



# **Cloud Volumes Service for AWS**

## **Cloud Manager**

NetApp

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# Cloud Volumes Service for AWS

## Learn about Cloud Volumes Service for AWS

NetApp Cloud Volumes Service for AWS is a cloud native file service that provides NAS volumes over NFS and SMB with all-flash performance. This service enables any workload, including legacy applications, to run in the AWS cloud.



With the launch of [Amazon FSx for ONTAP](#), you can no longer create new CVS for AWS working environments in Cloud Manager. However, if you had previously added CVS for AWS working environments to Cloud Manager, you can continue to create and manage volumes.

## Benefits of using Cloud Volumes Service for AWS

Cloud Volumes Service for AWS provides the following benefits:

- Fully managed service, therefore no need to configure or manage storage devices
- Support for NFSv3 and NFSv4.1, and SMB 3.0 and 3.1.1 NAS protocols
- Secure access to Linux and Windows Elastic Container Service (ECS) instances, with support including the following:
  - Amazon Linux 2, Red Hat Enterprise Linux 7.5, SLES 12 SP3, and Ubuntu 16.04 LTS
  - Windows Server 2008 R2, Windows Server 2012 R2, and Windows Server 2016
- Choice of bundled and pay-as-you-go pricing

## Cost

Volumes created by the Cloud Volumes Service for AWS are charged based on your subscription to the service, not through Cloud Manager.

There are no charges to discover a Cloud Volumes Service for AWS region or volume from Cloud Manager.

## Quick start

Get started quickly by following these steps, or go to the next sections for full details.

1

### Verify support for your configuration

You must have set up AWS for Cloud Volumes Service and subscribed to one of the [NetApp Cloud Volumes Service offerings on the AWS Marketplace](#) and have an existing CVS for AWS working environment configured in Cloud Manager to create and manage volumes.

2

### Create, mount, and manage cloud volumes

Using an existing CVS for AWS working environment, you can create, mount, and manage cloud volumes for existing CVS for AWS subscriptions using Cloud Manager.

## Getting help

Use the Cloud Manager chat for general service questions.

For technical support issues associated with your cloud volumes, use your 20 digit “930” serial number located in the "Support" tab of the Cloud Volumes Service user interface. Use this support ID when opening a web ticket or calling for support. Be sure to activate your Cloud Volumes Service serial number for support from the Cloud Volumes Service user interface. [Those steps are explained here.](#)

## Limitations

- Cloud Manager doesn't support data replication between working environments when using Cloud Volumes Service volumes.
- Removing your Cloud Volumes Service for AWS subscription from Cloud Manager isn't supported. You can do this only through the Cloud Volumes Service for AWS interface.

## Related links

- [NetApp Cloud Central: Cloud Volumes Service for AWS](#)
- [NetApp Cloud Volumes Service for AWS documentation](#)

# Managing Cloud Volumes Service for AWS

Cloud Manager enables you to create cloud volumes based on your [Cloud Volumes Service for AWS](#) subscription. You can also discover cloud volumes that you have already created from the Cloud Volumes Service interface and add them to a working environment.



With the launch of [Amazon FSx for ONTAP](#), you can no longer create new CVS for AWS working environments in Cloud Manager. However, if you had previously added CVS for AWS working environments to Cloud Manager, you can continue to create and manage volumes.

## Create cloud volumes

For configurations where volumes already exist in the Cloud Volumes Service working environment you can use these steps to add new volumes.

For configurations where no volumes exist, you can create your first volume directly from Cloud Manager after you have set up your Cloud Volumes Service for AWS subscription. In the past, the first volume had to be created directly in the Cloud Volumes Service user interface.

### Before you begin

- If you want to use SMB in AWS, you must have set up DNS and Active Directory.
- When planning to create an SMB volume, you must have a Windows Active Directory server available to which you can connect. You will enter this information when creating the volume. Also, make sure that the Admin user is able to create a machine account in the Organizational unit (OU) path specified.
- You will need this information when creating the first volume in a new region/working environment:
  - AWS account ID: A 12-digit Amazon account identifier with no dashes. To find your account ID, refer to this [AWS topic](#).

- Classless Inter-Domain Routing (CIDR) Block: An unused IPv4 CIDR block. The network prefix must range between /16 and /28, and it must also fall within the ranges reserved for private networks (RFC 1918). Do not choose a network that overlaps your VPC CIDR allocations.

## Steps

1. Select a CVS for AWS working environment and click **Add New Volume**.



2. If you are adding the first volume to the working environment in the region, you have to add AWS networking information.
  - a. Enter the IPv4 range (CIDR) for the region.
  - b. Enter the 12-digit AWS account ID (with no dashes) to connect your Cloud Volumes account to your AWS account.
  - c. Click **Continue**.

A screenshot of the 'Network Setup' form. At the top, the title 'Network Setup' is displayed. Below it is a warning message: 'Your Cloud Volumes Service account isn't connected to your AWS account yet. Enter information about your AWS networking to connect the accounts. For details, see the [Cloud Volumes Service for AWS Account Setup document](#).' Below the warning are two input fields. The first is labeled 'CIDR (IPv4)' and contains the text '192.168.0.0/28'. The second is labeled 'AWS Account ID' and contains the text '123456789012345'.

3. The Accepting Virtual Interfaces page describes some steps you will need to perform after you add the volume so that you are prepared to complete that step. Just click **Continue** again.
4. In the Details & Tags page, enter details about the volume:
  - a. Enter a name for the volume.
  - b. Specify a size within the range of 100 GiB to 90,000 GiB (equivalent to 88 TiBs).  
[Learn more about allocated capacity.](#)
  - c. Specify a service level: Standard, Premium, or Extreme.  
[Learn more about service levels.](#)
  - d. Enter one or more tag names to categorize the volume if you want.
  - e. Click **Continue**.

5. In the Protocol page, select NFS, SMB, or Dual Protocol and then define the details. Required entries for NFS and SMB are shown in separate sections below.
6. In the Volume Path field, specify the name of the volume export you will see when you mount the volume.
7. If you select Dual-protocol you can select the security style by selecting NTFS or UNIX. Security styles affect the file permission type used and how permissions can be modified.
  - UNIX uses NFSv3 mode bits, and only NFS clients can modify permissions.
  - NTFS uses NTFS ACLs, and only SMB clients can modify permissions.
8. For NFS:
  - a. In the NFS Version field, select NFSv3, NFSv4.1, or both depending on your requirements.
  - b. Optionally, you can create an export policy to identify the clients that can access the volume. Specify the:
    - Allowed clients by using an IP address or Classless Inter-Domain Routing (CIDR).
    - Access rights as Read & Write or Read Only.
    - Access protocol (or protocols if the volume allows both NFSv3 and NFSv4.1 access) used for users.
    - Click **+ Add Export Policy Rule** if you want to define additional export policy rules.

The following image shows the Volume page filled out for the NFS protocol:

The screenshot shows the 'Protocol' configuration page. At the top, there's a section 'Select the volume's protocol:' with three radio buttons: 'NFS Protocol' (selected), 'SMB Protocol', and 'Dual Protocol'. Below this, the 'Volume Path' is set to 'vol1'. Under 'Select NFS Version:', both 'NFSv3' and 'NFSv4.1' are checked. The 'Export Policy' section contains two rules. The first rule has 'Allowed Client & Access' set to '192.168.1.2/24', 'Access' set to 'Read & Write' (selected over 'Read Only'), and 'Select NFS Version:' with 'NFSv3' checked and 'NFSv4.1' unchecked. The second rule has 'Allowed Client & Access' set to '192.168.1.22/24', 'Access' set to 'Read & Write' (selected over 'Read Only'), and 'Select NFS Version:' with 'NFSv3' unchecked and 'NFSv4.1' checked. Each rule has a close button (X) to its right.

9. For SMB:
  - a. You can enable SMB session encryption by checking the box for SMB Protocol Encryption.
  - b. You can integrate the volume with an existing Windows Active Directory server by completing the fields in the Active directory section:

Field	Description
DNS Primary IP Address	The IP addresses of the DNS servers that provide name resolution for the SMB server. Use a comma to separate the IP addresses when referencing multiple servers, for example, 172.31.25.223, 172.31.2.74..
Active Directory Domain to join	The FQDN of the Active Directory (AD) domain that you want the SMB server to join. When using AWS Managed Microsoft AD, use the value from the "Directory DNS name" field.
SMB Server NetBIOS name	A NetBIOS name for the SMB server that will be created.
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.
Organizational Unit	The organizational unit within the AD domain to associate with the SMB server. The default is CN=Computers for connections to your own Windows Active Directory server. If you configure AWS Managed Microsoft AD as the AD server for the Cloud Volumes Service, you should enter <b>OU=Computers,OU=corp</b> in this field.

The following image shows the Volume page filled out for the SMB protocol:

The screenshot shows the 'SMB Connectivity Setup' form. It contains six input fields arranged in three rows and two columns. The first row has 'DNS Primary IP Address' (127.0.0.1) and 'User Name' (administrator). The second row has 'Active Directory Domain to join' (yourdomain.com up to 107 characters) and 'Password' (empty). The third row has 'SMB Server NetBIOS Name' (WEName) and 'Organizational Unit' (CN=Computers).



You should follow the guidance on AWS security group settings to enable cloud volumes to integrate with Windows Active Directory servers correctly. See [AWS security group settings for Windows AD servers](#) for more information.

10. In the Volume from Snapshot page, if you want this volume to be created based on a snapshot of an existing volume, select the snapshot from the Snapshot Name drop-down list.
11. In the Snapshot Policy page, you can enable Cloud Volumes Service to create snapshot copies of your volumes based on a schedule. You can do this now or edit the volume later to define the snapshot policy.

See [Creating a snapshot policy](#) for more information about snapshot functionality.

12. Click **Add Volume**.

The new volume is added to the working environment.

### After you finish

If this is the first volume created in this AWS subscription, you need to launch the AWS Management Console to accept the two virtual interface that will be used in this AWS region to connect all your cloud volumes. See the [NetApp Cloud Volumes Service for AWS Account Setup Guide](#) for details.

You must accept the interfaces within 10 minutes after clicking the **Add Volume** button or the system may time out. If this happens, email [cvs-support@netapp.com](mailto:cvs-support@netapp.com) with your AWS Customer ID and NetApp Serial Number. Support will fix the issue and you can restart the onboarding process.

Then continue with [Mounting the cloud volume](#).

## Mount the cloud volume

You can mount a cloud volume to your AWS instance. Cloud volumes currently support NFSv3 and NFSv4.1 for Linux and UNIX clients, and SMB 3.0 and 3.1.1 for Windows clients.

**Note:** Please use the highlighted protocol/dialect supported by your client.

### Steps

1. Open the working environment.
2. Hover over the volume and click **Mount the volume**.

NFS and SMB volumes display mount instructions for that protocol. Dual-protocol volumes provide both sets of instructions.

3. Hover over the commands and copy them to your clipboard to make this process easier. Just add the destination directory/mount point at the end of the command.

### NFS example:



## Mount the volume - testk

### Setting up your instance

1. Open an SSH client and connect to your instance.
2. Install the nfs client on your instance.

On Red Hat Enterprise Linux or SuSE Linux instance:

```
$ sudo yum install -y nfs-utils
```

On an Ubuntu or Debian instance:

```
$ sudo apt-get install nfs-common
```

### Mounting your volume

1. Create a new directory on your instance:

```
$ sudo mkdir /dir
```

2. Mount your NFSv3 volume using the command below:

```
sudo mount -t nfs -o rw,hard,rsize=65536,wsiz=65536,vers=3,tc...
```

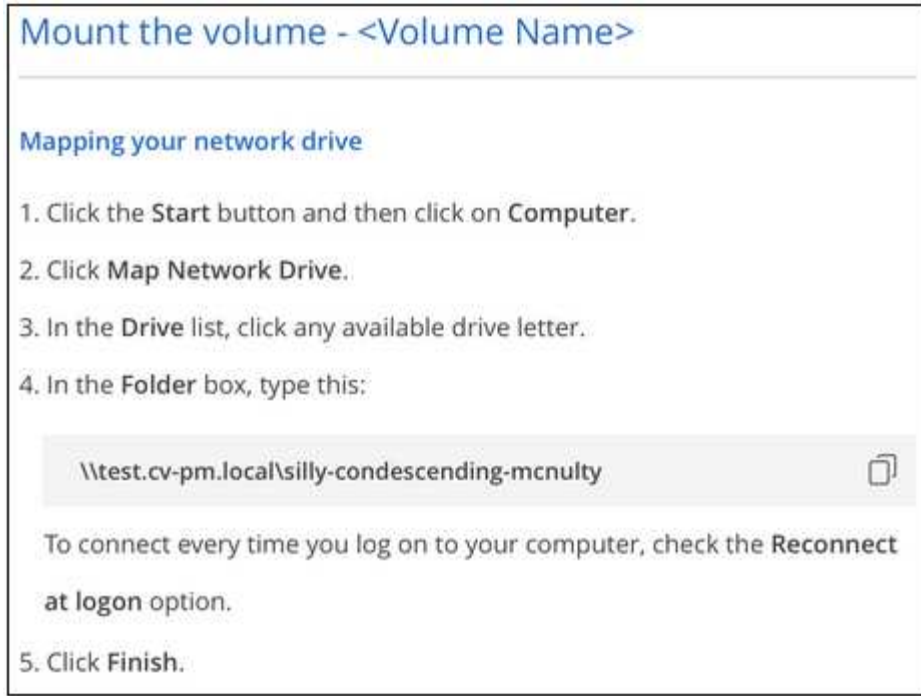
3. Mount your NFSv4.1 volume using the command below:

```
sudo mount -t nfs -o rw,hard,rsize=65536,wsiz=65536,vers=4.1,t...
```

The maximum I/O size defined by the `rsize` and `wsiz` options is 1048576, however 65536 is the recommended default for most use cases.

Note that Linux clients will default to NFSv4.1 unless the version is specified with the `vers=<nfs_version>` option.

### SMB example:



4. Connect to your Amazon Elastic Compute Cloud (EC2) instance by using an SSH or RDP client, and then follow the mount instructions for your instance.

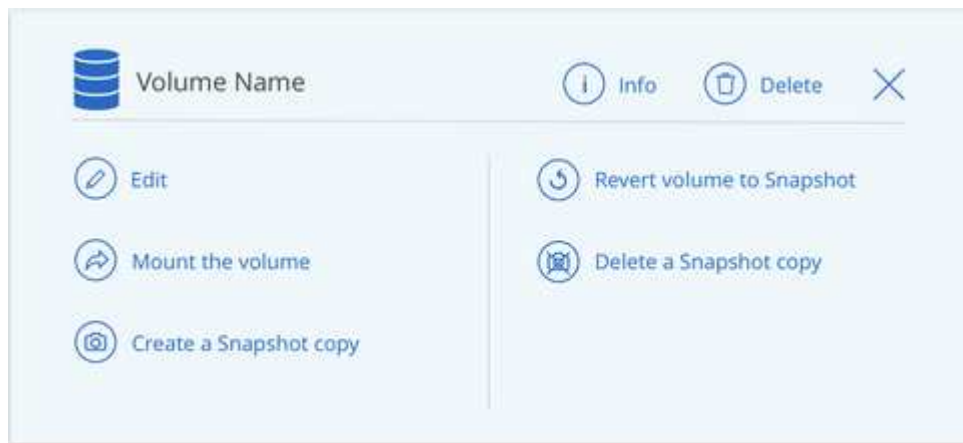
After completing the steps in the mount instructions, you have successfully mounted the cloud volume to your AWS instance.

## Managing existing volumes

You can manage existing volumes as your storage needs change. You can view, edit, restore, and delete volumes.

### Steps

1. Open the working environment.
2. Hover over the volume.



3. Manage your volumes:

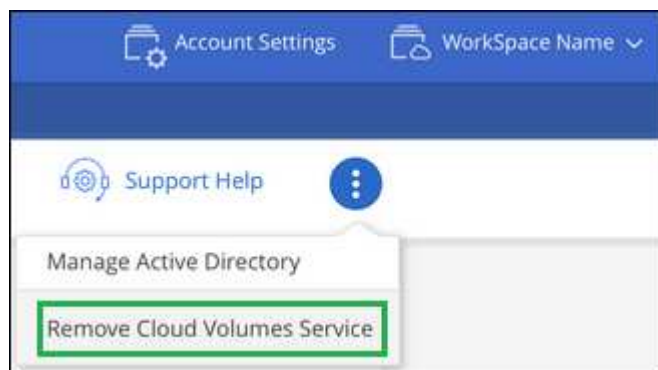
Task	Action
View information about a volume	Select a volume, and then click <b>Info</b> .
Edit a volume (including snapshot policy)	a. Select a volume, and then click <b>Edit</b> . b. Modify the volume's properties and then click <b>Update</b> .
Get the NFS or SMB mount command	a. Select a volume, and then click <b>Mount the volume</b> . b. Click <b>Copy</b> to copy the command(s).
Create a Snapshot copy on demand	a. Select a volume, and then click <b>Create a Snapshot copy</b> . b. Change the snapshot name, if needed, and then click <b>Create</b> .
Replace the volume with the contents of a Snapshot copy	a. Select a volume, and then click <b>Revert volume to Snapshot</b> . b. Select a Snapshot copy and click <b>Revert</b> .
Delete a Snapshot copy	a. Select a volume, and then click <b>Delete a Snapshot copy</b> . b. Select the Snapshot copy you want to delete and click <b>Delete</b> . c. Click <b>Delete</b> again to confirm.
Delete a volume	a. Unmount the volume from all clients: <ul style="list-style-type: none"> <li>◦ On Linux clients, use the <code>umount</code> command.</li> <li>◦ On Windows clients, click <b>Disconnect network drive</b>.</li> </ul> b. Select a volume, and then click <b>Delete</b> . c. Click <b>Delete</b> again to confirm.


## Remove Cloud Volumes Service from Cloud Manager

You can remove a Cloud Volumes Service for AWS subscription and all existing volumes from Cloud Manager. The volumes are not deleted, they are just removed from the Cloud Manager interface.

### Steps

1. Open the working environment.



2. Click the  button at the top of the page and click **Remove Cloud Volumes Service**.
3. In the confirmation dialog box, click **Remove**.

## Manage Active Directory configuration

If you change your DNS servers or Active Directory domain, you need to modify the SMB server in Cloud Volumes Services so that it can continue to serve storage to clients.

You can also delete the link to an Active Directory if you no longer need it.

### Steps

1. Open the working environment.
2. Click the  button at the top of the page and click **Manage Active Directory**.
3. If no Active Directory is configured, you can add one now. If one is configured, you can modify the settings or delete it using the  button.
4. Specify the settings for the Active Directory that you want to join:

Field	Description
DNS Primary IP Address	The IP addresses of the DNS servers that provide name resolution for the SMB server. Use a comma to separate the IP addresses when referencing multiple servers, for example, 172.31.25.223, 172.31.2.74.
Active Directory Domain to join	The FQDN of the Active Directory (AD) domain that you want the SMB server to join. When using AWS Managed Microsoft AD, use the value from the "Directory DNS name" field.
SMB Server NetBIOS name	A NetBIOS name for the SMB server that will be created.
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.
Organizational Unit	The organizational unit within the AD domain to associate with the SMB server. The default is CN=Computers for connections to your own Windows Active Directory server. If you configure AWS Managed Microsoft AD as the AD server for the Cloud Volumes Service, you should enter <b>OU=Computers,OU=corp</b> in this field.

5. Click **Save** to save your settings.

## Manage cloud volumes snapshots

You can create a snapshot policy for each volume so that you can recover or restore the entire contents of a volume from an earlier time. You can also create an on-demand snapshot of a cloud volume when needed.

## Create an on-demand snapshot

You can create an on-demand snapshot of a cloud volume if you want to create a snapshot with the current volume state.

### Steps

1. Open the working environment.
2. Hover over the volume and click **Create a snapshot copy**.
3. Enter a name for the snapshot, or use the automatically generated name, and click **Create**.



Create a Snapshot Copy - <Volume Name>

A NetApp Snapshot copy is a read-only, point-in-time image of a volume. The image protects your data with no performance impact and requires minimal storage.

Snapshot Copy Name

manually.2020-05-04\_1722

Create

## Create or modify a snapshot policy

You can create or modify a snapshot policy as necessary for a cloud volume. You define the snapshot policy from the *Snapshot Policy* tab either when creating a volume or when editing a volume.

### Steps

1. Open the working environment.
2. Hover over the volume and click **Edit**.
3. From the *Snapshot Policy* tab, move the enable snapshots slider to the right.
4. Define the schedule for snapshots:
  - a. Select the frequency: **Hourly**, **Daily**, **Weekly**, or **Monthly**
  - b. Select the number of snapshots you want to keep.
  - c. Select the day, hour, and minute when the snapshot should be taken.

**Schedule Snapshot Policies:**

<input checked="" type="checkbox"/> <b>Hourly</b>	Number of Snapshot to Keep	Minute	
	<input type="text" value="12"/>	<input type="text" value="30"/>	
<input type="checkbox"/> <b>Daily</b>	Number of Snapshot to Keep	Hour	Minute
	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>
<input checked="" type="checkbox"/> <b>Weekly</b>	Number of Snapshot to Keep	Days	Hour Minute
	<input type="text" value="3"/>	<div>Sunday x</div>	<input type="text" value="0"/> <input type="text" value="0"/>
<input type="checkbox"/> <b>Monthly</b>	Number of Snapshot to Keep		Hour Minute
	<input type="text" value="0"/>	<div> <input type="checkbox"/> Sunday  <input type="checkbox"/> Monday  <input type="checkbox"/> Tuesday </div>	<input type="text" value="0"/> <input type="text" value="0"/>

5. Click **Add volume** or **Update volume** to save your policy settings.

## Disable a snapshot policy

You can disable a snapshot policy to stop snapshots from being created for a short period of time while retaining your snapshot policy settings.

### Steps

1. Open the working environment.
2. Hover over the volume and click **Edit**.
3. From the *Snapshot Policy* tab, move the enable snapshots slider to the left.

Enable automatic Snapshot copies

When disabled, Cloud Volumes Service does not create Snapshot copies of your volumes.

4. Click **Update volume**.

When you want to re-enable the snapshot policy, move the enable snapshots slider to the right and click **Update volume**.

## Delete a snapshot

You can delete a snapshot from the Volumes page.

### Steps

1. Open the working environment.
2. Hover over the volume and click **Delete a Snapshot copy**.
3. Select the snapshot from the drop-down list and click **Delete**.



The screenshot shows a dialog box titled "Delete a Snapshot Copy - <Volume Name>". Inside the dialog, there is a message: "This action deletes the selected Snapshot copy." Below this message, there is a label "Snapshot Name" followed by a dropdown menu. The dropdown menu currently displays the text "manually.2020-05-04\_1722" and has a small downward arrow on the right. At the bottom right of the dialog box, there is a blue button labeled "Delete".

4. In the confirmation dialog box, click **Delete**.

### Revert a volume from a snapshot

You can revert a volume to an earlier point in time from an existing snapshot.

When you revert a volume, the content of the snapshot overwrites the existing volume configuration. Any changes that were made to the data in the volume after the snapshot was created are lost.

Note that clients do not need to remount the volume after the revert operation.

### Steps

1. Open the working environment.
2. Hover over the volume and click **Revert volume to Snapshot**.
3. Select the snapshot that you want to use to restore the existing volume from the drop-down list and click **Revert**.

Revert volume to Snapshot - <Volume Name>

! This action reverts the volume to a previous state. Any data saved after the Snapshot copy was created will be lost. This action can't be reversed.

Snapshot Name

- Select a snapshot copy -

Revert

## Reference

### Service levels and allocated capacity

The cost for Cloud Volumes Service for AWS is based on the *service level* and the *allocated capacity* that you select. Selecting the appropriate service level and capacity helps you meet your storage needs at the lowest cost.

### Considerations

Storage needs include two fundamental aspects:

- The storage *capacity* for holding data
- The storage *bandwidth* for interacting with data

If you consume more storage space than the capacity you selected for the volume, the following considerations apply:

- You will be billed for the additional storage capacity that you consume at the price defined by your service level.
- The amount of storage bandwidth available to the volume does not increase until you increase the allocated capacity size or change the service level.

### Service levels

Cloud Volumes Service for AWS supports three service levels. You specify your service level when you create or modify the volume.

The service levels are catered to different storage capacity and storage bandwidth needs:

- **Standard** (capacity)

If you want capacity at the lowest cost, and your bandwidth needs are limited, then the Standard service level might be most appropriate for you. An example is using the volume as a backup target.



- Bandwidth: 16 KB of bandwidth per GB provisioned capacity

- **Premium** (a balance of capacity and performance)

If your application has a balanced need for storage capacity and bandwidth, then the Premium service level might be most appropriate for you. This level is less expensive per MB/s than the Standard service level, and it is also less expensive per GB of storage capacity than the Extreme service level.

- Bandwidth: 64 KB of bandwidth per GB provisioned capacity

- **Extreme** (performance)

The Extreme service level is least expensive in terms of storage bandwidth. If your application demands storage bandwidth without the associated demand for lots of storage capacity, then the Extreme service level might be most appropriate for you.

- Bandwidth: 128 KB of bandwidth per GB provisioned capacity

## **Allocated capacity**

You specify your allocated capacity for the volume when you create or modify the volume.

While you would select your service level based on your general, high-level business needs, you should select your allocated capacity size based on the specific needs of applications, for example:

- How much storage space the applications need
- How much storage bandwidth per second the applications or the users require

Allocated capacity is specified in GBs. A volume's allocated capacity can be set within the range of 100 GB to 100,000 GB (equivalent to 100 TBs).

## **Number of inodes**

Volumes less than or equal to 1 TB can use up to 20 million inodes. The number of inodes increase by 20 million for each TB you allocate, up to a maximum of 100 million inodes.

- <= 1TB = 20 million inodes
- >1 TB to 2 TB = 40 million inodes
- >2 TB to 3 TB = 60 million inodes
- >3 TB to 4 TB = 80 million inodes
- >4 TB to 100 TB = 100 million inodes

## **Bandwidth**

The combination of both the service level and the allocated capacity you select determines the maximum bandwidth for the volume.

If your applications or users need more bandwidth than your selections, you can change the service level or increase the allocated capacity. The changes do not disrupt data access.

## **Selecting the service level and the allocated capacity**

To select the most appropriate service level and allocated capacity for your needs, you need to know how much capacity and bandwidth you require at the peak or the edge.

### List of service levels and allocated capacity

The leftmost column indicates the capacity, and the other columns define the MB/s available at each capacity point based on service level.

See [Contract subscription pricing](#) and [Metered subscription pricing](#) for complete details on pricing.

Capacity (TB)	Standard (MB/s)	Premium (MB/s)	Extreme (MB/s)
0.1 (100 GB)	1.6	6.4	12.8
1	16	64	128
2	32	128	256
3	48	192	384
4	64	256	512
5	80	320	640
6	96	384	768
7	112	448	896
8	128	512	1,024
9	144	576	1,152
10	160	640	1,280
11	176	704	1,408
12	192	768	1,536
13	208	832	1,664
14	224	896	1,792
15	240	960	1,920
16	256	1,024	2,048
17	272	1,088	2,176
18	288	1,152	2,304
19	304	1,216	2,432
20	320	1,280	2,560
21	336	1,344	2,688
22	352	1,408	2,816
23	368	1,472	2,944
24	384	1,536	3,072
25	400	1,600	3,200
26	416	1,664	3,328
27	432	1,728	3,456
28	448	1,792	3,584

Capacity (TB)	Standard (MB/s)	Premium (MB/s)	Extreme (MB/s)
29	464	1,856	3,712
30	480	1,920	3,840
31	496	1,984	3,968
32	512	2,048	4,096
33	528	2,112	4,224
34	544	2,176	4,352
35	560	2,240	4,480
36	576	2,304	4,500
37	592	2,368	4,500
38	608	2,432	4,500
39	624	2,496	4,500
40	640	2,560	4,500
41	656	2,624	4,500
42	672	2,688	4,500
43	688	2,752	4,500
44	704	2,816	4,500
45	720	2,880	4,500
46	736	2,944	4,500
47	752	3,008	4,500
48	768	3,072	4,500
49	784	3,136	4,500
50	800	3,200	4,500
51	816	3,264	4,500
52	832	3,328	4,500
53	848	3,392	4,500
54	864	3,456	4,500
55	880	3,520	4,500
56	896	3,584	4,500
57	912	3,648	4,500
58	928	3,712	4,500
59	944	3,776	4,500
60	960	3,840	4,500
61	976	3,904	4,500

Capacity (TB)	Standard (MB/s)	Premium (MB/s)	Extreme (MB/s)
62	992	3,968	4,500
63	1,008	4,032	4,500
64	1,024	4,096	4,500
65	1,040	4,160	4,500
66	1,056	4,224	4,500
67	1,072	4,288	4,500
68	1,088	4,352	4,500
69	1,104	4,416	4,500
70	1,120	4,480	4,500
71	1,136	4,500	4,500
72	1,152	4,500	4,500
73	1,168	4,500	4,500
74	1,184	4,500	4,500
75	1,200	4,500	4,500
76	1,216	4,500	4,500
77	1,232	4,500	4,500
78	1,248	4,500	4,500
79	1,264	4,500	4,500
80	1,280	4,500	4,500
81	1,296	4,500	4,500
82	1,312	4,500	4,500
83	1,328	4,500	4,500
84	1,344	4,500	4,500
85	1,360	4,500	4,500
86	1,376	4,500	4,500
87	1,392	4,500	4,500
88	1,408	4,500	4,500
89	1,424	4,500	4,500
90	1,440	4,500	4,500
91	1,456	4,500	4,500
92	1,472	4,500	4,500
93	1,488	4,500	4,500
94	1,504	4,500	4,500

Capacity (TB)	Standard (MB/s)	Premium (MB/s)	Extreme (MB/s)
95	1,520	4,500	4,500
96	1,536	4,500	4,500
97	1,552	4,500	4,500
98	1,568	4,500	4,500
99	1,584	4,500	4,500
100	1,600	4,500	4,500

#### Example 1

For example, your application requires 25 TB of capacity and 100 MB/s of bandwidth. At 25 TB of capacity, the Standard service level would provide 400 MB/s of bandwidth at a cost of \$2,500 (estimate: see current pricing), making Standard the most suitable service level in this case.

#### Example 2

For example, your application requires 12 TB of capacity and 800 MB/s of peak bandwidth. Although the Extreme service level can meet the demands of the application at the 12 TB mark, it is more cost-effective (estimate: see current pricing) to select 13 TB at the Premium service level.

## AWS security group settings for Windows AD servers

If you use Windows Active Directory (AD) servers with cloud volumes, you should familiarize yourself with the guidance on AWS security group settings. The settings enable cloud volumes to integrate with AD correctly.

By default, the AWS security group applied to an EC2 Windows instance does not contain inbound rules for any protocol except RDP. You must add rules to the security groups that are attached to each Windows AD instance to enable inbound communication from Cloud Volumes Service. The required ports are as follows:

Service	Port	Protocol
AD Web Services	9389	TCP
DNS	53	TCP
DNS	53	UDP
ICMPv4	N/A	Echo Reply
Kerberos	464	TCP
Kerberos	464	UDP
Kerberos	88	TCP
Kerberos	88	UDP
LDAP	389	TCP

Service	Port	Protocol
LDAP	389	UDP
LDAP	3268	TCP
NetBIOS name	138	UDP
SAM/LSA	445	TCP
SAM/LSA	445	UDP
Secure LDAP	636	TCP
Secure LDAP	3269	TCP
w32time	123	UDP

If you are deploying and managing your AD installation domain controllers and member servers on an AWS EC2 instance, you will require several security group rules to allow traffic for the Cloud Volumes Service. Below is an example of how to implement these rules for AD applications as part of the AWS CloudFormation template.

```
{
  "AWSTemplateFormatVersion" : "2010-09-09",
  "Description" : "Security Group for AD",
  "Parameters" :
  {
    "VPC" :
    {
      "Type" : "AWS::EC2::VPC::Id",
      "Description" : "VPC where the Security Group will belong:"
    },
    "Name" :
    {
      "Type" : "String",
      "Description" : "Name Tag of the Security Group:"
    },
    "Description" :
    {
      "Type" : "String",
      "Description" : "Description Tag of the Security Group:",
      "Default" : "Security Group for Active Directory for CVS "
    },
    "CIDRrangeforTCPandUDP" :
    {
      "Type" : "String",
      "Description" : "CIDR Range for the UDP ports
445,138,464,389,53,123 and for the TCP ports
464,339,3389,3268,88,636,9389,445 and 0-65535: *CIDR range format:
10.0.0.0/24"
```

```

    }
  },
  "Resources" :
  {
    "ADSGWest" :
    {
      "Type" : "AWS::EC2::SecurityGroup",
      "Properties" :
      {
        "GroupDescription" : {"Ref" : "Description"},
        "VpcId" : { "Ref" : "VPC" },
        "SecurityGroupIngress" : [
          {
            "IpProtocol" : "udp",
            "CidrIp" : {"Ref" : "CIDRrangeforTCPandUDP"},
            "FromPort" : "445",
            "ToPort" : "445"
          },
          {
            "IpProtocol" : "udp",
            "CidrIp" : {"Ref" : "CIDRrangeforTCPandUDP"},
            "FromPort" : "138",
            "ToPort" : "138"
          },
          {
            "IpProtocol" : "udp",
            "CidrIp" : {"Ref" : "CIDRrangeforTCPandUDP"},
            "FromPort" : "464",
            "ToPort" : "464"
          },
          {
            "IpProtocol" : "tcp",
            "CidrIp" : {"Ref" : "CIDRrangeforTCPandUDP"},
            "FromPort" : "464",
            "ToPort" : "464"
          },
          {
            "IpProtocol" : "udp",
            "CidrIp" : {"Ref" : "CIDRrangeforTCPandUDP"},
            "FromPort" : "389",
            "ToPort" : "389"
          },
          {
            "IpProtocol" : "udp",
            "CidrIp" : {"Ref" : "CIDRrangeforTCPandUDP"},
            "FromPort" : "53",

```

```

        "ToPort" : "53"
    },
    {
        "IpProtocol" : "tcp",
        "CidrIp" : {"Ref" : "CIDRrangeforTCPandUDP"},
        "FromPort" : "339",
        "ToPort" : "339"
    },
    {
        "IpProtocol" : "udp",
        "CidrIp" : {"Ref" : "CIDRrangeforTCPandUDP"},
        "FromPort" : "123",
        "ToPort" : "123"
    },
    {
        "IpProtocol" : "tcp",
        "CidrIp" : {"Ref" : "CIDRrangeforTCPandUDP"},
        "FromPort" : "3389",
        "ToPort" : "3389"
    },
    {
        "IpProtocol" : "tcp",
        "CidrIp" : {"Ref" : "CIDRrangeforTCPandUDP"},
        "FromPort" : "3268",
        "ToPort" : "3268"
    },
    {
        "IpProtocol" : "tcp",
        "CidrIp" : {"Ref" : "CIDRrangeforTCPandUDP"},
        "FromPort" : "88",
        "ToPort" : "88"
    },
    {
        "IpProtocol" : "tcp",
        "CidrIp" : {"Ref" : "CIDRrangeforTCPandUDP"},
        "FromPort" : "636",
        "ToPort" : "636"
    },
    {
        "IpProtocol" : "tcp",
        "CidrIp" : {"Ref" : "CIDRrangeforTCPandUDP"},
        "FromPort" : "3269",
        "ToPort" : "3269"
    },
    {
        "IpProtocol" : "tcp",

```



```

        "CidrIp" : { "Ref" : "CIDRrangeforTCPandUDP" },
        "FromPort" : "53",
        "ToPort" : "53"
    },
    {
        "IpProtocol" : "tcp",
        "CidrIp" : { "Ref" : "CIDRrangeforTCPandUDP" },
        "FromPort" : "0",
        "ToPort" : "65535"
    },
    {
        "IpProtocol" : "tcp",
        "CidrIp" : { "Ref" : "CIDRrangeforTCPandUDP" },
        "FromPort" : "9389",
        "ToPort" : "9389"
    },
    {
        "IpProtocol" : "tcp",
        "CidrIp" : { "Ref" : "CIDRrangeforTCPandUDP" },
        "FromPort" : "445",
        "ToPort" : "445"
    }
    ]
}

}

},
"Outputs" :
{
    "SecurityGroupID" :
    {
        "Description" : "Security Group ID",
        "Value" : { "Ref" : "ADSGWest" }
    }
}
}

```

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