Upgrade ONTAP

ONTAP 9

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Upgrade ONTAP

Upgrade ONTAP overview

The method you use to upgrade your ONTAP software depends upon your configuration. If it is supported by your configuration, you should perform an automated nondisruptive upgrade (ANDU) using System Manager.

You can use these procedures to upgrade on-premises ONTAP and ONTAP select. For more information on ONTAP select see the general procedure for Upgrading the ONTAP Select nodes. For information about upgrading ONTAP in the cloud, see Upgrading Cloud Volumes ONTAP software.

If you have an active SupportEdge contract for Active IQ Digital Advisor, before you begin your upgrade, you should launch Upgrade Advisor in Active IQ Digital Advisor to help you plan your upgrade.

The procedures in this section guide you through the steps you should take before and after you upgrade, including the resources you should read and the necessary pre- and post-upgrade checks you should perform.

What version of ONTAP can I upgrade to?

The version of ONTAP that you can upgrade to varies based on your hardware platform and the version of ONTAP currently running on your cluster's nodes. See NetApp Hardware Universe to verify that your platform is supported for the target upgrade release.

You can use these guidelines to upgrade on-premises ONTAP and ONTAP select. For more information on ONTAP select see the general procedure for Upgrading the ONTAP Select nodes. For information about upgrading ONTAP in the cloud, see Upgrading Cloud Volumes ONTAP software.

To determine your current ONTAP version:

- In System Manager, click **Cluster > Overview**.
- From the command line interface (CLI), use the `cluster image show` command.
  You can also use the `system node image show` command in the advanced privilege level to display details.

Types of upgrade paths

Automated nondisruptive upgrades (ANDU) are recommended whenever possible. Depending on your current and target releases, your upgrade path will be *direct*, *direct multi-hop*, or *multi-stage*. Unless otherwise noted, these paths apply to all upgrade methods; nondisruptive or disruptive, automated or manual.

- *direct*
  You can always upgrade directly to the next adjacent ONTAP release family using a single software image. For most releases, you can also install a software image that allows you to upgrade directly to releases that are two releases higher than the running release.

  For example, you can use the direct update path from 9.8 to 9.9.1, or from 9.8 to 9.10.1.

  Note: Beginning with ONTAP 9.11.1, software images support upgrading directly to releases that are three releases higher than the running release. For example, you can use the direct upgrade path from 9.8 to 9.11.1.

- *direct multi-hop*
  For some automated nondisruptive upgrades (ANDU) to non-adjacent releases, you can install the software image for an intermediate release as well the target release. The automated upgrade process uses the intermediate image in the background to complete the update to the target release.

  For example, if the cluster is running 9.3 and you want to upgrade to 9.7, you would load the ONTAP install packages for both 9.5 and 9.7, then initiate ANDU to 9.7. ONTAP then automatically upgrades the cluster first to 9.5 and then to 9.7. You should expect multiple takeover/giveback operations and related reboots during the process.

- *multi-stage*
  If a direct or direct multi-hop path is not available for your non-adjacent target release, you must first upgrade to a supported intermediate release, and then upgrade to the target release.

  For example, if you are currently running 9.6 and you want to upgrade to 9.11.1, you must complete a multi-stage upgrade: first from 9.6 to 9.8, and then from 9.8 to 9.11.1. Upgrades from earlier releases might require three or more stages, with several intermediate upgrades.

  Note: Before beginning multi-stage upgrades, be sure your target release is supported on your hardware platform.

It is a best practice to upgrade first to the latest patch release in the same ONTAP release family and then upgrade to the next supported major release. This will ensure that any issues in your current version of ONTAP are resolved before upgrading.

For example, if your system is running ONTAP 9.3P9 and you are planning to upgrade to 9.11.1, you should first upgrade to the latest 9.3 patch release, then follow the upgrade path from 9.3 to 9.11.1.

Learn about Minimum Recommended ONTAP releases on the NetApp Support Site.

Supported upgrade paths

Detailed upgrade paths are available for the following scenarios:

- Automated nondisruptive upgrades (ANDU) within the ONTAP 9 release family (recommended).
- Manual nondisruptive and disruptive upgrades within the ONTAP 9 release family.
- Upgrades from Data ONTAP 8.* releases to ONTAP 9 releases.

Upgrade images for some earlier releases are no longer available.

ANDU paths, ONTAP 9

If your current ONTAP release is…	And your target ONTAP release is…	Your ANDU upgrade path is…
9.11.1	9.12.1	direct
9.10.1	9.12.1	direct
	9.11.1	direct
9.9.1	9.12.1	direct
	9.11.1	direct
	9.10.1	direct
9.8	9.12.1	direct
	9.11.1	direct
	9.10.1	direct **Attention Metrocluster configurations**: If you are upgrading a MetroCluster IP configuration from 9.8 to 9.10.1 on any of the following platforms, you must upgrade to 9.9.1 before you upgrade to 9.10.1. • FAS2750 • FAS500f • AFF A220 • AFF A250 MetroCluster IP configurations on these platforms, cannot upgrade from 9.8 directly to 9.10.1.
	9.9.1	direct
9.7	9.12.1	direct multi-hop (requires images for 9.8 & 9.12.1)
	9.11.1	direct multi-hop (requires images for 9.8 & 9.11.1)
	9.10.1	direct multi-hop (requires images for 9.8 & 9.10.1P1 or later P release)
	9.9.1	direct
	9.8	direct

If your current ONTAP release is…	And your target ONTAP release is…	Your ANDU upgrade path is…
9.6	9.12.1	multi-stage - 9.6 → 9.8 -9.8 → 9.12.1
	9.11.1	multi-stage - 9.6 → 9.8 - 9.8 → 9.11.1
	9.10.1	direct multi-hop (requires images for 9.8 & 9.10.1P1 or later P release)
	9.9.1	multi-stage - 9.6 → 9.8 - 9.8 → 9.9.1
	9.8	direct
	9.7	direct
9.5	9.12.1	multi-stage - 9.5 → 9.9.1 (direct multi-hop, requires images for 9.7 & 9.9.1) - 9.9.1 → 9.12.1
	9.11.1	multi-stage - 9.5 → 9.9.1 (direct multi-hop, requires images for 9.7 & 9.9.1) - 9.9.1 → 9.11.1
	9.10.1	multi-stage - 9.5 → 9.9.1 (direct multi-hop, requires images for 9.7 & 9.9.1) - 9.9.1 → 9.10.1
	9.9.1	direct multi-hop (requires images for 9.7 & 9.9.1)
	9.8	multi-stage - 9.5 → 9.7 - 9.7 → 9.8
	9.7	direct
	9.6	direct

If your current ONTAP release is…	And your target ONTAP release is…	Your ANDU upgrade path is…
9.4	9.12.1	multi-stage - 9.4 → 9.5 - 9.5 → 9.9.1 (direct multi-hop, requires images for 9.7 & 9.9.1) - 9.9.1 → 9.12.1
	9.11.1	multi-stage - 9.4 → 9.5 - 9.5 → 9.9.1 (direct multi-hop, requires images for 9.7 & 9.9.1) - 9.9.1 → 9.11.1
	9.10.1	multi-stage - 9.4 → 9.5 - 9.5 → 9.9.1 (direct multi-hop, requires images for 9.7 & 9.9.1) - 9.9.1 → 9.10.1
	9.9.1	multi-stage - 9.4 → 9.5 - 9.5 → 9.9.1 (direct multi-hop, requires images for 9.7 & 9.9.1)
	9.8	multi-stage - 9.4 → 9.5 - 9.5 → 9.8 (direct multi-hop, requires images for 9.7 & 9.8)
	9.7	multi-stage - 9.4 → 9.5 - 9.5 → 9.7
	9.6	multi-stage - 9.4 → 9.5 - 9.5 → 9.6
	9.5	direct

If your current ONTAP release is…	And your target ONTAP release is…	Your ANDU upgrade path is…
9.3	9.12.1	multi-stage - 9.3 → 9.7 (direct multi-hop, requires images for 9.5 & 9.7) - 9.7 → 9.9.1 - 9.9.1 → 9.12.1
	9.11.1	multi-stage - 9.3 → 9.7 (direct multi-hop, requires images for 9.5 & 9.7) - 9.7 → 9.9.1 - 9.9.1 → 9.11.1
	9.10.1	multi-stage - 9.3 → 9.7 (direct multi-hop, requires images for 9.5 & 9.7) - 9.7 → 9.10.1 (direct multi-hop, requires images for 9.8 & 9.10.1)
	9.9.1	multi-stage - 9.3 → 9.7 (direct multi-hop, requires images for 9.5 & 9.7) - 9.7 → 9.9.1
	9.8	multi-stage - 9.3 → 9.7 (direct multi-hop, requires images for 9.5 & 9.7) - 9.7 → 9.8
	9.7	direct multi-hop (requires images for 9.5 & 9.7)
	9.6	multi-stage - 9.3 → 9.5 - 9.5 → 9.6
	9.5	direct
	9.4	not available

If your current ONTAP release is…	And your target ONTAP release is…	Your ANDU upgrade path is…
9.2	9.12.1	multi-stage - 9.2 → 9.3 - 9.3 → 9.7 (direct multi-hop, requires images for 9.5 & 9.7) - 9.7 → 9.9.1 (direct multi-hop, requires images for 9.8 & 9.9.1) - 9.9.1 → 9.12.1
	9.11.1	multi-stage - 9.2 → 9.3 - 9.3 → 9.7 (direct multi-hop, requires images for 9.5 & 9.7) - 9.7 → 9.9.1 (direct multi-hop, requires images for 9.8 & 9.9.1) - 9.9.1 → 9.11.1
	9.10.1	multi-stage - 9.2 → 9.3 - 9.3 → 9.7 (direct multi-hop, requires images for 9.5 & 9.7) - 9.7 → 9.10.1 (direct multi-hop, requires images for 9.8 & 9.10.1)
	9.9.1	multi-stage - 9.2 → 9.3 - 9.3 → 9.7 (direct multi-hop, requires images for 9.5 & 9.7) - 9.7 → 9.9.1
	9.8	multi-stage - 9.2 → 9.3 - 9.3 → 9.7 (direct multi-hop, requires images for 9.5 & 9.7) - 9.7 → 9.8
	9.7	multi-stage - 9.2 → 9.3 - 9.3 → 9.7 (direct multi-hop, requires images for 9.5 & 9.7)
	9.6	multi-stage - 9.2 → 9.3 - 9.3 → 9.6 (direct multi-hop, requires images for 9.5 & 9.6)
	9.5	multi-stage - 9.3 → 9.5 - 9.5 → 9.6
	9.4	not available
	9.3	direct

If your current ONTAP release is…	And your target ONTAP release is…	Your ANDU upgrade path is…
9.1	9.12.1	multi-stage - 9.1 → 9.3 - 9.3 → 9.7 (direct multi-hop, requires images for 9.5 & 9.7) - 9.7 → 9.9.1 - 9.9.1 → 9.12.1
	9.11.1	multi-stage - 9.1 → 9.3 - 9.3 → 9.7 (direct multi-hop, requires images for 9.5 & 9.7) - 9.7 → 9.9.1 - 9.9.1 → 9.11.1
	9.10.1	multi-stage - 9.1 → 9.3 - 9.3 → 9.7 (direct multi-hop, requires images for 9.5 & 9.7) - 9.7 → 9.10.1 (direct multi-hop, requires images for 9.8 & 9.10.1)
	9.9.1	multi-stage - 9.1 → 9.3 - 9.3 → 9.7 (direct multi-hop, requires images for 9.5 & 9.7) - 9.7 → 9.9.1
	9.8	multi-stage - 9.1 → 9.3 - 9.3 → 9.7 (direct multi-hop, requires images for 9.5 & 9.7) - 9.7 → 9.8
	9.7	multi-stage - 9.1 → 9.3 - 9.3 → 9.7 (direct multi-hop, requires images for 9.5 & 9.7)
	9.6	multi-stage - 9.1 → 9.3 - 9.3 → 9.6 (direct multi-hop, requires images for 9.5 & 9.6)
	9.5	multi-stage - 9.1 → 9.3 - 9.3 → 9.5
	9.4	not available
	9.3	direct
	9.2	not available

If your current ONTAP release is…	And your target ONTAP release is…	Your ANDU upgrade path is…
9.0		

	9.6	multi-stage - 9.0 → 9.1 - 9.1 → 9.3 - 9.3 → 9.5 - 9.5 → 9.6
If your current ONTAP release is…	**And your target ONTAP release is…**	**Your ANDU upgrade path is…**
	9.5	multi-stage - 9.0 → 9.1 - 9.1 → 9.3 - 9.3 → 9.5
	9.4	not available
	9.3	multi-stage - 9.0 → 9.1 - 9.1 → 9.3
	9.2	not available
	9.1	direct

Manual paths, ONTAP 9

If your current ONTAP release is…	And your target ONTAP release is…	Your manual upgrade path is…
9.10.1	9.12.1	direct
	9.11.1	direct
9.9.1	9.12.1	direct
	9.11.1	direct
	9.10.1	direct
9.8	9.12.1	direct
	9.11.1	direct
	9.10.1	direct
	9.9.1	direct
9.7	9.12.1	multi-stage - 9.7 → 9.9.1 - 9.9.1 → 9.12.1
	9.11.1	multi-stage - 9.7 → 9.9.1 - 9.9.1 → 9.11.1
	9.10.1	multi-stage - 9.7 → 9.9.1 - 9.9.1 → 9.10.1
	9.9.1	direct
	9.8	direct

If your current ONTAP release is…	And your target ONTAP release is…	Your manual upgrade path is…
9.6	9.12.1	multi-stage - 9.6 → 9.8 - 9.8 → 9.12.1
	9.11.1	multi-stage - 9.6 → 9.8 - 9.8 → 9.11.1
	9.10.1	multi-stage - 9.6 → 9.8 - 9.8 → 9.10.1
	9.9.1	multi-stage - 9.6 → 9.8 - 9.8 → 9.9.1
	9.8	direct
	9.7	direct
9.5	9.12.1	multi-stage - 9.5 → 9.7 - 9.7 → 9.9.1 - 9.9.1 → 9.12.1
	9.11.1	multi-stage - 9.5 → 9.7 - 9.7 → 9.9.1 - 9.9.1 → 9.11.1
	9.10.1	multi-stage - 9.5 → 9.7 - 9.7 → 9.9.1 - 9.9.1 → 9.10.1
	9.9.1	multi-stage - 9.5 → 9.7 - 9.7 → 9.9.1
	9.8	multi-stage - 9.5 → 9.7 - 9.7 → 9.8
	9.7	direct
	9.6	direct

If your current ONTAP release is…	And your target ONTAP release is…	Your manual upgrade path is…
9.4	9.12.1	multi-stage - 9.4 → 9.5 - 9.5 → 9.7 - 9.7 → 9.9.1 - 9.9.1 → 9.12.1
	9.11.1	multi-stage - 9.4 → 9.5 - 9.5 → 9.7 - 9.7 → 9.9.1 - 9.9.1 → 9.11.1
	9.10.1	multi-stage - 9.4 → 9.5 - 9.5 → 9.7 - 9.7 → 9.9.1 - 9.9.1 → 9.10.1
	9.9.1	multi-stage - 9.4 → 9.5 - 9.5 → 9.7 - 9.7 → 9.9.1
	9.8	multi-stage - 9.4 → 9.5 - 9.5 → 9.7 - 9.7 → 9.8
	9.7	multi-stage - 9.4 → 9.5 - 9.5 → 9.7
	9.6	multi-stage - 9.4 → 9.5 - 9.5 → 9.6
	9.5	direct

If your current ONTAP release is…	And your target ONTAP release is…	Your manual upgrade path is…
9.3	9.12.1	multi-stage - 9.3 → 9.5 - 9.5 → 9.7 - 9.7 → 9.9.1 - 9.9.1 → 9.12.1
	9.11.1	multi-stage - 9.3 → 9.5 - 9.5 → 9.7 - 9.7 → 9.9.1 - 9.9.1 → 9.11.1
	9.10.1	multi-stage - 9.3 → 9.5 - 9.5 → 9.7 - 9.7 → 9.9.1 - 9.9.1 → 9.10.1
	9.9.1	multi-stage - 9.3 → 9.5 - 9.5 → 9.7 - 9.7 → 9.9.1
	9.8	multi-stage - 9.3 → 9.5 - 9.5 → 9.7 - 9.7 → 9.8
	9.7	multi-stage - 9.3 → 9.5 - 9.5 → 9.7
	9.6	multi-stage - 9.3 → 9.5 - 9.5 → 9.6
	9.5	direct
	9.4	not available

If your current ONTAP release is…	And your target ONTAP release is…	Your manual upgrade path is…
9.2	9.12.1	multi-stage - 9.2 → 9.3 - 9.3 → 9.5 - 9.5 → 9.7 - 9.7 → 9.9.1 - 9.9.1 → 9.12.1
	9.11.1	multi-stage - 9.2 → 9.3 - 9.3 → 9.5 - 9.5 → 9.7 - 9.7 → 9.9.1 - 9.9.1 → 9.11.1
	9.10.1	multi-stage - 9.2 → 9.3 - 9.3 → 9.5 - 9.5 → 9.7 - 9.7 → 9.9.1 - 9.9.1 → 9.10.1
	9.9.1	multi-stage - 9.2 → 9.3 - 9.3 → 9.5 - 9.5 → 9.7 - 9.7 → 9.9.1
	9.8	multi-stage - 9.2 → 9.3 - 9.3 → 9.5 - 9.5 → 9.7 - 9.7 → 9.8
	9.7	multi-stage - 9.2 → 9.3 - 9.3 → 9.5 - 9.5 → 9.7
	9.6	multi-stage - 9.2 → 9.3 - 9.3 → 9.5 - 9.5 → 9.6
	9.5	multi-stage - 9.2 → 9.3 - 9.3 → 9.5
	9.4	not available
	9.3	direct

If your current ONTAP release is…	And your target ONTAP release is…	Your manual upgrade path is…
9.1	9.12.1	multi-stage - 9.1 → 9.3 - 9.3 → 9.5 - 9.5 → 9.7 - 9.7 → 9.9.1 - 9.9.1 → 9.12.1
	9.11.1	multi-stage - 9.1 → 9.3 - 9.3 → 9.5 - 9.5 → 9.7 - 9.7 → 9.9.1 - 9.9.1 → 9.11.1
	9.10.1	multi-stage - 9.1 → 9.3 - 9.3 → 9.5 - 9.5 → 9.7 - 9.7 → 9.9.1 - 9.9.1 → 9.10.1
	9.9.1	multi-stage - 9.1 → 9.3 - 9.3 → 9.5 - 9.5 → 9.7 - 9.7 → 9.9.1
	9.8	multi-stage - 9.1 → 9.3 - 9.3 → 9.5 - 9.5 → 9.7 - 9.7 → 9.8
	9.7	multi-stage - 9.1 → 9.3 - 9.3 → 9.5 - 9.5 → 9.7
	9.6	multi-stage - 9.1 → 9.3 - 9.3 → 9.5 - 9.5 → 9.6
	9.5	multi-stage - 9.1 → 9.3 - 9.3 → 9.5
	9.4	not available
	9.3	direct
	9.2	not available

If your current ONTAP release is…	And your target ONTAP release is…	Your manual upgrade path is…
9.0		

	9.6	multi-stage - 9.0 → 9.1 - 9.1 → 9.3 - 9.3 → 9.5 - 9.5 → 9.6
If your current ONTAP release is…	**And your target ONTAP release is…**	**Your manual upgrade path is…**
	9.5	multi-stage - 9.0 → 9.1 - 9.1 → 9.3 - 9.3 → 9.5
	9.4	not available
	9.3	multi-stage - 9.0 → 9.1 - 9.1 → 9.3
	9.2	not available
	9.1	direct

Upgrade paths, Data ONTAP 8

Be sure to verify that your platform can run the target ONTAP release by using the NetApp Hardware Universe.

Note: The Data ONTAP 8.3 Upgrade Guide erroneously states that in a four-node cluster, you should plan to upgrade the node that holds epsilon last. This is no longer a requirement for upgrades beginning with Data ONTAP 8.2.3. For more information, see NetApp Bugs Online Bug ID 805277.

From Data ONTAP 8.3.x

You can upgrade directly to ONTAP 9.1, then upgrade to later releases.

From Data ONTAP releases earlier than 8.3.x, including 8.2.x

You must first upgrade to Data ONTAP 8.3.x, then upgrade to ONTAP 9.1, then upgrade to later releases.

Plan your upgrade with Upgrade Advisor

The Upgrade Advisor service in Active IQ Digital Advisor provides intelligence that helps you plan your upgrade and minimizes uncertainty and risk.

Active IQ identifies issues in your environment that can be resolved by upgrading to a newer version of ONTAP. The Upgrade Advisor service helps you plan for a successful upgrade and provides a report of issues you might need to be aware of in the ONTAP version you're upgrading to.

An active SupportEdge contract is required for Active IQ.

1. Launch Active IQ
2. Review the Active IQ health summary to help assess the health of your cluster.
3. Review the recommended upgrade path and generate your upgrade plan.

Related information

SupportEdge Services

Upgrade without Upgrade Advisor

Plan your upgrade without Upgrade Advisor

It is a best practice to use Upgrade Advisor in Active IQ to plan your upgrade. If you do not have an active SupportEdge contract for Active IQ, you should perform the necessary pre-upgrade checks and create your own upgrade plan.

How long will my upgrade take?

You should plan for at least 30 minutes to complete preparatory steps, 60 minutes to upgrade each HA pair, and at least 30 minutes to complete post-upgrade steps.

If you are using NetApp Encryption with an external key management server and the Key Management Interoperability Protocol (KMIP), you should expect the upgrade for each HA pair to be longer than one hour.

Our upgrade duration guidelines are based on typical configurations and workloads. You can use these guidelines to estimate the time it will take to perform a nondisruptive upgrade in your environment. However, the actual duration of your upgrade process will depend on your individual environment and the number of nodes.

Resources to read before you upgrade

If you don't use Active IQ Upgrade Advisor, you need to review a number of NetApp resources before upgrading your ONTAP software. These resources will help you understand issues you must resolve, new system behavior in the target release, and confirm hardware support.

1. Review the *Release Notes* for the target release.

   ONTAP 9 Release Notes

   The "Important cautions" section describes potential issues that you should be aware of before upgrading to the new release. The "New and changed features" and "Known problems and limitations" sections describe new system behavior after upgrading to the new release.

2. Confirm that your hardware platform as well as your cluster and management switches are supported in the target release.

   You can upgrade in a transitional state, but ultimately your NX-OS (cluster network switches), IOS (management network switches), and reference configuration file (RCF) software versions should be compatible with the version of ONTAP to which you are upgrading.

   NetApp Hardware Universe

3. Confirm that your MetroCluster IP switches are supported in the target release.

   NetApp Interoperability Matrix Tool

4. If your cluster and management switches do not have the minimum software versions for the target ONTAP release, upgrade to supported software versions.

- NetApp Downloads: Broadcom Cluster Switches
- NetApp Downloads: Cisco Ethernet Switches
- NetApp Downloads: NetApp Cluster Switches

5. If your cluster is configured for SAN, confirm that the SAN configuration is fully supported.

   All SAN components—including the target ONTAP software version, host OS and patches, required Host Utilities software, multipathing software, and adapter drivers and firmware—should be supported.

   NetApp Interoperability Matrix Tool

6. If you are transitioning from 7-Mode using the 7-Mode Transition Tool, confirm that the tool supports transition to the ONTAP version to which you are upgrading.

   All the projects in the tool must be in the completed or aborted state before you upgrade the 7-Mode Transition Tool that supports the ONTAP version to which you are upgrading.

   7-Mode Transition Tool installation and administration

What should I verify before I upgrade without Upgrade Advisor?

What to verify before upgrading

If you don't use Active IQ Upgrade Advisor to plan your upgrade, you should verify your cluster upgrade limits and your cluster activity before you upgrade.

Verify cluster upgrade limits

If you don't use Active IQ Upgrade Advisor, you need to verify that your cluster does not exceed the platform system limits. SAN also has limits that you should verify in addition to the platform system limits.

1. Verify that the cluster does not exceed the system limits for your platform.

   NetApp Hardware Universe

2. If your cluster is configured for SAN, verify that it does not exceed the configuration limits for FC, FCoE, and iSCSI.

   NetApp Hardware Universe

3. Determine the CPU and disk utilization: `node run -node node_name -command sysstat -c 10 -x 3`

   You should monitor CPU and disk utilization for 30 seconds. The values in the **CPU** and **Disk Util** columns should not exceed 50% for all 10 measurements reported. No additional load should be added to the cluster until the upgrade is complete.
   NOTE: CPU and disk utilization can vary at different times in your environment. Therefore, it is best to check your CPU and disk utilization during the timeframe of your anticipated upgrade window.

Verify current cluster activity

If you don't use Active IQ Upgrade Advisor, before upgrading, you should manually verify that no jobs are running and that any CIFS sessions that are not continuously available are terminated.

Verify that no jobs are running

Before upgrading the ONTAP software, you must verify the status of cluster jobs. If any aggregate, volume, NDMP (dump or restore), or Snapshot jobs (such as create, delete, move, modify, replicate, and mount jobs) are running or queued, you must allow the jobs to finish successfully or stop the queued entries.

1. Review the list of any running or queued aggregate, volume, or Snapshot jobs: `job show`

```
cluster1::> job show
                            Owning
Job ID Name                 Vserver    Node           State
------ -------------------- ---------- -------------- ----------
8629   Vol Reaper           cluster1   -              Queued
       Description: Vol Reaper Job
8630   Certificate Expiry Check
                            cluster1   -              Queued
       Description: Certificate Expiry Check
.
.
.
```

2. If there are any running jobs, allow them to finish successfully.
3. Delete any of the queued aggregate, volume, or Snapshot copy jobs: `job delete -id job_id`

```
cluster1::> job delete -id 8629
```

4. Verify that no aggregate, volume, or Snapshot jobs are running or queued: `job show`

   In this example, all running and queued jobs have been deleted:

```
cluster1::> job show
                            Owning
Job ID Name                 Vserver    Node           State
------ -------------------- ---------- -------------- ----------
9944   SnapMirrorDaemon_7_2147484678
                            cluster1   node1          Dormant
       Description: Snapmirror Daemon for 7_2147484678
18377  SnapMirror Service Job
                            cluster1   node0          Dormant
       Description: SnapMirror Service Job
2 entries were displayed
```

Identifying active CIFS sessions that should be terminated

Before upgrading the ONTAP software, you should identify and gracefully terminate any CIFS sessions that are not continuously available.

Continuously available CIFS shares, which are accessed by Hyper-V or Microsoft SQL Server clients using the SMB 3.0 protocol, do not need to be terminated before upgrading.

1. Identify any established CIFS sessions that are not continuously available: `vserver cifs session show -continuously-available Yes -instance`

   This command displays detailed information about any CIFS sessions that have no continuous availability. You should terminate them before proceeding with the ONTAP upgrade.

```
cluster1::> vserver cifs session show -continuously-available Yes
-instance

                        Node: node1
                     Vserver: vs1
                  Session ID: 1
               Connection ID: 4160072788
Incoming Data LIF IP Address: 198.51.100.5
      Workstation IP address: 203.0.113.20
    Authentication Mechanism: NTLMv2
                Windows User: CIFSLAB\user1
                   UNIX User: nobody
                 Open Shares: 1
                  Open Files: 2
                  Open Other: 0
              Connected Time: 8m 39s
                   Idle Time: 7m 45s
           Protocol Version: SMB2_1
      Continuously Available: No
1 entry was displayed.
```

2. If necessary, identify the files that are open for each CIFS session that you identified: `vserver cifs session file show -session-id session_ID`

```
cluster1::> vserver cifs session file show -session-id 1

Node:       node1
Vserver:    vs1
Connection: 4160072788
Session:    1
File    File      Open Hosting
Continuously
ID      Type      Mode Volume          Share                 Available
------- --------- ---- --------------- ---------------------
------------
1       Regular   rw   vol10           homedirshare          No
Path: \TestDocument.docx
2       Regular   rw   vol10           homedirshare          No
Path: \file1.txt
2 entries were displayed.
```

Related information

Considerations for session-oriented protocols

What should I verify before I upgrade with or without Upgrade Advisor?

What to check before upgrading

Even if you use Active IQ Upgrade Advisor to plan your upgrade, there are still various pre-checks you should perform before you upgrade to verify cluster health, storage health, configuration, and more.

Verify cluster health

Before you upgrade a cluster, you should verify that the nodes are healthy and eligible to participate in the cluster, and that the cluster is in quorum.

1. Verify that the nodes in the cluster are online and are eligible to participate in the cluster: `cluster show`

```
cluster1::> cluster show
Node                  Health  Eligibility
--------------------- ------- ------------
node0                 true    true
node1                 true    true
```

   If any node is unhealthy or ineligible, check EMS logs for errors and take corrective action.

2. If you are operating in a SAN environment, verify that each node is in a SAN quorum: `event log show -severity informational -message-name scsiblade.*`

   The most recent scsiblade event message for each node should indicate that the scsi-blade is in quorum.

```
cluster1::*> event log show  -severity informational -message-name
scsiblade.*
Time              Node       Severity       Event
---------------  ---------- -------------- ---------------------------
MM/DD/YYYY TIME  node0      INFORMATIONAL  scsiblade.in.quorum: The
scsi-blade ...
MM/DD/YYYY TIME  node1      INFORMATIONAL  scsiblade.in.quorum: The
scsi-blade ...
```

Related information

System administration

Verify storage health

Before and after you upgrade a cluster, you should verify the status of your disks, aggregates, and volumes.

1. Verify disk status:

To check for…	Do this…
Broken disks	a. Display any broken disks: `storage disk show -state broken` b. Remove or replace any broken disks.
Disks undergoing maintenance or reconstruction	a. Display any disks in maintenance, pending, or reconstructing states: `storage disk show -state maintenance|pending|reconstructing` b. Wait for the maintenance or reconstruction operation to finish before proceeding.

2. Verify that all aggregates are online by displaying the state:
`storage aggregate show -state !online`
This command displays the aggregates that are *not* online. All aggregates must be online before and after performing a major upgrade or reversion.

```
cluster1::> storage aggregate show -state !online
There are no entries matching your query.
```

3. Verify that all volumes are online by displaying any volumes that are *not* online:
`volume show -state !online`
All volumes must be online before and after performing a major upgrade or reversion.

```
cluster1::> volume show -state !online
There are no entries matching your query.
```

4. Verify that there are no inconsistent volumes:
`volume show -is-inconsistent true`
See the Knowledge Base article Volume Showing WAFL Inconsistent on how to address the inconsistent volumes.

Related information

Logical storage management

Reboot SP or BMC to prepare for firmware update

You do not need to manually update your firmware prior to an ONTAP upgrade. The firmware for your cluster is included with the ONTAP upgrade package and is copied to each node's boot device. The new firmware is then installed as part of the upgrade process.

Firmware for the following components is updated automatically if the version in your cluster is older than the

firmware that is bundled with the ONTAP upgrade package:

- BIOS/LOADER
- Service Processor (SP) or baseboard management controller (BMC)
- Storage shelf
- Disk
- Flash Cache

To prepare for a smooth update, you should reboot the SP or BMC before the upgrade begins.

Step

1. Reboot the SP or BMC prior to the upgrade: `system service-processor reboot-sp -node node_name`

If desired, you can also update firmware manually in between ONTAP upgrades. If you have Active IQ, you can view the list of firmware versions currently included in your ONTAP image.

Updated firmware versions are available as follows:

- System firmware (BIOS, BMC, SP)
- Shelf firmware
- Disk and flash cache firmware

Verify SVM routing configuration

It is a best practice to configure one default route for an SVM. To avoid disruption, you should ensure that the default route is able to reach any network address that is not reachable by a more specific route. For more information, see SU134: Network access might be disrupted by incorrect routing configuration in clustered ONTAP.

The routing table for an SVM determines the network path the SVM uses to communicate with a destination. It's important to understand how routing tables work so that you can prevent network problems before they occur.

Routing rules are as follows:

- ONTAP routes traffic over the most specific available route.
- ONTAP routes traffic over a default gateway route (having 0 bits of netmask) as a last resort, when more specific routes are not available.

In the case of routes with the same destination, netmask, and metric, there is no guarantee that the system will use the same route after a reboot or after an upgrade. This is especially an issue if you have configured multiple default routes.

Verifying the LIF failover configuration

Before you perform an upgrade, you must verify that the failover policies and failover groups are configured correctly.

During the upgrade process, LIFs are migrated based on the upgrade method. Depending upon the upgrade method, the LIF failover policy might or might not be used.

If you have 8 or more nodes in your cluster, the automated upgrade is performed using the batch method. The batch upgrade method involves dividing the cluster into multiple upgrade batches, upgrading the set of nodes in the first batch, upgrading their high-availability (HA) partners, and then repeating the process for the remaining batches. In ONTAP 9.7 and earlier, if the batch method is used, LIFs are migrated to the HA partner of the node being upgraded. In ONTAP 9.8 and later, if the batch method is used, LIFs are migrated to the other batch group.

If you have less than 8 nodes in your cluster, the automated upgrade is performed using the rolling method. The rolling upgrade method involves initiating a failover operation on each node in an HA pair, updating the "failed" node, initiating giveback, and then repeating the process for each HA pair in the cluster. If the rolling method is used, LIFs are migrated to the failover target node as defined by the LIF failover policy.

1. Display the failover policy for each data LIF:

If your ONTAP version is…	Use this command
9.6 or later	`network interface show -service-policy data -failover`
9.5 or earlier	`network interface show -role data -failover`

This example shows the default failover configuration for a two-node cluster with two data LIFs:

```
cluster1::> network interface show -role data -failover
         Logical         Home                  Failover        Failover
Vserver  Interface       Node:Port             Policy          Group
-------- --------------- --------------------- --------------
---------------
vs0
         lif0            node0:e0b             nextavail       system-
defined
                         Failover Targets: node0:e0b, node0:e0c,
                                           node0:e0d, node0:e0e,
                                           node0:e0f, node1:e0b,
                                           node1:e0c, node1:e0d,
                                           node1:e0e, node1:e0f
vs1
         lif1            node1:e0b             nextavail       system-
defined
                         Failover Targets: node1:e0b, node1:e0c,
                                           node1:e0d, node1:e0e,
                                           node1:e0f, node0:e0b,
                                           node0:e0c, node0:e0d,
                                           node0:e0e, node0:e0f
```

The **Failover Targets** field shows a prioritized list of failover targets for each LIF. For example, if lif0 fails over from its home port (e0b on node0), it's first attempts to fail over to port e0c on node0. If lif0 cannot fail over to e0c, it next attempts to fail over to port e0d on node0, and so on.

2. If the failover policy is set to disabled for any LIFs, other than SAN LIFs, use the network interface modify command to enable failover.
3. For each LIF, verify that the **Failover Targets** field includes data ports from a different node that will remain up while the LIF's home node is being upgraded.

   You can use the `network interface failover-groups modify` command to add a failover target to the failover group.

   Example

```
network interface failover-groups modify -vserver vs0 -failover-group
fg1 -targets sti8-vsim-ucs572q:e0d,sti8-vsim-ucs572r:e0d
```

Related information

Network and LIF management

Verify status

Before you upgrade, you should verify the following:

- HA pair status
- LDAP status (for ONTAP 9.2 or later)
- DNS server status (for ONTAP 9.2 or later),
- Networking and storage status (for MetroCluster configurations)

Verifying HA status

Before performing a nondisruptive upgrade, you should verify that storage failover is enabled for each HA pair. If the cluster consists of only two nodes, you should also verify that cluster HA is enabled.

You do not need to verify the HA status if you plan to perform a disruptive upgrade, because this upgrade method does not require storage failover.

1. Verify that storage failover is enabled and possible for each HA pair: `storage failover show`

   This example shows that storage failover is enabled and possible on node0 and node1:

   ```
   cluster1::> storage failover show
                                Takeover
   Node           Partner        Possible State
   -------------- -------------- --------
   -----------------------------------
   node0          node1          true     Connected to node1
   node1          node0          true     Connected to node0
   2 entries were displayed.
   ```

   If necessary, you can enable storage failover by using the storage failover modify command.

2. If the cluster consists of only two nodes (a single HA pair), verify that cluster HA is configured: `cluster ha show`

   This example shows that cluster HA is configured:

   ```
   cluster1::> cluster ha show
   High Availability Configured: true
   ```

   If necessary, you can enable cluster HA by using the cluster ha modify command.

Verifying LDAP status (ONTAP 9.2 and later)

Beginning with ONTAP 9.2, if LDAP is used by your storage virtual machines (SVMs), you must have an established LDAP connection to perform a nondisruptive upgrade. You should verify the LDAP connection before you begin the upgrade.

The task does not apply if you are upgrading from ONTAP 9.1 or earlier.

1. Check the LDAP status: `ldap check -vserver vserver_name`

2. If the LDAP status is down, modify it: `ldap client modify -client-config LDAP_client -ldap -servers ip_address`
3. Verify that the LDAP status is up: `ldap check -vserver vserver_name`

Verifying DNS server status (ONTAP 9.2 and later)

Beginning with ONTAP 9.2 and later, you should verify the status of your Domain Name Service (DNS) server before and after performing a nondisruptive upgrade.

The task does not apply if you are upgrading from ONTAP 9.1 or earlier.

1. Check the status of your DNS servers: `dns check -vserver vserver_name`

   An up status indicates the service is running. A down status indicates that the service is not running.

2. If the DNS server is down, modify it: `dns modify -vserver vserver_name -domains domain_name -name-servers name_server_ipaddress`
3. Verify the status of the DNS server is up.

Verify all LIFS are on home ports before upgrade

During a reboot, some LIFs might have been migrated to their assigned failover ports. Before and after you upgrade a cluster, you must enable and revert any LIFs that are not on their home ports.

The network interface revert command reverts a LIF that is not currently on its home port back to its home port, provided that the home port is operational. A LIF's home port is specified when the LIF is created; you can determine the home port for a LIF by using the network interface show command.

1. Display the status of all LIFs: `network interface show`

   This example displays the status of all LIFs for a storage virtual machine (SVM).

```
cluster1::> network interface show -vserver vs0
            Logical    Status     Network            Current
Current Is
Vserver     Interface  Admin/Oper Address/Mask       Node          Port
Home
----------- ---------- ---------- ------------------ -------------
------- ----
vs0
            data001    down/down  192.0.2.120/24     node0         e0e
true
            data002    down/down  192.0.2.121/24     node0         e0f
true
            data003    down/down  192.0.2.122/24     node0         e2a
true
            data004    down/down  192.0.2.123/24     node0         e2b
true
            data005    down/down  192.0.2.124/24     node0         e0e
false
            data006    down/down  192.0.2.125/24     node0         e0f
false
            data007    down/down  192.0.2.126/24     node0         e2a
false
            data008    down/down  192.0.2.127/24     node0         e2b
false
8 entries were displayed.
```

If any LIFs appear with a Status Admin status of down or with an Is home status of false, continue with the next step.

2. Enable the data LIFs: `network interface modify {-role data} -status-admin up`

```
cluster1::> network interface modify {-role data} -status-admin up
8 entries were modified.
```

3. Revert LIFs to their home ports: `network interface revert *`

   This command reverts all LIFs back to their home ports.

```
cluster1::> network interface revert *
8 entries were acted on.
```

4. Verify that all LIFs are in their home ports: `network interface show`

   This example shows that all LIFs for SVM vs0 are on their home ports.

```
cluster1::> network interface show -vserver vs0
            Logical    Status     Network            Current
Current Is
Vserver     Interface  Admin/Oper Address/Mask       Node          Port
Home
----------- ---------- ---------- ------------------ -------------
------- ----
vs0
            data001      up/up    192.0.2.120/24     node0         e0e
true
            data002      up/up    192.0.2.121/24     node0         e0f
true
            data003      up/up    192.0.2.122/24     node0         e2a
true
            data004      up/up    192.0.2.123/24     node0         e2b
true
            data005      up/up    192.0.2.124/24     node1         e0e
true
            data006      up/up    192.0.2.125/24     node1         e0f
true
            data007      up/up    192.0.2.126/24     node1         e2a
true
            data008      up/up    192.0.2.127/24     node1         e2b
true
8 entries were displayed.
```

Use Active IQ Config Advisor to verify there are no common configuration errors

Before you upgrade, you can use the Active IQ Config Advisor tool to check for common configuration errors.

Active IQ Config Advisor is a configuration validation and health check tool for NetApp systems. This tool can be deployed at both secure sites and nonsecure sites for data collection and system analysis.

Support for Active IQ Config Advisor is limited and is available only online.

1. Log in to the NetApp Support Site, and then click **TOOLS** > **Tools**.
2. Under **Active IQ Config Advisor**, click Download App.
3. Download, install, and run Active IQ Config Advisor by following the directions on the web page.
4. After running Active IQ Config Advisor, review the tool's output, and follow the recommendations that are provided to address any issues that are discovered by the tool.

Special considerations

Pre-upgrade checks

Depending on your environment, you need to consider certain factors before you start your upgrade. Get started by reviewing the table below to see what special considerations you need to consider.

Ask yourself…	If your answer is yes, then do this…
Do I have a mixed version cluster?	Check mixed version requirements
Do I have a SAN configuration?	Verify the SAN configuration
Do I have a MetroCluster configuration?	• Review specific upgrade requirements for MetroCluster configurations • Verify networking and storage status
Are nodes on my cluster using root-data partitioning and root-data-data-partitioning?	Examine upgrade considerations for root-data and root-data-data partitioning
Do I have deduplicated volumes and aggregates?	Verify you have enough free space for your deduplicated volumes and aggregates
Is my cluster running SnapMirror?	• Review upgrade requirements for SnapMirror • Prepare your SnapMirror relationships for upgrade
Is my cluster running SnapLock?	Review upgrade considerations for SnapLock
Am I upgrading from ONTAP 8.3 and have load-sharing mirrors?	Prepare all load-sharing mirrors for upgrade
Am I using NetApp Storage Encryption with external key management servers?	Delete any existing key management server connections
Do I have netgroups loaded into SVMs?	Vefiry that the netgroup file is present on each node
Do I have LDAP clients using SSLv3?	Configure LDAP clients to use TLS
Am I using session-oriented protocols?	Review considerations for session-oriented protocols
Is SSL FIPS mode enabled on a cluster where administrator accounts authenticate with an SSH public key?	Review requirements for SSH public keys
Am I upgrading to ONTAP 9.12.1 or later and have DP-type relationships?	Convert existing DP-type relationships to XDP

Mixed version requirements

Beginning with ONTAP 9.3, by default, you cannot join new nodes to the cluster that are running a version of ONTAP that is different from the version running on the existing nodes.

If you plan to add new nodes to your cluster that are running a version of ONTAP that is later than the nodes in your existing cluster, you should upgrade the nodes in your cluster to the later version first, then add the new nodes.

Mixed version clusters are not recommended, but in certain cases you might need to temporarily enter a mixed version state. For example, you need to enter a mixed version state if you are upgrading to a later version of ONTAP that is not supported on certain nodes in your existing cluster. In this case, you should upgrade the nodes that do support the later version of ONTAP, then unjoin the nodes that do not support the version of ONTAP you are upgrading to using the advanced privilege `cluster unjoin -skip-lastlow-version -node check` command.

You might also need to enter a mixed version state for a technical refresh or an interrupted upgrade. In such cases you can override ONTAP default behavior and join nodes of a different version using the following advanced privilege commands:

- `cluster join -allow-mixed-version-join`
- `cluster add-node -allow-mixed-version-join`

When you have to enter a mixed version state, you should complete the upgrade as quickly as possible. An HA pair must not run an ONTAP version from a release that is different from other HA pairs in the cluster for more than seven days. For correct cluster operation, the period the cluster is in a mixed version state should be as short as possible.

When the cluster is in a mixed version state, you should not enter any commands that alter the cluster operation or configuration except as necessary to satisfy the upgrade requirements.

Verifying the SAN configuration

Upgrading in a SAN environment changes which paths are direct. Therefore, before performing an upgrade, you should verify that each host is configured with the correct number of direct and indirect paths, and that each host is connected to the correct LIFs.

1. On each host, verify that a sufficient number of direct and indirect paths are configured, and that each path is active.

   Each host must have a path to each node in the cluster.

2. Verify that each host is connected to a LIF on each node.

   You should record the list of initiators for comparison after the upgrade.

For…	Enter…
iSCSI	`iscsi initiator show -fields igroup,initiator-name,tpgroup`
FC	`fcp initiator show -fields igroup,wwpn,lif`

MetroCluster configurations

Upgrade requirements for MetroCluster configurations

If you have to upgrade a MetroCluster configuration, you should be aware of some important requirements.

Required methods for performing major and minor upgrades of MetroCluster configurations

Patch upgrades to MetroCluster configurations can be performed with automatic non-disruptive upgrade (NDU) procedure.

Beginning with ONTAP 9.3, major upgrades to MetroCluster configurations can be performed with automatic non-disruptive upgrade (NDU) procedure. On systems running ONTAP 9.2 or earlier, major upgrades to MetroCluster configurations must be performed with the NDU procedure that is specific to MetroCluster configurations.

General requirements

- Both clusters must be running the same version of ONTAP.

  You can verify the ONTAP version by using the version command.

- The MetroCluster configuration must be in either normal or switchover mode.

  Upgrade in switchover mode is only supported in minor patch upgrades.

- For all configurations except two-node clusters, you can nondisruptively upgrade both clusters at the same time.

  For nondisruptive upgrade in two-node clusters, the clusters must be upgraded one node at a time.

- The aggregates in both clusters must not be in resyncing RAID status.

  During MetroCluster healing, the mirrored aggregates are resynchronized. You can verify if the MetroCluster configuration is in this state by using the `storage aggregate plex show -in -progress true` command. If any aggregates are being synchronized, you should not perform an upgrade until the resynchronization is complete.

- Negotiated switchover operations will fail while the upgrade is in progress.

  To avoid issues with upgrade or revert operations, do not attempt an unplanned switchover during an upgrade or revert operation unless all nodes on both clusters are running the same version of ONTAP.

Configuration requirements for normal operation

- The source SVM LIFs must be up and located on their home nodes.

  Data LIFs for the destination SVMs are not required to be up or to be on their home nodes.

- All aggregates at the local site must be online.
- All root and data volumes owned by the local cluster's SVMs must be online.

Configuration requirements for switchover

- All LIFs must be up and located on their home nodes.
- All aggregates must be online, except for the root aggregates at the DR site.

  Root aggregates at the DR site are offline during certain phases of switchover.

- All volumes must be online.

Related information

Verifying networking and storage status for MetroCluster configurations

Verify networking and storage status for MetroCluster configurations

Before performing an upgrade in a MetroCluster configuration, you should verify the status of the LIFs, aggregates, and volumes for each cluster.

1. Verify the LIF status: `network interface show`

   In normal operation, LIFs for source SVMs must have an admin status of up and be located on their home nodes. LIFs for destination SVMs are not required to be up or located on their home nodes. In switchover, all LIFs have an admin status of up, but they do not need to be located on their home nodes.

```
cluster1::> network interface show
            Logical    Status     Network            Current
Current Is
Vserver     Interface  Admin/Oper Address/Mask       Node          Port
Home
----------- ---------- ---------- ------------------ -------------
------- ----
Cluster
            cluster1-a1_clus1
                         up/up    192.0.2.1/24       cluster1-01
                                                                  e2a
true
            cluster1-a1_clus2
                         up/up    192.0.2.2/24       cluster1-01
                                                                  e2b
true


cluster1-01
            clus_mgmt    up/up    198.51.100.1/24    cluster1-01
                                                                  e3a
true
            cluster1-a1_inet4_intercluster1
                         up/up    198.51.100.2/24    cluster1-01
                                                                  e3c
true
            ...

27 entries were displayed.
```

2. Verify the state of the aggregates: `storage aggregate show -state !online`

This command displays any aggregates that are *not* online. In normal operation, all aggregates located at the local site must be online. However, if the MetroCluster configuration is in switchover, root aggregates at the disaster recovery site are permitted to be offline.

This example shows a cluster in normal operation:

```
cluster1::> storage aggregate show -state !online
There are no entries matching your query.
```

This example shows a cluster in switchover, in which the root aggregates at the disaster recovery site are offline:

```
cluster1::> storage aggregate show -state !online
Aggregate     Size Available Used% State   #Vols  Nodes            RAID
Status
--------- -------- --------- ----- ------- ------ ----------------
------------
aggr0_b1
                0B        0B    0% offline      0 cluster2-01
raid_dp,

mirror

degraded
aggr0_b2
                0B        0B    0% offline      0 cluster2-02
raid_dp,

mirror

degraded
2 entries were displayed.
```

3. Verify the state of the volumes: `volume show -state !online`

   This command displays any volumes that are *not* online.

   If the MetroCluster configuration is in normal operation (it is not in switchover state), the output should show all volumes owned by the cluster's secondary SVMs (those with the SVM name appended with "-mc").

   Those volumes come online only in the event of a switchover.

   This example shows a cluster in normal operation, in which the volumes at the disaster recovery site are not online.

```
cluster1::> volume show -state !online
  (volume show)
Vserver   Volume       Aggregate    State      Type       Size
Available Used%
--------- ------------ ------------ ---------- ---- ----------
---------- -----
vs2-mc    vol1         aggr1_b1     -          RW            -
-     -
vs2-mc    root_vs2     aggr0_b1     -          RW            -
-     -
vs2-mc    vol2         aggr1_b1     -          RW            -
-     -
vs2-mc    vol3         aggr1_b1     -          RW            -
-     -
vs2-mc    vol4         aggr1_b1     -          RW            -
-     -
5 entries were displayed.
```

4. Verify that there are no inconsistent volumes: `volume show -is-inconsistent true`

   If any inconsistent volumes are returned, you must contact NetApp Support before you precede with the upgrade.

Related information

Upgrade requirements for MetroCluster configurations

Upgrade considerations for root-data partitioning and root-data-data partitioning

Root-data partitioning and root-data-data-partitioning is supported for some platform models and configurations. This partitioning capability is enabled during system initialization; it cannot be applied to existing aggregates.

For information about migrating your data to a node that is configured for root-data partitioning or root-data-data partitioning, contact your account team or partner organization.

Related information

ONTAP concepts

Verify that deduplicated volumes and aggregates contain sufficient free space

Before upgrading ONTAP, you must verify that any deduplicated volumes and the aggregates that contain them have sufficient free space for the deduplication metadata. If there is insufficient free space, deduplication will be disabled when the ONTAP upgrade is completed.

Each deduplicated volume must contain at least 4% free space. Each aggregate that contains a deduplicated volume must contain at least 3% free space.

1. Determine which volumes are deduplicated: `volume efficiency show`
2. Determine the free space available on each volume that you identified: `vol show -vserver Vserver_name -volume volume_name -fields volume, size, used, available, percent-used, junction-path`

   Each deduplicated volume must not contain more than 96% used capacity. If necessary, you can increase the sizes of any volumes that exceed this capacity.

   Logical storage management

   In this example, the percent-used field displays the percentage of used space on the deduplicated volume.:

```
vserver    volume size    junction-path available used   percent-used
---------- ------ ------- -------------
cluster1-01 vol0   22.99GB -             14.11GB      7.73GB 35%
cluster1-02 vol0   22.99GB -             12.97GB      8.87GB    40%
2 entries were displayed.
```

3. Identify the free space available on each aggregate that contains a deduplicated volume: `aggr show -aggregate aggregate_name -fields aggregate, size, usedsize, availsize, percent-used`

   Each aggregate must not contain more than 97% used capacity. If necessary, you can increase the sizes of any aggregates that exceed this capacity.

   Disk and aggregate management

   In this example, the percent-used field displays the percentage of used space on the aggregate containing the deduplicated volume (aggr_2):

```
aggr show -aggregate aggregate_name -fields
aggregate,size,usedsize,availsize,percent-used
aggregate         availsize percent-used size    usedsize
----------------- --------- ------------    ------- --------
aggr0_cluster1_01    1.11GB    95%          24.30GB 23.19GB
aggr0_cluster1_02 1022MB    96%          24.30GB    23.30GB
2 entries were displayed.
```

SnapMirror

Upgrade requirements for SnapMirror

You must perform certain tasks to successfully upgrade a cluster that is running SnapMirror.

- If you are upgrading clusters with DP SnapMirror relationships, you must upgrade the destination cluster/nodes before you upgrade the source cluster/nodes.

- Before upgrading a cluster that is running SnapMirror, SnapMirror operations must be quiesced for each node that contains destination volumes, and each peered SVM must have a unique name across the clusters.

  To prevent SnapMirror transfers from failing, you must suspend SnapMirror operations and, in some cases, upgrade destination nodes before upgrading source nodes. The following table describes the two options for suspending SnapMirror operations.

Option	Description	Upgrade destination nodes before source nodes?
Suspend SnapMirror operations for the duration of the NDU (nondisruptive upgrade).	The simplest method for upgrading in a SnapMirror environment is to suspend all SnapMirror operations, perform the upgrade, and then resume the SnapMirror operations. However, no SnapMirror transfers will occur during the entire NDU. You must use this method if your cluster contains nodes that are mirroring volumes to each other.	No, the nodes can be upgraded in any order.
Suspend SnapMirror operations one destination volume at a time.	You can suspend SnapMirror transfers for a particular destination volume, upgrade the node (or HA pair) that contains the destination volume, upgrade the node (or HA pair) that contains the source volume, and then resume the SnapMirror transfers for the destination volume. By using this method, SnapMirror transfers for all other destination volumes can continue while the nodes that contain the original destination and source volumes are upgraded.	Yes.

SVM peering requires SVM names to be unique across clusters. It is best practice to name SVMs with a unique fully qualified domain name (FQDN), for example, “dataVerser.HQ” or “mirrorVserver.Offsite”. Using the FQDN naming style makes it much easier to make sure of uniqueness.

Related information

ONTAP concepts

Prepare SnapMirror relationships for a nondisruptive upgrade

It is recommended that you quiesce your SnapMirror operations before performing a nondisruptive upgrade of ONTAP.

Steps

1. Use the `snapmirror show` command to determine the destination path for each SnapMirror relationship.
2. For each destination volume, suspend future SnapMirror transfers:

   `snapmirror quiesce -destination-path destination`

   If there are no active transfers for the SnapMirror relationship, this command sets its status to "Quiesced". If the relationship has active transfers, the status is set to "Quiescing" until the transfer is completed, and then the status becomes "Quiesced".

   This example quiesces transfers involving the destination volume "vol1" from "SVMvs0.example.com":

   ```
   cluster1::> snapmirror quiesce -destination-path vs0.example.com:vol1
   ```

3. Verify that all SnapMirror relationships are quiesced:

   `snapmirror show -status !Quiesced`

   This command displays any SnapMirror relationships that are *not* quiesced.

   This example shows that all SnapMirror relationships are quiesced:

   ```
   cluster1::> snapmirror show -status !Quiesced
   There are no entries matching your query.
   ```

4. If any SnapMirror relationships are currently being transferred, do one of the following options:

Option	Description
Wait for the transfers to finish before performing the ONTAP upgrade.	After each transfer finishes, the relationship changes to "Quiesced" status.
Stop the transfers: `snapmirror abort -destination-path destination -h` **Note:** You must use the `-foreground true` parameter if you are aborting load-sharing mirror transfers.	This command stops the SnapMirror transfer and restores the destination volume to the last Snapshot copy that was successfully transferred. The relationship is set to "Quiesced" status.

Related information

Upgrade requirements for SnapMirror

Upgrade considerations for SnapLock

SnapLock does not allow the download of certain kernel versions if these are qualified as bad SnapLock releases or if SnapLock is disabled in those releases. These download

restrictions only apply if the node has SnapLock data.

Prepare all load-sharing mirrors before upgrading from ONTAP 8.3

Before upgrading from ONTAP 8.3, you should move all of the load-sharing mirror source volumes to an aggregate on the node that you will upgrade last. This ensures that load-sharing mirror destination volumes are the same or later versions of ONTAP.

You only need to perform this procedure when upgrading from ONTAP 8.3.

1. Record the locations of all load-sharing mirror source volumes.

   Knowing where the load-sharing mirror source volumes came from helps facilitate returning them to their original locations after the major upgrade.

2. Determine the node and aggregate to which you will move the load-sharing mirror source volumes.
3. Move the load-sharing mirror source volumes to the node and aggregate by using the volume move start command.

Delete existing external key management server connections before upgrading

If you are using NetApp Storage Encryption (NSE) on ONTAP 9.2 or earlier and upgrading to ONTAP 9.3 or later, you must use the command line interface (CLI) to delete any existing external key management (KMIP) server connections before performing the upgrade.

1. Verify that the NSE drives are unlocked, open, and set to the default manufacture secure ID 0x0:

   ```
   storage encryption disk show -disk*
   ```

2. Enter the advanced privilege mode:

   ```
   set -privilege advanced
   ```

3. Use the default manufacture secure ID 0x0 to assign the FIPS key to the self-encrypting disks (SEDs): `storage encryption disk modify -fips-key-id 0x0 -disk *`
4. Verify that assigning the FIPS key to all disks is complete: `storage encryption disk show-status`
5. Verify that the **mode** for all disks is set to data: `storage encryption disk show`
6. View the configured KMIP servers: `security key-manager show`
7. Delete the configured KMIP servers: `security key-manager delete -address kmip_ip_address`
8. Delete the external key manager configuration:`security key-manager delete-kmip-config`

   This step does not remove the NSE certificates.

After the upgrade is complete, you must reconfigure the KMIP server connections.

Related information

Reconfiguring KMIP server connections after upgrading to ONTAP 9.3 or later

Verifying that the netgroup file is present on all nodes

If you have loaded netgroups into storage virtual machines (SVMs), before you upgrade or revert, you must verify that the netgroup file is present on each node. A missing netgroup file on a node can cause an upgrade or revert to fail.

NFS management contains more information about netgroups and loading them from a URI.

1. Set the privilege level to advanced: `set -privilege advanced`
2. Display the netgroup status for each SVM: `vserver services netgroup status`
3. Verify that for each SVM, each node shows the same netgroup file hash value: `vserver services name-service netgroup status`

   If this is the case, you can skip the next step and proceed with the upgrade or revert. Otherwise, proceed to the next step.

4. On any one node of the cluster, manually load the netgroup file: `vserver services netgroup load -vserver vserver_name -source uri`

   This command downloads the netgroup file on all nodes. If a netgroup file already exists on a node, it is overwritten.

Configure LDAP clients to use TLS for highest security

Before upgrading to the target ONTAP release, you must configure LDAP clients using SSLv3 for secure communications with LDAP servers to use TLS. SSL will not be available after the upgrade.

By default, LDAP communications between client and server applications are not encrypted. You must disallow the use of SSL and enforce the use of TLS.

1. Verify that the LDAP servers in your environment support TLS.

   If they do not, do not proceed. You should upgrade your LDAP servers to a version that supports TLS.

2. Check which ONTAP LDAP client configurations have LDAP over SSL/TLS enabled: `vserver services name-service ldap client show`

   If there are none, you can skip the remaining steps. However, you should consider using LDAP over TLS for better security.

3. For each LDAP client configuration, disallow SSL to enforce the use of TLS: `vserver services name-service ldap client modify -vserver vserver_name -client-config ldap_client_config_name -allow-ssl false`
4. Verify that the use of SSL is no longer allowed for any LDAP clients: `vserver services name-service ldap client show`

Related information

Considerations for session-oriented protocols

Clusters and session-oriented protocols might cause adverse effects on clients and applications in certain areas during upgrades.

If you are using session-oriented protocols, consider the following:

- SMB

  If you serve continuously available (CA) shares with SMBv3, you can use the automated nondisruptive upgrade method (with System Manager or the CLI), and no disruption is experienced by the client.

  If you are serving shares with SMBv1 or SMBv2, or non-CA shares with SMBv3, client sessions are disrupted during upgrade takeover and reboot operations. You should direct users to end their sessions before you upgrade.

  Hyper-V and SQL Server over SMB support nondisruptive operations (NDOs). If you configured a Hyper-V or SQL Server over SMB solution, the application servers and the contained virtual machines or databases remain online and provide continuous availability during the ONTAP upgrade.

- NFSv4.x

  NFSv4.x clients will automatically recover from connection losses experienced during the upgrade using normal NFSv4.x recovery procedures. Applications might experience a temporary I/O delay during this process.

- NDMP

  State is lost and the client user must retry the operation.

- Backups and restores

  State is lost and the client user must retry the operation.

  > Do not initiate a backup or restore during or immediately before an upgrade. Doing so might result in data loss.

- Applications (for example, Oracle or Exchange)

  Effects depend on the applications. For timeout-based applications, you might be able to change the timeout setting to longer than the ONTAP reboot time to minimize adverse effects.

Considerations for session-oriented protocols

If SSL FIPS mode is enabled on a cluster where administrator accounts authenticate with an SSH public key, you must ensure that the host key algorithm is supported on the target release before upgrading ONTAP.

Note: Host key algorithm support has changed in ONTAP 9.11.1 and later releases.

ONTAP release	Supported key types	Unsupported key types
9.11.1 and later	ecdsa-sha2-nistp256	rsa-sha2-512 rsa-sha2-256 ssh-ed25519 ssh-dss ssh-rsa
9.10.1 and earlier	ecdsa-sha2-nistp256 ssh-ed25519	ssh-dss ssh-rsa

Existing SSH public key accounts without the supported key algorithms must be reconfigured with a supported key type before enabling upgrading, or administrator authentication will fail.

Learn more about enabling SSH public key accounts.

Convert an existing DP-type relationship to XDP

You can easily convert an existing DP-type relationship to XDP to take advantage of version-flexible SnapMirror.

About this task

- If you are upgrading to ONTAP 9.12.1 or later, you must convert DP-type relationships to XDP before upgrading. ONTAP 9.12.1 and later does not support DP-type relationships.
- SnapMirror does not automatically convert existing DP-type relationships to XDP. To convert the relationship, you need to break and delete the existing relationship, create a new XDP relationship, and resync the relationship. For background information, see XDP replaces DP as the SnapMirror default.
- When planning your conversion, you should be aware that background preparation and the data warehousing phase of an XDP SnapMirror relationship can take a long time. It is not uncommon to see the SnapMirror relationship reporting the status "preparing" for an extended time period.

After you convert a SnapMirror relationship type from DP to XDP, space-related settings, such as autosize and space guarantee are no longer replicated to the destination.

Steps

1. From the destination cluster, ensure that the SnapMirror relationship is type DP, that the mirror state is SnapMirrored, the relationship status is Idle, and the relationship is healthy:

   `snapmirror show -destination-path` *`SVM:volume|cluster://SVM/volume`*

   The following example shows the output from the `snapmirror show` command:

```
cluster_dst::>snapmirror show -destination-path svm_backup:volA_dst

Source Path: svm1:volA
Destination Path: svm_backup:volA_dst
Relationship Type: DP
SnapMirror Schedule: -
Tries Limit: -
Throttle (KB/sec): unlimited
Mirror State: Snapmirrored
Relationship Status: Idle
Transfer Snapshot: -
Snapshot Progress: -
Total Progress: -
Snapshot Checkpoint: -
Newest Snapshot: snapmirror.10af643c-32d1-11e3-954b-
123478563412_2147484682.2014-06-27_100026
Newest Snapshot Timestamp: 06/27 10:00:55
Exported Snapshot: snapmirror.10af643c-32d1-11e3-954b-
123478563412_2147484682.2014-06-27_100026
Exported Snapshot Timestamp: 06/27 10:00:55
Healthy: true
```

You might find it helpful to retain a copy of the `snapmirror show` command output to keep track existing of the relationship settings.

2. From the source and the destination volumes, ensure that both volumes have a common Snapshot copy:

   `volume snapshot show -vserver` *`SVM`* `-volume` *`volume`*

   The following example shows the `volume snapshot show` output for the souce and the destination volumes:

```
cluster_src:> volume snapshot show -vserver vsm1 -volume volA
---Blocks---
Vserver Volume Snapshot State Size Total% Used%
-------- ------- ------------------------------ -------- --------
------ -----
svm1 volA
weekly.2014-06-09_0736 valid 76KB 0% 28%
weekly.2014-06-16_1305 valid 80KB 0% 29%
daily.2014-06-26_0842 valid 76KB 0% 28%
hourly.2014-06-26_1205 valid 72KB 0% 27%
hourly.2014-06-26_1305 valid 72KB 0% 27%
hourly.2014-06-26_1405 valid 76KB 0% 28%
hourly.2014-06-26_1505 valid 72KB 0% 27%
hourly.2014-06-26_1605 valid 72KB 0% 27%
daily.2014-06-27_0921 valid 60KB 0% 24%
hourly.2014-06-27_0921 valid 76KB 0% 28%
snapmirror.10af643c-32d1-11e3-954b-123478563412_2147484682.2014-06-
27_100026
valid 44KB 0% 19%
11 entries were displayed.


cluster_dest:> volume snapshot show -vserver svm_backup -volume volA_dst
---Blocks---
Vserver Volume Snapshot State Size Total% Used%
-------- ------- ------------------------------ -------- --------
------ -----
svm_backup volA_dst
weekly.2014-06-09_0736 valid 76KB 0% 30%
weekly.2014-06-16_1305 valid 80KB 0% 31%
daily.2014-06-26_0842 valid 76KB 0% 30%
hourly.2014-06-26_1205 valid 72KB 0% 29%
hourly.2014-06-26_1305 valid 72KB 0% 29%
hourly.2014-06-26_1405 valid 76KB 0% 30%
hourly.2014-06-26_1505 valid 72KB 0% 29%
hourly.2014-06-26_1605 valid 72KB 0% 29%
daily.2014-06-27_0921 valid 60KB 0% 25%
hourly.2014-06-27_0921 valid 76KB 0% 30%
snapmirror.10af643c-32d1-11e3-954b-123478563412_2147484682.2014-06-
27_100026
```

3. To ensure scheduled updates will not run during the conversion, quiesce the existing DP-type relationship:

   ```
   snapmirror quiesce -source-path SVM:volume|cluster://SVM/volume, …
   -destination-path SVM:volume|cluster://SVM/volume, …
   ```

For complete command syntax, see the man page.

> You must run this command from the destination SVM or the destination cluster.

The following example quiesces the relationship between the source volume `volA` on `svm1` and the destination volume `volA_dst` on `svm_backup`:

```
cluster_dst::> snapmirror quiesce -destination-path svm_backup:volA_dst
```

4. Break the existing DP-type relationship:

   `snapmirror break -destination-path` *`SVM:volume|cluster://SVM/volume`*`, …`

   For complete command syntax, see the man page.

   > You must run this command from the destination SVM or the destination cluster.

   The following example breaks the relationship between the source volume `volA` on `svm1` and the destination volume `volA_dst` on `svm_backup`:

   ```
   cluster_dst::> snapmirror break -destination-path svm_backup:volA_dst
   ```

5. If automatic deletion of Snapshot copies is enabled on the destination volume, disable it:

   `volume snapshot autodelete modify -vserver` *`SVM`* `-volume` *`volume`* `-enabled false`

   The following example disables Snapshot copy autodelete on the destination volume `volA_dst`:

   ```
   cluster_dst::> volume snapshot autodelete modify -vserver svm_backup
   -volume volA_dst -enabled false
   ```

6. Delete the existing DP-type relationship:

   `snapmirror delete -destination-path` *`SVM:volume|cluster://SVM/volume`*`, …`

   For complete command syntax, see the man page.

   > You must run this command from the destination SVM or the destination cluster.

   The following example deletes the relationship between the source volume `volA` on `svm1` and the destination volume `volA_dst` on `svm_backup`:

   ```
   cluster_dst::> snapmirror delete -destination-path svm_backup:volA_dst
   ```

7. You can use the output you retained from the `snapmirror show` command to create the new XDP-type

relationship:

`snapmirror create -source-path` *`SVM:volume|cluster://SVM/volume`*`, … -destination -path` *`SVM:volume|cluster://SVM/volume`*`, … -type XDP -schedule` *`schedule`* `-policy` *`policy`*

The new relationship must use the same source and destination volume. For complete command syntax, see the man page.

You must run this command from the destination SVM or the destination cluster.

The following example creates a SnapMirror DR relationship between the source volume `volA` on `svm1` and the destination volume `volA_dst` on `svm_backup` using the default `MirrorAllSnapshots` policy:

```
cluster_dst::> snapmirror create -source-path svm1:volA -destination
-path svm_backup:volA_dst
-type XDP -schedule my_daily -policy MirrorAllSnapshots
```

8. Resync the source and destination volumes:

   `snapmirror resync -source-path` *`SVM:volume|cluster://SVM/volume`*`, … -destination -path` *`SVM:volume|cluster://SVM/volume`*`, …`

   To improve resync time, you can use the `-quick-resync` option, but you should be aware that storage efficiency savings can be lost. For complete command syntax, see the man page: SnapMirror resync command.

   You must run this command from the destination SVM or the destination cluster. Although resync does not require a baseline transfer, it can be time-consuming. You might want to run the resync in off-peak hours.

   The following example resyncs the relationship between the source volume `volA` on `svm1` and the destination volume `volA_dst` on `svm_backup`:

   ```
   cluster_dst::> snapmirror resync -source-path svm1:volA -destination
   -path svm_backup:volA_dst
   ```

9. If you disabled automatic deletion of Snapshot copies, reenable it:

   `volume snapshot autodelete modify -vserver` *`SVM`* `-volume` *`volume`* `-enabled true`

After you finish

1. Use the `snapmirror show` command to verify that the SnapMirror relationship was created. For complete command syntax, see the man page.
2. Once the SnapMirror XDP destination volume begins updating Snapshot copies as defined by the SnapMirror policy, you can use the output of `snapmirror list-destinations` command from the source cluster to display the new SnapMirror XDP relationship.

Download and install the ONTAP software image

You must first download the ONTAP software from the NetApp Support site; then you can install it using the automatic nondisruptive upgrade (ANDU) or manual upgrade process.

Download the software image

Depending on your ONTAP release, you can copy the ONTAP software image from the NetApp Support Site to one of the following locations: an HTTP, HTTPS or FTP server on your network, or a local folder.

You should note the following important information:

- Software images are specific to platform models.

  You must obtain the correct image for your cluster. Software images, firmware version information, and the latest firmware for your platform model are available on the NetApp Support Site.

- Software images include the latest version of system firmware that was available when a given version of ONTAP was released.
- If you are upgrading a system with NetApp Volume Encryption to ONTAP 9.5 or later, you must download the ONTAP software image for non-restricted countries, which includes NetApp Volume Encryption.

  If you use the ONTAP software image for restricted countries to upgrade a system with NetApp Volume Encryption, the system panics and you lose access to your volumes.

- If you are upgrading from ONTAP 9.5 to 9.9.1, you must copy the software image for ONTAP 9.7 and 9.9.1.
- If you are upgrading from ONTAP 9.3 to 9.7, you must copy the software image for ONTAP 9.5 and 9.7.

Steps

1. Locate the target ONTAP software in the Software Downloads area of the NetApp Support Site.

   For an ONTAP Select upgrade, select **ONTAP Select Node Upgrade**.

2. Copy the software image (for example, 97_q_image.tgz) to the appropriate location.

   Depending on your ONTAP release, the location will be a directory an HTTP, HTTPS or FTP server from which the image will be served to the local system, or to a local folder on the storage system.

You can copy the image to this location…	If you are running these ONTAP releases…
An HTTP or FTP server	ONTAP 9.0 and later
A local folder	ONTAP 9.4 and later
An HTTPS server The server's CA certificate must be installed on the local system.	ONTAP 9.6 and later

Install the software image

You must install the target software image on the cluster's nodes.

- If you are upgrading a system with NetApp Volume Encryption to ONTAP 9.5 or later, you must have

downloaded the ONTAP software image for non-restricted countries, which includes NetApp Volume Encryption.

If you use the ONTAP software image for restricted countries to upgrade a system with NetApp Volume Encryption, the system panics and you lose access to your volumes.

- If you are upgrading from ONTAP 9.5 directly to 9.9.1, you must download the software image for ONTAP 9.7 and 9.9.1. If you are upgrading from ONTAP 9.3 directly to 9.7, you must download the software image for ONTAP 9.5 and 9.7.

  The automated upgrade process uses both images in the background to complete the upgrade.

For automatic nondisruptive upgrade (ANDU)

1. Check the image repository and delete any previous images.

   `cluster image package show-repository`

   ```
   cluster image package show-repository\
   <<name_of_vsim|There are no packages in the repository.\r\n
   ```

2. Download the image.

   `cluster image package get -url url_to_image_on_nss`

   Example

   `cluster image package get -url http://10.60.132.98/x/eng/rlse/DOT/9.7P13X2/promo/9.7P13X2/x86_64.optimize/image.tgz`

3. Verify the package is downloaded.

   `cluster image package show-repository`

   Example

   ```
   cluster image package show-repository -fields download-ver\
   <<name_of_vsim| download-verX;X\r\n
   <<name_of_vsim| Downloaded VersionX;X\r\n
   <<name_of_vsim| ONTAP 9.10.1.X;X\r\n
   ```

For manual upgrades

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

   The advanced prompt (`*>`) appears.

2. Download the image.

   a. If you are upgrading a cluster without a MetroCluster configuration or a two-node MetroCluster configuration, use the following command to download the image:

```
system node image update -node * -package location -replace-package true
-setdefault true -background true
```

location can be a web server or a local folder, depending on the ONTAP version. See the `system node image update` man page for details.

This command downloads and installs the software image on all of the nodes simultaneously. To download and install the image on each node one at a time, do not specify the `-background` parameter.

b. If you are upgrading a four or eight-node MetroCluster configuration, you must issue the following command on both clusters:

```
system node image update -node * -package location -replace-package true
-background true -setdefault false
```

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

3. Enter `y` to continue when prompted.
4. Verify that the software image is downloaded and installed on each node.

```
system node image show-update-progress -node *
```

This command displays the current status of the software image download and installation. You should continue to run this command until all nodes report a **Run Status** of **Exited**, and an **Exit Status** of **Success**.

The system node image update command can fail and display error or warning messages. After resolving any errors or warnings, you can run the command again.

This example shows a two-node cluster in which the software image is downloaded and installed successfully on both nodes:

```
cluster1::*> system node image show-update-progress -node *
There is no update/install in progress
Status of most recent operation:
        Run Status:     Exited
        Exit Status:    Success
        Phase:          Run Script
        Exit Message:   After a clean shutdown, image2 will be set as
the default boot image on node0.
There is no update/install in progress
Status of most recent operation:
        Run Status:     Exited
        Exit Status:    Success
        Phase:          Run Script
        Exit Message:   After a clean shutdown, image2 will be set as
the default boot image on node1.
2 entries were acted on.
```

Which upgrade method should I use?

Which upgrade method should I use?

The method you use to upgrade — nondisruptive or disruptive, automated or manual — depends upon your configuration. If available, the automated nondisruptive upgrade (ANDU) using System Manager is the preferred method.

Nondisruptive upgrades
Nondisruptive upgrades take advantage of ONTAP's high-availability (HA) failover technology to ensure that clusters continue to serve data during the upgrade. There are two types of nondisruptive upgrade processes.

- *Batch* updates
  In a batch update, the cluster is divided into several batches, each of which contains multiple HA pairs. In the first batch, half of the nodes are upgraded, followed by their HA partners. The process is then repeated sequentially for the remaining batches.
- *Rolling* updates
  In a rolling update, a node is taken offline and upgraded while its partner takes over its storage. When the node upgrade is complete, the partner node gives control back to the original owning node and the process is repeated, this time on the partner node. Each additional HA pair is upgraded in sequence until all HA pairs are running the target release.
  Note: The term *rolling upgrade* is frequently used in the software industry for software upgrades that don't cause disruptions in service and hence is often synonymous with "nondisruptive upgrade". In ONTAP 9 upgrades, a *rolling update* is one of the processes that can be used for nondisruptive upgrades.

Nondisruptive upgrades can be performed using an *automated* or *manual* method.

- **Automated nondisruptive upgrade (ANDU)**
  - When an administrator initiates an ANDU, ONTAP automatically installs the target ONTAP image on each node, validates the cluster components to ensure that the cluster can be upgraded

nondisruptively, and then executes a batch or rolling update in the background.

    - Batch updates are the default for clusters of 8 nodes or more.
    - Rolling updates are the default for clusters with fewer than 8 nodes. Rolling updates can also be selected explicitly for clusters with 8 nodes or more.
  - An ANDU can be executed using System Manager or the ONTAP command line interface (CLI). If available for your configuration, ANDU using System Manager is the recommended method of upgrade.
- **Manual nondisruptive upgrade**
  - An administrator must manually confirm upgrade readiness of the cluster components on each node, then manually perform rolling update process steps in the foreground.
  - Manual nondisruptive upgrades are executed using the ONTAP CLI.
  - You should only use a manual method if ANDU is not supported for your configuration.

Disruptive upgrades
In a disruptive upgrade, storage failover is disabled for each HA pair, and then each node is rebooted one at a time. Disruptive upgrades can be performed more quickly than nondisruptive upgrades, and require fewer steps to complete. However, you should not perform a disruptive upgrade unless you can take the cluster offline for the duration of the upgrade. If you are operating in a SAN environment, you should be prepared to shut down or suspend all SAN clients before performing a disruptive upgrade. Disruptive upgrades are performed using the ONTAP CLI.

Methods for non-MetroCluster configurations

Clusters with 2 or more nodes can use any of the following upgrade methods, which are listed in order of recommended usage.

- Automated nondisruptive using System Manager
- Automated nondisruptive using the CLI
- Manual nondisruptive using the CLI
- Manual disruptive using the CLI

Single node clusters must use one of disruptive methods, although the automated method is recommended.

- Automated disruptive using the CLI
- Manual disruptive using the CLI

Methods for MetroCluster configurations

The upgrade methods available for each configuration are listed in order of recommended usage.

ONTAP version	Number of nodes	Upgrade method
9.3 or later	2,4	• Automated nondisruptive using System Manager • Automated nondisruptive using the CLI • Manual disruptive using the CLI

ONTAP version	Number of nodes	Upgrade method
9.3 or later	8	• Automated nondisruptive using the CLI • Manual nondisruptive using the CLI • Manual disruptive using the CLI
9.2 or earlier	2	• Manual nondisruptive (for 2-node clusters) using the CLI • Manual disruptive using the CLI
9.2 or earlier	4, 8	• Manual nondisruptive using the CLI • Manual disruptive using the CLI
9.0 or later	4, 8 (patch only)	Automated nondisruptive using System Manager
9.2 or earlier	2, 4, 8 (patch only)	Automated nondisruptive using System Manager

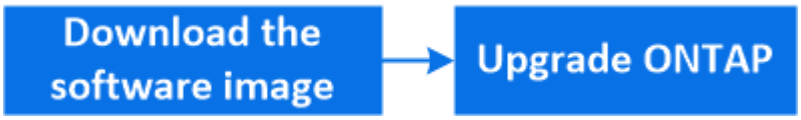
Automated nondisruptive update using System Manager

You can nondisruptively update the version of ONTAP on your cluster using System Manager.

The update process checks your hardware platform and configuration to verify that your system is supported by the ONTAP version to which you are upgrading. ONTAP automatically shifts workloads during an upgrade between clusters so you can continue serving data.

This procedure updates your system to the specified version of ONTAP. It is assumed that your hardware platform and configuration is supported for the target release.

Beginning with ONTAP 9.10.1, if you have a cluster with 8 or more nodes you can select to have them updated one HA pair at a time. This allows you, if needed, to correct upgrade issues on the first HA pair before moving to subsequent pairs.



If issues are encountered during your automated upgrade, you can view EMS messages and details in System Manager: Click **Events & Jobs** > **Events**.

Steps

1. If you want to download the software image to an HTTP or FTP server on your network, copy the software image from the NetApp support site to the directory on the HTTP or FTP server from which the image will be served.

If you want to download the software image to a local folder, then click the software image on the NetApp support site, select **Save As**, and then choose the local folder to place the image.

2. Depending on the ONTAP version that you are running, perform one of the following steps:

ONTAP version	Steps
ONTAP 9.8 or later	Click **Cluster > Overview**.
ONTAP 9.5, 9.6, and 9.7	Click **Configuration** > **Cluster** > **Update**.
ONTAP 9.4 or earlier	Click **Configuration** > **Cluster Update**.

3. In the right corner of the Overview pane, click ⋮.
4. Click **ONTAP Update**.
5. In the Cluster Update tab, add a new image or select an available image.

If you want to…	Then…
Add a new software image from the local client **Note:** You should have already downloaded the image to the local client. Download and install the ONTAP software images	a. Under Available Software Images, click **Add from Local**. b. Browse to the location you saved the software image, select the image, and then click **Open**. The software image uploads after you click **Open**.
Add a new software image from the NetApp Support Site	a. Click **Add from Server**. b. In the Add a New Software Image dialog box, enter the URL of the HTTP server or FTP server on which you have saved the image that was downloaded from the NetApp Support Site. For anonymous FTP, you must specify the URL in the ftp://anonymous@ftpserver format. c. Click **Add**.
Select an available image	Choose one of the listed images.

6. Click **Validate** to run the pre-update validation checks to verify whether the cluster is ready for an update.

The validation operation checks the cluster components to validate that the update can be completed nondisruptively, and then displays any errors or warnings. It also displays any required remedial action that you must perform before updating the software.

You must perform all of the required remedial actions for the errors before proceeding with the update. Although you can ignore the remedial actions for the warnings, the best practice is to perform all of the remedial actions before proceeding with the update.

7. Click **Next**.
8. Click **Update**.

   Validation is performed again.

   - When the validation is complete, a table displays any errors and warnings, along with any required remedial actions to be taken before proceeding.
   - If the validation is completed with warnings, you can choose to select **Update with warnings**.

   > If you prefer to have your nodes updated one HA pair at a time instead of a batch update of all the HA pairs in your cluster, select **Update one HA pair at a time**. This option is only available in ONTAP 9.10.1 or later for clusters of eight or more nodes.

When the validation is complete and the update is in progress, the update might be paused because of errors. You can click the error message to view the details, and then perform the remedial actions before resuming the update.

After the update is completed successfully, the node reboots, and you are redirected to the System Manager login page. If the node takes a long time to reboot, you must refresh your browser.

Resuming an upgrade (using System Manager) after an error in the automated upgrade process

If an automated upgrade pauses because of an error, you can resolve the error and resume the automated upgrade, or you can cancel the automated upgrade and complete the process manually. If you choose to continue the automated upgrade, do not perform any of the upgrade steps manually.

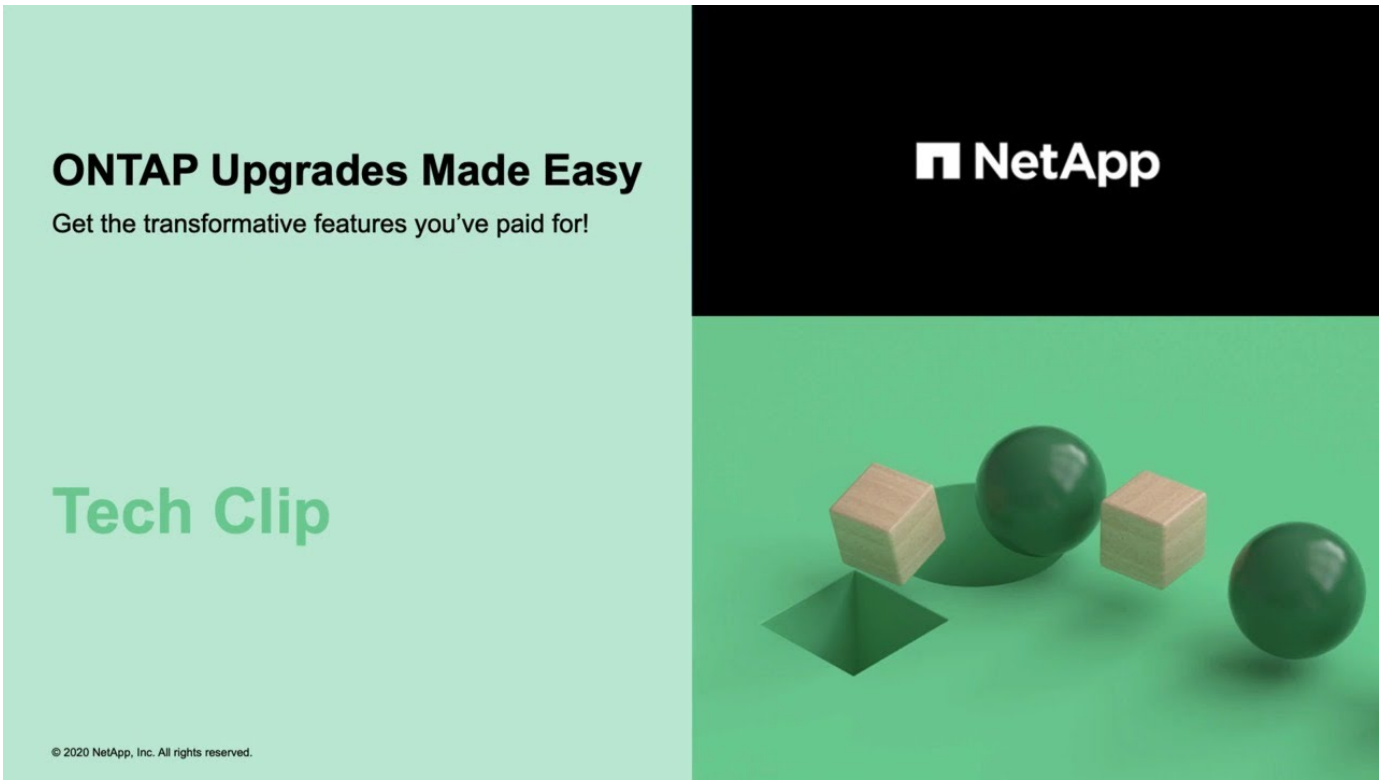
1. Depending on the ONTAP version that you are running, perform one of the following steps:
   - ONTAP 9.8 or later: Click **Cluster** > **Overview**
   - ONTAP 9.5, 9.6, or 9.7: Click **Configuration** > **Cluster** > **Update**.
   - ONTAP 9.4 or earlier: Click **Configuration** > **Cluster Update**.

     Then in the right corner of the Overview pane, click the three blue vertical dots, and **ONTAP Update**.
2. Continue the automated update or cancel it and continue manually.

If you want to…	Then…
Resume the automated update	Click **Resume**.
Cancel the automated update and continue manually	Click **Cancel**.

Video: Upgrades made easy

Take a look at the simplified ONTAP upgrade capabilities of System Manager in ONTAP 9.8.



Automated nondisruptive ONTAP upgrade using the CLI

You can use the command line interface (CLI) to verify that the cluster can be upgraded nondisruptively, install the target ONTAP image on each node, and then execute an upgrade in the background.

After you upgrade, you should verify your cluster version, cluster health, and storage health.

If you are using a MetroCluster FC configuration, you also need to verify that the cluster is enabled for automatic unplanned switchover.

If you do not plan to monitor the progress of the upgrade process, it is a good practice to request EMS notifications of errors that might require manual intervention.

Before you begin

- You should launch Active IQ Digital Advisor.

  The Upgrade Advisor component of Active IQ Digital Advisor helps you plan for a successful upgrade.

  Data-driven insights and recommendations from Active IQ Digital Advisor are provided to all NetApp customers with an active **SupportEdge** contract (features vary by product and support tier).

- You must have met the upgrade preparation requirements.
- For each HA pair, each node should have one or more ports on the same broadcast domain.

  If you have 8 or more nodes, the batch upgrade method is used in the automatic nondisruptive upgrade. In ONTAP 9.7 and earlier, if the batch method is used, LIFs are migrated to the HA partner of the node being upgraded. If the partners do not have any ports in the same broadcast domain, then the LIF migration fails.

In ONTAP 9.8 and later, if the batch method is used, LIFs are migrated to the other batch group.

- If you are performing a direct multi-hop upgrade, you must have obtained both of the correct ONTAP images required for your specific upgrade path.

About this task

The `cluster image validate` command checks the cluster components to validate that the upgrade can be completed nondisruptively, and then it provides the status of each check and any required action you must take before performing the software upgrade.

> Modifying the setting of the `storage failover modify-auto-giveback` command option before the start of an automatic nondisruptive upgrade (ANDU) has no impact on the upgrade process. The ANDU process ignores any preset value to this option during the takeover/giveback required for the update. For example, setting `-autogiveback` to false prior to beginning ANDU does not interrupt the automatic upgrade before giveback.

1. Delete the previous ONTAP software package:

   ```
   cluster image package delete -version previous_ONTAP_Version
   ```

2. Download the target ONTAP software package:

   ```
   cluster image package get -url location
   ```

   > If you are upgrading from ONTAP 9.3 to 9.7, download the software package for ONTAP 9.5, and then use the same command to download the software package for 9.7. If you are upgrading from ONTAP 9.5 to 9.9.1, download the software package for ONTAP 9.7, and then use the same command to download the software package for 9.9.1.

   ```
   cluster1::> cluster image package get -url
   http://www.example.com/software/9.7/image.tgz

   Package download completed.
   Package processing completed.
   ```

3. Verify that the software package is available in the cluster package repository:

   ```
   cluster image package show-repository
   ```

   ```
   cluster1::> cluster image package show-repository
   Package Version  Package Build Time
   ---------------- ------------------
   9.7              MM/DD/YYYY 10:32:15
   ```

4. Verify that the cluster is ready to be upgraded nondisruptively:

   ```
   cluster image validate -version package_version_number
   ```

- If you are upgrading a two-node or four-node MetroCluster configuration, you must run this command on both clusters before proceeding.
- If you are upgrading from ONTAP 9.3 to 9.7, use the 9.7 package for verification. You do not need to validate the 9.5 package separately.
- If you are upgrading from ONTAP 9.5 to 9.9.1, use the 9.9.1 package for verification. You do not need to validate the 9.7 package separately.

```
cluster1::> cluster image validate -version 9.7

WARNING: There are additional manual upgrade validation checks that must
be performed after these automated validation checks have completed...
```

5. Monitor the progress of the validation:

   `cluster image show-update-progress`

6. Complete all required actions identified by the validation.
7. Generate a software upgrade estimate:

   `cluster image update -version package_version_number -estimate-only`

   The software upgrade estimate displays details about each component to be updated, and the estimated duration of the upgrade.

8. Perform the software upgrade:

   `cluster image update -version package_version_number`

   - If you are upgrading from ONTAP 9.3 to 9.7, use the 9.7 package_version_number in the above command.
   - If you are upgrading from ONTAP 9.5 to 9.9.1, use the 9.9.1 package_version_number in the above command.
   - For any MetroCluster configuration, except a 2-node MetroCluster system, the ONTAP upgrade process starts simultaneously on the HA pairs at both sites (the local site and the disaster recovery site) after the user initiates and provides confirmation on the command line. For a 2-node MetroCluster system, the update is started first on the disaster recovery site, that is, the site where the upgrade is not initiated. After the update is fully completed on the disaster recovery site, the upgrade begins on the local site.
   - If the cluster consists of 2 to 6 nodes, a rolling upgrade is performed. If the cluster consists of 8 or more nodes, a batch upgrade is performed by default. If desired, you can use the `-force-rolling` parameter to specify a rolling upgrade instead.
   - After completing each takeover and giveback, the upgrade waits for 8 minutes to enable client applications to recover from the pause in I/O that occurs during the takeover and giveback. If your environment requires more or less time for client stabilization, you can use the `-stabilize-minutes` parameter to specify a different amount of stabilization time.

```
cluster1::> cluster image update -version 9.7

Starting validation for this update. Please wait..

It can take several minutes to complete validation...

WARNING: There are additional manual upgrade validation checks...

Pre-update Check      Status     Error-Action
--------------------- ----------
-----------------------------------------
...
20 entries were displayed

Would you like to proceed with update ? {y|n}: y
Starting update...

cluster-1::>
```

9. Display the cluster update progress:

   `cluster image show-update-progress`

   > If you are upgrading a 4-node or 8-node MetroCluster configuration, the `cluster image show-update-progress` command only displays the progress for the node on which you run the command. You must run the command on each node to see individual node progress.

10. Verify that the upgrade was completed successfully on each node.

```
cluster1::> cluster image show-update-progress

                                          Estimated         Elapsed
Update Phase         Status                 Duration        Duration
-------------------- ----------------- --------------- ---------------
Pre-update checks    completed               00:10:00        00:02:07
Data ONTAP updates   completed               01:31:00        01:39:00
Post-update checks   completed               00:10:00        00:02:00
3 entries were displayed.

Updated nodes: node0, node1.

cluster1::>
```

11. Trigger an AutoSupport notification:

```
autosupport invoke -node * -type all -message "Finishing_NDU"
```

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

12. Verify that the cluster is enabled for automatic unplanned switchover:

> This procedure is performed only for MetroCluster FC configurations. If you are using a MetroCluster IP configuration, skip this procedure.

a. Check whether automatic unplanned switchover is enabled:

```
metrocluster show
```

If automatic unplanned switchover is enabled, the following statement appears in the command output:

```
AUSO Failure Domain    auso-on-cluster-disaster
```

b. If the statement does not appear in the output, enable automatic unplanned switchover:

```
metrocluster modify -auto-switchover-failure-domain auso-on-cluster-disaster
```

c. Verify that automatic unplanned switchover has been enabled by repeating Step 1.

Resuming an upgrade (using the CLI) after an error in the automated upgrade process

If an automated upgrade pauses because of an error, you can resolve the error and resume the automated upgrade, or you can cancel the automated upgrade and complete the process manually. If you choose to continue the automated upgrade, do not perform any of the upgrade steps manually.

About this task

If you want to manually complete the upgrade, use the `cluster image cancel-update` command to cancel the automated process and proceed manually. If you want to continue the automated upgrade, complete the following steps.

Steps

1. View the upgrade error:

```
cluster image show-update-progress
```

2. Resolve the error.
3. Resume the update:

```
cluster image resume-update
```

Related information

Launch Active IQ

Active IQ documentation

Automated disruptive using the CLI (single-node cluster only)

Beginning with ONTAP 9.2, you can perform an automated update of a single-node cluster. Because single-node clusters lack redundancy, updates are always disruptive.

- You must have satisfied upgrade preparation requirements.

1. Delete the previous ONTAP software package: `cluster image package delete -version previous_package_version`
2. Download the target ONTAP software package: `cluster image package get -url location`

```
cluster1::> cluster image package get -url
http://www.example.com/software/9.7/image.tgz

Package download completed.
Package processing completed.
```

3. Verify that the software package is available in the cluster package repository: `cluster image package show-repository`

```
cluster1::> cluster image package show-repository
Package Version  Package Build Time
---------------- ------------------
9.7              M/DD/YYYY 10:32:15
```

4. Verify that the cluster is ready to be upgraded: `cluster image validate -version package_version_number`

```
cluster1::> cluster image validate -version 9.7

WARNING: There are additional manual upgrade validation checks that
must be performed after these automated validation checks have
completed...
```

5. Monitor the progress of the validation: `cluster image show-update-progress`
6. Complete all required actions identified by the validation.
7. Optionally, generate a software upgrade estimate: `cluster image update -version package_version_number -estimate-only`

   The software upgrade estimate displays details about each component to be updated, and the estimated duration of the upgrade.

8. Perform the software upgrade: `cluster image update -version package_version_number`

If an issue is encountered, the update pauses and prompts you to take corrective action. You can use the cluster image show-update-progress command to view details about any issues and the progress of the update. After correcting the issue, you can resume the update by using the cluster image resume-update command.

9. Display the cluster update progress: `cluster image show-update-progress`

   The node is rebooted as part of the update and cannot be accessed while rebooting.

10. Trigger a notification: `autosupport invoke -node * -type all -message "Finishing_Upgrade"`

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

Manual nondisruptive using the CLI

Manual nondisruptive upgrade using the CLI (non-MetroCluster systems)

To upgrade a cluster of two or more nodes using the manual nondisruptive method, you must initiate a failover operation on each node in an HA pair, update the “failed” node, initiate giveback, and then repeat the process for each HA pair in the cluster.

You must have satisfied upgrade preparation requirements.

1. Update the first node in an HA pair

   You upgrade the first node in an HA pair by initiating a takeover by the node’s partner. The partner serves the node’s data while the first node is upgraded.

2. Update the second node in an HA pair

   After upgrading or downgrading the first node in an HA pair, you upgrade its partner by initiating a takeover on it. The first node serves the partner’s data while the partner node is upgraded.

3. Repeat these steps for each additional HA pair.

You should complete post-upgrade tasks.

Updating the first node in an HA pair

You can update the first node in an HA pair by initiating a takeover by the node’s partner. The partner serves the node’s data while the first node is upgraded.

If you are performing a major upgrade, the first node to be upgraded must be the same node on which you configured the data LIFs for external connectivity and installed the first ONTAP image.

After upgrading the first node, you should upgrade the partner node as quickly as possible. Do not allow the two nodes to remain in a state of version mismatch longer than necessary.

1. Update the first node in the cluster by invoking an AutoSupport message: `autosupport invoke -node * -type all -message "Starting_NDU"`

   This AutoSupport notification includes a record of the system status just prior to update. It saves useful

troubleshooting information in case there is a problem with the update process.

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

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

   The advanced prompt (`*>`) appears.

3. Set the new ONTAP software image to be the default image: `system image modify {-node nodenameA -iscurrent false} -isdefault true`

   The system image modify command uses an extended query to change the new ONTAP software image (which is installed as the alternate image) to the default image for the node.

4. Monitor the progress of the update: `system node upgrade-revert show`
5. Verify that the new ONTAP software image is set as the default image: `system image show`

   In the following example, image2 is the new ONTAP version and is set as the default image on node0:

```
cluster1::*> system image show
                  Is      Is                 Install
Node     Image    Default Current Version    Date
-------- -------  ------- ------- ---------  -------------------
node0
         image1   false   true    X.X.X      MM/DD/YYYY TIME
         image2   true    false   Y.Y.Y      MM/DD/YYYY TIME
node1
         image1   true    true    X.X.X      MM/DD/YYYY TIME
         image2   false   false   Y.Y.Y      MM/DD/YYYY TIME
4 entries were displayed.
```

6. Disable automatic giveback on the partner node if it is enabled: `storage failover modify -node nodenameB -auto-giveback false`

   If the cluster is a two-node cluster, a message is displayed warning you that disabling automatic giveback prevents the management cluster services from going online in the event of an alternating-failure scenario. Enter `y` to continue.

7. Verify that automatic giveback is disabled for node's partner: `storage failover show -node nodenameB -fields auto-giveback`

```
cluster1::> storage failover show -node node1 -fields auto-giveback
node     auto-giveback
-------- -------------
node1    false
1 entry was displayed.
```

8. Run the following command twice to determine whether the node to be updated is currently serving any clients `system node run -node nodenameA -command uptime`

   The uptime command displays the total number of operations that the node has performed for NFS, SMB, FC, and iSCSI clients since the node was last booted. For each protocol, you must 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 updated, you can verify that client traffic has resumed.

   The following example shows a node with NFS, SMB, FC, and iSCSI operations. However, the node is currently serving only NFS and iSCSI clients.

```
cluster1::> 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

cluster1::> 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
```

9. Migrate all of the data LIFs away from the node: `network interface migrate-all -node nodenameA`
10. Verify any LIFs that you migrated: `network interface show`

    For more information about parameters you can use to verify LIF status, see the network interface show man page.

    The following example shows that node0's data LIFs migrated successfully. For each LIF, the fields included in this example enable you to verify the LIF's home node and port, the current node and port to which the LIF migrated, and the LIF's operational and administrative status.

```
cluster1::> network interface show -data-protocol nfs|cifs -role data
-home-node node0 -fields home-node,curr-node,curr-port,home-port,status-
admin,status-oper
vserver lif     home-node home-port curr-node curr-port status-oper
status-admin
------- ------- --------- --------- --------- --------- -----------
------------
vs0     data001 node0     e0a       node1     e0a       up          up
vs0     data002 node0     e0b       node1     e0b       up          up
vs0     data003 node0     e0b       node1     e0b       up          up
vs0     data004 node0     e0a       node1     e0a       up          up
4 entries were displayed.
```

11. Initiate a takeover: `storage failover takeover -ofnode nodenameA`

    Do not specify the -option immediate parameter, because a normal takeover is required for the node that is being taken over to boot onto the new software image. If you did not manually migrate the LIFs away from the node, they automatically migrate to the node's HA partner to ensure that there are no service disruptions.

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

    NOTE: If AutoSupport is enabled, an AutoSupport message is sent indicating that the node is out of cluster quorum. You can ignore this notification and proceed with the update.

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

    You might see error messages indicating version mismatch and mailbox format problems. This is expected behavior and it represents a temporary state in a major nondisruptive upgrade and is not harmful.

    The following example shows that the takeover was successful. Node node0 is in the Waiting for giveback state, and its partner is in the In takeover state.

    ```
    cluster1::> storage failover show
                                  Takeover
    Node           Partner        Possible State Description
    -------------- -------------- --------
    -------------------------------------
    node0          node1          -        Waiting for giveback (HA
    mailboxes)
    node1          node0          false    In takeover
    2 entries were displayed.
    ```

13. Wait at least eight minutes for the following conditions to take effect:
    - Client multipathing (if deployed) is stabilized.
    - Clients are recovered from the pause in an I/O operation 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.

14. Return the aggregates to the first node: `storage failover giveback –ofnode nodenameA`

    The giveback first returns the root aggregate to the partner node and then, after that node has finished booting, returns the non-root aggregates and any LIFs that were set to automatically revert. The newly booted node begins to serve data to clients from each aggregate as soon as the aggregate is returned.

15. Verify that all aggregates have been returned: `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.

16. If any aggregates have not been returned, perform the following steps:

a. Review the veto workaround to determine whether you want to address the “veto” condition or override the veto.

   High-availability configuration

b. If necessary, address the “veto” condition described in the error message, ensuring that any identified operations are terminated gracefully.

c. Rerun the storage failover giveback command.

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

17. Wait at least eight minutes for the following conditions to take effect:
    - Client multipathing (if deployed) is stabilized.
    - Clients are recovered from the pause in an I/O operation 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.

18. Verify that the update was completed successfully for the node:
    a. Go to the advanced privilege level :`set -privilege advanced`
    b. Verify that update status is complete for the node: `system node upgrade-revert show -node nodenameA`

       The status should be listed as complete.

       If the status is not complete, contact technical support.

    c. Return to the admin privilege level: `set -privilege admin`
19. Verify that the node’s ports are up: `network port show -node nodenameA`

    You must run this command on a node that is upgraded to the higher version of ONTAP 9.

    The following example shows that all of the node’s ports are up:

```
cluster1::> network port show -node node0
                                                                        Speed
(Mbps)
Node   Port      IPspace      Broadcast Domain Link   MTU    Admin/Oper
------ --------- ------------ ---------------- ----- -------
------------
node0
       e0M       Default      -                up       1500  auto/100
       e0a       Default      -                up       1500  auto/1000
       e0b       Default      -                up       1500  auto/1000
       e1a       Cluster      Cluster          up       9000  auto/10000
       e1b       Cluster      Cluster          up       9000  auto/10000
5 entries were displayed.
```

20. Revert the LIFs back to the node: `network interface revert *`

    This command returns the LIFs that were migrated away from the node.

```
cluster1::> network interface revert *
8 entries were acted on.
```

21. Verify that the node's data LIFs successfully reverted back to the node, and that they are up: `network interface show`

    The following example shows that all of the data LIFs hosted by the node have successfully reverted back to the node, and that their operational status is up:

```
cluster1::> network interface show
            Logical    Status     Network            Current
Current Is
Vserver     Interface  Admin/Oper Address/Mask       Node           Port
Home
----------- ---------- ---------- ------------------ -------------
------- ----
vs0
            data001      up/up    192.0.2.120/24     node0          e0a
true
            data002      up/up    192.0.2.121/24     node0          e0b
true
            data003      up/up    192.0.2.122/24     node0          e0b
true
            data004      up/up    192.0.2.123/24     node0          e0a
true
4 entries were displayed.
```

22. If you previously determined that this node serves clients, verify that the node is providing service for each protocol that it was previously serving: `system node run -node nodenameA -command uptime`

    The operation counts reset to zero during the update.

    The following example shows that the updated node has resumed serving its NFS and iSCSI clients:

```
cluster1::> system node run -node node0 -command uptime
  3:15pm up  0 days, 0:16 129 NFS ops, 0 CIFS ops, 0 HTTP ops, 0 FCP
ops, 2 iSCSI ops
```

23. Reenable automatic giveback on the partner node if it was previously disabled: `storage failover modify -node nodenameB -auto-giveback true`

You should proceed to update the node's HA partner as quickly as possible. If you must suspend the update process for any reason, both nodes in the HA pair should be running the same ONTAP version.

Updating the partner node in an HA pair

After updating the first node in an HA pair, you update its partner by initiating a takeover on it. The first node serves the partner's data while the partner node is upgraded.

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

   The advanced prompt (`*>`) appears.

2. Set the new ONTAP software image to be the default image: `system image modify {-node nodenameB -iscurrent false} -isdefault true`

   The system image modify command uses an extended query to change the new ONTAP software image (which is installed as the alternate image) to be the default image for the node.

3. Monitor the progress of the update: `system node upgrade-revert show`
4. Verify that the new ONTAP software image is set as the default image: `system image show`

   In the following example, `image2` is the new version of ONTAP and is set as the default image on the node:

```
cluster1::*> system image show
                  Is      Is                  Install
Node     Image    Default Current Version     Date
-------- -------  ------- ------- ---------   -------------------
node0
         image1   false   false   X.X.X       MM/DD/YYYY TIME
         image2   true    true    Y.Y.Y       MM/DD/YYYY TIME
node1
         image1   false   true    X.X.X       MM/DD/YYYY TIME
         image2   true    false   Y.Y.Y       MM/DD/YYYY TIME
4 entries were displayed.
```

5. Disable automatic giveback on the partner node if it is enabled: `storage failover modify -node nodenameA -auto-giveback false`

   If the cluster is a two-node cluster, a message is displayed warning you that disabling automatic giveback prevents the management cluster services from going online in the event of an alternating-failure scenario. Enter `y` to continue.

6. Verify that automatic giveback is disabled for the partner node: `storage failover show -node nodenameA -fields auto-giveback`

```
cluster1::> storage failover show -node node0 -fields auto-giveback
node     auto-giveback
-------- -------------
node0    false
1 entry was displayed.
```

7. Run the following command twice to determine whether the node to be updated is currently serving any clients: `system node run -node nodenameB -command uptime`

   The uptime command displays the total number of operations that the node has performed for NFS, SMB, FC, and iSCSI clients since the node was last booted. For each protocol, you must 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 updated, you can verify that client traffic has resumed.

   The following example shows a node with NFS, SMB, FC, and iSCSI operations. However, the node is currently serving only NFS and iSCSI clients.

```
cluster1::> system node run -node node1 -command uptime
  2:58pm up  7 days, 19:16 800000260 NFS ops, 1017333 CIFS ops, 0 HTTP
ops, 40395 FCP ops, 32810 iSCSI ops

cluster1::> system node run -node node1 -command uptime
  2:58pm up  7 days, 19:17 800001573 NFS ops, 1017333 CIFS ops, 0 HTTP
ops, 40395 FCP ops, 32815 iSCSI ops
```

8. Migrate all of the data LIFs away from the node: `network interface migrate-all -node nodenameB`
9. Verify the status of any LIFs that you migrated: `network interface show`

   For more information about parameters you can use to verify LIF status, see the network interface show man page.

   The following example shows that node1's data LIFs migrated successfully. For each LIF, the fields included in this example enable you to verify the LIF's home node and port, the current node and port to which the LIF migrated, and the LIF's operational and administrative status.

```
cluster1::> network interface show -data-protocol nfs|cifs -role data
-home-node node1 -fields home-node,curr-node,curr-port,home-port,status-
admin,status-oper
vserver lif     home-node home-port curr-node curr-port status-oper
status-admin
------- ------- --------- --------- --------- --------- -----------
------------
vs0     data001 node1     e0a       node0     e0a       up          up
vs0     data002 node1     e0b       node0     e0b       up          up
vs0     data003 node1     e0b       node0     e0b       up          up
vs0     data004 node1     e0a       node0     e0a       up          up
4 entries were displayed.
```

10. Initiate a takeover: `storage failover takeover -ofnode nodenameB -option allow-version-mismatch`

    Do not specify the -option immediate parameter, because a normal takeover is required for the node that is being taken over to boot onto the new software image. If you did not manually migrate the LIFs away from the node, they automatically migrate to the node's HA partner so that there are no service disruptions.

    The node that is taken over boots up to the Waiting for giveback state.

    NOTE: If AutoSupport is enabled, an AutoSupport message is sent indicating that the node is out of cluster quorum. You can ignore this notification and proceed with the update.

11. Verify that the takeover was successful: `storage failover show`

    The following example shows that the takeover was successful. Node node1 is in the Waiting for giveback state, and its partner is in the In takeover state.

```
cluster1::> storage failover show
                              Takeover
Node           Partner        Possible State Description
-------------- -------------- --------
-------------------------------------
node0          node1          -        In takeover
node1          node0          false    Waiting for giveback (HA
mailboxes)
2 entries were displayed.
```

12. Wait at least eight minutes for the following conditions to take effect:
    - 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.

13. Return the aggregates to the partner node: `storage failover giveback -ofnode nodenameB`

    The giveback operation first returns the root aggregate to the partner node and then, after that node has finished booting, returns the non-root aggregates and any LIFs that were set to automatically revert. The newly booted node begins to serve data to clients from each aggregate as soon as the aggregate is returned.

14. Verify that all aggregates are returned: `storage failover show-giveback`

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

15. If any aggregates are not returned, perform the following steps:
    a. Review the veto workaround to determine whether you want to address the “veto” condition or override the veto.

       High-availability configuration

    b. If necessary, address the “veto” condition described in the error message, ensuring that any identified operations are terminated gracefully.
    c. Rerun the storage failover giveback command.

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

16. Wait at least eight minutes for the following conditions to take effect:
    - Client multipathing (if deployed) is stabilized.
    - Clients are recovered from the pause in an I/O operation 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.

17. Verify that the update was completed successfully for the node:
    a. Go to the advanced privilege level :`set -privilege advanced`
    b. Verify that update status is complete for the node: `system node upgrade-revert show -node nodenameB`

       The status should be listed as complete.

       If the status is not complete, from the node, run the system node upgrade-revert upgrade command. If the command does not complete the update, contact technical support.

    c. Return to the admin privilege level: `set -privilege admin`

18. Verify that the node’s ports are up: `network port show -node nodenameB`

    You must run this command on a node that has been upgraded to ONTAP 9.4.

    The following example shows that all of the node’s data ports are up:

```
cluster1::> network port show -node node1
                                                                        Speed
(Mbps)
Node   Port      IPspace      Broadcast Domain Link   MTU    Admin/Oper
------ --------- ------------ ---------------- ----- -------
------------
node1
       e0M       Default      -                up       1500  auto/100
       e0a       Default      -                up       1500  auto/1000
       e0b       Default      -                up       1500  auto/1000
       e1a       Cluster      Cluster          up       9000  auto/10000
       e1b       Cluster      Cluster          up       9000  auto/10000
5 entries were displayed.
```

19. Revert the LIFs back to the node: `network interface revert *`

    This command returns the LIFs that were migrated away from the node.

```
cluster1::> network interface revert *
8 entries were acted on.
```

20. Verify that the node's data LIFs successfully reverted back to the node, and that they are up: `network interface show`

    The following example shows that all of the data LIFs hosted by the node is successfully reverted back to the node, and that their operational status is up:

```
cluster1::> network interface show
            Logical    Status     Network            Current
Current Is
Vserver     Interface  Admin/Oper Address/Mask       Node          Port
Home
----------- ---------- ---------- ------------------ -------------
------- ----
vs0
            data001      up/up    192.0.2.120/24     node1         e0a
true
            data002      up/up    192.0.2.121/24     node1         e0b
true
            data003      up/up    192.0.2.122/24     node1         e0b
true
            data004      up/up    192.0.2.123/24     node1         e0a
true
4 entries were displayed.
```

21. If you previously determined that this node serves clients, verify that the node is providing service for each protocol that it was previously serving: `system node run -node nodenameB -command uptime`

    The operation counts reset to zero during the update.

    The following example shows that the updated node has resumed serving its NFS and iSCSI clients:

    ```
    cluster1::> system node run -node node1 -command uptime
      3:15pm up  0 days, 0:16 129 NFS ops, 0 CIFS ops, 0 HTTP ops, 0 FCP
    ops, 2 iSCSI ops
    ```

22. If this was the last node in the cluster to be updated, trigger an AutoSupport notification: `autosupport invoke -node * -type all -message "Finishing_NDU"`

    This AutoSupport notification includes a record of the system status just prior to update. It saves useful troubleshooting information in case there is a problem with the update process.

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

23. Confirm that the new ONTAP software is running on both nodes of the HA pair: `system node image show`

    In the following example, image2 is the updated version of ONTAP and is the default version on both nodes:

    ```
    cluster1::*> system node image show
                     Is      Is                  Install
    Node     Image   Default Current Version     Date
    -------- ------- ------- ------- --------- -------------------
    node0
             image1  false   false   X.X.X     MM/DD/YYYY TIME
             image2  true    true    Y.Y.Y     MM/DD/YYYY TIME
    node1
             image1  false   false   X.X.X     MM/DD/YYYY TIME
             image2  true    true    Y.Y.Y     MM/DD/YYYY TIME
    4 entries were displayed.
    ```

24. Reenable automatic giveback on the partner node if it was previously disabled: `storage failover modify -node nodenameA -auto-giveback true`
25. Verify that the cluster is in quorum and that services are running by using the cluster show and cluster ring show (advanced privilege level) commands.

    You must perform this step before upgrading any additional HA pairs.

26. Return to the admin privilege level: `set -privilege admin`

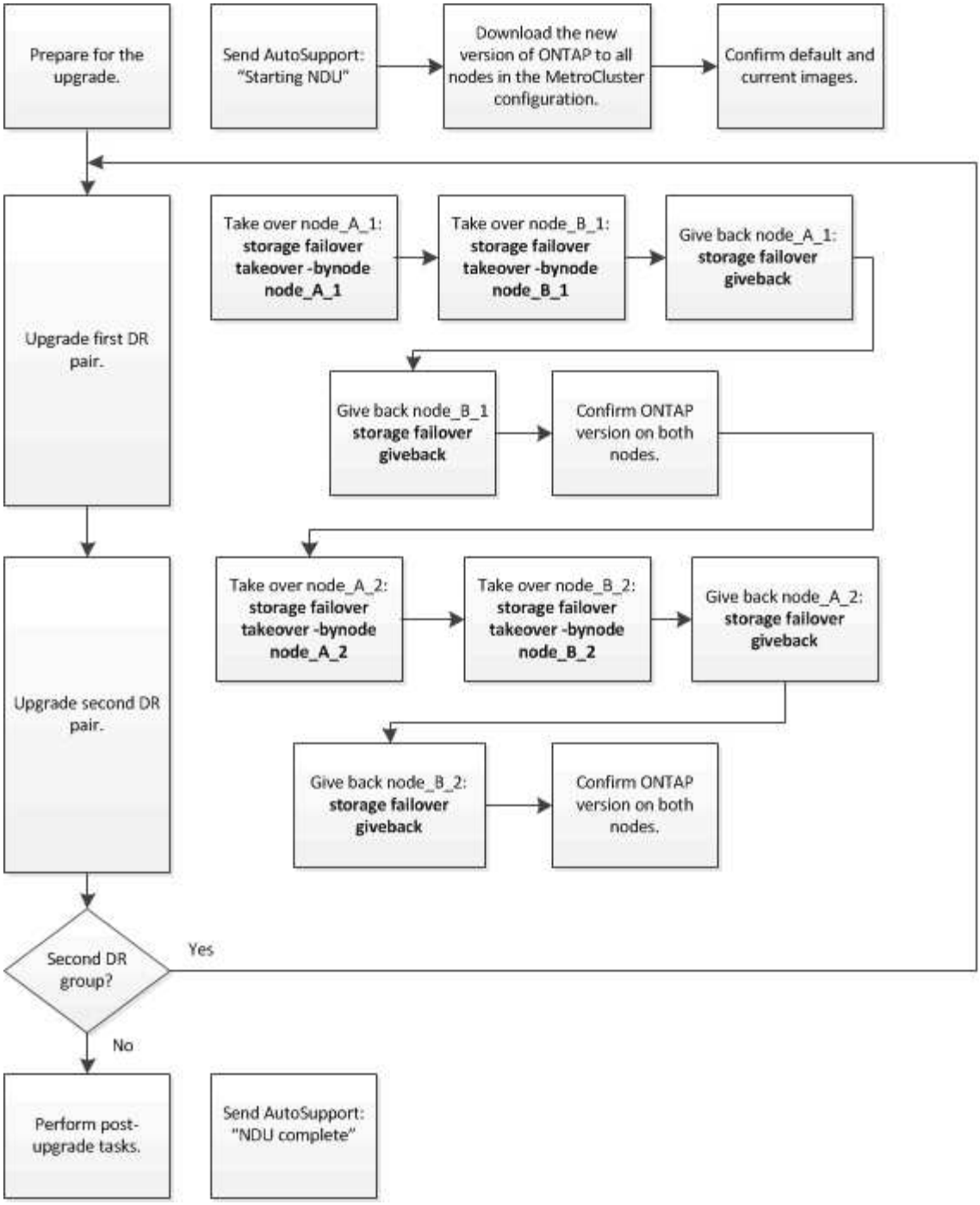
Upgrade any additional HA pairs.

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.

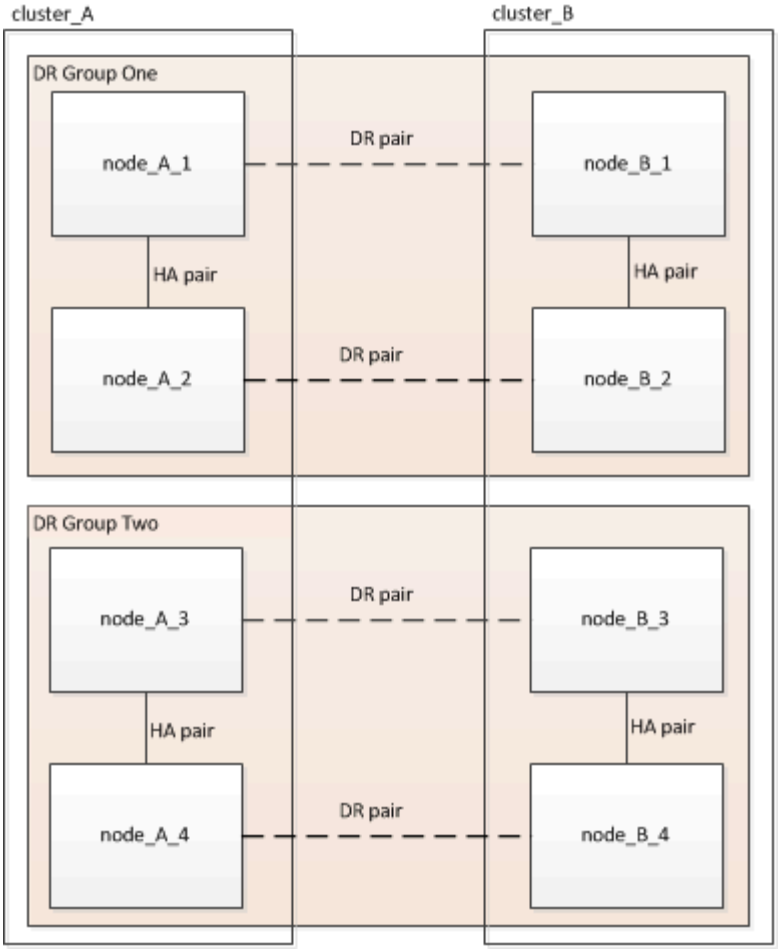
- This task applies to the following configurations:
  - Four-node MetroCluster FC or IP configurations running ONTAP 9.2 or earlier
  - Eight-node MetroCluster FC configurations, regardless of ONTAP version
- If you have a two-node MetroCluster configuration, do not use this procedure.
- The following 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.

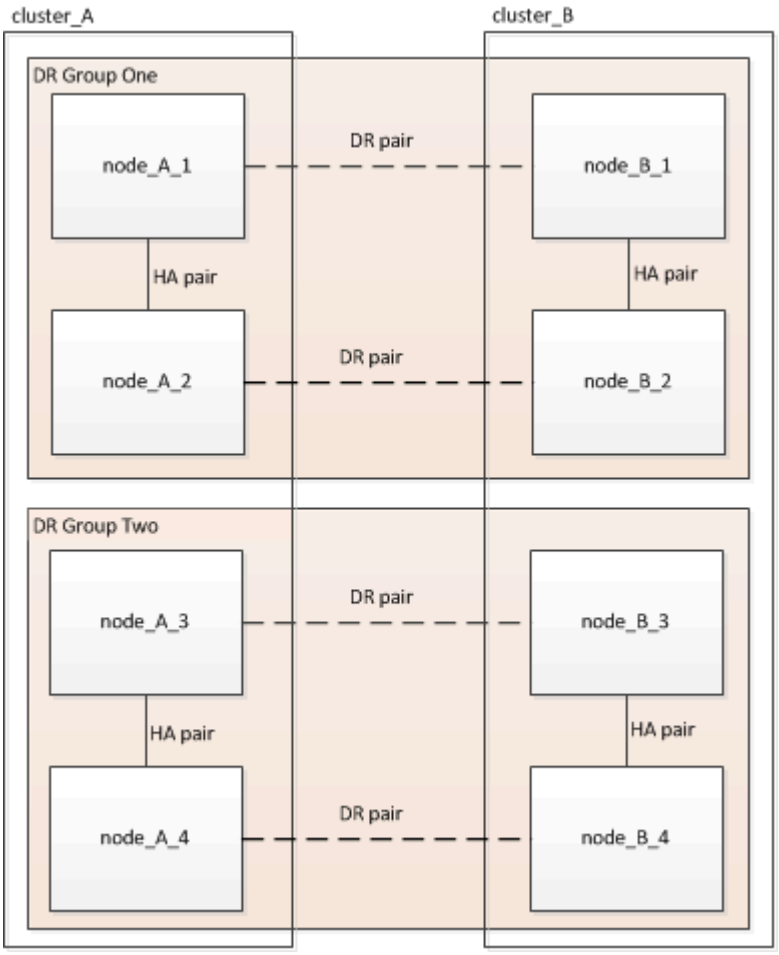
Preparing to update a MetroCluster DR group

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
                  Is      Is                Install
Node     Image    Default Current Version   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
                  Is      Is                 Install
Node     Image    Default Current Version    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
                  Is      Is              Install
Node     Image    Default Current Version 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
                  Is      Is              Install
Node     Image    Default Current Version 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
                                    Takeover
      Node           Partner        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
                                Takeover
Node           Partner          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.

   a. Give back the aggregates to the DR partner on cluster_A: `storage failover giveback –ofnode node_A_1`
   b. 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:
    a. Review the veto workaround to determine whether you want to address the “veto” condition or override the veto.
    b. If necessary, address the “veto” condition described in the error message, ensuring that any identified operations are terminated gracefully.
    c. 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 is the default and current version on node_A_1:

```
cluster_A::*> system image show
                  Is      Is                Install
Node     Image    Default Current Version   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
                  Is      Is                Install
Node     Image    Default Current Version   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
                                    Takeover
      Node           Partner        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	`storage failover takeover -ofnode node_B_2`
ONTAP 9.0 or Data ONTAP 8.3.x	`storage failover takeover -ofnode node_B_2 -option allow-version-mismatch` NOTE: 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.

+
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
                              Takeover
Node           Partner        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
                  Is      Is                  Install
Node     Image    Default Current Version     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
                  Is      Is                  Install
Node     Image    Default Current Version     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 switchback, 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
                     Is      Is                            Install
Node     Image       Default Current Version               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 vserver 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

Manual disruptive upgrade using the CLI

If you can take your cluster offline to upgrade to a new ONTAP release, then you can use the disruptive upgrade method. This method has several steps: disabling storage failover

for each HA pair, rebooting each node in the cluster, and then reenabling storage failover.

- You must have satisfied preparation requirements.

  In particular, you must download and install the software image using the procedure for manual upgrades.

- If you are operating in a SAN environment, all SAN clients must be shut down or suspended until the upgrade is complete.

  If SAN clients are not shut down or suspended prior to a disruptive upgrade , then the client file systems and applications suffer errors that might require manual recovery after the upgrade is completed.

In a disruptive upgrade, downtime is required because storage failover is disabled for each HA pair, and each node is updated. When storage failover is disabled, each node behaves as a single-node cluster; that is, system services associated with the node are interrupted for as long as it takes the system to reboot.

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

   The advanced prompt (`*>`) appears.

2. Set the new ONTAP software image to be the default image: `system image modify {-node * -iscurrent false} -isdefault true`

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

3. Verify that the new ONTAP software image is set as the default image: `system image show`

   In the following example, image 2 is the new ONTAP version and is set as the default image on both nodes:

   ```
   cluster1::*> system image show
                     Is      Is                Install
   Node     Image    Default Current Version    Date
   -------- -------  ------- ------- --------- -------------------
   node0
            image1   false   true    X.X.X     MM/DD/YYYY TIME
            image2   true    false   Y.Y.Y     MM/DD/YYYY TIME
   node1
            image1   false   true    X.X.X     MM/DD/YYYY TIME
            image2   true    false   Y.Y.Y     MM/DD/YYYY TIME
   4 entries were displayed.
   ```

4. Perform either one of the following steps:

If the cluster consists of…	Do this…
One node	Continue to the next step.

If the cluster consists of…	Do this…
Two nodes	a. Disable cluster high availability: `cluster ha modify -configured false` Enter `y` to continue when prompted. b. Disable storage failover for the HA pair: `storage failover modify -node * -enabled false`
More than two nodes	Disable storage failover for each HA pair in the cluster: `storage failover modify -node * -enabled false`

5. Reboot a node in the cluster: `system node reboot -node nodename -ignore-quorum-warnings`

   Do not reboot more than one node at a time.

   The node boots the new ONTAP image. The ONTAP login prompt appears, indicating that the reboot process is complete.

6. After the node or set of nodes has rebooted with the new ONTAP image, confirm that the new software is running: `system node image show`

   In the following example, image1 is the new ONTAP version and is set as the current version on node0:

```
cluster1::*> system node image show
                  Is      Is                    Install
Node     Image    Default Current Version       Date
-------- -------  ------- ------- --------      -------------------
node0
         image1   true    true    X.X.X          MM/DD/YYYY TIME
         image2   false   false   Y.Y.Y         MM/DD/YYYY TIME
node1
         image1   true    false   X.X.X         MM/DD/YYYY TIME
         image2   false   true    Y.Y.Y         MM/DD/YYYY TIME
4 entries were displayed.
```

7. Verify that the upgrade is completed successfully:

   a. Set the privilege level to advanced: `set -privilege advanced`

   b. Verify that the upgrade status is complete for each node: `system node upgrade-revert show -node nodename`

      The status should be listed as complete.

      If the status is not complete, contact NetApp Support immediately.

c. Return to the admin privilege level: `set -privilege admin`

8. Repeat Steps 2 through 7 for each additional node.
9. If the cluster consists of two or more nodes, enable storage failover for each HA pair in the cluster: `storage failover modify -node * -enabled true`
10. If the cluster consists of only two nodes, enable cluster high availability: `cluster ha modify -configured true`

What should I do after my upgrade?

What to do after upgrading

After upgrading your ONTAP software, there are several tasks you should perform to verify your cluster readiness.

Post-upgrade cluster verification

After you upgrade, you should verify your cluster version, cluster health, and storage health.

Before you begin

If you are using a MetroCluster FC configuration, you also need to verify that the cluster is enabled for automatic unplanned switchover.

Verify cluster version

After all of the HA pairs have been upgraded, you must use the version command to verify that all of the nodes are running the target release.

The cluster version is the lowest version of ONTAP running on any node in the cluster. If the cluster version is not the target ONTAP release, you can upgrade your cluster.

1. Verify that the cluster version is the target ONTAP release:

   ```
   version
   ```

2. If the cluster version is not the target ONTAP release, you can verify the upgrade status of all nodes:

   ```
   system node upgrade-revert show
   ```

Verify cluster health

After you upgrade a cluster, you should verify that the nodes are healthy and eligible to participate in the cluster, and that the cluster is in quorum.

1. Verify that the nodes in the cluster are online and are eligible to participate in the cluster:

   ```
   cluster show
   ```

```
cluster1::> cluster show
Node                  Health  Eligibility
--------------------- ------- ------------
node0                 true    true
node1                 true    true
```

If any node is unhealthy or ineligible, check EMS logs for errors and take corrective action.

2. Set the privilege level to advanced:

   `set -privilege advanced`

   Enter “y” to continue.

3. Verify the configuration details for each RDB process.

   - The relational database epoch and database epochs should match for each node.
   - The per-ring quorum master should be the same for all nodes.

     Note that each ring might have a different quorum master.

To display this RDB process…	Enter this command…
Management application	`cluster ring show -unitname mgmt`
Volume location database	`cluster ring show -unitname vldb`
Virtual-Interface manager	`cluster ring show -unitname vifmgr`
SAN management daemon	`cluster ring show -unitname bcomd`

   This example shows the volume location database process:

```
cluster1::*> cluster ring show -unitname vldb
Node      UnitName Epoch    DB Epoch DB Trnxs Master    Online
--------- -------- -------- -------- -------- --------- ---------
node0     vldb     154      154      14847    node0     master
node1     vldb     154      154      14847    node0     secondary
node2     vldb     154      154      14847    node0     secondary
node3     vldb     154      154      14847    node0     secondary
4 entries were displayed.
```

4. If you are operating in a SAN environment, verify that each node is in a SAN quorum: `event log show -severity informational -message-name scsiblade.*`

   The most recent scsiblade event message for each node should indicate that the scsi-blade is in quorum.

```
cluster1::*> event log show  -severity informational -message-name
scsiblade.*
Time             Node       Severity       Event
---------------  ---------- -------------- --------------------------
MM/DD/YYYY TIME  node0      INFORMATIONAL  scsiblade.in.quorum: The
scsi-blade ...
MM/DD/YYYY TIME  node1      INFORMATIONAL  scsiblade.in.quorum: The
scsi-blade ...
```

Related information

System administration

Verify that automatic unplanned switchover is enabled

After you upgrade a cluster, you should verify that automatic unplanned switchover is enabled.

About this task

This procedure is performed only for MetroCluster FC configurations. If you are using a MetroCluster IP configuration, skip this procedure.

Steps

1. Check whether automatic unplanned switchover is enabled:

   `metrocluster show`

   If automatic unplanned switchover is enabled, the following statement appears in the command output:

   ```
   AUSO Failure Domain  auso-on-cluster-disaster
   ```

2. If the statement does not appear, enable an automatic unplanned switchover:

   `metrocluster modify -auto-switchover-failure-domain auso-on-cluster-disaster`

3. Verify that an automatic unplanned switchover has been enabled by repeating Step 1.

Verify storage health

After you upgrade a cluster, you should verify the status of your disks, aggregates, and volumes.

1. Verify disk status:

To check for…	Do this…

Broken disks	a. Display any broken disks: `storage disk show -state broken` b. Remove or replace any broken disks.
Disks undergoing maintenance or reconstruction	a. Display any disks in maintenance, pending, or reconstructing states: `storage disk show -state maintenance|pending|reconstructing` b. Wait for the maintenance or reconstruction operation to finish before proceeding.

2. Verify that all aggregates are online by displaying the state of physical and logical storage, including storage aggregates:

   `storage aggregate show -state !online`

   This command displays the aggregates that are *not* online. All aggregates must be online before and after performing a major upgrade or reversion.

   ```
   cluster1::> storage aggregate show -state !online
   There are no entries matching your query.
   ```

3. Verify that all volumes are online by displaying any volumes that are *not* online:

   `volume show -state !online`

   All volumes must be online before and after performing a major upgrade or reversion.

   ```
   cluster1::> volume show -state !online
   There are no entries matching your query.
   ```

4. Verify that there are no inconsistent volumes:

   `volume show -is-inconsistent true`

   See the Knowledge Base article Volume Showing WAFL Inconsistent on how to address the inconsistent volumes.

Related information

Disk and aggregate management

Verify all LIFS are on home ports after upgrade

During a reboot, some LIFs might have been migrated to their assigned failover ports. After you upgrade a cluster, you must enable and revert any LIFs that are not on their home ports.

The network interface revert command reverts a LIF that is not currently on its home port back to its home port, provided that the home port is operational. A LIF's home port is specified when the LIF is created; you can determine the home port for a LIF by using the network interface show command.

1. Display the status of all LIFs: `network interface show -fields home-port,curr-port`

   This example displays the status of all LIFs for a storage virtual machine (SVM).

```
cluster1::> network interface show -fields home-port,curr-port
vserver                           lif       home-port curr-port
--------------------------------- --------- --------- ---------
C1_sti96-vsim-ucs539g_1622463615 clus_mgmt e0d       e0d
C1_sti96-vsim-ucs539g_1622463615 sti96-vsim-ucs539g_cluster_mgmt_inet6
e0d e0d
C1_sti96-vsim-ucs539g_1622463615 sti96-vsim-ucs539g_mgmt1 e0c e0c
C1_sti96-vsim-ucs539g_1622463615 sti96-vsim-ucs539g_mgmt1_inet6 e0c e0c
C1_sti96-vsim-ucs539g_1622463615 sti96-vsim-ucs539h_cluster_mgmt_inet6
e0d e0d
C1_sti96-vsim-ucs539g_1622463615 sti96-vsim-ucs539h_mgmt1 e0c e0c
C1_sti96-vsim-ucs539g_1622463615 sti96-vsim-ucs539h_mgmt1_inet6 e0c e0c
Cluster                           sti96-vsim-ucs539g_clus1 e0a e0a
Cluster                           sti96-vsim-ucs539g_clus2 e0b e0b
Cluster                           sti96-vsim-ucs539h_clus1 e0a e0a
Cluster                           sti96-vsim-ucs539h_clus2 e0b e0b
vs0                               sti96-vsim-ucs539g_data1 e0d e0d
vs0                               sti96-vsim-ucs539g_data1_inet6 e0d e0d
vs0                               sti96-vsim-ucs539g_data2 e0e e0e
vs0                               sti96-vsim-ucs539g_data2_inet6 e0e e0e
vs0                               sti96-vsim-ucs539g_data3 e0f e0f
vs0                               sti96-vsim-ucs539g_data3_inet6 e0f e0f
vs0                               sti96-vsim-ucs539g_data4 e0d e0d
vs0                               sti96-vsim-ucs539g_data4_inet6 e0d e0d
vs0                               sti96-vsim-ucs539g_data5 e0e e0e
vs0                               sti96-vsim-ucs539g_data5_inet6 e0e e0e
vs0                               sti96-vsim-ucs539g_data6 e0f e0f
vs0                               sti96-vsim-ucs539g_data6_inet6 e0f e0f
vs0                               sti96-vsim-ucs539h_data1 e0d e0d
vs0                               sti96-vsim-ucs539h_data1_inet6 e0d e0d
vs0                               sti96-vsim-ucs539h_data2 e0e e0e
vs0                               sti96-vsim-ucs539h_data2_inet6 e0e e0e
vs0                               sti96-vsim-ucs539h_data3 e0f e0f
vs0                               sti96-vsim-ucs539h_data3_inet6 e0f e0f
vs0                               sti96-vsim-ucs539h_data4 e0d e0d
vs0                               sti96-vsim-ucs539h_data4_inet6 e0d e0d
vs0                               sti96-vsim-ucs539h_data5 e0e e0e
vs0                               sti96-vsim-ucs539h_data5_inet6 e0e e0e
vs0                               sti96-vsim-ucs539h_data6 e0f e0f
vs0                               sti96-vsim-ucs539h_data6_inet6 e0f e0f
35 entries were displayed.
```

If any LIFs appear with a Status Admin status of "down" or with an Is home status of "false", continue with the next step.

2. Enable the data LIFs: `network interface modify {-role data} -status-admin up`

```
cluster1::> network interface modify {-role data} -status-admin up
8 entries were modified.
```

3. Revert LIFs to their home ports: `network interface revert *`

   This command reverts all LIFs back to their home ports.

```
cluster1::> network interface revert *
8 entries were acted on.
```

4. Verify that all LIFs are in their home ports: `network interface show`

   This example shows that all LIFs for SVM vs0 are on their home ports.

```
cluster1::> network interface show -vserver vs0
         Logical    Status     Network         Current  Current Is
Vserver  Interface  Admin/Oper Address/Mask    Node     Port    Home
-------- ---------- ---------- --------------- -------- ------- ----
vs0
         data001    up/up      192.0.2.120/24  node0    e0e     true
         data002    up/up      192.0.2.121/24  node0    e0f     true
         data003    up/up      192.0.2.122/24  node0    e2a     true
         data004    up/up      192.0.2.123/24  node0    e2b     true
         data005    up/up      192.0.2.124/24  node1    e0e     true
         data006    up/up      192.0.2.125/24  node1    e0f     true
         data007    up/up      192.0.2.126/24  node1    e2a     true
         data008    up/up      192.0.2.127/24  node1    e2b     true
8 entries were displayed.
```

Verify special configurations

Post upgrade checks for special configurations

If your cluster is configured with any of the following features you might need to perform additional steps after you upgrade.

Ask yourself…	If your answer is yes, then do this…
Did I upgrade to ONTAP 9.8 or later from ONTAP 9.7 or earlier	Verify your network configuration Remove the EMS LIF service from network service polices that do not provide reachabiity to the EMS destination
Do I have a MetroCluster configuration?	Verify your networking and storage status
Do I have a SAN configuration?	Verify your SAN configuration
Am I using NetApp Storage Encryption and I upgraded to ONTAP 9.3 or later?	Reconfigure KMIP server connections
Do I have load-sharing mirrors?	Relocate moved load-sharing mirror source volumes
Am I using SnapMirror?	Resume SnapMirror operations
Did I upgrade from ONTAP 8.3.0?	Set the desired NT ACL permissions display level for NFS clients
Do I have administrator accounts created prior to ONTAP 9.0?	Enforce SHA-2 on administrator passwords
Do I have user accounts for Service Processor (SP) access created prior to ONTAP 9.9.1?	Verify the change in accounts that can access the Service Processor

Verifying your network configuration after upgrade

ONTAP 9.8 and later automatically monitors layer 2 reachability. After you upgrade from ONTAP 9.7x or earlier to ONTAP 9.8 or later, you should verify that each .network port has reachability to its expected broadcast domain.

1. Verify each port has reachability to its expected domain:`network port reachability show -detail`

   A reachability-status of ok indicates that the port has layer 2 reachability to its assigned domain.

Verify networking and storage status for MetroCluster configurations

After performing an update in a MetroCluster configuration, you should verify the status of the LIFs, aggregates, and volumes for each cluster.

1. Verify the LIF status: `network interface show`

   In normal operation, LIFs for source SVMs must have an admin status of up and be located on their home nodes. LIFs for destination SVMs are not required to be up or located on their home nodes. In switchover, all LIFs have an admin status of up, but they do not need to be located on their home nodes.

```
cluster1::> network interface show
            Logical    Status     Network            Current
Current Is
Vserver     Interface  Admin/Oper Address/Mask       Node          Port
Home
----------- ---------- ---------- ------------------ -------------
------- ----
Cluster
            cluster1-a1_clus1
                         up/up    192.0.2.1/24       cluster1-01
                                                                  e2a
true
            cluster1-a1_clus2
                         up/up    192.0.2.2/24       cluster1-01
                                                                  e2b
true


cluster1-01
            clus_mgmt    up/up    198.51.100.1/24    cluster1-01
                                                                  e3a
true
            cluster1-a1_inet4_intercluster1
                         up/up    198.51.100.2/24    cluster1-01
                                                                  e3c
true
            ...

27 entries were displayed.
```

2. Verify the state of the aggregates: `storage aggregate show -state !online`

   This command displays any aggregates that are *not* online. In normal operation, all aggregates located at the local site must be online. However, if the MetroCluster configuration is in switchover, root aggregates at the disaster recovery site are permitted to be offline.

   This example shows a cluster in normal operation:

```
cluster1::> storage aggregate show -state !online
There are no entries matching your query.
```

   This example shows a cluster in switchover, in which the root aggregates at the disaster recovery site are offline:

```
cluster1::> storage aggregate show -state !online
Aggregate     Size Available Used% State   #Vols  Nodes            RAID
Status
--------- -------- --------- ----- ------- ------ ----------------
------------
aggr0_b1
                0B        0B    0% offline      0 cluster2-01
raid_dp,

mirror

degraded
aggr0_b2
                0B        0B    0% offline      0 cluster2-02
raid_dp,

mirror

degraded
2 entries were displayed.
```

3. Verify the state of the volumes: `volume show -state !online`

   This command displays any volumes that are *not* online.

   If the MetroCluster configuration is in normal operation (it is not in switchover state), the output should show all volumes owned by the cluster's secondary SVMs (those with the SVM name appended with "-mc").

   Those volumes come online only in the event of a switchover.

   This example shows a cluster in normal operation, in which the volumes at the disaster recovery site are not online.

```
cluster1::> volume show -state !online
  (volume show)
Vserver   Volume       Aggregate    State      Type       Size
Available Used%
--------- ------------ ------------ ---------- ---- ----------
---------- -----
vs2-mc    vol1         aggr1_b1     -          RW            -
-     -
vs2-mc    root_vs2     aggr0_b1     -          RW            -
-     -
vs2-mc    vol2         aggr1_b1     -          RW            -
-     -
vs2-mc    vol3         aggr1_b1     -          RW            -
-     -
vs2-mc    vol4         aggr1_b1     -          RW            -
-     -
5 entries were displayed.
```

4. Verify that there are no inconsistent volumes: `volume show -is-inconsistent true`

   See the Knowledge Base article Volume Showing WAFL Inconsistent on how to address the inconsistent volumes.

Verify the SAN configuration after an upgrade

If you are upgrading in a SAN environment, then after the upgrade, you should verify that each initiator that was connected to a LIF before the upgrade has successfully reconnected to the LIF.

1. Verify that each initiator is connected to the correct LIF.

   You should compare the list of initiators to the list you made during the upgrade preparation.

For…	Enter…
iSCSI	`iscsi initiator show -fields igroup,initiator-name,tpgroup`
FC	`fcp initiator show -fields igroup,wwpn,lif`

Reconfiguring KMIP server connections after upgrading to ONTAP 9.3 or later

After performing an upgrade to ONTAP 9.3 or later, you must reconfigure your external key management (KMIP) server connections.

1. Configure the key manager connectivity:`security key-manager setup`
2. Add your KMIP servers: `security key-manager add -address key_management_server_ip_address`
3. Verify that KMIP servers are connected: `security key-manager show -status`
4. Query the key servers: `security key-manager query`
5. Create a new authentication key and passphrase: `security key-manager create-key -prompt -for-key true`

   The passphrase must have a minimum of 32 characters.
6. Query the new authentication key: `security key-manager query`
7. Assign the new authentication key to your self-encrypting disks (SEDs): `storage encryption disk modify -disk disk_ID -data-key-id key_ID`

   Make sure you are using the new authentication key from your query.
8. If needed, assign a FIPS key to the SEDs: `storage encryption disk modify -disk disk_id -fips-key-id fips_authentication_key_id`

   If your security setup requires you to use different keys for data authentication and FIPS 140-2 authentication, you should create a separate key for each. If that is not the case, you can use the same authentication key for FIPS compliance that you use for data access.

Relocating moved load-sharing mirror source volumes

After successfully completing a nondisruptive upgrade, you can move load-sharing mirror source volumes back to the locations they were in originally before the upgrade.

1. Identify the location to which you are moving the load-sharing mirror source volume by using the record you created before moving the load-sharing mirror source volume.
2. Move the load-sharing mirror source volume back to its original location by using the volume move start command.

Resuming SnapMirror operations

After completing a nondisruptive upgrade, you must resume any SnapMirror relationships that were suspended.

Existing SnapMirror relationships must have been suspended by using the snapmirror quiesce command, and the cluster must have been nondisruptively upgraded.

1. Resume transfers for each SnapMirror relationship that was previously quiesced: `snapmirror resume *`

   This command resumes the transfers for all quiesced SnapMirror relationships.
2. Verify that the SnapMirror operations have resumed: `snapmirror show`

```
cluster1::> snapmirror show

Source            Destination  Mirror  Relationship  Total
Last
Path        Type  Path         State   Status        Progress  Healthy
Updated
----------- ---- ------------ ------- -------------- --------- -------
--------
cluster1-vs1:dp_src1
            DP   cluster1-vs2:dp_dst1
                              Snapmirrored
                                      Idle           -         true    -
cluster1-vs1:xdp_src1
            XDP  cluster1-vs2:xdp_dst1
                              Snapmirrored
                                      Idle           -         true    -
cluster1://cluster1-vs1/ls_src1
            LS   cluster1://cluster1-vs1/ls_mr1
                              Snapmirrored
                                      Idle           -         true    -
                 cluster1://cluster1-vs1/ls_mr2
                              Snapmirrored
                                      Idle           -         true    -
4 entries were displayed.
```

For each SnapMirror relationship, verify that the Relationship Status is **Idle**. If the status is **Transferring**, wait for the SnapMirror transfer to complete, and then reenter the command to verify that the status has changed to **Idle**.

For each SnapMirror relationship that is configured to run on a schedule, you should verify that the first scheduled SnapMirror transfer completes successfully.

Setting the desired NT ACL permissions display level for NFS clients

After upgrading from ONTAP 8.3.0, the default handling for displaying NT ACL permissions to NFS clients has changed. You should check the setting and change it to the desired setting for your environment if necessary. This task does not apply if you are upgrading from ONTAP 8.3.1 or later.

In multiprotocol environments, ONTAP displays to NFS clients the permissions of NTFS security-style files and directories based on the access granted by the NT ACL to any user. In ONTAP 8.3.0, ONTAP by default displayed to NFS clients the permission based on the maximum access granted by the NT ACL. After upgrading, the default setting changes to display permissions based on the minimum access granted by the NT ACL. This change applies to new and existing storage virtual machines (SVMs).

1. Set the privilege level to advanced: `set -privilege advanced`

2. Check the setting for displaying NT ACL permissions for NFS clients: `vserver nfs show -vserver vserver_name -fields ntacl-display-permissive-perms`

   After upgrading from 8.3.0, the value for this new parameter is disabled, meaning ONTAP displays the minimum permissions.

3. If you prefer to display the maximum permissions, change the setting individually for each SVM as desired: `vserver nfs modify -vserver vserver_name -ntacl-display-permissive-perms enabled`
4. Verify that the change took effect: `vserver nfs show -vserver vserver_name -fields ntacl-display-permissive-perms`
5. Return to the admin privilege level: `set -privilege admin`

Enforcing SHA-2 on administrator account passwords

Administrator accounts created prior to ONTAP 9.0 continue to use MD5 passwords after the upgrade, until the passwords are manually changed. MD5 is less secure than SHA-2. Therefore, after upgrading, you should prompt users of MD5 accounts to change their passwords to use the default SHA-512 hash function.

The password hash functionality enables you to do the following:

- Display user accounts that match the specified hash function.
- Expire accounts that use a specified hash function (for example, MD5), forcing the users to change their passwords in their next login.
- Lock accounts whose passwords use the specified hash function.
- When reverting to a release earlier than ONTAP 9, reset the cluster administrator's own password for it to be compatible with the hash function (MD5) that is supported by the earlier release.

ONTAP accepts pre-hashed SHA-2 passwords only by using NetApp Manageability SDK (security-login-create and security-login-modify-password).

Manageability enhancements

1. Migrate the MD5 administrator accounts to the SHA-512 password hash function:
   a. Expire all MD5 administrator accounts: `security login expire-password -vserver * -username * -hash-function md5`

      Doing so forces MD5 account users to change their passwords upon next login.

   b. Ask users of MD5 accounts to log in through a console or SSH session.

      The system detects that the accounts are expired and prompts users to change their passwords. SHA-512 is used by default for the changed passwords.

2. For MD5 accounts whose users do not log in to change their passwords within a period of time, force the account migration:
   a. Lock accounts that still use the MD5 hash function (advanced privilege level): `security login expire-password -vserver * -username * -hash-function md5 -lock-after integer`

After the number of days specified by -lock-after, users cannot access their MD5 accounts.

b. Unlock the accounts when the users are ready to change their passwords: `security login unlock -vserver vserver_name -username user_name`

c. Have users log in to their accounts through a console or SSH session and change their passwords when the system prompts them to do so.

Change in user accounts that can access the Service Processor

If you created user accounts in ONTAP 9.8 and earlier releases that can access the Service Processor (SP) with a non-admin role and you upgrade to ONTAP 9.9.1 or later, any non-admin value in the `-role` parameter is modified to `admin`.

For more information, see Accounts that can access the SP.

Remove EMS LIF service from network service policies

If you have Event Management System (EMS) messages set up before you upgrade from ONTAP 9.7 or earlier to ONTAP 9.8 or later , after the upgrade, your EMS messages might not be delivered.

During the upgrade, management-ems, which is the the EMS LIF service, is added to all existing service polices. This allows EMS messages to be sent from any of the LIFs associated with any of the service polices. If the selected LIF does not have reachability to the event notification destination, the message is not delivered.

To prevent this, after the upgrade, you should remove the EMS LIF service from the network service polices that do not provide reachability to the destination.

Steps

1. Identify the LIFs and associated network service polices through which EMS messages can be sent:

   `network interface show -fields service-policy -services management-ems`

```
vserver        lif            service-policy
-------------- ------------ ------------------
cluster-1      cluster_mgmt
                                    default-management
cluster-1      node1-mgmt
                                    default-management
cluster-1      node2-mgmt
                                    default-management
cluster-1      inter_cluster
                                    default-intercluster
4 entries were displayed.
```

2. Check each LIF for connectivity to the EMS destination:

   `network ping -lif lif_name -vserver svm_name -destination destination_address`

Perform this on each node.

Examples

```
cluster-1::> network ping -lif node1-mgmt -vserver cluster-1
-destination 10.10.10.10
10.10.10.10 is alive

cluster-1::> network ping -lif inter_cluster -vserver cluster-1
-destination 10.10.10.10
no answer from 10.10.10.10
```

3. Enter advanced privilege level:

   ```
   set advanced
   ```

4. For the LIFs that do not have reachability, remove the management-ems LIF service from the corresponding service polices:

   ```
   network interface service-policy remove-service -vserver svm_name -policy
   service_policy_name -service management-ems
   ```

5. Verify that the management-ems LIF is now only associated with the LIFs that provide reachability to the EMS destination:

   ```
   network interface show -fields service-policy -services management-ems
   ```

Related Links

LIFs and service polices in ONTAP 9.6 and later

When you need to update the Disk Qualification Package

The Disk Qualification Package (DQP) adds full support for newly qualified drives.

ONTAP treats disk drives differently than normally expected, for example, ONTAP allocates different sector sizes than those specified by manufacturers. The DQP contains the proper parameters for ONTAP for all newly qualified drives. Therefore, if you are running a version of ONTAP with a DQP that does not contain information for a newly qualified drive, ONTAP will not have the information to properly configure the drive.

You need to download and install the DQP in the following situations. A best practice is to also update the DQP regularly; for example, every quarter or semi-annually.

- Whenever you upgrade to a new version of ONTAP.

  The DQP is not updated as part of an ONTAP upgrade.

- Whenever you add a new drive type or size to the node

  For example, if you already have 1-TB drives and add 2-TB drives, you need to check for the latest DQP update.

- Whenever you update the disk firmware
- Whenever newer disk firmware or DQP files are available

Related information

NetApp Downloads: Disk Qualification Package

NetApp Downloads: Disk Drive Firmware

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