot copy policy specifies the frequency and number of automatically created NetApp Snapshot copies. A NetApp Snapshot copy is a point-in-time file system image that has no performance impact and requires minimal storage. You can choose the default policy or none. You might choose none for transient data: for example, tempdb for Microsoft SQL Server.
Advanced options (for NFS only)	Select an NFS version for the volume: either NFSv3 or NFSv4.
Initiator group and IQN (for iSCSI only)	<p>iSCSI storage targets are called LUNs (logical units) and are presented to hosts as standard block devices.</p> <p>Initiator groups are tables of iSCSI host node names and control which initiators have access to which LUNs.</p> <p>iSCSI targets connect to the network through standard Ethernet network adapters (NICs), TCP offload engine (TOE) cards with software initiators, converged network adapters (CNAs) or dedicated host bust adapters (HBAs) and are identified by iSCSI qualified names (IQNs).</p> <p>When you create an iSCSI volume, the Console automatically creates a LUN for you. We've made it simple by creating just one LUN per volume, so there's no management involved. After you create the volume, use the IQN to connect to the LUN from your hosts.</p>

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

The screenshot shows the 'Volume Details & Protection' section of a volume creation wizard. It contains the following fields:

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

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

Field	Description
DNS Primary and Secondary IP Address	The IP addresses of the DNS servers that provide name resolution for the CIFS server. The listed DNS servers must contain the service location records (SRV) needed to locate the Active Directory LDAP servers and domain controllers for the domain that the CIFS server will join.
Active Directory Domain to join	The FQDN of the Active Directory (AD) domain that you want the CIFS server to join.
Credentials authorized to join the domain	The name and password of a Windows account with sufficient privileges to add computers to the specified Organizational Unit (OU) within the AD domain.
CIFS server NetBIOS name	A CIFS server name that is unique in the AD domain.
Organizational Unit	The organizational unit within the AD domain to associate with the CIFS server. The default is CN=Computers. If you configure AWS Managed Microsoft AD as the AD server for Cloud Volumes ONTAP, you should enter OU=Computers,OU=corp in this field.
DNS Domain	The DNS domain for the Cloud Volumes ONTAP storage virtual machine (SVM). In most cases, the domain is the same as the AD domain.
NTP Server	Select Use Active Directory Domain to configure an NTP server using the Active Directory DNS. If you need to configure an NTP server using a different address, then you should use the API. Refer to the NetApp Console automation docs for details. Note that you can configure an NTP server only when creating a CIFS server. It's not configurable after you create the CIFS server.

19. **Usage Profile, Disk Type, and Tiering Policy:** Choose whether you want to enable storage efficiency features and edit the volume tiering policy, if needed.

For more information, refer to [Understanding volume usage profiles](#), [Data tiering overview](#), and [KB: What Inline Storage Efficiency features are supported with CVO?](#)

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

Result

The Console launches the Cloud Volumes ONTAP instance. You can track the progress on the **Audit** page.

If you have any issues launching the Cloud Volumes ONTAP instance, review the failure message. You can also select the system and click **Re-create environment**.

For additional help, go to [NetApp Cloud Volumes ONTAP Support](#).



After the deployment process completes, do not modify the system-generated Cloud Volumes ONTAP configurations in the AWS cloud portal, especially the system tags. Any changes made to these configurations may lead to unexpected behavior or data loss.

After you finish

- If you provisioned a CIFS share, give users or groups permissions to the files and folders and verify that those users can access the share and create a file.
- If you want to apply quotas to volumes, use ONTAP System Manager or the ONTAP CLI.

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

Launch a Cloud Volumes ONTAP HA pair in AWS

If you want to launch a Cloud Volumes ONTAP HA pair in AWS, you need to create an HA system in the Console.

Limitation

At this time, HA pairs are not supported with AWS Outposts.

About this task

Immediately after you create the Cloud Volumes ONTAP system, the Console launches a test instance in the specified VPC to verify connectivity. If successful, the Console immediately terminates the instance and then starts deploying the Cloud Volumes ONTAP system. If the connectivity can't be verified, system creation fails. The test instance is either a `t2.nano` (for default VPC tenancy) or `m3.medium` (for dedicated VPC tenancy).

Steps

1. From the left navigation menu, select **Storage > Management**.
2. On the **Systems** page, click **Add System** and follow the prompts.
3. Select **Amazon Web Services** and **Cloud Volumes ONTAP HA**.

Some AWS Local Zones are available.

Before you can use AWS Local Zones, you must enable Local Zones and create a subnet in the Local Zone in your AWS account. Follow the **Opt in to an AWS Local Zone** and **Extend your Amazon VPC to the Local Zone** steps in the [AWS tutorial "Get Started Deploying Low Latency Applications with AWS Local Zones"](#).

If you are running the Console agent 3.9.36 or below, you need to add the `DescribeAvailabilityZones` permission to the AWS role in the AWS EC2 console.

4. **Details and Credentials:** Optionally change the AWS credentials and subscription, enter a system name, add tags if needed, and then enter a password.

Some of the fields in this page are self-explanatory. The following table describes fields for which you might need guidance:

Field	Description
System Name	The Console uses the system name to name both the Cloud Volumes ONTAP system and the Amazon EC2 instance. It also uses the name as the prefix for the predefined security group, if you select that option.

Field	Description
Add tags	<p>AWS tags are metadata for your AWS resources. The Console adds the tags to the Cloud Volumes ONTAP instance and each AWS resource associated with the instance.</p> <p>You can add up to four tags from the user interface when creating a system, and then you can add more after it's created. Note that the API does not limit you to four tags when creating a system.</p> <p>For information about tags, refer to AWS Documentation: Tagging your Amazon EC2 Resources.</p>
User name and password	<p>These are the credentials for the Cloud Volumes ONTAP cluster administrator account. You can use these credentials to connect to Cloud Volumes ONTAP through ONTAP System Manager or the ONTAP CLI. Keep the default <i>admin</i> user name or change it to a custom user name.</p>
Edit Credentials	<p>Choose the AWS credentials and marketplace subscription to use with this Cloud Volumes ONTAP system.</p> <p>Click Add Subscription to associate the selected credentials with a new AWS marketplace subscription. The subscription can be for an annual contract or to pay for Cloud Volumes ONTAP at an hourly rate.</p> <p>If you purchased a license directly from NetApp (bring your own license (BYOL)), then an AWS subscription isn't required. NetApp has restricted the purchase, extension, and renewal of BYOL licensing. For more information, refer to Restricted availability of BYOL licensing for Cloud Volumes ONTAP.</p> <p>Learn how to add additional AWS credentials to the Console.</p>



If multiple IAM users work in the same AWS account, then each user needs to subscribe. After the first user subscribes, the AWS marketplace informs subsequent users that they're already subscribed, as shown in the image below. While a subscription is in place for the *AWS account*, each IAM user needs to associate themselves with that subscription. If you see the message shown below, click the **click here** link to go to the Console website and complete the process.

5. **Services:** Keep the services enabled or disable the individual services that you don't want to use with this Cloud Volumes ONTAP system.

- [Learn more about NetApp Data Classification](#)
- [Learn more about Backup and Recovery](#)



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

6. **HA Deployment Models:** Choose an HA configuration.

For an overview of the deployment models, refer to [Cloud Volumes ONTAP HA for AWS](#).

7. **Location and Connectivity** (single availability zone (AZ)) or **Region & VPC** (multiple AZs): Enter the

network information that you recorded in the AWS worksheet.

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

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

8. **Connectivity and SSH Authentication:** Choose connection methods for the HA pair and the mediator.

9. **Floating IPs:** If you chose multiple AZs, specify the floating IP addresses.

The IP addresses must be outside of the CIDR block for all VPCs in the region. For additional details, refer to [AWS networking requirements for Cloud Volumes ONTAP HA in multiple AZs](#).

10. **Route Tables:** If you chose multiple AZs, select the route tables that should include routes to the floating IP addresses.

If you have more than one route table, it is very important to select the correct route tables. Otherwise, some clients might not have access to the Cloud Volumes ONTAP HA pair. For more information about route tables, refer to the [AWS Documentation: Route Tables](#).

11. **Data Encryption:** Choose no data encryption or AWS-managed encryption.

For AWS-managed encryption, you can choose a different Customer Master Key (CMK) from your account or another AWS account.



You can't change the AWS data encryption method after you create a Cloud Volumes ONTAP system.

[Learn how to set up the AWS KMS for Cloud Volumes ONTAP.](#)

[Learn more about supported encryption technologies.](#)

12. **Charging Methods and NSS Account:** Specify which charging option would you like to use with this system, and then specify a NetApp Support Site account.

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

13. **Cloud Volumes ONTAP Configuration** (annual AWS Marketplace contract only): Review the default configuration and click **Continue** or click **Change Configuration** to select your own configuration.

If you keep the default configuration, then you only need to specify a volume and then review and approve the configuration.

14. **Preconfigured Packages** (hourly or BYOL only): Select one of the packages to quickly launch Cloud Volumes ONTAP, or click **Change Configuration** to select your own configuration.

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

15. **IAM Role**: It's best to keep the default option to let the Console create the role for you.

If you prefer to use your own policy, it must meet [policy requirements for Cloud Volumes ONTAP nodes and the HA mediator](#).

16. **Licensing**: Change the Cloud Volumes ONTAP version as needed and select an instance type and the instance tenancy.



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

17. **Underlying Storage Resources**: Choose a disk type, configure the underlying storage, and choose whether to keep data tiering enabled.

Note the following:

- The disk type is for the initial volume (and aggregate). You can choose a different disk type for subsequent volumes (and aggregates).
- If you choose a gp3 or io1 disk, the Console uses the Elastic Volumes feature in AWS to automatically increase the underlying storage disk capacity as needed. You can choose the initial capacity based on your storage needs and revise it after Cloud Volumes ONTAP is deployed. [Learn more about support for Elastic Volumes in AWS](#).
- If you choose a gp2 or st1 disk, you can select a disk size for all disks in the initial aggregate and for any additional aggregates that the Console creates when you use the simple provisioning option. You can create aggregates that use a different disk size by using the advanced allocation option.
- You can choose a specific volume tiering policy when you create or edit a volume.
- If you disable data tiering, you can enable it on subsequent aggregates.

[Learn how data tiering works](#).

18. **Write Speed & WORM**:

- a. Choose **Normal** or **High** write speed, if desired.

[Learn more about write speed](#).

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

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

[Learn more about WORM storage](#).

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

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

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

Some of the fields in this page are self-explanatory. The following table describes fields for which you might need guidance:

Field	Description
Size	The maximum size that you can enter largely depends on whether you enable thin provisioning, which enables you to create a volume that is bigger than the physical storage currently available to it.
Access control (for NFS only)	An export policy defines the clients in the subnet that can access the volume. By default, the Console enters a value that provides access to all instances in the subnet.
Permissions and Users / Groups (for CIFS only)	These fields enable you to control the level of access to a share for users and groups (also called access control lists or ACLs). You can specify local or domain Windows users or groups, or UNIX users or groups. If you specify a domain Windows user name, you must include the user's domain using the format domain\username.
Snapshot Policy	A Snapshot copy policy specifies the frequency and number of automatically created NetApp Snapshot copies. A NetApp Snapshot copy is a point-in-time file system image that has no performance impact and requires minimal storage. You can choose the default policy or none. You might choose none for transient data: for example, tempdb for Microsoft SQL Server.
Advanced options (for NFS only)	Select an NFS version for the volume: either NFSv3 or NFSv4.
Initiator group and IQN (for iSCSI only)	<p>iSCSI storage targets are called LUNs (logical units) and are presented to hosts as standard block devices.</p> <p>Initiator groups are tables of iSCSI host node names and control which initiators have access to which LUNs.</p> <p>iSCSI targets connect to the network through standard Ethernet network adapters (NICs), TCP offload engine (TOE) cards with software initiators, converged network adapters (CNAs) or dedicated host bus adapters (HBAs) and are identified by iSCSI qualified names (IQNs).</p> <p>When you create an iSCSI volume, the Console automatically creates a LUN for you. We've made it simple by creating just one LUN per volume, so there's no management involved. After you create the volume, use the IQN to connect to the LUN from your hosts.</p>

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

Volume Details & Protection

<p>Volume Name i</p> <input style="width: 90%;" type="text" value="ABDcv5689"/>	<p>Storage VM (SVM)</p> <input style="width: 90%;" type="text" value="svm_c...CVO1"/>
<p>Volume Size i Unit</p> <input style="width: 45%;" type="text" value="100"/> <input style="width: 45%;" type="text" value="GiB"/>	<p>Snapshot Policy</p> <input style="width: 90%;" type="text" value="default"/> <p style="text-align: center;">default policy i</p>

20. **CIFS Setup:** If you selected the CIFS protocol, set up a CIFS server.

Field	Description
DNS Primary and Secondary IP Address	The IP addresses of the DNS servers that provide name resolution for the CIFS server. The listed DNS servers must contain the service location records (SRV) needed to locate the Active Directory LDAP servers and domain controllers for the domain that the CIFS server will join.
Active Directory Domain to join	The FQDN of the Active Directory (AD) domain that you want the CIFS server to join.
Credentials authorized to join the domain	The name and password of a Windows account with sufficient privileges to add computers to the specified Organizational Unit (OU) within the AD domain.
CIFS server NetBIOS name	A CIFS server name that is unique in the AD domain.
Organizational Unit	The organizational unit within the AD domain to associate with the CIFS server. The default is CN=Computers. If you configure AWS Managed Microsoft AD as the AD server for Cloud Volumes ONTAP, you should enter OU=Computers,OU=corp in this field.
DNS Domain	The DNS domain for the Cloud Volumes ONTAP storage virtual machine (SVM). In most cases, the domain is the same as the AD domain.
NTP Server	Select Use Active Directory Domain to configure an NTP server using the Active Directory DNS. If you need to configure an NTP server using a different address, then you should use the API. Refer to the NetApp Console automation docs for details. Note that you can configure an NTP server only when creating a CIFS server. It's not configurable after you create the CIFS server.

21. **Usage Profile, Disk Type, and Tiering Policy:** Choose whether you want to enable storage efficiency features and edit the volume tiering policy, if needed.

For more information, refer to [Choose a volume usage profile](#) and [Data tiering overview](#).

22. **Review & Approve:** Review and confirm your selections.

- a. Review details about the configuration.
- b. Click **More information** to review details about support and the AWS resources that the Console will purchase.
- c. Select the **I understand...** check boxes.
- d. Click **Go**.

Result

The Console launches the Cloud Volumes ONTAP HA pair. You can track the progress on the **Audit** page.

If you experience any issues launching the HA pair, review the failure message. You can also select the system and click Re-create environment.

For additional help, go to [NetApp Cloud Volumes ONTAP Support](#).

After you finish

- If you provisioned a CIFS share, give users or groups permissions to the files and folders and verify that those users can access the share and create a file.
- If you want to apply quotas to volumes, use ONTAP System Manager or the ONTAP CLI.

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



After the deployment process completes, do not modify the system-generated Cloud Volumes ONTAP configurations in the AWS cloud portal, especially the system tags. Any changes made to these configurations may lead to unexpected behavior or data loss.

Related links

- [Planning your Cloud Volumes ONTAP configuration](#)
- [Deploy Cloud Volumes ONTAP in AWS using quick deployment](#)

Deploy Cloud Volumes ONTAP in AWS Secret Cloud or AWS Top Secret Cloud

Similar to a standard AWS region, you can use the NetApp Console in [AWS Secret Cloud](#) and in [AWS Top Secret Cloud](#) to deploy Cloud Volumes ONTAP, which provides enterprise-class features for your cloud storage. AWS Secret Cloud and Top Secret Cloud are closed regions specific to the U.S. Intelligence Community; the instructions on this page only apply to AWS Secret Cloud and Top Secret Cloud region users.

Before you begin

Before you get started, review the supported versions in AWS Secret Cloud and Top Secret Cloud, and learn about private mode in the Console.

- Review the following supported versions in AWS Secret Cloud and Top Secret Cloud:
 - Cloud Volumes ONTAP 9.12.1 P2
 - Version 3.9.32 of the Console agent

The Console agent is required to deploy and manage Cloud Volumes ONTAP in AWS. You'll log in to

the Console from the software that gets installed on the instance of the Console agent. The SaaS website for the Console isn't supported in AWS Secret Cloud and Top Secret Cloud.

- Learn about private mode

In AWS Secret Cloud and Top Secret Cloud, the Console operates in *private mode*. In private mode, there is no connectivity to the SaaS layer from the Console. You can access the Console through a local a web-based application that can access the Console agent.

To learn more about how private mode works, refer to [the private deployment mode in the Console](#).

Step 1: Set up your networking

Set up your AWS networking so Cloud Volumes ONTAP can operate properly.

Steps

1. Choose the VPC and subnets in which you want to launch the instance of the Console agent and Cloud Volumes ONTAP instances.
2. Ensure that your VPC and subnets will support connectivity between the Console agent and Cloud Volumes ONTAP.
3. Set up a VPC endpoint to the Amazon Simple Storage Service (Amazon S3) service.

A VPC endpoint is required if you want to tier cold data from Cloud Volumes ONTAP to low-cost object storage.

Step 2: Set up permissions

Set up IAM policies and roles that provide the Console agent and Cloud Volumes ONTAP with the permissions that they need to perform actions in the AWS Secret Cloud or Top Secret Cloud.

You need an IAM policy and IAM role for each of the following:

- The instance of the Console agent
- Cloud Volumes ONTAP instances
- For HA pairs, the Cloud Volumes ONTAP HA mediator instance (if you want to deploy HA pairs)

Steps

1. Go to the AWS IAM console and click **Policies**.
2. Create a policy for the instance of the Console agent.



You create these policies to support the S3 buckets in your AWS environment. While creating the buckets later, ensure that the bucket names are prefixed with `fabric-pool-`. This requirement applies to both the AWS Secret Cloud and Top Secret Cloud regions.

Secret regions

```
{
  "Version": "2012-10-17",
  "Statement": [{
    "Effect": "Allow",
    "Action": [
      "ec2:DescribeInstances",
      "ec2:DescribeInstanceStatus",
      "ec2:RunInstances",
      "ec2:ModifyInstanceAttribute",
      "ec2:DescribeRouteTables",
      "ec2:DescribeImages",
      "ec2:CreateTags",
      "ec2:CreateVolume",
      "ec2:DescribeVolumes",
      "ec2:ModifyVolumeAttribute",
      "ec2>DeleteVolume",
      "ec2:CreateSecurityGroup",
      "ec2>DeleteSecurityGroup",
      "ec2:DescribeSecurityGroups",
      "ec2:RevokeSecurityGroupEgress",
      "ec2:RevokeSecurityGroupIngress",
      "ec2:AuthorizeSecurityGroupEgress",
      "ec2:AuthorizeSecurityGroupIngress",
      "ec2:CreateNetworkInterface",
      "ec2:DescribeNetworkInterfaces",
      "ec2>DeleteNetworkInterface",
      "ec2:ModifyNetworkInterfaceAttribute",
      "ec2:DescribeSubnets",
      "ec2:DescribeVpcs",
      "ec2:DescribeDhcpOptions",
      "ec2:CreateSnapshot",
      "ec2>DeleteSnapshot",
      "ec2:DescribeSnapshots",
      "ec2:GetConsoleOutput",
      "ec2:DescribeKeyPairs",
      "ec2:DescribeRegions",
      "ec2>DeleteTags",
      "ec2:DescribeTags",
      "cloudformation:CreateStack",
      "cloudformation>DeleteStack",
      "cloudformation:DescribeStacks",
      "cloudformation:DescribeStackEvents",
      "cloudformation:ValidateTemplate",
      "iam:PassRole",
```

```

        "iam:CreateRole",
        "iam:DeleteRole",
        "iam:PutRolePolicy",
        "iam:ListInstanceProfiles",
        "iam:CreateInstanceProfile",
        "iam:DeleteRolePolicy",
        "iam:AddRoleToInstanceProfile",
        "iam:RemoveRoleFromInstanceProfile",
        "iam:DeleteInstanceProfile",
        "s3:GetObject",
        "s3:ListBucket",
        "s3:GetBucketTagging",
        "s3:GetBucketLocation",
        "s3:ListAllMyBuckets",
        "kms:List*",
        "kms:Describe*",
        "ec2:AssociateIamInstanceProfile",
        "ec2:DescribeIamInstanceProfileAssociations",
        "ec2:DisassociateIamInstanceProfile",
        "ec2:DescribeInstanceAttribute",
        "ec2:CreatePlacementGroup",
        "ec2>DeletePlacementGroup"
    ],
    "Resource": "*"
},
{
    "Sid": "fabricPoolPolicy",
    "Effect": "Allow",
    "Action": [
        "s3:DeleteBucket",
        "s3:GetLifecycleConfiguration",
        "s3:PutLifecycleConfiguration",
        "s3:PutBucketTagging",
        "s3:ListBucketVersions"
    ],
    "Resource": [
        "arn:aws-iso-b:s3:::fabric-pool*"
    ]
},
{
    "Effect": "Allow",
    "Action": [
        "ec2:StartInstances",
        "ec2:StopInstances",
        "ec2:TerminateInstances",
        "ec2:AttachVolume",

```

```

        "ec2:DetachVolume"
    ],
    "Condition": {
        "StringLike": {
            "ec2:ResourceTag/WorkingEnvironment": "*"
        }
    },
    "Resource": [
        "arn:aws-iso-b:ec2:*:*:instance/*"
    ]
},
{
    "Effect": "Allow",
    "Action": [
        "ec2:AttachVolume",
        "ec2:DetachVolume"
    ],
    "Resource": [
        "arn:aws-iso-b:ec2:*:*:volume/*"
    ]
}
]
}

```

Top Secret regions

```

{
    "Version": "2012-10-17",
    "Statement": [{
        "Effect": "Allow",
        "Action": [
            "ec2:DescribeInstances",
            "ec2:DescribeInstanceStatus",
            "ec2:RunInstances",
            "ec2:ModifyInstanceAttribute",
            "ec2:DescribeRouteTables",
            "ec2:DescribeImages",
            "ec2:CreateTags",
            "ec2:CreateVolume",
            "ec2:DescribeVolumes",
            "ec2:ModifyVolumeAttribute",
            "ec2>DeleteVolume",
            "ec2:CreateSecurityGroup",
            "ec2>DeleteSecurityGroup",
            "ec2:DescribeSecurityGroups",
            "ec2:RevokeSecurityGroupEgress",

```

```
"ec2:RevokeSecurityGroupIngress",
"ec2:AuthorizeSecurityGroupEgress",
"ec2:AuthorizeSecurityGroupIngress",
"ec2:CreateNetworkInterface",
"ec2:DescribeNetworkInterfaces",
"ec2>DeleteNetworkInterface",
"ec2:ModifyNetworkInterfaceAttribute",
"ec2:DescribeSubnets",
"ec2:DescribeVpcs",
"ec2:DescribeDhcpOptions",
"ec2:CreateSnapshot",
"ec2>DeleteSnapshot",
"ec2:DescribeSnapshots",
"ec2:GetConsoleOutput",
"ec2:DescribeKeyPairs",
"ec2:DescribeRegions",
"ec2>DeleteTags",
"ec2:DescribeTags",
"cloudformation:CreateStack",
"cloudformation>DeleteStack",
"cloudformation:DescribeStacks",
"cloudformation:DescribeStackEvents",
"cloudformation:ValidateTemplate",
"iam:PassRole",
"iam:CreateRole",
"iam>DeleteRole",
"iam:PutRolePolicy",
"iam:ListInstanceProfiles",
"iam:CreateInstanceProfile",
"iam>DeleteRolePolicy",
"iam:AddRoleToInstanceProfile",
"iam:RemoveRoleFromInstanceProfile",
"iam>DeleteInstanceProfile",
"s3:GetObject",
"s3:ListBucket",
"s3:GetBucketTagging",
"s3:GetBucketLocation",
"s3:ListAllMyBuckets",
"kms:List*",
"kms:Describe*",
"ec2:AssociateIamInstanceProfile",
"ec2:DescribeIamInstanceProfileAssociations",
"ec2:DisassociateIamInstanceProfile",
"ec2:DescribeInstanceAttribute",
"ec2:CreatePlacementGroup",
"ec2>DeletePlacementGroup"
```

```

    ],
    "Resource": "*"
  },
  {
    "Sid": "fabricPoolPolicy",
    "Effect": "Allow",
    "Action": [
      "s3:DeleteBucket",
      "s3:GetLifecycleConfiguration",
      "s3:PutLifecycleConfiguration",
      "s3:PutBucketTagging",
      "s3:ListBucketVersions"
    ],
    "Resource": [
      "arn:aws-iso:s3:::fabric-pool*"
    ]
  },
  {
    "Effect": "Allow",
    "Action": [
      "ec2:StartInstances",
      "ec2:StopInstances",
      "ec2:TerminateInstances",
      "ec2:AttachVolume",
      "ec2:DetachVolume"
    ],
    "Condition": {
      "StringLike": {
        "ec2:ResourceTag/WorkingEnvironment": "*"
      }
    },
    "Resource": [
      "arn:aws-iso:ec2:*:*:instance/*"
    ]
  },
  {
    "Effect": "Allow",
    "Action": [
      "ec2:AttachVolume",
      "ec2:DetachVolume"
    ],
    "Resource": [
      "arn:aws-iso:ec2:*:*:volume/*"
    ]
  }
]

```

```
}
```

3. Create a policy for Cloud Volumes ONTAP.

Secret regions

```
{
  "Version": "2012-10-17",
  "Statement": [{
    "Action": "s3:ListAllMyBuckets",
    "Resource": "arn:aws-iso-b:s3:::*",
    "Effect": "Allow"
  }, {
    "Action": [
      "s3:ListBucket",
      "s3:GetBucketLocation"
    ],
    "Resource": "arn:aws-iso-b:s3:::fabric-pool-*",
    "Effect": "Allow"
  }, {
    "Action": [
      "s3:GetObject",
      "s3:PutObject",
      "s3>DeleteObject"
    ],
    "Resource": "arn:aws-iso-b:s3:::fabric-pool-*",
    "Effect": "Allow"
  }
]
```

Top Secret regions

```

{
  "Version": "2012-10-17",
  "Statement": [{
    "Action": "s3:ListAllMyBuckets",
    "Resource": "arn:aws-iso:s3:::*",
    "Effect": "Allow"
  }, {
    "Action": [
      "s3:ListBucket",
      "s3:GetBucketLocation"
    ],
    "Resource": "arn:aws-iso:s3:::fabric-pool-*",
    "Effect": "Allow"
  }, {
    "Action": [
      "s3:GetObject",
      "s3:PutObject",
      "s3>DeleteObject"
    ],
    "Resource": "arn:aws-iso:s3:::fabric-pool-*",
    "Effect": "Allow"
  }]
}

```

For HA pairs, if you plan to deploy a Cloud Volumes ONTAP HA pair, create a policy for the HA mediator.

```

{
  "Version": "2012-10-17",
  "Statement": [{
    "Effect": "Allow",
    "Action": [
      "ec2:AssignPrivateIpAddresses",
      "ec2:CreateRoute",
      "ec2>DeleteRoute",
      "ec2:DescribeNetworkInterfaces",
      "ec2:DescribeRouteTables",
      "ec2:DescribeVpcs",
      "ec2:ReplaceRoute",
      "ec2:UnassignPrivateIpAddresses"
    ],
    "Resource": "*"
  }
]
}

```

4. Create IAM roles with the role type Amazon EC2 and attach the policies that you created in the previous steps.

Create the role:

Similar to the policies, you should have one IAM role for the Console agent and one for the Cloud Volumes ONTAP nodes.

For HA pairs: Similar to the policies, you should have one IAM role for the Console agent, one for the Cloud Volumes ONTAP nodes, and one for the HA mediator (if you want to deploy HA pairs).

Select the role:

You must select the Console agent IAM role when you launch the instance of the Console agent. You can select the IAM roles for Cloud Volumes ONTAP when you create a Cloud Volumes ONTAP system from the Console.

For HA pairs, you can select the IAM roles for Cloud Volumes ONTAP and the HA mediator when you create a Cloud Volumes ONTAP system.

Step 3: Set up the AWS KMS

If you want to use Amazon encryption with Cloud Volumes ONTAP, ensure that requirements are met for the AWS Key Management Service (KMS).

Steps

1. Ensure that an active Customer Master Key (CMK) exists in your account or in another AWS account.

The CMK can be an AWS-managed CMK or a customer-managed CMK.

2. If the CMK is in an AWS account separate from the account where you plan to deploy Cloud Volumes ONTAP, then you need to obtain the ARN of that key.

You need to provide the ARN to the Console when you create the Cloud Volumes ONTAP system.

3. Add the IAM role for the instance to the list of key users for a CMK.

This gives the Console permissions to use the CMK with Cloud Volumes ONTAP.

Step 4: Install the Console agent and set up the Console

Before you can start using the Console to deploy Cloud Volumes ONTAP in AWS, you must install and set up the Console agent. It enables the Console to manage resources and processes within your public cloud environment (this includes Cloud Volumes ONTAP).

Steps

1. Obtain a root certificate signed by a certificate authority (CA) in the Privacy Enhanced Mail (PEM) Base-64 encoded X.509 format. Consult your organization's policies and procedures for obtaining the certificate.



For AWS Secret Cloud regions, you should upload the `NSS Root CA 2` certificate, and for Top Secret Cloud, the `Amazon Root CA 4` certificate. Ensure that you upload only these certificates and not the entire chain. The file for the certificate chain is large, and the upload can fail. If you have additional certificates, you can upload them later, as described in the next step.

You need to upload the certificate during the setup process. The Console uses the trusted certificate when sending requests to AWS over HTTPS.

2. Launch the instance of the Console agent:
 - a. Go to the AWS Intelligence Community Marketplace page for the Console.
 - b. On the Custom Launch tab, choose the option to launch the instance from the EC2 console.
 - c. Follow the prompts to configure the instance.

Note the following as you configure the instance:

- We recommend `t3.xlarge`.
- You must choose the IAM role that you created when you set up permissions.
- You should keep the default storage options.
- The required connection methods for the Console agent are as follows: SSH, HTTP, and HTTPS.

3. Set up the Console from a host that has a connection to the instance:
 - a. Open a web browser and enter `https://ipaddress` where *ipaddress* is the IP address of the Linux host where you installed the Console agent.
 - b. Specify a proxy server for connectivity to AWS services.
 - c. Upload the certificate that you obtained in step 1.
 - d. Follow the prompts to set up a new system.
 - **System Details:** Enter a name for the Console agent and your company name.
 - **Create Admin User:** Create the admin user for the system.

This user account runs locally on the system. There's no connection to the `auth0` service available through the Console.

- **Review:** Review the details, accept the license agreement, and then select **Set Up**.
 - e. To complete installation of the CA-signed certificate, restart the Console agent instance from the EC2 console.
4. After the Console agent restarts, log in using the administrator user account that you created in the Setup wizard.

Step 5: (optional) Install a private mode certificate

This step is optional for AWS Secret Cloud and Top Secret Cloud regions, and is required only if you have additional certificates apart from the root certificates that you installed in the previous step.

Steps

1. List existing installed certificates.
 - a. To collect the occm container docker id (identified name “ds-occm-1”), run the following command:

```
docker ps
```

- b. To get inside occm container, run the following command:

```
docker exec -it <docker-id> /bin/sh
```

- c. To collect the password from “TRUST_STORE_PASSWORD” environment variable, run the following command:

```
env
```

- d. To list all installed certificates in truststore, run the following command and use the password collected in the previous step:

```
keytool -list -v -keystore occm.truststore
```

2. Add a certificate.

- a. To collect occm container docker id (identified name “ds-occm-1”), run the following command:

```
docker ps
```

- b. To get inside occm container, run the following command:

```
docker exec -it <docker-id> /bin/sh
```

Save the new certificate file inside.

- c. To collect the password from “TRUST_STORE_PASSWORD” environment variable, run the following command:

```
env
```

- d. To add the certificate to the truststore, run the following command and use the password from the previous step:

```
keytool -import -alias <alias-name> -file <certificate-file-name>  
-keystore occm.truststore
```

- e. To check that the certificate installed, run the following command:

```
keytool -list -v -keystore occm.truststore -alias <alias-name>
```

- f. To exit occm container, run the following command:

```
exit
```

- g. To reset occm container, run the following command:

```
docker restart <docker-id>
```

Step 6: Add a license to the Console

If you purchased a license from NetApp, you need to add it to the Console, so that you can select the license when you create a new Cloud Volumes ONTAP system. These licenses remain unassigned until you associate them with a new Cloud Volumes ONTAP system.

Steps

1. From the left navigation menu, select **Licenses and subscriptions**.
2. On the **Cloud Volumes ONTAP** panel, select **View**.
3. On the **Cloud Volumes ONTAP** tab, select **Licenses > Node Based Licenses**.
4. Click **Unassigned**.
5. Click **Add Unassigned Licenses**.
6. Enter the serial number of the license or upload the license file.
7. If you don't have the license file yet, you'll need to manually upload the license file from netapp.com.
 - a. Go to the [NetApp License File Generator](#) and log in using your NetApp Support Site credentials.
 - b. Enter your password, choose your product, enter the serial number, confirm that you have read and accepted the privacy policy, and then click **Submit**.

c. Choose whether you want to receive the serialnumber.NLF JSON file through email or direct download.

8. Click **Add License**.

Result

The Console adds the license as unassigned until you associate it with a new Cloud Volumes ONTAP system. You can see the license on the left navigation menu under **Licenses and subscriptions > Cloud Volumes ONTAP > View > Licenses**.

Step 7: Launch Cloud Volumes ONTAP from the Console

You can launch Cloud Volumes ONTAP instances in AWS Secret Cloud and Top Secret Cloud by creating new systems in the Console.

Before you begin

For HA pairs, a key pair is required to enable key-based SSH authentication to the HA mediator.

Steps

1. On the **Systems** page, click **Add System**.
2. Under **Create**, select Cloud Volumes ONTAP.

For HA: Under **Create**, select Cloud Volumes ONTAP or Cloud Volumes ONTAP HA.

3. Complete the steps in the wizard to launch the Cloud Volumes ONTAP system.



While making selections through the wizard, do not select **Data Sense & Compliance** and **Backup to Cloud** under **Services**. Under **Preconfigured Packages**, select **Change Configuration** only, and ensure that you haven't selected any other option. Preconfigured packages aren't supported in AWS Secret Cloud and Top Secret Cloud regions, and if selected, your deployment will fail.

Notes for deploying Cloud Volumes ONTAP HA in multiple Availability Zones

Note the following as you complete the wizard for HA pairs.

- You should configure a transit gateway when you deploy Cloud Volumes ONTAP HA in multiple Availability Zones (AZs). For instructions, refer to [Set up an AWS transit gateway](#).
- Deploy the configuration as the following because only two AZs were available in the AWS Top Secret Cloud at the time of publication:
 - Node 1: Availability Zone A
 - Node 2: Availability Zone B
 - Mediator: Availability Zone A or B

Notes for deploying Cloud Volumes ONTAP in both single and HA nodes

Note the following as you complete the wizard:

- You should leave the default option to use a generated security group.

The predefined security group includes the rules that Cloud Volumes ONTAP needs to operate successfully. If you have a requirement to use your own, you can refer to the security group section below.

- You must choose the IAM role that you created when preparing your AWS environment.

- The underlying AWS disk type is for the initial Cloud Volumes ONTAP volume.

You can choose a different disk type for subsequent volumes.

- The performance of AWS disks is tied to disk size.

You should choose the disk size that gives you the sustained performance that you need. Refer to the AWS documentation for more details about EBS performance.

- The disk size is the default size for all disks on the system.



If you need a different size later, you can use the Advanced allocation option to create an aggregate that uses disks of a specific size.

Result

The Cloud Volumes ONTAP instance is launched. You can track the progress in the **Audit** page.

Step 8: Install security certificates for data tiering

You need to manually install security certificates for enabling data tiering in AWS Secret Cloud and Top Secret Cloud regions.

Before you begin

1. Create S3 buckets.



Ensure that the bucket names are prefixed with `fabric-pool-`. For example `fabric-pool-testbucket`.

2. Keep the root certificates that you installed in `step 4` handy.

Steps

1. Copy the text from the root certificates that you installed in `step 4`.
2. Securely connect to the Cloud Volumes ONTAP system by using the CLI.
3. Install the root certificates. You might need to press the `ENTER` key multiple times:

```
security certificate install -type server-ca -cert-name <certificate-name>
```

4. When prompted, enter the entire copied text, including and from `----- BEGIN CERTIFICATE -----` to `----- END CERTIFICATE -----`.
5. Keep a copy of the CA-signed digital certificate for future reference.
6. Retain the CA name and certificate serial number.
7. Configure the object store for AWS Secret Cloud and Top Secret Cloud regions: `set -privilege advanced -confirmations off`
8. Run this command to configure the object store.



All Amazon Resource Names (ARNs) should be suffixed with `-iso-b`, such as `arn:aws-iso-b`. For example, if a resource requires an ARN with a region, for Top Secret Cloud, use the naming convention as `us-iso-b` for the `-server` flag. For AWS Secret Cloud, use `us-iso-b-1`.

```
storage aggregate object-store config create -object-store-name
<S3Bucket> -provider-type AWS_S3 -auth-type EC2-IAM -server <s3.us-iso-
b-1.server_name> -container-name <fabric-pool-testbucket> -is-ssl
-enabled true -port 443
```

9. Verify that the object store was created successfully: `storage aggregate object-store show -instance`
10. Attach the object store to the aggregate. This should be repeated for every new aggregate: `storage aggregate object-store attach -aggregate <aggr1> -object-store-name <S3Bucket>`

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