



FlexGroup volume setup

ONTAP 9

NetApp
June 17, 2023

Table of Contents

- FlexGroup volume setup 1
 - FlexGroup volume setup workflow 1
 - Enable 64-bit NFSv3 identifiers on an SVM..... 1
 - Provision a FlexGroup volume automatically..... 2
 - Create a FlexGroup volume 5

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...
---------------------	---------------------

<p>ONTAP 9.2 or later</p>	<pre>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]</pre> <p>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>Disk and aggregate management</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>Performance management</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 data-bbox="873 1339 928 1390">  </div> <p>You must enable encryption on FlexGroup volumes at the time of creation. You cannot enable encryption on existing FlexGroup volumes.</p> <p>Encryption of data at rest</p>
<p>ONTAP 9.1</p>	<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.

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
```

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 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.

Before you begin

- Beginning in 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](#).

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 vs0 -volume fg2 -junction-path /fg
```

```
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](#)

Copyright information

Copyright © 2023 NetApp, Inc. All Rights Reserved. Printed in the U.S. No part of this document covered by copyright may be reproduced in any form or by any means—graphic, electronic, or mechanical, including photocopying, recording, taping, or storage in an electronic retrieval system—without prior written permission of the copyright owner.

Software derived from copyrighted NetApp material is subject to the following license and disclaimer:

THIS SOFTWARE IS PROVIDED BY NETAPP “AS IS” AND WITHOUT ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, WHICH ARE HEREBY DISCLAIMED. IN NO EVENT SHALL NETAPP BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

NetApp reserves the right to change any products described herein at any time, and without notice. NetApp assumes no responsibility or liability arising from the use of products described herein, except as expressly agreed to in writing by NetApp. The use or purchase of this product does not convey a license under any patent rights, trademark rights, or any other intellectual property rights of NetApp.

The product described in this manual may be protected by one or more U.S. patents, foreign patents, or pending applications.

LIMITED RIGHTS LEGEND: Use, duplication, or disclosure by the government is subject to restrictions as set forth in subparagraph (b)(3) of the Rights in Technical Data -Noncommercial Items at DFARS 252.227-7013 (FEB 2014) and FAR 52.227-19 (DEC 2007).

Data contained herein pertains to a commercial product and/or commercial service (as defined in FAR 2.101) and is proprietary to NetApp, Inc. All NetApp technical data and computer software provided under this Agreement is commercial in nature and developed solely at private expense. The U.S. Government has a non-exclusive, non-transferrable, nonsublicensable, worldwide, limited irrevocable license to use the Data only in connection with and in support of the U.S. Government contract under which the Data was delivered. Except as provided herein, the Data may not be used, disclosed, reproduced, modified, performed, or displayed without the prior written approval of NetApp, Inc. United States Government license rights for the Department of Defense are limited to those rights identified in DFARS clause 252.227-7015(b) (FEB 2014).

Trademark information

NETAPP, the NETAPP logo, and the marks listed at <http://www.netapp.com/TM> are trademarks of NetApp, Inc. Other company and product names may be trademarks of their respective owners.