



MetroCluster configurations

ONTAP 9

NetApp
March 03, 2023

This PDF was generated from https://docs.netapp.com/us-en/ontap/upgrade/task_updating_a_four_or_eight_node_mcc.html on March 03, 2023. Always check docs.netapp.com for the latest.

Table of Contents

- MetroCluster configurations 1
 - Manual nondisruptive upgrade of a four- or eight-node MetroCluster configuration using the CLI 1
 - Manual nondisruptive upgrade of a two-node MetroCluster configuration in ONTAP 9.2 or earlier using the CLI 14

MetroCluster configurations

Manual nondisruptive upgrade of a four- or eight-node MetroCluster configuration using the CLI

The manual update procedure for upgrading or downgrading a four- or eight-node MetroCluster configuration involves preparing for the update, updating the DR pairs in each of the one or two DR groups simultaneously, and performing some post-update tasks.

- This task applies to the following configurations:
 - Four-node MetroCluster FC or IP configurations running ONTAP 9.2 or earlier
 - Eight-node MetroCluster FC configurations, regardless of ONTAP version
- If you have a two-node MetroCluster configuration, do not use this procedure.
- The following tasks refer to the old and new versions of ONTAP.
 - When upgrading, the old version is a previous version of ONTAP, with a lower version number than the new version of ONTAP.
 - When downgrading, the old version is a later version of ONTAP, with a higher version number than the new version of ONTAP.
- This task uses the following high-level workflow:



Differences when updating software on an eight-node or four-node MetroCluster configuration

The MetroCluster software update process differs, depending on whether there are eight or four nodes in the MetroCluster configuration.

A MetroCluster configuration consists of one or two DR groups. Each DR group consists of two HA pairs, one HA pair at each MetroCluster cluster. An eight-node MetroCluster includes two DR groups:



The MetroCluster software update procedure involves upgrading or downgrading one DR group at a time.

For four-node MetroCluster configurations:

1. Update DR Group One:
 - a. Update node_A_1 and node_B_1.
 - b. Update node_A_2 and node_B_2.

For eight-node MetroCluster configurations, you perform the DR group update procedure twice:

1. Update DR Group One:
 - a. Update node_A_1 and node_B_1.
 - b. Update node_A_2 and node_B_2.
2. Update DR Group Two:
 - a. Update node_A_3 and node_B_3.
 - b. Update node_A_4 and node_B_4.

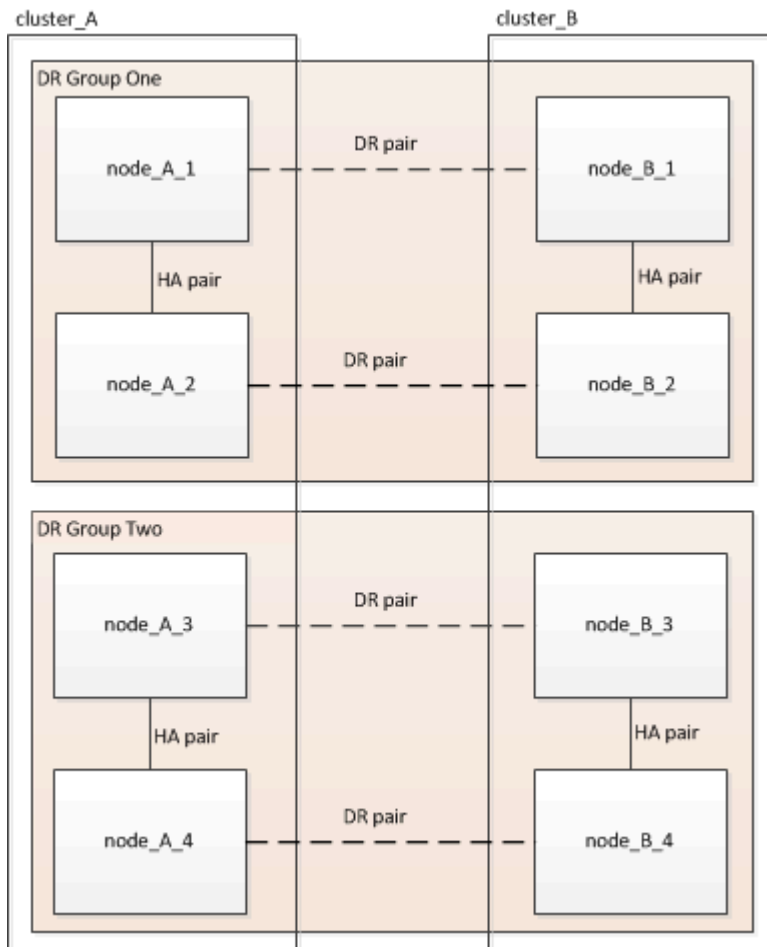
Preparing to update a MetroCluster DR group

Before you actually update the software on the nodes, you must identify the DR relationships among the nodes, send an AutoSupport message that you are initiating an update, and confirm the ONTAP version running on each node.

You must have [downloaded and installed the software images](#).

This task must be repeated on each DR group. If the MetroCluster configuration consists of eight nodes, there are two DR groups. Thereby, this task must be repeated on each DR group.

The examples provided in this task use the names shown in the following illustration to identify the clusters and nodes:



1. Identify the DR pairs in the configuration: `metrocluster node show -fields dr-partner`

```
cluster_A::> metrocluster node show -fields dr-partner
(metrocluster node show)
dr-group-id cluster      node          dr-partner
-----
1            cluster_A   node_A_1     node_B_1
1            cluster_A   node_A_2     node_B_2
1            cluster_B   node_B_1     node_A_1
1            cluster_B   node_B_2     node_A_2
4 entries were displayed.

cluster_A::>
```

2. Set the privilege level from admin to advanced, entering **y** when prompted to continue: `set -privilege advanced`

The advanced prompt (***>**) appears.

3. Confirm the ONTAP version running on each node:

- a. Confirm the version on cluster_A: `system image show`

```
cluster_A::*> system image show
```

Node	Image	Is Default	Is Current	Version	Install Date
node_A_1					
	image1	true	true	X.X.X	MM/DD/YYYY TIME
	image2	false	false	Y.Y.Y	MM/DD/YYYY TIME
node_A_2					
	image1	true	true	X.X.X	MM/DD/YYYY TIME
	image2	false	false	Y.Y.Y	MM/DD/YYYY TIME

4 entries were displayed.

```
cluster_A::>
```

- b. Confirm the version on cluster_B: `system image show`

```
cluster_B::*> system image show
```

Node	Image	Is Default	Is Current	Version	Install Date
node_B_1					
	image1	true	true	X.X.X	MM/DD/YYYY TIME
	image2	false	false	Y.Y.Y	MM/DD/YYYY TIME
node_B_2					
	image1	true	true	X.X.X	MM/DD/YYYY TIME
	image2	false	false	Y.Y.Y	MM/DD/YYYY TIME

4 entries were displayed.

```
cluster_B::>
```

4. Trigger an AutoSupport notification: `autosupport invoke -node * -type all -message "Starting_NDU"`

This AutoSupport notification includes a record of the system status before the update. It saves useful troubleshooting information if there is a problem with the update process.

If your cluster is not configured to send AutoSupport messages, then a copy of the notification is saved locally.

5. For each node in the first set, set the target ONTAP software image to be the default image: `system image modify {-node nodename -iscurrent false} -isdefault true`

This command uses an extended query to change the target software image, which is installed as the alternate image, to be the default image for the node.

6. Verify that the target ONTAP software image is set as the default image:

- a. Verify the images on cluster_A: `system image show`

In the following example, image2 is the new ONTAP version and is set as the default image on each of the nodes in the first set:

```
cluster_A::*> system image show
```

Node	Image	Is Default	Is Current	Version	Install Date
node_A_1					
	image1	false	true	X.X.X	MM/DD/YYYY TIME
	image2	true	false	Y.Y.Y	MM/DD/YYYY TIME
node_A_2					
	image1	false	true	X.X.X	MM/DD/YYYY TIME
	image2	true	false	Y.Y.Y	MM/DD/YYYY TIME

2 entries were displayed.

- b. Verify the images on cluster_B: `system image show`

The following example shows that the target version is set as the default image on each of the nodes in the first set:

```
cluster_B::*> system image show
```

Node	Image	Is Default	Is Current	Version	Install Date
node_A_1					
	image1	false	true	X.X.X	MM/DD/YYYY TIME
	image2	true	false	Y.Y.Y	MM/YY/YYYY TIME
node_A_2					
	image1	false	true	X.X.X	MM/DD/YYYY TIME
	image2	true	false	Y.Y.Y	MM/DD/YYYY TIME

2 entries were displayed.

7. Determine whether the nodes to be upgraded are currently serving any clients twice for each node: `system node run -node target-node -command uptime`

The uptime command displays the total number of operations that the node has performed for NFS, CIFS, FC, and iSCSI clients since the node was last booted. For each protocol, you need to run the command twice to determine whether the operation counts are increasing. If they are increasing, the node is currently serving clients for that protocol. If they are not increasing, the node is not currently serving clients for that protocol.

NOTE: You should make a note of each protocol that has increasing client operations so that after the node is upgraded, you can verify that client traffic has resumed.

This example shows a node with NFS, CIFS, FC, and iSCSI operations. However, the node is currently serving only NFS and iSCSI clients.

```
cluster_x::> system node run -node node0 -command uptime
2:58pm up 7 days, 19:16 800000260 NFS ops, 1017333 CIFS ops, 0 HTTP
ops, 40395 FCP ops, 32810 iSCSI ops

cluster_x::> system node run -node node0 -command uptime
2:58pm up 7 days, 19:17 800001573 NFS ops, 1017333 CIFS ops, 0 HTTP
ops, 40395 FCP ops, 32815 iSCSI ops
```

Updating the first DR pair in a MetroCluster DR group

You must perform a takeover and giveback of the nodes in the correct order to make the new version of ONTAP the current version of the node.

All nodes must be running the old version of ONTAP.

In this task, node_A_1 and node_B_1 are updated.

If you have updated the ONTAP software on the first DR group, and are now updating the second DR group in an eight-node MetroCluster configuration, in this task you would be updating node_A_3 and node_B_3.

1. If MetroCluster Tiebreaker software is enabled, disabled it.
2. For each node in the HA pair, disable automatic giveback: `storage failover modify -node target-node -auto-giveback false`

This command must be repeated for each node in the HA pair.

3. Verify that automatic giveback is disabled: `storage failover show -fields auto-giveback`

This example shows that automatic giveback has been disabled on both nodes:

```
cluster_x::> storage failover show -fields auto-giveback
node      auto-giveback
-----
node_x_1  false
node_x_2  false
2 entries were displayed.
```

4. Ensure that I/O is not exceeding ~50% for each controller. Ensure that CPU utilization is not exceeding ~50% per controller.
5. Initiate a takeover of the target node on cluster_A:

Do not specify the `-option immediate` parameter, because a normal takeover is required for the nodes that are being taken over to boot onto the new software image.

- a. Take over the DR partner on cluster_A (node_A_1): `storage failover takeover -ofnode node_A_1`

The node boots up to the "Waiting for giveback" state.



If AutoSupport is enabled, then an AutoSupport message is sent indicating that the nodes are out of cluster quorum. You can ignore this notification and proceed with the upgrade.

- b. Verify that the takeover is successful: `storage failover show`

The following example shows that the takeover is successful. Node_A_1 is in the "Waiting for giveback" state and node_A_2 is in the "In takeover" state.

```
cluster1::> storage failover show
```

Node	Partner	Takeover Possible	State Description
node_A_1	node_A_2	-	Waiting for giveback (HA mailboxes)
node_A_2	node_A_1	false	In takeover

2 entries were displayed.

6. Take over the DR partner on cluster_B (node_B_1):

Do not specify the `-option immediate` parameter, because a normal takeover is required for the nodes that are being taken over to boot onto the new software image.

- a. Take over node_B_1: `storage failover takeover -ofnode node_B_1`

The node boots up to the "Waiting for giveback" state.



If AutoSupport is enabled, then an AutoSupport message is sent indicating that the nodes are out of cluster quorum. You can ignore this notification and proceed with the upgrade.

- b. Verify that the takeover is successful: `storage failover show`

The following example shows that the takeover is successful. Node_B_1 is in the "Waiting for giveback" state and node_B_2 is in the "In takeover" state.

```
cluster1::> storage failover show
```

Node	Partner	Takeover Possible	State Description
node_B_1	node_B_2	-	Waiting for giveback (HA mailboxes)
node_B_2	node_B_1	false	In takeover

2 entries were displayed.

7. Wait at least eight minutes to ensure the following conditions:

- Client multipathing (if deployed) is stabilized.
- Clients are recovered from the pause in I/O that occurs during takeover.

The recovery time is client-specific and might take longer than eight minutes depending on the characteristics of the client applications.

8. Return the aggregates to the target nodes:

After upgrading MetroCluster IP configurations to ONTAP 9.5 or later, the aggregates will be in a degraded state for a short period before resynchronizing and returning to a mirrored state.

- Give back the aggregates to the DR partner on cluster_A: `storage failover giveback -ofnode node_A_1`
- Give back the aggregates to the DR partner on cluster_B: `storage failover giveback -ofnode node_B_1`

The giveback operation first returns the root aggregate to the node and then, after the node has finished booting, returns the non-root aggregates.

9. Verify that all aggregates have been returned by issuing the following command on both clusters: `storage failover show-giveback`

If the Giveback Status field indicates that there are no aggregates to give back, then all aggregates have been returned. If the giveback is vetoed, the command displays the giveback progress and which subsystem vetoed the giveback.

10. If any aggregates have not been returned, do the following:

- Review the veto workaround to determine whether you want to address the “veto” condition or override the veto.
- If necessary, address the “veto” condition described in the error message, ensuring that any identified operations are terminated gracefully.
- Reenter the `storage failover giveback` command.

If you decided to override the “veto” condition, set the `-override-vetoes` parameter to true.

11. Wait at least eight minutes to ensure the following conditions:

- Client multipathing (if deployed) is stabilized.

- Clients are recovered from the pause in I/O that occurs during giveback.

The recovery time is client-specific and might take longer than eight minutes depending on the characteristics of the client applications.

12. Set the privilege level from admin to advanced, entering **y** when prompted to continue: `set -privilege advanced`

The advanced prompt (***>**) appears.

13. Confirm the version on cluster_A: `system image show`

The following example shows that System image2 should be the default and current version on node_A_1:

```
cluster_A::*> system image show
```

Node	Image	Is Default	Is Current	Version	Install Date

node_A_1					
	image1	false	false	X.X.X	MM/DD/YYYY TIME
	image2	true	true	Y.Y.Y	MM/DD/YYYY TIME
node_A_2					
	image1	false	true	X.X.X	MM/DD/YYYY TIME
	image2	true	false	Y.Y.Y	MM/DD/YYYY TIME

4 entries were displayed.

```
cluster_A::>
```

14. Confirm the version on cluster_B: `system image show`

The following example shows that System image2 (ONTAP 9.0.0) is the default and current version on node_A_1:

```
cluster_A::*> system image show
```

Node	Image	Is Default	Is Current	Version	Install Date

node_B_1					
	image1	false	false	X.X.X	MM/DD/YYYY TIME
	image2	true	true	Y.Y.Y	MM/DD/YYYY TIME
node_B_2					
	image1	false	true	X.X.X	MM/DD/YYYY TIME
	image2	true	false	Y.Y.Y	MM/DD/YYYY TIME

4 entries were displayed.

```
cluster_A::>
```

Updating the second DR pair in a MetroCluster DR group

You must perform a takeover and giveback of the node in the correct order to make the new version of ONTAP the current version of the node.

You should have upgraded the first DR pair (node_A_1 and node_B_1).

In this task, node_A_2 and node_B_2 are updated.

If you have updated the ONTAP software on the first DR group, and are now updating the second DR group in an eight-node MetroCluster configuration, in this task you are updating node_A_4 and node_B_4.

1. Initiate a takeover of the target node on cluster_A:

Do not specify the `-option immediate` parameter, because a normal takeover is required for the nodes that are being taken over to boot onto the new software image.

a. Take over the DR partner on cluster_A:

```
storage failover takeover -ofnode node_A_2 -option allow-version-mismatch
```



The `allow-version-mismatch` option is not required for upgrades from ONTAP 9.0 to ONTAP 9.1 or for any patch upgrades.

The node boots up to the "Waiting for giveback" state.

If AutoSupport is enabled, then an AutoSupport message is sent indicating that the nodes are out of cluster quorum. You can ignore this notification and proceed with the upgrade.

b. Verify that the takeover is successful: `storage failover show`

The following example shows that the takeover is successful. Node_A_2 is in the "Waiting for giveback" state and node_A_1 is in the "In takeover" state.

```
cluster1::> storage failover show
```

Node	Partner	Takeover Possible	State Description
node_A_1	node_A_2	false	In takeover
node_A_2	node_A_1	-	Waiting for giveback (HA mailboxes)

2 entries were displayed.

2. Initiate a takeover of the target node on cluster_B:

Do not specify the `-option immediate` parameter, because a normal takeover is required for the nodes that are being taken over to boot onto the new software image.

a. Take over the DR partner on cluster_B (node_B_2):

If you are upgrading from...	Enter this command...
ONTAP 9.2 or ONTAP 9.1	<code>storage failover takeover -ofnode node_B_2</code>
ONTAP 9.0 or Data ONTAP 8.3.x	<code>storage failover takeover -ofnode node_B_2 -option allow-version-mismatch</code> NOTE: The <code>allow-version-mismatch</code> option is not required for upgrades from ONTAP 9.0 to ONTAP 9.1 or for any patch upgrades.

The node boots up to the "Waiting for giveback" state.

+ NOTE: If AutoSupport is enabled, an AutoSupport message is sent indicating that the nodes are out of cluster quorum. You can safely ignore this notification and proceed with the upgrade.

- a. Verify that the takeover is successful: `storage failover show`

The following example shows that the takeover is successful. Node_B_2 is in the "Waiting for giveback" state and node_B_1 is in the "In takeover" state.

```
cluster1::> storage failover show
```

Node	Partner	Takeover Possible	State Description
node_B_1	node_B_2	false	In takeover
node_B_2	node_B_1	-	Waiting for giveback (HA mailboxes)

2 entries were displayed.

1. Wait at least eight minutes to ensure the following conditions:

- Client multipathing (if deployed) is stabilized.
- Clients are recovered from the pause in I/O that occurs during takeover.

The recovery time is client-specific and might take longer than eight minutes depending on the characteristics of the client applications.

2. Return the aggregates to the target nodes:

After upgrading MetroCluster IP configurations to ONTAP 9.5, the aggregates will be in a degraded state for a short period before resynchronizing and returning to a mirrored state.

- b. Give back the aggregates to the DR partner on cluster_A: `storage failover giveback -ofnode node_A_2`
- c. Give back the aggregates to the DR partner on cluster_B: `storage failover giveback -ofnode node_B_2`

The giveback operation first returns the root aggregate to the node and then, after the node has finished booting, returns the non-root aggregates.

1. Verify that all aggregates have been returned by issuing the following command on both clusters:

```
storage failover show-giveback
```

If the Giveback Status field indicates that there are no aggregates to give back, then all aggregates have been returned. If the giveback is vetoed, the command displays the giveback progress and which subsystem vetoed the giveback.

2. If any aggregates have not been returned, do the following:
- d. Review the veto workaround to determine whether you want to address the “veto” condition or override the veto.
- e. If necessary, address the “veto” condition described in the error message, ensuring that any identified operations are terminated gracefully.
- f. Reenter the storage failover giveback command.

If you decided to override the “veto” condition, set the `-override-vetoes` parameter to `true`. . Wait at least eight minutes to ensure the following conditions: **Client multipathing (if deployed) is stabilized**. Clients are recovered from the pause in I/O that occurs during giveback.

+ The recovery time is client-specific and might take longer than eight minutes depending on the characteristics of the client applications.

1. Set the privilege level from admin to advanced, entering **y** when prompted to continue: `set -privilege advanced`

The advanced prompt (`*>`) appears.

2. Confirm the version on cluster_A: `system image show`

The following example shows that System image2 (target ONTAP image) is the default and current version on node_A_2:

```
cluster_B::*> system image show
```

Node	Image	Is Default	Is Current	Version	Install Date
node_A_1					
	image1	false	false	X.X.X	MM/DD/YYYY TIME
	image2	true	true	Y.Y.Y	MM/DD/YYYY TIME
node_A_2					
	image1	false	false	X.X.X	MM/DD/YYYY TIME
	image2	true	true	Y.Y.Y	MM/DD/YYYY TIME

4 entries were displayed.

```
cluster_A::>
```

3. Confirm the version on cluster_B: `system image show`

The following example shows that System image2 (target ONTAP image) is the default and current version on node_B_2:

```
cluster_B::*> system image show
```

Node	Image	Is Default	Is Current	Version	Install Date
node_B_1					
	image1	false	false	X.X.X	MM/DD/YYYY TIME
	image2	true	true	Y.Y.Y	MM/DD/YYYY TIME
node_B_2					
	image1	false	false	X.X.X	MM/DD/YYYY TIME
	image2	true	true	Y.Y.Y	MM/DD/YYYY TIME

4 entries were displayed.

```
cluster_A::>
```

4. For each node in the HA pair, enable automatic giveback: `storage failover modify -node target-node -auto-giveback true`

This command must be repeated for each node in the HA pair.

5. Verify that automatic giveback is enabled: `storage failover show -fields auto-giveback`

This example shows that automatic giveback has been enabled on both nodes:

```
cluster_x::> storage failover show -fields auto-giveback
```

node	auto-giveback
node_x_1 true	
node_x_2 true	

2 entries were displayed.

Manual nondisruptive upgrade of a two-node MetroCluster configuration in ONTAP 9.2 or earlier using the CLI

You can upgrade ONTAP nondisruptively for a two-node MetroCluster configuration. This method has several steps: initiating a negotiated switchover, updating the cluster at the “failed” site, initiating switchover, and then repeating the process on the cluster at the other site.

This procedure is for two-node MetroCluster configurations running ONTAP 9.2 or earlier only.

+ Do not use this procedure if you have a four-node MetroCluster configuration.

+ If you have a two-node MetroCluster configuration running ONTAP 9.3 or later, perform an [automated nondisruptive upgrade using System Manager](#).

1. Set the privilege level to advanced, entering **y** when prompted to continue: `set -privilege advanced`

The advanced prompt (***>**) appears.

2. On the cluster to be upgraded, install the new ONTAP software image as the default: `system node image update -package package_location -setdefault true -replace-package true`

```
cluster_B::*> system node image update -package
http://www.example.com/NewImage.tgz -setdefault true -replace-package
true
```

3. Verify that the target software image is set as the default image: `system node image show`

The following example shows that NewImage is set as the default image:

```
cluster_B::*> system node image show
```

Node	Image	Is Default	Is Current	Version	Install Date

node_B_1					
	OldImage	false	true	X.X.X	MM/DD/YYYY TIME
	NewImage	true	false	Y.Y.Y	MM/DD/YYYY TIME

2 entries were displayed.

4. If the target software image is not set as the default image, then change it: `system image modify {-node * -iscurrent false} -isdefault true`
5. Verify that all cluster SVMs are in a health state: `metrocluster vserver show`
6. On the cluster that is not being updated, initiate a negotiated switchover: `metrocluster switchover`

The operation can take several minutes. You can use the `metrocluster operation show` command to verify that the switchover is completed.

In the following example, a negotiated switchover is performed on the remote cluster ("cluster_A"). This causes the local cluster ("cluster_B") to halt so that you can update it.

```
cluster_A::> metrocluster switchover
```

Warning: negotiated switchover is about to start. It will stop all the data

Vservers on cluster "cluster_B" and
automatically re-start them on cluster
"cluster_A". It will finally gracefully shutdown
cluster "cluster_B".

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

7. Verify that all cluster SVMs are in a health state: `metrocluster vservers show`
8. Resynchronize the data aggregates on the "surviving" cluster: `metrocluster heal -phase aggregates`

After upgrading MetroCluster IP configurations to ONTAP 9.5 or later, the aggregates will be in a degraded state for a short period before resynchronizing and returning to a mirrored state.

```
cluster_A::> metrocluster heal -phase aggregates
[Job 130] Job succeeded: Heal Aggregates is successful.
```

9. Verify that the healing operation was completed successfully: `metrocluster operation show`

```
cluster_A::> metrocluster operation show
Operation: heal-aggregates
State: successful
Start Time: MM/DD/YYYY TIME
End Time: MM/DD/YYYY TIME
Errors: -
```

10. Resynchronize the root aggregates on the "surviving" cluster: `metrocluster heal -phase root-aggregates`

```
cluster_A::> metrocluster heal -phase root-aggregates
[Job 131] Job succeeded: Heal Root Aggregates is successful.
```

11. Verify that the healing operation was completed successfully: `metrocluster operation show`

```
cluster_A::> metrocluster operation show
Operation: heal-root-aggregates
State: successful
Start Time: MM/DD/YYYY TIME
End Time: MM/DD/YYYY TIME
Errors: -
```

12. On the halted cluster, boot the node from the LOADER prompt: `boot_ontap`
13. Wait for the boot process to finish, and then verify that all cluster SVMs are in a health state:
`metrocluster vserver show`
14. Perform a switchback from the “surviving” cluster: `metrocluster switchback`
15. Verify that the switchback was completed successfully: `metrocluster operation show`

```
cluster_A::> metrocluster operation show
Operation: switchback
State: successful
Start Time: MM/DD/YYYY TIME
End Time: MM/DD/YYYY TIME
Errors: -
```

16. Verify that all cluster SVMs are in a health state: `metrocluster vserver show`
17. Repeat all previous steps on the other cluster.
18. Verify that the MetroCluster configuration is healthy:
 - a. Check the configuration: `metrocluster check run`

```
cluster_A::> metrocluster check run
Last Checked On: MM/DD/YYYY TIME
Component          Result
-----
nodes              ok
lifs               ok
config-replication ok
aggregates         ok
4 entries were displayed.
```

Command completed. Use the "metrocluster check show -instance" command or sub-commands in "metrocluster check" directory for detailed results.

To check if the nodes are ready to do a switchover or switchback operation, run "metrocluster switchover -simulate" or "metrocluster switchback -simulate", respectively.

- b. If you want to view more detailed results, use the metrocluster check run command: `metrocluster check aggregate showmetrocluster check config-replication showmetrocluster check lif show`metrocluster check node show`
- c. Set the privilege level to advanced: `set -privilege advanced`
- d. Simulate the switchover operation: `metrocluster switchover -simulate`
- e. Review the results of the switchover simulation: `metrocluster operation show`

```
cluster_A::*> metrocluster operation show
Operation: switchover
State: successful
Start time: MM/DD/YYYY TIME
End time: MM/DD/YYYY TIME
Errors: -
```

- f. Return to the admin privilege level: `set -privilege admin`
- g. Repeat these substeps on the other cluster.

You should perform any post-upgrade tasks.

Related information

[MetroCluster Disaster recovery](#)

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.