ONTAP® 9

Scalability and Performance Using FlexGroup™ Volumes Power Guide

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Contents

Deciding whether to use the Scalability and Performance using FlexGroup Volumes Power Guide

This guide describes how to 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 should use this guide if you want to configure FlexGroup volumes in the following way:

- You want to use NFSv3, SMB 2.0, or SMB 2.1.

- You want to use the ONTAP command-line interface (CLI), not OnCommand System Manager or an automated scripting tool.
  An important subset of FlexGroup functionality is available in OnCommand System Manager.
  You can create, view, and delete FlexGroup volumes using OnCommand System Manager.

- You want to use best practices, not explore every available option.
  Details about command syntax are available from CLI help and ONTAP man pages.

- You do not want to read a lot of conceptual background.
  Information about ONTAP technology is available in the ONTAP Reference Library and in Technical Reports (TRs).

- You have cluster administrator privileges, not SVM administrator privileges.

If this guide is not suitable for your situation, you should see the following documentation instead:

- *NetApp Technical Report 4557: NetApp FlexGroup - A Technical Overview*

- *Cluster management using System Manager*

- *ONTAP 9 commands*

What a FlexGroup volume is

A FlexGroup volume is a scale-out NAS container that leverages the cluster resources to provide performance and scale. FlexGroup volumes provide high performance along with automatic load distribution and scalability.

A FlexGroup volume contains a number of constituents that automatically and transparently share a traffic load.
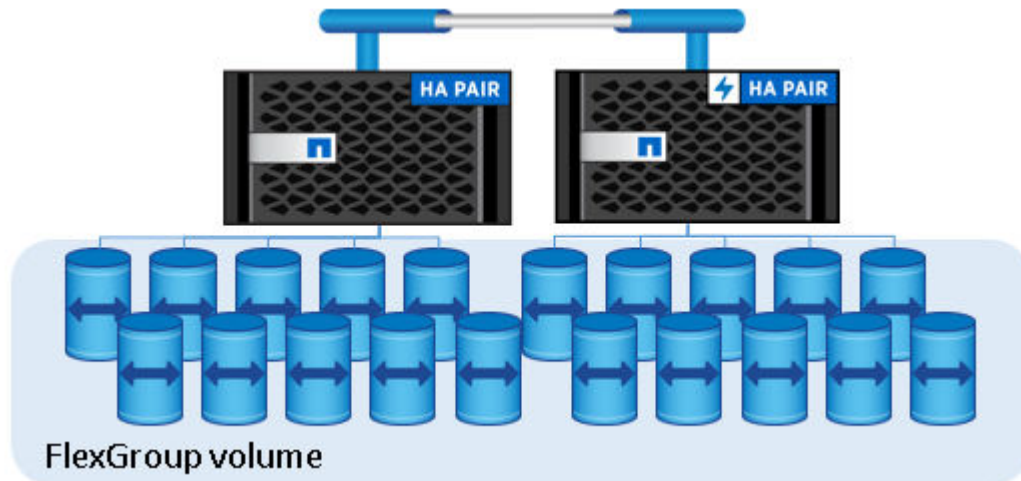
FlexGroup volume

FlexGroup volumes provide the following benefits:

- FlexGroup volumes provide high scalability.
  The qualified limits for a FlexGroup volume in ONTAP 9.1 are 20 PB maximum size with 400 billion files on a 10-node cluster.

- FlexGroup volumes can leverage the resources of an entire cluster to serve high-throughput and low-latency workloads

- A FlexGroup volume is single name space container that allows simplified management that is similar to FlexVol volumes.

Unsupported configurations for FlexGroup volumes

FlexGroup volumes support NFSv3 and SMB 2.x in ONTAP 9.1. You must be aware of the ONTAP features that are not supported for FlexGroup volumes.

Unsupported protocols	Unsupported data protection features	Unsupported storage management features	Other unsupported ONTAP features

• pNFS
• NFSv4.1
• SMB 1.0
• SMB 3.0
  ◦ SMB transparent failover
  ◦ Continuously available SMB shares
• SAN
	• SnapLock
	• SnapVault
	• SVM DR
	• SnapRestore To restore a FlexGroup volume, contact technical support.
	• NDMP
	• Cascade and fan-out SnapMirror relationships
	• MetroCluster
		• Qtrees
		• Quota enforcement
		• FlexClone
			• FPolicy
			• AntiVirus
			• File auditing
			• ODX copy offload
			• Change notifications for SMB shares
			• Remote VSS (Volume Shadow Copy Service)
			• Storage-Level Access Guard

FlexGroup volume setup workflow

You can either deploy a FlexGroup volume where ONTAP automatically selects the aggregates based on best practices and configures the FlexGroup volume, or create a FlexGroup volume by manually selecting the aggregates and configuring it for data access.
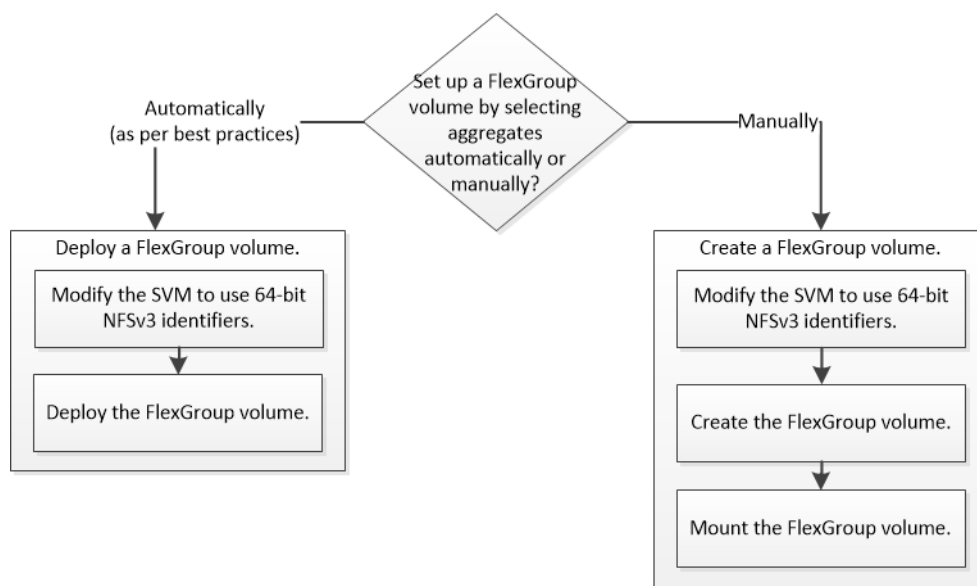
Before you begin

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

About this task

When you deploy a FlexGroup volume, aggregates are automatically selected based on the best practices for optimum performance. When you create a FlexGroup volume, you manually select the aggregates.

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

Choices

- Deploying a FlexGroup volume on page 7
- Creating a FlexGroup volume on page 9

Deploying a FlexGroup volume

You can automatically deploy a FlexGroup volume by using the `volume flexgroup deploy` command. When you use this command, ONTAP creates and configures the FlexGroup volume by

automatically selecting aggregates. Aggregates are selected based on the best practices for optimum performance.

Before you begin

Each node in the cluster must have two or more aggregates.

Each node in an All Flash FAS cluster must have one aggregate.

About this task

ONTAP selects two aggregates with the largest amount of usable space on each node to create the FlexGroup volume. For All Flash FAS clusters, one aggregate is selected per node.

Steps

1. If the SVM on which the FlexGroup volume must be created uses 32-bit NFSv3 FSIDs and file IDs, modify the SVM to use 64-bit NFSv3 identifiers.

   a. Log in to the advanced privilege level:

      set -privilege advanced

   b. Modify the SVM to use 64-bit NFSv3 identifiers:

      vserver nfs modify -vserver *svm_name* -v3-64bit-identifiers enabled

      Example

      ```
      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
      ```

2. Create the FlexGroup volume:

   volume flexgroup deploy -vserver *svm_name* -size *fg_size*

   Example

   ```
   cluster-1::> volume flexgroup deploy -vserver vs1 -size 400TB

           The FlexGroup "fg" will be created with the following number of
   constituents of size 25TB: 16.
   Do you want to continue? {y|n}: y
   [Job 35] Job succeeded: The FlexGroup "fg" was created successfully on the
   following aggregates: Aggr_cmode,aggr1,aggr2,aggr3
   ```

   The FlexGroup volume is created with eight constituents on each node in the cluster. The constituents are split equally between the two largest aggregates on each node. On All Flash FAS clusters, all the eight constituents are created on the largest aggregate on each node.

   The FlexGroup volume is created with the **volume** space guarantee except for All Flash FAS systems. For All Flash FAS systems, the FlexGroup volume is created with the **none** space guarantee.

After you finish

If the 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 from the client.

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

Creating a FlexGroup volume

Creating a FlexGroup volume involves manually selecting the aggregates on which the FlexGroup volume must be created, and specifying the number of constituents on each aggregate. After creating the FlexGroup volume, you must then mount the FlexGroup volume for NFS and CIFS access.

About this task

You should create at least eight constituents spread over two or more aggregates on each node. On an All Flash FAS cluster, you should create eight constituents on a single aggregate on each node.

Steps

1. If the SVM on which the FlexGroup volume must be created uses 32-bit NFSv3 FSIDs and file IDs, modify the SVM to use 64-bit NFSv3 identifiers.

   a. Log in to the advanced privilege level:

      set -privilege advanced

   b. Modify the SVM to use 64-bit NFSv3 identifiers:

      vserver nfs modify -vserver *svm_name* -v3-64bit-identifiers enabled

      Example

      ```
      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
      ```

2. 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*

   - `-aggr-list` 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 it.

     Important: All aggregates must use the same disk type.

   - `-aggr-list-multiplier` specifies the number of times to iterate over the aggregates listed with the `-aggr-list` parameter when creating a FlexGroup volume. The default value of this parameter is 4.

- `size` specifies the size of the FlexGroup volume in [KB|MB|GB|TB|PB].

Example

```
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
```

3. Optional: Mount the FlexGroup volume with a junction path:

volume mount -vserver *vserver_name* -volume *vol_name* -junction-path *junction_path*

Example

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

After you finish

If the 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 from the client.

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

Managing FlexGroup volumes

You can manage FlexGroup volumes by performing operations such as monitoring the space usage, increasing the capacity, adding constituents, setting quota rules, creating Snapshot copies, and moving the constituents of FlexGroup volumes.

Monitoring 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.

Step

1. View the FlexGroup volume and its constituents:

    volume show -vserver *vserver_name* -is-constituent *

    Example

    ```
    cluster-1::> volume show  -vserver fg1_vs -is-constituent *
    Vserver    Volume        Aggregate    State      Type      Size  Available Used%
    ---------- ------------- ------------ ---------- ---- ---------- ---------- -----
    fg1_vs     fg1           -            online     RW        400TB  172.86GB   56%
    fg1_vs     fg1__0001     Aggr_cmode   online     RW         25GB  10.86TB    56%
    fg1_vs     fg1__0002     aggr1        online     RW         25TB  10.86TB    56%
    fg1_vs     fg1__0003     Aggr_cmode   online     RW         25TB  10.72TB    57%
    fg1_vs     fg1__0004     aggr1        online     RW         25TB  10.73TB    57%
    fg1_vs     fg1__0005     Aggr_cmode   online     RW         25TB  10.67TB    57%
    fg1_vs     fg1__0006     aggr1        online     RW         25TB  10.64TB    57%
    fg1_vs     fg1__0007     Aggr_cmode   online     RW         25TB  10.63TB    57%
    ...
    ```

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

Increasing the size of a FlexGroup volume

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

Before you begin

Sufficient space must be available in the aggregates.

About this task

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

- If you want to improve performance, you can expand the FlexGroup volume.
  You might want to expand the 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.

◦ Existing constituents of the FlexGroup volume have reached the maximum FlexVol size for the hardware, and therefore the FlexGroup volume cannot be resized.

• If you have FlexGroup volumes in a SnapMirror relationship, you must not expand the FlexGroup volumes after the SnapMirror relationship is established; however, you can increase the capacity of the FlexGroup volumes.

Step

1. Increase capacity or performance of the FlexGroup volume, as desired:

If you want to increase the...	Then...
Capacity by resizing the existing constituents	`volume modify -vserver vserver_name -volume fg_name -size new_size`
Performance by adding new constituents	`volume expand -vserver vserver_name -volume fg_name -aggr-list aggregate name,... [-aggr-list-multiplier constituents_per_aggr]` The default value of the `-aggr-list-multiplier` parameter is 1.

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 svm1 -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 new constituents are of the same size as that of the existing constituents.

Using quotas for FlexGroup volumes

You can use only user and group type tracking quotas for FlexGroup volumes. Hard, soft, and threshold limit quotas are not supported for FlexGroup volumes.

About this task

Tracking quotas generate reports of disk and file usage, and do not limit resource usage. Because you cannot use quotas to limit space usage for FlexGroup volumes, you can use the default tracking quota for FlexGroup volumes. Default tracking quotas enable you to track usage for all instances of a quota type (users or groups).

Steps

1. Create quota rules for targets by using the `volume quota policy rule create` command.

- The quota target type can only be **user** or **group** for FlexGroup volumes.
  Tree quota type is not supported for FlexGroup volumes.

- A path is not supported as the target when creating quota rules for FlexGroup volumes.

- You cannot specify disk limit, file limit, threshold for disk limit, soft disk limit, or soft file limit when creating quota rules for FlexGroup volumes.

- You must use "" string with the -qtree option when creating a quota rule for FlexGroup volumes.

Example

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

2. Activate the quotas for the specified FlexGroup volume by using the volume quota modify command.

Logging of quota exceeded messages cannot be enabled for a FlexGroup volume.

Example

```
cluster1::> volume quota modify -vserver vs0 -volume fg1 -state on
```

3. Monitor the state of the quota initialization by using the volume quota show command.

FlexGroup volumes might show the **mixed** state that indicates that all constituent volumes are not in the same state.

Example

```
cluster1::> volume quota show -vserver vs0
                                        Scan
Vserver     Volume         State          Status
---------   ------------   ---------------  ------
vs0         fg1            initializing       95%
vs0         vol1           off                 -
2 entries were displayed.
```

4. View the quota report for the FlexGroup volume with active quotas by using the volume quota report command.

Example

```
cluster1::> volume quota report -vserver vs0 -volume fg1
  Vserver: vs0
                                     ----Disk----   ----Files-----   Quota
  Volume   Tree       Type    ID      Used  Limit    Used   Limit   Specifier
  -------  --------   ------  -------  -----  -----   ------  ------  ---------
  fg1                 user    *         0B     -        0       -    *
  fg1                 user    root     1GB     -        1       -    *
  2 entries were displayed.
```

Related information

[ONTAP concepts: Using quotas to restrict or track resource usage](#)

Enabling 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.

Before you begin

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*

    Example

    ```
    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
        Efficiency Policy Name: -
        Blocks Skipped Sharing: 0
          Last Operation State: Success
    Last Success Operation Begin: Wed Jul 27 00:00:03
    Last Success Operation End: Wed Jul 27 00:00:03
          Last Operation Begin: Wed Jul 27 00:00:03 2016
            Last Operation End: Wed Jul 27 00:00:03 2016
           Last Operation Size: 0B
          Last Operation Error: -
                Changelog Usage: 0%
              Logical Data Size: 484KB
             Logical Data Limit: 640TB
           Logical Data Percent: 0%
                     Queued Job: -
    ```

```
Stale Fingerprint Percentage: 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
```

Protecting FlexGroup volumes using Snapshot copies

You can create Snapshot policies that automatically manage the creation of Snapshot copies or 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 their schedules do not overlap.

> **Attention:** You cannot restore a FlexGroup volume from a Snapshot copy. For restoring a FlexGroup volume, contact technical support.

Steps

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

If you want to create a...	Use this command...
Snapshot policy	`volume snapshot policy create`
	Important: The schedules associated with the Snapshot policy of a FlexGroup volume must have an interval greater than 30 minutes.
	When you create a FlexGroup volume, the **default** Snapshot policy is applied to the FlexGroup volume.
Snapshot copy manually	`volume snapshot create`
	Note: You cannot modify the attributes of a Snapshot copy for a FlexGroup volume. You must delete and then re-create the Snapshot copy.

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`

Example

```
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 a FlexGroup volume:

`volume snapshot show -is-constituent true`

Example

```
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%
```

Related information

[ONTAP concepts: Working with Snapshot copies](#)

Moving 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.

Before you begin

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

Steps

1. Determine the FlexGroup volume constituent that you want to move by using the `volume show` command.

   Example

   ```
   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. Determine an aggregate to which you can move the FlexGroup volume constituent by using the `volume move target-aggr show` command.

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

   Example

   ```
   cluster1::> volume move target-aggr show -vserver vs2 -volume fg1_0002
   Aggregate Name    Available Size    Storage Type
   --------------    --------------    ------------
   aggr2             467.9TB           FCAL
   node12a_aggr3     100.34TB          FCAL
   node12a_aggr2     100.36TB          FCAL
   node12a_aggr1     100.36TB          FCAL
   node12a_aggr4     100.36TB          FCAL
   5 entries were displayed.
   ```

3. Verify that the FlexGroup volume constituent can be moved to the intended aggregate by using the `volume move start -perform-validation-only` command to run a validation check.

4. Move the FlexGroup volume constituent by using the `volume move start` command.

The move operation runs as a background process.

Example

```
cluster1::> volume move start -vserver vs2 -volume fg1_002 -destination-
aggregate node12a_aggr3 -cutover-window 35
```

Troubleshooting: If the volume move operation fails due to an active SnapMirror operation, abort the SnapMirror operation by using the `snapmirror abort -h` command.

In some cases, the SnapMirror abort might also fail. In such situations, you should abort the move operation and retry later.

5. Verify the state of the move operation by using the `volume move show` command.

Example

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

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

Disaster recovery preparation workflow for FlexGroup volumes

Preparing FlexGroup volumes for disaster recovery involves creating a SnapMirror relationship between FlexGroup volumes residing on the peered clusters and monitoring the SnapMirror relationship periodically.
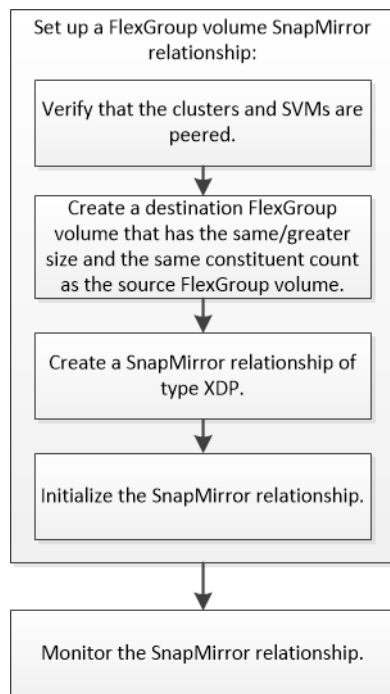
Steps

Creating a SnapMirror relationship for FlexGroup volumes

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

Before you begin

You must have created the cluster and SVM peering relationships.

Data protection using SnapMirror and SnapVault technology

About this task

- You can create both intercluster and intracluster SnapMirror relationships for FlexGroup volumes.

- If you create multiple SnapMirror relationships for FlexGroup volumes in a cluster, you should ensure that the schedules do not overlap.

- You must not expand a FlexGroup volume (add constituents) after the SnapMirror relationship is established; however, you can increase the capacity of the FlexGroup volume.

Steps

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

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

   volume show -is-constituent *

   Example

   ```
   cluster1::> volume show  -vserver vss -is-constituent *
   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 the destination FlexGroup volume of type **DP** with the same number of constituents as the source FlexGroup volume.

   Example

   ```
   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 -is-constituent *

   Example

   ```
   cluster2::> volume show  -vserver vsd -is-constituent *
   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%
   ...
   ```

> **Important:** The destination FlexGroup volume does not automatically grow during replication based on the source volume size. Therefore, if you increase the size of the source FlexGroup volume, you must also increase the size of the destination FlexGroup volume.

2. From the destination cluster, create the 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 relationship for FlexGroup volumes must be of the type **XDP**. By default, the **MirrorAllSnapshots** policy is used for FlexGroup volume SnapMirror relationships.

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

   > **Note:** You cannot use SnapMirror labels of Snapshot copies for FlexGroup volumes.

   Example

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

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

   snapmirror initialize -destination-path *dest_svm:dest_flexgroup*

   Example

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

Result

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

After you finish

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

Related tasks

Creating a FlexGroup volume on page 9
Deploying a FlexGroup volume on page 7

Related information

NetApp Documentation: ONTAP 9

Monitoring 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`

   Example

   ```
   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`

   Example

   ```
   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`

Example

```
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.

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.
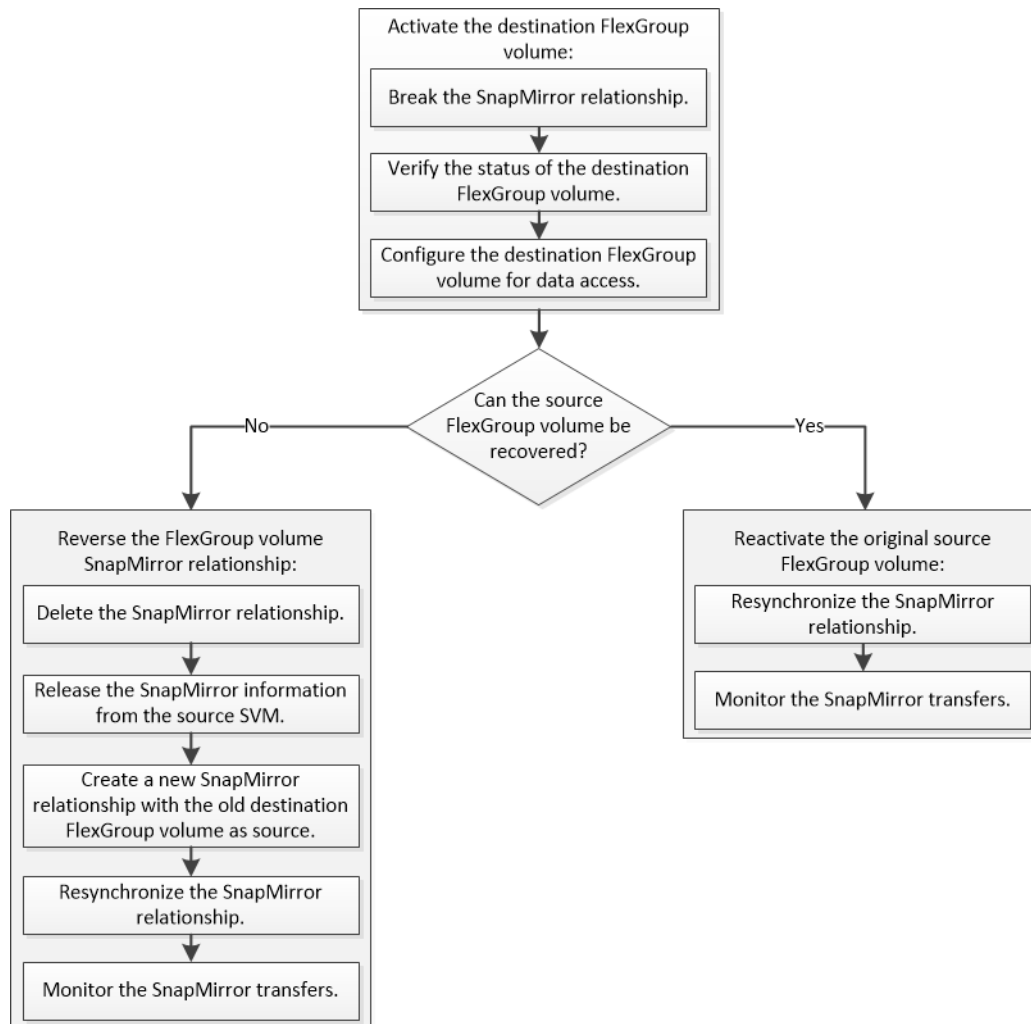
About this task

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.

Activating 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*

   Example

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

2. Break the FlexGroup volume SnapMirror relationship:

   snapmirror break *dest_svm:dest_flexgroup*

   Example

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

3. View the status of the SnapMirror relationship:

   snapmirror show -expand

   Example

   ```
   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*

Example

```
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.

Reactivating 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.

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

Example

```
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**.

Reversing the FlexGroup volume SnapMirror relationship after disaster

When 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.

Steps

1. On the original destination FlexGroup volume, use the `snapmirror delete` command to remove the data protection mirror relationship between the source and the destination FlexGroup volumes.

   Example

   ```
   cluster2::> snapmirror delete vsd:dst
   ```

2. On the original source FlexGroup volume, use the `snapmirror release` command to remove relationship information from the source.

   Example

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

3. On the new destination FlexGroup volume, use the `snapmirror create` command to create the mirror relationship.

   Example

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

4. On the new destination FlexGroup volume, use the `snapmirror resync` command to resynchronize the source FlexGroup.

   Example

   ```
   cluster1::> snapmirror resync vss:src
   ```

5. Monitor the SnapMirror transfers by using the `snapmirror show` command:

   Example

   ```
   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    -
   vsd:dst__0002 XDP  vss:src__0002  Snapmirrored
                                       Idle          -            true    -
   vsd:dst__0003 XDP  vss:src__0003  Snapmirrored
                                       Idle          -            true    -
   vsd:dst__0004 XDP  vss:src__0004  Snapmirrored
                                       Idle          -            true    -
   vsd:dst__0005 XDP  vss:src__0005  Snapmirrored
                                       Idle          -            true    -
   vsd:dst__0006 XDP  vss:src__0006  Snapmirrored
                                       Idle          -            true    -
   vsd:dst__0007 XDP  vss:src__0007  Snapmirrored
   ```

```
                                      Idle            -          true    -
vsd:dst__0008 XDP  vss:src__0008  Snapmirrored
                                      Idle            -          true    -
...
```

The SnapMirror relationship status of each constituent is **Snapmirrored**.

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