



# **FlexGroup volumes management with the CLI**

**ONTAP 9**

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# FlexGroup volumes management with the CLI

## FlexGroup volumes management overview with the CLI

You can set up, manage, and protect FlexGroup volumes for scalability and performance. A FlexGroup volume is a scale-out volume that provides high performance along with automatic load distribution.

You can configure FlexGroup volumes if the following are true:

- You are running ONTAP 9.1 or later.
- You want to use NFSv4.x, NFSv3, SMB 2.0, or SMB 2.1.
- You want to use the ONTAP command-line interface (CLI), not System Manager or an automated scripting tool.

Details about command syntax are available from the CLI help and the ONTAP man pages.

An important subset of FlexGroup functionality is available in System Manager.

- You want to use best practices, not explore every available option.
- You have cluster administrator privileges, not SVM administrator privileges.



FlexGroups replace Infinite Volumes, which are not supported in newer versions of ONTAP.

### Related information

Conceptual information about FlexVol volumes is applicable to FlexGroup volumes. Information about FlexVol volumes and ONTAP technology is available in the ONTAP Reference Library and in Technical Reports (TRs).

## What a FlexGroup volume is

A FlexGroup volume is a scale-out NAS container that provides high performance along with automatic load distribution and scalability. A FlexGroup volume contains several constituents that automatically and transparently share the traffic.



FlexGroup volumes provide the following benefits:

- High scalability

The maximum size for a FlexGroup volume in ONTAP 9.1 and later is 20 PB, with 400 billion files on a 10-node cluster.

- High performance

FlexGroup volumes can utilize the resources of the cluster to serve workloads that have high throughput and low latency.

- Simplified management

A FlexGroup volume is a single namespace container that can be managed in a similar way as FlexVol volumes.

## Supported and unsupported configurations for FlexGroup volumes

You should be aware of the ONTAP features that are supported and not supported with FlexGroup volumes in ONTAP 9.

### Features supported beginning with ONTAP 9.11.1

- SnapLock volumes

SnapLock does not support the following features with FlexGroup volumes:

- Legal-hold
- Event-based retention
- SnapLock for SnapVault

You configure SnapLock at the FlexGroup level. You cannot configure SnapLock at the constituent level.

#### [What SnapLock is](#)

- Client asynchronous directory delete

[Manage client rights to delete directories rapidly](#)

### Features supported beginning with ONTAP 9.10.1

- Convert FlexVol volumes to FlexGroup volumes in an SVM-DR source

[Convert a FlexVol volume to a FlexGroup volume within an SVM-DR relationship](#)

- SVM-DR FlexClone support for FlexGroup volumes

[Learn more about creating FlexClone volumes.](#)

## Features supported beginning with ONTAP 9.9.1

- SVM disaster recovery

Cloning a FlexGroup volume that is part of an SVM-DR relationship is not supported.

- SnapMirror fanout relationships of 2 or more (A to B, A to C), with a maximum of 8 fanout legs.

[Considerations for creating SnapMirror cascade and fanout relationships for FlexGroups](#)

- SnapMirror cascading relationships up to two levels (A to B to C)

[Considerations for creating SnapMirror cascade and fanout relationships for FlexGroups](#)

## Features supported beginning with ONTAP 9.8

- Restoring a single file from a FlexGroup SnapMirror vault or from a UDP destination
  - Restore can be from a FlexGroup volume of any geometry to FlexGroup volume of any geometry
  - Only one file per restore operation is supported
- Converting volumes transitioned from 7-mode systems to FlexGroup volumes

Converting transitioned volumes to FlexGroup volumes requires diag mode and should be performed only under NetApp Support supervision. It is highly recommended that you contact NetApp Support before you proceed with the conversion process.

- NFSv4.2
- Asynchronous delete of files and directories
- Files System Analytics (FSA)
- FlexGroup as a VMware vSphere datastore
- Additional support for tape backup and restore using NDMP, including the following features:
  - NDMP restartable backup extension (RBE) and Snapshot Management Extension (SSME)
  - Environment variables EXCLUDE and MULTI\_SUBTREE\_NAMES support FlexGroup backups
  - Introduction of IGNORE\_CTIME\_MTIME environment variable for FlexGroup backups
  - Individual file recovery in a FlexGroup using the NDMP\_SNAP\_RECOVER message, which is part of extension 0x2050 Dump and restore sessions are aborted during an upgrade or revert.

## Features supported beginning with ONTAP 9.7

- FlexClone volume
- NFSv4 and NFSv4.1
- pNFS
- Tape backup and restore by using NDMP

You must be aware of the following points for NDMP support on FlexGroup volumes:

- The NDMP\_SNAP\_RECOVER message in the extension class 0x2050 can be used only for recovering an entire FlexGroup volume.

Individual files in a FlexGroup volume cannot be recovered.

- NDMP restartable backup extension (RBE) is not supported for FlexGroup volumes.
- Environment variables EXCLUDE and MULTI\_SUBTREE\_NAMES are not supported for FlexGroup volumes.
- The `ndmpcopy` command is supported for data transfer between FlexVol and FlexGroup volumes.

If you revert from Data ONTAP 9.7 to an earlier version, the incremental transfer information of the previous transfers is not retained and therefore, you must perform a baseline copy after reverting.

- VMware vStorage APIs for Array Integration (VAAI)
- Conversion of a FlexVol volume to a FlexGroup volume
- FlexGroup volumes as FlexCache origin volumes

## Features supported beginning with ONTAP 9.6

- Continuously available SMB shares
- MetroCluster configurations
- Renaming a FlexGroup volume (`volume rename` command)
- Shrinking or reducing the size of a FlexGroup volume (`volume size` command)
- Elastic sizing
- NetApp aggregate encryption (NAE)
- Cloud Volumes ONTAP

## Features supported beginning with ONTAP 9.5

- ODX copy offload
- Storage-Level Access Guard
- Enhancements to change notifications for SMB shares

Change notifications are sent for changes to the parent directory on which the `changenotify` property is set and for changes to all of the subdirectories in that parent directory.

- FabricPool
- Quota enforcement
- Qtree statistics
- Adaptive QoS for files in FlexGroup volumes
- FlexCache (cache only; FlexGroup as origin supported in ONTAP 9.7)

## Features supported beginning with ONTAP 9.4

- FPolicy
- File auditing
- Throughput floor (QoS Min) and adaptive QoS for FlexGroup volumes
- Throughput ceiling (QoS Max) and throughput floor (QoS Min) for files in FlexGroup volumes

You use the `volume file modify` command to manage the QoS policy group that is associated with a file.

- Relaxed SnapMirror limits
- SMB 3.x multichannel

## Features supported beginning with ONTAP 9.3

- Antivirus configuration
- Change notifications for SMB shares

Notifications are sent only for changes to the parent directory on which the `changenotify` property is set. Change notifications are not sent for changes to subdirectories in the parent directory.

- Qtrees
- Throughput ceiling (QoS Max)
- Expand the source FlexGroup volume and destination FlexGroup volume in a SnapMirror relationship
- SnapVault backup and restore
- Unified data protection relationships
- Autogrow option and autoshrink option
- Inode count factored to ingest

## Feature supported beginning with ONTAP 9.2

- Volume encryption
- Aggregate inline deduplication (cross-volume deduplication)
- NetApp volume encryption (NVE)

## Features supported beginning with ONTAP 9.1

FlexGroup volumes were introduced in ONTAP 9.1, with support for several ONTAP features.

- SnapMirror technology
- Snapshot copies
- Active IQ
- Inline adaptive compression
- Inline deduplication
- Inline data compaction
- AFF
- Quota reporting
- NetApp Snapshot technology
- SnapRestore software (FlexGroup level)
- Hybrid aggregates
- Constituent or member volume move

- Postprocess deduplication
- NetApp RAID-TEC technology
- Per-aggregate consistency point
- Sharing FlexGroup with FlexVol volume in the same SVM

## Unsupported configurations in ONTAP 9

Unsupported protocols	Unsupported data protection features	Other unsupported ONTAP features
<ul style="list-style-type: none"> <li>• pNFS (ONTAP 9.0 to 9.6)</li> <li>• SMB 1.0</li> <li>• SMB transparent failover (ONTAP 9.0 to 9.5)</li> <li>• SAN</li> </ul>	<ul style="list-style-type: none"> <li>• SnapLock volumes (ONTAP 9.10.1 and earlier)</li> <li>• SMTape</li> </ul>	Remote Volume Shadow Copy Service (VSS)

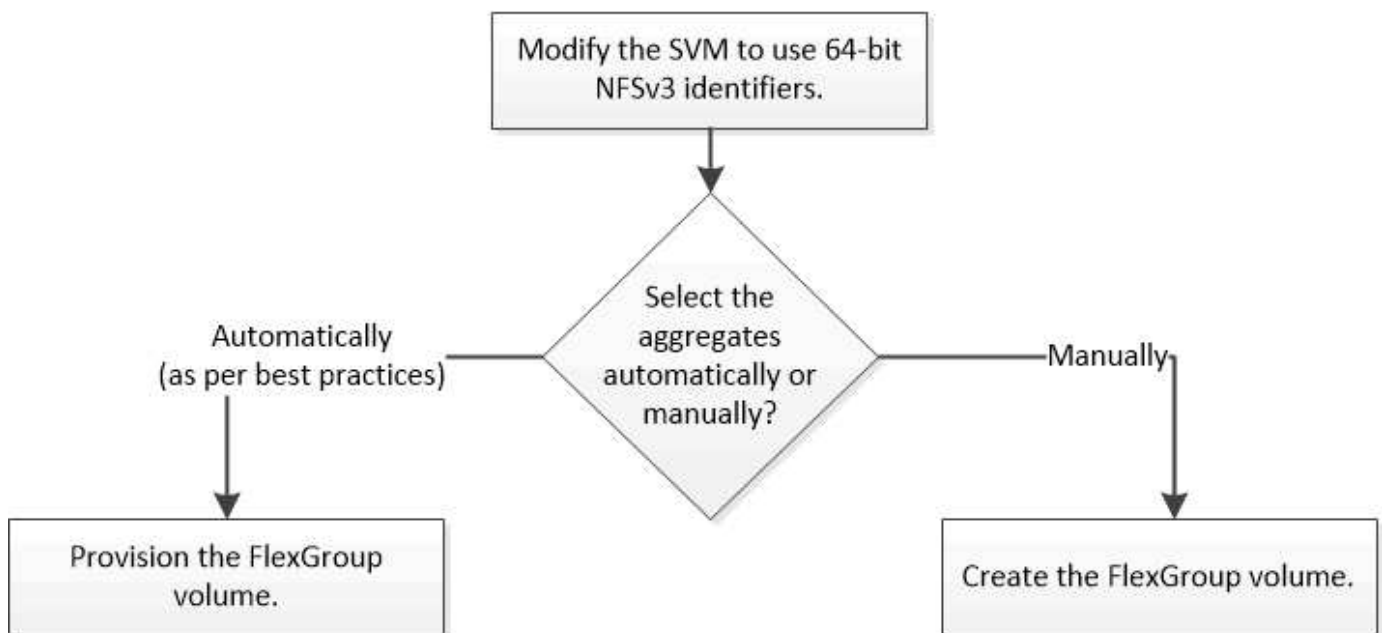
### Related information

[ONTAP 9 Documentation Center](#)

## FlexGroup volume setup

### FlexGroup volume setup workflow

You can either provision a FlexGroup volume where ONTAP automatically selects the aggregates based on the best practices for optimum performance, or create a FlexGroup volume by manually selecting the aggregates and configuring it for data access.



### What you'll need

You must have created the SVM with NFS and SMB added to the list of allowed protocols for the SVM.



### About this task

You can automatically provision a FlexGroup volume only on clusters with four nodes or less. On clusters with more than four nodes, you must create a FlexGroup volume manually.

## Enable 64-bit NFSv3 identifiers on an SVM

To support the high file count of FlexGroup volumes and to avoid file ID collisions, you should enable 64-bit file identifiers on the SVM on which the FlexGroup volume must be created.

### Steps

1. Log in to the advanced privilege level: `set -privilege advanced`
2. Modify the SVM to use 64-bit NFSv3 FSIDs and file IDs: `vserver nfs modify -vserver svm_name -v3-64bit-identifiers enabled`

```
cluster1::*> vserver nfs modify -vserver vs0 -v3-64bit-identifiers
enabled
```

```
Warning: You are attempting to increase the number of bits used for
NFSv3
```

```
        FSIDs and File IDs from 32 to 64 on Vserver "vs0". This could
        result in older client software no longer working with the
volumes
```

```
        owned by Vserver "vs0".
Do you want to continue? {y|n}: y
```

```
Warning: Based on the changes you are making to the NFS server on
Vserver
```

```
        "vs0", it is highly recommended that you remount all NFSv3
clients
```

```
        connected to it after the command completes.
Do you want to continue? {y|n}: y
```

### After you finish

All of the clients must be remounted. This is required because the file system IDs change, and the clients might receive stale file handle messages when attempting NFS operations.

## Provision a FlexGroup volume automatically

You can automatically provision a FlexGroup volume. ONTAP creates and configures a FlexGroup volume by automatically selecting the aggregates. Aggregates are selected based on the best practices for optimum performance.

### What you'll need

Each node in the cluster must have at least one aggregate.




For creating a FlexGroup volume for FabricPool in ONTAP 9.5, each node must have at least one aggregate that is FabricPool.

### About this task

ONTAP selects two aggregates with the largest amount of usable space on each node to create the FlexGroup volume. If two aggregates are not available, ONTAP selects one aggregate per node to create the FlexGroup volume.

### Steps

1. Provision the FlexGroup volume:

If you are using...	Use this command...
ONTAP 9.2 or later	<p><code>volume create -vserver svm_name -volume fg_vol_name -auto-provision-as flexgroup -size fg_size [-encrypt true] [-qos-policy-group qos_policy_group_name] [-support-tiering true]</code> Beginning with ONTAP 9.5, you can create FlexGroup volumes for FabricPool. To automatically provision a FlexGroup volume on FabricPool, you must set the <code>-support-tiering</code> parameter to <code>true</code>. The volume guarantee must be always set to <code>none</code> for FabricPool. You can also specify the tiering policy and tiering minimum cooling period for the FlexGroup volume.</p> <p><a href="#">Disk and aggregate management</a></p> <p>Beginning with ONTAP 9.3, you can specify a throughput ceiling (QoS Max) for FlexGroup volumes, which limits the performance resources that the FlexGroup volume can consume. Beginning with ONTAP 9.4, you can specify throughput floors (QoS Min) and adaptive QoS for FlexGroup volumes.</p> <p><a href="#">Performance management</a></p> <p>Beginning with ONTAP 9.2, you can set the <code>-encrypt</code> parameter to <code>true</code> if you want to enable encryption on the FlexGroup volume. For creating an encrypted volume, you must have installed the volume encryption license and the key manager.</p> <div><p>You must enable encryption on FlexGroup volumes at the time of creation. You cannot enable encryption on existing FlexGroup volumes.</p></div> <p><a href="#">Encryption of data at rest</a></p>

ONTAP 9.1	<pre>volume flexgroup deploy -vserver svm_name -size fg_size</pre>
-----------	--

The `size` parameter specifies the size of the FlexGroup volume in KB, MB, GB, TB, or PB.

The following example shows how to provision a FlexGroup volume of size 400 TB in ONTAP 9.2:

```
cluster-1::> volume create -vserver vs0 -volume fg -auto-provision-as
flexgroup -size 400TB
Warning: The FlexGroup "fg" will be created with the following number of
constituents of size 25TB: 16.
The constituents will be created on the following aggregates:
aggr1,aggr2
Do you want to continue? {y|n}: y
[Job 34] Job succeeded: Successful
```

The following example shows how to create a QoS policy group for throughput ceiling and how to apply it to a FlexGroup volume:

```
cluster1::> qos policy-group create -policy group pg-vs1 -vserver vs1
-max-throughput 5000iops
```

```
cluster-1::> volume create -vserver vs0 -volume fg -auto-provision-as
flexgroup -size 400TB -qos-policy-group pg-vs1
Warning: The FlexGroup "fg" will be created with the following number of
constituents of size 25TB: 16.
The constituents will be created on the following aggregates:
aggr1,aggr2
Do you want to continue? {y|n}: y
[Job 34] Job succeeded: Successful
```

The following example shows how to provision a FlexGroup volume of size 400 TB on aggregates in FabricPool in ONTAP 9.5:

```
cluster-1::> volume create -vserver vs0 -volume fg -auto-provision-as
flexgroup -size 400TB -support-tiering true -tiering-policy auto
Warning: The FlexGroup "fg" will be created with the following number of
constituents of size 25TB: 16.
The constituents will be created on the following aggregates:
aggr1,aggr2
Do you want to continue? {y|n}: y
[Job 34] Job succeeded: Successful
```

The FlexGroup volume is created with eight constituents on each node in the cluster. The constituents are distributed equally between the two largest aggregates on each node.

The FlexGroup volume is created with the `volume` space guarantee except on AFF systems. For AFF systems, the FlexGroup volume is created with the `none` space guarantee.

2. Mount the FlexGroup volume with a junction path: `volume mount -vserver vs0 -volume fg2 -junction-path /fg2`

```
cluster1::> volume mount -vserver vs0 -volume fg2 -junction-path /fg2
```

### After you finish

You should mount the FlexGroup volume from the client.

If you are running ONTAP 9.6 or earlier and if the storage virtual machine (SVM) has both NFSv3 and NFSv4 configured, mounting the FlexGroup volume from the client might fail. In such cases, you must explicitly specify the NFS version when mounting the FlexGroup volume from the client.

```
# mount -t nfs -o vers=3 192.53.19.64:/fg2 /mnt/fg2
# ls /mnt/fg2
file1  file2
```

## Create a FlexGroup volume

You can create a FlexGroup volume by manually selecting the aggregates on which the FlexGroup volume must be created, and then specifying the number of constituents on each aggregate.

### About this task

You must be aware of the space required in the aggregates for creating a FlexGroup volume.

### [Guidelines for aggregate space when provisioning a FlexGroup volume](#)

You should also be aware of the considerations and requirements when selecting the aggregates for provisioning a FlexGroup volume.

You must consider the following guidelines when creating a FlexGroup volume for obtaining the best performance results with a FlexGroup volume:

- A FlexGroup volume should span only aggregates that are on identical hardware systems.

The use of identical hardware systems helps in providing predictable performance across the FlexGroup volume.

- A FlexGroup volume should span aggregates with the same disk type and RAID group configurations.

For consistent performance, you must ensure that all of the aggregates are made of all SSDs, all HDDs, or all hybrid aggregates. Additionally, the aggregates should have the same number of drives and RAID groups across the FlexGroup volume.

- A FlexGroup volume can span parts of a cluster.

A FlexGroup volume does not have to be configured to span the entire cluster, but doing so can take greater advantage of the hardware resources that are available.

- When creating a FlexGroup volume, it is best if the aggregates on which the FlexGroup volume is deployed have the following characteristics:
  - Approximately the same amount of free space should be available across multiple aggregates, especially when using thin provisioning.
  - Approximately 3 percent of the free space should be reserved for aggregate metadata after creation of the FlexGroup volume.
- For FAS systems, it is best to have two aggregates per node and for AFF systems, you must have one aggregate per node for the FlexGroup volume.
- For each FlexGroup volume, you should create at least eight constituents that are distributed over two or more aggregates on FAS systems, and over one or more aggregates on AFF systems.

## Steps

1. Create the FlexGroup volume: `volume create -vserver svm_name -volume flexgroup_name -aggr-list aggr1,aggr2,.. -aggr-list-multiplier constituents_per_aggr -size fg_size [-encrypt true] [-qos-policy-group qos_policy_group_name]`

- The `-aggr-list` parameter specifies the list of aggregates to be used for FlexGroup volume constituents.

Each entry in the list creates a constituent on the specified aggregate. You can specify an aggregate multiple times to have multiple constituents created on the aggregate.

For consistent performance across the FlexGroup volume, all of the aggregates must use the same disk type and RAID group configurations.

- The `-aggr-list-multiplier` parameter specifies the number of times to iterate over the aggregates that are listed with the `-aggr-list` parameter when creating a FlexGroup volume.

The default value of the `-aggr-list-multiplier` parameter is 4.

- The `size` parameter specifies the size of the FlexGroup volume in KB, MB, GB, TB, or PB.
- Beginning with ONTAP 9.5, you can create FlexGroup volumes for FabricPool, which use only all SSD aggregates.

To create a FlexGroup volume for FabricPool, all the aggregates specified with the `-aggr-list` parameter must be FabricPool. The volume guarantee must be always set to `none` for FabricPool. You can also specify the tiering policy and tiering minimum cooling period for the FlexGroup volume.

## Disk and aggregate management

- Beginning with ONTAP 9.4, you can specify throughput floors (QoS Min) and adaptive QoS for FlexGroup volumes.

## Performance management

- Beginning with ONTAP 9.3, you can specify a throughput ceiling (QoS Max) for FlexGroup volumes, which limits the performance resources that the FlexGroup volume can consume.

- Beginning with ONTAP 9.2, you can set the `-encrypt` parameter to `true` if you want to enable encryption on the FlexGroup volume.

For creating an encrypted volume, you must have installed the volume encryption license and the key manager.



You must enable encryption on FlexGroup volumes at the time of creation. You cannot enable encryption on existing FlexGroup volumes.

### Encryption of data at rest

```
cluster-1::> volume create -vserver vs0 -volume fg2 -aggr-list  
aggr1,aggr2,aggr3,aggr1 -aggr-list-multiplier 2 -size 500TB
```

```
Warning: A FlexGroup "fg2" will be created with the following number of  
constituents of size 62.50TB: 8.
```

```
Do you want to continue? {y|n}: y
```

```
[Job 43] Job succeeded: Successful
```

In the previous example, if you want to create the FlexGroup volume for FabricPool, all aggregates (aggr1, aggr2, and aggr3) must be aggregates in FabricPool. . Mount the FlexGroup volume with a junction path:  
`volume mount -vserver vserver_name -volume vol_name -junction-path junction_path`

```
cluster1::> volume mount -vserver vs0 -volume fg2 -junction-path /fg
```

### After you finish

You should mount the FlexGroup volume from the client.

If you are running ONTAP 9.6 or earlier and if the storage virtual machine (SVM) has both NFSv3 and NFSv4 configured, mounting the FlexGroup volume from the client might fail. In such cases, you must explicitly specify the NFS version when you are mounting the FlexGroup volume from the client.

```
# mount -t nfs -o vers=3 192.53.19.64:/fg /mnt/fg2  
# ls /mnt/fg2  
file1  file2
```

### Related information

[NetApp Technical Report 4571: NetApp FlexGroup Best Practices and Implementation Guide](#)

## Manage FlexGroup volumes

### Monitor the space usage of a FlexGroup volume

You can view a FlexGroup volume and its constituents, and monitor the space used by

the FlexGroup volume.

About this task

Beginning with ONTAP 9.6, elastic sizing is supported. ONTAP automatically grows a constituent of a FlexGroup volume if it is running out of space by shrinking any other constituent in the FlexGroup volume that has free space by an equivalent amount. Elastic sizing avoids any out-of-space errors that are generated because of one or more FlexGroup constituent volumes running out of space.



Beginning with ONTAP 9.9.1, logical space reporting and enforcement is also available for FlexGroup volumes. For more information, see [Logical space reporting and enforcement for volumes](#).

Step

- 1. View the space used by the FlexGroup volume and its constituents: `volume show -vserver vs1 -volume-style-extended flexgroup`

```
cluster-2::> volume show -vserver vs1 -volume-style-extended flexgroup
Vserver   Volume      Aggregate   State      Type      Size
Available Used%
-----
vs1       fg1         -           online     RW        500GB
207.5GB   56%
```

```
ccluster-2::> volume show -vserver vs1 -volume-style-extended flexgroup-constituent
```

Vserver	Volume	Aggregate	State	Type	Size
Available	Used%				

vs1	fg1__0001	aggr3	online	RW	31.25GB
12.97GB	56%				
vs1	fg1__0002	aggr1	online	RW	31.25GB
12.98GB	56%				
vs1	fg1__0003	aggr1	online	RW	31.25GB
13.00GB	56%				
vs1	fg1__0004	aggr3	online	RW	31.25GB
12.88GB	56%				
vs1	fg1__0005	aggr1	online	RW	31.25GB
13.00GB	56%				
vs1	fg1__0006	aggr3	online	RW	31.25GB
12.97GB	56%				
vs1	fg1__0007	aggr1	online	RW	31.25GB
13.01GB	56%				
vs1	fg1__0008	aggr1	online	RW	31.25GB
13.01GB	56%				
vs1	fg1__0009	aggr3	online	RW	31.25GB
12.88GB	56%				
vs1	fg1__0010	aggr1	online	RW	31.25GB
13.01GB	56%				
vs1	fg1__0011	aggr3	online	RW	31.25GB
12.97GB	56%				
vs1	fg1__0012	aggr1	online	RW	31.25GB
13.01GB	56%				
vs1	fg1__0013	aggr3	online	RW	31.25GB
12.95GB	56%				
vs1	fg1__0014	aggr3	online	RW	31.25GB
12.97GB	56%				
vs1	fg1__0015	aggr3	online	RW	31.25GB
12.88GB	56%				
vs1	fg1__0016	aggr1	online	RW	31.25GB
13.01GB	56%				

16 entries were displayed.

You can use the available space and percentage space used to monitor the space usage of the FlexGroup volume.



## Increase the size of a FlexGroup volume

You can increase the size of a FlexGroup volume either by adding more capacity to the existing constituents of the FlexGroup volume or by expanding the FlexGroup volume with new constituents.

### What you'll need

Sufficient space must be available in the aggregates.

### About this task

If you want to add more space, you can increase the collective size of the FlexGroup volume. Increasing the size of a FlexGroup volume resizes the existing constituents of the FlexGroup volume.

If you want to improve performance, you can expand the FlexGroup volume. You might want to expand a FlexGroup volume and add new constituents in the following situations:

- New nodes have been added to the cluster.
- New aggregates have been created on the existing nodes.
- The existing constituents of the FlexGroup volume have reached the maximum FlexVol size for the hardware, and therefore the FlexGroup volume cannot be resized.

In releases earlier than ONTAP 9.3, you must not expand FlexGroup volumes after a SnapMirror relationship is established. If you expand the source FlexGroup volume after breaking the SnapMirror relationship in releases earlier than ONTAP 9.3, you must perform a baseline transfer to the destination FlexGroup volume once again. Beginning with ONTAP 9.3, you can expand FlexGroup volumes that are in a SnapMirror relationship.

### Step

1. Increase the size of the FlexGroup volume by increasing the capacity or performance of the FlexGroup volume, as required:

If you want to increase the...	Then do this...
Capacity of the FlexGroup volume	<p>Resize the constituents of the FlexGroup volume:</p> <pre>volume modify -vserver vservers_name -volume fg_name -size new_size</pre>
Performance to the FlexGroup volume	<p>Expand the FlexGroup volume by adding new constituents:</p> <pre>volume expand -vserver vservers_name -volume fg_name -aggr-list aggregate name,... [-aggr-list-multiplier constituents_per_aggr]</pre> <p>The default value of the <code>-aggr-list-multiplier</code> parameter is 1.</p> <p>To expand a FlexGroup volume for FabricPool in ONTAP 9.5, any new aggregates used must be FabricPool.</p>

Whenever possible, you should increase the capacity of a FlexGroup volume. If you must expand a FlexGroup volume, you should add constituents in the same multiples as the constituents of the existing FlexGroup volume to ensure consistent performance. For example, if the existing FlexGroup volume has 16 constituents with eight constituents per node, you can expand the existing FlexGroup volume by 8 or 16 constituents.

## Examples

### Example of increasing the capacity of the existing constituents

The following example shows how to add 20 TB space to a FlexGroup volume volX:

```
cluster1::> volume modify -vserver svml -volume volX -size +20TB
```

If the FlexGroup volume has 16 constituents, the space of each constituent is increased by 1.25 TB.

### Example of improving performance by adding new constituents

The following example shows how to add two more constituents to the FlexGroup volume volX:

```
cluster1::> volume expand -vserver vs1 -volume volX -aggr-list aggr1,aggr2
```

The size of the new constituents is the same as that of the existing constituents.

## Reduce the size of a FlexGroup volume

Beginning with ONTAP 9.6, you can resize a FlexGroup volume to a value lower than its current size to free up the unused space from the volume. When you reduce the size of a FlexGroup volume, ONTAP automatically resizes all of the FlexGroup constituents.

### Step

1. Reduce the size of the FlexGroup volume: `volume size -vserver vserver_name -volume fg_name -size new_size`

`new_size` is the size of the FlexGroup volume. You can either specify a lower value than the current size or a negative value by which the current size of the FlexGroup volume is reduced.



If automatic shrinking is enabled for the volume (`volume autosize` command), the minimum autosize is set to the new size of the volume.

```
cluster1::> volume size -vserver svml -volume volX -size 10TB
```

```
cluster1::> volume size -vserver svml -volume volX -size -5TB
```

## Configure FlexGroup volumes to automatically grow and shrink their size

Beginning with ONTAP 9.3, you can configure FlexGroup volumes to automatically grow and shrink according to how much space they currently require.

### What you'll need

The FlexGroup volume must be online.

### About this task

You can autosize FlexGroup volumes in two modes:

- Increase the size of the volume automatically (`grow` mode)

Automatic growing helps prevent a FlexGroup volume from running out of space, if the aggregate can supply more space. You can configure the maximum size for the volume. The increase is automatically triggered based on the amount of data being written to the volume in relation to the current amount of used space and any thresholds set.

By default, the maximum size a volume can grow to is 120% of the size at which autogrow is enabled. If you need to ensure that the volume can grow to be larger than that, you must set the maximum size for the volume accordingly.

- Shrink the size of the volume automatically (`grow_shrink` mode)

Automatic shrinking prevents a volume from being larger than needed, freeing space in the aggregate for use by other volumes.

Autoshrink can only be used in combination with autogrow to meet changing space demands and is not available alone. When autoshrink is enabled, ONTAP automatically manages the shrinking behavior of a volume to prevent an endless loop of autogrow and autoshrink actions.

As a volume grows, the maximum number of files it can contain might be automatically increased. When a volume is shrunk, the maximum number of files it can contain is left unchanged, and a volume cannot be automatically shrunk below the size that corresponds to its current maximum number of files. For this reason, it might not be possible to automatically shrink a volume all the way to its original size.

### Step

1. Configure the volume to grow and shrink its size automatically: `volume autosize -vserver vs_server_name -volume vol_name -mode [grow | grow_shrink]`

You can also specify the maximum size, minimum size, and thresholds for growing or shrinking the volume.

The following command enables automatic size changes for a volume called `fg1`. The volume is configured to grow to a maximum size of 5 TB when it is 70% full.

```
cluster1::> volume autosize -volume fg1 -mode grow -maximum-size 5TB
-grow-threshold-percent 70
vol autosize: volume "vs_src:fg1" autosize settings UPDATED.
```

## Delete files and directories rapidly on the cluster

Beginning with ONTAP 9.8, you can use low-latency *fast-directory delete* functionality to delete files and directories from Linux and Windows client shares asynchronously (that is, in the background). Cluster and SVM administrators can perform asynchronous delete operations on both FlexVol and FlexGroup volumes.

If you are using a version of ONTAP earlier than ONTAP 9.11.1, you must be a cluster administrator or a SVM administrator using the advanced privilege mode.

Beginning with ONTAP 9.11.1, a storage administrator can grant rights on a volume to allow NFS and SMB clients to perform asynchronous delete operations. For more information, see [Manage client rights to delete directories rapidly](#).

Beginning with ONTAP 9.8, you can use fast directory delete functionality using the ONTAP CLI. Beginning with ONTAP 9.9.1, you can use this functionality with System Manager. For more information about this process, see [Take corrective action based on analytics](#).

## CLI

### Perform a fast directory delete with the CLI:

1. Enter advanced privilege mode: `-privilege advance`
2. Delete files or directories on a FlexVol or FlexGroup volume: `volume file async-delete start -vserver vserver_name -volume volume_name -path file_path -throttle throttle`

The minimum throttle value is 10, the maximum is 100,000, and the default is 5000.

The following example deletes the directory named d2, which is located in the directory named d1.

```
cluster::*>volume file async-delete start -vserver vs1 -volume vol1  
-path d1/d2
```

3. Verify that the directory was deleted: `event log show`

The following example shows output for the event log when the directory is successfully deleted.

```
cluster-cli::*> event log show  
Time                               Node                               Severity                           Event  
-----  
MM/DD/YYYY 00:11:11  cluster-vsim      INFORMATIONAL  
asyncDelete.message.success: Async delete job on path d1/d2 of  
volume (MSID: 2162149232) was completed.
```

### Cancel a directory delete job

1. Enter advanced privilege mode:

```
-privilege advanced
```

2. Verify that the directory delete is in progress:

```
volume file async-delete show
```

If the SVM, volume, JobID and path of your directory is displayed, you can cancel the job.

3. Cancel the directory delete:

```
volume file async-delete cancel -vserver SVM_name -volume volume_name  
-jobid job_id
```

## System Manager

For more information, see [Take corrective action based on analytics](#).

## Manage client rights to delete directories rapidly

Beginning with ONTAP 9.11.1, storage administrators can grant rights on a volume to allow NFS and SMB clients to perform low latency *fast-directory delete* operations themselves. When asynchronous delete is enabled on the cluster, Linux client users can use the `mv` command and Windows client users can use the `rename` command to delete a directory rapidly on the specified volume by moving it to a hidden directory that by default is named `.ontaptrashbin`.

### Enable client asynchronous directory delete

#### Steps

1. From the cluster CLI, enter advanced privilege mode: `-privilege advance`
2. Enable client asynchronous delete and, if desired, provide an alternate name for the trashbin directory:

```
volume file async-delete client enable volume volname vservers vserverName  
trashbinname name
```

Example using the default trashbin name:

```
cluster1::*> volume file async-delete client enable -volume v1 -vservers  
vs0  
  
Info: Async directory delete from the client has been enabled on volume  
"v1" in  
Vserver "vs0".
```

Example specifying an alternate trashbin name:

```
cluster1::*> volume file async-delete client enable -volume test  
-trashbin ntaptrash -vservers vs1  
  
Success: Async directory delete from the client is enabled on volume  
"v1" in  
Vserver "vs0".
```

3. Verify client asynchronous delete is enabled:

```
volume file async-delete client show
```

Example:

```
cluster1::*> volume file async-delete client show
```

Vserver	Volume	async-delete client	TrashBinName
vs1	vol1	Enabled	.ntaptrash
vs2	vol2	Disabled	-

```
2 entries were displayed.
```

## Disable client asynchronous directory delete

### Steps

1. From the cluster CLI, disable client asynchronous directory delete:

```
volume file async-delete client disable volume volname vservers vserverName
```

Example:

```
cluster1::*> volume file async-delete client disable -volume vol1  
-vserver vs1
```

```
Success: Asynchronous directory delete client disabled  
successfully on volume.
```

2. Verify client asynchronous delete is disabled:

```
volume file async-delete client show
```

Example:

```
cluster1::*> volume file async-delete client show
```

Vserver	Volume	async-delete client	TrashBinName
vs1	vol1	Disabled	-
vs2	vol2	Disabled	-

```
2 entries were displayed.
```

## Create qtrees with FlexGroup volumes

Beginning with ONTAP 9.3, you can create qtrees with FlexGroup volumes. Qtrees enable you to partition your FlexGroup volumes into smaller segments that you can manage individually.

### About this task

- If you want to revert to ONTAP 9.2 or earlier and if you have created one or more qtrees in the FlexGroup volume or modified the attributes (security style and SMB oplocks) of the default qtree, you must delete all of the non-default qtrees and then disable the qtree functionality on each FlexGroup volume before reverting to ONTAP 9.2 or earlier.

#### [Disable qtree functionality in FlexGroup volumes before reverting](#)

- If the source FlexGroup volume has qtrees in a SnapMirror relationship, the destination cluster must be running ONTAP 9.3 or later (a version of ONTAP software that supports qtrees).
- Beginning with ONTAP 9.5, qtree statistics are supported for FlexGroup volumes.

### Steps

1. Create a qtree in the FlexGroup volume: `volume qtree create -vserver vs0 -volume fg1 -qtree qtree1 -security-style mixed`

You can optionally specify the security style, SMB oplocks, UNIX permissions, and export policy for the qtree.

```
cluster1::> volume qtree create -vserver vs0 -volume fg1 -qtree qtree1  
-security-style mixed
```

### Related information

[Logical storage management](#)

## Use quotas for FlexGroup volumes

In ONTAP 9.4 and earlier, you can apply quotas rules to FlexGroup volumes only for reporting purposes, but not for enforcing quota limits. Beginning with ONTAP 9.5, you can enforce limits on quota rules that are applied to FlexGroup volumes.

### About this task

- Beginning with ONTAP 9.5, you can specify hard, soft, and threshold limit quotas for FlexGroup volumes.

You can specify these limits to constrain the amount of space, the number of files that a specific user, group, or qtree can create, or both. Quota limits generate warning messages in the following scenarios:

- When usage exceeds a configured soft limit, ONTAP issues a warning message, but further traffic is still allowed.

If usage later drops below the configured soft limit again, an all-clear message is issued.

- When usage exceeds a configured threshold limit, ONTAP issues a second warning message.

No all-clear administrative message is issued when usage later drops below a configured threshold limit.

- If usage reaches a configured hard limit, ONTAP prevents further resource consumption by rejecting traffic.



- In ONTAP 9.5, quota rules cannot be created or activated on the destination FlexGroup volume of a SnapMirror relationship.

## Quota targets and types

Quotas have a type: they can be either user, group, or tree. Quota targets specify the user, group, or qtree for which the quota limits are applied.

The following table lists the kinds of quota targets, what types of quotas each quota target is associated with, and how each quota target is represented:

Quota target	Quota type	How target is represented	Notes
user	user quota	UNIX user name UNIX UID  Windows user name in pre-Windows 2000 format  Windows SID	User quotas can be applied for a specific volume or qtree.
group	group quota	UNIX group name UNIX GID	Group quotas can be applied for a specific volume or qtree.   ONTAP does not apply group quotas based on Windows IDs.
qtree	tree quota	qtree name	Tree quotas are applied to a particular volume and do not affect qtrees in other volumes.
	user quotagroup quota  tree quota	Double quotation marks ("" )	A quota target of "" denotes a <i>default quota</i> . For default quotas, the quota type is determined by the value of the type field.

## Behavior of FlexGroup volumes when quota limits are exceeded

Beginning with ONTAP 9.5, quota limits are supported on FlexGroup volumes. There are some differences in the way quota limits are enforced on a FlexGroup volume when compared to a FlexVol volume.

FlexGroup volumes might show the following behaviors when the quota limits are exceeded:

- The space and file usage in a FlexGroup volume might reach up to 5 percent higher than the configured hard limit before the quota limit is enforced by rejecting further traffic.

To provide the best performance, ONTAP might allow the space consumption to exceed the configured hard limit by a small margin before the quota enforcement begins. This additional space consumption does not exceed 5 percent of the configured hard limits, 1 GB, or 65536 files, whichever is lower.

- After the quota limit is reached, if a user or administrator deletes some files or directories such that the quota usage is now below the limit, the subsequent quota-consuming file operation might resume with a delay (might take up to 5 seconds to resume).
- When the total space and file usage of a FlexGroup volume exceed the configured quota limits, there might be a slight delay in logging an event log message.
- You might get “no space” errors if some constituents of the FlexGroup volume get full, but the quota limits are not reached.
- Operations, such as renaming a file or directory or moving files between qtrees, on quota targets, for which quota hard limits are configured, might take longer when compared to similar operations on FlexVol volumes.

### Examples of quota enforcement for FlexGroup volumes

You can use the examples to understand how to configure quotas with limits in ONTAP 9.5 and later.

#### Example 1: Enforcing a quota rule with disk limits

1. You should create a quota policy rule of type `user` with both an achievable soft disk limit and hard disk limit.

```
cluster1::> volume quota policy rule create -vserver vs0 -policy-name
default -volume FG -type user -target "" -qtree "" -disk-limit 1T -soft
-disk-limit 800G
```

2. You can view the quota policy rule:

```
cluster1::> volume quota policy rule show -vserver vs0 -policy-name
default -volume FG
```

Vserver: vs0			Policy: default		Volume: FG		
			User	Disk	Soft	Files	Soft
Type	Target	Qtree	Mapping	Limit	Disk Limit	Limit	Files Limit
Threshold							
-----	-----	-----	-----	-----	-----	-----	-----
user	""	""	off	1TB	800GB	-	-
-							

3. To activate the new quota rule, you initialize quotas on the volume:

```
cluster1::> volume quota on -vserver vs0 -volume FG -foreground true
[Job 49] Job succeeded: Successful
```

4. You can view the disk usage and file usage information of the FlexGroup volume by using the quota report.

```
cluster1::> volume quota report -vserver vs0 -volume FG
Vserver: vs0
```

Volume Specifier	Tree	Type	ID	----Disk----		----Files-----		Quota
				Used	Limit	Used	Limit	
FG		user	root	50GB	-	1	-	
FG		user	*	800GB	1TB	0	-	*

2 entries were displayed.

After the hard disk limit is reached, the quota policy rule target (user, in this case) is blocked from writing more data to the files.

#### Example 2: Enforcing a quota rule for multiple users

1. You should create a quota policy rule of type `user`, where multiple users are specified in the quota target (UNIX users, SMB users, or a combination of both) and where the rule has both an achievable soft disk limit and hard disk limit.

```
cluster1::> quota policy rule create -vserver vs0 -policy-name default
-volume FG -type user -target "rdavis,ABCCORP\RobertDavis" -qtree ""
-disk-limit 1TB -soft-disk-limit 800GB
```

2. You can view the quota policy rule:

```
cluster1::> quota policy rule show -vserver vs0 -policy-name default
-volume FG
```

```
Vserver: vs0                Policy: default                Volume: FG
```

Type	Target	Qtree	User Mapping	Disk Limit	Soft Disk Limit	Files Limit	Soft Files Limit
Threshold							
-----	-----	-----	-----	-----	-----	-----	-----
-----							
user	"rdavis,ABCCORP\RobertDavis"			off	1TB	800GB	- -

3. To activate the new quota rule, you initialize quotas on the volume:

```
cluster1::> volume quota on -vserver vs0 -volume FG -foreground true
[Job 49] Job succeeded: Successful
```

4. You can verify that the quota state is active:

```
cluster1::> volume quota show -vserver vs0 -volume FG
Vserver Name: vs0
Volume Name: FG
Quota State: on
Scan Status: -
Logging Messages: on
Logging Interval: 1h
Sub Quota Status: none
Last Quota Error Message: -
Collection of Quota Errors: -
```

5. You can view the disk usage and file usage information of the FlexGroup volume by using the quota report.

```
cluster1::> quota report -vserver vs0 -volume FG
Vserver: vs0
```

Volume	Tree	Type	ID	----Disk----		----Files-----		Quota
				Used	Limit	Used	Limit	
Specifier								
-----	-----	-----	-----	-----	-----	-----	-----	
-----								
FG		user	rdavis,ABCCORP\RobertDavis	0B	1TB	0	-	
rdavis,ABCCORP\RobertDavis								

The quota limit is shared among all users listed in the quota target.

After the hard disk limit is reached, users listed in the quota target are blocked from writing more data to the files.

### Example 3: Enforcing quota with user mapping enabled

1. You should create a quota policy rule of type user, specify a UNIX user or a Windows user as the quota target with user-mapping set to on, and create the rule with both an achievable soft disk limit and hard disk limit.

The mapping between UNIX and Windows users must be configured earlier by using the `vserver name-mapping create` command.

```
cluster1::> quota policy rule create -vserver vs0 -policy-name default
-volume FG -type user -target rdavis -qtree "" -disk-limit 1TB -soft
-disk-limit 800GB -user-mapping on
```

2. You can view the quota policy rule:

```
cluster1::> quota policy rule show -vserver vs0 -policy-name default
-volume FG
```

Vserver: vs0			Policy: default			Volume: FG	
Type	Target	Qtree	User Mapping	Disk Limit	Soft Disk Limit	Files Limit	Soft Files Limit
Threshold							
-----	-----	-----	-----	-----	-----	-----	-----
-----							
user	rdavis	""	on	1TB	800GB	-	-
-							

3. To activate the new quota rule, you initialize quotas on the volume:

```
cluster1::> volume quota on -vserver vs0 -volume FG -foreground true
[Job 49] Job succeeded: Successful
```

4. You can verify that the quota state is active:

```
cluster1::> volume quota show -vserver vs0 -volume FG
      Vserver Name: vs0
      Volume Name: FG
      Quota State: on
      Scan Status: -
      Logging Messages: on
      Logging Interval: 1h
      Sub Quota Status: none
      Last Quota Error Message: -
      Collection of Quota Errors: -
```

5. You can view the disk usage and file usage information of the FlexGroup volume by using the quota report.

```
cluster1::> quota report -vserver vs0 -volume FG
Vserver: vs0
```

Volume	Tree	Type	ID	-----Disk-----	-----Files-----	Quota	
Specifier				Used	Limit	Used	Limit
-----	-----	-----	-----	-----	-----	-----	-----
FG		user	rdavis,ABCCORP\RobertDavis	0B	1TB	0	-
rdavis							

The quota limit is shared between the user listed in the quota target and its corresponding Windows or UNIX user.

After the hard disk limit is reached, both the user listed in the quota target and its corresponding Windows or UNIX user is blocked from writing more data to the files.

#### Example 4: Verifying the qtree size when quota is enabled

1. You should create a quota policy rule of type `tree` and where the rule has both an achievable soft disk limit and hard disk limit.

```
cluster1::> quota policy rule create -vserver vs0 -policy-name default
-volume FG -type tree -target tree_4118314302 -qtree "" -disk-limit 48GB
-soft-disk-limit 30GB
```

2. You can view the quota policy rule:

```
cluster1::> quota policy rule show -vserver vs0
```

Vserver: vs0			Policy: default			Volume: FG	
			User	Disk	Soft	Files	Soft
Type	Target	Qtree	Mapping	Limit	Disk	Files	Files
Threshold					Limit	Limit	Limit
-----	-----	-----	-----	-----	-----	-----	-----
tree	tree_4118314302	""	-	48GB	-	20	-

3. To activate the new quota rule, you initialize quotas on the volume:

```
cluster1::> volume quota on -vserver vs0 -volume FG -foreground true
[Job 49] Job succeeded: Successful
```

a. You can view the disk usage and file usage information of the FlexGroup volume by using the quota report.

```
cluster1::> quota report -vserver vs0
Vserver: vs0
----Disk---- ----Files----- Quota
Volume Tree Type ID Used Limit Used Limit Specifier
-----
FG tree_4118314302 tree 1 30.35GB 48GB 14 20 tree_4118314302
```

The quota limit is shared between the user listed in the quota target and its corresponding Windows or UNIX user.

4. From an NFS client, use the `df` command to view the total space usage, available space, and the used space.

```
scsps0472342001# df -m /t/10.53.2.189/FG-3/tree_4118314302
Filesystem 1M-blocks Used Available Use% Mounted on
10.53.2.189/FG-3 49152 31078 18074 63% /t/10.53.2.189/FG-3
```

With hard limit, the space usage is calculated from an NFS client as follows:

- Total space usage = hard limit for tree
- Free space = Hard limit minus qtree space usage Without hard limit, the space usage is calculated from an NFS client as follows:
- Space usage = quota usage
- Total space = Sum of quota usage and physical free space in the volume

5. From the SMB share, use Windows Explorer to view the total space usage, available space, and the used space.

From an SMB share, you should be aware of the following considerations for calculating the space usage:

- The user quota hard limit for the user and group is taken into consideration for calculating the total available space.
- The minimum value among the free space of the tree quota rule, the user quota rule, and the group quota rule is considered as the free space for the SMB share.
- The total space usage is variable for SMB and depends on the hard limit that corresponds to the minimum free space among the tree, user, and group.

## Apply rules and limits on the FlexGroups volume

### Steps

1. Create quota rules for targets:  

```
volume quota policy rule create -vserver vs0 -policy-name quota_policy_of_the_rule -volume flexgroup_vol -type {tree|user|group} -target target_for_rule -qtree qtree_name [-disk-limit hard_disk_limit_size] [-file-limit hard_limit_number_of_files] [-threshold threshold_disk_limit_size] [-soft-disk-limit soft_disk_limit_size] [-soft-file-limit soft_limit_number_of_files]
```

- In ONTAP 9.2 and ONTAP 9.1, the quota target type can be only `user` or `group` for FlexGroup volumes.

Tree quota type is not supported for FlexGroup volumes in ONTAP 9.2 and ONTAP 9.1.

- In ONTAP 9.3 and later, the quota target type can be `user`, `group`, or `tree` for FlexGroup volumes.
- A path is not supported as the target when creating quota rules for FlexGroup volumes.
- Beginning with ONTAP 9.5, you can specify hard disk limit, hard file limit, soft disk limit, soft file limit, and threshold limit quotas for FlexGroup volumes.

In ONTAP 9.4 and earlier, you cannot specify the disk limit, file limit, threshold for disk limit, soft disk limit, or soft file limit when you create quota rules for FlexGroup volumes.

The following example shows a default quota rule being created for the user target type:

```
cluster1::> volume quota policy rule create -vserver vs0 -policy-name quota_policy_vs0_1 -volume fg1 -type user -target "" -qtree ""
```

The following example shows a tree quota rule being created for the qtree named qtree1:



```
cluster1::> volume quota policy rule create -policy-name default -vserver
vs0 -volume fg1 -type tree -target "qtree1"
```

1. Activate the quotas for the specified FlexGroup volume: `volume quota on -vserver svm_name -volume flexgroup_vol -foreground true`

```
cluster1::> volume quota on -vserver vs0 -volume fg1 -foreground true
```

1. Monitor the state of quota initialization: `volume quota show -vserver svm_name`

FlexGroup volumes might show the mixed state, which indicates that all of the constituent volumes are not in the same state yet.

```
cluster1::> volume quota show -vserver vs0
```

Vserver	Volume	State	Scan Status
vs0	fg1	initializing	95%
vs0	vol1	off	-

2 entries were displayed.

1. View the quota report for the FlexGroup volume with active quotas: `volume quota report -vserver svm_name -volume flexgroup_vol`

You cannot specify a path with the `volume quota report` command for FlexGroup volumes.

The following example shows the user quota for the FlexGroup volume fg1:

```
cluster1::> volume quota report -vserver vs0 -volume fg1
```

Vserver: vs0

Quota				----Disk----		----Files----	
Volume	Tree	Type	ID	Used	Limit	Used	Limit
Specifier							
fg1		user	*	0B	-	0	-
fg1		user	root	1GB	-	1	-

2 entries were displayed.

The following example shows the tree quota for the FlexGroup volume fg1:

```
cluster1::> volume quota report -vserver vs0 -volume fg1
```

```
Vserver: vs0
```

Volume Specifier	Tree	Type	ID	----Disk----		----Files-----		Quota
				Used	Limit	Used	Limit	
fg1	qtreen1	tree	1	68KB	-	18	-	
fg1		tree	*	0B	-	0	-	*

2 entries were displayed.

## Results

The quota rules and limits are applied on the FlexGroups volume.

The usage might reach up to 5 percent higher than a configured hard limit before ONTAP enforces the quota by rejecting further traffic.

## Related information

[ONTAP 9 commands](#)

## Enable storage efficiency on a FlexGroup volume

You can run deduplication and data compression together or independently on a FlexGroup volume to achieve optimal space savings.

### What you'll need

The FlexGroup volume must be online.

### Steps

1. Enable storage efficiency on the FlexGroup volume: `volume efficiency on -vserver svm_name -volume volume_name`

Storage efficiency operations are enabled on all the constituents of the FlexGroup volume.

If a FlexGroup volume is expanded after storage efficiency is enabled on the volume, storage efficiency is automatically enabled on the new constituents.

2. Enable the required storage efficiency operation on the FlexGroup volume by using the `volume efficiency modify` command.

You can enable inline deduplication, postprocess deduplication, inline compression, and postprocess compression on FlexGroup volumes. You can also set the type of compression (secondary or adaptive) and specify a schedule or efficiency policy for the FlexGroup volume.

3. If you are not using schedules or efficiency policies for running the storage efficiency operations, start the efficiency operation: `volume efficiency start -vserver svm_name -volume volume_name`

If deduplication and data compression are enabled on a volume, data compression is run initially followed by deduplication. This command fails if any efficiency operation is already active on the FlexGroup volume.

4. Verify the efficiency operations that are enabled on the FlexGroup volume: `volume efficiency show -vserver svm_name -volume volume_name`

```
cluster1::> volume efficiency show -vserver vs1 -volume fg1
Vserver Name: vs1
Volume Name: fg1
Volume Path: /vol/fg1
State: Enabled
Status: Idle
Progress: Idle for 17:07:25
Type: Regular
Schedule: sun-sat@0

...

Compression: true
Inline Compression: true
Incompressible Data Detection: false
Constituent Volume: false
Compression Quick Check File Size: 524288000
Inline Dedupe: true
Data Compaction: false
```

## Protect FlexGroup volumes using Snapshot copies

You can create Snapshot policies that automatically manage the creation of Snapshot copies or you can manually create Snapshot copies for FlexGroup volumes. A valid Snapshot copy is created for a FlexGroup volume only after ONTAP can successfully create a Snapshot copy for each constituent of the FlexGroup volume.

### About this task

- If you have multiple FlexGroup volumes associated with a Snapshot policy, you should ensure that the FlexGroup volumes schedules do not overlap.
- Beginning with ONTAP 9.8, the maximum number of Snapshot copies supported on a FlexGroup volume is 1023.



Beginning with ONTAP 9.8, the `volume snapshot show` command for FlexGroup volumes reports Snapshot copy size using logical blocks, rather than calculating the youngest owned blocks. This new size calculation method might make the Snapshot copy size appear larger than calculations in earlier versions of ONTAP.

### Steps

1. Create a Snapshot policy or manually create a Snapshot copy:

If you want to create a...	Enter this command...
Snapshot policy	<pre>volume snapshot policy create</pre> <div>  <p>The schedules that are associated with the Snapshot policy of a FlexGroup volume must have an interval greater than 30 minutes.</p> </div> <p>When you create a FlexGroup volume, the default Snapshot policy is applied to the FlexGroup volume.</p>
Snapshot copy manually	<pre>volume snapshot create</pre> <div>  <p>After you create a Snapshot copy for a FlexGroup volume, you cannot modify the attributes of the Snapshot copy. If you want to modify the attributes, you must delete and then re-create the Snapshot copy.</p> </div>

Client access to the FlexGroup volume is briefly quiesced when a Snapshot copy is created.

2. Verify that a valid Snapshot copy is created for the FlexGroup volume: `volume snapshot show -volume volume_name -fields state`

```
cluster1::> volume snapshot show -volume fg -fields state
vserver volume snapshot                state
-----
fg_vs    fg      hourly.2016-08-23_0505 valid
```

3. View the Snapshot copies for the constituents of the FlexGroup volume: `volume snapshot show -is -constituent true`

```
cluster1::> volume snapshot show -is-constituent true
```

---Blocks---				
Vserver	Volume	Snapshot	Size	Total%
Used%				
-----	-----	-----	-----	-----
fg_vs	fg__0001	hourly.2016-08-23_0505	72MB	0%
27%				
	fg__0002	hourly.2016-08-23_0505	72MB	0%
27%				
	fg__0003	hourly.2016-08-23_0505	72MB	0%
27%				
...				
	fg__0016	hourly.2016-08-23_0505	72MB	0%
27%				

## Move the constituents of a FlexGroup volume

You can move the constituents of a FlexGroup volume from one aggregate to another for balancing the load when certain constituents experience more traffic. Moving constituents also helps in freeing up space on an aggregate for resizing the existing constituents.

### What you'll need

To move a FlexGroup volume constituent that is in a SnapMirror relationship, you must have initialized the SnapMirror relationship.

### About this task

You cannot perform a volume move operation while the constituents of the FlexGroup volume are being expanded.

### Steps

1. Identify the FlexGroup volume constituent that you want to move: `volume show -vserver svm_name -is-constituent *`

```
cluster1::> volume show -vserver vs2 -is-constituent *
```

Vserver	Volume	Aggregate	State	Type	Size
Available	Used%				
vs2	fg1	-	online	RW	400TB
15.12TB	62%				
vs2	fg1__0001	aggr1	online	RW	25TB
8.12MB	59%				
vs2	fg1__0002	aggr2	online	RW	25TB
2.50TB	90%				
...					

2. Identify an aggregate to which you can move the FlexGroup volume constituent: `volume move target-aggr show -vserver svm_name -volume vol_constituent_name`

The available space in the aggregate that you select must be greater than the size of the FlexGroup volume constituent that you are moving.

```
cluster1::> volume move target-aggr show -vserver vs2 -volume fg1_0002
```

Aggregate Name	Available Size	Storage Type
aggr2	467.9TB	hdd
node12a_aggr3	100.34TB	hdd
node12a_aggr2	100.36TB	hdd
node12a_aggr1	100.36TB	hdd
node12a_aggr4	100.36TB	hdd

5 entries were displayed.

3. Verify that the FlexGroup volume constituent can be moved to the intended aggregate: `volume move start -vserver svm_name -volume vol_constituent_name -perform-validation-only true`

```
cluster1::> volume move start -vserver vs2 -volume fg1_0002 -destination
-aggregate node12a_aggr3 -perform-validation-only true
```

Validation succeeded.

4. Move the FlexGroup volume constituent: `volume move start -vserver svm_name -volume vol_constituent_name -destination-aggregate aggr_name [-allow-mixed-aggr-types {true|false}]`

The volume move operation runs as a background process.

Beginning with ONTAP 9.5, you can move FlexGroup volume constituents from a Fabric Pool to a non-Fabric Pool, or vice versa by setting the `-allow-mixed-aggr-types` parameter to `true`. By default, the

`-allow-mixed-aggr-types` option is set to false.



You cannot use the `volume move` command for enabling encryption on FlexGroup volumes.

```
cluster1::> volume move start -vserver vs2 -volume fg1_002 -destination
-aggregate node12a_aggr3
```



If the volume move operation fails due to an active SnapMirror operation, you should abort the SnapMirror operation by using the `snapmirror abort -h` command. In some cases, the SnapMirror abort operation might also fail. In such situations, you should abort the volume move operation and retry later.

5. Verify the state of the volume move operation: `volume move show -volume vol_constituent_name`

The following example shows the state of a FlexGroup constituent volume that completed the replication phase and is in the cutover phase of the volume move operation:

```
cluster1::> volume move show -volume fg1_002
Vserver    Volume      State      Move Phase  Percent-Complete  Time-To-
Complete
-----
vs2        fg1_002     healthy   cutover     -                  -
```

## Use aggregates in FabricPool for existing FlexGroup volumes

Beginning with ONTAP 9.5, FabricPool is supported for FlexGroup volumes. If you want to use aggregates in FabricPool for your existing FlexGroup volumes, you can either convert the aggregates on which the FlexGroup volume resides to aggregates in FabricPool or migrate the FlexGroup volume constituents to aggregates in FabricPool.

### What you'll need

- The FlexGroup volume must have space-guarantee set to `none`.
- If you want to convert the aggregates on which the FlexGroup volume resides to aggregates in FabricPool, the aggregates must be using all SSD disks.

### About this task

If an existing FlexGroup volume resides on non-SSD aggregates, you must migrate the FlexGroup volume constituents to aggregates in FabricPool.

### Choices

- To convert the aggregates on which the FlexGroup volume resides to aggregates in FabricPool, perform the following steps:

- a. Set the tiering policy on the existing FlexGroup volume: `volume modify -volume flexgroup_name -tiering-policy [auto|snapshot|none|backup]`

```
cluster-2::> volume modify -volume fg1 -tiering-policy auto
```

- b. Identify the aggregates on which the FlexGroup volume resides: `volume show -volume flexgroup_name -fields aggr-list`

```
cluster-2::> volume show -volume fg1 -fields aggr-list
vserver volume aggr-list
-----
vs1      fg1      aggr1,aggr3
```

- c. Attach an object store to each aggregate listed in the aggregate list: `storage aggregate object-store attach -aggregate aggregate name -name object-store-name -allow-flexgroup true`

You must attach all of the aggregates to an object store.

```
cluster-2::> storage aggregate object-store attach -aggregate aggr1
-object-store-name Amazon01B1
```

- To migrate the FlexGroup volume constituents to aggregates in FabricPool, perform the following steps:

- a. Set the tiering policy on the existing FlexGroup volume: `volume modify -volume flexgroup_name -tiering-policy [auto|snapshot|none|backup]`

```
cluster-2::> volume modify -volume fg1 -tiering-policy auto
```

- b. Move each constituent of the FlexGroup volume to an aggregate in FabricPool in the same cluster:

```
volume move start -volume constituent-volume -destination-aggregate
FabricPool_aggregate -allow-mixed-aggr-types true
```

You must move all FlexGroup volume constituents to aggregates in FabricPool (in case the FlexGroup volume constituents are on mixed aggregate types) and ensure that all the constituents are balanced across the nodes in the cluster.

```
cluster-2::> volume move start -volume fg1_001 -destination-aggregate
FP_aggr1 -allow-mixed-aggr-types true
```

## Related information

[Disk and aggregate management](#)



# Data protection for FlexGroup volumes

## Data protection workflow for FlexGroup volumes

You can create SnapMirror disaster recovery (DR) relationships for FlexGroup volumes. Beginning with ONTAP 9.3, you can also backup and restore FlexGroup volumes by using SnapVault technology, and you can create a unified data protection relationship that uses the same destination for backup and DR.

The data protection workflow consists of verifying the cluster and SVM peer relationships, creating a destination volume, creating a job schedule, specifying a policy, creating a data protection relationship, and initializing the relationship.



### About this task

The SnapMirror relationship type is always **XDP** for FlexGroup volumes. The type of data protection that is provided by a SnapMirror relationship is determined by the replication policy that you use. You can use either the default policy or a custom policy of the required type for the replication relationship that you want to create.

The following table shows the default policy types and supported custom policy types for different types of data protection relationships.

Relationship type	Default Policy	Custom policy type
SnapMirror DR	MirrorAllSnapshots	async-mirror
SnapVault backup	XDPDefault	vault
Unified data protection	MirrorAndVault	mirror-vault

The MirrorLatest policy is not supported with FlexGroup volumes.

## Create a SnapMirror relationship for FlexGroup volumes

You can create a SnapMirror relationship between the source FlexGroup volume and the destination FlexGroup volume on a peered SVM for replicating data for disaster recovery. You can use the mirror copies of the FlexGroup volume to recover data when a disaster occurs.

### What you'll need

You must have created the cluster peering relationship and SVM peering relationship.

### Cluster and SVM peering

#### About this task

- You can create both intercluster SnapMirror relationships and intracluster SnapMirror relationships for FlexGroup volumes.
- Beginning with ONTAP 9.3, you can expand FlexGroup volumes that are in a SnapMirror relationship.

If you are using a version of ONTAP earlier than ONTAP 9.3, you must not expand FlexGroup volumes after a SnapMirror relationship is established; however, you can increase the capacity of FlexGroup volumes after establishing a SnapMirror relationship. If you expand the source FlexGroup volume after breaking the SnapMirror relationship in releases earlier than ONTAP 9.3, you must perform a baseline transfer to the destination FlexGroup volume.

### Steps

1. Create a destination FlexGroup volume of type `DP` that has the same number of constituents as that of the source FlexGroup volume:
  - a. From the source cluster, determine the number of constituents in the source FlexGroup volume:

```
volume show -volume volume_name* -is-constituent true
```

```
cluster1::> volume show -volume srcFG* -is-constituent true
```

Vserver	Volume	Aggregate	State	Type	Size
Available	Used%				
vss	srcFG	-	online	RW	400TB
172.86GB	56%				
vss	srcFG__0001	Aggr_cmode	online	RW	25GB
10.86TB	56%				
vss	srcFG__0002	aggr1	online	RW	25TB
10.86TB	56%				
vss	srcFG__0003	Aggr_cmode	online	RW	25TB
10.72TB	57%				
vss	srcFG__0004	aggr1	online	RW	25TB
10.73TB	57%				
vss	srcFG__0005	Aggr_cmode	online	RW	25TB
10.67TB	57%				
vss	srcFG__0006	aggr1	online	RW	25TB
10.64TB	57%				
vss	srcFG__0007	Aggr_cmode	online	RW	25TB
10.63TB	57%				
...					

- b. From the destination cluster, create a destination FlexGroup volume of type DP with the same number of constituents as that of the source FlexGroup volume.

```
cluster2::> volume create -vserver vsd -aggr-list aggr1,aggr2 -aggr
-list-multiplier 8 -size 400TB -type DP dstFG
```

Warning: The FlexGroup volume "dstFG" will be created with the following number of constituents of size 25TB: 16.

Do you want to continue? {y|n}: y

[Job 766] Job succeeded: Successful

- c. From the destination cluster, verify the number of constituents in the destination FlexGroup volume:

```
volume show -volume volume_name* -is-constituent true
```

```
cluster2::> volume show -volume dstFG* -is-constituent true
```

Vserver	Volume	Aggregate	State	Type	Size
Available	Used%				
-----	-----	-----	-----	----	-----
-----	-----				
vsd	dstFG	-	online	DP	400TB
172.86GB	56%				
vsd	dstFG__0001	Aggr_cmode	online	DP	25GB
10.86TB	56%				
vsd	dstFG__0002	aggr1	online	DP	25TB
10.86TB	56%				
vsd	dstFG__0003	Aggr_cmode	online	DP	25TB
10.72TB	57%				
vsd	dstFG__0004	aggr1	online	DP	25TB
10.73TB	57%				
vsd	dstFG__0005	Aggr_cmode	online	DP	25TB
10.67TB	57%				
vsd	dstFG__0006	aggr1	online	DP	25TB
10.64TB	57%				
vsd	dstFG__0007	Aggr_cmode	online	DP	25TB
10.63TB	57%				
...					

2. Create a job schedule: `job schedule cron create -name job_name -month month -dayofweek day_of_week -day day_of_month -hour hour -minute minute`

For the `-month`, `-dayofweek`, and `-hour` options, you can specify `all` to run the job every month, every day of the week, and every hour, respectively.

The following example creates a job schedule named `my_weekly` that runs on Saturdays at 3:00 a.m.:

```
cluster1::> job schedule cron create -name my_weekly -dayofweek
"Saturday" -hour 3 -minute 0
```

3. Create a custom policy of type `async-mirror` for the SnapMirror relationship: `snapmirror policy create -vserver SVM -policy snapmirror_policy -type async-mirror`

If you do not create a custom policy, you should specify the `MirrorAllSnapshots` policy for SnapMirror relationships.

4. From the destination cluster, create a SnapMirror relationship between the source FlexGroup volume and the destination FlexGroup volume: `snapmirror create -source-path src_svm:src_flexgroup -destination-path dest_svm:dest_flexgroup -type XDP -policy snapmirror_policy -schedule sched_name`

SnapMirror relationships for FlexGroup volumes must be of type `XDP`.

If you specify a throttle value for the SnapMirror relationship for the FlexGroup volume, each constituent uses the same throttle value. The throttle value is not divided among the constituents.



You cannot use SnapMirror labels of Snapshot copies for FlexGroup volumes.

In ONTAP 9.4 and earlier, if the policy is not specified with the `snapmirror create` command, the `MirrorAllSnapshots` policy is used by default. In ONTAP 9.5, if the policy is not specified with the `snapmirror create` command, the `MirrorAndVault` policy is used by default.

```
cluster2::> snapmirror create -source-path vss:srcFG -destination-path  
vsd:dstFG -type XDP -policy MirrorAllSnapshots -schedule hourly  
Operation succeeded: snapmirror create for the relationship with  
destination "vsd:dstFG".
```

5. From the destination cluster, initialize the SnapMirror relationship by performing a baseline transfer:

```
snapmirror initialize -destination-path dest_svm:dest_flexgroup
```

After the baseline transfer is completed, the destination FlexGroup volume is updated periodically based on the schedule of the SnapMirror relationship.

```
cluster2::> snapmirror initialize -destination-path vsd:dstFG  
Operation is queued: snapmirror initialize of destination "vsd:dstFG".
```



If you have created any SnapMirror relationship between FlexGroup volumes with the source cluster running ONTAP 9.3 and the destination cluster running ONTAP 9.2 or earlier, and if you create any qtrees in the source FlexGroup volume, the SnapMirror updates fail. To recover from this situation, you must delete all of the non-default qtrees in the FlexGroup volume, disable the qtree functionality on the FlexGroup volume, and then delete all of the Snapshot copies that are enabled with the qtree functionality. You must also perform these steps before reverting from ONTAP 9.3 to an earlier version of ONTAP, if you have the qtree functionality enabled on the FlexGroup volumes. [Disable qtree functionality in FlexGroup volumes before reverting](#)

### After you finish

You should set up the destination SVM for data access by setting up required configurations such as LIFs and export policies.

## Create a SnapVault relationship for FlexGroup volumes

You can configure a SnapVault relationship and assign a SnapVault policy to the relationship to create a SnapVault backup.

### What you'll need

You must be aware of the considerations for creating a SnapVault relationship for FlexGroup volumes.

### Steps

1. Create a destination FlexGroup volume of type `DP` that has the same number of constituents as that of the

source FlexGroup volume:

- a. From the source cluster, determine the number of constituents in the source FlexGroup volume:

```
volume show -volume volume_name* -is-constituent true
```

```
cluster1::> volume show -volume src* -is-constituent true
Vserver    Volume          Aggregate      State      Type      Size
Available Used%
-----
-----
vss        src             -             online     RW        400TB
172.86GB   56%
vss        src__0001       Aggr_cmode    online     RW        25GB
10.86TB    56%
vss        src__0002       aggr1         online     RW        25TB
10.86TB    56%
vss        src__0003       Aggr_cmode    online     RW        25TB
10.72TB    57%
vss        src__0004       aggr1         online     RW        25TB
10.73TB    57%
vss        src__0005       Aggr_cmode    online     RW        25TB
10.67TB    57%
vss        src__0006       aggr1         online     RW        25TB
10.64TB    57%
vss        src__0007       Aggr_cmode    online     RW        25TB
10.63TB    57%
...
```

- b. From the destination cluster, create a destination FlexGroup volume of type DP with the same number of constituents as that of the source FlexGroup volume.

```
cluster2::> volume create -vserver vsd -aggr-list aggr1,aggr2 -aggr
-list-multiplier 8 -size 400TB -type DP dst
```

Warning: The FlexGroup volume "dst" will be created with the following number of constituents of size 25TB: 16.

Do you want to continue? {y|n}: y

[Job 766] Job succeeded: Successful

- c. From the destination cluster, verify the number of constituents in the destination FlexGroup volume:

```
volume show -volume volume_name* -is-constituent true
```

```
cluster2::> volume show -volume dst* -is-constituent true
```

Vserver	Volume	Aggregate	State	Type	Size
Available	Used%				
-----	-----	-----	-----	-----	-----
vsd	dst	-	online	RW	400TB
172.86GB	56%				
vsd	dst__0001	Aggr_cmode	online	RW	25GB
10.86TB	56%				
vsd	dst__0002	aggr1	online	RW	25TB
10.86TB	56%				
vsd	dst__0003	Aggr_cmode	online	RW	25TB
10.72TB	57%				
vsd	dst__0004	aggr1	online	RW	25TB
10.73TB	57%				
vsd	dst__0005	Aggr_cmode	online	RW	25TB
10.67TB	57%				
vsd	dst__0006	aggr1	online	RW	25TB
10.64TB	57%				
vsd	dst__0007	Aggr_cmode	online	RW	25TB
10.63TB	57%				
...					

2. Create a job schedule: `job schedule cron create -name job_name -month month -dayofweek day_of_week -day day_of_month -hour hour -minute minute`

For `-month`, `-dayofweek`, and `-hour`, you can specify `all` to run the job every month, day of the week, and hour, respectively.

The following example creates a job schedule named `my_weekly` that runs on Saturdays at 3:00 a.m.:

```
cluster1::> job schedule cron create -name my_weekly -dayofweek
"Saturday" -hour 3 -minute 0
```

3. Create a SnapVault policy, and then define a rule for the SnapVault policy:
  - a. Create a custom policy of type `vault` for the SnapVault relationship: `snapmirror policy create -vserver svm_name -policy policy_name -type vault`
  - b. Define a rule for the SnapVault policy that determines which Snapshot copies are transferred during initialization and update operations: `snapmirror policy add-rule -vserver svm_name -policy policy_for_rule - snapmirror-label snapmirror-label -keep retention_count -schedule schedule`

If you do not create a custom policy, you should specify the `XDPDefault` policy for SnapVault relationships.

4. Create a SnapVault relationship: `snapmirror create -source-path src_svm:src_flexgroup -destination-path dest_svm:dest_flexgroup -type XDP -schedule schedule_name -policy XDPDefault`

In ONTAP 9.4 and earlier, if the policy is not specified with the `snapmirror create` command, the `MirrorAllSnapshots` policy is used by default. In ONTAP 9.5, if the policy is not specified with the `snapmirror create` command, the `MirrorAndVault` policy is used by default.

```
cluster2::> snapmirror create -source-path vss:srcFG -destination-path  
vsd:dstFG -type XDP -schedule Daily -policy XDPDefault
```

5. From the destination cluster, initialize the SnapVault relationship by performing a baseline transfer:  
`snapmirror initialize -destination-path dest_svm:dest_flexgroup`

```
cluster2::> snapmirror initialize -destination-path vsd:dst  
Operation is queued: snapmirror initialize of destination "vsd:dst".
```

## Create a unified data protection relationship for FlexGroup volumes

Beginning with ONTAP 9.3, you can create and configure SnapMirror unified data protection relationships to configure disaster recovery and archiving on the same destination volume.

### What you'll need

You must be aware of the considerations for creating unified data protection relationships for FlexGroup volumes.

[Considerations for creating a SnapVault backup relationship and a unified data protection relationship for FlexGroup volumes](#)

### Steps

1. Create a destination FlexGroup volume of type `DP` that has the same number of constituents as that of the source FlexGroup volume:
  - a. From the source cluster, determine the number of constituents in the source FlexGroup volume:  
`volume show -volume volume_name* -is-constituent true`



```
cluster1::> volume show -volume srcFG* -is-constituent true
```

Vserver	Volume	Aggregate	State	Type	Size
Available	Used%				
vss	srcFG	-	online	RW	400TB
172.86GB	56%				
vss	srcFG__0001	Aggr_cmode	online	RW	25GB
10.86TB	56%				
vss	srcFG__0002	aggr1	online	RW	25TB
10.86TB	56%				
vss	srcFG__0003	Aggr_cmode	online	RW	25TB
10.72TB	57%				
vss	srcFG__0004	aggr1	online	RW	25TB
10.73TB	57%				
vss	srcFG__0005	Aggr_cmode	online	RW	25TB
10.67TB	57%				
vss	srcFG__0006	aggr1	online	RW	25TB
10.64TB	57%				
vss	srcFG__0007	Aggr_cmode	online	RW	25TB
10.63TB	57%				
...					

- b. From the destination cluster, create a destination FlexGroup volume of type DP with the same number of constituents as that of the source FlexGroup volume.

```
cluster2::> volume create -vserver vsd -aggr-list aggr1,aggr2 -aggr
-list-multiplier 8 -size 400TB -type DP dstFG
```

Warning: The FlexGroup volume "dstFG" will be created with the following number of constituents of size 25TB: 16.

Do you want to continue? {y|n}: y

[Job 766] Job succeeded: Successful

- c. From the destination cluster, verify the number of constituents in the destination FlexGroup volume:

```
volume show -volume volume_name* -is-constituent true
```

```
cluster2::> volume show -volume dstFG* -is-constituent true
```

Vserver	Volume	Aggregate	State	Type	Size
Available	Used%				
-----	-----	-----	-----	-----	-----
vsd	dstFG	-	online	RW	400TB
172.86GB	56%				
vsd	dstFG__0001	Aggr_cmode	online	RW	25GB
10.86TB	56%				
vsd	dstFG__0002	aggr1	online	RW	25TB
10.86TB	56%				
vsd	dstFG__0003	Aggr_cmode	online	RW	25TB
10.72TB	57%				
vsd	dstFG__0004	aggr1	online	RW	25TB
10.73TB	57%				
vsd	dstFG__0005	Aggr_cmode	online	RW	25TB
10.67TB	57%				
vsd	dstFG__0006	aggr1	online	RW	25TB
10.64TB	57%				
vsd	dstFG__0007	Aggr_cmode	online	RW	25TB
10.63TB	57%				
...					

2. Create a job schedule: `job schedule cron create -name job_name -month month -dayofweek day_of_week -day day_of_month -hour hour -minute minute`

For the `-month`, `-dayofweek`, and `-hour` options, you can specify `all` to run the job every month, every day of the week, and every hour, respectively.

The following example creates a job schedule named `my_weekly` that runs on Saturdays at 3:00 a.m.:

```
cluster1::> job schedule cron create -name my_weekly -dayofweek
"Saturday" -hour 3 -minute 0
```

3. Create a custom policy of type `mirror-vault`, and then define a rule for the mirror and vault policy:
  - a. Create a custom policy of type `mirror-vault` for the unified data protection relationship:

```
snapmirror policy create -vserver svm_name -policy policy_name -type mirror-vault
```
  - b. Define a rule for the mirror and vault policy that determines which Snapshot copies are transferred during initialization and update operations:

```
snapmirror policy add-rule -vserver svm_name -policy policy_for_rule - snapmirror-label snapmirror-label -keep retention_count -schedule schedule
```

If you do not specify a custom policy, the `MirrorAndVault` policy is used for unified data protection relationships.

4. Create a unified data protection relationship: `snapmirror create -source-path src_svm:src_flexgroup -destination-path dest_svm:dest_flexgroup -type XDP -schedule schedule_name -policy MirrorAndVault`

In ONTAP 9.4 and earlier, if the policy is not specified with the `snapmirror create` command, the `MirrorAllSnapshots` policy is used by default. In ONTAP 9.5, if the policy is not specified with the `snapmirror create` command, the `MirrorAndVault` policy is used by default.

```
cluster2::> snapmirror create -source-path vss:srcFG -destination-path vsd:dstFG -type XDP -schedule Daily -policy MirrorAndVault
```

5. From the destination cluster, initialize the unified data protection relationship by performing a baseline transfer: `snapmirror initialize -destination-path dest_svm:dest_flexgroup`

```
cluster2::> snapmirror initialize -destination-path vsd:dstFG
Operation is queued: snapmirror initialize of destination "vsd:dstFG".
```

## Create an SVM disaster recovery relationship for FlexGroup volumes

Beginning with ONTAP 9.9.1, you can create SVM disaster recovery (SVM DR) relationships using FlexGroup volumes. An SVM DR relationship provides redundancy and the ability to recover FlexGroups in the event of a disaster by synchronizing and replicating the SVM configuration and its data. A SnapMirror license is required for SVM DR.

### Before you begin

You should be aware of the conditions when you cannot create a FlexGroup SVM DR relationship.

- A FlexClone FlexGroup configuration exists
- A FlexGroup volume contains a FabricPool configuration
- The FlexGroup volume is part of a fanout or cascading relationship

### About this task

- All nodes in both clusters must be running the same ONTAP version as the node on which SVM DR support was added (ONTAP 9.9.1 or later).
- The SVM DR relationship between the primary and secondary sites should be healthy and should have enough space on both the primary and secondary SVMs to support the FlexGroup volumes.

For information about creating an SVM DR relationship, see [Manage SnapMirror SVM replication](#).

### Steps

1. Create an SVM DR relationship, or use an existing relationship.

[Replicate an entire SVM configuration](#)

2. Create a FlexGroup volume on the primary site with the required number of constituents.

### Creating a FlexGroup volume.

Wait until FlexGroup and all of its constituents are created before proceeding.

3. To replicate the FlexGroup volume, update the SVM at the secondary site: `snapmirror update -destination-path destination_svm_name: -source-path source_svm_name:` + You can also check if a scheduled SnapMirror update already exists by entering `snapmirror show -fields schedule`
4. From the secondary site, verify that the SnapMirror relationship is healthy: `snapmirror show`

```
cluster2::> snapmirror show
```

Progress

Source	Destination	Mirror	Relationship	Total
--------	-------------	--------	--------------	-------

Last

Path	Type	Path	State	Status	Progress	Healthy
------	------	------	-------	--------	----------	---------

Updated

-----

-----

vs1:	XDP	vs1_dst:	Snapmirrored			
			Idle		-	true

5. From the secondary site, verify that the new FlexGroup volume and its constituents exist: `snapmirror show -expand`

```
cluster2::> snapmirror show -expand
```

Source	Destination	Mirror	Relationship	Total	Progress	Healthy
Last Path	Type	Path	State	Status	Progress	Healthy
Updated						
vs1:	XDP	vs1_dst:	Snapmirrored	Idle	-	true -
vs1:fg_src	XDP	vs1_dst:fg_src	Snapmirrored	Idle	-	true -
vs1:fg_src__0001	XDP	vs1_dst:fg_src__0001	Snapmirrored	Idle	-	true -
vs1:fg_src__0002	XDP	vs1_dst:fg_src__0002	Snapmirrored	Idle	-	true -
vs1:fg_src__0003	XDP	vs1_dst:fg_src__0003	Snapmirrored	Idle	-	true -
vs1:fg_src__0004	XDP	vs1_dst:fg_src__0004	Snapmirrored	Idle	-	true -

6 entries were displayed.

## Transition an existing FlexGroup SnapMirror relationship to SVM DR

You can create a FlexGroup SVM DR relationship by transitioning an existing FlexGroup volume SnapMirror relationship.

### What you'll need

- The FlexGroup volume SnapMirror relationship is in a healthy state.
- The source and destination FlexGroup volumes have the same name.

### Steps

1. From the SnapMirror destination, resynchronize the FlexGroup level SnapMirror relationship: `snapmirror resync`

2. Create the FlexGroup SVM DR SnapMirror relationship: `snapmirror create -policy DPDefault -identity-preserve true -destination-path dest_svm:dest_flexgroup -source-path src_svm:src_flexgroup`
3. Verify the relationship is broken off: `snapmirror show -destination-path dest_svm:dest_flexgroup -source-path src_svm:src_flexgroup`

```
snapmirror show -destination-path fg_vs_renamed: -source-path fg_vs:
```

Progress		Source		Destination		Mirror	Relationship	Total
Last	Path	Type	Path	State	Status	Progress	Healthy	
Updated								
-----	-----	-----	-----	-----	-----	-----	-----	
-----	fg_vs:	XDP	fg_vs1_renamed:		Broken-off Idle	-	true -	

4. Stop the destination SVM: `vserver stop -vserver vs_name`

```
vserver stop -vserver fg_vs_renamed
[Job 245] Job is queued: Vserver Stop fg_vs_renamed.
[Job 245] Done
```

5. Resynchronize the SVM SnapMirror relationship: `snapmirror resync -destination-path dest_svm:dest_flexgroup -source-path src_svm:src_flexgroup`

```
snapmirror resync -destination-path fg_vs_renamed: -source-path fg_vs:
Warning: This Vserver has volumes which are the destination of FlexVol
or FlexGroup SnapMirror relationships. A resync on the Vserver
SnapMirror relationship will cause disruptions in data access
```

6. Verify that the SVM DR level SnapMirror relationship reaches a healthy idle state: `snapmirror show -expand`
7. Verify that the FlexGroup SnapMirror relationship is in a healthy state: `snapmirror show`

## Convert a FlexVol volume to a FlexGroup volume within an SVM-DR relationship

Beginning with ONTAP 9.10.1, you can convert a FlexVol volume to a FlexGroup volume on an SVM-DR source.

### What you'll need

- The FlexVol volume that is being converted must be online.
- The operations and configurations on the FlexVol volume must be compatible with the conversion process.

An error message is generated if the FlexVol volume has any incompatibility, and the volume conversion is cancelled. You can take corrective actions and retry the conversion. For more details, see [Considerations for converting FlexVol volumes to FlexGroup volumes](#)

## Steps

1. From the destination, update the SVM-DR relationship:

```
snapmirror update -destination-path destination_svm_name: -source-path
source_svm_name:
```

2. Ensure that the SVM-DR relationship is in a SnapMirrored state and is not broken-off:

```
snapmirror show
```

3. From the destination SVM, verify that the FlexVol volume is ready for conversion:

```
volume conversion start -vserver svm_name -volume vol_name -check-only true
```

4. From the destination, disable transfers on the SVM-DR relationship:

```
snapmirror quiesce -destination-path dest_svm:
```

5. Start the conversion:

```
volume conversion start -vserver svm_name -volume vol_name
```

6. Verify that the conversion is successful:

```
volume show vol_name -fields -volume-style-extended,state
```

```
cluster-1::*> volume show my_volume -fields volume-style-extended,state
```

vserver	volume	state	volume-style-extended
vs0	my_volume	online	flexgroup

7. From the destination cluster, resume transfers for the relationship:

```
snapmirror resume -destination-path dest_svm:
```

8. From the destination cluster, perform an update to propagate the conversion to the destination:

```
snapmirror update -destination-path dest_svm:
```

9. Ensure that the SVM-DR relationship is in a SnapMirrored state and is not broken off:

```
snapmirror show
```

10. Ensure the conversion occurred on the destination:

```
volume show vol_name -fields -volume-style-extended,state
```

```
cluster-2::*> volume show my_volume -fields volume-style-extended,state

vserver      volume      state      volume-style-extended
-----      -
vs0_dst      my_volume   online     flexgroup
```

## Considerations for creating SnapMirror cascade and fanout relationships for FlexGroups

There are support considerations and limitations you should keep in mind when creating SnapMirror cascade and fanout relationships for FlexGroup volumes.

### Considerations for creating cascading relationships

- Each relationship can be either an inter cluster or intra cluster relationship.
- All asynchronous policy types, including async-mirror, mirror-vault, and vault, are supported for both relationships.
- Only "MirrorAllSnapshots," not "MirrorLatest" async-mirror policies are supported.
- Concurrent updates of cascaded XDP relationships is supported.
- Supports removing A to B and B to C and resync A to C or resync C to A
- A and B FlexGroup volumes also support fanout when all nodes are running ONTAP 9.9.1 or later.
- Restore operations from B or C FlexGroup volumes are supported.
- Transfers on FlexGroup relationships are not support while the destination is the source of a restore relationship.
- The destination of a FlexGroup restore cannot be the destination of any other FlexGroup relationship.
- FlexGroup file restore operations have the same restrictions as regular FlexGroup restore operations.
- All nodes in the cluster where the B and C FlexGroup volumes reside must be running ONTAP 9.9.1 or later.
- All expand and auto expand functionality is supported.
- In a cascade configuration such as A to B to C, if A to B and B to C have different numbers of constituent SnapMirror relationships, then an abort operation from the source is not supported for the B to C SnapMirror relationship.
- System Manager does not support cascading relationships in ONTAP 9.9.1.
- When converting an A to B to C set of FlexVol relationship to a FlexGroup relationship, you must convert the B to C hop first.
- All FlexGroup cascade configurations for relationships with policy types supported by REST are also supported by REST APIs in cascading FlexGroup configurations.
- As with FlexVol relationships, FlexGroup cascading is not supported by the `snapmirror protect` command.



## Considerations for creating fanout relationships

- Two or more FlexGroup fanout relationships are supported; for example, A to B, A to C, with a maximum of 8 fanout legs.
- Each relationship can be either intercluster or intracluster.
- Concurrent updates are supported for the two relationships.
- All expand and auto expand functionality is supported.
- If the fanout legs of the relationship have different numbers of constituent SnapMirror relationships, then an abort operation from the source is not supported for the A to B and A to C relationships.
- All nodes in the cluster where the source and destination FlexGroups reside must be running ONTAP 9.9.1 or later.
- All asynchronous policy types currently supported for FlexGroup SnapMirror are supported in fanout relationships.
- You can perform restore operations from B to C FlexGroups.
- All fanout configurations with policy types supported by rest are also supported for REST APIs in FlexGroup fanout configurations.

## Considerations for creating a SnapVault backup relationship and a unified data protection relationship for FlexGroup volumes

You must be aware of the considerations for creating a SnapVault backup relationship and unified data protection relationship for FlexGroup volumes.

- You can resynchronize a SnapVault backup relationship and a unified data protection relationship by using the `-preserve` option that enables you to preserve Snapshot copies on the destination volume that are newer than the latest common Snapshot copy.
- Long-term retention is not supported with FlexGroup volumes.

Long-term retention enables creating Snapshot copies directly on the destination volume without requiring to store the Snapshot copies on the source volume.

- The `snapshot` command `expiry-time` option is not supported for FlexGroup volumes.
- Storage efficiency cannot be configured on the destination FlexGroup volume of a SnapVault backup relationship and unified data protection relationship.
- You cannot rename Snapshot copies of a SnapVault backup relationship and unified data protection relationship for FlexGroup volumes.
- A FlexGroup volume can be the source volume of only one backup relationship or restore relationship.

A FlexGroup volume cannot be the source of two SnapVault relationships, two restore relationships, or a SnapVault backup relationship and a restore relationship.

- If you delete a Snapshot copy on the source FlexGroup volume and re-create a Snapshot copy with the same name, the next update transfer to the destination FlexGroup volume fails if the destination volume has a Snapshot copy of the same name.

This is because Snapshot copies cannot be renamed for FlexGroup volumes.

# Monitor SnapMirror data transfers for FlexGroup volumes

You should periodically monitor the status of the FlexGroup volume SnapMirror relationships to verify that the destination FlexGroup volume is updated periodically as per the specified schedule.

## About this task

You must perform this task from the destination cluster.

## Steps

- 1. View the SnapMirror relationship status of all FlexGroup volume relationships: `snapmirror show -relationship-group-type flexgroup`

```
cluster2::> snapmirror show -relationship-group-type flexgroup

Progress
Source          Destination Mirror  Relationship  Total
Last
Path            Type  Path          State   Status          Progress  Healthy
Updated
-----
-----
vss:s           XDP   vsd:d         Snapmirrored
                               Idle           -          true    -
vss:s2          XDP   vsd:d2        Uninitialized
                               Idle           -          true    -
2 entries were displayed.
```

- 2. View the SnapMirror relationship status for each constituent in the FlexGroup volume: `snapmirror show -expand`

```
cluster2::> snapmirror show -expand
```

Progress							
Source		Destination	Mirror	Relationship	Total		
Last							
Path	Type	Path	State	Status	Progress	Healthy	
Updated							
-----	----	-----	-----	-----	-----	-----	-----
vss:s	XDP	vsd:d	Snapmirrored				
			Idle		-	true	-
vss:s__0001	XDP	vsd:d__0001	Snapmirrored				
			Idle		-	true	-
vss:s__0002	XDP	vsd:d__0002	Snapmirrored				
			Idle		-	true	-
vss:s__0003	XDP	vsd:d__0003	Snapmirrored				
			Idle		-	true	-
vss:s__0004	XDP	vsd:d__0004	Snapmirrored				
			Idle		-	true	-
vss:s__0005	XDP	vsd:d__0005	Snapmirrored				
			Idle		-	true	-
vss:s__0006	XDP	vsd:d__0006	Snapmirrored				
			Idle		-	true	-
vss:s__0007	XDP	vsd:d__0007	Snapmirrored				
			Idle		-	true	-
vss:s__0008	XDP	vsd:d__0008	Snapmirrored				
			Idle		-	true	-
...							

3. If the SnapMirror transfer fails, identify the FlexGroup volume constituent for which the transfer failed and the reason for the error: `snapmirror show -fields last-transfer-error -expand`

```

cluster2::> snapmirror show -fields last-transfer-error -expand
source-path destination-path last-transfer-error
-----
-----
vss:s          vsd:d          Group Update failed (Failed to complete
update operation on one or more item relationships.)
vss:s__0001 vsd:d__0001      -
vss:s__0002 vsd:d__0002      -
vss:s__0003 vsd:d__0003      Failed to get information for source volume
"vss:s__0003" for setup of transfer. (Failed to get volume attributes
for e2de028c-8049-11e6-96ea-005056851ca2:s__0003. (Volume is offline))
vss:s__0004 vsd:d__0004      -
vss:s__0005 vsd:d__0005      -
vss:s__0006 vsd:d__0006      -
vss:s__0007 vsd:d__0007      -
vss:s__0008 vsd:d__0008      -
9 entries were displayed.

```

After rectifying the issue, you must rerun the SnapMirror operation.

## Manage data protection operations for FlexGroup volumes

### Disaster recovery for FlexGroup volumes

#### Disaster recovery workflow for FlexGroup volumes

When a disaster strikes on the source FlexGroup volume, you should activate the destination FlexGroup volume and redirect client access. Depending on whether the source FlexGroup volume can be recovered, you should either reactivate the source FlexGroup volume or reverse the SnapMirror relationship.



### About this task

Client access to the destination FlexGroup volume is blocked for a brief period when some SnapMirror operations, such as SnapMirror break and resynchronization, are running. If the SnapMirror operation fails, it is possible that some of the constituents remain in this state and access to the FlexGroup volume is denied. In such cases, you must retry the SnapMirror operation.

### Activate the destination FlexGroup volume

When the source FlexGroup volume is unable to serve data due to events such as data corruption, accidental deletion or an offline state, you must activate the destination FlexGroup volume to provide data access until you recover the data on the source FlexGroup volume. Activation involves stopping future SnapMirror data transfers and breaking the SnapMirror relationship.

### About this task

You must perform this task from the destination cluster.

### Steps

1. Disable future transfers for the FlexGroup volume SnapMirror relationship: `snapmirror quiesce dest_svm:dest_flexgroup`

```
cluster2::> snapmirror quiesce -destination-path vsd:dst
```

2. Break the FlexGroup volume SnapMirror relationship: `snapmirror break dest_svm:dest_flexgroup`

```
cluster2::> snapmirror break -destination-path vsd:dst
```

3. View the status of the SnapMirror relationship: `snapmirror show -expand`

```
cluster2::> snapmirror show -expand
```

Progress	Source	Destination	Mirror	Relationship	Total		
Last	Path	Type	Path	State	Status	Progress	Healthy
Updated							
-----	-----	-----	-----	-----	-----	-----	-----
-----							
vss:s	XDP	vsd:dst	Broken-off				
			Idle		-	true	-
vss:s__0001	XDP	vsd:dst__0001	Broken-off				
			Idle		-	true	-
vss:s__0002	XDP	vsd:dst__0002	Broken-off				
			Idle		-	true	-
vss:s__0003	XDP	vsd:dst__0003	Broken-off				
			Idle		-	true	-
vss:s__0004	XDP	vsd:dst__0004	Broken-off				
			Idle		-	true	-
vss:s__0005	XDP	vsd:dst__0005	Broken-off				
			Idle		-	true	-
vss:s__0006	XDP	vsd:dst__0006	Broken-off				
			Idle		-	true	-
vss:s__0007	XDP	vsd:dst__0007	Broken-off				
			Idle		-	true	-
vss:s__0008	XDP	vsd:dst__0008	Broken-off				
			Idle		-	true	-
...							

The SnapMirror relationship status of each constituent is Broken-off.

4. Verify that the destination FlexGroup volume is read/write: `volume show -vserver svm_name`

```
cluster2::> volume show -vserver vsd
```

Vserver	Volume	Aggregate	State	Type	Size
Available	Used%				
-----	-----	-----	-----	-----	-----
vsd	dst	-	online	**RW**	2GB
1.54GB	22%				
vsd	d2	-	online	DP	2GB
1.55GB	22%				
vsd	root_vs0	aggr1	online	RW	100MB
94.02MB	5%				

3 entries were displayed.

5. Redirect clients to the destination FlexGroup volume.

### Reactivate the original source FlexGroup volume after disaster

When the source FlexGroup volume becomes available, you can resynchronize the original source and original destination FlexGroup volumes. Any new data on the destination FlexGroup volume is lost.

#### About this task

Any active quota rules on the destination volume are deactivated and the quota rules are deleted before resynchronization is performed.

You can use the `volume quota policy rule create` and `volume quota modify` commands to create and reactivate quota rules after the resynchronization operation is complete.

#### Steps

1. From the destination cluster, resynchronize the FlexGroup volume SnapMirror relationship: `snapmirror resync -destination-path dst_svm:dest_flexgroup`
2. View the status of the SnapMirror relationship: `snapmirror show -expand`



```
cluster2::> snapmirror show -expand
```

Progress	Source	Destination	Mirror	Relationship	Total		
Last	Path	Type	Path	State	Status	Progress	Healthy
Updated							
-----	-----	-----	-----	-----	-----	-----	-----
-----	vss:s	XDP	vsd:dst	Snapmirrored			
				Idle	-	true	-
	vss:s__0001	XDP	vsd:dst__0001	Snapmirrored			
				Idle	-	true	-
	vss:s__0002	XDP	vsd:dst__0002	Snapmirrored			
				Idle	-	true	-
	vss:s__0003	XDP	vsd:dst__0003	Snapmirrored			
				Idle	-	true	-
	vss:s__0004	XDP	vsd:dst__0004	Snapmirrored			
				Idle	-	true	-
	vss:s__0005	XDP	vsd:dst__0005	Snapmirrored			
				Idle	-	true	-
	vss:s__0006	XDP	vsd:dst__0006	Snapmirrored			
				Idle	-	true	-
	vss:s__0007	XDP	vsd:dst__0007	Snapmirrored			
				Idle	-	true	-
	vss:s__0008	XDP	vsd:dst__0008	Snapmirrored			
				Idle	-	true	-
...							

The SnapMirror relationship status of each constituent is Snapmirrored.

## Reverse a SnapMirror relationship between FlexGroup volumes during disaster recovery

When a disaster disables the source FlexGroup volume of a SnapMirror relationship, you can use the destination FlexGroup volume to serve data while you repair or replace the source FlexGroup volume. After the source FlexGroup volume is online, you can make the original source FlexGroup volume a read-only destination and reverse the SnapMirror relationship.

### About this task

Any active quota rules on the destination volume are deactivated and the quota rules are deleted before resynchronization is performed.

You can use the `volume quota policy rule create` and `volume quota modify` commands to create and reactivate quota rules after the resynchronization operation is complete.

## Steps

1. On the original destination FlexGroup volume, remove the data protection mirror relationship between the source FlexGroup volume and the destination FlexGroup volume: `snapmirror delete -destination -path svm_name:volume_name`

```
cluster2::> snapmirror delete -destination-path vsd:dst
```

2. On the original source FlexGroup volume, remove the relationship information from the source FlexGroup volume: `snapmirror release -destination-path svm_name:volume_name -relationship -info-only`

After deleting a SnapMirror relationship, you must remove the relationship information from the source FlexGroup volume before attempting a resynchronization operation.

```
cluster1::> snapmirror release -destination-path vsd:dst -relationship  
-info-only true
```

3. On the new destination FlexGroup volume, create the mirror relationship: `snapmirror create -source-path src_svm_name:volume_name -destination-path dst_svm_name:volume_name -type XDP -policy MirrorAllSnapshots`

```
cluster1::> snapmirror create -source-path vsd:dst -destination-path  
vss:src -type XDP -policy MirrorAllSnapshots
```

4. On the new destination FlexGroup volume, resynchronize the source FlexGroup: `snapmirror resync -source-path svm_name:volume_name`

```
cluster1::> snapmirror resync -source-path vsd:dst
```

5. Monitor the SnapMirror transfers: `snapmirror show -expand`

```
cluster2::> snapmirror show -expand
```

```
Progress
Source          Destination Mirror Relationship Total
Last
Path           Type Path           State Status           Progress Healthy
Updated
-----
-----
vsd:dst         XDP  vss:src         Snapmirrored
Idle           -           true            -
vss:dst__0001 XDP  vss:src__0001 Snapmirrored
Idle           -           true            -
vss:dst__0002 XDP  vss:src__0002 Snapmirrored
Idle           -           true            -
vss:dst__0003 XDP  vss:src__0003 Snapmirrored
Idle           -           true            -
vss:dst__0004 XDP  vss:src__0004 Snapmirrored
Idle           -           true            -
vss:dst__0005 XDP  vss:src__0005 Snapmirrored
Idle           -           true            -
vss:dst__0006 XDP  vss:src__0006 Snapmirrored
Idle           -           true            -
vss:dst__0007 XDP  vss:src__0007 Snapmirrored
Idle           -           true            -
vss:dst__0008 XDP  vss:src__0008 Snapmirrored
Idle           -           true            -
...
```

The SnapMirror relationship status of each constituent shows as `Snapmirrored` that indicates that the resynchronization was successful.

## Expand FlexGroup volumes in a SnapMirror relationship

### Expand FlexGroup volumes in a SnapMirror relationship

Beginning with ONTAP 9.3, you can expand the source FlexGroup volume and destination FlexGroup volume that are in a SnapMirror relationship by adding new constituents to the volumes. You can expand the destination volumes either manually or automatically.

#### About this task

- After expansion, the number of constituents in the source FlexGroup volume and destination FlexGroup volume of a SnapMirror relationship must match.

If the number of constituents in the volumes does not match, the SnapMirror transfers fail.

- You should not perform any SnapMirror operation when the expansion process is in progress.
- If a disaster strikes before the expansion process is complete, you must break the SnapMirror relationship and wait until the operation succeeds.



You should break the SnapMirror relationship when the expansion process is in progress only in the case of a disaster. In the case of a disaster, the break operation can take some time to complete. You should wait for the break operation to get completed successfully before performing a resync operation. If the break operation fails, you must retry the break operation. If the break operation fails, some of the new constituents might remain in the destination FlexGroup volume after the break operation. It is best to delete these constituents manually before proceeding further.

## Expand the source FlexGroup volume of a SnapMirror relationship

Beginning with ONTAP 9.3, you can expand the source FlexGroup volume of a SnapMirror relationship by adding new constituents to the source volume. You can expand the source volume in the same way that you expand a regular FlexGroup volume (read-write volume).

### Steps

1. Expand the source FlexGroup volume: `volume expand -vserver vs_server_name -volume fg_src -aggr-list aggregate name,... [-aggr-list-multiplier constituents_per_aggr]`

```
cluster1::> volume expand -volume src_fg -aggr-list aggr1 -aggr-list
-multiplier 2 -vserver vs_src
```

```
Warning: The following number of constituents of size 50GB will be added
to FlexGroup "src_fg": 2.
```

```
Expanding the FlexGroup will cause the state of all Snapshot copies to
be set to "partial".
```

```
Partial Snapshot copies cannot be restored.
```

```
Do you want to continue? {y|n}: Y
```

```
[Job 146] Job succeeded: Successful
```

The state of all of the Snapshot copies that are taken before the volume is expanded changes to partial.

## Expand the destination FlexGroup volume of a SnapMirror relationship

You can expand the destination FlexGroup volume and reestablish the SnapMirror relationship either automatically or manually. By default, the SnapMirror relationship is set for automatic expansion, and the destination FlexGroup volume expands automatically if the source volume expands.

### What you'll need

- The source FlexGroup volume must have been expanded.
- The SnapMirror relationship must be in the SnapMirrored state.

The SnapMirror relationship must not be broken or deleted.

### About this task

- When the destination FlexGroup volume is created, the volume is set up for automatic expansion by default.

You can modify the destination FlexGroup volume for manual expansion, if required.



The best practice is to expand the destination FlexGroup volume automatically.

- All SnapMirror operations fail until both the source FlexGroup volume and destination FlexGroup volume have expanded and have the same number of constituents.
- If you expand the destination FlexGroup volume after the SnapMirror relationship is broken or deleted, you cannot resync the original relationship again.

If you intend to reuse the destination FlexGroup volume, you must not expand the volume after deleting the SnapMirror relationship.

### Choices

- Perform an update transfer to expand the destination FlexGroup volume automatically:
  - a. Perform a SnapMirror update transfer: `snapmirror update -destination-path svm:vol_name`
  - b. Verify that the status of the SnapMirror relationship is in the SnapMirrored state: `snapmirror show`

```
cluster2::> snapmirror show

Progress
Source          Destination Mirror Relationship Total
Last
Path           Type Path           State Status Progress
Healthy Updated
-----
vs_src:src_fg
                XDP vs_dst:dst_fg
                               Snapmirrored
                               Idle           -         true
-
```

Based on the size and availability of aggregates, the aggregates are automatically selected, and new constituents that match the constituents of the source FlexGroup volume are added to the destination FlexGroup volume. After expansion, a resynchronization operation is automatically triggered.

- Expand the destination FlexGroup volume manually:
  - a. If the SnapMirror relationship is in the auto-expand mode, set the SnapMirror relationship to the manual expand mode: `snapmirror modify -destination-path svm:vol_name -is-auto-expand`

-enabled false

```
cluster2::> snapmirror modify -destination-path vs_dst:dst_fg -is
-auto-expand-enabled false
Operation succeeded: snapmirror modify for the relationship with
destination "vs_dst:dst_fg".
```

- b. Quiesce the SnapMirror relationship: `snapmirror quiesce -destination-path svm:vol_name`

```
cluster2::> snapmirror quiesce -destination-path vs_dst:dst_fg
Operation succeeded: snapmirror quiesce for destination
"vs_dst:dst_fg".
```

- c. Expand the destination FlexGroup volume: `volume expand -vserver vs_server_name -volume fg_name -aggr-list aggregate name,... [-aggr-list-multiplier constituents_per_aggr]`

```
cluster2::> volume expand -volume dst_fg -aggr-list aggr1 -aggr-list
-multiplier 2 -vserver vs_dst
```

```
Warning: The following number of constituents of size 50GB will be
added to FlexGroup "dst_fg": 2.
Do you want to continue? {y|n}: y
[Job 68] Job succeeded: Successful
```

- d. Resynchronize the SnapMirror relationship: `snapmirror resync -destination-path svm:vol_name`

```
cluster2::> snapmirror resync -destination-path vs_dst:dst_fg
Operation is queued: snapmirror resync to destination
"vs_dst:dst_fg".
```

- e. Verify that the status of the SnapMirror relationship is SnapMirrored: `snapmirror show`

```
cluster2::> snapmirror show
```

Progress	Source	Destination	Mirror	Relationship	Total	
Last	Path	Type	Path	State	Status	Progress
Healthy	Updated					
-----	-----	-----	-----	-----	-----	-----
-----	-----					
vs_src:src_fg		XDP	vs_dst:dst_fg			
			Snapmirrored			
			Idle		-	true
-						

## Perform a SnapMirror single file restore from a FlexGroup volume

Beginning with ONTAP 9.8, you can restore a single file from a FlexGroup SnapMirror vault or from a UDP destination.

### About this task

- You can restore from a FlexGroup volume of any geometry to FlexGroup volume of any geometry
- Only one file per restore operation is supported
- You can restore to either the original source FlexGroup volume or to a new FlexGroup volume
- Remote fenced file lookup is not supported.

Single file restore fails if the source file is fenced.

- You can restart or clean up an aborted single file restore
- You should clean up a failed single file restore transfer by using the `clean-up-failure` option of the `snapmirror restore` command
- Expansion of FlexGroup volumes is supported when a FlexGroup single file restore is in progress or in an aborted state

### Steps

1. Restore a file from a FlexGroup volume: `snapmirror restore -destination-path destination_path -source-path source_path -file-list /f1 -throttle throttle -source-snapshot snapshot`

The following is an example of a FlexGroup volume single file restore operation.

```
vserverA::> snapmirror restore -destination-path vs0:fg2 -source-path
vs0:fgd -file-list /f1 -throttle 5 -source-snapshot snapmirror.81072ce1-
d57b-11e9-94c0-005056a7e422_2159190496.2019-09-19_062631
[Job 135] Job is queued: snapmirror restore from source "vs0:fgd" for
```

```
the snapshot snapmirror.81072ce1-d57b-11e9-94c0-005056a7e422_2159190496.2019-09-19_062631.
```

```
vserverA::> snapmirror show
```

Source		Destination	Mirror	Relationship	
Total	Last				
Path	Type	Path	State	Status	Progress
Healthy	Updated				
-----	----	-----		-----	-----
-----	-----	-----			
vs0:v1d	RST	vs0:v2	-	Transferring	Idle 83.12KB
true	09/19 11:38:42				

```
vserverA::*> snapmirror show vs0:fg2
```

```
Source Path: vs0:fgd
Source Cluster: -
Source Vserver: vs0
Source Volume: fgd
Destination Path: vs0:fg2
Destination Cluster: -
Destination Vserver: vs0
Destination Volume: fg2
Relationship Type: RST
Relationship Group Type: none
Managing Vserver: vs0
SnapMirror Schedule: -
SnapMirror Policy Type: -
SnapMirror Policy: -
Tries Limit: -
Throttle (KB/sec): unlimited
Current Transfer Throttle (KB/sec): 2
Mirror State: -
Relationship Status: Transferring
File Restore File Count: 1
File Restore File List: f1
Transfer Snapshot: snapmirror.81072ce1-d57b-11e9-94c0-005056a7e422_2159190496.2019-09-19_062631
Snapshot Progress: 2.87MB
Total Progress: 2.87MB
Network Compression Ratio: 1:1
Snapshot Checkpoint: 2.97KB
Newest Snapshot: -
Newest Snapshot Timestamp: -
Exported Snapshot: -
Exported Snapshot Timestamp: -
```



```
Healthy: true
Physical Replica: -
Relationship ID: e6081667-dacb-11e9-94c0-005056a7e422
Source Vserver UUID: 81072ce1-d57b-11e9-94c0-005056a7e422
Destination Vserver UUID: 81072ce1-d57b-11e9-94c0-005056a7e422
Current Operation ID: 138f12e6-dacc-11e9-94c0-005056a7e422
Transfer Type: cg_file_restore
Transfer Error: -
Last Transfer Type: -
Last Transfer Error: -
Last Transfer Error Codes: -
Last Transfer Size: -
Last Transfer Network Compression Ratio: -
Last Transfer Duration: -
Last Transfer From: -
Last Transfer End Timestamp: -
Unhealthy Reason: -
Progress Last Updated: 09/19 07:07:36
Relationship Capability: 8.2 and above
Lag Time: -
Current Transfer Priority: normal
SMTape Operation: -
Constituent Relationship: false
Destination Volume Node Name: vserverA
Identity Preserve Vserver DR: -
Number of Successful Updates: 0
Number of Failed Updates: 0
Number of Successful Resyncs: 0
Number of Failed Resyncs: 0
Number of Successful Breaks: 0
Number of Failed Breaks: 0
Total Transfer Bytes: 0
Total Transfer Time in Seconds: 0
Source Volume MSIDs Preserved: -
OpMask: ffffffffffffffff
Is Auto Expand Enabled: -
Source Endpoint UUID: -
Destination Endpoint UUID: -
Is Catalog Enabled: false
```

## Restore a FlexGroup volume from a SnapVault backup

You can perform a full-volume restore operation of FlexGroup volumes from a Snapshot copy in the SnapVault secondary volume. You can restore the FlexGroup volume either to the original source volume or to a new FlexGroup volume.

## Before you begin

You must be aware of certain considerations when you restore from SnapVault backups for FlexGroup volumes.

- Only baseline restore is supported with partial Snapshot copies from a SnapVault backup. The number of constituents in the destination volume must match the number of constituents in the source volume when the Snapshot copy was taken.
- If a restore operation fails, no other operations are allowed until the restore operation is complete. You can either retry the restore operation or run the restore operation with the `cleanup` parameter.
- A FlexGroup volume can be the source volume of only one backup relationship or restore relationship. A FlexGroup volume cannot be the source of two SnapVault relationships, two restore relationships, or a SnapVault relationship and a restore relationship.
- SnapVault backup and restore operations cannot run in parallel. When either a baseline restore operation or an incremental restore operation is in progress, you should quiesce the backup operations.
- You must abort a restore operation of a partial Snapshot copy from the destination FlexGroup volume. You cannot abort the restore operation of a partial Snapshot copy from the source volume.
- If you abort a restore operation, you must restart the restore operation with the same Snapshot copy that was used for the previous restore operation.

## About this task

Any active quota rules on the destination FlexGroup volume are deactivated before the restore is performed.

You can use the `volume quota modify` command to reactivate quota rules after the restore operation is complete.

## Steps

1. Restore the FlexGroup volume: `snapmirror restore -source-path src_svm:src_flexgroup -destination-path dest_svm:dest_flexgroup -snapshot snapshot_name`  
`snapshot_name` is the Snapshot copy that is to be restored from the source volume to the destination volume. If the Snapshot copy is not specified, the destination volume is restored from the latest Snapshot copy.

```
vserverA::> snapmirror restore -source-path vserverB:dstFG -destination
-path vserverA:newFG -snapshot daily.2016-07-15_0010
Warning: This is a disruptive operation and the volume vserverA:newFG
will be read-only until the operation completes
Do you want to continue? {y|n}: y
```

## Disable SVM protection on a FlexGroup volume

When the SVM DR flag is set to `protected` on a FlexGroup volume, you can set the flag to `unprotected` to disable SVM DR protection on a FlexGroup volume.

## What you'll need

- The SVM DR relationship between the primary and secondary is healthy.

- SVM DR protection parameter is set to `protected`.

### Steps

1. Disable protection by using the `volume modify` command to change the `vserver-dr-protection` parameter for the FlexGroup volume to `unprotected`.

```
cluster2::> volume modify -vserver vs1 -volume fg_src -vserver-dr
-protection unprotected
[Job 5384] Job is queued: Modify fg_src.
[Job 5384] Steps completed: 4 of 4.
cluster2::>
```

2. Update the SVM at the secondary site: `snapmirror update -destination-path destination_svm_name: -source-path Source_svm_name:`
3. Verify that the SnapMirror relationship is healthy: `snapmirror show`
4. Verify that the FlexGroup SnapMirror relationship has been removed: `snapmirror show -expand`

## Enable SVM protection on a FlexGroup volume

When the SVM DR protection flag is set to `unprotected` on a FlexGroup volume, you can set the flag to `protected` to enable SVM DR protection.

### What you'll need

- The SVM DR relationship between the primary and secondary is healthy.
- SVM DR protection parameter is set to `unprotected`.

### Steps

1. Enable protection by using the `volume modify` to change the `vserver-dr-protection` parameter for the FlexGroup volume to `protected`.

```
cluster2::> volume modify -vserver vs1 -volume fg_src -vserver-dr
-protection protected
[Job 5384] Job is queued: Modify fg_src.
[Job 5384] Steps completed: 4 of 4.
cluster2::>
```

2. Update the SVM at the secondary site: `snapmirror update -destination-path destination_svm_name -source-path source_svm_name`

```
snapmirror update -destination-path vs1_dst: -source-path vs1:
```

3. Verify that the SnapMirror relationship is healthy: `snapmirror show`

```
cluster2::> snapmirror show
```

Progress

Source	Destination	Mirror	Relationship	Total
--------	-------------	--------	--------------	-------

Last

Path	Type	Path	State	Status	Progress	Healthy
------	------	------	-------	--------	----------	---------

Updated

-----

-----

vs1:	XDP	vs1_dst:	Snapmirrored			
			Idle		-	true
						-

4. Verify that the FlexGroup SnapMirror relationship is healthy: `snapmirror show -expand`

```
cluster2::> snapmirror show -expand
```

```

Progress
Source          Destination Mirror Relationship Total
Last
Path            Type  Path            State  Status          Progress Healthy
Updated
-----
-----
vs1:             XDP  vs1_dst:        Snapmirrored
                                Idle          -          true  -
vs1:fg_src       XDP  vs1_dst:fg_src  Snapmirrored
                                Idle          -          true  -
vs1:fg_src__0001 XDP  vs1_dst:fg_src__0001
                                Snapmirrored
                                Idle          -          true  -
vs1:fg_src__0002 XDP  vs1_dst:fg_src__0002
                                Snapmirrored
                                Idle          -          true  -
vs1:fg_src__0003 XDP  vs1_dst:fg_src__0003
                                Snapmirrored
                                Idle          -          true  -
vs1:fg_src__0004 XDP  vs1_dst:fg_src__0004
                                Snapmirrored
                                Idle          -          true  -

6 entries were displayed.
```

## Convert FlexVol volumes to FlexGroup volumes

### Converting FlexVol volumes to FlexGroup volumes overview

If you want to expand a FlexVol volume beyond its space limit, you can convert the FlexVol volume to a FlexGroup volume. Beginning with ONTAP 9.7, you can convert standalone FlexVol volumes or FlexVol volumes that are in a SnapMirror relationship to FlexGroup volumes.

### Considerations for converting FlexVol volumes to FlexGroup volumes

You should be aware of the features and operations that are supported before you decide to convert FlexVol volumes to FlexGroup volumes.

## Operations not supported during conversion

The following operations are not allowed when volume conversion is in progress:

- Volume move
- Aggregate autobalance
- Aggregate relocation
- Planned takeover and giveback in a high-availability configuration
- Manual and automatic giveback in an high-availability configuration
- Cluster upgrade and revert
- FlexClone volume split
- Volume rehost
- Volume modify and autosize
- Volume rename
- Attaching an object store to an aggregate
- Negotiated switchover in MetroCluster configuration
- SnapMirror operations
- Restoring from a Snapshot copy
- Quota operations
- Storage efficiency operations

You can perform these operations on the FlexGroup volume after successful conversion.

## Configurations that are not supported with FlexGroup volumes

- Offline or restricted volume
- SVM root volume
- SnapLock volumes
- SAN
- SMB 1.0
- NVMe namespaces
- Remote Volume Shadow Copy Service (VSS)

## Convert a FlexVol volume to a FlexGroup volume

Beginning with ONTAP 9.7, you can perform an in-place conversion of a FlexVol volume to a FlexGroup volume without requiring a data copy or additional disk space.

### What you'll need

- Transitioned volumes can be converted to FlexGroup volumes.

Converting transitioned volumes to FlexGroup volumes requires diag mode and should be performed only under NetApp Support supervision. It is highly recommended that you contact NetApp Support before you proceed with the conversion process.

- The FlexVol volume that is being converted must be online.
- The operations and configurations on the FlexVol volume must be compatible with the conversion process.

An error message is generated if the FlexVol volume has any incompatibility and the volume conversion is aborted. You can take corrective actions and retry the conversion.

## Steps

1. Verify that the FlexVol volume is online: `volume show vol_name -volume-style-extended,state`

```
cluster-1::> volume show my_volume -fields volume-style-extended,state
vserver volume      state  volume-style-extended
-----
vs0      my_volume online flexvol
```

2. Verify whether the FlexVol volume can be converted without issues:

- a. Log in to the advance privilege mode: `set -privilege advanced`
- b. Verify the conversion process: `volume conversion start -vserver vs1 -volume flexvol -check-only true`

You must rectify all errors before converting the volume.



You cannot convert a FlexGroup volume back to a FlexVol volume. If you want to do so, you should contact support.

3. Start the conversion: `volume conversion start -vserver svm_name -volume vol_name`

```
cluster-1::*> volume conversion start -vserver vs0 -volume my_volume

Warning: Converting flexible volume "my_volume" in Vserver "vs0" to a
FlexGroup
        will cause the state of all Snapshot copies from the volume to
be set
        to "pre-conversion". Pre-conversion Snapshot copies cannot be
        restored.
Do you want to continue? {y|n}: y
[Job 57] Job succeeded: success
```

4. Verify that the conversion is successful: `volume show vol_name -fields -volume-style-extended,state`

```
cluster-1::*> volume show my_volume -fields volume-style-extended,state
vserver volume      state  volume-style-extended
-----
vs0      my_volume  online flexgroup
```

## Results

The FlexVol volume is converted to a single-member FlexGroup volume.

## After you finish

You can expand the FlexGroup volume, as required.

## Convert a FlexVol volume SnapMirror relationship to a FlexGroup volume SnapMirror relationship

To convert a FlexVol volume SnapMirror relationship to a FlexGroup volume SnapMirror relationship in ONTAP, you must first convert the destination FlexVol volume followed by the source FlexVol volume.

### What you'll need

- The FlexVol volume that is being converted must be online.
- The source FlexVol volume in the SnapMirror relationship must not be the source volume for multiple SnapMirror relationships.

Fan-out SnapMirror relationships are not supported for FlexGroup volumes.

- The operations and configurations on the FlexVol volume must be compatible with the conversion process.

An error message is generated if the FlexVol volume has any incompatibility and the volume conversion is aborted. You can take corrective actions and retry the conversion.

### About this task

FlexGroup conversion is supported only for asynchronous SnapMirror relationships.

### Steps

1. Verify that the SnapMirror relationship is healthy: `snapmirror show`

Only XDP type mirror relationships can be converted.



```
cluster2::> snapmirror show
```

Progress

Source		Destination	Mirror	Relationship	Total		
Last							
Path	Type	Path	State	Status	Progress	Healthy	
Updated							
-----	----	-----	-----	-----	-----	-----	-----
-----							
vs0:src_dpv	DP	vs2:dst_dpv	Snapmirrored	Idle	-	true	-
vs0:src_xdp	XDP	vs2:dst_xdp	Snapmirrored	Idle	-	true	-

## 2. Verify whether the source volume is compatible for conversion:

- Log in to the advance privilege mode: `set -privilege advanced`
- Verify the conversion process: `volume conversion start -vserver vs1 -volume src_vol -check-only true`

You must rectify all errors before converting the volume.

## 3. Convert the destination FlexVol volume to FlexGroup volume.

- Quiesce the FlexVol SnapMirror relationship: `snapmirror quiesce -destination-path dest_svm:dest_volume`

```
cluster2::> snapmirror quiesce -destination-path vs2:dst_xdp
```

- Start the conversion: `volume conversion start -vserver dest_svm -volume dest_volume`

```
cluster-1::> volume conversion start -vserver vs2 -volume dst_xdp
```

Warning: After the volume is converted to a FlexGroup, it will not be possible to change it back to a flexible volume.  
Do you want to continue? {y|n}: y

[Job 510] Job succeeded: SnapMirror destination volume "dst\_xdp" has been successfully converted to a FlexGroup volume.  
You must now convert the relationship's source volume, "vs0:src\_xdp", to a FlexGroup.  
Then, re-establish the SnapMirror relationship using the "snapmirror resync" command.

4. Convert the source FlexVol volume to FlexGroup volume: `volume conversion start -vserver src_svm_name -volume src_vol_name`

```
cluster-1::> volume conversion start -vserver vs0 -volume src_xdp
```

```
Warning: Converting flexible volume "src_xdp" in Vserver "vs0" to a FlexGroup
```

```
will cause the state of all Snapshot copies from the volume to be set
```

```
to "pre-conversion". Pre-conversion Snapshot copies cannot be restored.
```

```
Do you want to continue? {y|n}: y
```

```
[Job 57] Job succeeded: success
```

5. Resync the relationship: `snapmirror resync -destination-path dest_svm_name:dest_volume`

```
cluster2::> snapmirror resync -destination-path vs2:dst_xdp
```

### After you finish

You must ensure that when the source FlexGroup volume is expanded to include more constituents, the destination volume is also expanded.

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