



Set up, upgrade and revert ONTAP

ONTAP 9

NetApp
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Table of Contents

- Set up, upgrade and revert ONTAP software and firmware 1
 - Set up ONTAP 1
 - Upgrade ONTAP 18
 - Firmware and system updates 158
 - Revert ONTAP 164

Set up, upgrade and revert ONTAP software and firmware

Set up ONTAP

Get started with ONTAP cluster set up

You can use System Manager or the ONTAP command line interface (CLI) to set up new ONTAP clusters. Before you begin, you should gather the information you'll need to complete the cluster setup, such as your cluster management interface port and IP address.

NetApp recommends that you [use System Manager to set up new clusters](#). System Manager provides a simple and easy workflow for cluster set up and configuration including assigning a node management IP address, initializing the cluster, creating a local tier, configuring protocols and provisioning initial storage.

It is only necessary to [use the ONTAP CLI to set up your cluster](#) if you are running ONTAP 9.7 or earlier on a MetroCluster configuration. Beginning in ONTAP 9.13.1, on the AFF A800 and FAS8700 platforms, you can also use the ONTAP CLI to create and configure new clusters in IPv6-only networking environments. If you need to use IPv6 in ONTAP 9.13.0 and earlier, or on other platforms in ONTAP 9.13.1 and later, you can use System Manager to create new clusters using IPv4 and then [convert to IPv6](#).

What you'll need for cluster set up

Setting up the cluster involves gathering the information needed to configure setting up each node, creating the cluster on the first node, and joining any remaining nodes to the cluster.

Get started by gathering all the relevant information in the cluster setup worksheets.

The cluster setup worksheet enables you to record the values that you need during the cluster setup process. If a default value is provided, you can use that value or else enter your own.

System defaults

The system defaults are the default values for the private cluster network. It is best to use these default values. However, if they do not meet your requirements, you can use the table to record your own values.



For clusters configured to use network switches, each cluster switch must use the 9000 MTU size.

Types of information	Your values
Private cluster network ports	
Cluster network netmask	

Types of information	Your values
<p>Cluster interface IP addresses (for each cluster network port on each node)</p> <p>The IP addresses for each node must be on the same subnet.</p>	

Cluster information


Types of information	Your values
<p>Cluster name</p> <p>The name must begin with a letter, and it must be fewer than 44 characters. The name can include the following special characters:</p> <p>. - _</p>	

Feature license keys

You can find license keys for your initial or add-on software orders at the NetApp Support Site under **My Support > Software Licenses**.

Types of information	Your values
Feature license keys	

Admin storage virtual machine (SVM)

Types of information	Your values
<p>Cluster administrator password</p> <p>The password for the admin account that the cluster requires before granting cluster administrator access to the console or through a secure protocol.</p> <div>  <p>For security purposes, recording passwords in this worksheet is not recommended.</p> </div> <p>The default rules for passwords are as follows:</p> <ul style="list-style-type: none"> • A password must be at least eight characters long. • A password must contain at least one letter and one number. 	

Types of information	Your values
<p>Cluster management interface port</p> <p>The physical port that is connected to the data network and enables the cluster administrator to manage the cluster.</p>	
<p>Cluster management interface IP address</p> <p>A unique IPv4 or IPv6 address for the cluster management interface. The cluster administrator uses this address to access the admin SVM and manage the cluster. Typically, this address should be on the data network.</p> <p>You can obtain this IP address from the administrator responsible for assigning IP addresses in your organization.</p> <p>Example: 192.0.2.66</p>	
<p>Cluster management interface netmask (IPv4)</p> <p>The subnet mask that defines the range of valid IPv4 addresses on the cluster management network.</p> <p>Example: 255.255.255.0</p>	
<p>Cluster management interface netmask length (IPv6)</p> <p>If the cluster management interface uses an IPv6 address, then this value represents the prefix length that defines the range of valid IPv6 addresses on the cluster management network.</p> <p>Example: 64</p>	
<p>Cluster management interface default gateway</p> <p>The IP address for the router on the cluster management network.</p>	
<p>DNS domain name</p> <p>The name of your network's DNS domain.</p> <p>The domain name must consist of alphanumeric characters. To enter multiple DNS domain names, separate each name with either a comma or a space.</p>	

Types of information	Your values
<p>Name server IP addresses</p> <p>The IP addresses of the DNS name servers. Separate each address with either a comma or a space.</p>	

Node information (for each node in the cluster)

Types of information	Your values
<p>Physical location of the controller (optional)</p> <p>A description of the physical location of the controller. Use a description that identifies where to find this node in the cluster (for example, "Lab 5, Row 7, Rack B").</p>	
<p>Node management interface port</p> <p>The physical port that is connected to the node management network and enables the cluster administrator to manage the node.</p>	
<p>Node management interface IP address</p> <p>A unique IPv4 or IPv6 address for the node management interface on the management network. If you defined the node management interface port to be a data port, then this IP address should be a unique IP address on the data network.</p> <p>You can obtain this IP address from the administrator responsible for assigning IP addresses in your organization.</p> <p>Example: 192.0.2.66</p>	
<p>Node management interface netmask (IPv4)</p> <p>The subnet mask that defines the range of valid IP addresses on the node management network.</p> <p>If you defined the node management interface port to be a data port, then the netmask should be the subnet mask for the data network.</p> <p>Example: 255.255.255.0</p>	

Types of information	Your values
<p>Node management interface netmask length (IPv6)</p> <p>If the node management interface uses an IPv6 address, then this value represents the prefix length that defines the range of valid IPv6 addresses on the node management network.</p> <p>Example: 64</p>	
<p>Node management interface default gateway</p> <p>The IP address for the router on the node management network.</p>	

NTP server information

Types of information	Your values
<p>NTP server addresses</p> <p>The IP addresses of the Network Time Protocol (NTP) servers at your site. These servers are used to synchronize the time across the cluster.</p>	

Configure ONTAP on a new cluster with System Manager

System Manager provides a simple and easy workflow for setting up a new cluster and configuring your storage.

In some cases, such as certain MetroCluster deployments or clusters that require IPv6 network addressing, you might need to use the ONTAP CLI to set up a new cluster. Click [here](#) for more details about these requirements, as well as steps for cluster setup with the ONTAP CLI.

Before you begin

- You should have installed, cabled and powered on your new storage system according to the installation and setup instructions for your platform model.
See the [AFF and FAS documentation](#).
- Cluster network interfaces should be configured on each node of the cluster for intra-cluster communication.
- You should be aware of the following System Manager support requirements:
 - When you set up node management manually using the CLI, System Manager supports only IPv4 and does not support IPv6. However, if you launch System Manager after completing your hardware setup using DHCP with an auto assigned IP address and with Windows discovery, System Manager can configure an IPv6 management address.

In ONTAP 9.6 and earlier, System Manager does not support deployments that require IPv6 networking.

- MetroCluster setup support is for MetroCluster IP configurations with two nodes at each site.

In ONTAP 9.7 and earlier, System Manager does not support new cluster setup for MetroCluster configurations.



Assign a node-management IP address

Windows System

You should connect your Windows computer to the same subnet as the controllers. This will automatically assign a node-management IP address to your system.

Step

1. From the Windows system, open the **Network** drive to discover the nodes.
2. Double-click the node to launch the cluster setup wizard.

Other systems

You should configure the node-management IP address for one of the nodes in your cluster. You can use this node-management IP address to launch the cluster set up wizard.

See [Creating the cluster on the first node](#) for information about assigning a node-management IP address.

Initialize the cluster

You initialize the cluster by setting an administrative password for the cluster and setting up the cluster management and node management networks. You can also configure services like a DNS server to resolve host names and an NTP server to synchronize time.

Steps

1. On a web browser, enter the node-management IP address that you have configured: "https://node-management-IP"

System Manager automatically discovers the remaining nodes in the cluster.

2. Initialize the storage system by configuring the cluster management network and node management IP addresses for all the nodes.

Create your local tier

Create local tiers from the available disks or SSDs in your nodes. System Manager automatically calculates the best tier configuration based on your hardware.

Steps

1. Click **Dashboard** and then click **Prepare Storage**.

Accept the storage recommendation for your local tier.

Configure protocols

Depending on the licenses enabled on your cluster, you can enable the desired protocols on your cluster. You then create network interfaces using which you can access the storage.

Steps

1. Click **Dashboard** and then click **Configure Protocols**.
 - Enable iSCSI or FC for SAN access.
 - Enable NFS or SMB for NAS access.
 - Enable NVMe for FC-NVMe access.

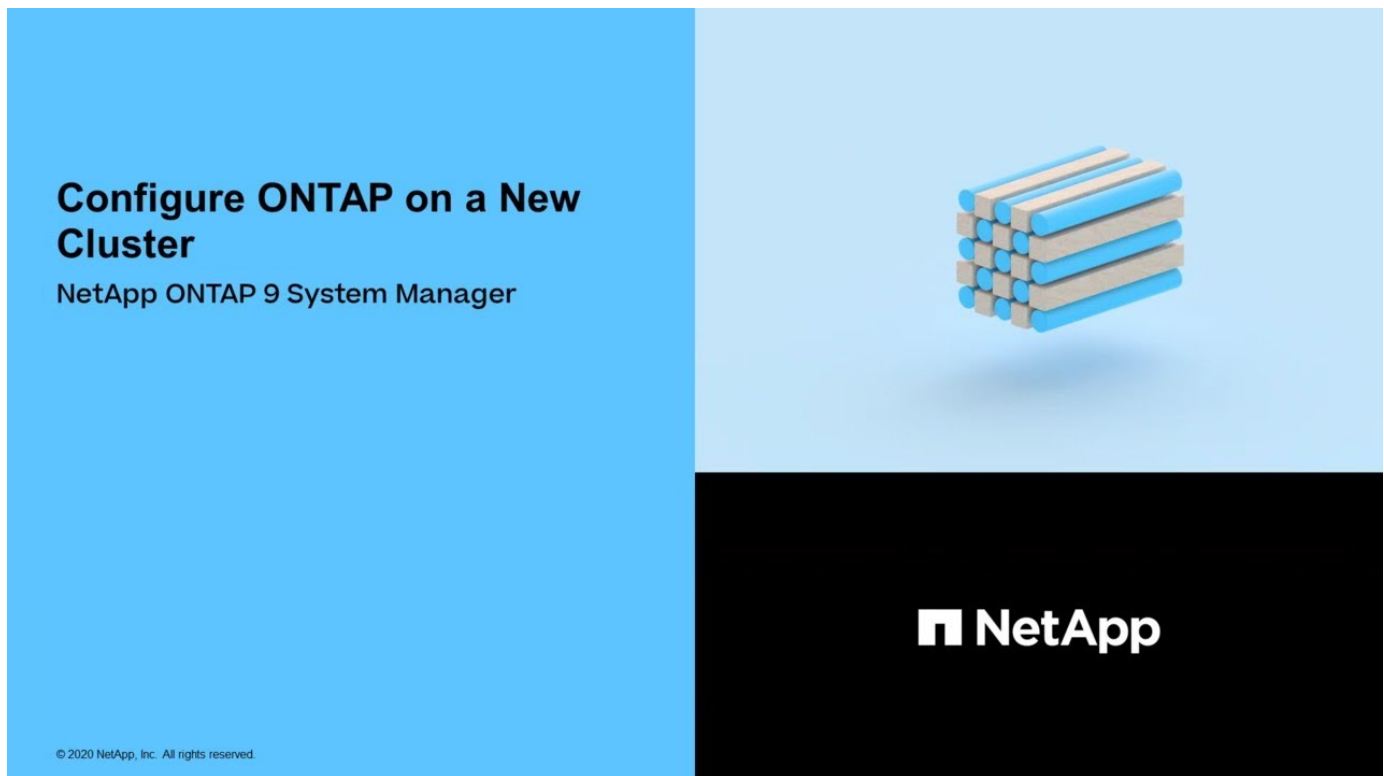
Provision Storage

After configuring protocols, you can provision storage. The options you see depend on the licenses that are installed.

Steps

1. Click **Dashboard** and then click **Provision Storage**.
 - To [provision SAN access](#), click **Add LUNs**.
 - To [provision NAS access](#), click **Add Volumes**.
 - To [provision NVMe storage](#), click **Add Namespaces**.

Configure ONTAP on a new cluster video



Set up a cluster with the CLI

Create the cluster on the first node

You use the Cluster Setup wizard to create the cluster on the first node. The wizard helps you to configure the cluster network that connects the nodes, create the cluster admin storage virtual machine (SVM), add feature license keys, and create the node management interface for the first node.

Before you begin

- You should have installed, cabled and powered on your new storage system according to the installation and setup instructions for your platform model.
See the [AFF and FAS documentation](#).
- Cluster network interfaces should be configured on each node of the cluster for intra-cluster communication.
- If you are configuring IPv6 on your cluster, IPv6 should be configured on the Base Management Controller (BMC) so that you can access the system using SSH.

Steps

1. Power on all the nodes you are adding to the cluster. This is required to enable discovery for your cluster setup.
2. Connect to the console of the first node.

The node boots, and then the Cluster Setup wizard starts on the console.

```
Welcome to the cluster setup wizard....
```

3. Acknowledge the AutoSupport statement.

```
Type yes to confirm and continue {yes}: yes
```



AutoSupport is enabled by default.

4. Follow the instructions on the screen to assign an IP address to the node.

Beginning in ONTAP 9.13.1, you can assign IPv6 addresses for management LIFs on A800 and FAS8700 platforms. For ONTAP releases earlier than 9.13.1, or for 9.13.1 and later on other platforms, you must assign IPv4 addresses for management LIFs, then convert to IPv6 after you complete cluster setup.

5. Press **Enter** to continue.

```
Do you want to create a new cluster or join an existing cluster?  
{create, join}:
```

6. Create a new cluster: `create`
7. Accept the system defaults or enter your own values.
8. After setup is completed, log in to the cluster and verify that the cluster is active and the first node is

healthy by entering the ONTAP CLI command: `cluster show`

The following example shows a cluster in which the first node (cluster1-01) is healthy and eligible to participate:

```
cluster1::> cluster show
Node                               Health  Eligibility
-----
cluster1-01                       true    true
```

You can access the Cluster Setup wizard to change any of the values you entered for the admin SVM or node SVM by using the `cluster setup` command.

After you finish

If needed, [convert from IPv4 to IPv6](#).

Join remaining nodes to the cluster

After creating a new cluster, you use the Cluster Setup wizard to join each remaining node to the cluster one at a time. The wizard helps you to configure each node's node management interface.

When you join two nodes in a cluster, you are creating a high availability (HA) pair. If you join 4 nodes, you create two HA pairs. To learn more about HA, see [Learn about HA](#).

You can only join one node to the cluster at a time. When you start to join a node to the cluster, you must complete the join operation for that node, and the node must be part of the cluster before you can start to join the next node.

Best Practice: If you have a FAS2720 with 24 or fewer NL-SAS drives, you should verify that the storage configuration default is set to active/passive to optimize performance.

For more information, see [Setting up an active-passive configuration on nodes using root-data partitioning](#)

1. Log in to the node you plan to join in the cluster.

Cluster Setup wizard starts on the console.

```
Welcome to the cluster setup wizard....
```

2. Acknowledge the AutoSupport statement.



AutoSupport is enabled by default.

```
Type yes to confirm and continue {yes}: yes
```

3. Follow the instructions on the screen to assign an IP address to the node.

Beginning in ONTAP 9.13.1, you can assign IPv6 addresses for management LIFs on A800 and FAS8700 platforms. For ONTAP releases earlier than 9.13.1, or for 9.13.1 and later on other platforms, you must assign IPv4 addresses for management LIFs, then convert to IPv6 after you complete cluster setup.

4. Press **Enter** to continue.

```
Do you want to create a new cluster or join an existing cluster?
{create, join}:
```

5. Join the node to the cluster: `join`
6. Follow the instructions on the screen to set up the node and join it to the cluster.
7. After setup is completed, verify that the node is healthy and eligible to participate in the cluster: `cluster show`

The following example shows a cluster after the second node (cluster1-02) has been joined to the cluster:

```
cluster1::> cluster show
Node                               Health  Eligibility
-----
cluster1-01                       true    true
cluster1-02                       true    true
```

You can access the Cluster Setup wizard to change any of the values you entered for the admin SVM or node SVM by using the cluster setup command.

8. Repeat this task for each remaining node.

After you finish

If needed, [convert from IPv4 to IPv6](#).

Convert management LIFs from IPv4 to IPv6

Beginning in ONTAP 9.13.1, you can assign IPv6 addresses to management LIFs on A800 and FAS8700 platforms during the initial cluster setup. For ONTAP releases earlier than 9.13.1, or for 9.13.1 and later on other platforms, you must first assign IPv4 addresses to management LIFs, and then convert to IPv6 addresses after you complete cluster setup.

Steps

1. Enable IPv6 for the cluster:

```
network options ipv6 modify -enable true
```

2. Set privilege to advanced:

```
set priv advanced
```

3. View the list of RA prefixes learned on various interfaces:

```
network ndp prefix show
```

4. Create an IPv6 management LIF:

Use the format `prefix::id` in the address parameter to construct the IPv6 address manually.

```
network interface create -vserver <svm_name> -lif <LIF> -home-node  
<home_node> -home-port <home_port> -address <IPv6prefix::id> -netmask  
-length <netmask_length> -failover-policy <policy> -service-policy  
<service_policy> -auto-revert true
```

5. Verify that the LIF was created:

```
network interface show
```

6. Verify that the configured IP address is reachable:

```
network ping6
```

7. Mark the IPv4 LIF as administratively down:

```
network interface modify -vserver <svm_name> -lif <lif_name> -status  
-admin down
```

8. Delete the IPv4 management LIF:

```
network interface delete -vserver <svm_name> -lif <lif_name>
```

9. Confirm that the IPv4 management LIF is deleted:

```
network interface show
```

Check your cluster with Active IQ Config Advisor

After you have joined all the nodes to your new cluster, you should run Active IQ Config

Advisor to validate your configuration and check for common configuration errors.

Config Advisor is a web-based application that you install on your laptop, virtual machine or a server, and works across Windows, Linux, and Mac platforms.

Config Advisor runs a series of commands to validate your installation and check the overall health of the configuration, including the cluster and storage switches.

1. Download and install Active IQ Config Advisor.

[Active IQ Config Advisor](#)

2. Launch Active IQ, and set up a passphrase when prompted.
3. Review your settings and click **Save**.
4. On the **Objectives** page, click **ONTAP Post-Deployment Validation**.
5. Choose either Guided or Expert mode.

If you choose Guided mode, connected switches are discovered automatically.

6. Enter the cluster credentials.
7. (Optional) Click **Form Validate**.
8. To begin collecting data, click **Save & Evaluate**.
9. After data collection is complete, under **Job Monitor > Actions**, view the data collected by clicking **Data View** icon, and view the results by clicking the **Results** icon.
10. Resolve the issues identified by Config Advisor.

Synchronize the system time across the cluster

Synchronizing the time ensures that every node in the cluster has the same time, and prevents CIFS and Kerberos failures.

A Network Time Protocol (NTP) server should be set up at your site. Beginning with ONTAP 9.5, you can set up your NTP server with symmetric authentication.

For more information, see [Managing the cluster time \(cluster administrators only\)](#).

You synchronize the time across the cluster by associating the cluster with one or more NTP servers.

1. Verify that the system time and time zone is set correctly for each node.

All nodes in the cluster should be set to the same time zone.

- a. Use the cluster date show command to display the current date, time, and time zone for each node.

```
cluster1::> cluster date show
```

Node	Date	Time zone
cluster1-01	01/06/2015 09:35:15	America/New_York
cluster1-02	01/06/2015 09:35:15	America/New_York
cluster1-03	01/06/2015 09:35:15	America/New_York
cluster1-04	01/06/2015 09:35:15	America/New_York

4 entries were displayed.

- b. Use the cluster date modify command to change the date or time zone for all of the nodes.

This example changes the time zone for the cluster to be GMT:

```
cluster1::> cluster date modify -timezone GMT
```

2. Use the cluster time-service ntp server create command to associate the cluster with your NTP server.

- To set up your NTP server without symmetric authentication enter the following command: `cluster time-service ntp server create -server server_name`
- To set up your NTP server with symmetric authentication, enter the following command: `cluster time-service ntp server create -server server_ip_address -key-id key_id`



Symmetric authentication is available Beginning with ONTAP 9.5. It is not available in ONTAP 9.4 or earlier.

This example assumes that DNS has been configured for the cluster. If you have not configured DNS, you must specify the IP address of the NTP server:

```
cluster1::> cluster time-service ntp server create -server
ntp1.example.com
```

3. Verify that the cluster is associated with an NTP server: `cluster time-service ntp server show`

```
cluster1::> cluster time-service ntp server show
```

Server	Version
ntp1.example.com	auto

Related information

[System administration](#)

Commands for managing symmetric authentication on NTP servers

Beginning with ONTAP 9.5, Network Time Protocol (NTP) version 3 is supported. NTPv3 includes symmetric authentication using SHA-1 keys which increases network security.

To do this...	Use this command...
Configure an NTP server without symmetric authentication	<pre>cluster time-service ntp server create -server server_name</pre>
Configure an NTP server with symmetric authentication	<pre>cluster time-service ntp server create -server server_ip_address -key-id key_id</pre>
Enable symmetric authentication for an existing NTP server An existing NTP server can be modified to enable authentication by adding the required key-id.	<pre>cluster time-service ntp server modify -server server_name -key-id key_id</pre>
Configure a shared NTP key	<pre>cluster time-service ntp key create -id shared_key_id -type shared_key_type -value shared_key_value</pre> <p>Note: Shared keys are referred to by an ID. The ID, its type, and value must be identical on both the node and the NTP server</p>
Configure an NTP server with an unknown key ID	<pre>cluster time-service ntp server create -server server_name -key-id key_id</pre>
Configure a server with a key ID not configured on the NTP server.	<pre>cluster time-service ntp server create -server server_name -key-id key_id</pre> <p>Note: The key ID, type, and value must be identical to the key ID, type, and value configured on the NTP server.</p>
Disable symmetric authentication	<pre>cluster time-service ntp server modify -server server_name -authentication disabled</pre>

Additional system configuration tasks to complete

After setting up a cluster, you can use either System Manager or the ONTAP command-line interface (CLI) to continue configuring the cluster.

System configuration task	Resource
Configure networking: <ul style="list-style-type: none"> • Create broadcast domains • Create subnets • Create IP spaces 	Setting up the network
Set up the Service Processor	System administration
Lay out your aggregates	Disk and aggregate management
Create and configure data storage virtual machines (SVMs)	NFS configuration SMB configuration SAN administration
Configure event notifications	EMS configuration

Configure All-Flash SAN Array software

All-Flash SAN Array software configuration overview

The NetApp All-Flash SAN Arrays (ASAs) are available beginning with ONTAP 9.7. ASAs are all-flash SAN-only solutions built on proven AFF NetApp platforms.

ASA platforms use symmetric active-active for multipathing. All paths are active/optimized so in the event of a storage failover, the host does not need to wait for the ALUA transition of the failover paths to resume I/O. This reduces time to failover.

Set up an ASA

All-Flash SAN Arrays (ASAs) follow the same setup procedure as non-ASA systems.

System Manager guides you through the procedures necessary to initialize your cluster, create a local tier, configure protocols, and provision storage for your ASA.

[Get started with ONTAP cluster set up.](#)

ASA host settings and utilities

Host settings for setting up All-Flash SAN Arrays (ASAs) are the same as those for all other SAN hosts.

You can download the [NetApp Host Utilities software](#) for your specific hosts from the support site.

Ways to identify an ASA system

You can identify an ASA system using System Manager or using the ONTAP command line interface (CLI).

- **From the System Manager dashboard:** Click **Cluster > Overview** and then select the system node.

The **PERSONALITY** is displayed as **All-Flash SAN Array**.

- **From the CLI:** Enter the `san config show` command.

The "All-Flash SAN Array" value returns as true for ASA systems.

Related information

- [Technical Report 4968: NetApp All-SAN Array Data Availability and Integrity](#)
- [NetApp Technical Report 4080: Best Practices for Modern SAN](#)

All-Flash SAN Array configuration limits and support

All-Flash SAN Array (ASA) configuration limits and support varies by ONTAP version.

The most current details on supported configuration limits are available in [NetApp Hardware Universe](#).

SAN protocols and supported number of nodes per cluster

The supported SAN protocols and maximum number of nodes per cluster depends on whether you have a non-MetroCluster or MetroCluster configuration:

Non-MetroCluster configurations

The following table shows the ASA support for SAN protocols and the supported number of nodes per cluster in non-MetroCluster configurations:

Beginning with ONTAP...	Protocol support	Maximum nodes per cluster
9.11.1	<ul style="list-style-type: none">• NVMe/TCP• NVMe/FC	12
9.10.1	<ul style="list-style-type: none">• NVMe/TCP	2
9.9.1	<ul style="list-style-type: none">• NVMe/FC	2
	<ul style="list-style-type: none">• FC• iSCSI	12
9.7	<ul style="list-style-type: none">• FC• iSCSI	2

MetroCluster IP configurations

The following table shows the ASA support for SAN protocols and the supported number of nodes per cluster in MetroCluster IP configurations:

Beginning with ONTAP...	Protocol support	Maximum nodes per cluster
9.15.1	<ul style="list-style-type: none">• NVMe/TCP	2 nodes per cluster in four-node MetroCluster IP configurations
9.12.1	<ul style="list-style-type: none">• NVMe/FC	2 nodes per cluster in four-node MetroCluster IP configurations
9.9.1	<ul style="list-style-type: none">• FC• iSCSI	4 nodes per cluster in eight-node MetroCluster IP configurations
9.7	<ul style="list-style-type: none">• FC• iSCSI	2 nodes per cluster in four-node MetroCluster IP configurations

Support for persistent ports

Beginning with ONTAP 9.8, persistent ports are enabled by default on All-Flash SAN Arrays (ASAs) that are configured to use the FC protocol. Persistent ports are only available for FC and require zone membership identified by World Wide Port Name (WWPN).

Persistent ports reduce the impact of takeovers by creating a shadow LIF on the corresponding physical port of the high-availability (HA) partner. When a node is taken over, the shadow LIF on the partner node assumes the identity of the original LIF, including the WWPN. Before the status of path to the taken over node is changed

to faulty, the shadow LIF appears as an Active/Optimized path to the host MPIO stack, and I/O is shifted. This reduces I/O disruption because the host always sees the same number of paths to the target, even during storage failover operations.

For persistent ports, the following FCP port characteristics should be identical within the HA pair:

- FCP port counts
- FCP port names
- FCP port speeds
- FCP LIF WWPN-based zoning

If any of these characteristics are not identical within the HA pair, the following EMS message is generated:

```
EMS : scsiblade.lif.persistent.ports.fcp.init.error
```

For more information on persistent ports, see [NetApp Technical Report 4080: Best Practices for Modern SAN](#).

Upgrade ONTAP

ONTAP upgrade overview

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, you should [plan your 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.

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 BlueXP. If BlueXP is configured on your system, you can upgrade through the BlueXP working environment.

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.

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
9.15.1	May 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 9.9.1, it is likely on Limited Support or Self-Service Support. Consider upgrading to versions with full support.

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](#).

Execute 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 9.8 to 9.13.1, you need to download the software package for ONTAP 9.13.1. You don't need to download the software package for ONTAP 9.12.1.

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.	<ol style="list-style-type: none">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	<ol style="list-style-type: none">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/9.13.1/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  
-----  
9.13.1           MM/DD/YYYY 10:32:15
```

3. Execute the automated pre-upgrade checks:

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



If you are performing a [direct multi-hop upgrade](#), 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, you should 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 9.14.1 -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

Pre-update checks	completed	00:10:00
00:01:03		

Details:

Pre-update Check	Status	Error-Action

AMPQ Router and Broker Config Cleanup	OK	N/A
Aggregate online status and parity check	OK	N/A
Aggregate plex resync status check	OK	N/A
Application Provisioning Cleanup	OK	N/A
Autoboot Bootargs Status	OK	N/A
Backend	OK	N/A
...		
Volume Conversion	OK	N/A
In Progress Check		
Volume move progress status check	OK	N/A
Volume online status check	OK	N/A
iSCSI target portal groups status check	OK	N/A
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. Please use 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
```

Update Phase	Status	Estimated Duration	Elapsed 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
```

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

Details:

Pre-update Check	Status	Error-Action
-----	-----	-----
AMPQ Router and Broker Config Cleanup	OK	N/A
Aggregate online status and parity check	OK	N/A
Aggregate plex resync status check	OK	N/A
Application Provisioning Cleanup	OK	N/A
Autoboot Bootargs Status	OK	N/A
Backend Configuration Status	OK	N/A
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 availability and uniqueness for HA pair status	OK	N/A
CIFS compatibility status check	OK	N/A
CLAM quorum online status check	OK	N/A
CPU Utilization Status	OK	N/A
Capacity licenses install status check	OK	N/A
Check For SP/BMC Connectivity To Nodes	OK	N/A

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

configuration		
status check		
Infinite Volume	OK	N/A
availability 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 connectivity check	OK	N/A
OKM/KMIP enabled systems - Missing keys check	OK	N/A
ONTAP API to REST transition warning data last 30 days approaching automation REST	Warning	Warning: NetApp ONTAP API has been used on this cluster for ONTAP storage management within the last 30 days. NetApp ONTAP API is approaching end of availability. Action: Transition your tools from ONTAP API to ONTAP API. For more details, refer to CPC-00410 - End of availability: ONTAPI
		https://mysupport.netapp.com/info/communications/ECMLP2880232.html
ONTAP Image Capability Status	OK	N/A
OpenSSL 3.0.x upgrade validation check	OK	N/A
Openssh 7.2 upgrade validation check	OK	N/A
Platform Health Monitor check	OK	N/A
Pre-Update Configuration Verification	OK	N/A
RDB Replica Health Check	OK	N/A
Replicated database schema consistency check	OK	N/A
Running Jobs Status	OK	N/A
SAN LIF association status check	OK	N/A

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

Overall Status Warning Warning
75 entries were displayed.

Prepare for an ONTAP upgrade

Prepare for an ONTAP software upgrade

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.

You should do the following to prepare for an upgrade:

1. [Create an upgrade plan.](#)

If you have an active SupportEdge contract for [Active IQ Digital Advisor](#), plan your upgrade with Upgrade Advisor. If you do not have access to Active IQ Digital Advisor, create your own upgrade plan.

2. [Choose your target ONTAP release.](#)

3. Review the [ONTAP release notes](#) for the target release.

The “Upgrade cautions” section describes potential issues that you should be aware of before upgrading to the new release. The “What’s new” and “Known problems and limitations” sections describe new system behavior after upgrading to the new release.

4. [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.

5. [Use Active IQ Config Advisor to verify that you have no common configuration errors.](#)

6. 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.

7. [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.

8. [Verify your SVM routing configuration.](#)

9. [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.

10. [Reboot the SP or BMC.](#)

Create an ONTAP upgrade plan

It is a best practice to create an upgrade plan. If you have an active [SupportEdge Services](#) contract for [Active IQ Digital Advisor](#), you can use Upgrade Advisor to generate an upgrade plan. Otherwise, you should create your own plan.

Plan your upgrade with Upgrade Advisor

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

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

Steps

1. [Launch Active IQ](#)
2. In Active IQ [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](#).

How long will an ONTAP upgrade 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.

Choose your target ONTAP release 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 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. 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 configuration errors with 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 9.11.1 to 9.12.1, or from 9.11.1 to 9.15.1.

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 9.6 and you want to upgrade to 9.11.1, you must complete a multi-stage upgrade: first from 9.6 to 9.8, and then from 9.8 to 9.11.1. Upgrades from earlier releases might

require three or more stages, with several intermediate upgrades.



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

Automated and manual upgrades from ONTAP 9.10.1 and later follow the same upgrade paths.

If your current ONTAP release is...	And your target ONTAP release is...	Your automated or manual upgrade path is...
9.14.1	9.15.1	direct
9.13.1	9.15.1	direct
	9.14.1	direct
9.12.1	9.15.1	direct
	9.14.1	direct
	9.13.1	direct
9.11.1	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	9.15.1	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

Automated and manual upgrades from ONTAP 9.9.1 follow the same upgrade paths.

If your current ONTAP release is...	And your target ONTAP release is...	Your automated or manual upgrade path is...
9.9.1	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

Automated and manual upgrades from ONTAP 9.8 follow the same upgrade paths.



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 and manual upgrade path is...
9.8	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	9.15.1	multi-stage -9.7 → 9.8 -9.8 → 9.12.1 -9.12.1 → 9.15.1
	9.14.1	multi-stage -9.7 → 9.8 -9.8 → 9.12.1 -9.12.1 → 9.14.1
	9.13.1	multi-stage -9.7 → 9.9.1 -9.9.1 → 9.13.1
	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	9.15.1	multi-stage -9.7 → 9.8 -9.8 → 9.12.1 -9.12.1 → 9.15.1
	9.14.1	multi-stage -9.7 → 9.8 -9.8 → 9.12.1 -9.12.1 → 9.14.1
	9.13.1	multi-stage -9.7 → 9.9.1 -9.9.1 → 9.13.1
	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	9.15.1	multi-stage -9.6 → 9.8 -9.8 → 9.12.1 -9.12.1 → 9.15.1
	9.14.1	multi-stage -9.6 → 9.8 -9.8 → 9.12.1 -9.12.1 → 9.14.1
	9.13.1	multi-stage -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	9.15.1	multi-stage - 9.6 → 9.8 - 9.8 → 9.12.1 - 9.12.1 → 9.15.1
	9.14.1	multi-stage - 9.6 → 9.8 - 9.8 → 9.12.1 - 9.12.1 → 9.14.1
	9.13.1	multi-stage - 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	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	9.15.1	multi-stage - 9.5 → 9.9.1 (direct multi-hop, requires images for 9.7 and 9.9.1) - 9.9.1 → 9.13.1 - 9.13.1 → 9.15.1
	9.14.1	multi-stage - 9.5 → 9.9.1 (direct multi-hop, requires images for 9.7 and 9.9.1) - 9.9.1 → 9.13.1 - 9.13.1 → 9.14.1
	9.13.1	multi-stage - 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	9.15.1	multi-stage - 9.5 → 9.7 - 9.7 → 9.9.1 - 9.9.1 → 9.12.1 - 9.12.1 → 9.15.1
	9.14.1	multi-stage - 9.5 → 9.7 - 9.7 → 9.9.1 - 9.9.1 → 9.12.1 - 9.12.1 → 9.14.1
	9.13.1	multi-stage - 9.5 → 9.7 - 9.7 → 9.9.1 - 9.9.1 → 9.12.1 - 9.12.1 → 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.



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

		9.6 → 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
If your current ONTAP release is...	And your target ONTAP release is...	Your automated upgrade path is...
	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...	9.7	direct multi-hop (requires images for 9.5 and 9.7)
	9.6	multi-stage
	9.5	direct
	9.4	not available
And your target ONTAP release is...		
Your automated upgrade path is...		
- 9.5 → 9.6		

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...	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...	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		

		<ul style="list-style-type: none"> - 9.1 → 9.3 - 9.3 → 9.7 (direct multi-hop, requires images for 9.5 and 9.7)
If your current ONTAP release is...	And your target ONTAP release is...	Your automated upgrade path is...
	9.9.1	multi-stage <ul style="list-style-type: none"> - 9.0 → 9.1 - 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 <ul style="list-style-type: none"> - 9.0 → 9.1 - 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 <ul style="list-style-type: none"> - 9.0 → 9.1 - 9.1 → 9.3 - 9.3 → 9.7 (direct multi-hop, requires images for 9.5 and 9.7)
	9.6	multi-stage <ul style="list-style-type: none"> - 9.0 → 9.1 - 9.1 → 9.3 - 9.3 → 9.5 - 9.5 → 9.6
	9.5	multi-stage <ul style="list-style-type: none"> - 9.0 → 9.1 - 9.1 → 9.3 - 9.3 → 9.5
	9.4	not available
	9.3	multi-stage <ul style="list-style-type: none"> - 9.0 → 9.1 - 9.1 → 9.3
	9.2	not available
	9.1	direct



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

		9.8 → 9.7 - 9.7 → 9.8
	9.7	multi-stage - 9.7 → 9.6
If your current ONTAP release is...	And your target ONTAP release is...	Your ANDU upgrade path is... - 9.5 → 9.7
	9.6	multi-stage - 9.4 → 9.5 - 9.5 → 9.6
	9.5	direct

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

		9.8 → 9.7 - 9.7 → 9.8
	9.7	multi-stage
If your current ONTAP release is...	And your target ONTAP release is...	Your ANDU upgrade path is... - 9.5 → 9.7
	9.6	multi-stage - 9.3 → 9.5 - 9.5 → 9.6
	9.5	direct
	9.4	not available

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

	9.9.1	multi-stage - 9.2 → 9.3 - 9.3 → 9.5
If your current ONTAP release is...	And your target ONTAP release is...	Your ANDU upgrade path is... - 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		

	9.9.1	multi-stage - 9.1 → 9.3 - 9.3 → 9.5
If your current ONTAP release is...	And your target ONTAP release is...	Your ANDU upgrade path is...
	9.8	multi-stage - 9.1 → 9.3 - 9.3 → 9.5 - 9.5 → 9.7 - 9.7 → 9.8
	9.7	multi-stage - 9.1 → 9.3 - 9.3 → 9.5 - 9.5 → 9.7
	9.6	multi-stage - 9.1 → 9.3 - 9.3 → 9.5 - 9.5 → 9.6
	9.5	multi-stage - 9.1 → 9.3 - 9.3 → 9.5
	9.4	not available
	9.3	direct
	9.2	not available

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

		<ul style="list-style-type: none"> - 9.1 → 9.3 - 9.3 → 9.5 - 9.5 → 9.7
If your current ONTAP release is...	And your target ONTAP release is...	Your ANDU upgrade path is...
	9.9.1	multi-stage <ul style="list-style-type: none"> - 9.0 → 9.1 - 9.1 → 9.3 - 9.3 → 9.5 - 9.5 → 9.7 - 9.7 → 9.9.1
	9.8	multi-stage <ul style="list-style-type: none"> - 9.0 → 9.1 - 9.1 → 9.3 - 9.3 → 9.5 - 9.5 → 9.7 - 9.7 → 9.8
	9.7	multi-stage <ul style="list-style-type: none"> - 9.0 → 9.1 - 9.1 → 9.3 - 9.3 → 9.5 - 9.5 → 9.7
	9.6	multi-stage <ul style="list-style-type: none"> - 9.0 → 9.1 - 9.1 → 9.3 - 9.3 → 9.5 - 9.5 → 9.6
	9.5	multi-stage <ul style="list-style-type: none"> - 9.0 → 9.1 - 9.1 → 9.3 - 9.3 → 9.5
	9.4	not available
	9.3	multi-stage <ul style="list-style-type: none"> - 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.

Verify the LIF failover configuration

Related information

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	<code>network interface show -service-policy *data* -failover</code>
9.5 or earlier	<code>network interface show -role data -failover</code>

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

```
cluster1::> network interface show -role data -failover
```

Vserver	Logical Interface	Home Node:Port	Failover Policy	Failover 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.

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

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

Example

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

Related information

[Network and LIF management](#)

Verify SVM routing configuration

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

Special considerations prior to an ONTAP 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 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
Do I have LDAP clients using SSLv3?	Configure LDAP clients to use TLS
Am I using session-oriented protocols?	Review considerations for session-oriented protocols
Is SSL FIPS mode enabled on a cluster where administrator accounts authenticate with an SSH public key?	Verify SSH host key algorithm support

Mixed version ONTAP clusters

A mixed version ONTAP cluster consists of nodes running two different major ONTAP releases for a limited time. For example, if a cluster currently consists of nodes running ONTAP 9.8 and 9.12.1, the cluster is a mixed version cluster. Similarly, a cluster in which nodes are running ONTAP 9.9.1 and 9.13.1 would be a mixed version cluster. 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
- ONTAP software upgrades required when you plan to add new nodes to a cluster

The information applies to ONTAP versions that support NetApp platforms systems, such as AFF A-Series and C-Series, ASA, and FAS, and C-series systems. The information does not apply to ONTAP cloud releases (9.x.0) such as 9.12.0.

Requirements for mixed version ONTAP clusters

If your cluster needs to enter a mixed ONTAP version state, you need to be aware of important requirements and restrictions.

- There cannot be more than two different major ONTAP versions in a cluster at any given time. For example, ONTAP 9.9.1 and 9.13.1 is supported but ONTAP 9.9.1, 9.12.1, and 9.13.1 is not. Clusters that have nodes running with different P or D patch levels of the same ONTAP release, such as ONTAP 9.9.1P1 and 9.9.1P5, are not considered mixed version ONTAP clusters.
- 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.
- 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 can remain 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 higher	90 days
ONTAP 9.7 or lower	7 days

- Beginning with ONTAP 9.8, the version difference between the original nodes and the new nodes cannot be greater than four. For example, a mixed version ONTAP cluster could have nodes running ONTAP 9.8 and 9.12.1, or it could have nodes running ONTAP 9.9.1 and 9.13.1. However, a mixed version ONTAP cluster with nodes running ONTAP 9.8 and 9.13.1 would not be supported.

For a complete list of supported mixed version clusters, see [supported upgrade paths](#). All *direct* upgrade paths are supported for mixed version clusters.

Updating the ONTAP version of a large cluster

One scenario for entering a mixed version cluster state involves upgrading the ONTAP version of a cluster with multiple nodes to take advantage of the features available in later versions of ONTAP 9. When you need to upgrade the ONTAP version of a larger cluster, you will enter a mixed version cluster state for a period of time as you upgrade each node in your cluster.

Adding new nodes to an ONTAP cluster

Another scenario for entering a mixed version cluster state involves adding new nodes to your 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 to enable the migration of your data from existing controllers to the new nodes in your new system.

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. If you have nodes that do not support the minimum ONTAP version required by your new controllers, you should do the following:

1. [Upgrade](#) the nodes that do not support the minimum ONTAP version required by your new controllers to the maximum ONTAP version that they do 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 maximum 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 remaining nodes in your cluster to the same version as the new nodes.

Optionally, upgrade the entire cluster (including your new nodes) to the [latest recommended patch release](#) of the ONTAP version running on the new nodes.

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](#)

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.

- 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.

For...	Enter...
iSCSI	<pre>iscsi initiator show -fields igroup,initiator-name,tpgroup</pre>
FC	<pre>fc initiator show -fields igroup,wwpn,lif</pre>

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



Interoperability is bidirectional.

Interoperability for ONTAP version 9.3 and later

ONTAP version...	Interoperates with these previous ONTAP versions...
------------------	---

	9.1 5.1	9.1 5.0*	9.1 4.1	9.1 4.0*	9.1 3.1	9.1 3.0*	9.1 2.1	9.1 2.0*	9.1 1.1	9.1 1.0*	9.1 0.1	9.1 0.0*	9.9. 1	9.9. 0*	9.8	9.7	9.6	9.5	9.4	9.3
9.1 5.1	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No
9.1 5.0*	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No
9.1 4.1	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No
9.1 4.0*	Yes	Yes	Yes	Yes	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	No	No	No	No	No	No
9.1 3.1	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No
9.1 3.0*	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	No	No	No	No
9.1 2.1	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No
9.1 2.0*	Yes	Yes	Yes	No	Yes	No	Yes	Yes	Yes	No	Yes	No	Yes	No	Yes	Yes	No	No	No	No
9.1 1.1	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No
9.1 1.0*	Yes	Yes	Yes	No	Yes	No	Yes	No	Yes	Yes	Yes	No	Yes	No	Yes	Yes	Yes	Yes	No	No
9.1 0.1	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No
9.1 0.0*	Yes	Yes	Yes	No	Yes	No	Yes	No	Yes	No	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	No	No
9.9. 1	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No
9.9. 0*	No	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No
9.8	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
9.7	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
9.6	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
9.5	No	No	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
9.4	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	Yes	Yes	Yes
9.3	No	No	No	No	No	No	No	No	No	No	No	No	No	No	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...										
	9.15.1	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
9.15.1	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No
9.14.1	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No
9.13.1	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No
9.12.1	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No
9.11.1	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No
9.10.1	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No
9.9.1	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No
9.8	No	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No
9.7	No	No	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes
9.6	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes
9.5	No	No	No	No	No	No	No	No	Yes	Yes	Yes

SnapMirror SVM disaster recovery relationships

- 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, 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).

Source	Destination																			
	9.3	9.4	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
9.3	DR/Migration	Migration	Migration	Migration	Migration															

9.4		DR/ Mig rati on	Mig rati on	Mig rati on	Mig rati on	Mig rati on													
9.5			DR/ Mig rati on	Mig rati on	Mig rati on	Mig rati on	Mig rati on												
9.6				DR/ Mig rati on	Mig rati on	Mig rati on	Mig rati on	Mig rati on											
9.7					DR/ Mig rati on	Mig rati on	Mig rati on	Mig rati on	Mig rati on										
9.8						DR/ Mig rati on	Mig rati on	Mig rati on	Mig rati on	Mig rati on									
9.9. 0*							DR/ Mig rati on	Mig rati on	Mig rati on	Mig rati on	Mig rati on								
9.9. 1								DR/ Mig rati on	Mig rati on	Mig rati on	Mig rati on	Mig rati on							
9.1 0.0*									DR/ Mig rati on	Mig rati on	Mig rati on	Mig rati on	Mig rati on						
9.1 0.1										DR/ Mig rati on	Mig rati on	Mig rati on	Mig rati on	Mig rati on					
9.1 1.0*											DR/ Mig rati on	Mig rati on	Mig rati on	Mig rati on	Mig rati on				
9.1 1.1												DR/ Mig rati on	Mig rati on	Mig rati on	Mig rati on	Mig rati on			

9.1 2.0*													DR/ Mig rati on	Mig rati on	Mig rati on	Mig rati on	Mig rati on		
9.1 2.1													DR/ Mig rati on	Mig rati on	Mig rati on	Mig rati on	Mig rati on		
9.1 3.0*													DR/ Mig rati on	Mig rati on	Mig rati on	Mig rati on	Mig rati on		
9.1 3.1													DR/ Mig rati on	Mig rati on	Mig rati on	Mig rati on	Mig rati on		
9.1 4.0*													DR/ Mig rati on	Mig rati on	Mig rati on	Mig rati on	Mig rati on		
9.1 4.1													DR/ Mig rati on	Mig rati on	Mig rati on	Mig rati on	Mig rati on		
9.1 5.0*													DR/ Mig rati on	Mig rati on	Mig rati on	Mig rati on	Mig rati on		
9.1 5.1													DR/ Mig rati on	Mig rati on	Mig rati on	Mig rati on	Mig rati on		

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	9.2	9.1	9

9.11.1	Yes	No	No	No	No	No	No	No	No	No	No	No
9.10.1	Yes	Yes	No	No	No	No	No	No	No	No	No	No
9.9.1	Yes	Yes	Yes	No	No	No	No	No	No	No	No	No
9.8	No	Yes	Yes	Yes	No	No	No	No	No	No	No	No
9.7	No	No	Yes	Yes	Yes	No	No	No	No	No	No	No
9.6	No	No	No	Yes	Yes	Yes	No	No	No	No	No	No
9.5	No	No	No	No	Yes	Yes	Yes	No	No	No	No	No
9.4	No	No	No	No	No	Yes	Yes	Yes	No	No	No	No
9.3	No	No	No	No	No	No	Yes	Yes	Yes	No	No	No
9.2	No	No	No	No	No	No	No	Yes	Yes	Yes	No	No
9.1	No	No	No	No	No	No	No	No	Yes	Yes	Yes	No
9	No	No	No	No	No	No	No	No	No	Yes	Yes	Yes



Interoperability is not bidirectional.

Convert an existing 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.

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. For background information, see [XDP replaces DP as the SnapMirror default](#).
- When planning your conversion, you should be aware that background preparation and the data warehousing phase of an XDP SnapMirror relationship can take a long time. It is not uncommon to see the SnapMirror relationship reporting the status "preparing" for an extended time period.



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

Steps

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

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

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


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

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



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

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

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

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

```
cluster_src:> volume snapshot show -vserver vsml -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>
```

For complete command syntax, see the [man page](#).



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

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

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

4. Break the existing DP-type relationship:

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

For complete command syntax, see the [man page](#).



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

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

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

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

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

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

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

6. Delete the existing DP-type relationship:

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

For complete command syntax, see the [man page](#).



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

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

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

7. 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
```

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. For complete command syntax, see the man page.



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

The following example creates a SnapMirror 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. For complete command syntax, see the man page: [SnapMirror resync command](#).



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

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

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

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

```
volume snapshot autodelete modify -vserver <SVM> -volume <volume>  
-enabled true
```

After you finish

1. Use the `snapmirror show` command to verify that the SnapMirror relationship was created.
2. Once the SnapMirror XDP destination volume begins updating Snapshot copies 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.

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 *
```

2. Enter the advanced privilege mode:

```
set -privilege advanced
```

3. Use the default manufacture secure ID 0x0 to assign the FIPS key to the self-encrypting disks (SEDs):

```
storage encryption disk modify -fips-key-id 0x0 -disk *
```

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

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

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

```
storage encryption disk show
```

6. View the configured KMIP servers:

```
security key-manager show
```

7. Delete the configured KMIP servers:

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

8. Delete the external key manager configuration:

```
security key-manager delete-kmip-config
```



This step does not remove the NSE certificates.

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](#)

Configure LDAP clients to use TLS for highest security

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](#)

Considerations for session-oriented protocols

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](#).

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.

Step

1. Reboot the SP or BMC prior to the upgrade:

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

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 Active IQ, you can [view the list of firmware versions currently included in your ONTAP image](#).

Updated firmware versions are available as follows:

- [System firmware \(BIOS, BMC, SP\)](#)
- [Shelf firmware](#)
- [Disk and Flash Cache firmware](#)

Download the ONTAP software image

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	<ul style="list-style-type: none">• 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	<ul style="list-style-type: none">• 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 on 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. Alternately, you can perform an automated or manual upgrade using the ONTAP command line interface (CLI). The method you use to upgrade ONTAP depends upon 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 MetroCluster configuration with 4 nodes 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 have a MetroCluster configuration with 8 nodes running ONTAP 9.2 or earlier, you should use the CLI to perform a manual upgrade.

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.

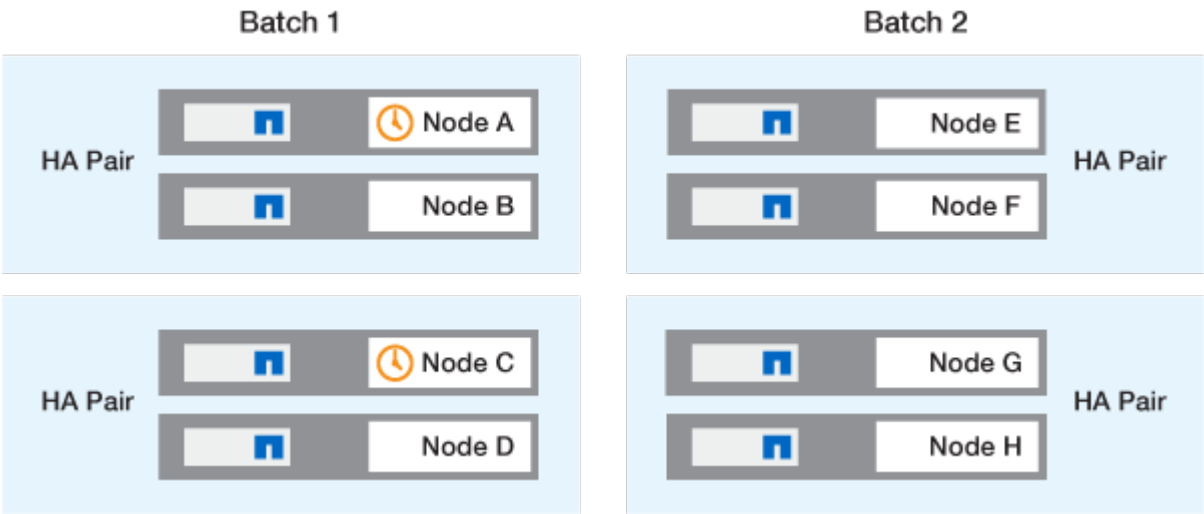
ONTAP rolling upgrades

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

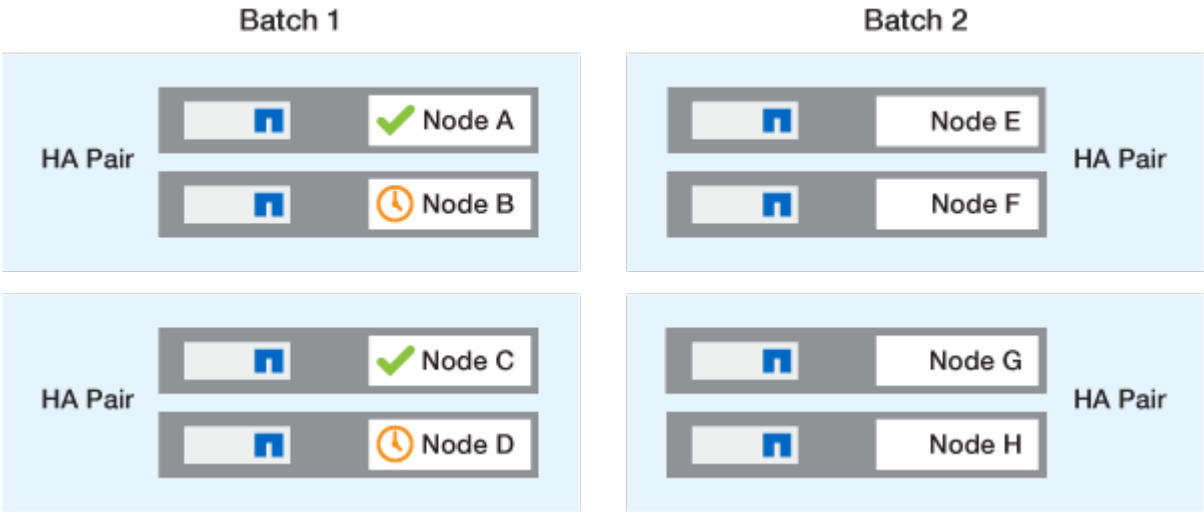
The batch upgrade process is the default for clusters of 8 nodes or more. In the batch upgrade process, the cluster is divided into two batches. Each batch contains multiple HA pairs. In the first batch, the first node of each HA pair is simultaneously upgraded with the first node of all other HA pairs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



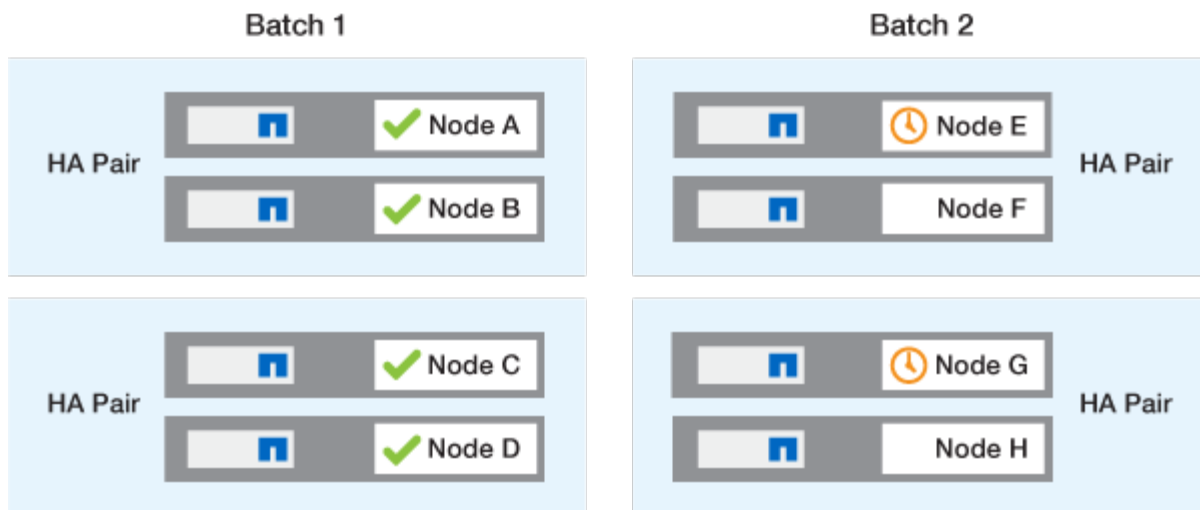
After the upgrade of the first nodes of each HA pair is complete, then the partner nodes in batch 1 are simultaneously upgraded.

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



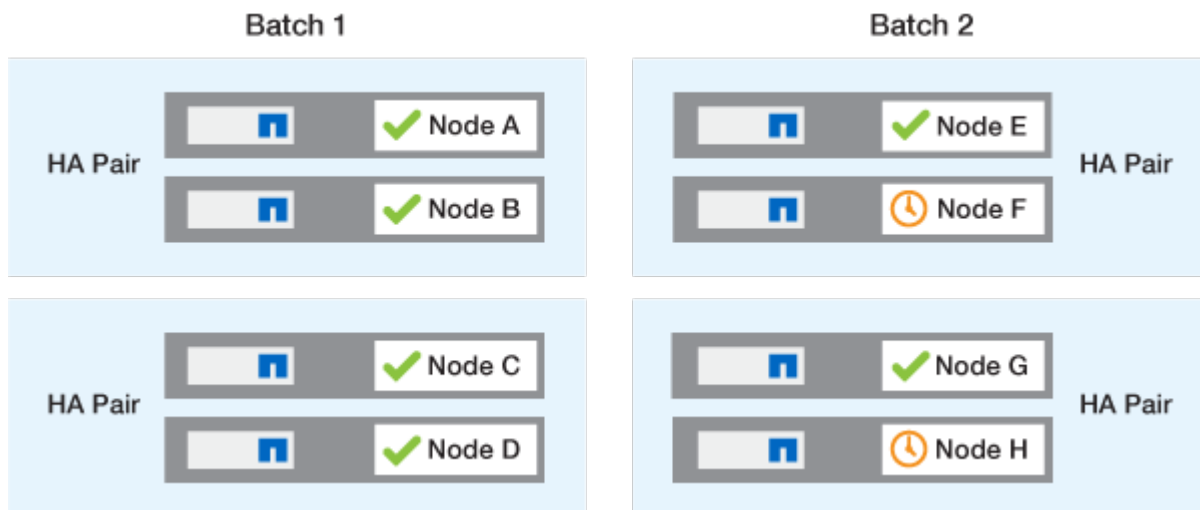
The process is then repeated for the nodes in batch 2; the first node of each HA pair is simultaneously upgraded with the first node of all other HA pairs in the batch.

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	<ul style="list-style-type: none"> Automated nondisruptive using System Manager Automated nondisruptive using the CLI
Standard	9.0 or later	Single	Automated disruptive

Configuration	ONTAP version	Number of nodes	Recommended upgrade method
MetroCluster	9.3 or later	8	<ul style="list-style-type: none"> Automated nondisruptive using the CLI Manual nondisruptive for 4 or 8 node MetroCluster using the CLI
MetroCluster	9.3 or later	2,4	<ul style="list-style-type: none"> 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
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.

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.



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.

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...
<ul style="list-style-type: none">• 9.15.1 or later• 9.14.1P5• 9.13.1P10• 9.12.1P13• 9.11.1P16, P17• 9.10.1P19	<p>To a node in the other batch group.</p> <p>If the migration to the other batch group fails, the LIFs are migrated to the node's HA partner in the same batch group.</p>
9.8 through 9.14.1	<p>To a node in the other batch group.</p> <p>If the network broadcast domain doesn't allow LIF migration to the other batch group, the LIF migration fails and ANDU pauses.</p>
9.7 or earlier	<p>To the HA partner of the node being upgraded.</p> <p>If the partner doesn't have any ports in the same broadcast domain, then LIF migration fails and ANDU pauses.</p>

- 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.	<ol style="list-style-type: none">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	<ol style="list-style-type: none">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 in 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
```

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

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	<ul style="list-style-type: none">• 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:

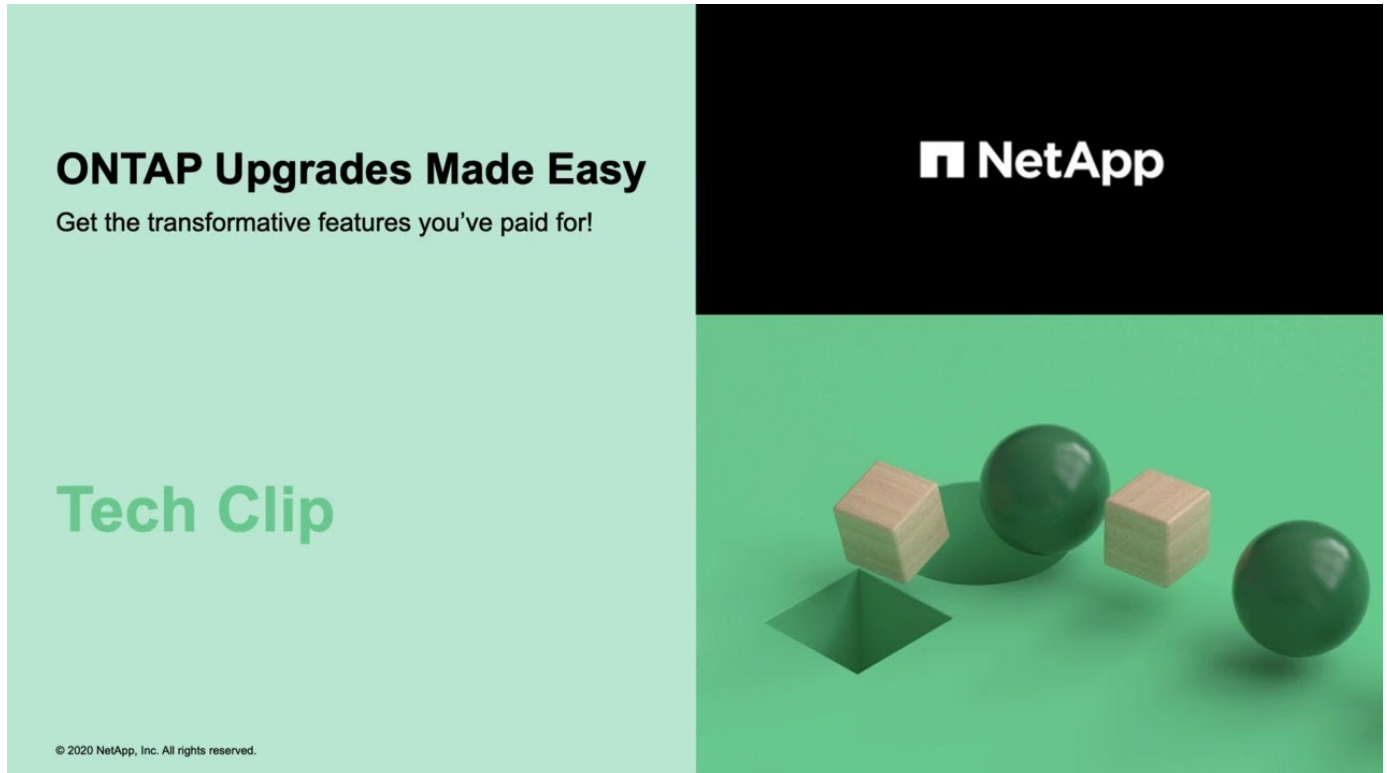
If you want to...	Enter the following command...
Resume the automated upgrade	<pre>cluster image resume-update</pre>
Cancel the automated upgrade and continue manually	<pre>cluster image cancel-update</pre>

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.



Related information

- [Launch Active IQ](#)
- [Active IQ documentation](#)

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...
<ul style="list-style-type: none"> • Non-MetroCluster • 2-node MetroCluster 	<pre data-bbox="873 191 1430 344">system node image update -node * -package _location_ -replace -package true -setdefault true -background true</pre> <p data-bbox="841 411 1481 512"><i>location</i> can be a web server or a local folder, depending on the ONTAP version. See the <code>system node image update</code> man page for details.</p> <p data-bbox="841 552 1471 688">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 <code>-background</code> parameter.</p>
<ul style="list-style-type: none"> • 4-node MetroCluster • 8-node MetroCluster configuration 	<pre data-bbox="873 772 1430 926">system node image update -node * -package location -replace -package true -background true -setdefault false</pre> <p data-bbox="841 993 1422 1020">You must issue this command on both clusters.</p> <p data-bbox="841 1060 1468 1161">This command uses an extended query to change the target software image, which is installed as the alternate image on each node.</p>

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 Manager 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
```

Node	Image	Is Default	Is Current	Version	Install 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
```

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

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

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

11. Initiate a takeover:

```
storage failover takeover -ofnode nodenameA
```

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

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



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
```

Node	Partner	Takeover 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
```

Node	Image	Is Default	Is Current	Version	Install Date
node0					
	image1	false	false	X.X.X	MM/DD/YYYY TIME
	image2	true	true	Y.Y.Y	MM/DD/YYYY TIME
node1					
	image1	false	true	X.X.X	MM/DD/YYYY TIME
	image2	true	false	Y.Y.Y	MM/DD/YYYY TIME

4 entries were displayed.

5. Disable automatic giveback on the partner node if it is enabled:

```
storage failover modify -node nodenameA -auto-giveback false
```

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

Enter `y` to continue.

6. Verify that automatic giveback is disabled for the partner node:

```
storage failover show -node nodenameA -fields auto-giveback
```

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

7. Run the following command twice to determine whether the node to be updated is currently serving any clients:

```
system node run -node nodenameB -command uptime
```

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

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

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

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

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

8. Migrate all of the data LIFs away from the node:

```
network interface migrate-all -node nodenameB
```

9. Verify the status of any LIFs that you migrated:

```
network interface show
```

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

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

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

10. Initiate a takeover:

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

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

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
```

Node	Partner	Takeover 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:

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

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

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

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

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

17. Verify that the update was completed successfully for the node:

- a. Go to the advanced privilege level :

```
set -privilege advanced
```

- b. Verify that update status is complete for the node:

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

The status should be listed as complete.

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

- c. Return to the admin privilege level:

```
set -privilege admin
```

18. Verify that the node's ports are up:

```
network port show -node nodenameB
```

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

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

```
cluster1::> network port show -node node1
```

						Speed
(Mbps)						
Node	Port	IPspace	Broadcast Domain	Link	MTU	Admin/Oper
-----	-----	-----	-----	-----	-----	

node1						
	e0M	Default	-	up	1500	auto/100
	e0a	Default	-	up	1500	auto/1000
	e0b	Default	-	up	1500	auto/1000
	e1a	Cluster	Cluster	up	9000	auto/10000
	e1b	Cluster	Cluster	up	9000	auto/10000
5 entries were displayed.						

19. Revert the LIFs back to the node:

```
network interface revert *
```

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

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

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

```
network interface show
```

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

```
cluster1::> network interface show
```

	Logical	Status	Network	Current	
Current Is					
Vserver	Interface	Admin/Oper	Address/Mask	Node	Port
Home					
-----	-----	-----	-----	-----	-----
vs0					
	data001	up/up	192.0.2.120/24	node1	e0a
true					
	data002	up/up	192.0.2.121/24	node1	e0b
true					
	data003	up/up	192.0.2.122/24	node1	e0b
true					
	data004	up/up	192.0.2.123/24	node1	e0a
true					

4 entries were displayed.

21. If you previously determined that this node serves clients, verify that the node is providing service for each protocol that it was previously serving:

```
system node run -node nodenameB -command uptime
```

The operation counts reset to zero during the update.

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

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

22. If this was the last node in the cluster to be updated, trigger an AutoSupport notification:

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

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

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

23. Confirm that the new ONTAP software is running on both nodes of the HA pair:

```
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
```

Node	Image	Is Default	Is Current	Version	Install Date
node0	image1	false	false	X.X.X	MM/DD/YYYY TIME
	image2	true	true	Y.Y.Y	MM/DD/YYYY TIME
node1	image1	false	false	X.X.X	MM/DD/YYYY TIME
	image2	true	true	Y.Y.Y	MM/DD/YYYY TIME

4 entries were displayed.

24. Reenable automatic giveback on the partner node if it was previously disabled:

```
storage failover modify -node nodenameA -auto-giveback true
```

25. Verify that the cluster is in quorum and that services are running by using the `cluster show` and `cluster ring show` (advanced privilege level) commands.

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

26. Return to the admin privilege level:

```
set -privilege admin
```

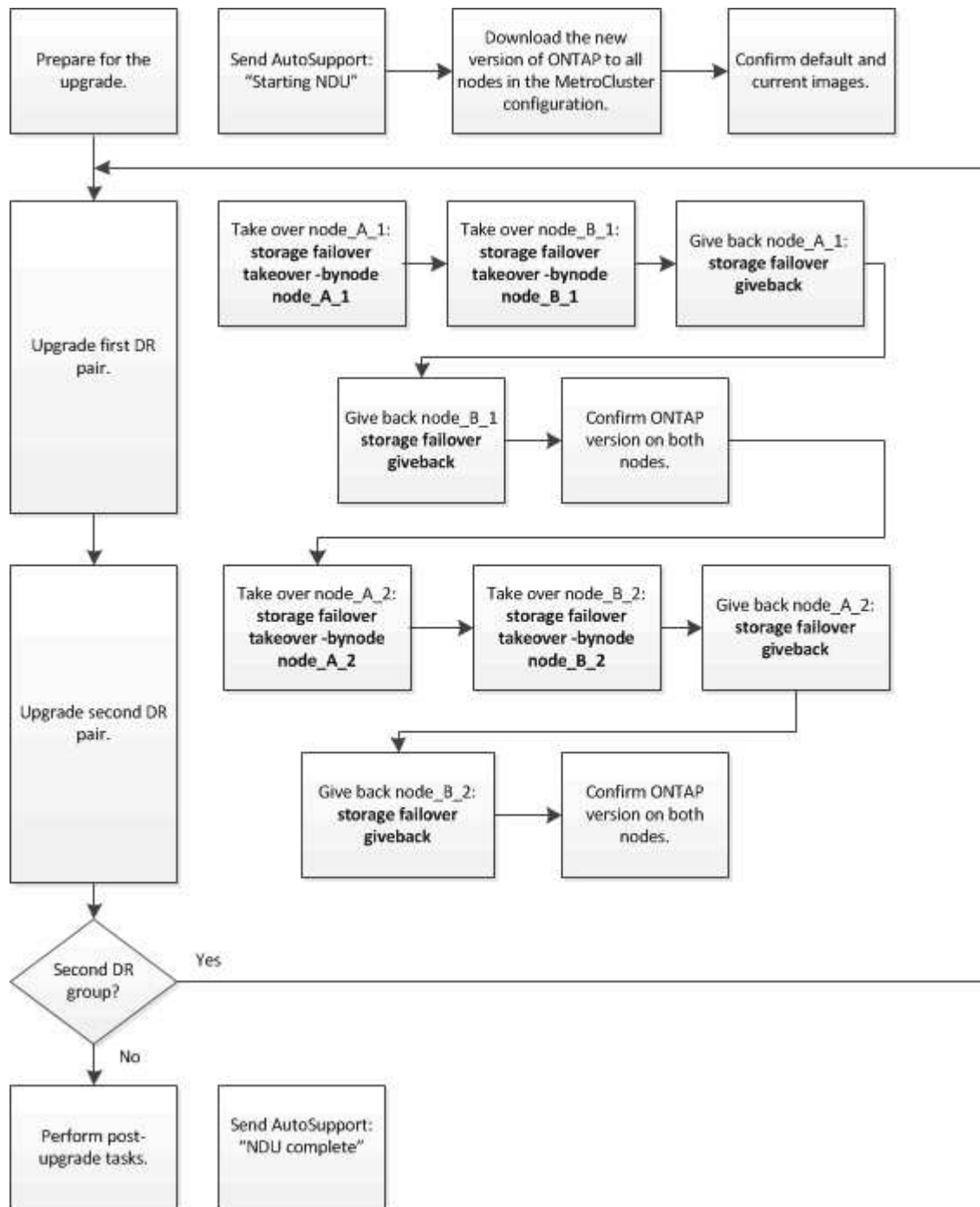
27. Upgrade any additional HA pairs.

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

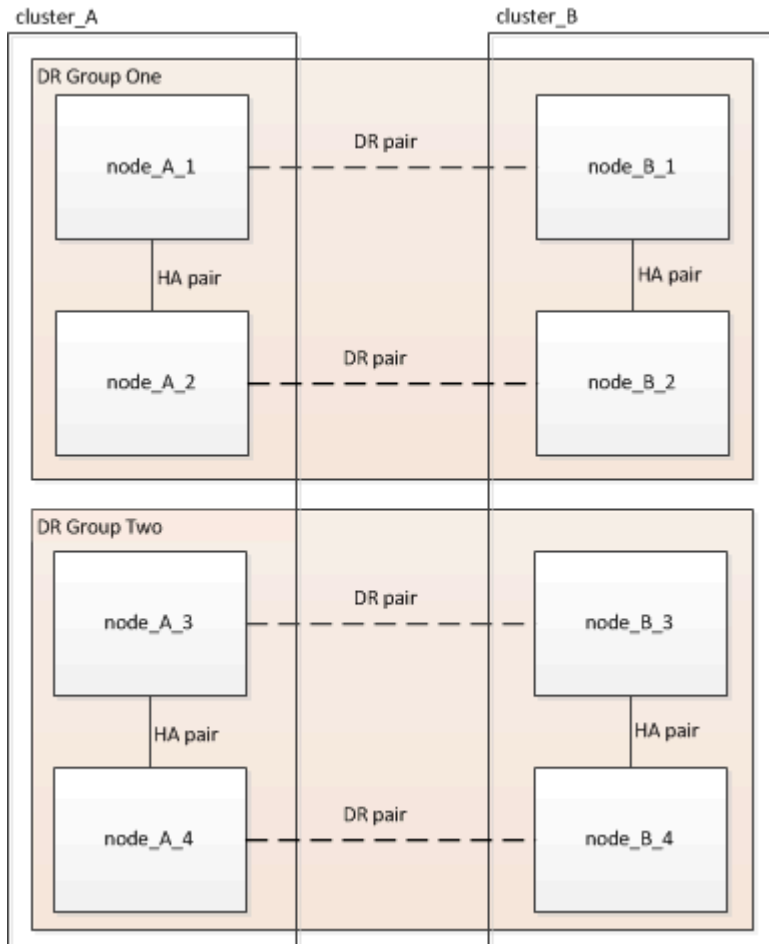
- Eight-node MetroCluster FC configurations, regardless of ONTAP version
- If you have a two-node MetroCluster configuration, do not use this procedure.
- The following tasks refer to the old and new versions of ONTAP.
 - When upgrading, the old version is a previous version of ONTAP, with a lower version 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:



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.

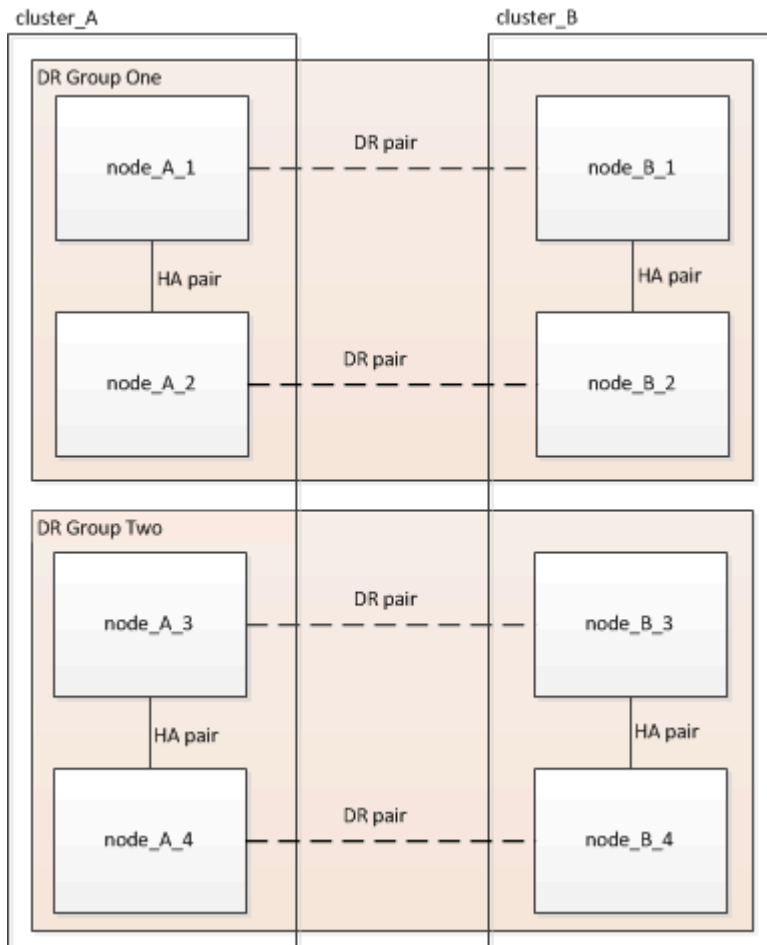
Preparing to upgrade a MetroCluster DR group

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
Node      Image      Is      Is      Version  Install
-----  -
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
```

Node	Image	Is Default	Is Current	Version	Install Date

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

4 entries were displayed.

```
cluster_B::>
```

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
```

Node	Image	Is Default	Is Current	Version	Install Date

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

2 entries were displayed.

- 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
```

Node	Image	Is Default	Is Current	Version	Install Date

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

2 entries were displayed.

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
Node      Partner      Takeover
Possible State Description
-----
node_A_1  node_A_2      -      Waiting for giveback (HA
mailboxes)
node_A_2  node_A_1      false   In takeover
2 entries were displayed.
```

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

Do not specify the `-option immediate` parameter, because a normal takeover is required for the nodes that

are being taken over to boot onto the new software image.

a. Take over node_B_1:

```
storage failover takeover -ofnode node_B_1
```

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



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

b. Verify that the takeover is successful:

```
storage failover show
```

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

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

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

2 entries were displayed.

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

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

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

8. Return the aggregates to the target nodes:

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

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

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

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

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

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

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

```
set -privilege advanced
```

The advanced prompt (`*>`) appears.

13. Confirm the version on cluster_A:

```
system image show
```

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

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

Node	Image	Is Default	Is Current	Version	Install Date

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

4 entries were displayed.

```
cluster_A::>
```

14. Confirm the version on cluster_B:

```
system image show
```

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

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

Node	Image	Is Default	Is Current	Version	Install Date

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

4 entries were displayed.

```
cluster_A::>
```

Updating the second DR pair in a MetroCluster DR group

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

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

In this task, node_A_2 and node_B_2 are 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
```

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

2 entries were displayed.

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	<pre>storage failover takeover -ofnode node_B_2</pre>
ONTAP 9.0 or Data ONTAP 8.3.x	<pre>storage failover takeover -ofnode node_B_2 -option allow- version-mismatch</pre> <div><p>The <code>allow-version-mismatch</code> option is not required for upgrades from ONTAP 9.0 to ONTAP 9.1 or for any patch upgrades.</p></div>

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

Node           Partner           Takeover
Possible State Description
-----
node_B_1       node_B_2           false    In takeover
node_B_2       node_B_1           -        Waiting for giveback (HA
mailboxes)
2 entries were displayed.
```

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
```

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

4 entries were displayed.

```
cluster_A::>
```

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
```

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

4 entries were displayed.

```
cluster_A::>
```

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.
```

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
```

Node	Image	Is Default	Is Current	Version	Install Date
node_B_1	OldImage	false	true	X.X.X	MM/DD/YYYY TIME
	NewImage	true	false	Y.Y.Y	MM/DD/YYYY TIME

2 entries were displayed.

4. If the target software image is not set as the default image, then change it:

```
system image modify {-node * -iscurrent false} -isdefault true
```

5. Verify that all cluster SVMs are in a health state:

```
metrocluster vserver show
```

6. On the cluster that is not being updated, initiate a negotiated switchover:

```
metrocluster switchover
```

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

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

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

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

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

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

7. Verify that all cluster SVMs are in a health state:

```
metrocluster vservers show
```

8. Resynchronize the data aggregates on the “surviving” cluster:

```
metrocluster heal -phase aggregates
```

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

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

9. Verify that the healing operation was completed successfully:

```
metrocluster operation show
```

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

10. Resynchronize the root aggregates on the “surviving” cluster:

```
metrocluster heal -phase root-aggregates
```

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

11. Verify that the healing operation was completed successfully:

```
metrocluster operation show
```

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

12. On the halted cluster, boot the node from the LOADER prompt:

```
boot_ontap
```

13. Wait for the boot process to finish, and then verify that all cluster SVMs are in a health state:

```
metrocluster vservers 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
Node      Image      Is      Is      Version  Install
           Image    Default Current
-----
node0
  image1  false    true    X.X.X   MM/DD/YYYY TIME
  image2  true     false   Y.Y.Y   MM/DD/YYYY TIME
node1
  image1  false    true    X.X.X   MM/DD/YYYY TIME
  image2  true     false   Y.Y.Y   MM/DD/YYYY TIME
4 entries were displayed.
```

- 4. Perform either one of the following steps:

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

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

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
```

Node	Image	Is Default	Is Current	Version	Install 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 2 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
```


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

```
version
```

2. 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. Set the privilege level to advanced:

```
set -privilege advanced
```

- 3. Verify the configuration details for each RDB process.

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

Note that each ring might have a different quorum master.

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

This example shows the volume location database process:

```
cluster1::*> cluster ring show -unitname vldb
```

Node	UnitName	Epoch	DB Epoch	DB Trnxs	Master	Online
node0	vldb	154	154	14847	node0	master
node1	vldb	154	154	14847	node0	secondary
node2	vldb	154	154	14847	node0	secondary
node3	vldb	154	154	14847	node0	secondary

4 entries were displayed.

- 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
cluster1-01	cluster1-01	in-quorum	true
cluster1-02	cluster1-02	in-quorum	true

2 entries were displayed.

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

- 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
```

Vserver	Logical Interface	Status Admin/Oper	Network Address/Mask	Current Node	Current Port	Is 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.

Special configurations

Special considerations after an ONTAP 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 polices 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 networking configuration after an ONTAP upgrade from ONTAP 9.7x or earlier

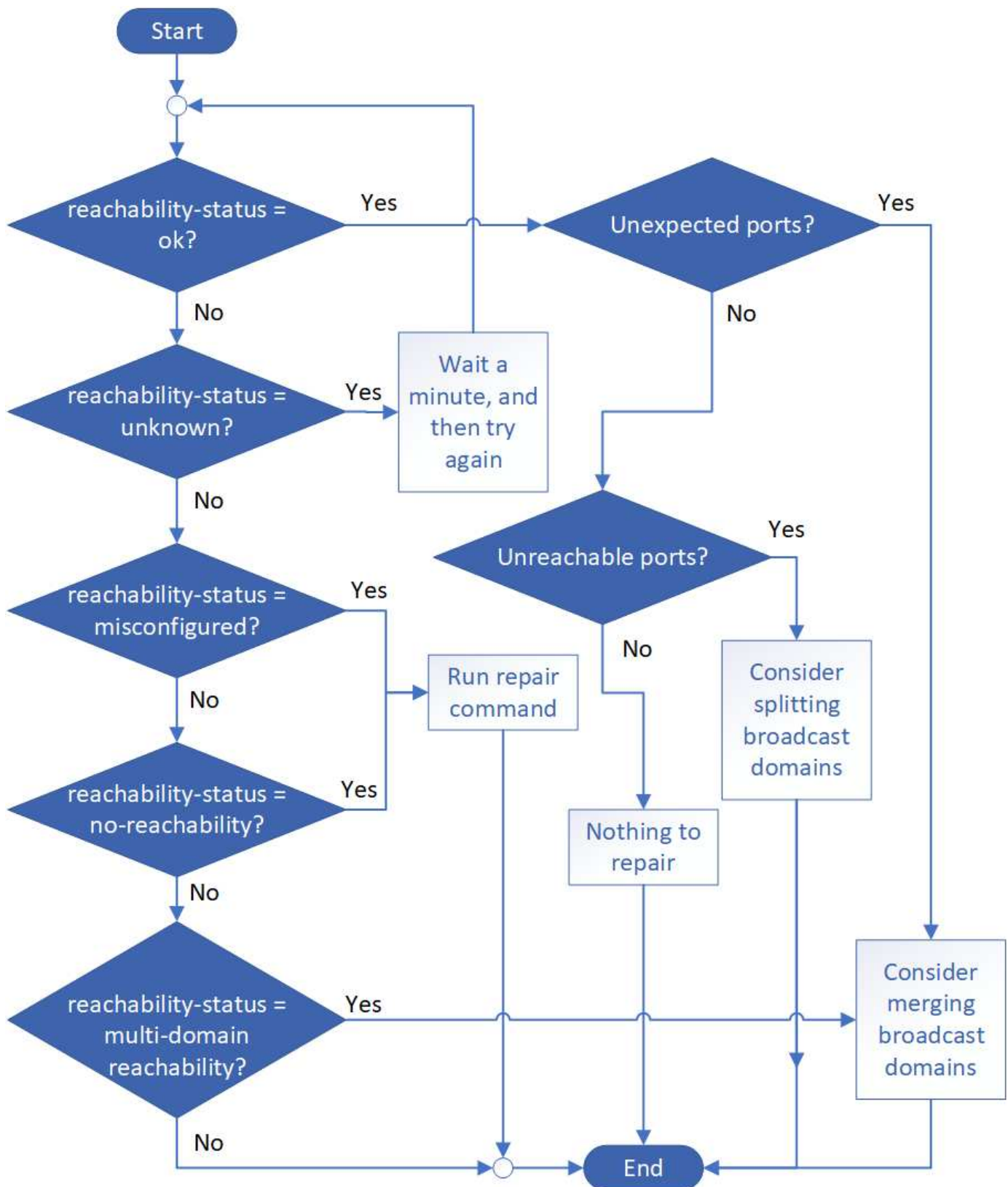
After you upgrade from ONTAP 9.7x or earlier to ONTAP 9.8 or later, you should verify your network configuration. After the upgrade, ONTAP automatically monitors layer 2 reachability.

Step

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

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

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.



reachability-status	Description
---------------------	-------------

ok	<p>The port has layer 2 reachability to its assigned broadcast domain.</p> <p>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.</p> <p>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.</p> <p>If the reachability-status is "ok", and there are no unexpected or unreachable ports, your configuration is correct.</p>
misconfigured-reachability	<p>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.</p> <p>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:</p> <pre>network port reachability repair -node -port</pre> <p>For more information, see Repair port reachability.</p>
no-reachability	<p>The port does not have layer 2 reachability to any existing broadcast domain.</p> <p>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:</p> <pre>network port reachability repair -node -port</pre> <p>For more information, see Repair port reachability.</p>
multi-domain-reachability	<p>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.</p> <p>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.</p> <p>For more information, see Merge broadcast domains or Repair port reachability.</p>
unknown	<p>If the reachability-status is "unknown", then wait a few minutes and try the command again.</p>

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

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. This allows EMS messages to be sent from any of the LIFs associated with any of 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.

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
```

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

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

Related Links

[LIFs and service policies in ONTAP 9.6 and later](#)

Verify networking 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

```

Current Is	Logical	Status	Network	Current	
Vserver	Interface	Admin/Oper	Address/Mask	Node	Port
Home					
-----	-----	-----	-----	-----	
Cluster					
	cluster1-a1_clus1	up/up	192.0.2.1/24	cluster1-01	e2a
true					
	cluster1-a1_clus2	up/up	192.0.2.2/24	cluster1-01	e2b
true					
cluster1-01					
	clus_mgmt	up/up	198.51.100.1/24	cluster1-01	e3a
true					
	cluster1-a1_inet4_intercluster1	up/up	198.51.100.2/24	cluster1-01	e3c
true					
	...				

```

27 entries were displayed.

```

2. Verify the state of the aggregates:

```
storage aggregate show -state !online
```

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

This example shows a cluster in normal operation:

```

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

```

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

offline:

```
cluster1::> storage aggregate show -state !online
Aggregate      Size Available Used% State  #Vols  Nodes      RAID
Status
-----
-----
aggr0_b1
      0B      0B    0% offline    0 cluster2-01
raid_dp,
mirror
degraded
aggr0_b2
      0B      0B    0% offline    0 cluster2-02
raid_dp,
mirror
degraded
2 entries were displayed.
```

3. Verify the state of the volumes:

```
volume show -state !online
```

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

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

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

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

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

4. Verify that there are no inconsistent volumes:

```
volume show -is-inconsistent true
```

See the Knowledge Base article [Volume Showing WAFL Inconsistent](#) on how to address the inconsistent volumes.

Verify the SAN configuration after an upgrade

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.

For...	Enter...
iSCSI	<pre>iscsi initiator show -fields igroup,initiator-name,tpgroup</pre>
FC	<pre>fcp initiator show -fields igroup,wwpn,lif</pre>

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
```

The passphrase must have a minimum of 32 characters.

6. Query the new authentication key:

```
security key-manager query
```

7. Assign the new authentication key to your self-encrypting disks (SEDs):

```
storage encryption disk modify -disk disk_ID -data-key-id key_ID
```



Make sure you are using the new authentication key from your query.

8. If needed, assign a FIPS key to the SEDs:

```
storage encryption disk modify -disk disk_id -fips-key-id  
fips_authentication_key_id
```

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

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

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 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](#)

Firmware and system updates

Firmware and system updates overview

Depending upon your version of ONTAP, you can enable automatic firmware and system updates.

ONTAP Version	What's included in automatic updates
9.13.1 and later	<ul style="list-style-type: none">• ONTAP Time Zone Database• Storage firmware for storage devices, disks, and disk shelves• SP/BMC firmware for service processors and BMC modules
9.10.1 and later	<ul style="list-style-type: none">• Storage firmware for storage devices, disks, and disk shelves• SP/BMC firmware for service processors and BMC modules
9.9.1 and earlier	Not supported

If you are running ONTAP 9.9.1 or earlier, or if you do not have [automatic system updates](#) enabled, you can [make firmware updates manually](#).

If you are running ONTAP 9.12.1 or earlier, or if you do not have [automatic system updates](#) enabled, you can update the Time Zone Database manually. See the Knowledge Base article, [How to update time zone information in ONTAP 9](#), for details.

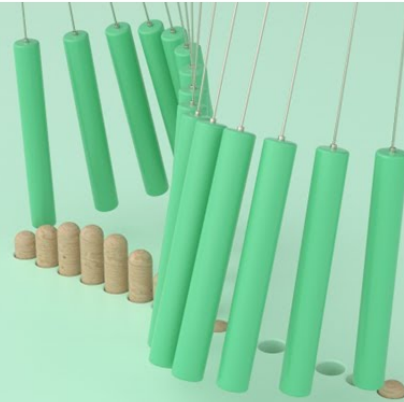
Video: Automatic firmware update feature

Take a look at the automatic firmware update feature available starting in ONTAP 9.10.1.



Automatic Firmware Update feature is available starting in ONTAP 9.10.1

By Jim Svesnik,
Quality Assurance Engineer



How automatic updates are scheduled for installation

All eligible nodes within the same cluster are grouped together for automatic updates. The timeframe in which the eligible nodes are scheduled for automatic update varies based upon the priority level of the update and the percentage of systems in your environment that require the update.

For example, if 10% or less of your total systems are eligible for a non-priority update, the update is scheduled for all eligible systems within 1 week. However, if 76% or more of your total systems are eligible for a non-priority update, then the update is staggered across the eligible systems over the course of 8 weeks. This staggered installation helps to mitigate risks to your overall environment if there is an issue with an update that needs to be remedied.

The percentage of your total systems scheduled for automatic updates by week are as follows:

For critical updates

% of systems requiring update	% of updates that occur week 1	% of updates that occur week 2
50% or less	100%	
50-100%	30%	70%

For high priority updates

% of systems requiring update	% of updates that occur by week			
	week 1	week 2	week 3	week 4
25% or less	100%			

% of systems requiring update	% of updates that occur by week			
26-50%	30%	70%		
50-100%	10%	20%	30%	40%

For normal priority updates

% of systems requiring update	% of updates that occur by week							
	week 1	week 2	week 3	week 4	week 5	week 6	week 7	week 8
10% or less	100%							
11-20%	30%	70%						
21-50%	10%	20%	30%	40%				
51-75%	5%	10%	15%	20%	20%	30%		
76-100%	5%	5%	10%	10%	15%	15%	20%	20%

Enable automatic updates

Beginning with ONTAP 9.10.1, you can enable automatic updates to allow ONTAP to download and install firmware updates without your intervention.

Beginning in ONTAP 9.13.1, these automatic updates also include automatic Time Zone Database updates.

Before you begin

You must have a current support entitlement. This can be validated on the [NetApp support site](#) in the **System Details** page.

About this task

To enable automatic updates, you must first enable AutoSupport with HTTPs. If AutoSupport is not enabled on your cluster, or if AutoSupport is enabled on your cluster with another transport protocol, you will be given the option to enable it with HTTPs during this procedure.

Steps

1. In System Manager, click **Events**.
2. In the **Overview** section, next to **Enable automatic update**, click **Actions>Enable**.
3. If you do not have AutoSupport with HTTPs enabled, select to enable it.
4. Accept the terms and conditions and select **Save**.


Related information

[Troubleshoot AutoSupport message delivery over HTTP or HTTPS](#)

Modify automatic updates

When automatic updates are enabled, by default, ONTAP automatically detects, downloads, and installs all recommended firmware updates and, beginning with ONTAP 9.13.1, ONTAP Time Zone Database updates. If you would like to view recommended updates before they are installed, or if you would like to have the recommendations automatically dismissed, you can modify the default behavior to your preference.

Steps

1. In System Manager, click **Cluster > Settings**.
2. In the **Automatic Update** section, click  to view a list of actions.
3. Click **Edit Automatic Update Settings**.
4. Specify the default actions to be taken for each event type.

You can choose to automatically update, show notifications, or automatically dismiss the updates for each event type.






The ONTAP Time Zone database is controlled by the SYSTEM FILES event type.

Manage recommended automatic updates

The automatic update log displays a list of update recommendations and details about each one, including a description, category, scheduled time to install, status, and any errors. You can view the log and then decide what action you would like to perform for each recommendation.

Steps

1. View the list of recommendations:

View from Cluster settings	View from the Firmware Update tab
<div>a. Click Cluster > Settings.</div> <div>b. In the Automatic Update section, click , then click View All Automatic Updates.</div>	<div>a. Click Cluster > Overview.</div> <div>b. In the Overview section, click More , then click ONTAP Update.</div> <div>c. Select the Firmware Update tab.</div> <div>d. On the Firmware Update tab, click More , then click View All Automatic Updates.</div>

2. Click  next to the description to view a list of actions you can perform on the recommendation.

You can perform one of the following actions, depending on the state of the recommendation:

If the update is in this state...	You can...
-----------------------------------	------------

Has not been scheduled	Update: Starts the updating process. Schedule: Lets you set a date for starting the updating process. Dismiss: Removes the recommendation from the list.
Has been scheduled	Update: Starts the updating process. Edit Schedule: Lets you modify the scheduled date for starting the updating process. Cancel Schedule: Cancels the scheduled date.
Has been dismissed	Undismiss: Returns the recommendation to the list.
Is being applied or is being downloaded	Cancel: Cancels the update.

Update firmware manually

Beginning with ONTAP 9.9.1, if you are registered with [Active IQ Unified Manager](#), you can receive alerts in System Manager that inform you when firmware updates for supported devices, such as disk, disk shelves, the service processor (SP), or the Baseboard Management Controller (BMC) are pending on the cluster.

If you are running ONTAP 9.8 or you are not registered with Active IQ Unified Manager, you can navigate to the NetApp Support Site to download firmware updates.

Before you begin

To prepare for a smooth firmware update, you should reboot the SP or BMC before the update begins. You can use the `system service-processor reboot-sp -node node_name` command to reboot.

Steps

Follow the appropriate procedure based upon your version of ONTAP and if you are registered with Active IQ Unified Manager.

ONTAP 9.9.1 and later with Active IQ

1. In System Manager, go to **Dashboard**.


In the **Health** section, a message displays if there are any recommended firmware updates for the cluster.

2. Click on the alert message.

The **Firmware Update** tab is displayed in the **Update** page.


3. Click **Download from NetApp Support Site** for the firmware update that you want to perform.

The NetApp Support Site is displayed.

4. Log into the NetApp Support Site and download the firmware image package needed for the update.
5. Copy the files to an HTTP or FTP server on your network or to a local folder.
6. In System Manager, click **Cluster > Overview**.
7. In the right corner of the **Overview** pane, click **More**  and select **ONTAP Update**.
8. Click **Firmware Update**.
9. Depending on your version of ONTAP do the following:

ONTAP 9.9.1 and 9.10.0	ONTAP 9.10.1 and later
<ol style="list-style-type: none">a. Select From Server or Local Clientb. Provide the server URL or the file location.	<ol style="list-style-type: none">a. In the list of recommended updates, select Actions.b. Click Update to install the update immediately or Schedule to schedule it for later. If the update is already scheduled, you can Edit or Cancel it.c. Select the Update Firmware button.

ONTAP 9.8 and later without Active IQ

1. Navigate to the [NetApp Support Site](#) and log in.
2. Select the firmware package that you want to use to update your cluster firmware.
3. Copy the files to an HTTP or FTP server on your network or to a local folder.
4. In System Manager, click **Cluster > Overview**.
5. In the right corner of the **Overview** pane, click **More**  and select **ONTAP Update**.
6. Click **Firmware Update**.
7. Depending on your version of ONTAP do the following:

ONTAP 9.8, 9.9.1 and 9.10.0	ONTAP 9.10.1 and later
<ul style="list-style-type: none"> a. Select From Server or Local Client b. Provide the server URL or the file location. 	<ul style="list-style-type: none"> a. In the list of recommended updates, select Actions. b. Click Update to install the update immediately or Schedule to schedule it for later. If the update is already scheduled, you can Edit or Cancel it. c. Select the Update Firmware button.

After you finish

You can monitor or verify updates under **Firmware Update Summary**. To view updates that were dismissed or failed to install click **Cluster > Settings > Automatic Update > View All Automatic Updates**.

Revert ONTAP

Revert ONTAP overview

To transition a cluster to an earlier ONTAP release, you must perform a reversion.

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



If you need to transition a cluster from ONTAP 9.1 to ONTAP 9.0, you need to use the downgrade procedure documented [here](#).

Do I need technical support to revert?

You can revert without assistance on new or test clusters. You should call technical support to revert production clusters. You should also call technical support if you experience any of the following:

- You are in a production environment and revert fails or you encounter any problems before or after the revert such as:
 - The revert process fails and cannot finish.
 - The revert process finishes, but the cluster is unusable in a production environment.
 - The revert process finishes and the cluster goes into production, but you are not satisfied with its behavior.
- You created volumes in ONTAP 9.5 or later and you need to revert to an earlier version. Volumes using adaptive compression must be uncompressed before reverting.

Revert paths

The version of ONTAP that you can revert to varies based on the version of ONTAP currently running on your nodes. You can use the `system image show` command to

determine the version of ONTAP running on each node.

These guidelines refer only to on-premises ONTAP releases. For information about reverting ONTAP in the cloud, see [Reverting or downgrading Cloud Volumes ONTAP](#).

You can revert from...	To...
ONTAP 9.15.1	ONTAP 9.14.1
ONTAP 9.14.1	ONTAP 9.13.1
ONTAP 9.13.1	ONTAP 9.12.1
ONTAP 9.12.1	ONTAP 9.11.1
ONTAP 9.11.1	ONTAP 9.10.1
ONTAP 9.10.1	ONTAP 9.9.1
ONTAP 9.9.1	ONTAP 9.8
ONTAP 9.8	ONTAP 9.7
ONTAP 9.7	ONTAP 9.6
ONTAP 9.6	ONTAP 9.5
ONTAP 9.5	ONTAP 9.4
ONTAP 9.4	ONTAP 9.3
ONTAP 9.3	ONTAP 9.2
ONTAP 9.2	ONTAP 9.1
ONTAP 9.1 or ONTAP 9	Data ONTAP 8.3.x



If you need to change from ONTAP 9.1 to 9.0, you should follow the [downgrade process](#) documented here.

What should I read before I revert?

Resources to review before you revert

Before you revert ONTAP, you should confirm hardware support and review resources to understand issues you might encounter or need to resolve.

1. Review the [ONTAP 9 Release Notes](#) for the target release.

The “Important cautions” section describes potential issues that you should be aware of before downgrading or reverting.

2. Confirm that your hardware platform is supported in the target release.

[NetApp Hardware Universe](#)

3. Confirm that your cluster and management switches are supported in the target release.

You must verify that the NX-OS (cluster network switches), IOS (management network switches), and reference configuration file (RCF) software versions are compatible with the version of ONTAP to which you are reverting.

[NetApp Downloads: Cisco Ethernet Switch](#)

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

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

[NetApp Interoperability Matrix Tool](#)

Revert considerations

You need to consider the revert issues and limitations before beginning an ONTAP reversion.

- Reversion is disruptive.

No client access can occur during the reversion. If you are reverting a production cluster, be sure to include this disruption in your planning.

- Reversion affects all nodes in the cluster.

The reversion affects all nodes in the cluster; however, the reversion must be performed and completed on each HA pair before other HA pairs are reverted.

- The reversion is complete when all nodes are running the new target release.

When the cluster is in a mixed-version state, you should not enter any commands that alter the cluster operation or configuration except as necessary to satisfy reversion requirements; monitoring operations are permitted.



If you have reverted some, but not all of the nodes, do not attempt to upgrade the cluster back to the source release.

- When you revert a node, it clears the cached data in a Flash Cache module.

Because there is no cached data in the Flash Cache module, the node serves initial read requests from disk, which results in decreased read performance during this period. The node repopulates the cache as it serves read requests.

- A LUN that is backed up to tape running on ONTAP 9.x can be restored only to 9.x and later releases and not to an earlier release.
- If your current version of ONTAP supports In-Band ACP (IBACP) functionality, and you revert to a version of ONTAP that does not support IBACP, the alternate path to your disk shelf is disabled.
- If LDAP is used by any of your storage virtual machines (SVMs), LDAP referral must be disabled before reversion.
- In MetroCluster IP systems using switches which are MetroCluster compliant but not MetroCluster validated, the reversion from ONTAP 9.7 to 9.6 is disruptive as there is no support for systems using ONTAP 9.6 and earlier.
- Before you revert a node to ONTAP 9.13.1 or earlier, you need to first convert an encrypted SVM root volume to a non-encrypted volume

If you attempt to revert to a version that does not support SVM root volume encryption, the system will respond with a warning and block the reversion.

Things to verify before you revert

Before revert, you should verify your cluster health, storage health, and system time. You should also delete any cluster jobs that are running and gracefully terminate any SMB sessions that are not continuously available.

Verify cluster health

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

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

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

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

2. Set the privilege level to advanced:

```
set -privilege advanced
```

Enter `y` to continue.

3. Verify the configuration details for each RDB process.

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

Note that each ring might have a different quorum master.

To display this RDB process...	Enter this command...
Management application	<code>cluster ring show -unitname mgmt</code>
Volume location database	<code>cluster ring show -unitname vlodb</code>
Virtual-Interface manager	<code>cluster ring show -unitname vifmgr</code>
SAN management daemon	<code>cluster ring show -unitname bcomd</code>

This example shows the volume location database process:

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

4. Return to the admin privilege level:

```
set -privilege admin
```

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

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

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

Related information

[System administration](#)

Verify storage health

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

1. Verify disk status:

To check for...	Do this...
Broken disks	<ul style="list-style-type: none">a. Display any broken disks: <code>storage disk show -state broken</code>b. Remove or replace any broken disks.
Disks undergoing maintenance or reconstruction	<ul style="list-style-type: none">a. Display any disks in maintenance, pending, or reconstructing states: <code>storage disk show -state maintenance pending reconstructing</code>b. Wait for the maintenance or reconstruction operation to finish before proceeding.

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

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

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

3. Verify that all volumes are online by displaying any volumes that are *not* online: `volume show -state !online`

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

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

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

See the Knowledge Base article [Volume Showing WAFL Inconsistent](#) on how to address the inconsistent volumes.

Related information

[Disk and aggregate management](#)

Verifying the system time

Before you revert, you should verify that NTP is configured, and that the time is synchronized across the cluster.

1. Verify that the cluster is associated with an NTP server: `cluster time-service ntp server show`

2. Verify that each node has the same date and time: `cluster date show`

```
cluster1::> cluster date show
```

Node	Date	Timezone
node0	4/6/2013 20:54:38	GMT
node1	4/6/2013 20:54:38	GMT
node2	4/6/2013 20:54:38	GMT
node3	4/6/2013 20:54:38	GMT

4 entries were displayed.

Verify that no jobs are running

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

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

```
cluster1::> job show
```

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

2. Delete any running or queued aggregate, volume, or Snapshot copy jobs: `job delete -id job_id`

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

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

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

```
cluster1::> job show
```

Job ID	Name	Owning Vserver	Node	State
9944	SnapMirrorDaemon_7_2147484678			
		cluster1	node1	Dormant
	Description: Snapmirror Daemon for 7_2147484678			
18377	SnapMirror Service Job			
		cluster1	node0	Dormant
	Description: SnapMirror Service Job			

2 entries were displayed

SMB sessions that should be terminated

Before you revert, you should identify and gracefully terminate any SMB sessions that are not continuously available.

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

1. Identify any established SMB sessions that are not continuously available: `vserver cifs session show -continuously-available No -instance`

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

```
cluster1::> vserver cifs session show -continuously-available No
-instance

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

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

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

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

NVMe in-band authentication

If you are reverting from ONTAP 9.12.1 or later to ONTAP 9.12.0 or earlier, you must [disable in-band](#)

[authentication](#) before you revert. If in-band authentication using DH-HMAC-CHAP is not disabled, revert will fail.

What else should I check before I revert?

Pre-revert checks

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

Ask yourself...	If your answer is yes, then do this...
Is my cluster running SnapMirror?	<ul style="list-style-type: none">• Review considerations for reverting systems with SnapMirror Synchronous relationships• Review reversion requirements for SnapMirror and SnapVault relationships
Is my cluster running SnapLock?	Set autocommit periods
Do I have Split FlexClone volumes?	Reverse physical block sharing
Do I have FlexGroup volumes?	Disable qtree functionality
Do I have CIFS servers in workgroup mode?	Move or delete CIFS servers in workgroup mode
Do I have deduplicated volumes?	Verify volume contains enough free space
Do I have Snapshot copies?	Prepare Snapshot copies
Am I reverting to ONTAP 8.3.x?	Identify user accounts that use SHA-2 hash function
Is anti-ransomware protection configured for ONTAP 9.11.1 or later?	Check anti-ransomware licensing
Is S3 multiprotocol access configured for ONTAP 9.12.1 or later?	Remove S3 NAS bucket configuration
Is NFSv4.1 session trunking configured for ONTAP 9.14.1 or later?	Remove NFSv4.1 session trunking configuration

MetroCluster pre-revert checks

Depending on your MetroCluster configuration, you need to consider certain factors before revert. Get started by reviewing the table below to see what special considerations you need to consider.

Ask yourself...	If your answer is yes, then do this...
Do I have a two- or four-node MetroCluster configuration?	Disable automatic unplanned switchover
Do I have a four- or eight-node MetroCluster IP or fabric-attached configuration running ONTAP 9.12.1 or later?	Disable IPsec

SnapMirror

Considerations for reverting systems with SnapMirror Synchronous relationships

You must be aware of the considerations for SnapMirror Synchronous relationships before reverting from ONTAP 9.6 to ONTAP 9.5.

Before reverting, you must take the following steps if you have SnapMirror Synchronous relationships:

- You must delete any SnapMirror Synchronous relationship in which the source volume is serving data using NFSv4 or SMB.

ONTAP 9.5 does not support NFSv4 and SMB.

- You must delete any SnapMirror Synchronous relationships in a mirror-mirror cascade deployment.

A mirror-mirror cascade deployment is not supported for SnapMirror Synchronous relationships in ONTAP 9.5.

- If the common Snapshot copies in ONTAP 9.5 are not available during revert, you must initialize the SnapMirror Synchronous relationship after reverting.

After two hours of upgrade to ONTAP 9.6, the common Snapshot copies from ONTAP 9.5 are automatically replaced by the common Snapshot copies in ONTAP 9.6. Therefore, you cannot resynchronize the SnapMirror Synchronous relationship after reverting if the common Snapshot copies from ONTAP 9.5 are not available.

Reversion requirements for SnapMirror and SnapVault relationships

The system node revert-to command notifies you of any SnapMirror and SnapVault relationships that need to be deleted or reconfigured for the reversion process to be completed. However, you should be aware of these requirements before you begin the reversion.

- All SnapVault and data protection mirror relationships must be quiesced and then broken.

After the reversion is completed, you can resynchronize and resume these relationships if a common Snapshot copy exists.

- SnapVault relationships must not contain the following SnapMirror policy types:
 - async-mirror

You must delete any relationship that uses this policy type.

- MirrorAndVault

If any of these relationships exist, you should change the SnapMirror policy to mirror-vault.

- All load-sharing mirror relationships and destination volumes must be deleted.
- SnapMirror relationships with FlexClone destination volumes must be deleted.
- Network compression must be disabled for each SnapMirror policy.
- The all_source_snapshot rule must be removed from any async-mirror type SnapMirror policies.



The Single File Snapshot Restore (SFSR) and Partial File Snapshot Restore (PFSR) operations are deprecated on the root volume.

- Any currently running single file and Snapshot restore operations must be completed before the reversion can proceed.

You can either wait for the restore operation to finish, or you can abort it.

- Any incomplete single file and Snapshot restore operations must be removed by using the `snapmirror restore` command.

Set autocommit periods for SnapLock volumes before reverting

To revert from ONTAP 9, the value of the autocommit period for SnapLock volumes must be set in hours, not days. Before attempting to revert, you must check the autocommit value for your SnapLock volumes and modify it from days to hours, if necessary.

1. Verify that there are SnapLock volumes in the cluster that have unsupported autocommit periods:
`volume snaplock show -autocommit-period *days`
2. Modify the unsupported autocommit periods to hours:
`volume snaplock modify -vserver vserver_name -volume volume_name -autocommit-period value hours`

Reverse physical block sharing in split FlexClone volumes

If you have split a FlexClone volume from its parent volume, you must undo the sharing of any physical block between the clone and its parent volume before reverting from ONTAP 9.4 or later to an earlier version of ONTAP.

This task is applicable only for AFF systems when `split` has been run on any of the FlexClone volumes.

1. Log in to the advanced privilege level: `set -privilege advanced`
2. Identify the split FlexClone volumes with shared physical blocks: `volume clone sharing-by-split show`

```
cluster1::> volume clone sharing-by-split show
Node           Vserver   Volume      Aggregate
-----
node1          vs1       vol_clone1   aggr1
node2          vs2       vol_clone2   aggr2
2 entries were displayed.
```

3. Undo the physical block sharing in all of the split FlexClone volumes across the cluster: `volume clone sharing-by-split undo start-all`
4. Verify that there are no split FlexClone volumes with shared physical blocks: `volume clone sharing-by-split show`

```
cluster1::> volume clone sharing-by-split show
This table is currently empty.
```

Disable qtree functionality in FlexGroup volumes before reverting

Qtrees for FlexGroup volumes are not supported prior to ONTAP 9.3. You must disable the qtree functionality on FlexGroup volumes before reverting from ONTAP 9.3 to an earlier version of ONTAP.

The qtree functionality is enabled either when you create a qtree or if you modify the security-style and oplock-mode attributes of the default qtree.

1. Identify and delete all of the non-default qtrees in each FlexGroup volume that are enabled with the qtree functionality:
 - a. Log in to the advanced privilege level: `set -privilege advanced`
 - b. Verify if any FlexGroup volume is enabled with the qtree functionality.

For ONTAP 9.6 or later, use: `volume show -is-qtree-caching-enabled true`

For ONTAP 9.5 or earlier, use: `volume show -is-flexgroup-qtree-enabled true`

```
cluster1::*> volume show -is-flexgroup-qtree-enabled true
Vserver    Volume      Aggregate    State      Type      Size
Available  Used%
-----
vs0        fg          -            online     RW        320MB
220.4MB    31%
```

- c. Delete all of the non-default qtrees in each FlexGroup volume that are enabled with the qtree functionality: `volume qtree delete -vserver svm_name -volume volume_name -qtree qtree_name`

If the qtree functionality is enabled because you modified the attributes of the default qtree and if you do not have any qtrees, you can skip this step.

```
cluster1::*> volume qtree delete -vserver vs0 -volume fg -qtree
qtree4
WARNING: Are you sure you want to delete qtree qtree4 in volume fg
vserver vs0? {y|n}: y
[Job 38] Job is queued: Delete qtree qtree4 in volume fg vserver vs0.
```

2. Disable the qtree functionality on each FlexGroup volume: `volume flexgroup qtree-disable -vserver svm_name -volume volume_name`

```
cluster1::*> volume flexgroup qtree-disable -vserver vs0 -volume fg
```

3. Identify and delete any Snapshot copies that are enabled with the qtree functionality.

- a. Verify if any Snapshot copies are enabled with the qtree functionality: `volume snapshot show -vserver vs0 -volume fg -fields is-flexgroup-qtree-enabled`

```
cluster1::*> volume snapshot show -vserver vs0 -volume fg -fields is-
flexgroup-qtree-enabled
vserver volume snapshot is-flexgroup-qtree-enabled
-----
vs0      fg      fg_snap1 true
vs0      fg      daily.2017-09-27_0010 true
vs0      fg      daily.2017-09-28_0010 true
vs0      fg      snapmirror.0241f354-a865-11e7-a1c0-
00a098a71764_2147867740.2017-10-04_124524 true
```

- b. Delete all of the Snapshot copies that are enabled with the qtree functionality: `volume snapshot delete -vserver vs0 -volume fg -snapshot daily.2017-09-27_0010 -force true -ignore-owners true`

The Snapshot copies that must be deleted include regular Snapshot copies and the Snapshot copies taken for SnapMirror relationships. If you have created any SnapMirror relationship for the FlexGroup volumes with a destination cluster that is running ONTAP 9.2 or earlier, you must delete all of the Snapshot copies that were taken when the source FlexGroup volume was enabled for the qtree functionality.

```
cluster1::*> volume snapshot delete -vserver vs0 -volume fg -snapshot
daily.2017-09-27_0010 -force true -ignore-owners true
```

Related information

[FlexGroup volumes management](#)

Identify and move SMB servers in workgroup mode

Before performing a revert, you must delete any SMB servers in workgroup mode or move them in to a domain. Workgroup mode is not supported on ONTAP versions prior to ONTAP 9.

1. Identify any SMB servers with a Authentication Style of workgroup: `vserver cifs show`
2. Move or delete the servers you identified:

If you are going to...	Then use this command....
Move the SMB server from the workgroup to an Active Directory domain:	<code>vserver cifs modify -vserver vserver_name -domain domain_name</code>
Delete the SMB server	<code>vserver cifs delete -vserver vserver_name</code>

3. If you deleted the SMB server, enter the username of the domain, then enter the user password.

Related information

[SMB management](#)

Verify deduplicated volumes have enough free space before reverting

Before reverting from any version of ONTAP 9, you must ensure that the volumes contain sufficient free space for the revert operation.

The volume must have enough space to accommodate the savings that were achieved through the inline detection of blocks of zeros. See the Knowledge Base article [How to see space savings from deduplication, compression, and compaction in ONTAP 9](#).

If you have enabled both deduplication and data compression on a volume that you want to revert, then you must revert data compression before reverting deduplication.

1. Use the volume efficiency show command with the -fields option to view the progress of the efficiency operations that are running on the volumes.

The following command displays the progress of efficiency operations: `volume efficiency show -fields vserver,volume,progress`

2. Use the volume efficiency stop command with the -all option to stop all active and queued deduplication operations.

The following command stops all active and queued deduplication operations on volume VolA: `volume efficiency stop -vserver vs1 -volume VolA -all`

3. Use the set -privilege advanced command to log in at the advanced privilege level.
4. Use the volume efficiency revert-to command with the -version option to downgrade the efficiency metadata of a volume to a specific version of ONTAP.

The following command reverts the efficiency metadata on volume VolA to ONTAP 9.x: `volume efficiency revert-to -vserver vs1 -volume VolA -version 9.x`



The volume efficiency revert-to command reverts volumes that are present on the node on which this command is executed. This command does not revert volumes across nodes.

5. Use the volume efficiency show command with the -op-status option to monitor the progress of the downgrade.

The following command monitors and displays the status of the downgrade: `volume efficiency show`

```
-vserver vs1 -op-status Downgrading
```

6. If the revert does not succeed, use the volume efficiency show command with the -instance option to see why the revert failed.

The following command displays detailed information about all fields: `volume efficiency show`

```
-vserver vs1 -volume vol1 - instance
```

7. After the revert operation is complete, return to the admin privilege level: `set -privilege admin`

Logical storage management

Prepare Snapshot copies before reverting

Before reverting to an earlier ONTAP release, you must disable all Snapshot copy policies and delete any Snapshot copies that were created after upgrading to the current release.

If you are reverting in a SnapMirror environment, you must first have deleted the following mirror relationships:

- All load-sharing mirror relationships
 - Any data protection mirror relationships that were created in ONTAP 8.3.x
 - All data protection mirror relationships if the cluster was re-created in ONTAP 8.3.x
1. Disable Snapshot copy policies for all data SVMs: `volume snapshot policy modify -vserver * -enabled false`
 2. Disable Snapshot copy policies for each node's aggregates:
 - a. Identify the node's aggregates by using the `run-nodenodenameaggr status` command.
 - b. Disable the Snapshot copy policy for each aggregate: `run -node nodename aggr options aggr_name nosnap on`
 - c. Repeat this step for each remaining node.
 3. Disable Snapshot copy policies for each node's root volume:
 - a. Identify the node's root volume by using the `run-nodenodenamevol status` command.

You identify the root volume by the word `root` in the Options column of the `vol status` command output.

```
vs1::> run -node node1 vol status
```

Volume	State	Status	Options
vol0	online	raid_dp, flex 64-bit	root, nvfail=on

- b. Disable the Snapshot copy policy on the root volume: `run -node nodename vol options root_volume_name nosnap on`
- c. Repeat this step for each remaining node.

4. Delete all Snapshot copies that were created after upgrading to the current release:

- a. Set the privilege level to advanced: `set -privilege advanced`
- b. Disable the snapshots: `snapshot policy modify -vserver * -enabled false`
- c. Delete the node's newer-version Snapshot copies: `volume snapshot prepare-for-revert -node nodename`

This command deletes the newer-version Snapshot copies on each data volume, root aggregate, and root volume.

If any Snapshot copies cannot be deleted, the command fails and notifies you of any required actions you must take before the Snapshot copies can be deleted. You must complete the required actions and then rerun the `volume snapshot prepare-for-revert` command before proceeding to the next step.

```
cluster1::*> volume snapshot prepare-for-revert -node node1
```

```
Warning: This command will delete all Snapshot copies that have  
the format used by the current version of ONTAP. It will fail if  
any Snapshot copy polices are enabled, or  
if any Snapshot copies have an owner. Continue? {y|n}: y
```

- d. Verify that the Snapshot copies have been deleted: `volume snapshot show -node nodename`

If any newer-version Snapshot copies remain, force them to be deleted: `volume snapshot delete {-fs-version 9.0 -node nodename -is-constituent true} -ignore -owners -force`

- e. Repeat this step c for each remaining node.
- f. Return to the admin privilege level: `set -privilege admin`



You must perform these steps on both the clusters in MetroCluster configuration.

Identify user accounts that use SHA-2 hash function

If you are reverting from ONTAP 9.1 or ONTAP 9.0 to ONTAP 8.3.x, SHA-2 account users can no longer be authenticated with their passwords. Before you revert, you should identify the user accounts that use the SHA-2 hash function, so that after reverting, you can have them reset their passwords to use the encryption type (MD5) that is supported by the release you revert to.

1. Change to the privilege setting to advanced: `set -privilege advanced`
2. Identify the user accounts that use the SHA-2 has function: `security login show -vserver * -username * -application * -authentication-method password -hash-function !md5`
3. Retain the command output for use after the revert.



During the revert, you will be prompted to run the advanced command `security login password-prepare-to-downgrade` to reset your own password to use the MD5 hash function. If your password is not encrypted with MD5, the command prompts you for a new password and encrypts it with MD5, enabling your credential to be authenticated after the revert.

Check Autonomous Ransomware Protection licensing before reverting from ONTAP 9.11.1 or later

If you have configured Autonomous Ransomware Protection (ARP) and you revert from ONTAP 9.11.1 or later to ONTAP 9.10.1 or earlier, you might experience warning messages and limited ARP functionality.

In ONTAP 9.11.1, the Anti-ransomware license replaced the Multi-Tenant Key Management (MTKM) license. If your system has the Anti_ransomware license but no MT_EK_MGMT license, you will see a warning during revert that ARP cannot be enabled on new volumes upon revert.

The volumes with existing protection will continue to work normally after revert, and ARP status can be displayed using the ONTAP CLI. System Manager cannot show ARP status without the MTKM license.

Therefore, if you want ARP to continue after reverting to ONTAP 9.10.1, be sure the MTKM license is installed before reverting. [Learn about ARP licensing](#).

Remove S3 NAS bucket configuration before reverting from ONTAP 9.12.1 or later

If you have configured S3 client access for NAS data, before you revert from ONTAP 9.12.1 or later to ONTAP 9.11.1 or earlier, you should use the ONTAP command line interface (CLI) to remove the NAS bucket configuration and to remove any name mappings (S3 users to Windows or Unix users).

About this task

The following tasks are completed in the background during the revert process.

- Remove all partially completed singleton object creations (that is, all entries in hidden directories).
- Remove all hidden directories; there might be one on for each volume that is accessible from the root of the export mapped from the S3 NAS bucket.
- Remove the upload table.
- Delete any default-unix-user and default-windows-user values for all configured S3 servers.

Steps

1. Remove S3 NAS bucket configuration:

```
vserver object-store-server bucket delete -vserver _svm_name_ -bucket  
_s3_nas_bucket_name_
```

2. Remove name mappings for UNIX:

```
vserver name-mapping delete -vserver _svm_name_ -direction s3-unix
```

3. Remove name mappings for Windows:

```
vserver name-mapping delete -vserver _svm_name_ -direction s3-win
```

4. Remove the S3 protocols from the SVM:

```
vserver remove-protocols -vserver <svm_name> -protocols s3
```

Remove NFSv4.1 session trunking configuration before reverting from ONTAP 9.14.1 or later

If you have enabled trunking for client connections and you revert to a release earlier to ONTAP 9.14.1, you must disable trunking on any NFSv4.1 servers before reverting.

When you enter the `revert-to` command, you will see a warning message advising you to disable trunking before proceeding.

After reverting to an earlier ONTAP release, the clients using trunked connections fall back to using a single connection. Their data throughput will be affected, but there will be no disruption. The revert behavior is the same as modifying the NFSv4.1 trunking option for the SVM from enabled to disabled.

Steps

1. Disable trunking on the NFSv4.1 server:

```
vserver nfs modify -vserver svm_name -v4.1-trunking disabled
```

2. Verify that NFS is configured as desired:

```
vserver nfs show -vserver svm_name
```

Disable automatic unplanned switchover before reverting two-node and four-node MetroCluster configurations

Before reverting a two-node or four-node MetroCluster configuration, you must disable automatic unplanned switchover (AUSO).

1. On both the clusters in MetroCluster, disable automatic unplanned switchover: `metrocluster modify -auto-switchover-failure-domain auso-disabled`

Related information

[MetroCluster management and disaster recovery](#)

Disable IPsec before reverting MetroCluster configurations

Before reverting a MetroCluster configuration, you must disable IPsec.

You cannot revert ONTAP in a MetroCluster configuration running ONTAP 9.12.1 with IPsec enabled. A check is performed before revert to ensure there are no IPsec configurations within the MetroCluster configuration. You must remove any IPsec configurations present and disable IPsec before continuing with the revert. Reverting ONTAP is blocked if IPsec is enabled, even when you have not configured any user policies.

Download and install the ONTAP software image

Related information

You must first download the ONTAP software from the NetApp Support site; then you can install it.

Download the software image

To downgrade or revert from ONTAP 9.4 and later, you can copy the ONTAP software image from the NetApp Support Site to a local folder. For a downgrade or revert to ONTAP 9.3 or earlier, you must copy the ONTAP software image to an HTTP server or FTP server on your network.

You should note the following important information:

- Software images are specific to platform models.

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

- Software images include the latest version of system firmware that was available when a given version of ONTAP was released.
- If you are downgrading a system with NetApp Volume Encryption from 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 downgrade or revert a system with NetApp Volume Encryption, the system panics and you lose access to your volumes.

1. Locate the target ONTAP software in the [Software Downloads](#) area of the NetApp Support Site.
2. Copy the software image.
 - For ONTAP 9.3 or earlier, copy the software image (for example, 93_q_image.tgz) from the NetApp Support Site to the directory on the HTTP server or FTP server from which the image will be served.
 - For ONTAP 9.4 or later, copy the software image (for example, 97_q_image.tgz) from the NetApp Support Site to the directory on the HTTP server or FTP server from which the image will be served or to a local folder.

Install the software image

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

- If you are downgrading or reverting a system with NetApp Volume Encryption from ONTAP 9.5 or later, you must have downloaded the ONTAP software image for non-restricted countries, which includes NetApp Volume Encryption.

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

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

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

2. Install the software image on the nodes.

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

- If you are downgrading or reverting a non-MetroCluster configuration or a two-node MetroCluster configuration: `system node image update -node * -package location -replace -package true -setdefault true -background 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.

- If you are downgrading or reverting a four or eight-node MetroCluster configuration, you must issue the following command on both clusters: `system node image update -node * -package location -replace-package true true -background true -setdefault false`

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

3. Enter `y` to continue when prompted.

4. Verify that the software image is downloaded and installed on each node: `system node image show-update-progress -node *`

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

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

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

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

Revert an ONTAP cluster

To take the cluster offline to revert to an earlier ONTAP release, you must disable storage failover and the data LIFs, address reversion preconditions, revert the cluster and file system configurations on a node, and then repeat the process for each additional node in the cluster.

You must have completed the revert [verifications](#) and [pre-checks](#).

Reverting a cluster requires you to take the cluster offline for the duration of the reversion.

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

Enter **y** when prompted to continue.

2. Verify that the target ONTAP software is installed: `system image show`

The following example shows that version 9.1 is installed as the alternate image on both nodes:

```
cluster1::*> system image show
```

Node	Image	Is Default	Is Current	Version	Install Date
node0	image1	true	true	9.2	MM/DD/YYYY TIME
	image2	false	false	9.1	MM/DD/YYYY TIME
node1	image1	true	true	9.2	MM/DD/YYYY TIME
	image2	false	false	9.1	MM/DD/YYYY TIME

4 entries were displayed.

3. Disable all of the data LIFs in the cluster: `network interface modify {-role data} -status -admin down`
4. Determine if you have inter-cluster flexcache relationships: `flexcache origin show-caches -relationship-type inter-cluster`
5. If inter-cluster flexcaches are present, disable the data lifs on the cache cluster: `network interface modify -vserver vservice_name -lif lif_name -status-admin down`
6. If the cluster consists of only two nodes, disable cluster HA: `cluster ha modify -configured false`
7. Disable storage failover for the nodes in the HA pair from either node: `storage failover modify -node nodename -enabled false`

You only need to disable storage failover once for the HA pair. When you disable storage failover for a node, storage failover is also disabled on the node's partner.

8. Log in to the node that you want to revert.

To revert a node, you must be logged in to the cluster through the node's node management LIF.

9. Set the node's target ONTAP software image to be the default image: `system image modify -node nodename -image target_image -isdefault true`
10. Verify that the target ONTAP software image is set as the default image for the node that you are reverting: `system image show`

The following example shows that version 9.1 is set as the default image on node0:

```
cluster1::*> system image show
```

Node	Image	Is Default	Is Current	Version	Install Date
node0	image1	false	true	9.2	MM/DD/YYYY TIME
	image2	true	false	9.1	MM/DD/YYYY TIME
node1	image1	true	true	9.2	MM/DD/YYYY TIME
	image2	false	false	9.1	MM/DD/YYYY TIME

4 entries were displayed.

11. If the cluster consists of only two nodes, verify that the node does not hold epsilon:
 - a. Check whether the node currently holds epsilon: `cluster show -node nodename`

The following example shows that the node holds epsilon:

```
cluster1::*> cluster show -node node1
```

Node: node1
UUID: 026efc12-ac1a-11e0-80ed-0f7eba8fc313
Epsilon: true
Eligibility: true
Health: true

- b. If the node holds epsilon, mark epsilon as false on the node so that epsilon can be transferred to the node's partner: `cluster modify -node nodenameA -epsilon false`
 - c. Transfer epsilon to the node's partner by marking epsilon true on the partner node: `cluster modify -node nodenameB -epsilon true`
12. Verify that the node is ready for reversion: `system node revert-to -node nodename -check -only true -version 9.x`

The check-only parameter identifies any preconditions that must be addressed before reverting, such as the following examples:

- Disabling storage failover

- Disabling the Snapshot policy
- Deleting Snapshot copies that were created after upgrading to the later version of ONTAP

13. Verify that all of the preconditions have been addressed: `system node revert-to -node nodename -check-only true -version 9.x`
14. Revert the cluster configuration of the node: `system node revert-to -node nodename -version 9.x`

The `-version` option refers to the target release. For example, if the software you installed and verified is ONTAP 9.1, the correct value of the `-version` option is 9.1.

The cluster configuration is reverted, and then you are logged out of the clustershell.

15. Log back in to the clustershell, and then switch to the nodeshell: `run -node nodename`

After logging on the clustershell again, it might take a few minutes before it is ready to accept the nodeshell command. So, if the command fails, wait a few minutes and try it again.

16. Revert the file system configuration of the node: `revert_to 9.x`

This command verifies that the node's file system configuration is ready to be reverted, and then reverts it. If any preconditions are identified, you must address them and then rerun the `revert_to` command.



Using a system console to monitor the revert process displays greater details than seen in nodeshell.

If AUTOBOOT is true, when the command finishes, the node will reboot to ONTAP.

If AUTOBOOT is false, when the command finishes the LOADER prompt is displayed. Enter `yes` to revert; then use `boot_ontap` to manually reboot the node.

17. After the node has rebooted, 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
```

Node	Image	Is Default	Is Current	Version	Install 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.

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

The status should be listed as "complete", "not needed", or "there are no table entries returned."

19. Repeat [\[step-6\]](#) through [\[step-16\]](#) on the other node in the HA pair.
20. If the cluster consists of only two nodes, reenable cluster HA: `cluster ha modify -configured true`
21. Reenable storage failover on both nodes if it was previously disabled: `storage failover modify -node nodename -enabled true`
22. Repeat [\[step-5\]](#) through [\[step-19\]](#) for each additional HA pair and both the clusters in MetroCluster Configuration.

What should I do after reverting my cluster?

Verify cluster and storage health after downgrade or revert

After you downgrade or revert a cluster, you should verify that the nodes are healthy and eligible to participate in the cluster, and that the cluster is in quorum. You should also verify the status of your disks, aggregates, and volumes.

Verify cluster health

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

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

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

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

Enter `y` to continue.

3. Verify the configuration details for each RDB process.
 - The relational database epoch and database epochs should match for each node.
 - The per-ring quorum master should be the same for all nodes.

Note that each ring might have a different quorum master.

To display this RDB process...	Enter this command...
Management application	<code>cluster ring show -unitname mgmt</code>
Volume location database	<code>cluster ring show -unitname vl原因</code>

To display this RDB process...	Enter this command...
Virtual-Interface manager	<code>cluster ring show -unitname vifmgr</code>
SAN management daemon	<code>cluster ring show -unitname bcomd</code>

This example shows the volume location database process:

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

- Return to the admin privilege level: `set -privilege admin`
- If you are operating in a SAN environment, verify that each node is in a SAN quorum: `event log show -severity informational -message-name scsibl原因.*`

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

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

Related information

[System administration](#)

Verify storage health

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

- Verify disk status:

To check for...	Do this...
Broken disks	<ol style="list-style-type: none"> Display any broken disks: <code>storage disk show -state broken</code> Remove or replace any broken disks.
Disks undergoing maintenance or reconstruction	<ol style="list-style-type: none"> Display any disks in maintenance, pending, or reconstructing states: <code>storage disk show -state maintenance pending reconstructing</code> Wait for the maintenance or reconstruction operation to finish before proceeding.

- Verify that all aggregates are online by displaying the state of physical and logical storage, including storage aggregates: `storage aggregate show -state !online`

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

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

- Verify that all volumes are online by displaying any volumes that are *not* online: `volume show -state !online`

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

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

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

See the Knowledge Base article [Volume Showing WAFL Inconsistent](#) on how to address the inconsistent volumes.

Related information

[Disk and aggregate management](#)

Enable automatic switchover for MetroCluster configurations

This topic provides information regarding the additional tasks that you must perform after the reversion of MetroCluster configurations.

- Enable automatic unplanned switchover: `metrocluster modify -auto-switchover-failure -domain auto-on-cluster-disaster`
- Validate the MetroCluster configuration: `metrocluster check run`

Enable and revert LIFs to home ports after a revert

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

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

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

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

```
cluster1::> network interface show -vserver vs0
```

	Logical	Status	Network	Current	
Current Is					
Vserver	Interface	Admin/Oper	Address/Mask	Node	Port
Home					
-----	-----	-----	-----	-----	

vs0					
	data001	down/down	192.0.2.120/24	node0	e0e
true					
	data002	down/down	192.0.2.121/24	node0	e0f
true					
	data003	down/down	192.0.2.122/24	node0	e2a
true					
	data004	down/down	192.0.2.123/24	node0	e2b
true					
	data005	down/down	192.0.2.124/24	node0	e0e
false					
	data006	down/down	192.0.2.125/24	node0	e0f
false					
	data007	down/down	192.0.2.126/24	node0	e2a
false					
	data008	down/down	192.0.2.127/24	node0	e2b
false					

8 entries were displayed.

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

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

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

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

This command reverts all LIFs back to their home ports.

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

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

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

```
cluster1::> network interface show -vserver vs0
```

Current Is	Logical	Status	Network	Current	
Vserver	Interface	Admin/Oper	Address/Mask	Node	Port
Home					
vs0					
true	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

```
8 entries were displayed.
```

Enable Snapshot copy policies after reverting

After reverting to an earlier version of ONTAP, you must enable Snapshot copy policies to

start creating Snapshot copies again.

You are reenabling the Snapshot schedules that you disabled before you reverted to an earlier version of ONTAP.

1. Enable Snapshot copy policies for all data SVMs:

```
volume snapshot policy modify -vserver * -enabled true
```

```
snapshot policy modify pg-rpo-hourly -enable true
```

2. For each node, enable the Snapshot copy policy of the root volume by using the `run-nodenodenamevol optionsroot_vol_namenosnap off` command.

```
cluster1::> run -node node1 vol options vol0 nosnap off
```

Verify client access (SMB and NFS)

For the configured protocols, test access from SMB and NFS clients to verify that the cluster is accessible.

Verify IPv6 firewall entries

A reversion from any version of ONTAP 9 might result in missing default IPv6 firewall entries for some services in firewall policies. You need to verify that the required firewall entries have been restored to your system.

1. Verify that all firewall policies are correct by comparing them to the default policies: `system services firewall policy show`

The following example shows the default policies:

```
cluster1::*> system services firewall policy show
```

Policy	Service	Action	IP-List

cluster	dns	allow	0.0.0.0/0
	http	allow	0.0.0.0/0
	https	allow	0.0.0.0/0
	ndmp	allow	0.0.0.0/0
	ntp	allow	0.0.0.0/0
	rsh	allow	0.0.0.0/0
	snmp	allow	0.0.0.0/0
	ssh	allow	0.0.0.0/0
	telnet	allow	0.0.0.0/0
data	dns	allow	0.0.0.0/0, ::/0
	http	deny	0.0.0.0/0, ::/0
	https	deny	0.0.0.0/0, ::/0
	ndmp	allow	0.0.0.0/0, ::/0
	ntp	deny	0.0.0.0/0, ::/0
	rsh	deny	0.0.0.0/0, ::/0
.			
.			
.			

2. Manually add any missing default IPv6 firewall entries by creating a new firewall policy: `system services firewall policy create`

```
cluster1::*> system services firewall policy create -policy newIPv6  
-service ssh -action allow -ip-list ::/0
```

3. Apply the new policy to the LIF to allow access to a network service: `network interface modify`

```
cluster1::*> network interface modify -vserver VS1 -lif LIF1  
-firewall-policy newIPv6
```

Revert password hash function to the supported encryption type

If you reverted from ONTAP 9.1 or ONTAP 9.0 to ONTAP 8.3.x, SHA-2 account users can no longer be authenticated with their passwords. Passwords must be reset to use the MDS encryption type.

1. Set a temporary password for each SHA-2 user account that you [identified prior to reverting](#): `security login password -username user_name -vserver vs_server_name`

2. Communicate the temporary password to the affected users and have them log in through a console or SSH session to change their passwords as prompted by the system.

Considerations for whether to manually update the SP firmware

If the SP automatic update functionality is enabled (the default), downgrading or reverting to ONTAP 8.3.x does not require a manual SP firmware update. The SP firmware is automatically updated to the newest compatible version that is supported by the ONTAP version you reverted or downgraded to.

If the SP automatic update functionality is disabled (not recommended), after the ONTAP revert or downgrade process is complete, you must manually update the SP firmware to a version that is supported for the ONTAP version you reverted or downgraded to.

[NetApp BIOS/ONTAP Support Matrix](#)

[NetApp Downloads: System Firmware and Diagnostics](#)

Change in user accounts that can access the Service Processor

If you created user accounts on ONTAP 9.8 or earlier, upgraded to ONTAP 9.9.1 or later (when the `-role` parameter is changed to `admin`), and then reverted back to ONTAP 9.8 or earlier, the `-role` parameter is restored to its original value. You should nonetheless verify that the modified values are acceptable.

During revert, if the role for an SP user has been deleted, the "rbac.spuser.role.notfound" EMS message will be logged.

For more information, see [Accounts that can access the SP](#).

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