Upgrade ONTAP

ONTAP 9

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Upgrade ONTAP

Learn about ONTAP upgrade

When you upgrade your ONTAP software, you can take advantage of new and enhanced ONTAP features that can help you reduce costs, accelerate critical workloads, improve security, and expand the scope of data protection available to your organization.

A major ONTAP upgrade consists of moving from a lower to higher ONTAP numbered release. An example would be an upgrade of your cluster from ONTAP 9.8 to ONTAP 9.12.1. A minor (or patch) upgrade consists of moving from a lower ONTAP version to a higher ONTAP version within the same numbered release. An example would be an upgrade of your cluster from ONTAP 9.12.1P1 to 9.12.1P4.

To get started, you should prepare for the upgrade. If you have an active SupportEdge contract for Active IQ Digital Advisor (also known as Digital Advisor), you should prepare to upgrade with Upgrade Advisor. Upgrade Advisor provides intelligence that helps you minimize uncertainty and risk by assessing your cluster and creating an upgrade plan specific to your configuration. If you don't have an active SupportEdge contract for Active IQ Digital Advisor, you should prepare to upgrade without Upgrade Advisor.

After you prepare for your upgrade, it is recommended that you perform upgrades using automated non-disruptive upgrade (ANDU) from System Manager. ANDU takes advantage of ONTAP's high-availability (HA) failover technology to ensure that clusters continue to serve data without interruption during the upgrade.

> ⓘ Beginning with ONTAP 9.12.1, System Manager is fully integrated with the NetApp Console. If the Console is configured on your system, you can upgrade through the Systems page.

If you want assistance upgrading your ONTAP software, NetApp Professional Services offers a Managed Upgrade Service. If you are interested in using this service, contact your NetApp sales representative or submit NetApp's sales inquiry form. The Managed Upgrade Service as well as other types of upgrade support are available to customers with SupportEdge Expert Services at no additional cost.

Related information

- Supported upgrade paths

When should I upgrade ONTAP?

You should upgrade your ONTAP software on a regular cadence. Upgrading ONTAP allows you to take advantage of new and enhanced features and functionality and implement current fixes for known issues.

Major ONTAP upgrades

A major ONTAP upgrade or feature release typically includes:

- New ONTAP features
- Key infrastructure changes, such as fundamental changes to NetApp WAFL operation or RAID operation
- Support for new NetApp-engineered hardware systems
- Support for replacement hardware components such as newer network interface cards or host bus adapters

New ONTAP releases are entitled to full support for 3 years. NetApp recommends that you run the newest release for 1 year after general availability (GA) and then use the remaining time within the full support window to plan for your transition to a newer ONTAP release.

ONTAP patch upgrades

Patch upgrades deliver timely fixes for critical bugs that cannot wait for the next major ONTAP feature release. Non-critical patch upgrades should be applied every 3-6 months. Critical patch upgrades should be applied as soon as possible.

Learn more about minimum recommended patch levels for ONTAP releases.

ONTAP release dates

Beginning with the ONTAP 9.8 release, NetApp delivers ONTAP releases twice per calendar year. Though plans are subject to change, the intent is to deliver new ONTAP releases in the second and fourth quarter of each calendar year. Use this information to plan the time frame of your upgrade to take advantage of the latest ONTAP release.

Version	Release date
9.18.1	November 2025
9.17.1	September 2025
9.16.1	January 2025
9.15.1	July 2024
9.14.1	January 2024
9.13.1	June 2023
9.12.1	February 2023
9.11.1	July 2022
9.10.1	January 2022
9.9.1	June 2021

ⓘ If you are running an ONTAP version prior to 9.10.1, it is likely on Limited Support or Self-Service Support. Consider upgrading to versions with full support. You can verify the level of support for your version of ONTAP on the NetApp Support Site.

ONTAP support levels

The level of support available for a specific version of ONTAP varies depending upon when the software was released.

Support level	**Full support**			**Limited support**		**Self-service support**		
Year	1	2	3	4	5	6	7	8
Access to online documentation	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Technical support	Yes	Yes	Yes	Yes	Yes			
Root-cause analysis	Yes	Yes	Yes	Yes	Yes			
Software downloads	Yes	Yes	Yes	Yes	Yes			
Service updates (patch releases [P-releases])	Yes	Yes	Yes					
Alerts about vulnerabilities	Yes	Yes	Yes					

Related information

- Learn what’s new in currently supported ONTAP releases.
- Learn more about minimum recommended ONTAP releases.
- Learn more about ONTAP software version support.
- Learn more about the ONTAP release model.

Run ONTAP automated pre-upgrade checks before a planned upgrade

You don’t have to be in the process of upgrading your ONTAP software to execute the ONTAP automated upgrade pre-checks. Executing the pre-upgrade checks independently of the ONTAP automated upgrade process allows you to see which checks are performed against your cluster and gives you a list of any errors or warnings that should be corrected before you begin the actual upgrade. For example, suppose you expect to upgrade your ONTAP software during a maintenance window scheduled to occur in two weeks. While you are waiting for the scheduled date, you can run the automated upgrade pre-checks and take any necessary corrective actions in advance of your maintenance window. This will mitigate risks of unexpected configuration errors after you start your upgrade.

If you are ready to begin your ONTAP software upgrade, you do not need to perform this procedure. You should follow the automated upgrade process, which includes execution of the automated upgrade pre-checks.

ⓘ For MetroCluster configurations, you should first execute these steps on Cluster A, then execute the same steps on Cluster B.

Before you begin

You should download the target ONTAP software image.

To execute the automated upgrade pre-checks for a direct multi-hop upgrade, you only need to download the software package for your target ONTAP version. You won’t need to load the intermediate ONTAP version until you begin the actual upgrade. For example, if you are executing automated pre-upgrade checks for an upgrade from 9.7 to 9.11.1, you need to download the software package for ONTAP 9.11.1. You don’t need to download the software package for ONTAP 9.8.1.

Example 1. Steps

System Manager

1. Validate the ONTAP target image:

   ⓘ If you are upgrading a MetroCluster configuration, you should validate Cluster A and then repeat the validation process on Cluster B.

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

If you are running…	Do this…
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**.

   b. In the right corner of the **Overview** pane, click ⋮.

   c. Click **ONTAP Update**.

   d. 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 a local folder. You should have already downloaded the image to the local client.	i. Under **Available Software Images**, click **Add from Local**. ii. Browse to the location you saved the software image, select the image, and then click **Open**.
Add a new software image from an HTTP or FTP server	i. Click **Add from Server**. ii. In the **Add a New Software Image** dialog box, enter the URL of the HTTP or FTP server to which you downloaded the ONTAP software image from the NetApp Support Site. For anonymous FTP, you must specify the URL in the ftp://anonymous@ftpserver format. iii. Click **Add**.
Select an available image	Choose one of the listed images.

   e. Click **Validate** to run the pre-upgrade validation checks.

   If any errors or warnings are found during validation, they are displayed along with a list of corrective actions. You must resolve all errors before proceeding with the upgrade. It is best practice to also resolve warnings.

CLI

1. Load the target ONTAP software image into the cluster package repository:

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

```
cluster1::> cluster image package get -url
http://www.example.com/software/9.15.1/image.tgz

Package download completed.
Package processing completed.
```

2. 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
---------------- ------------------
9.15.1              MM/DD/YYYY 10:32:15
```

3. Execute the automated pre-upgrade checks:

```
cluster image validate -version <package_version_number> -show
-validation-details true
```

```
cluster1::> cluster image validate -version 9.15.1 -show-validation
-details true

It can take several minutes to complete validation...
Validation checks started successfully.  Run the "cluster image
show-update-progress" command to check validation status.
```

4. Check the validation status:

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

> ⓘ If the **Status** is "in-progress", wait and run the command again until it is completed.

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

Update Phase         Status                   Duration
Duration
-------------------- ----------------- ---------------
---------------
Pre-update checks    completed                00:10:00
00:01:03

Details:

Pre-update Check     Status            Error-Action
-------------------- -----------------
--------------------------------------
AMPQ Router and      OK                N/A
Broker Config
Cleanup
Aggregate online     OK                N/A
status and parity
check
Aggregate plex       OK                N/A
resync status check
Application          OK                N/A
Provisioning Cleanup
Autoboot Bootargs    OK                N/A
Status
Backend              OK                N/A
...
Volume Conversion    OK                N/A
In Progress Check
Volume move          OK                N/A
progress status
check
Volume online        OK                N/A
status check
iSCSI target portal  OK                N/A
groups status check
Overall Status       Warning           Warning
75 entries were displayed.
```

A list of complete automated upgrade pre-checks is displayed along with any errors or warnings that should be addressed before you begin the upgrade process.

Example output

Full example output of upgrade pre-checks

```
cluster1::*> cluster image validate -version 9.14.1 -show-validation
-details true
It can take several minutes to complete validation...

WARNING: There are additional manual upgrade validation checks that
must be performed after these automated validation checks have
completed successfully.
Refer to the Upgrade Advisor Plan or the "What should I verify before I
upgrade with or without Upgrade Advisor" section in the "Upgrade ONTAP"
documentation for the remaining manual validation checks that need to
be performed before update.
Upgrade ONTAP documentation available at: https://docs.netapp.com/us-
en/ontap/upgrade/index.html
The list of checks are available at: https://docs.netapp.com/us-
en/ontap/upgrade/task_what_to_check_before_upgrade.html
Failing to do so can result in an update failure or an I/O disruption.
Use the Interoperability Matrix Tool (IMT
http://mysupport.netapp.com/matrix) to verify host system
supportability configuration information.

Validation checks started successfully.  Run the "cluster image show-
update-progress" command to check validation status.


fas2820-2n-wic-1::*> cluster image show-update-progress

                                             Estimated         Elapsed
Update Phase         Status                   Duration        Duration
-------------------- ----------------- --------------- ---------------
Pre-update checks    in-progress              00:10:00        00:00:42

Details:

Pre-update Check     Status            Error-Action
-------------------- -----------------
-------------------------------------

fas2820-2n-wic-1::*> cluster image show-update-progress

                                             Estimated         Elapsed
Update Phase         Status                   Duration        Duration
-------------------- ----------------- --------------- ---------------
Pre-update checks    completed                00:10:00        00:01:03
```

```
Details:

Pre-update Check     Status            Error-Action
-------------------- -----------------
--------------------------------------
AMPQ Router and      OK                N/A
Broker Config
Cleanup
Aggregate online     OK                N/A
status and parity
check
Aggregate plex       OK                N/A
resync status check
Application          OK                N/A
Provisioning Cleanup
Autoboot Bootargs    OK                N/A
Status
Backend              OK                N/A
Configuration Status
Boot Menu Status     Warning           Warning: bootarg.init.bootmenu
is
                                       enabled on nodes: fas2820-wic-
1a,
                                       fas2820-wic-1b. The boot process
of
                                       the nodes will be delayed.
                                       Action: Set the
bootarg.init.bootmenu
                                       bootarg to false before
proceeding
                                       with the upgrade.
Broadcast Domain     OK                N/A
availability and
uniqueness for HA
pair status
CIFS compatibility   OK                N/A
status check
CLAM quorum online   OK                N/A
status check
CPU Utilization      OK                N/A
Status
Capacity licenses    OK                N/A
install status check
Check For SP/BMC     OK                N/A
Connectivity To
Nodes
```

```
Check LDAP fastbind  OK                N/A
users using
unsecure connection.
Check for unsecure   OK                N/A
kex algorithm
configurations.
Check for unsecure   OK                N/A
mac configurations.
Cloud keymanager     OK                N/A
connectivity check
Cluster health and   OK                N/A
eligibility status
Cluster quorum       OK                N/A
status check
Cluster/management   OK                N/A
switch check
Compatible New       OK                N/A
Image Check
Current system       OK                N/A
version check if it
is susceptible to
possible outage
during NDU
Data ONTAP Version   OK                N/A
and Previous
Upgrade Status
Data aggregates HA   OK                N/A
policy check
Disk status check    OK                N/A
for failed, broken
or non-compatibility
Duplicate Initiator  OK                N/A
Check
Encryption key       OK                N/A
migration status
check
External             OK                N/A
key-manager with
legacy KMIP client
check
External keymanager  OK                N/A
key server status
check
Fabricpool Object    OK                N/A
Store Availability
High Availability    OK                N/A
```

```
configuration
status check
Infinite Volume      OK                 N/A
availibility check
LIF failover         OK                 N/A
capability status
check
LIF health check     OK                 N/A
LIF load balancing   OK                 N/A
status check
LIFs is on home      OK                 N/A
node status
Logically over       OK                 N/A
allocated DP
volumes check
MetroCluster         OK                 N/A
configuration
status check for
compatibility
Minimum number of    OK                 N/A
aggregate disks
check
NAE Aggregate and    OK                 N/A
NVE Volume
Encryption Check
NDMP sessions check  OK                 N/A
NFS mounts status    Warning            Warning: This cluster is serving
NFS
check                                   clients. If NFS soft mounts are
used,
                                        there is a possibility of
frequent
                                        NFS timeouts and race conditions
that
                                        can lead to data corruption
during
                                        the upgrade.
                                        Action: Use NFS hard mounts, if
                                        possible. To list Vservers
running
                                        NFS, run the following command:
                                        vserver nfs show
Name Service         OK                 N/A
Configuration DNS
Check
Name Service         OK                 N/A
```

```
Configuration LDAP
Check
Node to SP/BMC       OK                 N/A
connectivity check
OKM/KMIP enabled     OK                 N/A
systems - Missing
keys check
ONTAP API to REST    Warning            Warning: NetApp ONTAP API has
been
transition warning                      used on this cluster for ONTAP
data
                                        storage management within the
last 30
                                        days. NetApp ONTAP API is
approaching
                                        end of availability.
                                        Action: Transition your
automation
                                        tools from ONTAP API to ONTAP
REST
                                        API. For more details, refer to
                                        CPC-00410 - End of availability:
                                        ONTAPI

https://mysupport.netapp.com/info/
                                        communications/ECMLP2880232.html
ONTAP Image          OK                 N/A
Capability Status
OpenSSL 3.0.x        OK                 N/A
upgrade validation
check
Openssh 7.2 upgrade  OK                 N/A
validation check
Platform Health      OK                 N/A
Monitor check
Pre-Update           OK                 N/A
Configuration
Verification
RDB Replica Health   OK                 N/A
Check
Replicated database  OK                 N/A
schema consistency
check
Running Jobs Status  OK                 N/A
SAN LIF association  OK                 N/A
status check
```

```
SAN compatibility    OK                N/A
for manual
configurability
check
SAN kernel agent     OK                N/A
status check
Secure Purge         OK                N/A
operation Check
Shelves and Sensors  OK                N/A
check
SnapLock Version     OK                N/A
Check
SnapMirror           OK                N/A
Synchronous
relationship status
check
SnapMirror           OK                N/A
compatibility
status check
Supported platform   OK                N/A
check
Target ONTAP         OK                N/A
release support for
FiberBridge 6500N
check
Upgrade Version      OK                N/A
Compatibility Status
Verify all bgp       OK                N/A
peer-groups are in
the up state
Verify if a cluster  OK                N/A
management LIF
exists
Verify that e0M is   OK                N/A
home to no LIFs
with high speed
services.
Volume Conversion    OK                N/A
In Progress Check
Volume move          OK                N/A
progress status
check
Volume online        OK                N/A
status check
iSCSI target portal  OK                N/A
groups status check
```

```
Overall Status       Warning           Warning
75 entries were displayed.
```

Prepare for an ONTAP upgrade

Determine how long an ONTAP upgrade will take

You should plan for at least 30 minutes to complete preparatory steps for an ONTAP upgrade, 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.

These 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. The actual duration of your upgrade process will depend on your individual environment and the number of nodes.

Prepare for an ONTAP upgrade with Upgrade Advisor

If you have an active SupportEdge Services contract for Digital Advisor, it is recommended that you use Upgrade Advisor to generate an upgrade plan.

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

Digital Advisor 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.

Upgrade Advisor requires AutoSupport logs to create the report. If you have AutoSupport enabled, Upgrade Advisor has access to the logs and can successfully create the report. If you have not enabled AutoSupport, you can manually upload AutoSupport files.

If you do not have an active Support Edge Services contract for Digital Advisor, you should prepare for your upgrade without Upgrade Advisor.

Steps

1. Launch Active IQ Digital Advisor
2. In Digital Advisor view any risks associated with your cluster and manually take corrective actions.

   Risks included in the **SW Config Change**, **HW Config Change**, and **HW Replacement** categories need to be resolved prior to performing an ONTAP upgrade.

3. Review the recommended upgrade path and generate your upgrade plan.

What’s next

- You should review the ONTAP release notes for the target ONTAP release recommended for your cluster by Upgrade Advisor; then you should follow the plan generated by Upgrade Advisor to upgrade your cluster.
- You should reboot the SP or BMC before the upgrade begins.

Prepare to upgrade without Upgrade Advisor

Prepare for an ONTAP software upgrade without Upgrade Advisor

Properly preparing for an ONTAP software upgrade helps you identify and mitigate potential upgrade risks or blockers before you begin the upgrade process. During upgrade preparation, you can also identify any special considerations you might need to account for before you upgrade. For example, if SSL FIPs mode is enabled on your cluster and the administrator accounts use SSH public keys for authentication, you need to verify that the host key algorithm is supported in your target ONTAP release.

If you have an active SupportEdge contract for Digital Advisor, plan your upgrade with Upgrade Advisor. If you do not have access to Active IQ Digital Advisor (also known as Digital Advisor), you should do the following to prepare for an ONTAP upgrade.

1. Choose your target ONTAP release.
2. Review the *Upgrade cautions* and *Known problems and limitations* sections in the ONTAP 9 Release Notes for your target release.

   Upgrade cautions describe potential issues that you should be aware of before upgrading. *Known problems and limitations* describe potentially unexpected system behavior that you might experience after upgrading.

   You must sign in with your NetApp account or create an account to access the Release Notes.

3. Confirm ONTAP support for your hardware configuration.

   Your hardware platform, cluster management switches and MetroCluster IP switches must support the target release. If your cluster is configured for SAN, the SAN configuration must be fully supported.

4. Use Active IQ Config Advisor to verify that you have no common configuration errors.
5. Review the supported ONTAP upgrade paths to determine if you can perform a direct upgrade or if you need to complete the upgrade in stages.
6. Verify your LIF failover configuration.

   Before you perform an upgrade, you need to verify that the cluster’s failover policies and failover groups are configured correctly.

7. Verify your SVM routing configuration.
8. Verify special considerations for your cluster.

   If certain configurations exist on your cluster, there are specific actions you need to take before you begin an ONTAP software upgrade.

9. Reboot the SP or BMC.

Choose a NetApp-recommended target ONTAP version for an upgrade

When you use Upgrade Advisor to generate an upgrade plan for your cluster, the plan includes a recommended target ONTAP release for upgrade. The recommendation given by Upgrade Advisor is based on your current configuration and your current ONTAP version.

If you do not use Upgrade Advisor to plan your upgrade, you should choose your target ONTAP release for the upgrade based on NetApp recommendations or your need to be at the minimum release to meet your for performance needs.

- Upgrade to the latest available release (recommended)

  NetApp recommends that you upgrade your ONTAP software to the latest patch version of the latest numbered ONTAP release. If this is not possible because the latest numbered release is not supported by the storage systems in your cluster, you should upgrade to the latest numbered release that is supported.

- Minimum recommended release

  If you want to restrict your upgrade to the minimum recommended release for your cluster, see Minimum recommended ONTAP releases to determine the ONTAP version you should upgrade to.

Confirm ONTAP target release support for your hardware configuration

Before you upgrade ONTAP, you should confirm that your hardware configuration can support the target ONTAP release.

All configurations

Use NetApp Hardware Universe to confirm that your hardware platform and cluster and management switches are supported in the target ONTAP release.

The version of ONTAP that you can upgrade to might be limited based upon your hardware configuration. If your hardware doesn't support the version of ONTAP software that you want to upgrade to, you will need to first add new nodes to your cluster, migrate your data, remove the older nodes and then upgrade your ONTAP software. Follow the procedure to add new nodes to an ONTAP cluster.

Cluster and management switches include the cluster network switches (NX-OS), management network switches (IOS), and reference configuration file (RCF). If your cluster and management switches are supported but are not running the minimum software versions required for the target ONTAP release, upgrade your switches to supported software versions.

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

> ⓘ If you need to upgrade your switches, NetApp recommends that you complete the ONTAP software upgrade first, then perform the software upgrade for your switches.

MetroCluster configurations

Before you upgrade ONTAP, if you have a MetroCluster configuration, use the NetApp Interoperability Matrix

Tool to confirm that your MetroCluster IP switches are supported in the target ONTAP release.

SAN configurations

Before you upgrade ONTAP, if your cluster is configured for SAN, use the NetApp Interoperability Matrix Tool to 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.

Identify common configuration errors before upgrading ONTAP using Active IQ Config Advisor

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

Active IQ Config Advisor is a configuration validation tool for NetApp systems. It 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.

Steps

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.
4. After running Active IQ Config Advisor, review the tool's output, and follow the recommendations that are provided to address any issues discovered by the tool.

Supported ONTAP upgrade paths

The version of ONTAP that you can upgrade to depends on your hardware platform and the version of ONTAP currently running on your cluster's nodes.

To verify that your hardware platform is supported for the target upgrade release, see NetApp Hardware Universe. Use the NetApp Interoperability Matrix Tool to confirm support for your configuration.

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 at 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**.

- **Direct**

  You can always upgrade directly to the next adjacent ONTAP release family using a single software image. For many releases, you can also install a software image that allows you to upgrade directly to releases that are up to four releases later than the running release.

For example, you can use the direct upgrade path from 9.12.1 to 9.13.1, or from 9.13.1 to 9.17.1.

All *direct* upgrade paths are supported for mixed version clusters.

- **Direct multi-hop**

  For some automated nondisruptive upgrades (ANDU) to non-adjacent releases, you need to 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 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 9.8 and you want to upgrade to 9.16.1, you must complete a multi-stage upgrade: first from 9.8 to 9.12.1, and then from 9.12.1 to 9.16.1. Upgrades from earlier releases might require three or more stages, with several intermediate upgrades.

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

Before you begin any major upgrade, it is a best practice to upgrade first to the latest patch release of the ONTAP version running on your cluster. 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

The following upgrade paths are supported for automated and manual upgrades of your ONTAP software. These upgrade paths apply to on-premises ONTAP and ONTAP Select. There are different supported upgrade paths for Cloud Volumes ONTAP.

> ⓘ **For mixed version ONTAP clusters**: All *direct* and *direct multi-hop* upgrade paths include ONTAP versions that are compatible for mixed version clusters. ONTAP versions included in *multi-stage* upgrades are not compatible for mixed version clusters. For example, an upgrade from 9.8 to 9.12.1 is a *direct* upgrade. A cluster with nodes running 9.8 and 9.12.1 is a supported mixed version cluster. An upgrade from 9.8 to 9.13.1 is a *multi-stage* upgrade. A cluster with nodes running 9.8 and 9.13.1 is not a supported mixed version cluster.

From ONTAP 9.10.1 and later

If your current ONTAP release is…	And your target ONTAP release is…	Your automated or manual upgrade path is…
9.17.1	9.18.1	direct
9.16.1	9.18.1	direct
	9.17.1	direct
9.15.1	9.18.1	direct
	9.17.1	direct
	9.16.1	direct
9.14.1	9.18.1	direct
	9.17.1	direct
	9.16.1	direct
	9.15.1	direct
9.13.1	9.18.1	multi-stage • 9.13.1 → 9.17.1 • 9.17.1 → 9.18.1
	9.17.1	direct
	9.16.1	direct
	9.15.1	direct
	9.14.1	direct
9.12.1	9.18.1	multi-stage • 9.12.1 → 9.16.1 • 9.16.1 → 9.18.1
	9.17.1	multi-stage • 9.12.1 → 9.16.1 • 9.16.1 → 9.17.1
	9.16.1	direct
	9.15.1	direct
	9.14.1	direct
	9.13.1	direct

If your current ONTAP release is…	And your target ONTAP release is…	Your automated or manual upgrade path is…
9.11.1	9.18.1	multi-stage • 9.11.1 → 9.15.1 • 9.15.1 → 9.18.1
	9.17.1	multi-stage • 9.11.1 → 9.15.1 • 9.15.1 → 9.17.1
	9.16.1	multi-stage • 9.11.1 → 9.15.1 • 9.15.1 → 9.16.1
	9.15.1	direct
	9.14.1	direct
	9.13.1	direct
	9.12.1	direct

If your current ONTAP release is…	And your target ONTAP release is…	Your automated or manual upgrade path is…
9.10.1	9.18.1	multi-stage • 9.10.1 → 9.14.1 • 9.14.1 → 9.18.1
	9.17.1	multi-stage • 9.10.1 → 9.14.1 • 9.14.1 → 9.17.1
	9.16.1	multi-stage • 9.10.1 → 9.14.1 • 9.14.1 → 9.16.1
	9.15.1	multi-stage • 9.10.1 → 9.14.1 • 9.14.1 → 9.15.1
	9.14.1	direct
	9.13.1	direct
	9.12.1	direct
	9.11.1	direct

From ONTAP 9.9.1

If your current ONTAP release is…	And your target ONTAP release is…	Your automated or manual upgrade path is…
9.9.1	9.18.1	multi-stage • 9.9.1→9.13.1 • 9.13.1→9.17.1 • 9.17.1→9.18.1
	9.17.1	multi-stage • 9.9.1→9.13.1 • 9.13.1→9.17.1
	9.16.1	multi-stage • 9.9.1→9.13.1 • 9.13.1→9.16.1
	9.15.1	multi-stage • 9.9.1→9.13.1 • 9.13.1→9.15.1
	9.14.1	multi-stage • 9.9.1→9.13.1 • 9.13.1→9.14.1
	9.13.1	direct
	9.12.1	direct
	9.11.1	direct
	9.10.1	direct

From ONTAP 9.8

> If you are upgrading any of the following platform models in a MetroCluster IP configuration from ONTAP 9.8 to 9.10.1 or later, you must first upgrade to ONTAP 9.9.1:
>
> - FAS2750
> - FAS500f
> - AFF A220
> - AFF A250

If your current ONTAP release is…	And your target ONTAP release is…	Your automated or manual upgrade path is…
9.8	9.18.1	multi-stage • 9.8 → 9.12.1 • 9.12.1 → 9.16.1 • 9.16.1 → 9.18.1
	9.17.1	multi-stage • 9.8 → 9.12.1 • 9.12.1 → 9.16.1 • 9.16.1 → 9.17.1
	9.16.1	multi-stage • 9.8 → 9.12.1 • 9.12.1 → 9.16.1
	9.15.1	multi-stage • 9.8 → 9.12.1 • 9.12.1 → 9.15.1
	9.14.1	multi-stage • 9.8 → 9.12.1 • 9.12.1 → 9.14.1
	9.13.1	multi-stage • 9.8 → 9.12.1 • 9.12.1 → 9.13.1
	9.12.1	direct
	9.11.1	direct
	9.10.1	direct
	9.9.1	direct

From ONTAP 9.7

The upgrade paths from ONTAP 9.7 might vary based upon whether you are performing an automated or a manual upgrade.

Automated paths

If your current ONTAP release is…	And your target ONTAP release is…	Your automated upgrade path is…
9.7		

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

Manual paths

If your current ONTAP release is…	And your target ONTAP release is…	Your manual upgrade path is…
9.7		

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

From ONTAP 9.6

The upgrade paths from ONTAP 9.6 might vary based upon whether you are performing an automated or a manual upgrade.

Automated paths

If your current ONTAP release is…	And your target ONTAP release is…	Your automated upgrade path is…
9.6		

If your current ONTAP release is…	And your target ONTAP release is…	Your automated upgrade path is…
		• 9.6 → 9.8 • 9.8 → 9.12.1 • 9.12.1 → 9.13.1
	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 and 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

Manual paths

If your current ONTAP release is…	And your target ONTAP release is…	Your manual upgrade path is…
9.6		

- 9.6 → 9.8
- 9.8 → 9.12.1
- 9.12.1 → 9.13.1

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

From ONTAP 9.5

The upgrade paths from ONTAP 9.5 might vary based upon whether you are performing an automated or a manual upgrade.

Automated paths

If your current ONTAP release is…	And your target ONTAP release is…	Your automated upgrade path is…
9.5		

If your current ONTAP release is…	And your target ONTAP release is…	Your automated upgrade path is…
		• 9.5 → 9.9.1 (direct multi-hop, requires images for 9.7 and 9.9.1) • 9.9.1 → 9.13.1
	9.12.1	multi-stage • 9.5 → 9.9.1 (direct multi-hop, requires images for 9.7 and 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 and 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 and 9.9.1) • 9.9.1 → 9.10.1
	9.9.1	direct multi-hop (requires images for 9.7 and 9.9.1)
	9.8	multi-stage • 9.5 → 9.7 • 9.7 → 9.8
	9.7	direct
	9.6	direct

Manual upgrade paths

If your current ONTAP release is…	And your target ONTAP release is…	Your manual upgrade path is…
9.5		

If your current ONTAP release is…	And your target ONTAP release is…	Your manual upgrade path is…
		• 9.7 → 9.9.1 • 9.9.1 → 9.13.1 • 9.13.1 → 9.14.1
	9.13.1	multi-stage • 9.5 → 9.7 • 9.7 → 9.9.1 • 9.9.1 → 9.13.1
	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

From ONTAP 9.4-9.0

The upgrade paths from ONTAP 9.4, 9.3, 9.2, 9.1 and 9.0 might vary based upon whether you are performing an automated upgrade or a manual upgrade.

Automated upgrade paths

If your current ONTAP release is…	And your target ONTAP release is…	Your automated upgrade path is…
9.4		

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

If your current ONTAP release is…	And your target ONTAP release is…	Your automated upgrade path is…
		• 9.4 → 9.5 • 9.5 → 9.8 (direct multi-hop, requires images for 9.7 and 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 automated upgrade path is…
9.3		

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

If your current ONTAP release is…	And your target ONTAP release is…	Your automated upgrade path is…
		9.5 and 9.7) • 9.7 → 9.8
	9.7	direct multi-hop (requires images for 9.5 and 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 automated upgrade path is…
9.2		

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

If your current ONTAP release is…	And your target ONTAP release is…	Your automated upgrade path is…
		• 9.3 → 9.7 (direct multi-hop, requires images for 9.5 and 9.7) • 9.7 → 9.10.1 (direct multi-hop, requires images for 9.8 and 9.10.1)
	9.9.1	multi-stage • 9.2 → 9.3 • 9.3 → 9.7 (direct multi-hop, requires images for 9.5 and 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 and 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 and 9.7)
	9.6	multi-stage • 9.2 → 9.3 • 9.3 → 9.5 • 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 automated upgrade path is…
9.1		

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

If your current ONTAP release is…	And your target ONTAP release is…	Your automated upgrade path is…
		• 9.3 → 9.7 (direct multi-hop, requires images for 9.5 and 9.7) • 9.7 → 9.10.1 (direct multi-hop, requires images for 9.8 and 9.10.1)
	9.9.1	multi-stage • 9.1 → 9.3 • 9.3 → 9.7 (direct multi-hop, requires images for 9.5 and 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 and 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 and 9.7)
	9.6	multi-stage • 9.1 → 9.3 • 9.3 → 9.6 (direct multi-hop, requires images for 9.5 and 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 automated upgrade path is…
9.0		

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

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

		• 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 automated 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 upgrade paths

If your current ONTAP release is…	And your target ONTAP release is…	Your ANDU upgrade path is…
9.4		

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

If your current ONTAP release is…	And your target ONTAP release is…	Your ANDU upgrade path is…
		• 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 ANDU upgrade path is…
9.3		

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

- 9.5 → 9.7
- 9.7 → 9.9.1
- 9.9.1 → 9.10.1

If your current ONTAP release is…	And your target ONTAP release is…	Your ANDU upgrade path is…
	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 ANDU upgrade path is…
9.2		

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

- 9.5 → 9.7
- 9.7 → 9.9.1
- 9.9.1 → 9.11.1

If your current ONTAP release is…	And your target ONTAP release is…	Your ANDU upgrade path is…
	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 ANDU upgrade path is…
9.1		

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

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

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

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

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

If your current ONTAP release is…	And your target ONTAP release is…	Your ANDU upgrade path is…
		• 9.3 → 9.5 • 9.5 → 9.7 • 9.7 → 9.8
	9.7	multi-stage • 9.0 → 9.1 • 9.1 → 9.3 • 9.3 → 9.5 • 9.5 → 9.7
	9.6	multi-stage • 9.0 → 9.1 • 9.1 → 9.3 • 9.3 → 9.5 • 9.5 → 9.6
	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

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.

Related information

- ONTAP command reference
- cluster image show
- system node image show

Verify the ONTAP cluster LIF failover configuration before an upgrade

Before you upgrade ONTAP, you must verify that the cluster’s 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 node that has failed over, 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.

Steps

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 first attempts to fail over to port e0c on node0. If lif0 cannot fail over to e0c, it then attempts to fail over to port e0d on node0, and so on.

Learn more about `network interface show` in the ONTAP command reference.

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.

   Learn more about `network interface modify` in the ONTAP command reference.

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

- network interface
- network interface failover-groups modify

Verify ONTAP cluster SVM routing configuration before an upgrade

To avoid disruption, before you upgrade your ONTAP software, you should ensure that the default SVM route is able to reach any network address that is not reachable by a more specific route. It is a best practice to configure one default route for an SVM. For more information, see SU134: Network access might be disrupted by incorrect routing configuration in 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 can especially be an issue if you have configured multiple default routes.

Special considerations

Check for specific ONTAP configurations before an upgrade

Certain cluster configurations require you to take specific actions before you begin an ONTAP software upgrade. For example, if you have a SAN configuration, you should verify that each host is configured with the correct number of direct and indirect paths before you begin the upgrade.

Review the following table to determine what additional steps you might need to take.

Before you upgrade ONTAP, ask yourself…	If your answer is yes, then do this…
Is my cluster currently in a mixed version state?	Check mixed version requirements
Do I have a MetroCluster configuration?	Review specific upgrade requirements for MetroCluster configurations
Do I have a SAN configuration?	Verify the SAN host configuration
Does my cluster have SnapMirror relationships defined?	Verify compatibility of ONTAP versions for SnapMirror relationships
Do I have DP-type SnapMirror relationships defined, and am I upgrading to ONTAP 9.12.1 or later?	Convert existing DP-type relationships to XDP
Am I using SnapMirror S3, and am I upgrading to ONTAP 9.12.1 or later?	Verify licensing for SnapMirror S3 configurations

Before you upgrade ONTAP, ask yourself…	If your answer is yes, then do this…
Do I have long-term retention snapshots enabled on the middle volume of a cascade?	Disable long-term retention snapshots in middle volumes of cascade topologies
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?	Verify that the netgroup file is present on each node
Did I create an SVM and am I upgrading from ONTAP 9.12.1 or earlier to a later version?	Assign an explicit value to the v4.2-xattrs option
Do I have LDAP clients using SSLv3?	Configure LDAP clients to use TLS
Am I using session-oriented protocols?	Review adverse effects of session-oriented protocols
Is SSL FIPS mode enabled on a cluster where administrator accounts authenticate with an SSH public key?	Verify SSH host key algorithm support
Does my Autonomous Ransomware Protection have an active warning?	Respond to Autonomous Ransomware Protection warnings of abnormal activity

Verify compatibility of ONTAP versions for mixed version clusters

In a mixed version ONTAP cluster, nodes run two different major ONTAP versions for a short time. For example, a cluster with nodes running ONTAP 9.8 and 9.12.1 or ONTAP 9.9.1 and 9.13.1 is a mixed version cluster. Clusters with nodes running different patch levels within the same version, like ONTAP 9.9.1P1 and 9.9.1P5, are not mixed version clusters.

> Mixed version clusters are not supported for Cloud Volumes ONTAP.

NetApp supports mixed version ONTAP clusters for limited periods of time and in specific scenarios.

The following are the most common scenarios in which an ONTAP cluster will be in a mixed version state:

- ONTAP software upgrades in large clusters

  It can take several days or weeks to upgrade all the nodes in a large cluster. The cluster enters and remains in a mixed version state until all the nodes are upgraded.

- ONTAP software upgrades required when you plan to add new nodes to a cluster

  You might add new nodes to your cluster to expand its capacity, or you might add new nodes as part of the process of completely replacing your controllers. In either case, you need might need to enter a mixed version state to enable the migration of your data from existing controllers to the new nodes in your new system.

For optimal cluster operation, the length of time that the cluster is in a mixed version state should be as short as possible. The maximum length of time a cluster is eligible for support in a mixed version state depends on the lowest ONTAP version in the cluster.

If the lowest version of ONTAP running in the mixed version cluster is…	Then you can remain in a mixed version state for a maximum of…
ONTAP 9.8 or later	90 days
ONTAP 9.7 or earlier	7 days

While the cluster is in a mixed version state, you should not enter any commands that alter the cluster operation or configuration except those that are required for the upgrade or data migration process. For example, activities such as (but not limited to) LIF migration, planned storage failover operations, or large-scale object creation or deletion should not be performed until upgrade and data migration are complete.

Mixed version clusters supported for ONTAP software upgrades

You can enter a mixed version state with any ONTAP version supported for a direct upgrade from your lowest current release. For example, if you are running ONTAP 9.11.1, you can enter a mixed version state with nodes running ONTAP 9.15.1. You cannot enter a mixed version state with nodes running ONTAP 9.11.1 and ONTAP 9.16.1. ONTAP 9.16.1 is not supported for direct upgrade from ONTAP 9.11.1.

> ONTAP patch (P) release versions have no impact on compatibility for mixed version clusters. For example, if you are running ONTAP 9.11.1P6, your current ONTAP release for mixed-version cluster compatibility is ONTAP 9.11.1. Or, if you are running ONTAP 9.12.1 and you want to upgrade to ONTAP 9.15.1P2, your target ONTAP release for mixed-version cluster compatibility is ONTAP 9.15.1.

To upgrade to an ONTAP version that is not supported for a direct upgrade from your current release, you must perform a multi-stage upgrade. In a multi-stage upgrade, you first enter a mixed version state with the highest release supported for a direct upgrade from your current release. You complete that upgrade; then you perform a separate upgrade to your target release. For example, if your lowest current release is ONTAP 9.10.1 and you want to upgrade to ONTAP 9.16.1, you first enter a mixed version state to upgrade all your nodes to ONTAP 9.14.1; then you perform a separate upgrade from ONTAP 9.14.1 to ONTAP 9.16.1. Learn more about multi-stage upgrades and supported upgrade paths.

A mixed version cluster can contain only two major ONTAP releases. For example, you can have a mixed version cluster with nodes running ONTAP 9.13.1 and 9.15.1; or with nodes running ONTAP 9.13.1 and 9.16.1. You cannot have a mixed version cluster with nodes running ONTAP 9.13.1, 9.15.1 and 9.16.1.

If your current ONTAP release is…	And your target ONTAP release is…	Mixed version state for upgrade is…
9.17.1	9.18.1	Supported
9.16.1	9.18.1	Supported
	9.17.1	Supported
9.15.1	9.18.1	Supported
	9.17.1	Supported
	9.16.1	Supported

If your current ONTAP release is…	And your target ONTAP release is…	Mixed version state for upgrade is…
9.14.1	9.18.1	Supported
	9.17.1	Supported
	9.16.1	Supported
	9.15.1	Supported
9.13.1	9.18.1	Not supported
	9.17.1	Supported
	9.16.1	Supported
	9.15.1	Supported
	9.14.1	Supported
9.12.1	9.17.1 or later	Not supported
	9.16.1	Supported
	9.15.1	Supported
	9.14.1	Supported
	9.13.1	Supported
9.11.1	9.16.1 or later	Not supported
	9.15.1	Supported
	9.14.1	Supported
	9.13.1	Supported
	9.12.1	Supported
9.10.1	9.15.1 or later	Not supported
	9.14.1	Supported
	9.13.1	Supported
	9.12.1	Supported
	9.11.1	Supported
9.9.1	9.14.1 or later	Not supported
	9.13.1	Supported
	9.12.1	Supported
	9.11.1	Supported
	9.10.1	Supported

If your current ONTAP release is…	And your target ONTAP release is…	Mixed version state for upgrade is…
9.8	9.13.1 or later	Not supported
	9.12.1	Supported
	9.11.1	Supported
	9.10.1	Supported
	9.9.1	Supported

Adding new nodes to an ONTAP cluster

If you plan to add new nodes to your cluster, and those nodes require a minimum version of ONTAP that's later than the version currently running in your cluster, you need to perform any supported software upgrades on the existing nodes in your cluster before adding the new nodes. Ideally, you would upgrade all existing nodes to the minimum version of ONTAP required by the nodes you plan to add to the cluster. However, if this is not possible because some of your existing nodes don't support the later version of ONTAP, you'll need to enter a mixed version state for a limited amount of time as part of your upgrade process.

Steps

1. Upgrade the nodes that do not support the minimum ONTAP version required by your new controllers to the highest ONTAP version they support.

   For example, if you have a FAS8080 running ONTAP 9.5 and you are adding a new C-Series platform running ONTAP 9.12.1, you should upgrade your FAS8080 to ONTAP 9.8 (which is the highest ONTAP version it supports).

2. Add the new nodes to your cluster.
3. Migrate the data from the nodes being removed from the cluster to the newly added nodes.
4. Remove the unsupported nodes from the cluster.
5. Upgrade the cluster to the same ONTAP version and patch level running on the new nodes or to the latest recommended patch release for the ONTAP version running on the new nodes.
6. Verify that all nodes are running the same ONTAP version.

   a. Show the ONTAP version running on the cluster:

      ```
      version
      ```

   b. Show the ONTAP version running on each node of the cluster:

      ```
      version *
      ```

   If there is a difference between the ONTAP version reported in the output for the `version *` (cluster) and `version` (individual nodes) commands, update all nodes to the same ONTAP and patch version by running a cluster image update.

For details on data migration see:

- Create an aggregate and move volumes to the new nodes
- Setting up new iSCSI connections for SAN volume moves
- Moving volumes with encryption

Check ONTAP upgrade requirements for MetroCluster configurations

Before you upgrade your ONTAP software on a MetroCluster configuration, your clusters must meet certain requirements.

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

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

- If you’re performing a major ONTAP upgrade, the MetroCluster configuration must be in normal mode.
- If you’re performing a patch ONTAP upgrade, the MetroCluster configuration can be in either normal or switchover mode.
- 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.

  Learn more about `storage aggregate plex show` in the ONTAP command reference.

- 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 MetroCluster 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 MetroCluster 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 SAN host configuration before an ONTAP upgrade

Upgrading ONTAP in a SAN environment changes which paths are direct. Before you upgrade a SAN cluster, 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.

Steps

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. If you are running ONTAP 9.11.1 or later, use System Manager to view the connection status as it gives a much clearer display than CLI.

   System Manager

   1. In System Manager, click **Hosts > SAN Initiator Groups**.

      The page displays a list of initiator groups (igroups). If the list is large, you can view additional pages of the list by clicking the page numbers at the lower right corner of the page.

      The columns display various information about the igroups. Beginning with 9.11.1, the connection status of the igroup is also displayed. Hover over status alerts to view details.

   CLI

   - List iSCSI initiators:

     ```
     iscsi initiator show -fields igroup,initiator-name,tpgroup
     ```

   - List FC initiators:

     ```
     fcp initiator show -fields igroup,wwpn,lif
     ```

SnapMirror

Compatible ONTAP versions for SnapMirror relationships

The source and destination volumes must be running compatible ONTAP versions before creating a SnapMirror data protection relationship. Before you upgrade ONTAP, you should verify that your current ONTAP version is compatible with your target ONTAP version for SnapMirror relationships.

Unified replication relationships

For SnapMirror relationships of type “XDP”, using on premises or Cloud Volumes ONTAP releases:

Beginning with ONTAP 9.9.0:

- ONTAP 9.x.0 releases are cloud-only releases and support Cloud Volumes ONTAP systems. The asterisk (*) after the release version indicates a cloud-only release.

  > ONTAP 9.16.0 is an exception to the cloud-only rule because it provides support for ASA r2 systems. The plus sign (+) after the release version indicates both an ASA r2 and cloud supported release. ASA r2 systems support SnapMirror relationships only to other ASA r2 systems.

- ONTAP 9.x.1 releases are general releases and support both on-premises and Cloud Volumes ONTAP systems.

> When advanced capacity balancing is enabled on volumes in clusters running ONTAP 9.16.1 or later, SnapMirror transfers are not supported to clusters running ONTAP versions earlier than ONTAP 9.16.1.

> Interoperability is bidirectional.

Interoperability for ONTAP version 9.4 and later

ONTAP version…	**Interoperates with these previous ONTAP versions…**																					
	9.18.1	9.17.1	9.16.1	9.16.0+	9.15.1	9.15.0*	9.14.1	9.14.0*	9.13.1	9.13.0*	9.12.1	9.12.0*	9.11.1	9.11.0*	9.10.1	9.10.0*	9.9.1	9.9.0*	9.8	9.7	9.6	9.5
9.18.1	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	No	**Yes**	No	**Yes**	**Yes**	No	No	No	No	No	No	No	No	No	No	No	No
9.17.1	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	No	No	No	No	No	No	No	No	No	No	No
9.16.1	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	No	No	No	No	No	No	No	No	No

9.16.0+	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	No	**Yes**	No	**Yes**	No	**Yes**	No	**Yes**	No	**Yes**	No	No	No	No	No	No	No
9.15.1	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	No	No	No	No	No
9.15.0*	No	**Yes**	**Yes**	No	**Yes**	**Yes**	**Yes**	No	**Yes**	No	**Yes**	No	**Yes**	No	**Yes**	No	**Yes**	No	No	No	No	No
9.14.1	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	No	No	No	No
9.14.0*	No	**Yes**	**Yes**	No	**Yes**	No	**Yes**	**Yes**	**Yes**	No	**Yes**	No	**Yes**	No	**Yes**	No	**Yes**	No	No	No	No	No
9.13.1	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	No	No	No
9.13.0*	No	**Yes**	**Yes**	No	**Yes**	No	**Yes**	No	**Yes**	**Yes**	**Yes**	No	**Yes**	No	**Yes**	No	**Yes**	No	**Yes**	No	No	No
9.12.1	No	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	No	No
9.12.0*	No	No	**Yes**	No	**Yes**	No	**Yes**	No	**Yes**	No	**Yes**	**Yes**	**Yes**	No	**Yes**	No	**Yes**	No	**Yes**	**Yes**	No	No
9.11.1	No	No	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	No
9.11.0*	No	No	No	No	**Yes**	No	**Yes**	No	**Yes**	No	**Yes**	No	**Yes**	**Yes**	**Yes**	No	**Yes**	No	**Yes**	**Yes**	**Yes**	No
9.10.1	No	No	No	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
9.10.0*	No	No	No	No	**Yes**	No	**Yes**	No	**Yes**	No	**Yes**	No	**Yes**	No	**Yes**	**Yes**	**Yes**	No	**Yes**	**Yes**	**Yes**	**Yes**
9.9.1	No	No	No	No	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
9.9.0*	No	No	No	No	No	No	**Yes**	No	**Yes**	No	**Yes**	No	**Yes**	No	**Yes**	No	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
9.8	No	No	No	No	No	No	No	No	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
9.7	No	No	No	No	No	No	No	No	No	No	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
9.6	No	No	No	No	No	No	No	No	No	No	No	No	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**

9.5	No	No	No	No	No	No	No	No	No	No	No	No	No	No	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**

SnapMirror synchronous relationships

SnapMirror synchronous is not supported for ONTAP cloud instances.

ONTAP version…	**Interoperates with these previous ONTAP versions…**													
	9.18.1	9.17.1	9.16.1	9.15.1	9.14.1	9.13.1	9.12.1	9.11.1	9.10.1	9.9.1	9.8	9.7	9.6	9.5
9.18.1	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	No	No	No	No	No	No	No
9.17.1	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	No	No	No	No	No	No	No
9.16.1	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	No	No	No	No	No	No
9.15.1	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	No	No	No	No	No
9.14.1	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	No	No	No
9.13.1	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	No	No
9.12.1	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	No	No
9.11.1	No	No	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	No	No	No	No
9.10.1	No	No	No	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	No	No	No
9.9.1	No	No	No	No	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	No	No
9.8	No	No	No	No	**Yes**	**Yes**	**Yes**	No	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	No
9.7	No	No	No	No	No	**Yes**	**Yes**	No	No	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
9.6	No	No	No	No	No	No	No	No	No	No	**Yes**	**Yes**	**Yes**	**Yes**
9.5	No	No	No	No	No	No	No	No	No	No	No	**Yes**	**Yes**	**Yes**

SnapMirror SVM disaster recovery relationships

- This matrix applies to the SVM data mobility migration feature beginning with ONTAP 9.10.1.
- You can use SVM DR to migrate an SVM that does not meet the restrictions indicated for SVM migration (SVM data mobility).
- In both cases, a maximum of 2 major **newer** ONTAP versions can separate the source and destination clusters, with the requirement that the destination be same version or newer than source ONTAP version.

For SVM disaster recovery data and SVM protection:

SVM disaster recovery is supported only between clusters running the same version of ONTAP. **Version-independence is not supported for SVM replication**.

For SVM disaster recovery for SVM migration:

- Replication is supported in a single direction from an earlier version of ONTAP on the source to the same or later version of ONTAP on the destination.

- The ONTAP version on the target cluster must be no more than two major on-premises versions newer or two major cloud versions newer (beginning with ONTAP 9.9.0), as shown in the table below.
  - Replication is not supported for long-term data protection use cases.

The asterisk (*) after the release version indicates a cloud-only release.

To determine support, locate the source version in the left table column, and then locate the destination version on the top row (DR/Migration for like versions and Migration only for newer versions).

> If you are using ONTAP 9.10.1 or later, you can use the SVM data mobility feature instead of SVM DR to migrate SVMs from one cluster to another.

Source	Destination																					
	9.5	9.6	9.7	9.8	9.9.0*	9.9.1	9.10.0*	9.10.1	9.11.0*	9.11.1	9.12.0*	9.12.1	9.13.0*	9.13.1	9.14.0*	9.14.1	9.15.0*	9.15.1	9.16.0	9.16.1	9.17.1	9.18.1
9.5	DR/Migration	Migration	Migration																			
9.6		DR/Migration	Migration	Migration																		
9.7			DR/Migration	Migration	Migration																	
9.8				DR/Migration	Migration	Migration		Migration														
9.9.0*					DR/Migration	Migration	Migration	Migration	Migration	Migration												
9.9.1						DR/Migration	Migration	Migration	Migration	Migration												
9.10.0*							DR/Migration	Migration	Migration	Migration	Migration	Migration										

9.10.1								DR/Migration	Migration	Migration	Migration	Migration										
9.11.0 *									DR/Migration	Migration	Migration	Migration	Migration	Migration								
9.11.1										DR/Migration	Migration	Migration	Migration	Migration								
9.12.0 *											DR/Migration	Migration	Migration	Migration	Migration	Migration						
9.12.1												DR/Migration	Migration	Migration	Migration	Migration						
9.13.0 *													DR/Migration	Migration	Migration	Migration	Migration	Migration				
9.13.1														DR/Migration	Migration	Migration	Migration	Migration				
9.14.0 *															DR/Migration	Migration	Migration	Migration	Migration	Migration		
9.14.1																DR/Migration	Migration	Migration	Migration	Migration		
9.15.0 *																	DR/Migration	Migration	Migration	Migration	Migration	
9.15.1																		DR/Migration	Migration	Migration	Migration	

9.16.0																			DR/Migration	Migration	Migration	Migration
9.16.1																				DR/Migration	Migration	Migration
9.17.1																					DR/Migration	Migration
9.18.1																						DR/Migration

SnapMirror disaster recovery relationships

For SnapMirror relationships of type “DP” and policy type “async-mirror”:

DP-type mirrors cannot be initialized beginning with ONTAP 9.11.1 and are completely deprecated in ONTAP 9.12.1. For more information, see Deprecation of data protection SnapMirror relationships.

In the following table, the column on the left indicates the ONTAP version on the source volume, and the top row indicates the ONTAP versions you can have on your destination volume.

Source	Destination								
	9.11.1	9.10.1	9.9.1	9.8	9.7	9.6	9.5	9.4	9.3
9.11.1	Yes	No	No	No	No	No	No	No	No
9.10.1	Yes	Yes	No	No	No	No	No	No	No
9.9.1	Yes	Yes	Yes	No	No	No	No	No	No
9.8	No	Yes	Yes	Yes	No	No	No	No	No
9.7	No	No	Yes	Yes	Yes	No	No	No	No
9.6	No	No	No	Yes	Yes	Yes	No	No	No
9.5	No	No	No	No	Yes	Yes	Yes	No	No
9.4	No	No	No	No	No	Yes	Yes	Yes	No
9.3	No	No	No	No	No	No	Yes	Yes	Yes

Interoperability is not bidirectional.

Convert an existing ONTAP SnapMirror DP-type relationship to XDP

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

Before upgrading to ONTAP 9.12.1, you must convert existing DP-type relationships to XDP before you can upgrade to ONTAP 9.12.1 and later releases.

About this task

- 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.
- 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>
   ```

   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. Learn more about `snapmirror show` in the ONTAP command reference.

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

```
volume snapshot show -vserver <SVM> -volume <volume>
```

The following example shows the `volume snapshot show` output for the source 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> -destination-path
<SVM:volume>
```

> 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
```

Learn more about `snapmirror quiesce` in the ONTAP command reference.

4. Break the existing DP-type relationship:

   ```
   snapmirror break -destination-path <SVM:volume>
   ```

   > 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
   ```

   Learn more about `snapmirror break` in the ONTAP command reference.

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

   ```
   volume snapshot autodelete modify -vserver _SVM_ -volume _volume_
   -enabled false
   ```

   The following example disables snapshot 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>
   ```

   Learn more about `snapmirror-delete` in the ONTAP command reference.

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. Release the origin SVM disaster recovery relationship on the source:

```
snapmirror release -destination-path <SVM:volume> -relationship-info
-only true
```

The following example releases the SVM disaster recovery relationship:

```
cluster_src::> snapmirror release -destination-path svm_backup:volA_dst
-relationship-info-only true
```

Learn more about `snapmirror release` in the ONTAP command reference.

8. 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> -destination-path
<SVM:volume>  -type XDP -schedule <schedule> -policy <policy>
```

The new relationship must use the same source and destination volume. Learn more about the commands described in this procedure in the ONTAP command reference.

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

The following example creates a SnapMirror disaster recovery 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
```

9. Resync the source and destination volumes:

```
snapmirror resync -source-path <SVM:volume> -destination-path
<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.

> 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
```

Learn more about `snapmirror resync` in the ONTAP command reference.

10. If you disabled automatic deletion of snapshots, 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.

   Learn more about `snapmirror show` in the ONTAP command reference.

2. Once the SnapMirror XDP destination volume begins updating snapshots as defined by the SnapMirror policy, use the output of `snapmirror list-destinations` command from the source cluster to display the new SnapMirror XDP relationship.

Additional information about DP-type relationships

Beginning with ONTAP 9.3, XDP mode is the default, and any invocations of DP mode on the command line or in new or existing scripts are automatically converted to XDP mode.

Existing relationships are not affected. If a relationship is already of type DP, it will continue to be of type DP. Beginning with ONTAP 9.5, MirrorAndVault is the default policy when no data protection mode is specified or when XDP mode is specified as the relationship type. The table below shows the expected behavior.

If you specify…	The type is…	The default policy (if you do not specify a policy) is…
DP	XDP	MirrorAllSnapshots (SnapMirror DR)

Nothing	XDP	MirrorAndVault (unified replication)
XDP	XDP	MirrorAndVault (unified replication)

As the table shows, the default policies assigned to XDP in different circumstances ensure that the conversion maintains the functional equivalence of the previous types. Of course, you can use different policies as needed, including policies for unified replication:

If you specify…	And the policy is…	The result is…
DP	MirrorAllSnapshots	SnapMirror DR
	XDPDefault	SnapVault
	MirrorAndVault	Unified replication
XDP	MirrorAllSnapshots	SnapMirror DR
	XDPDefault	SnapVault
	MirrorAndVault	Unified replication

The only exceptions to conversion are as follows:

- SVM data protection relationships continue to default to DP mode in ONTAP 9.3 and earlier.

  Beginning with ONTAP 9.4, SVM data protection relationships default to XDP mode.

- Root volume load-sharing data protection relationships continue to default to DP mode.
- SnapLock data protection relationships continue to default to DP mode in ONTAP 9.4 and earlier.

  Beginning with ONTAP 9.5, SnapLock data protection relationships default to XDP mode.

- Explicit invocations of DP continue to default to DP mode if you set the following cluster-wide option:

  ```
  options replication.create_data_protection_rels.enable on
  ```

  This option is ignored if you do not explicitly invoke DP.

Related information

- snapmirror create
- snapmirror delete
- snapmirror quiesce
- snapmirror release
- snapmirror resync

Disable long-term retention snapshots before ONTAP upgrade

In a relationship of cascaded volumes, long-term retention snapshots are supported only on the final SnapMirror destination volume of the cascade in all versions of ONTAP 9. Enabling long-term retention snapshots on any middle volume in the cascade results in missed backups and snapshots.

Learn more about long-term retention snapshots.

If you have an unsupported configuration in which long-term retention snapshots have been enabled on any middle volume of a cascade, contact technical support and reference the link:https://kb.netapp.com/on-prem/ontap/DP/SnapMirror/SnapMirror-KBs/Cascading_a_volume_with_Long-Term_Retention_(long-term retention)_snapshots_enabled_is_not_supported[NetApp Knowledge Base: Cascading a volume with Long-Term Retention (LTR) snapshots enabled is not supported^] for assistance.

The following ONTAP versions do not allow you to enable long-term retention snapshots on any volume in a cascade except the final SnapMirror destination volume.

- 9.15.1 and later
- 9.14.1P2 and P4 through P14
- 9.13.1P9 through P17
- 9.12.1 P12 through P19
- 9.11.1P15 through P20
- 9.10.1P18 through P20
- 9.9.1P20

Before upgrading from an ONTAP version that allows you to enable long-term retention snapshots on middle volumes of a cascade to an ONTAP version that blocks it, you need to disable long-term retention snapshots to avoid missed backups and snapshots.

You need to take action in the following scenarios:

- Long-Term Retention snapshots are configured on the "B" volume in an **A** › **B** › **C** SnapMirror cascade or on another middle SnapMirror destination volume in your larger cascade.
- long-term retention snapshots are defined by a schedule applied to a SnapMirror policy rule. This rule does not replicate snapshots from the source volume but creates them directly on the destination volume.

> ⓘ For more information on schedules and SnapMirror policies, see the NetApp Knowledge Base: How does the "schedule" parameter in an ONTAP 9 SnapMirror policy rule work?.

Steps

1. Remove the long-term retention rule from the SnapMirror policy on the middle volume of the cascade:

```
Secondary::> snapmirror policy remove-rule -vserver <> -policy <>
-snapmirror-label <>
```

   Learn more about `snapmirror policy remove-rule` in the ONTAP command reference.

2. Add the rule again for the SnapMirror label without the long-term retention schedule:

   ```
   Secondary::> snapmirror policy add-rule -vserver <> -policy <>
   -snapmirror-label <> -keep <>
   ```

   > Removing long-term retention snapshots from the SnapMirror policy rules means SnapMirror will pull the snapshots with the given label from the source volume. You might also need to add or modify a schedule on the source volume's snapshot policy to create properly labeled snapshots.

   Learn more about `snapmirror policy add-rule` in the ONTAP command reference.

3. If necessary, modify (or create) a schedule on the source volume snapshot policy to allow snapshots to be created with a SnapMirror label:

   ```
   Primary::> volume snapshot policy modify-schedule -vserver <> -policy <>
   -schedule <> -snapmirror-label <>
   ```

   ```
   Primary::> volume snapshot policy add-schedule -vserver <> -policy <>
   -schedule <> -snapmirror-label <> -count <>
   ```

> long-term retention snapshots can still be enabled on the final SnapMirror destination volume within a SnapMirror cascade configuration.

Verify ONTAP licensing for SnapMirror S3 configurations

Before you upgrade ONTAP, if you are using SnapMirror S3, and you are upgrading to ONTAP 9.12.1 or later, you should verify that you have the proper SnapMirror licenses.

After upgrading ONTAP, licensing changes that occurred between ONTAP 9.11.1 and earlier and ONTAP 9.12.1 and later might cause SnapMirror S3 relationships to fail.

ONTAP 9.11.1 and earlier

- When replicating to a NetApp-hosted destination bucket (ONTAP S3 or StorageGRID), SnapMirror S3 checks for the SnapMirror synchronous license, included in the Data Protection Bundle prior to the introduction of the ONTAP One software suite.
- When replicating to a non-NetApp destination bucket, SnapMirror S3 checks for the SnapMirror cloud license, included in the Hybrid Cloud Bundle which was available prior to the introduction of the ONTAP One software suite.

ONTAP 9.12.1 and later

- When replicating to a NetApp-hosted destination bucket (ONTAP S3 or StorageGRID), SnapMirror S3 checks for the SnapMirror S3 license, included in the Data Protection bundle which was available prior to the introduction of the ONTAP One software suite.

- When replicating to a non-NetApp destination bucket, SnapMirror S3 checks for the SnapMirror S3 External license, included in the Hybrid Cloud Bundle which was available prior to the introduction of ONTAP One software suite and the ONTAP One Compatibility bundle.

Existing SnapMirror S3 relationships

Existing SnapMirror S3 relationships should continue to work after an upgrade from ONTAP 9.11.1 or earlier to ONTAP 9.12.1 or later, even if the cluster does not have the new licensing.

Creation of new SnapMirror S3 relationships will fail if the cluster does not have the proper license installed.

Delete existing external key management server connections before upgrading ONTAP

Before you upgrade ONTAP, if you are running ONTAP 9.2 or earlier with NetApp Storage Encryption (NSE) 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.

Steps

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

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

   Learn more about `storage encryption disk show` in the ONTAP command reference.

2. Enter the advanced privilege mode:

   ```
   set -privilege advanced
   ```

   Learn more about `set` in the ONTAP command reference.

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 *
   ```

   Learn more about `storage encryption disk modify` in the ONTAP command reference.

4. Verify that assigning the FIPS key to all disks is complete:

   ```
   storage encryption disk show-status
   ```

   Learn more about `storage encryption disk show-status` in the ONTAP command reference.

5. Verify that the **mode** for all disks is set to data

```
storage encryption disk show
```

Learn more about `storage encryption disk show` in the ONTAP command reference.

6. View the configured KMIP servers:

```
security key-manager keystore show
```

Learn more about `security key-manager keystore show` in the ONTAP command reference.

7. Delete the configured KMIP servers:

```
security key-manager delete -address <kmip_ip_address>
```

Learn more about `security key-manager delete` in the ONTAP command reference.

8. Delete the external key manager configuration:

```
security key-manager external disable
```

Learn more about `security key-manager external disable` in the ONTAP command reference.

> ⓘ This step does not remove the NSE certificates.

What's next

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

Verify netgroup file is present on all nodes before an ONTAP upgrade

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

Steps

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.

Related information

Working with Netgroups

Assign an explicit value to the v4.2-xattrs option before an ONTAP upgrade

If you have an NFSv4.2 client, before you upgrade from certain releases and patches of ONTAP 9.12.1 and later you need to give an explicit value for the NFSv4.2 extended attributes option to prevent NFS response errors after upgrade.

If the `v4.2-xattrs` option is never explicitly assigned a value before the ONTAP upgrade to affected versions, NFSv4.2 clients are not informed that the server's extended attributes option has changed. This causes NFS response errors to specific `xattrs` calls due to a client and server mismatch.

Before you begin

You need to assign an explicit value for the NFSv4.2 extended attributes option if the following is true:

- You are using NFSv4.2 with an SVM created using ONTAP 9.11.1 or earlier
- You are upgrading ONTAP from any of these affected releases and patches:
  - 9.12.1RC1 to 9.12.1P11
  - 9.13.1RC1 to 9.13.1P8
  - 9.14.1RC1 to 9.14.1P1

About this task

You must be running ONTAP 9.12.1 or later to set the value using the command described in this procedure.

If `v4.2-xattrs` is already set to `enabled`, it should still be explicitly set to `enabled` to avoid future disruption. If you set `v4.2-xattrs` to disabled, NFSv4.2 clients can receive "invalid argument" responses until they are remounted or the `v4.2-xattrs` option is set to `enabled`.

Steps

- Assign an explicit value to the `v4.2-xattrs` option:

```
nfs modify -v4.2-xattrs <enabled/disabled> -vserver <vserver_name>
```

Related information

NFS v4.2-xattrs field getting flipped after upgrades

Configure LDAP clients to use TLS before an ONTAP upgrade

Before you upgrade ONTAP, 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.

Steps

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

NFS management

Learn about adverse effects of session-oriented protocols during ONTAP upgrades

Clusters and session-oriented protocols might cause adverse effects on clients and applications in certain areas such as I/O service 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.

Verify SSH host key algorithm support before ONTAP upgrade

Before you upgrade ONTAP, 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 ONTAP release.

The following table indicates host key type algorithms that are supported for ONTAP SSH connections. These key types do not apply to configuring SSH public authentication.

ONTAP release	Key types supported in FIPS mode	Key types supported in non-FIPS mode

9.11.1 and later	ecdsa-sha2-nistp256	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	ecdsa-sha2-nistp256 ssh-ed25519 ssh-dss ssh-rsa

> Support for the ssh-ed25519 host key algorithm is removed beginning with ONTAP 9.11.1.

For more information, see Configure network security using FIPS.

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

Learn more about enabling SSH public key accounts.

Resolve activity warnings in Autonomous Ransomware Protection (ARP) before an ONTAP upgrade

Before you upgrade to ONTAP 9.16.1 or later, you should respond to any abnormal activity warnings reported by Autonomous Ransomware Protection (ARP). In ONTAP 9.16.1, ARP changed to a machine learning/artificial intelligence (AI)-based model. Because of this change, any unresolved active warnings from the existing ARP in ONTAP 9.15.1 or earlier will be lost after upgrade.

Steps

1. Respond to any abnormal activity warnings reported by ARP and resolve any potential issues.
2. Confirm the resolution of these issues before upgrading by selecting **Update and Clear Suspect File Types** to record your decision and resume normal ARP monitoring.

Reboot SP or BMC to prepare for firmware update during an ONTAP upgrade

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.

Use the ONTAP CLI, the SP or the BMC to reboot.

CLI

1. Reboot the SP or BMC:

```
system service-processor reboot-sp -node <node_name>
```

SP

1. Reboot the SP:

```
sp reboot
```

BMC

1. Reboot the BMC:

```
bmc reboot
```

Only reboot one SP or BMC at a time. Wait for the rebooted SP or BMC to completely recycle before rebooting the next.

You can also update firmware manually in between ONTAP upgrades. If you have Digital Advisor, 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

Download the ONTAP software image before an upgrade

Before you upgrade ONTAP, you must first download the target ONTAP software image from the NetApp Support site. Depending on your ONTAP release, you can download the ONTAP software to an HTTPs, HTTP or FTP server on your network, or to a local folder.

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

About this task

- If you are performing an automated nondisruptive upgrade (ANDU) using a direct multi-hop upgrade path, you need to download the software package for both the intermediate ONTAP version and the target ONTAP version required for your upgrade. For example, if you are upgrading from ONTAP 9.8 to ONTAP 9.13.1, you must download the software packages for both ONTAP 9.12.1 and ONTAP 9.13.1. See supported upgrade paths to determine if your upgrade path requires you to download an intermediate software package.
- 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.
- You do not need to download a separate software package for your firmware. The firmware update for your cluster is included with the ONTAP software upgrade package and is copied to each node’s boot device. The new firmware is then installed as part of the upgrade process.

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.

ONTAP upgrade methods

ONTAP software upgrade methods

You can perform an automated upgrade of your ONTAP software using System Manager. Alternatively, you can perform an automated or manual upgrade using the ONTAP command line interface (CLI). The method you use to upgrade ONTAP depends on your configuration, your current ONTAP version, and the number of nodes in your cluster. NetApp recommends using System Manager to perform automated upgrades unless your configuration requires a different approach. For example, if you have a four-node MetroCluster configuration running ONTAP 9.3 or later, you should use System Manager to perform an automated upgrade (sometimes referred to as automated nondisruptive upgrade or ANDU).

> ⓘ If you are upgrading to ONTAP 9.15.1 or later through the NetApp Console, follow the upgrade procedure in the NetApp Console documentation.

An upgrade can be executed using the rolling upgrade process or the batch upgrade process. Both are nondisruptive.

For automated upgrades, 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 upgrade in the background based on the number of nodes. For manual upgrades, the administrator manually confirms that each node in the cluster is ready for upgrade, then performs steps to execute a rolling upgrade.

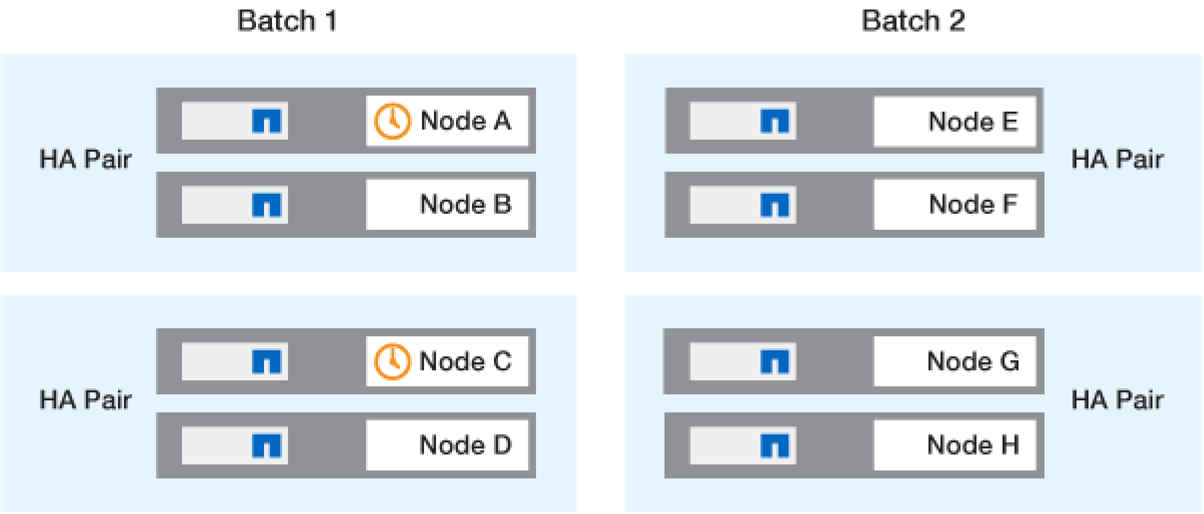
ONTAP rolling upgrades

The rolling upgrade process is the default for clusters with fewer than 8 nodes. In the rolling upgrade process, 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 on the partner node. Each additional HA pair is upgraded in sequence until all HA pairs are running the target release.

ONTAP batch upgrades

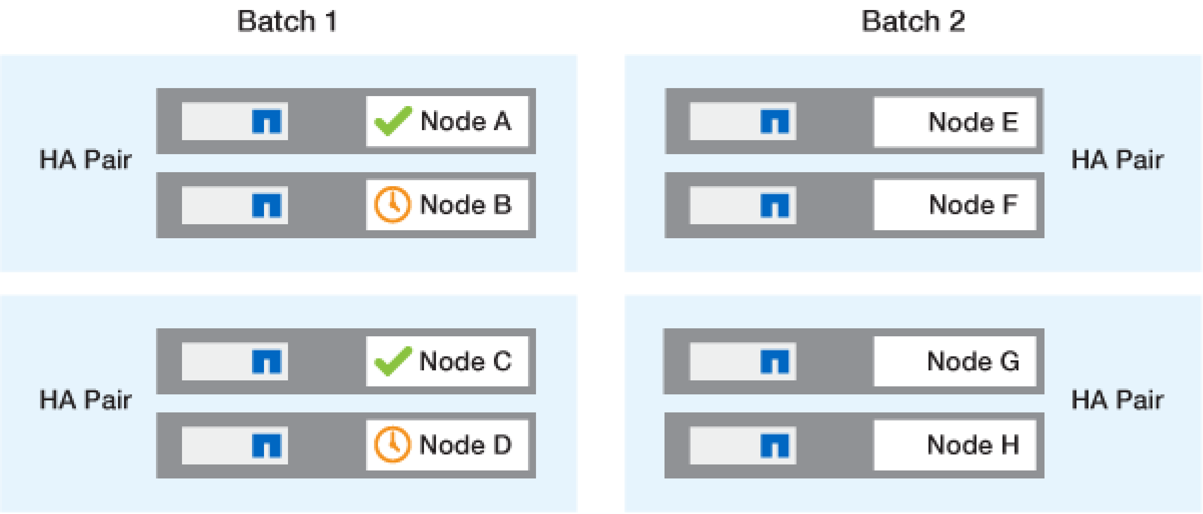
The batch upgrade process is the default for clusters of 8 nodes or more. In the batch upgrade process, the cluster is divided into two batches. Each batch contains multiple HA pairs. In the first batch, the first node of each HA pair is simultaneously upgraded with the first node of all other HA pairs in the batch.

In following example, there are two HA pairs in each batch. When the batch upgrade begins, Node A and Node C are upgraded simultaneously.



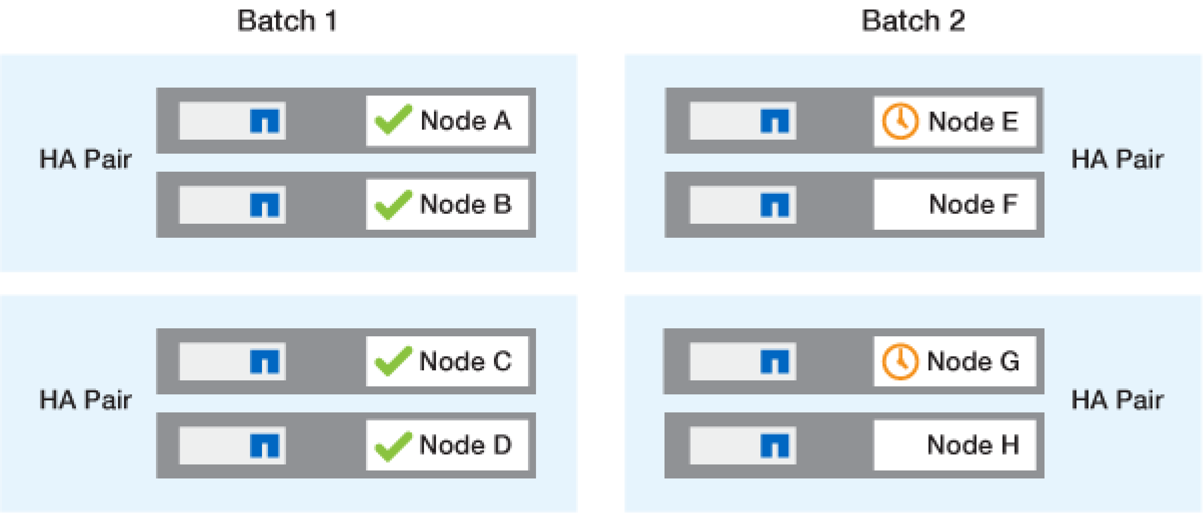
After the upgrade of the first nodes of each HA pair is complete, then the partner nodes in batch 1 are simultaneously upgraded.

In the following example, after Node A and Node C are upgraded, then Node B and Node D are simultaneously upgraded.



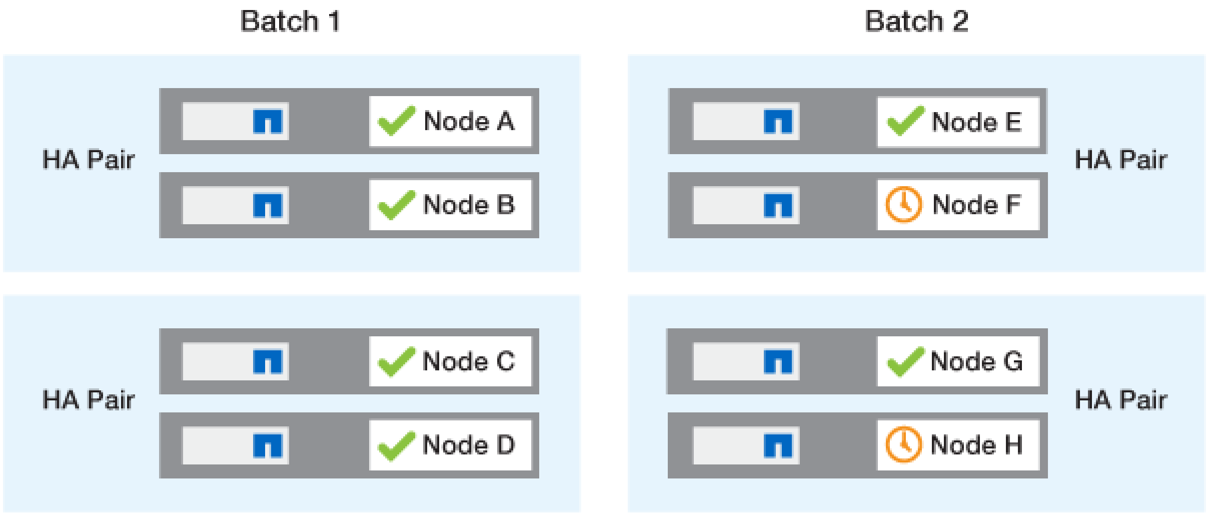
The process is then repeated for the nodes in batch 2; the first node of each HA pair is simultaneously upgraded with the first node of all other HA pairs in the batch.

In the following example, Node E and Node G are upgraded simultaneously.



After the upgrade of the first nodes of each HA pair is complete, then the partner nodes in batch 2 are simultaneously upgraded.

In the following example, Node F and Node H are simultaneously upgraded to complete the batch upgrade process.



Recommended ONTAP upgrade methods based on configuration

Upgrade methods supported by your configuration are listed in order of recommended usage.

Configuration	ONTAP version	Number of nodes	Recommended upgrade method
Standard	9.0 or later	2 or more	• Automated nondisruptive using System Manager • Automated nondisruptive using the CLI
Standard	9.0 or later	Single	Automated disruptive
MetroCluster	9.3 or later	8	• Automated nondisruptive using the CLI • Manual nondisruptive for 4 or 8 node MetroCluster using the CLI
MetroCluster	9.3 or later	2,4	• Automated nondisruptive using System Manager • Automated nondisruptive using the CLI
MetroCluster	9.2 or earlier	4, 8	Manual nondisruptive for 4 or 8 node MetroCluster using the CLI

Configuration	ONTAP version	Number of nodes	Recommended upgrade method
MetroCluster	9.2 or earlier	2	Manual nondisruptive for 2-node MetroCluster using the CLI

ANDU using System Manager is the recommended upgrade method for all patch upgrades regardless of configuration.

ⓘ A manual disruptive upgrade can be performed on any configuration. 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.

Install the ONTAP image with automated nondisruptive ONTAP upgrade

When you perform an automated upgrade, ONTAP automatically installs the target ONTAP image on each node, validates that the cluster can be upgraded successfully, and then executes either a batch or rolling upgrade in the background based on the number of nodes in the cluster.

If it is supported by your configuration, you should use System Manager to perform an automated upgrade. If your configuration does not support automated upgrade using System Manager, you can use the ONTAP command line interface (CLI) to perform an automated upgrade.

ⓘ If you are upgrading to ONTAP 9.15.1 or later through the NetApp, follow the upgrade procedure in the NetApp Console documentation.

ⓘ 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. Learn more about `storage failover modify-auto-giveback` in the ONTAP command reference.

Before you begin

- You should prepare for your upgrade.
- You should download the ONTAP software image for your target ONTAP release.

  If you are performing a direct multi-hop upgrade, you need to download both of the ONTAP images required for your specific upgrade path.
- For each HA pair, each node should have one or more ports on the same broadcast domain.

  If your ONTAP cluster has 8 or more nodes, the batch upgrade method is used in the automatic nondisruptive upgrade to preemptively force data LIF migration prior to SFO takeover. How LIFs are migrated during a batch upgrade varies based on your version of ONTAP.

If you are running ONTAP…	LIFs are migrated…
• 9.15.1 or later • 9.14.1P5 • 9.13.1P10 • 9.12.1P13 • 9.11.1P16, P17 • 9.10.1P19	To a node in the other batch group. If the migration to the other batch group fails, the LIFs are migrated to the node's HA partner in the same batch group.
9.8 through 9.14.1	To a node in the other batch group. If the network broadcast domain doesn't allow LIF migration to the other batch group, the LIF migration fails and ANDU pauses.
9.7 or earlier	To the HA partner of the node being upgraded. If the partner doesn't have any ports in the same broadcast domain, then LIF migration fails and ANDU pauses.

- If you are upgrading ONTAP in a MetroCluster FC configuration, the cluster should be enabled for automatic unplanned switchover.
- If you don't plan to monitor the progress of the upgrade process, you should request EMS notifications of errors that might require manual intervention.
- If you have an single-node cluster follow the automated-disruptive upgrade process.

  Upgrades of single-node clusters are disruptive.

Example 2. Steps

System Manager

1. Validate the ONTAP target image:

   > ⓘ If you are upgrading a MetroCluster configuration, you should validate Cluster A and then repeat the validation process on Cluster B.

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

If you are running…	Do this…
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**.

   b. In the right corner of the **Overview** pane, click ⋮.

   c. Click **ONTAP Update**.

   d. 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 a local folder You should have already downloaded the image to the local client.	i. Under **Available Software Images**, click **Add from Local**. ii. Browse to the location you saved the software image, select the image, and then click **Open**.
Add a new software image from an HTTP or FTP server	i. Click **Add from Server**. ii. In the **Add a New Software Image** dialog box, enter the URL of the HTTP or FTP server to which you downloaded the ONTAP software image from the NetApp Support Site. For anonymous FTP, you must specify the URL in the ftp://anonymous@ftpserver format. iii. Click **Add**.
Select an available image	Choose one of the listed images.

   e. Click **Validate** to run the pre-upgrade validation checks.

   If any errors or warnings are found during validation, they are displayed along with a list of corrective actions. You must resolve all errors before proceeding with the upgrade. It is best practice to also resolve warnings.

2. Click **Next**.
3. Click **Update**.

   Validation is performed again. Any remaining errors or warnings are displayed along with a list of corrective actions. Errors must be corrected before you can proceed with the upgrade. If the validation is completed with warnings, you correct the warnings or choose **Update with warnings**.

   > By default, ONTAP uses the batch upgrade process to upgrade clusters with eight or more nodes. Beginning with ONTAP 9.10.1, if preferred, you can select **Update one HA pair at a time** to override the default and have your cluster upgrade one HA pair at a time using the rolling upgrade process.

   For MetroCluster configurations with more than 2 nodes, the ONTAP upgrade process starts simultaneously on the HA pairs at both sites. For a 2-node MetroCluster configuration, the upgrade is started first on the site where the upgrade is not initiated. The upgrade on the remaining site begins after the first upgrade is fully completed.

4. If your upgrade pauses because of an error, click the error message to view the details, then correct the error and resume the upgrade.

After you finish

After the upgrade 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 should refresh your browser.

CLI

1. Validate the ONTAP target software image

   > If you are upgrading a MetroCluster configuration you should first execute the following steps on cluster A, then execute the same steps on cluster B.

   a. Delete the previous ONTAP software package:

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

   b. Load the target ONTAP software image into the cluster package repository:

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

   ```
   cluster1::> cluster image package get -url
   http://www.example.com/software/9.13.1/image.tgz

   Package download completed.
   Package processing completed.
   ```

   If you are performing a direct multi-hop upgrade, you also need to load the software package for the intermediate version of ONTAP required for your upgrade. For example, if you are upgrading from 9.8 to 9.13.1, you need to load the software package for ONTAP 9.12.1, and then use the same command to load the software package for 9.13.1.

c. 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
---------------- ------------------
9.13.1              MM/DD/YYYY 10:32:15
```

d. Execute the automated pre-upgrade checks:

```
cluster image validate -version <package_version_number>
```

If you are performing a direct multi-hop upgrade, you only need to use the target ONTAP package for verification. You don’t need to validate the intermediate upgrade image separately. For example, if you are upgrading from 9.8 to 9.13.1, use the 9.13.1 package for verification. You don’t need to validate the 9.12.1 package separately.

```
cluster1::> cluster image validate -version 9.13.1

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

e. Monitor the progress of the validation:

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

f. Complete all required actions identified by the validation.

g. If you are upgrading a MetroCluster configuration, repeat the above steps on cluster B.

2. Generate a software upgrade estimate:

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

ⓘ If you are upgrading a MetroCluster configuration, you can run this command on either Cluster A or Cluster B. You don’t need to run it on both clusters.

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

3. Perform the software upgrade:

   ```
   cluster image update -version <package_version_number>
   ```

   - If you are performing a direct multi-hop upgrade, use the target ONTAP version for the package_version_number. For example, if you are upgrading from ONTAP 9.8 to 9.13.1, use 9.13.1 as the package_version_number.
   - By default, ONTAP uses the batch upgrade process to upgrade clusters with eight or more nodes. If preferred, you can use the `-force-rolling` parameter to override the default process and have your cluster upgraded one node at a time using the rolling upgrade process.
   - 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.
   - For MetroCluster configurations with 4 nodes more, the automated upgrade starts simultaneously on the HA pairs at both sites. For a 2-node MetroCluster configuration, the upgrade starts on the site where the upgrade is not initiated. The upgrade on the remaining site begins after the first upgrade is fully completed.

   ```
   cluster1::> cluster image update -version 9.13.1

   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::>
   ```

4. 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.

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

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

```
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.
```

6. 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.

7. If you are upgrading a 2-node MetroCluster FC configuration, verify that the cluster is enabled for automatic unplanned switchover.

ⓘ If you are upgrading a standard configuration, a MetroCluster IP configuration, or a MetroCluster FC configuration greater than 2 nodes, you don’t need to perform this step.

   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:

```
metrocluster show
```

Resume ONTAP software upgrade after an error in the automated upgrade process

If an automated ONTAP software upgrade pauses because of an error, you should resolve the error and then continue the upgrade. After the error is resolved, you can choose to continue the automated upgrade process or complete the upgrade process manually. If you choose to continue the automated upgrade, don’t perform any of the upgrade steps manually.

Example 3. Steps

System Manager

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

If you are running…	Then…
ONTAP 9.8 or later	Click **Cluster** > **Overview**
ONTAP 9.7, 9.6, or 9.5	Click **Configuration** > **Cluster** > **Update**.
ONTAP 9.4 or earlier	• Click **Configuration** > **Cluster Update**. • In the right corner of the **Overview** pane, click the three blue vertical dots, and select **ONTAP Update**.

2. Continue the automated upgrade or cancel it and continue manually.

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

CLI

1. View the upgrade error:

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

2. Resolve the error.

3. Resume the upgrade:

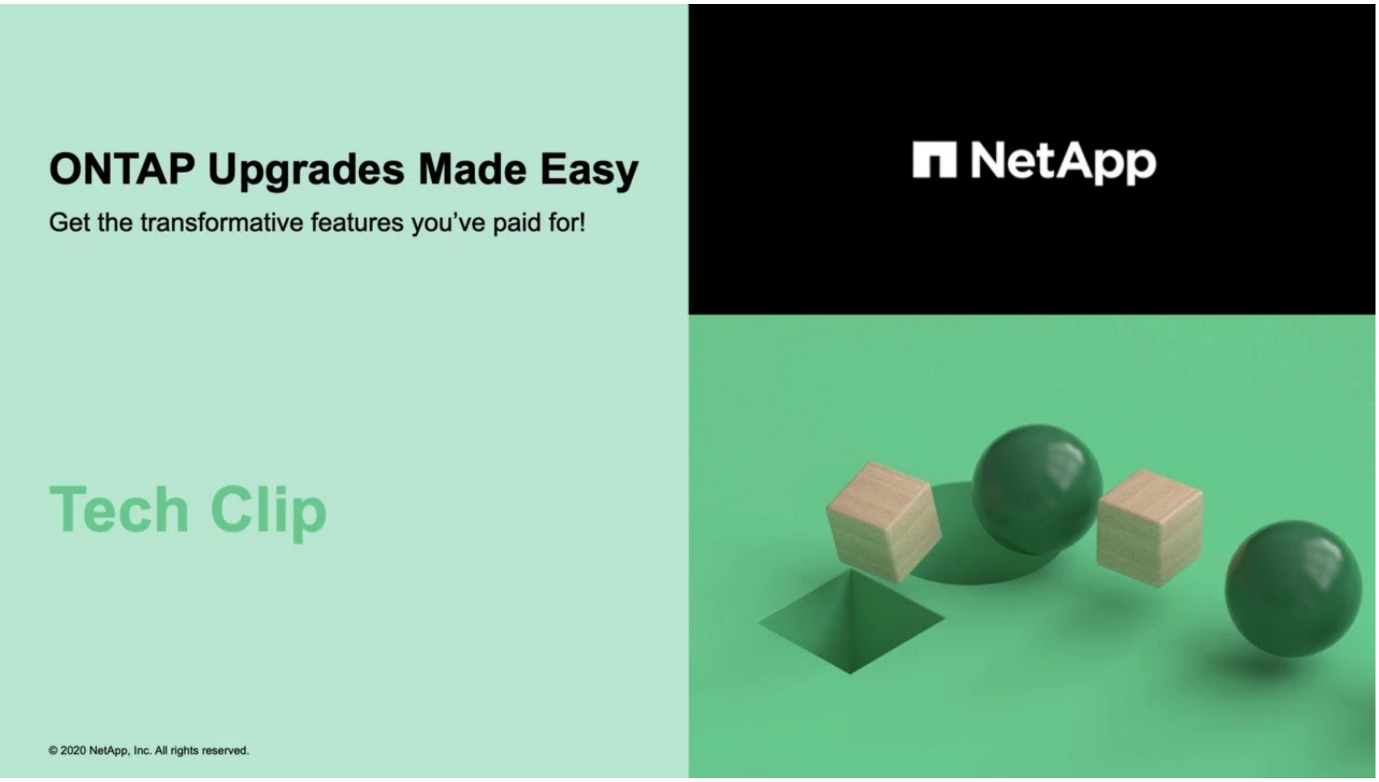
If you want to…	Enter the following command…
Resume the automated upgrade	`cluster image resume-update`
Cancel the automated upgrade and continue manually	`cluster image cancel-update`

After you finish

Perform post-upgrade checks.

Video: Upgrades made easy

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


ONTAP Upgrades Made Easy
Get the transformative features you've paid for!
Tech Clip
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Related information

- Launch Active IQ Digital Advisor
- Active IQ Digital Advisor documentation
- cluster image
- autosupport invoke
- metrocluster

Manual upgrades

Install the ONTAP software package for manual upgrades

After you have downloaded the ONTAP software package for a manual upgrade, you must install it locally before you begin your upgrade.

Steps

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

   The advanced prompt (`*>`) appears.

2. Install the image.

If you have the following configuration…	Use this command…
- Non-MetroCluster - 2-node MetroCluster	`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. Learn more about `system node image update` in the ONTAP command reference. This command installs the software image on all of the nodes simultaneously. To install the image on each node one at a time, do not specify the `-background` parameter.
- 4-node MetroCluster - 8-node MetroCluster configuration	`system node image update -node * -package <location> -replace -package true -background true -setdefault false` You must issue this command on both clusters. 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 installed on each node.

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

This command displays the current status of the software image 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 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.
```

Manual nondisruptive ONTAP upgrade using the CLI (standard configurations)

Automated upgrade using System Manager is the preferred upgrade method. If System Manger does not support your configuration, you can use the ONTAP command line interface (CLI) to perform a manual nondisruptive upgrade. 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.

Before you begin

You must have satisfied upgrade preparation requirements.

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 mixed version state longer than necessary.

Steps

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.

> 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
    ```

    Learn more about `network interface show` and parameters you can use to verify LIF status in the ONTAP command reference.

    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.

    > ⓘ 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.
    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.

> 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
```

Learn more about `network interface show` and parameters you can use to verify LIF status in the ONTAP command reference.

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.

A warning is displayed. You must enter `y` to continue.

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

> 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.
    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.
```

Learn more about `network port show` in the ONTAP command reference.

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:

```
set -privilege advanced
```

```
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.

    Learn more about `cluster show` and `cluster ring show` in the ONTAP command reference.

26. Return to the admin privilege level:

```
set -privilege admin
```

27. Upgrade any additional HA pairs.

Related information

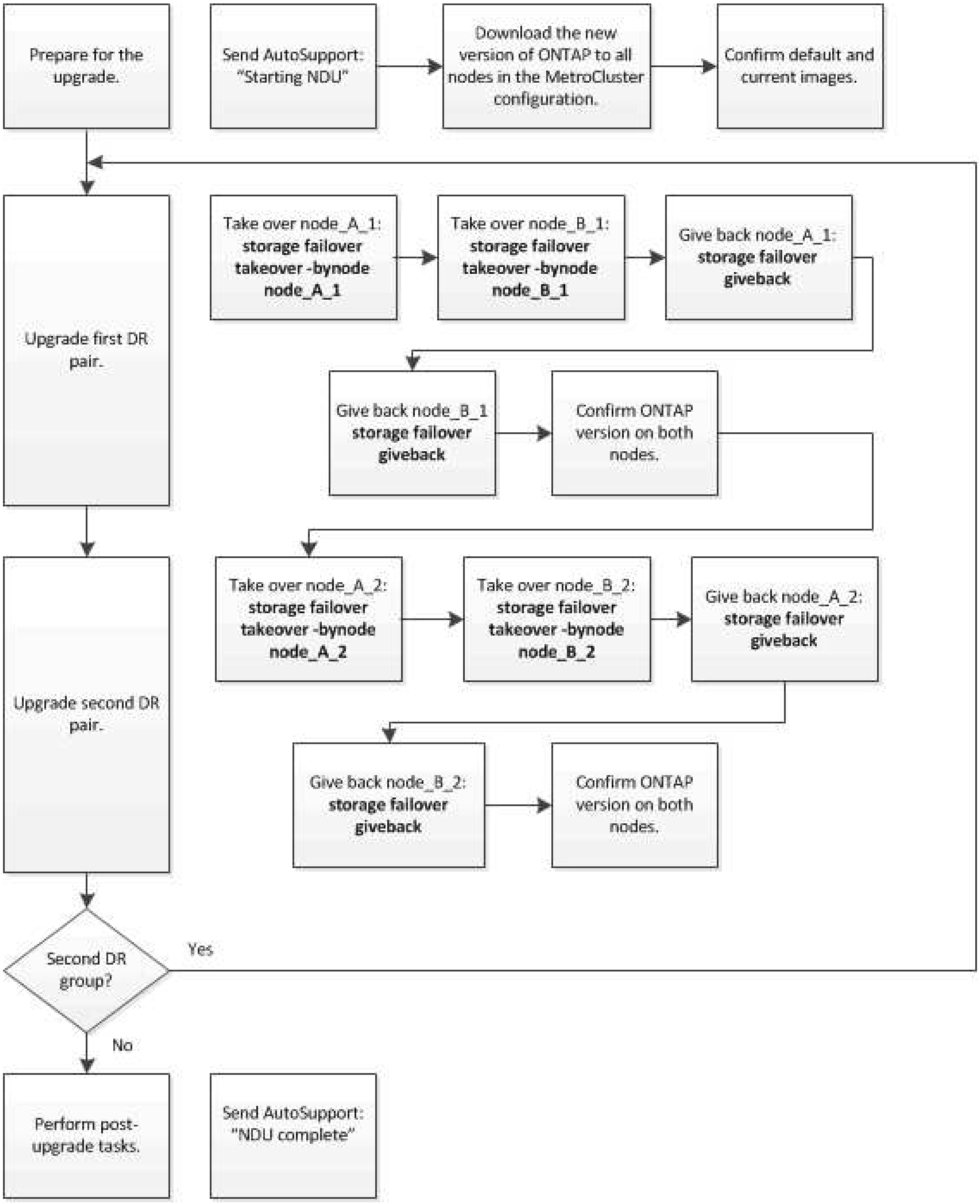
- autosupport invoke
- system image
- system node
- storage failover

- network interface
- network port show
- set -privilege advanced

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

A manual upgrade of 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 post-upgrade tasks.

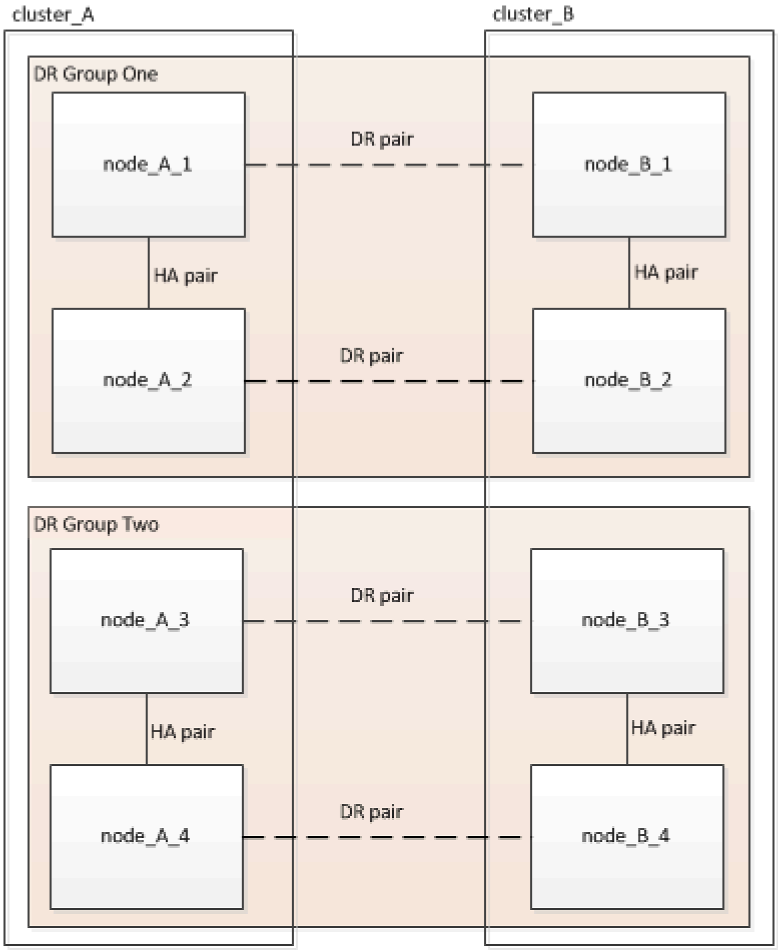
- This task applies to the following configurations:
  - Four-node MetroCluster FC or IP configurations running ONTAP 9.2 or earlier
  - Eight-node MetroCluster FC configurations, regardless of ONTAP version
- If you have a two-node MetroCluster configuration, do not use this procedure.
- The following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


Prepare for the upgrade.
Send AutoSupport: "Starting NDU"
Download the new version of ONTAP to all nodes in the MetroCluster configuration.
Confirm default and current images.
Upgrade first DR pair.
Take over node_A_1: storage failover takeover -bynode node_A_1
Take over node_B_1: storage failover takeover -bynode node_B_1
Give back node_A_1: storage failover giveback
Give back node_B_1 storage failover giveback
Confirm ONTAP version on both nodes.
Upgrade second DR pair.
Take over node_A_2: storage failover takeover -bynode node_A_2
Take over node_B_2: storage failover takeover -bynode node_B_2
Give back node_A_2: storage failover giveback
Give back node_B_2: storage failover giveback
Confirm ONTAP version on both nodes.
Second DR group?
Yes
No
Perform post-upgrade tasks.
Send AutoSupport: "NDU complete"

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

The MetroCluster software upgrade 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:



You upgrade one DR group at a time.

For four-node MetroCluster configurations:

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

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

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

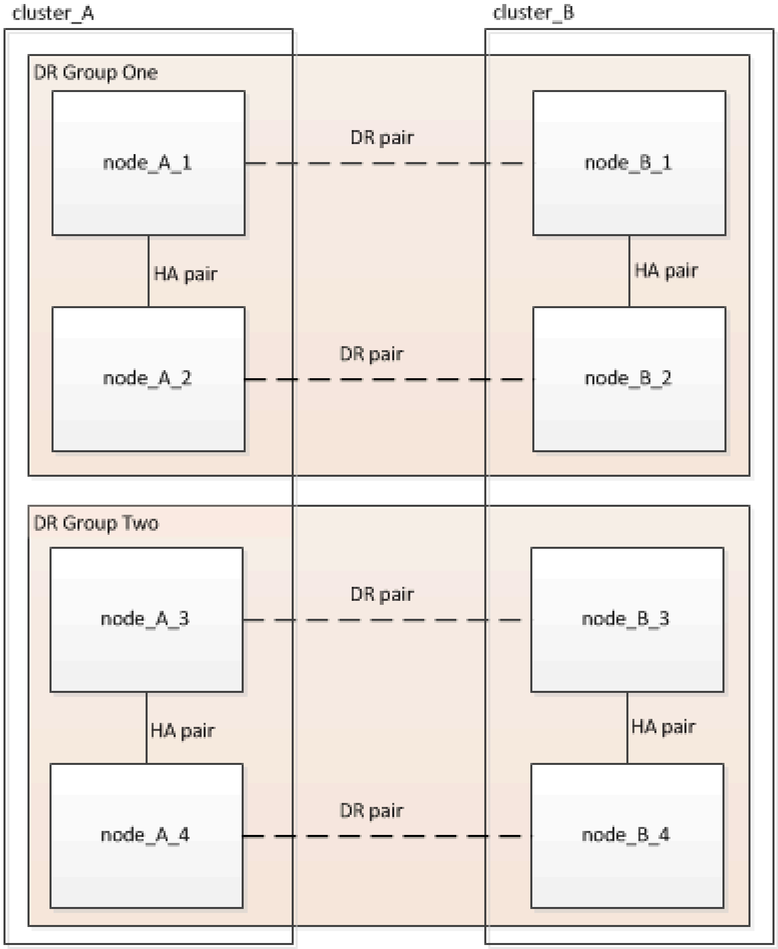
Preparing to upgrade a MetroCluster DR group

Before you upgrade the ONTAP software on the nodes, you must identify the DR relationships among the nodes, send an AutoSupport message that you are initiating an upgrade, 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 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::>
```

4. 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::>
```

5. Trigger an AutoSupport notification:

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

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

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

6. 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.

7. Verify that the target ONTAP software image is set as the default image 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.
```

a. Verify that the target ONTAP software image is set as the default image 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.
```

8. 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.

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 upgraded.

If you have upgraded the ONTAP software on the first DR group, and are now upgrading 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 and 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 upgraded.

If you have upgraded 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. Migrate all of the data LIFs away from the node:

   ```
   network interface migrate-all -node nodenameA
   ```

2. 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.
      ```

3. 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` 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, 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.

b. 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.
```

4. 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.

5. 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.

   a. Give back the aggregates to the DR partner on cluster_A:

      ```
      storage failover giveback -ofnode node_A_2
      ```

   b. 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.

6. 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.

7. 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.

8. 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.

9. Set the privilege level from admin to advanced, entering **y** when prompted to continue:

   ```
   set -privilege advanced
   ```

The advanced prompt (*>) appears.

10. 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::>
```

11. 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::>
```

12. 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.

13. 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.
```

Related information

- storage failover giveback
- storage failover modify
- storage failover show-giveback
- storage failover takeover

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

How you upgrade a two-node MetroCluster configuration varies based on your ONTAP version. If you are running ONTAP 9.2 or earlier, you should use this procedure to perform a manual nondisruptive upgrade which includes 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.

If you have a two-node MetroCluster configuration running ONTAP 9.3 or later, perform an automated upgrade using System Manager.

Steps

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 show
    ```

    ```
    metrocluster check config-replication show
    ```

```
metrocluster 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.

After you finish

Perform any post-upgrade tasks.

Related information

MetroCluster Disaster recovery

Manual disruptive ONTAP 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 download and install the software image.
- 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.

Steps

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.

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, set the privilege level to advanced:

```
set -privilege advanced
```

Enter **y** when prompted to continue

7. 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.
```

8. 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
   ```

9. Repeat Steps 5 through 8 for each additional node.
10. 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
```

11. If the cluster consists of only two nodes, enable cluster high availability:

```
cluster ha modify -configured true
```

Related information

- storage failover modify

What to do after an ONTAP upgrade

What to do after an ONTAP upgrade

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

1. Verify your cluster.

   After you upgrade ONTAP, 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.

2. Verify that all LIFs are on home ports.

   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.

3. Verify special considerations specific to your cluster.

   If certain configurations exist on your cluster, you might need to perform additional steps after you upgrade.

4. Update the Disk Qualification Package (DQP).

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

Verify your cluster after ONTAP upgrade

After you upgrade ONTAP, verify the cluster version, cluster health, and storage health. For MetroCluster FC configurations, also verify that the cluster is enabled for automatic unplanned switchover.

Verify cluster version

After all 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. Change to advanced privilege level:

   ```
   set -privilege advanced
   ```

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

```
system node image show -version
```

3. If the cluster version is not the target ONTAP release, you should 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. 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`

Learn more about `cluster ring show` in the ONTAP command reference.

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.
```

3. If you are operating in a SAN environment, verify that each node is in a SAN quorum:

```
cluster kernel-service show
```

```
cluster1::*> cluster kernel-service show
Master            Cluster           Quorum        Availability
Operational
Node              Node              Status        Status        Status
----------------- ----------------- ------------- -------------
-------------
cluster1-01       cluster1-01       in-quorum     true
operational
                  cluster1-02       in-quorum     true
operational
2 entries were displayed.
```

4. Return the privilege level to admin:

```
set -privilege admin
```

Related information

System administration

Verify automatic unplanned switchover is enabled (MetroCluster FC configurations only)

If your cluster is in a MetroCluster FC configuration, you should verify that automatic unplanned switchover is enabled after you upgrade ONTAP.

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:

```
metrocluster show
```

Related information

Disk and aggregate management

Verify all LIFS are on home ports after ONTAP upgrade

During the reboot that occurs as part of the ONTAP upgrade process, some LIFs might be migrated from their home ports to their assigned failover ports. After an upgrade, you need to enable and revert any LIFs that are not on their home ports.

Steps

1. Display the status of all LIFs:

```
network interface show -fields home-port,curr-port
```

If **Status Admin** is "down" or **Is home** is "false" for any LIFs, continue with the next step.

2. Enable the data LIFs:

```
network interface modify {-role data} -status-admin up
```

3. Revert LIFs to their home ports:

```
network interface revert *
```

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.
```

Related information

- network interface

Special configurations

Check for specific ONTAP configurations after an upgrade

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

Ask yourself…	If your answer is yes, then do this…
Did I upgrade from ONTAP 9.7 or earlier to ONTAP 9.8 or later?	Verify your network configuration Remove the EMS LIF service from network service policies that do not provide reachability to the EMS destination
Is my cluster in a a MetroCluster configuration?	Verify your networking and storage status
Do I have a SAN configuration?	Verify your SAN configuration
Did I upgrade from ONTAP 9.3 or earlier, and am using NetApp Storage Encryption?	Reconfigure KMIP server connections
Do I have load-sharing mirrors?	Relocate moved load-sharing mirror source volumes
Do I have user accounts for Service Processor (SP) access that were created prior to ONTAP 9.9.1?	Verify the change in accounts that can access the Service Processor

Verify your ONTAP networking configuration after an upgrade

After you upgrade from ONTAP 9.7x or earlier to ONTAP 9.8 or later, you should verify your network configuration. After the upgrade, ONTAP automatically monitors layer 2 reachability.

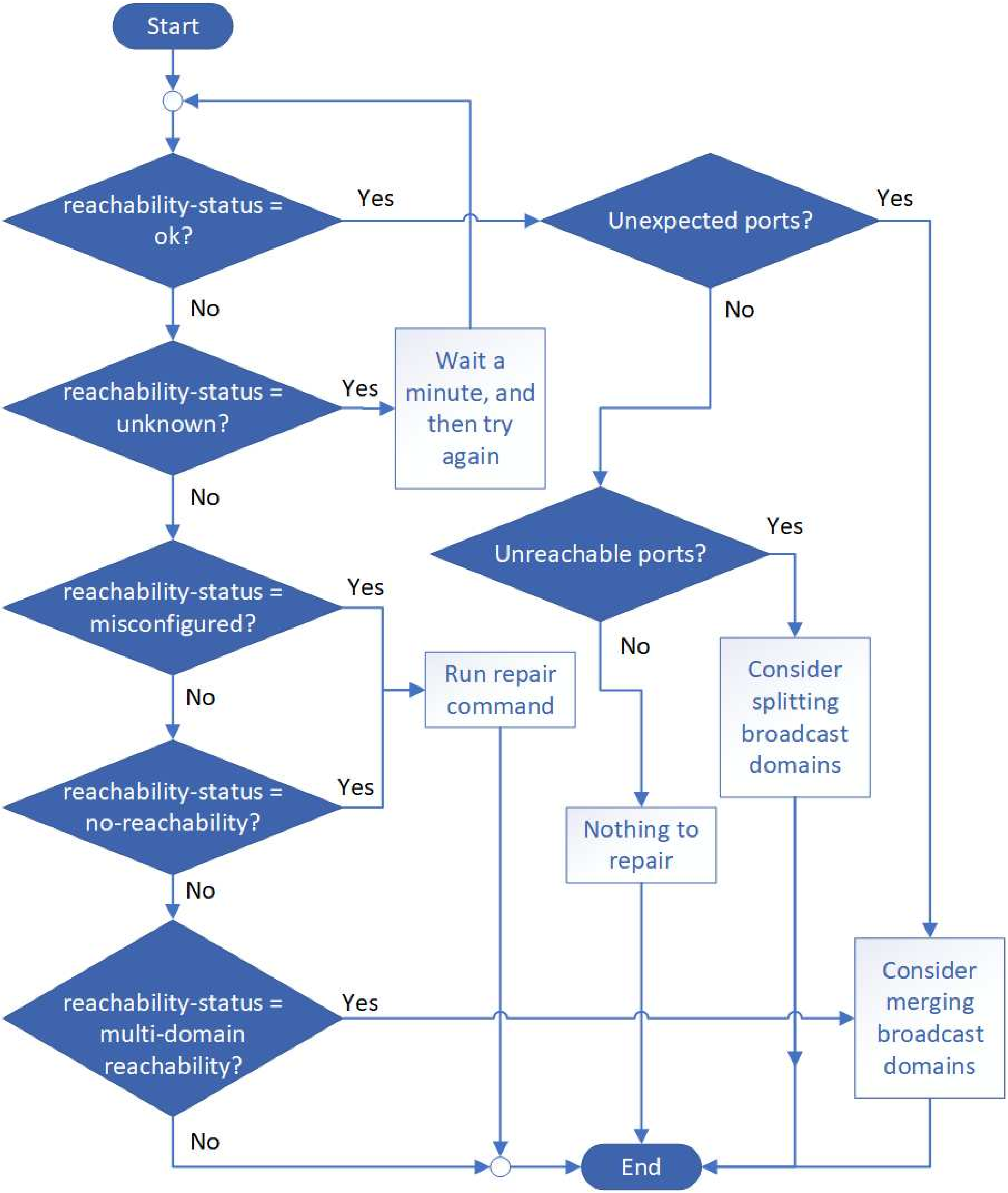
Step

1. Verify each port has reachability to its expected broadcast domain:

   ```
   network port reachability show -detail
   ```

   Learn more about `network port reachability show` in the ONTAP command reference.

The command output contains reachability results. Use the following decision tree and table to understand the reachability results (reachability-status) and determine what, if anything, to do next.



Start
reachability-status = ok?
Yes
Unexpected ports?
Yes
No
No
Wait a minute, and then try again
reachability-status = unknown?
Yes
No
Unreachable ports?
Yes
reachability-status = misconfigured?
Yes
No
No
Run repair command
Consider splitting broadcast domains
reachability-status = no-reachability?
Yes
Nothing to repair
No
Consider merging broadcast domains
reachability-status = multi-domain reachability?
Yes
No
End

reachability-status	Description

ok	The port has layer 2 reachability to its assigned broadcast domain. If the reachability-status is "ok", but there are "unexpected ports", consider merging one or more broadcast domains. For more information, see Merge broadcast domains. If the reachability-status is "ok", but there are "unreachable ports", consider splitting one or more broadcast domains. For more information, see Split broadcast domains. If the reachability-status is "ok", and there are no unexpected or unreachable ports, your configuration is correct.
misconfigured-reachability	The port does not have layer 2 reachability to its assigned broadcast domain; however, the port does have layer 2 reachability to a different broadcast domain. You can repair the port reachability. When you run the following command, the system will assign the port to the broadcast domain to which it has reachability: `network port reachability repair -node -port` For more information, see Repair port reachability. Learn more about `network port reachability repair` in the ONTAP command reference.
no-reachability	The port does not have layer 2 reachability to any existing broadcast domain. You can repair the port reachability. When you run the following command, the system will assign the port to a new automatically created broadcast domain in the Default IPspace: `network port reachability repair -node -port` For more information, see Repair port reachability.
multi-domain-reachability	The port has layer 2 reachability to its assigned broadcast domain; however, it also has layer 2 reachability to at least one other broadcast domain. Examine the physical connectivity and switch configuration to determine if it is incorrect or if the port's assigned broadcast domain needs to be merged with one or more broadcast domains. For more information, see Merge broadcast domains or Repair port reachability.
unknown	If the reachability-status is "unknown", then wait a few minutes and try the command again.

After you repair a port, you need to check for and resolve displaced LIFs and VLANs. If the port was part of an interface group, you also need to understand what happened to that interface group. For more information, see Repair port reachability.

Remove EMS LIF service from network service policies after an ONTAP upgrade

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 EMS LIF service, is added to all existing service policies in admin SVMs. This allows EMS messages to be sent from any of the LIFs associated with the service policies. 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 policies that do not provide reachability to the destination.

Learn more about ONTAP LIFs and service policies.

Steps

1. Identify the LIFs and associated network service policies 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 policies:

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

   Learn more about `network interface service-policy remove-service` in the ONTAP command reference.

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
   ```

Verify network and storage status for MetroCluster configurations after an ONTAP upgrade

After you upgrade an ONTAP cluster 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 NetApp Knowledge Base: Volume Showing WAFL Inconsistent on how to address the inconsistent volumes.

Verify the SAN configuration after an ONTAP upgrade

After an ONTAP upgrade, in a SAN environment, 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. If you are running ONTAP 9.11.1 or later, use System Manager to view the connection status as it gives a much clearer display than CLI.

System Manager

1. In System Manager, click **Hosts > SAN Initiator Groups**.

   The page displays a list of initiator groups (igroups). If the list is large, you can view additional pages of the list by clicking the page numbers at the lower right corner of the page.

   The columns display various information about the igroups. Beginning with 9.11.1, the connection status of the igroup is also displayed. Hover over status alerts to view details.

CLI

- List iSCSI initiators:

  ```
  iscsi initiator show -fields igroup,initiator-name,tpgroup
  ```

- List FC initiators:

  ```
  fcp initiator show -fields igroup,wwpn,lif
  ```

Reconfigure KMIP server connections after an upgrade from ONTAP 9.2 or earlier

After you upgrade from ONTAP 9.2 or earlier to ONTAP 9.3 or later, you need to reconfigure any external key management (KMIP) server connections.

Steps

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
```

   Set a passphrase with at least 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>
```

   ⓘ Use 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. Otherwise, use the same authentication key for both.

Related information

- security key-manager setup
- storage encryption disk modify

Relocate moved load-sharing mirror source volumes after an ONTAP upgrade

After you upgrade ONTAP, you need to move load-sharing mirror source volumes back to their pre-upgrade locations.

Steps

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:

```
volume move start
```

Change in user accounts that can access the Service Processor after an ONTAP upgrade

If you created user accounts in ONTAP 9.8 or earlier 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.

Update the Disk Qualification Package after an ONTAP upgrade

After you upgrade your ONTAP software, you should download and install the ONTAP Disk Qualification Package (DQP). The DQP is not updated as part of an ONTAP upgrade.

The DQP contains the proper parameters for ONTAP interaction with all newly qualified drives. If your version of the DQP does not contain information for a newly qualified drive, ONTAP will not have the information to properly configure the drive.

It is best practice to update the DQP every quarter. You should also update the DQP for the following reasons:

- Whenever you add a new drive type or size to a node in your cluster

  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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