FlexGroup volume setup

ONTAP 9

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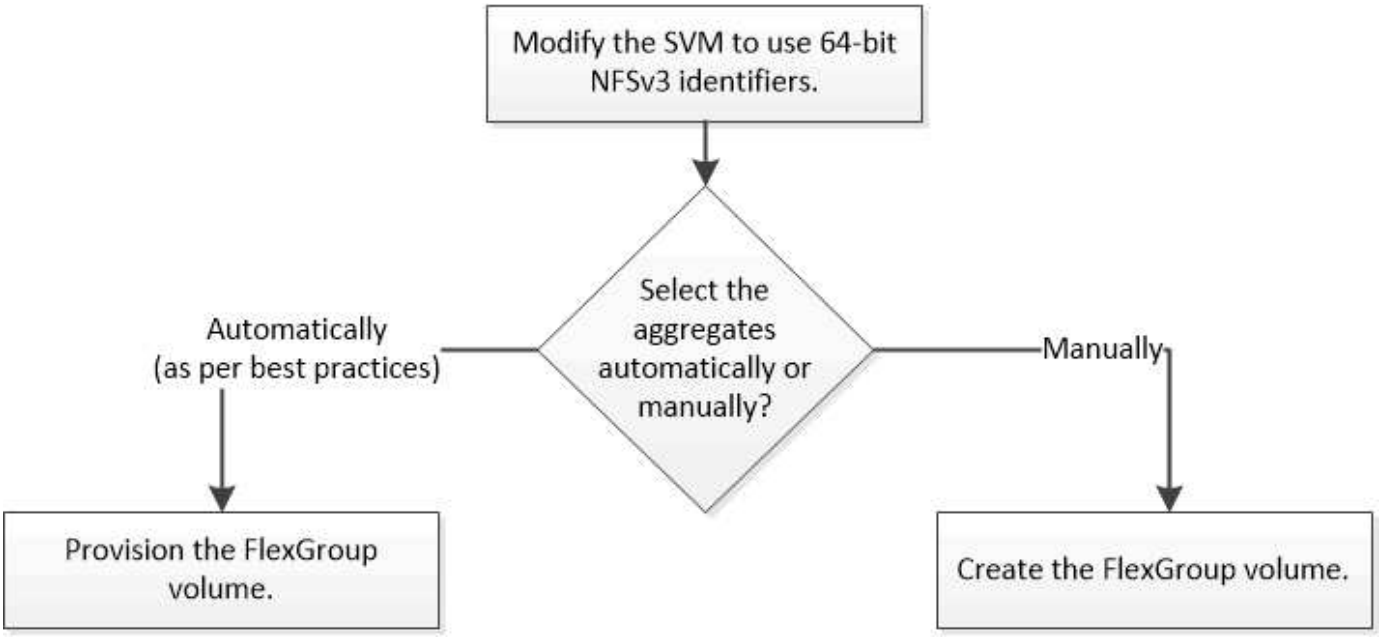
ONTAP FlexGroup volume setup workflow

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.



Before you begin

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 ONTAP SVMs with FlexGroups

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 an ONTAP FlexGroup volume automatically

When you create a FlexGroup volume, you can choose to have ONTAP automatically provision the FlexGroup volume by selecting the underlying local tiers (aggregates). Local tiers are selected based on the best practices for optimum performance and capacity.

Before you begin

Each node in the cluster must have at least one local tier.

> When creating a FlexGroup volume that will tier inactive data, each node must have at least one local tier with FabricPool enabled.

About this task

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

Beginning with ONTAP 9.15.1, when you automatically provision a FlexGroup volume, ONTAP uses balanced placement (BP) to choose the local tiers and FlexGroup member (constituent) volumes layout. One aspect of BP is how it limits over-provisioning local tiers when creating 'none' guaranteed (thin-provisioned) FlexGroup volumes. The size of the overall FlexGroup volume is limited by the amount of free space on the local tier, although the limit is higher than it is for 'volume' guaranteed (thick-provisioned) FlexGroup volumes. When you create a FlexGroup volume using REST APIs or `auto-provision-as` with the ONTAP CLI, provisioning might fail because of insufficient space due to this limit. You can avoid this by creating smaller FlexGroup volumes, or by creating a FlexGroup volume and selecting the local tiers manually using the `aggr-list`

parameter.

Steps

1. Provision the FlexGroup volume:

   ```
   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] [-granular-data advanced]
   ```

   Beginning with ONTAP 9.16.1, you can enable advanced capacity balancing (`-granular-data advanced` in the CLI) to write data across multiple FlexGroup member volumes when files are larger than 10GB.

   Beginning with ONTAP 9.5, you can create FlexGroup volumes on local tiers with FabricPool enabled. To automatically provision a FlexGroup volume on local tiers with FabricPool enabled, you must set the `-support-tiering` parameter to `true`. 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

   You can specify a throughput ceiling (QoS Max) for FlexGroup volumes. This 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.

   Performance management

   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

   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:

   ```
   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 local tiers with FabricPool enabled:

```
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 member volumes on each node in the cluster. The member volumes are distributed equally between the two largest local tiers on each node.

By default, the FlexGroup volume is created with the `volume` space guarantee setting except on AFF systems. For AFF systems, by default the FlexGroup volume is created with the `none` space guarantee.

2. 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 /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
```

Related information

- qos policy-group create

Create ONTAP FlexGroup volumes

You can create a FlexGroup volume by manually selecting the local tiers (aggregates) on which the FlexGroup volume must be created, and then specifying the number of member volumes (constituents) on each local tier.

Alternatively, you can choose to have ONTAP automatically provision the FlexGroup volume by selecting the local tiers and letting ONTAP set the number of member volumes based on the best practices for optimum performance and capacity.

About this task

You must be aware of the space required in the local tiers for creating 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 use local tiers that are on identical hardware systems.

  The use of identical hardware systems helps in providing predictable performance across the FlexGroup volume. Note: C-Series r1 and C-Series r2 systems are not identical systems. For example, the AFF C80 r1 and AFF C80 r2 are not identical.

- A FlexGroup volume should span local tiers using the same disk type and RAID group configurations.

  For consistent performance, you must ensure that all of the local tiers are made of all SSDs, all HDDs, or all Flash Pool (hybrid) local tiers. Additionally, the local tiers 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 local tiers on which the FlexGroup volume is deployed have the following characteristics:
  - Approximately the same amount of free space should be available across multiple local tier, especially when using thin provisioning.
  - Approximately 3 percent of the free space should be reserved for local tier metadata after creation of the FlexGroup volume.
- For FAS systems, it is best to have two local tiers per node and for AFF systems, you must have one local tier per node for the FlexGroup volume.
- For each FlexGroup volume, you should create at least eight member volumes that are distributed over two

or more local tiers on FAS systems, and over one or more local tiers on AFF systems.

- Beginning with ONTAP 9.9.1, SnapMirror fanout relationships of two or more FlexGroup volumes are supported, with a maximum of eight fanout legs. System Manager does not support SnapMirror cascading FlexGroup volume relationships.
- When you use System Manager to create a FlexGroup volume, ONTAP automatically selects the local tiers required for creating the FlexGroup volume.
- Beginning with ONTAP 9.8, when you provision storage, QoS is enabled by default. You can disable QoS, or choose a custom QoS policy during the provisioning process or at a later time.

Before you begin

- Beginning with ONTAP 9.13.1, you can create volumes with capacity analytics and Activity Tracking enabled. To enable capacity or Activity Tracking, issue the `volume create` command with `-analytics-state` or `-activity-tracking-state` set to `on`.

  To learn more about capacity analytics and Activity Tracking, see Enable File System Analytics. Learn more about `volume create` in the ONTAP command reference.

System Manager

Using System Manager, you can create a FlexGroup volume.

Steps

1. Navigate to **Storage > Volumes** and select + Add .
2. In the **Add volume** window, enter a volume name and size, then select **More options**.
3. In the **Storage and optimization** section, select **Distribute volume data across the cluster (FlexGroup)**.

   If you are running ONTAP 9.8 or later and you want to disable QoS or choose a custom QoS policy, click **More Options**, and then under **Storage and Optimization**, select **Performance Service Level**.

4. Complete the remaining information for the volume and select **Save**.

CLI

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] [-granular-data advanced]
```

   - The `-aggr-list` parameter specifies the list of local tiers to be used for FlexGroup member volumes.

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

   - The `-aggr-list-multiplier` parameter specifies the number of member volumes that will be created on each local tier listed with the `-aggr-list` parameter.

     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 9.16.1, you can enable advanced capacity balancing (`-granular-data advanced` in the CLI) to write data across multiple FlexGroup member volumes when files are larger than 10GB.
   - Beginning with ONTAP 9.5, you can create FlexGroup volumes using local tiers with FabricPool enabled.

     To create a FlexGroup volume for FabricPool, all the local tiers specified with the `-aggr-list` parameter must have FabricPool enabled. The volume guarantee must be always set to `none` when using 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

- You can specify a throughput ceiling (QoS Max) for FlexGroup volumes, which limits the performance resources that the FlexGroup volume can consume.
- 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 local tiers (aggr1, aggr2, and aggr3) must have FabricPool enabled. 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

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