



Use "system controller replace" commands to upgrade controller hardware introduced in ONTAP 9.15.1

Upgrade controllers

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Use "system controller replace" commands to upgrade controller hardware introduced in ONTAP 9.15.1

Overview

This procedure describes how to upgrade the controller hardware using aggregate relocation (ARL) for the following system configurations:

Method	ONTAP version	Supported systems
Using <code>system controller replace</code> commands	9.15.1 or later	Link to supported systems matrix



You cannot use this procedure to upgrade a MetroCluster FC or IP configuration. To upgrade a MetroCluster configuration, see [References](#) to link to the *MetroCluster Upgrade and Expansion documentation*.

During the procedure, you upgrade the original controller hardware with the replacement controller hardware, relocating the ownership of non-root aggregates. You migrate aggregates multiple times from node to node to confirm that at least one node is serving data from the aggregates throughout the upgrade procedure. You also migrate data logical interfaces (LIFs) and assign the network ports on the new controller to the interface groups as you proceed.

Terminology used in this information

In this information, the original nodes are called "node1" and "node2", and the new nodes are called "node3" and "node4". During the described procedure, node1 is replaced by node3, and node2 is replaced by node4.

The terms "node1", "node2", "node3", and "node4" are used only to distinguish between the original and new nodes. When following the procedure, you must substitute the real names of your original and new nodes. However, in reality, the names of the nodes do not change: node3 has the name node1, and node4 has the name node2 after the controller hardware is upgraded.

Important information:

- This procedure is complex and assumes that you have advanced ONTAP administration skills. You also must read and understand the [Guidelines for upgrading controllers with ARL](#) and the [Overview of the ARL upgrade](#) sections before beginning the upgrade.
- This procedure assumes that the replacement controller hardware is new and has not been used. The steps required to prepare used controllers with the `wipeconfig` command are not included in this procedure. You must contact technical support if the replacement controller hardware was previously used.
- You can use this procedure to upgrade the controller hardware in clusters with more than two nodes; however, you need to perform the procedure separately for each high-availability (HA) pair in the cluster.
- When you upgrade to an AFF A70, AFF A90, or AFF A1K system introduced in ONTAP 9.15.1, ONTAP converts the storage efficiency of all existing thin-provisioned volumes, including those not using storage efficiency, and applies the new storage efficiency features that make use of the hardware offload functionality. This is an automatic background process, with no visible performance impact to the system. [Learn more](#).

Automate the controller upgrade process

During a controller upgrade, the controller is replaced with another controller running a newer or more powerful platform. This content provides the steps for the partially automated procedure, which utilizes automatic network port reachability checks to further simplify the controller upgrade experience.

Decide whether to use the aggregate relocation procedure

This procedure describes how to upgrade the storage controllers in an HA pair with new controllers while keeping the existing data and disks. This is a complex procedure that should be used only by experienced administrators.

You can use this procedure under the following circumstances:

- You are running ONTAP 9.15.1 or later.
- You do not want to add the new controllers as a new HA pair to the cluster and migrate the data using the volume move procedure.
- You are experienced in administering ONTAP and are comfortable with the risks of working in the diagnostic privilege mode.



You can use NetApp Storage Encryption (NSE), NetApp Volume Encryption (NVE), and NetApp Aggregate Encryption (NAE) with this procedure.

You cannot use this procedure under the following circumstances:

- You are upgrading an AFF A800 to an AFF A70 or AFF A90. To perform this AFF A800 upgrade, see [References](#) to link to *Use "system controller replace" commands to upgrade controller models in the same chassis*.
- You are upgrading a V-Series system or FlexArray Virtualization storage system using an external array for backend storage. Contact technical support for options to upgrade a V-series or FlexArray system.
- You are upgrading a MetroCluster FC or IP configuration. To upgrade a MetroCluster configuration, see [References](#) to link to the *MetroCluster Upgrade and Expansion documentation*.

The following table shows the supported model matrix for the controller upgrade.

Existing controller	Replacement controller
AFF A300	AFF A70, AFF A90, and AFF A1K
AFF A400	AFF A70, AFF A90, and AFF A1K
AFF A700	AFF A70, AFF A90, and AFF A1K
AFF A900	AFF A90 and AFF A1K



The AFF A70 and AFF A90 are integrated systems with onboard disks. The two controllers and disks are in a single chassis. You cannot upgrade an existing system if the new controllers have internal drives.

If your controller upgrade model combination is not in the above table, contact technical support.

If you prefer a different method of upgrading the controller hardware and are willing to do volume moves, refer to [References](#) to link to *Upgrade by moving volumes or storage*.

Refer to [References](#) to link to the *ONTAP 9 Documentation Center* where you can access ONTAP 9 product documentation.

Required tools and documentation

You must have specific tools to install the new hardware, and you need to reference other documents during the upgrade process.

You need the following tools to perform the upgrade:

- Grounding strap
- #2 Phillips screwdriver

Go to the [References](#) section to access the list of reference documents and reference sites required for this upgrade

Guidelines for upgrading controllers with ARL

To understand whether you can use ARL to upgrade a pair of controllers running ONTAP 9.15.1 or later depends on the platform and the configuration of both the original and replacement controllers.

Supported upgrades for ARL

Before upgrading a pair of nodes using this ARL procedure, review the following requirements to ensure your configuration is supported:

- Verify that ARL can be performed on the original and replacement controllers.
- Check the size of all defined aggregates and number of disks supported by the original system. You then compare the aggregate sizes and number of disks supported to the aggregate size and number of disks supported by the new system. Refer to [References](#) to link to the *Hardware Universe* where this information is available. The aggregate size and the number of disks supported by the new system must be equal to or greater than the aggregate size and number of disks supported by the original system.
- Validate in the cluster mixing rules whether new nodes can become part of the cluster with the existing nodes when the original controller is replaced. For more information about cluster mixing rules, refer to [References](#) to link to the *Hardware Universe*.
- Migrate and re-home the cluster LIFs to two cluster ports per node if you have a system, such as an AFF 700, with the following configuration:
- More than two cluster ports per node

- A cluster interconnect card in slot4 in breakout mode to create ports e4a, e4b, e4c, and e4d, and ports e4e, e4f, e4g, and e4h



Performing a controller upgrade with more than two cluster ports per node might result in missing cluster LIFs on the new controller after the upgrade.

For more information, see the Knowledge Base article [How to delete unwanted or unnecessary cluster LIFs](#).

Controller upgrade using ARL is supported on systems configured with SnapLock Enterprise and SnapLock Compliance volumes.

Two-node switchless clusters

If you are upgrading nodes in a two-node switchless cluster, you can leave the nodes in the switchless cluster while performing the upgrade. You do not need to convert them to a switched cluster.

Upgrades not supported for ARL

You cannot upgrade replacement controllers that do not support the disk shelves connected to the original controllers.

Refer to [References](#) to link to the *Hardware Universe* for disk-support information.

If you want to upgrade entry level controllers with internal drives, refer to [References](#) to link to *Upgrade by moving volumes or storage* and go to the procedure *Upgrading a pair of nodes running clustered Data ONTAP by moving volumes*.

Troubleshoot

If any problems occur while upgrading the controllers, see [Troubleshoot](#) for more information and possible solutions.

If you do not find a solution to the problem you encountered, contact technical support.

Overview of the ARL upgrade

Before you upgrade the nodes using ARL, you should understand how the procedure works. In this content, the procedure is broken down into several stages.

Upgrade the node pair

To upgrade the node pair, you need to prepare the original nodes and then perform a series of steps on both the original and new nodes. You can then decommission the original nodes.

ARL upgrade sequence overview

During the procedure, you upgrade the original controller hardware with the replacement controller hardware, one controller at a time, taking advantage of the HA pair configuration to relocate the ownership of non-root aggregates. All non-root aggregates must undergo two relocations to reach their final destination, which is the correct upgraded node.

Each aggregate has a home owner and current owner. The home owner is the actual owner of the aggregate, and the current owner is the temporary owner.

The following table describes the high-level tasks you perform during each stage and the state of aggregate ownership at the end of the stage. Detailed steps are provided later in the procedure:

Stage	Description
<p>Stage 1. Prepare for upgrade</p>	<p>During Stage 1, you run prechecks and, if required, correct aggregate ownership. You must record certain information if you are managing storage encryption by using the OKM and you can choose to quiesce the SnapMirror relationships.</p> <p>Aggregate ownership at the end of Stage 1:</p> <ul style="list-style-type: none"> • Node1 is the home owner and current owner of the node1 aggregates. • Node2 is the home owner and current owner of the node2 aggregates.
<p>Stage 2. Relocate and retire node1</p>	<p>During Stage 2, you relocate node1 non-root aggregates and NAS data LIFs to node2. This process is largely automated; the operation pauses to enable you to check its status. You must manually resume the operation. If required, you relocate failed or vetoed aggregates. You record node1 information for use later in the procedure before retiring node1. You can also prepare to netboot node3 and node4 later in the procedure.</p> <p>Aggregate ownership at the end of Stage 2:</p> <ul style="list-style-type: none"> • Node2 is the current owner of node1 aggregates. • Node2 is the home owner and current owner of node2 aggregates.
<p>Stage 3. Install and boot node3</p>	<p>During Stage 3, you install and boot node3, check that the cluster and node-management ports from node1 come online on node3, and verify the node3 installation. If you are using NetApp Volume Encryption (NVE), you restore key-manager configuration. You also relocate the node1 NAS data LIFs and non-root aggregates from node2 to node3 and verify that the SAN LIFs exist on node3.</p> <p>Aggregate ownership at the end of Stage 3:</p> <ul style="list-style-type: none"> • Node3 is the home owner and current owner of node1 aggregates. • Node2 is the home owner and current owner of node2 aggregates.

Stage	Description
Stage 4. Relocate and retire node2	<p>During Stage 4, you relocate non-root aggregates and NAS data LIFs from node2 to node3. You also record node2 information for use later in the procedure before retiring node2.</p> <p>Aggregate ownership at the end of Stage 4:</p> <ul style="list-style-type: none"> • Node3 is the home owner and current owner of aggregates that originally belonged to node1. • Node2 is the home owner of node2 aggregates. • Node3 is the current owner of node2 aggregates.
Stage 5. Install and boot node4	<p>During Stage 5, you install and boot node4, check that the cluster and node-management ports from node2 come online on node4, and verify the node4 installation. If you are using NVE, you restore key-manager configuration. You also relocate node2 NAS data LIFs and non-root aggregates from node3 to node4 and verify that the SAN LIFs exist on node4.</p> <p>Aggregate ownership at the end of Stage 5:</p> <ul style="list-style-type: none"> • Node3 is the home owner and current owner of the aggregates that originally belonged to node1. • Node4 is the home owner and current owner of aggregates that originally belonged to node2.
Stage 6. Complete the upgrade	<p>During Stage 6, you confirm that the new nodes are set up correctly and, if the new nodes are encryption-enabled, you configure and set up Storage Encryption or NVE. You should also decommission the old nodes and resume the SnapMirror operations.</p>

Stage 1. Prepare for upgrade

Stage 1 overview

During Stage 1, you run prechecks and, if required, correct aggregate ownership. You also record certain information if you are managing storage encryption by using the Onboard Key Manager and you can choose to quiesce the SnapMirror relationships.

Steps

1. [Prepare the nodes for upgrade](#)
2. [Manage storage encryption using the Onboard Key Manager](#)

Prepare the nodes for upgrade

The controller replacement process begins with a series of prechecks. You also gather information about the original nodes for use later in the procedure and, if required,

determine the type of self-encrypting drives that are in use.

Steps

1. Begin the controller replacement process by entering the following command in the ONTAP command line:

```
system controller replace start -nodes <node_names>
```



You can only execute the system controller replace start command at the advanced privilege level: `set -privilege advanced`

You will see output similar to the following example. The output displays the ONTAP version running on your cluster:

```
Warning: 1. Current ONTAP version is 9.15.1
```

```
2. Verify that NVMEM or NVRAM batteries of the new nodes are charged, and charge them if they are not. You need to physically check the new nodes to see if the NVMEM or NVRAM batteries are charged. You can check the battery status either by connecting to a serial console or using SSH, logging into the Service Processor (SP) or Baseboard Management Controller (BMC) for your system, and use the system sensors to see if the battery has a sufficient charge.
```

```
Attention: Do not try to clear the NVRAM contents. If there is a need to clear the contents of NVRAM, contact NetApp technical support.
```

```
3. If a controller was previously part of a different cluster, run wipeconfig before using it as the replacement controller.
```

```
4. Note: This is not a MetroCluster configuration. Controller replacement supports only ARL based procedure.  
Do you want to continue? {y|n}: y
```

2. Press `y`, you will see the following output:

```
Controller replacement operation: Prechecks in progress.  
Controller replacement operation has been paused for user intervention.
```

The system runs the following prechecks; record the output of each precheck for use later in the procedure:

Precheck	Description
Cluster Health Check	Checks all the nodes in the cluster to confirm they are healthy.
Aggregate Relocation Status Check	Checks whether an aggregate relocation is already in progress. If another aggregate relocation is in progress, the check fails.

Precheck	Description
Model Name Check	Checks whether the controller models are supported for this procedure. If the models are not supported, the task fails.
Cluster Quorum Check	Checks that the nodes being replaced are in quorum. If the nodes are not in quorum, the task fails.
Image Version Check	Checks that the nodes being replaced run the same version of ONTAP. If the ONTAP image versions are different, the task fails. The new nodes must have the same version of ONTAP 9.x installed on them that is installed on the original nodes. If the new nodes have a different version of ONTAP installed, you need to netboot the new controllers after you install them. For instructions on how to upgrade ONTAP, refer to References to link to <i>Upgrade ONTAP</i> .
HA Status Check	Checks if both the nodes being replaced are in a high-availability (HA) pair configuration. If storage failover is not enabled for the controllers, the task fails.
Aggregate Status Check	If the nodes being replaced own aggregates for which they are not the home owner, the task fails. The nodes should not own any non-local aggregates.
Disk Status Check	If any nodes being replaced have missing or failed disks, the task fails. If any disks are missing, refer to References to link to <i>Disk and aggregate management with the CLI</i> , <i>Logical storage management with the CLI</i> , and <i>High Availability management</i> to configure storage for the HA pair.
Data LIF Status Check	Checks if any of the nodes being replaced have non-local data LIFs. The nodes should not contain any data LIFs for which they are not the home owner. If one of the nodes contains non-local data LIFs, the task fails.
Cluster LIF Status	Checks whether the cluster LIFs are up for both nodes. If the cluster LIFs are down, the task fails.
ASUP Status Check	If ASUP notifications are not configured, the task fails. You must enable ASUP before beginning the controller replacement procedure.
CPU Utilization Check	Checks if the CPU utilization is more than 50% for any of the nodes being replaced. If the CPU usage is more than 50% for a considerable period of time, the task fails.
Aggregate Reconstruction Check	Checks if reconstruction is occurring on any data aggregates. If aggregate reconstruction is in progress, the task fails.
Node Affinity Job Check	Checks if any node affinity jobs are running. If node affinity jobs are running, the check fails.

3. After the controller replacement operation is started and the prechecks are completed, the operation

pauses enabling you to collect output information that you might need later when configuring node3.



Before you start the upgrade, you migrate and re-home the cluster LIFs to two cluster ports per node if you have a system, such as an AFF 700, with the following configuration:

- More than two cluster ports per node
- A cluster interconnect card in slot4 in breakout mode to create ports e4a, e4b, e4c, and e4d, and ports e4e, e4f, e4g, and e4h

Performing a controller upgrade with more than two cluster ports per node might result in missing cluster LIFs on the new controller after the upgrade.

For more information, see the Knowledge Base article [How to delete unwanted or unnecessary cluster LIFs](#).

4. Run the below set of commands as directed by the controller replacement procedure on the system console.

From the serial port connected to each node, run and save the output of the following commands individually:

- `vserver services name-service dns show`
- `network interface show -curr-node <local> -role <cluster,intercluster,node-mgmt,cluster-mgmt,data>`
- `network port show -node <local> -type physical`
- `service-processor show -node <local> -instance`
- `network fcp adapter show -node <local>`
- `network port ifgrp show -node <local>`
- `system node show -instance -node <local>`
- `run -node <local> sysconfig`
- `storage aggregate show -r`
- `storage aggregate show -node <local>`
- `volume show -node <local>`
- `system license show -owner <local>`
- `storage encryption disk show`
- `security key-manager onboard show-backup`
- `security key-manager external show`
- `security key-manager external show-status`
- `network port reachability show -detail -node <local>`



If NetApp Volume Encryption (NVE) or NetApp Aggregate Encryption (NAE) using the Onboard Key Manager (OKM) is in use, keep the key manager passphrase ready to complete the key manager resync later in the procedure.

5. If your system uses self-encrypting drives, see the Knowledge Base article [How to tell if a drive is FIPS certified](#) to determine the type of self-encrypting drives that are in use on the HA pair that you are upgrading. ONTAP software supports two types of self-encrypting drives:

- FIPS-certified NetApp Storage Encryption (NSE) SAS or NVMe drives
- Non-FIPS self-encrypting NVMe drives (SED)

[Learn more about supported self-encrypting drives.](#)

Correct aggregate ownership if an ARL precheck fails

If the Aggregate Status Check fails, you must return aggregates owned by the partner node to the home owner node and initiate the precheck process again.

Steps

1. Return the aggregates currently owned by the partner node to the home owner node:

```
storage aggregate relocation start -node source_node -destination destination_node -aggregate-list *
```

2. Verify that neither node1 nor node2 still owns aggregates for which it is the current owner (but not the home owner):

```
storage aggregate show -nodes node_name -is-home false -fields owner-name, home-name, state
```

The following example shows the output of the command when a node is both the current owner and home owner of aggregates:

```
cluster::> storage aggregate show -nodes node1 -is-home true -fields
owner-name,home-name,state
aggregate   home-name  owner-name  state
-----
aggr1      node1      node1       online
aggr2      node1      node1       online
aggr3      node1      node1       online
aggr4      node1      node1       online

4 entries were displayed.
```

After you finish

You must restart the controller replacement process:

```
system controller replace start -nodes node_names
```

License

For detailed information about ONTAP licensing, refer to [License management](#).



Using unlicensed features on the controller might put you out of compliance with your license agreement.

Manage storage encryption using the Onboard Key Manager

You can use the Onboard Key Manager (OKM) to manage encryption keys. If you have the OKM set up, you must record the passphrase and backup material before beginning the upgrade.

Steps

1. Record the cluster-wide passphrase.

This is the passphrase that was entered when the OKM was configured or updated using the CLI or REST API.

2. Back up the key-manager information by running the `security key-manager onboard show-backup` command.

Quiesce the SnapMirror relationships (optional)

Before continuing with the procedure, you must confirm that all the SnapMirror relationships are quiesced. When a SnapMirror relationship is quiesced, it remains quiesced across reboots and failovers.

Steps

1. Verify the SnapMirror relationship status on the destination cluster:

```
snapmirror show
```



If the status is "Transferring", you must abort those transfers:

```
snapmirror abort -destination-vserver vservers_name
```

The abort fails if the SnapMirror relationship is not in the "Transferring" state.

2. Quiesce all relationships between the cluster:

```
snapmirror quiesce -destination-vserver *
```

Stage 2. Relocate and retire node1

Stage 2 overview

During Stage 2, you relocate node1 non-root aggregates and NAS data LIFs to node2. This process is largely automated; the operation pauses to enable you to check its status. You must manually resume the operation. If required, you relocate failed or vetoed aggregates. You also record the necessary node1 information, retire node1, and prepare to netboot node3 and node4 later in the procedure.

Steps

1. [Relocate non-root aggregates and NAS data LIFs owned by node1 to node2](#)
2. [Relocate failed or vetoed aggregates](#)
3. [Retire node1](#)
4. [Prepare for netboot](#)

Relocate non-root aggregates and NAS data LIFs owned by node1 to node2

Before you can replace node1 with node3, you must move the non-root aggregates and NAS data LIFs from node1 to node2 before eventually moving node1's resources to node3.

Before you begin

The operation should already be paused when you begin the task; you must manually resume the operation.

About this task

After the aggregates and LIFs are migrated, the operation is paused for verification purposes. At this stage, you must verify whether or not all the non-root aggregates and non-SAN data LIFs are migrated to node3.



The home owner for the aggregates and LIFs is not modified; only the current owner is modified.

Steps

1. Resume the aggregate relocation and NAS data LIF move operations:

```
system controller replace resume
```

All the non-root aggregates and NAS data LIFs are migrated from node1 to node2.

The operation pauses to enable you to verify whether all node1 non-root aggregates and non-SAN data LIFs have been migrated to node2.

2. Check the status of the aggregate relocation and NAS data LIF move operations:

```
system controller replace show-details
```

3. With the operation still paused, verify that all the non-root aggregates are online for their state on node2:

```
storage aggregate show -node node2 -state online -root false
```

The following example shows that the non-root aggregates on node2 are online:

```
cluster::> storage aggregate show -node node2 state online -root false
```

Aggregate	Size	Available	Used%	State	#Vols	Nodes	RAID Status
aggr_1	744.9GB	744.8GB	0%	online	5	node2	raid_dp,normal
aggr_2	825.0GB	825.0GB	0%	online	1	node2	raid_dp,normal

2 entries were displayed.

If the aggregates have gone offline or become foreign on node2, bring them online by using the following command on node2, once for each aggregate:

```
storage aggregate online -aggregate aggr_name
```

- Verify that all the volumes are online on node2 by using the following command on node2 and examining its output:

```
volume show -node node2 -state offline
```

If any volumes are offline on node2, bring them online by using the following command on node2, once for each volume:

```
volume online -vserver vserver_name -volume volume_name
```

The *vserver_name* to use with this command is found in the output of the previous `volume show` command.

- If any LIFs are down, set the administrative status of the LIFs to `up` by using the following command, once for each LIF:

```
network interface modify -vserver vserver_name -lif LIF_name -home-node nodename -status-admin up
```

Relocate failed or vetoed aggregates

If any aggregates fail to relocate or are vetoed, you must manually relocate the aggregates, or if necessary, override either the vetoes or destination checks.

About this task

The relocation operation will have paused due to the error.

Steps

- Check the event management system (EMS) logs to determine why the aggregate failed to relocate or was vetoed.
- Relocate any failed or vetoed aggregates:

```
storage aggregate relocation start -node node1 -destination node2 -aggregate
-list aggr_name -ndo-controller-upgrade true
```

- When prompted, enter `y`.
- You can force relocation by using one of the following methods:

Option	Description
Overriding veto checks	Use the following command: <pre>storage aggregate relocation start -node node1 -destination node2 -aggregate-list aggr_list -ndo -controller-upgrade true -override-vetoes true</pre>
Overriding destination checks	Use the following command: <pre>storage aggregate relocation start -node node1 -destination node2 -aggregate-list aggr_list -ndo -controller-upgrade true -override-vetoes true -override-destination-checks true</pre>

Retire node1

To retire node1, you resume the automated operation to disable the HA pair with node2 and shut node1 down correctly. Later in the procedure, you remove node1 from the rack or chassis.

Steps

- Resume the operation:

```
system controller replace resume
```

- Verify that node1 has been halted:

```
system controller replace show-details
```

After you finish

You can decommission node1 after the upgrade is completed. See [Decommission the old system](#).

Prepare for netboot

After you physically rack node3 and node4 later in the procedure, you might need to netboot them. The term "netboot" means you are booting from an ONTAP image stored on a remote server. When preparing for netboot, you put a copy of the ONTAP 9 boot image onto a web server that the system can access.

You can also use the USB boot option to perform a netboot. See the Knowledge Base article [How to use the boot_recovery LOADER command for installing ONTAP for initial setup of a system](#).

Before you begin

- Verify that you can access a HTTP server with the system.

- Refer to [References](#) to link to the *NetApp Support Site* and download the necessary system files for your platform and the correct version of ONTAP.

About this task

You must netboot the new controllers if they do not have the same version of ONTAP 9 installed on them that is installed on the original controllers. After you install each new controller, you boot the system from the ONTAP 9 image stored on the web server. You can then download the correct files to the boot media device for subsequent system boots.

Steps

1. Access the NetApp Support Site to download the files used for performing the netboot of the system.
2. Download the appropriate ONTAP software from the software download section of the NetApp Support Site and store the `<ontap_version>_image.tgz` file on a web-accessible directory.
3. Change to the web-accessible directory and verify that the files you need are available.

Your directory listing should contain the following file:

```
<ontap_version>_image.tgz
```



You do not need to extract the contents of the `<ontap_version>_image.tgz` file.

You will use the information in the directories in [Stage 3](#).

Stage 3. Install and boot node3

Stage 3 overview

During Stage 3, you install and boot node3, check that the cluster and node-management ports from node1 come online on node3, and verify the node3 installation. If you are using NetApp Volume Encryption (NVE), you restore key-manager configuration. You also relocate the node1 NAS data LIFs and non-root aggregates from node2 to node3 and verify that the SAN LIFs exist on node3.

Steps

1. [Install and boot node3](#)
2. [Verify the node3 installation](#)
3. [Restore key-manager configuration on node3](#)
4. [Move non-root aggregates and NAS data LIFs owned by node1 from node2 to node3](#)

Install and boot node3

You install node3 in the rack, transfer node1's connections to node3, boot node3, and install ONTAP. You then reassign any of node1's spare disks, any disks belonging to the root volume, and any non-root aggregates that were not relocated to node2 earlier in the process, as outlined in this section.

About this task

The relocation operation is paused at the beginning of this stage. This process is largely automated; the

operation pauses to enable you to check its status. You must manually resume the operation. In addition, you must verify that the SAN LIFs have successfully come online and are assigned to the correct FC physical ports on node3.

You need to netboot node3 if it does not have the same version of ONTAP 9 that is installed on node1. After you install node3, boot it from the ONTAP 9 image stored on the web server. You can then download the correct files to the boot media device for subsequent system boots, by following the instructions in [Prepare for netboot](#).

Steps

1. Make sure that you have rack space for node3.

The space and height requirements for the new nodes might be different from the existing nodes. Plan for the space requirements for your upgrade scenario.

2. Install node3 in the rack, following the *Installation and Setup Instructions* for your node model.
3. Cable node3, moving the connections from node1 to node3.

Beginning with ONTAP 9.15.1, new controller models have only one "wrench" port for the baseboard management controller (BMC) and management connections. Plan the cabling changes accordingly.

- Console (remote management port)
- Cluster and HA ports
- Data ports
- Cluster and node management ports
- Serial-attached SCSI (SAS) and Ethernet storage ports
- SAN configurations: iSCSI Ethernet, FC, and NVMe/FC switch ports



You might need to change the interconnect cables between the old and new controllers to allow interoperability between the different controller and card models. Refer to the [system installation procedures](#) for a cabling map of the Ethernet storage shelves for your systems.

For controllers introduced in ONTAP 9.15.1 and later, cluster and HA interconnects use the same ports. For switch connected configurations, it is required to connect similar ports to the same cluster switches. For example, when upgrading to an AFF A1K from an existing controller, you should connect e1a ports on both nodes to one switch and e7a ports on both nodes to the second switch.

4. Turn on the power to node3, and then interrupt the boot process by pressing Ctrl-C at the console terminal to access the boot environment prompt.



When you boot node3, you might see the following warning message:

WARNING: The battery is unfit to retain data during a power outage. This is likely because the battery is discharged but could be due to other temporary conditions.

When the battery is ready, the boot process will complete and services will be engaged.

To override this delay, press 'c' followed by 'Enter'

5. If you see the warning message in [Step 4](#), take the following actions:
 - a. Check for any console messages that might indicate a problem other than a low NVRAM battery, and, if necessary, take any required corrective action.
 - b. Allow the battery to charge and the boot process to complete.



Attention: Do not override the delay; failure to allow the battery to charge could result in a loss of data.



Refer to [Prepare for netboot](#).

6. Configure the netboot connection by choosing one of the following actions.



You must use the management port and IP as the netboot connection. Do not use a data LIF IP or a data outage might occur while the upgrade is being performed.

If Dynamic Host Configuration Protocol (DHCP) is...	Then...
Running	Configure the connection automatically by using the following command at the boot environment prompt: <pre>ifconfig e0M -auto</pre>
Not running	Manually configure the connection by using the following command at the boot environment prompt: <pre>ifconfig e0M -addr=<i>filer_addr</i> -mask=<i>netmask</i> -gw=<i>gateway</i> -dns=<i>dns_addr</i> -domain=<i>dns_domain</i></pre> <p><i>filer_addr</i> is the IP address of the storage system (mandatory). <i>netmask</i> is the network mask of the storage system (mandatory). <i>gateway</i> is the gateway for the storage system (mandatory). <i>dns_addr</i> is the IP address of a name server on your network (optional). <i>dns_domain</i> is the Domain Name Service (DNS) domain name (optional).</p> <div style="display: flex; align-items: center;"><p>Other parameters might be necessary for your interface. Enter <code>help ifconfig</code> at the firmware prompt for details.</p></div>

7. Perform netboot on node3:

```
netboot http://<web_server_ip/path_to_web-
accessible_directory>/<ontap_version>_image.tgz
```

The <path_to_the_web-accessible_directory> should lead to where you downloaded the <ontap_version>_image.tgz in the section [Prepare for netboot](#).



Do not interrupt the boot.

8. From the boot menu, select option (7) Install new software first.

This menu option downloads and installs the new ONTAP image to the boot device.

Disregard the following message:

```
This procedure is not supported for Non-Disruptive Upgrade on an HA pair
```

The note applies to nondisruptive upgrades of ONTAP, and not upgrades of controllers.



Always use netboot to update the new node to the desired image. If you use another method to install the image on the new controller, the incorrect image might install. This issue applies to all ONTAP releases. The netboot procedure combined with option (7) `Install new software` wipes the boot media and places the same ONTAP version on both image partitions.

9. If you are prompted to continue the procedure, enter `y`, and when prompted for the package, enter the URL:

```
http://<web_server_ip/path_to_web-
accessible_directory>/<ontap_version>_image.tgz
```

10. Complete the following substeps to reboot the controller module:
 - a. Enter `n` to skip the backup recovery when you see the following prompt:

```
Do you want to restore the backup configuration now? {y|n}
```

- b. Enter `y` to reboot when you see the following prompt:

```
The node must be rebooted to start using the newly installed software. Do
you want to reboot now? {y|n}
```

The controller module reboots but stops at the boot menu because the boot device was reformatted, and the configuration data must be restored.

11. Select maintenance mode 5 from the boot menu and enter `y` when you are prompted to continue with the boot.
12. Verify that the controller and chassis are configured as ha:

```
ha-config show
```

The following example shows the output of the `ha-config show` command:

```
Chassis HA configuration: ha
Controller HA configuration: ha
```



System records in a PROM whether they are in an HA pair or stand-alone configuration. The state must be the same on all components within the stand-alone system or HA pair.

13. If the controller and chassis are not configured as ha, use the following commands to correct the configuration:

```
ha-config modify controller ha
```

```
ha-config modify chassis ha
```

14. Confirm that all Ethernet ports used to connect to the Ethernet shelves are configured as storage:

```
storage port show
```

The output displayed depends on the system configuration. The following output example is for a node with a single storage card in slot11. The output for your system might be different:

```
*> storage port show
Port Type Mode      Speed(Gb/s) State      Status  VLAN ID
---- ---- -
e11a ENET storage 100 Gb/s   enabled   online  30
e11b ENET storage 100 Gb/s   enabled   online  30
```

15. Modify the ports that are not set to storage:

```
storage port modify -p <port> -m storage
```

All Ethernet ports connected to storage shelves must be configured as storage to allow access to the disks and shelves.

16. Exit maintenance mode:

```
halt
```

Interrupt the autoboot by pressing `Ctrl-C` at the boot environment prompt.

17. On node2, check the system date, time, and time zone:

```
date
```

18. On node3, check the date by using the following command at the boot environment prompt:

```
show date
```

19. If necessary, set the date on node3:

```
set date <mm/dd/yyyy>
```

20. On node3, check the time by using the following command at the boot environment prompt:

```
show time
```

21. If necessary, set the time on node3:

```
set time <hh:mm:ss>
```

22. In boot loader, set the partner system ID on node3:

```
setenv partner-sysid <node2_sysid>
```

For node3, partner-sysid must be that of node2.

- a. Save the settings:

```
saveenv
```

23. Verify the partner-sysid for node3:

```
printenv partner-sysid
```

24. If you have NetApp Storage Encryption (NSE) drives installed, perform the following steps.



If you have not already done so earlier in the procedure, see the Knowledge Base article [How to tell if a drive is FIPS certified](#) to determine the type of self-encrypting drives that are in use.

- a. Set `bootarg.storageencryption.support` to true or false:

If the following drives are in use...	Then...
NSE drives that conform to FIPS 140-2 Level 2 self-encryption requirements	<code>setenv bootarg.storageencryption.support true</code>
NetApp non-FIPS SEDs	<code>setenv bootarg.storageencryption.support false</code>

- b. Go to the special boot menu and select option (10) Set Onboard Key Manager recovery secrets.

Enter the passphrase and the backup information that you recorded earlier procedure. See [Manage storage encryption using the Onboard Key Manager](#).

25. Boot node into boot menu:

```
boot_ontap menu
```

26. On node3, go to the boot menu and using 22/7, select the hidden option

`boot_after_controller_replacement`. At the prompt, enter node1 to reassign the disks of node1 to node3, as per the following example.

Expand the console output example

```
LOADER-A> boot_ontap menu
.
<output truncated>
.
All rights reserved.
*****
*                                     *
* Press Ctrl-C for Boot Menu. *
*                                     *
*****
.
<output truncated>
.
Please choose one of the following:
(1) Normal Boot.
(2) Boot without /etc/rc.
(3) Change password.
(4) Clean configuration and initialize all disks.
(5) Maintenance mode boot.
(6) Update flash from backup config.
(7) Install new software first.
(8) Reboot node.
(9) Configure Advanced Drive Partitioning.
(10) Set Onboard Key Manager recovery secrets.
(11) Configure node for external key management.
Selection (1-11)? 22/7
(22/7) Print this secret List
(25/6) Force boot with multiple filesystem disks missing.
(25/7) Boot w/ disk labels forced to clean.
(29/7) Bypass media errors.
(44/4a) Zero disks if needed and create new flexible root volume.
(44/7) Assign all disks, Initialize all disks as SPARE, write DDR
labels
.
<output truncated>
.
(wipeconfig) Clean all configuration on boot
device
(boot_after_controller_replacement) Boot after controller upgrade
(boot_after_mcc_transition) Boot after MCC transition
(9a) Unpartition all disks and remove
their ownership information.
(9b) Clean configuration and
initialize node with partitioned disks.
```

```
(9c) Clean configuration and
initialize node with whole disks.
(9d) Reboot the node.
(9e) Return to main boot menu.
```

The boot device has changed. System configuration information could be lost. Use option (6) to restore the system configuration, or option (4) to initialize all disks and setup a new system.

Normal Boot is prohibited.

Please choose one of the following:

- (1) Normal Boot.
- (2) Boot without /etc/rc.
- (3) Change password.
- (4) Clean configuration and initialize all disks.
- (5) Maintenance mode boot.
- (6) Update flash from backup config.
- (7) Install new software first.
- (8) Reboot node.
- (9) Configure Advanced Drive Partitioning.
- (10) Set Onboard Key Manager recovery secrets.
- (11) Configure node for external key management.

Selection (1-11)? boot_after_controller_replacement

This will replace all flash-based configuration with the last backup to disks. Are you sure you want to continue?: yes

.

<output truncated>

.

Controller Replacement: Provide name of the node you would like to replace:<nodename of the node being replaced>

Changing sysid of node nodel disks.

Fetches sanown old_owner_sysid = 536940063 and calculated old sys id = 536940063

Partner sysid = 4294967295, owner sysid = 536940063

.

<output truncated>

.

varfs_backup_restore: restore using /mroot/etc/varfs.tgz

varfs_backup_restore: attempting to restore /var/kmip to the boot device

varfs_backup_restore: failed to restore /var/kmip to the boot device

varfs_backup_restore: attempting to restore env file to the boot device

varfs_backup_restore: successfully restored env file to the boot device wrote key file "/tmp/rndc.key"

varfs_backup_restore: timeout waiting for login

varfs_backup_restore: Rebooting to load the new varfs

Terminated


```

<node reboots>
System rebooting...
.
Restoring env file from boot media...
copy_env_file:scenario = head upgrade
Successfully restored env file from boot media...
Rebooting to load the restored env file...
.
System rebooting...
.
<output truncated>
.
WARNING: System ID mismatch. This usually occurs when replacing a
boot device or NVRAM cards!
Override system ID? {y|n} y
.
Login:

```



In the above console output example, ONTAP will prompt you for the partner node name if the system uses Advanced Disk Partitioning (ADP) disks.

27. If the system goes into a reboot loop with the message `no disks found`, it indicates that there was a problem with the disk reassignment. See [Troubleshoot](#) to resolve the issue.
28. Press `Ctrl-C` during autoboot to stop the node at the `LOADER>` prompt.
29. At the `LOADER` prompt, enter maintenance mode:

```
boot_ontap maint
```

30. Verify the disk connectivity, controller model string, HA-configuration, and other hardware connectivity related details.
31. Exit maintenance mode:

```
halt
```

32. At the `LOADER` prompt, boot up:

```
boot_ontap menu
```

Now, on booting, the node can detect all the disks that were previously assigned to it and can boot up as expected.

When the cluster nodes you are replacing use root volume encryption, ONTAP is unable to read the volume information from the disks. Restore the keys for the root volume.



This only applies when the root volume is using NetApp Volume Encryption.

- a. Return to the special boot menu:

```
LOADER> boot_ontap menu
```

```
Please choose one of the following:
(1) Normal Boot.
(2) Boot without /etc/rc.
(3) Change password.
(4) Clean configuration and initialize all disks.
(5) Maintenance mode boot.
(6) Update flash from backup config.
(7) Install new software first.
(8) Reboot node.
(9) Configure Advanced Drive Partitioning.
(10) Set Onboard Key Manager recovery secrets.
(11) Configure node for external key management.

Selection (1-11)? 10
```

b. Select **(10) Set Onboard Key Manager recovery secrets**

c. Enter `y` at the following prompt:

```
This option must be used only in disaster recovery procedures. Are you sure?
(y or n): y
```

d. At the prompt, enter the key-manager passphrase.

e. Enter the backup data when prompted.



You must have obtained the passphrase and backup data in the [Prepare the nodes for upgrade](#) section of this procedure.

f. After the system boots to the special boot menu again, run option **(1) Normal Boot**



You might encounter an error at this stage. If an error occurs, repeat the substeps in [Step 32](#) until the system boots normally.

Verify the node3 installation

You must verify that the physical ports from node1 map correctly to the physical ports on node3. This will enable node3 to communicate with other nodes in the cluster and with the network after the upgrade.

About this task

Refer to [References](#) to link to the *Hardware Universe* to capture information about the ports on the new nodes. You will use the information later in this section.

Physical port layout might vary, depending on the model of the nodes. When the new node boots up, ONTAP will try to determine which ports should host cluster LIFs in order to automatically come into quorum.

If the physical ports on node1 do not map directly to the physical ports on node3, the subsequent section [Restore network configuration on node3](#) must be used to repair the network connectivity.

After you install and boot node3, you must verify that it is installed correctly. You must wait for node3 to join quorum and then resume the relocation operation.

At this point in the procedure, the operation will have paused as node3 joins quorum.

Steps

1. Verify that node3 has joined quorum:

```
cluster show -node node3 -fields health
```

The output of the `health` field should be `true`.

2. Verify that node3 is part of the same cluster as node2 and that it is healthy:

```
cluster show
```

3. Switch to advanced privilege mode:

```
set advanced
```

4. Check the status of the controller replacement operation and verify that it is in a paused state and in the same state that it was in before node1 was halted to perform the physical tasks of installing new controllers and moving cables:

```
system controller replace show
```

```
system controller replace show-details
```

5. Resume the controller replacement operation:

```
system controller replace resume
```

6. Controller replacement will pause for intervention with the following message:

```
Cluster::*> system controller replace show
```

Node	Status	Error-Action
Node1(now node3)	Paused-for-intervention	Follow the instructions given in
Node2	None	Step Details

Step Details:

To complete the Network Reachability task, the ONTAP network configuration must be manually adjusted to match the new physical network configuration of the hardware. This includes:

1. Re-create the interface group, if needed, before restoring VLANs. For detailed commands and instructions, refer to the "Re-creating VLANs, ifgrps, and broadcast domains" section of the upgrade controller hardware guide for the ONTAP version running on the new controllers.
2. Run the command "cluster controller-replacement network displaced-vlans show" to check if any VLAN is displaced.
3. If any VLAN is displaced, run the command "cluster controller-replacement network displaced-vlans restore" to restore the VLAN on the desired port.

2 entries were displayed.



In this procedure, the section *Re-creating VLANs, ifgrps, and broadcast domains* has been renamed *Restore network configuration on node3*.

7. With the controller replacement in a paused state, proceed to the next section of this document to restore network configuration on the node.

Restore network configuration on node3

After you confirm that node3 is in quorum and can communicate with node2, verify that node1's VLANs, interface groups, and broadcast domains are seen on node3. Also, verify that all node3 network ports are configured in their correct broadcast domains.

About this task

For more information on creating and re-creating VLANs, interface groups, and broadcast domains, refer to [References](#) to link to *Network Management*.

Steps

1. List all the physical ports that are on upgraded node1 (referred to as node3):

```
network port show -node node3
```

All physical network ports, VLAN ports and interface group ports on the node are displayed. From this output, you can see any physical ports that have been moved into the `Cluster` broadcast domain by ONTAP. You can use this output to aid in deciding which ports must be used as interface group member ports, VLAN base ports or standalone physical ports for hosting LIFs.

2. List the broadcast domains on the cluster:

```
network port broadcast-domain show
```

3. List the network port reachability of all ports on node3:

```
network port reachability show
```

You should see output like the following example:

```
ClusterA::*> network port reachability show
Node      Port      Expected Reachability      Reachability
Status
-----
node1_node3
      e0M      Default:Mgmt      ok
      e10a     Default:Default   ok
      e10b     -                 no-reachability
      e10c     Default:Default   ok
      e10d     -                 no-reachability
      e1a      Cluster:Cluster   ok
      e1b     -                 no-reachability
      e7a      Cluster:Cluster   ok
      e7b     -                 no-reachability
node2_node4
      e0M      Default:Mgmt      ok
      e4a     Default:Default   ok
      e4b     -                 no-reachability
      e4c     Default:Default   ok
      e4d     -                 no-reachability
      e3a     Cluster:Cluster   ok
      e3b     Cluster:Cluster   ok
18 entries were displayed.
```

In the preceding example, `node1_node3` is just booted after controller replacement. Some ports do not have reachability to their expected broadcast domains and must be repaired.

4. Repair the reachability for each of the ports on node3 with a reachability status other than `ok`. Run the following command, first on any physical ports, then on any VLAN ports, one at a time:

```
network port reachability repair -node <node_name> -port <port_name>
```

You should see output like the following example:

```
Cluster ::> reachability repair -node node1_node3 -port e4a
```

```
Warning: Repairing port "node1_node3: e4a" may cause it to move into a
different broadcast domain, which can cause LIFs to be re-homed away
from the port. Are you sure you want to continue? {y|n}:
```

A warning message, as shown above, is expected for ports with a reachability status that might be different from the reachability status of the broadcast domain where it is currently located. Review the connectivity of the port and answer `y` or `n` as appropriate.

Verify that all physical ports have their expected reachability:

```
network port reachability show
```

As the reachability repair is performed, ONTAP attempts to place the ports in the correct broadcast domains. However, if a port's reachability cannot be determined and does not belong to any of the existing broadcast domains, ONTAP will create new broadcast domains for these ports.

5. If interface group configuration does not match the new controller physical port layout, modify it by using the following steps.
 - a. You must first remove physical ports that should be interface group member ports from their broadcast domain membership. You can do this by using the following command:

```
network port broadcast-domain remove-ports -broadcast-domain <broadcast-
domain_name> -ports <node_name:port_name>
```

- b. Add a member port to an interface group:

```
network port ifgrp add-port -node <node_name> -ifgrp <ifgrp> -port
<port_name>
```

- c. The interface group is automatically added to the broadcast domain about a minute after the first member port is added.
 - d. Verify that the interface group was added to the appropriate broadcast domain:

```
network port reachability show -node <node_name> -port <ifgrp>
```

If the interface group's reachability status is not `ok`, assign it to the appropriate broadcast domain:

```
network port broadcast-domain add-ports -broadcast-domain
<broadcast_domain_name> -ports <node:port>
```

6. Assign appropriate physical ports to the `Cluster` broadcast domain by using the following steps:
 - a. Determine which ports have reachability to the `Cluster` broadcast domain :

```
network port reachability show -reachable-broadcast-domains Cluster:Cluster
```

b. Repair any port with reachability to the `Cluster` broadcast domain, if its reachability status is not `ok`:

```
network port reachability repair -node <node_name> -port <port_name>
```

7. Move the remaining physical ports into their correct broadcast domains by using one of the following commands:

```
network port reachability repair -node <node_name> -port <port_name>
```

```
network port broadcast-domain remove-port
```

```
network port broadcast-domain add-port
```

Verify that there are no unreachable or unexpected ports present. Check the reachability status for all physical ports by using the following command and examining the output to confirm the status is `ok`:

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

8. Restore any VLANs that might have become displaced by using the following steps:

a. List displaced VLANs:

```
cluster controller-replacement network displaced-vlans show
```

Output like the following should display:

```
Cluster::*> displaced-vlans show
(cluster controller-replacement network displaced-vlans show)
      Original
Node   Base Port   VLANs
-----
Node1  a0a         822, 823
       e4a         822, 823
2 entries were displayed.
```

b. Restore VLANs that were displaced from their previous base ports:

```
cluster controller-replacement network displaced-vlans restore
```

The following is an example of restoring VLANs that have been displaced from interface group "a0a" back onto the same interface group:

```
Cluster::*> displaced-vlans restore -node node1_node3 -port a0a
-destination-port a0a
```

The following is an example of restoring displaced VLANs on port "e9a" to 'e9d':

```
Cluster::*> displaced-vlans restore -node node1_node3 -port e9a
-destination-port e9d
```

When a VLAN restore is successful, the displaced VLANs are created on the specified destination port. The VLAN restore fails if the destination port is a member of an interface group, or if the destination port is down.

Wait about one minute for newly restored VLANs to be placed into their appropriate broadcast domains.

- c. Create new VLAN ports as needed for VLAN ports that are not in the `cluster controller-replacement network displaced-vlans show` output but should be configured on other physical ports.

9. Delete any empty broadcast domains after all port repairs have been completed:

```
network port broadcast-domain delete -broadcast-domain <broadcast_domain_name>
```

10. Verify port reachability:

```
network port reachability show
```

When all ports are correctly configured and added to the correct broadcast domains, the `network port reachability show` command should report the reachability status as `ok` for all connected ports, and the status as `no-reachability` for ports with no physical connectivity. If any port reports a status other than these two, perform the reachability repair and add or remove ports from their broadcast domains as instructed in [Step 4](#).

11. Verify that all ports have been placed into broadcast domains:

```
network port show
```

12. Verify that all ports in the broadcast domains have the correct maximum transmission unit (MTU) configured:

```
network port broadcast-domain show
```

13. Restore LIF home ports, specifying the Vserver(s) and LIF(s) home ports, if any, that need to be restored by using the following steps:

- a. List any LIFs that are displaced:

```
displaced-interface show
```

- b. Restore LIF home nodes and home ports:

```
cluster controller-replacement network displaced-interface restore-home-node
-node <node_name> -vserver <vserver_name> -lif-name <LIF_name>
```

14. Verify that all LIFs have a home port and are administratively up:

```
network interface show -fields home-port, status-admin
```


Restore key-manager configuration on node3

If you are using NetApp Volume Encryption (NVE) and NetApp Aggregate Encryption (NAE) to encrypt volumes on the system you are upgrading, the encryption configuration must be synchronized to the new nodes. If you do not synchronize the key-manager, when you relocate the node1 aggregates from node2 to node3 by using ARL, failures might occur because node3 does not have the required encryption keys to bring encrypted volumes and aggregates online.

About this task

Synchronize the encryption configuration to the new nodes by performing the following steps:

Steps

1. Run the following command from node3:

```
security key-manager onboard sync
```

2. Verify that the SVM-KEK key is restored to "true" on node3 before you relocate the data aggregates:

```
::> security key-manager key query -node node3 -fields restored -key  
-type SVM-KEK
```

Example

```
::> security key-manager key query -node node3 -fields restored -key  
-type SVM-KEK
```

node	vserver	key-server	key-id
restored			
-----	-----	-----	-----
node3	svm1	""	0000000000000000020000000000a008a81976
true			2190178f9350e071fbb90f000000000000000

Move non-root aggregates and NAS data LIFs owned by node1 from node2 to node3

After you verify network configuration on node3 and before you relocate aggregates from node2 to node3, you must verify that the NAS data LIFs belonging to node1 that are currently on node2 are relocated from node2 to node3. You must also verify that the SAN LIFs exist on node3.

About this task

Remote LIFs handle traffic to SAN LUNs during the upgrade procedure. Moving SAN LIFs is not necessary for cluster or service health during the upgrade. SAN LIFs are not moved unless they need to be mapped to new

ports. You will verify that the LIFs are healthy and located on appropriate ports after you bring node3 online.

Steps

1. The iSCSI LIFs automatically find the correct home ports using the reachability scan. The FC and NVMe/FC SAN LIFs do not move automatically. They continue to show the home port they were on before upgrading.

Check the SAN LIFs on node3:

- a. Modify any iSCSI SAN LIFs reporting a "down" operation status to the new data ports:

```
network interface modify -vserver <vserver> -lif <iscsi_san_lif> admin down
```

```
network interface modify -vserver <vserver> -lif <iscsi_san_lif> port  
<new_port> node <node>
```

```
network interface modify -vserver <vserver> -lif <iscsi_san_lif>
```

- b. Modify any FC and NVMe/FC SAN LIFs that are home to the new controller and reporting a "down" operational status to the FCP ports on the new controller:

```
network interface modify -vserver <vserver> -lif <fc_san_lif> admin down
```

```
network interface modify -vserver <vserver> -lif <fc_san_lif> port  
<new_port> node <node>
```

```
network interface modify -vserver <vserver> -lif <fc_san_lif>
```

2. Resume the relocation operation:

```
system controller replace resume
```

The system performs the following tasks:

- Cluster quorum check
- System ID check
- Image version check
- Target platform check
- Network reachability check

The operation pauses at this stage in the network reachability check.

3. Resume the relocation operation:

```
system controller replace resume
```

The system performs the following checks:

- Cluster health check
- Cluster LIF status check

After performing these checks, the system relocates the non-root aggregates and NAS data LIFs owned by node1 to the new controller, node3.

The controller replacement operation pauses after the resource relocation is complete.

4. Check the status of the aggregate relocation and NAS data LIF move operations:

```
system controller replace show-details
```

If the controller replacement procedure is paused, check and correct the error, if any, and then issue `resume` to continue the operation.

5. If necessary, restore and revert any displaced LIFs. List any displaced LIFs:

```
cluster controller-replacement network displaced-interface show
```

If any LIFs are displaced, restore the home node back to node3:

```
cluster controller-replacement network displaced-interface restore-home-node
```

6. Resume the operation to prompt the system to perform the required post-checks:

```
system controller replace resume
```

The system performs the following post-checks:

- Cluster quorum check
- Cluster health check
- Aggregates reconstruction check
- Aggregate status check
- Disk status check
- Cluster LIF status check
- Volume check

Stage 4. Relocate and retire node2

Stage 4 overview

During Stage 4, you relocate non-root aggregates and NAS data LIFs from node2 to node3. You also record the necessary node2 information for use later in the procedure and then retire node2.

Steps

1. [Relocate non-root aggregates and NAS data LIFs from node2 to node3](#)
2. [Retire node2](#)

Relocate non-root aggregates and NAS data LIFs from node2 to node3

Before replacing node2 with node4, you relocate the non-root aggregates and NAS data LIFs that are owned by node2 to node3.

Before you begin

After the post-checks from the previous stage complete, the resource release for node2 starts automatically. The non-root aggregates and non-SAN data LIFs are migrated from node2 to node3.

About this task

Remote LIFs handle traffic to SAN LUNs during the upgrade procedure. Moving SAN LIFs is not necessary for cluster or service health during the upgrade.

After the aggregates and LIFs are migrated, the operation is paused for verification purposes. At this stage, you must verify whether or not all the non-root aggregates and non-SAN data LIFs are migrated to node3.



The home owner for the aggregates and LIFs are not modified; only the current owner is modified.

Steps

1. Verify that all the non-root aggregates are online and their state on node3:

```
storage aggregate show -node node3 -state online -root false
```

The following example shows that the non-root aggregates on node2 are online:

```
cluster::> storage aggregate show -node node3 state online -root false

Aggregate      Size           Available    Used%   State   #Vols  Nodes
RAID           Status
-----
aggr_1         744.9GB        744.8GB     0%      online  5      node2
raid_dp        normal
aggr_2         825.0GB        825.0GB     0%      online  1      node2
raid_dp        normal
2 entries were displayed.
```

If the aggregates have gone offline or become foreign on node3, bring them online by using the following command on node3, once for each aggregate:

```
storage aggregate online -aggregate aggr_name
```

2. Verify that all the volumes are online on node3 by using the following command on node3 and examining the output:

```
volume show -node node3 -state offline
```

If any volumes are offline on node3, bring them online by using the following command on node3, once for each volume:

```
volume online -vserver vserver_name -volume volume_name
```

The *vserver_name* to use with this command is found in the output of the previous `volume show` command.

3. Verify that the LIFs have been moved to the correct ports and have a status of `up`. If any LIFs are down, set the administrative status of the LIFs to `up` by entering the following command, once for each LIF:

```
network interface modify -vserver vserver_name -lif LIF_name -home-node
node_name -status-admin up
```

4. If the ports currently hosting data LIFs will not exist on the new hardware, remove them from the broadcast domain:

```
network port broadcast-domain remove-ports
```

5. Verify that there are no data LIFs remaining on `node2` by entering the following command and examining the output:

```
network interface show -curr-node node2 -role data
```

Retire node2

To retire `node2`, you first shut `node2` down correctly and remove it from the rack or chassis.

Steps

1. Resume the operation:

```
system controller replace resume
```

The node halts automatically.

After you finish

You can decommission `node2` after the upgrade is completed. See [Decommission the old system](#).

Stage 5. Install and boot node4

Stage 5 overview

During Stage 5, you install and boot `node4`, check that the cluster and node-management ports from `node2` come online on `node4`, and verify the `node4` installation. If you are using NVE, you restore key-manager configuration. You also relocate `node2` NAS data LIFs and non-root aggregates from `node3` to `node4` and verify that the SAN LIFs exist on `node4`.

Steps

1. [Install and boot node4](#)
2. [Verify the node4 installation](#)
3. [Restore key-manager configuration on node4](#)
4. [Move non-root aggregates and NAS data LIFs owned by node2 from node3 to node4](#)

Install and boot node4

You install node4 in the rack, transfer node2's connections to node4, boot node4, and install ONTAP. You then reassign any of node2's spare disks, any disks belonging to the root volume, and any non-root aggregates that were not relocated to node3 earlier in the process, as outlined in this section.

About this task

The relocation operation is paused at the beginning of this stage. This process is mostly automated; the operation pauses to enable you to check its status. You must manually resume the operation.

You need to netboot node4 if it does not have the same version of ONTAP 9 that is installed on node2. After you install node4, boot it from the ONTAP 9 image stored on the web server. You can then download the correct files to the boot media device for subsequent system boots, by following the instructions in [Prepare for netboot](#).

Steps

1. Make sure that node4 has sufficient rack space.

If node4 is in a separate chassis from node2, you can put node4 in the same location as node3. If node2 and node4 are in the same chassis, then node4 is already in its appropriate rack location.

2. Install node4 in the rack, following the instructions in the *Installation and Setup Instructions* for the node model.
3. Cable node4, moving the connections from node2 to node4.

Cable the following connections, using the instructions in the *Installation and Setup Instructions* or the *FlexArray Virtualization Installation Requirements and Reference* for the node4 platform, the appropriate disk shelf document, and *High Availability management*.

Refer to [References](#) to link to the *FlexArray Virtualization Installation Requirements and Reference* and *High Availability management*.

- Console (remote management port)
- Cluster and HA ports
- Data ports
- Cluster and node management ports
- Serial-attached SCSI (SAS) and Ethernet storage ports
- SAN configurations: iSCSI Ethernet, FC, and NVMe/FC switch ports



You might need to change the interconnect cables between the old and new controllers to allow interoperability between the different controller and card models. Refer to the [system installation procedures](#) for a cabling map of the Ethernet storage shelves for your systems.

For controllers introduced in ONTAP 9.15.1 and later, cluster and HA interconnects use the same ports. For switch connected configurations, it is required to connect similar ports to the same cluster switches. For example, when upgrading to an AFF A1K from an existing controller, you should connect e1a ports on both nodes to one switch and e7a ports on both nodes to the second switch.

4. Turn on the power to node4, and then interrupt the boot process by pressing `Ctrl-C` at the console terminal to access the boot environment prompt.



When you boot node4, you might see the following warning message:

```
WARNING: The battery is unfit to retain data during a power outage. This
is likely
        because the battery is discharged but could be due to other
temporary
        conditions.
        When the battery is ready, the boot process will complete
and services will be engaged. To override this delay, press 'c'
followed
        by 'Enter'
```

5. If you see the warning message in Step 4, take the following actions:
 - a. Check for any console messages that might indicate a problem other than a low NVRAM battery, and, if necessary, take any required corrective action.
 - b. Allow the battery to charge and the boot process to complete.



Attention: Do not override the delay; failure to allow the battery to charge could result in a loss of data.




Refer to [Prepare for netboot](#).

6. Configure the netboot connection by choosing one of the following actions.



You must use the management port and IP as the netboot connection. Do not use a data LIF IP or a data outage might occur while the upgrade is being performed.

If Dynamic Host Configuration Protocol (DHCP) is...	Then...
Running	Configure the connection automatically by using the following command at the boot environment prompt: <code>ifconfig e0M -auto</code>

If Dynamic Host Configuration Protocol (DHCP) is...	Then...
Not running	<p>Manually configure the connection by entering the following command at the boot environment prompt:</p> <pre>ifconfig e0M -addr=<i>filer_addr</i> -mask=<i>netmask</i> -gw=<i>gateway</i> -dns=<i>dns_addr</i> -domain=<i>dns_domain</i></pre> <p><i>filer_addr</i> is the IP address of the storage system (mandatory). <i>netmask</i> is the network mask of the storage system (mandatory). <i>gateway</i> is the gateway for the storage system (mandatory). <i>dns_addr</i> is the IP address of a name server on your network (optional). <i>dns_domain</i> is the DNS domain name (optional).</p> <div style="border-left: 1px solid #ccc; padding-left: 10px; margin-top: 10px;">  <p>Other parameters might be necessary for your interface. Enter <code>help ifconfig</code> at the firmware prompt for details.</p> </div>

7. Perform netboot on node4:

```
netboot http://<web_server_ip/path_to_web-accessible_directory>/<ontap_version>_image.tgz
```

The <path_to_the_web-accessible_directory> should lead to where you downloaded the <ontap_version>_image.tgz in Step 1 in the section [Prepare for netboot](#).



Do not interrupt the boot.

8. From the boot menu, select option (7) `Install new software first`.

This menu option downloads and installs the new ONTAP image to the boot device.

Disregard the following message:

```
This procedure is not supported for Non-Disruptive Upgrade on an HA pair
```

The note applies to nondisruptive upgrades of ONTAP, and not upgrades of controllers.



Always use netboot to update the new node to the desired image. If you use another method to install the image on the new controller, the incorrect image might install. This issue applies to all ONTAP releases. The netboot procedure combined with option (7) `Install new software` wipes the boot media and places the same ONTAP version on both image partitions.

9. If you are prompted to continue the procedure, enter `y`, and when prompted for the package, enter the URL:

```
http://<web_server_ip/path_to_web-accessible_directory>/<ontap_version>_image.tgz
```

10. Complete the following substeps to reboot the controller module:

- a. Enter `n` to skip the backup recovery when you see the following prompt:

```
Do you want to restore the backup configuration now? {y|n}
```

- b. Reboot by entering `y` when you see the following prompt:

```
The node must be rebooted to start using the newly installed software. Do you want to reboot now? {y|n}
```

The controller module reboots but stops at the boot menu because the boot device was reformatted, and the configuration data must be restored.

11. Select maintenance mode 5 from the boot menu and enter `y` when you are prompted to continue with the boot.
12. Verify that the controller and chassis are configured as HA:

```
ha-config show
```

The following example shows the output of the `ha-config show` command:

```
Chassis HA configuration: ha
Controller HA configuration: ha
```



System records in a PROM whether they are in an HA pair or stand-alone configuration. The state must be the same on all components within the stand-alone system or HA pair.

13. If the controller and chassis are not configured as HA, use the following commands to correct the configuration:

```
ha-config modify controller ha
```

```
ha-config modify chassis ha
```

14. Confirm that all Ethernet ports used to connect to the Ethernet shelves are configured as storage:

```
storage port show
```

The output displayed depends on the system configuration. The following output example is for a node with a single storage card in slot11. The output for your system might be different:

```
*> storage port show
Port Type Mode      Speed (Gb/s) State      Status  VLAN ID
---- -
e11a ENET storage 100 Gb/s    enabled  online  30
e11b ENET storage 100 Gb/s    enabled  online  30
```

15. Modify the ports that are not set to storage:

```
storage port modify -p <port> -m storage
```

All Ethernet ports connected to storage shelves must be configured as storage to allow access to the disks and shelves.

16. Exit maintenance mode:

```
halt
```

Interrupt the autoboot by pressing Ctrl-C at the boot environment prompt.

17. On node3, check the system date, time, and time zone:

```
date
```

18. On node4, check the date by using the following command at the boot environment prompt:

```
show date
```

19. If necessary, set the date on node4:

```
set date <mm/dd/yyyy>
```

20. On node4, check the time by using the following command at the boot environment prompt:

```
show time
```

21. If necessary, set the time on node4:

```
set time <hh:mm:ss>
```

22. In boot loader, set the partner system ID on node4:

```
setenv partner-sysid <node3_sysid>
```

For node4, partner-sysid must be that of node3.

Save the settings:

```
saveenv
```

23. Verify the partner-sysid for node4:

```
printenv partner-sysid
```

24. If you have NetApp Storage Encryption (NSE) drives installed, perform the following steps.



If you have not already done so earlier in the procedure, see the Knowledge Base article [How to tell if a drive is FIPS certified](#) to determine the type of self-encrypting drives that are in use.

- a. Set `bootarg.storageencryption.support` to `true` or `false`.

If the following drives are in use...	Then...
NSE drives that conform to FIPS 140-2 Level 2 self-encryption requirements	<code>setenv bootarg.storageencryption.support true</code>
NetApp non-FIPS SEDs	<code>setenv bootarg.storageencryption.support false</code>

- b. Go to the special boot menu and select option (10) `Set Onboard Key Manager recovery secrets`.

Enter the passphrase and the backup information that you recorded earlier procedure. See [Manage storage encryption using the Onboard Key Manager](#).

25. Boot node into boot menu:

```
boot_ontap menu.
```

26. On node4, go to the boot menu and using 22/7, select the hidden option `boot_after_controller_replacement`. At the prompt, enter `node2` to reassign the disks of node2 to node4, as per the following example.

Expand the console output example

```
LOADER-A> boot_ontap menu
.
.
<output truncated>
.
All rights reserved.
*****
*
* Press Ctrl-C for Boot Menu. *
*
*****
.
<output truncated>
.
Please choose one of the following:
(1) Normal Boot.
(2) Boot without /etc/rc.
(3) Change password.
(4) Clean configuration and initialize all disks.
(5) Maintenance mode boot.
(6) Update flash from backup config.
(7) Install new software first.
(8) Reboot node.
(9) Configure Advanced Drive Partitioning.
(10) Set Onboard Key Manager recovery secrets.
(11) Configure node for external key management.
Selection (1-11)? 22/7
(22/7) Print this secret List
(25/6) Force boot with multiple filesystem
disks missing.
(25/7) Boot w/ disk labels forced to clean.
(29/7) Bypass media errors.
(44/4a) Zero disks if needed and create new
flexible root volume.
(44/7) Assign all disks, Initialize all
disks as SPARE, write DDR labels
.
.
<output truncated>
.
.
(wipeconfig) Clean all configuration on boot
device
(boot_after_controller_replacement) Boot after controller upgrade
```

```
(boot_after_mcc_transition)      Boot after MCC transition
(9a)                             Unpartition all disks and remove
their ownership information.
(9b)                             Clean configuration and
initialize node with partitioned disks.
(9c)                             Clean configuration and
initialize node with whole disks.
(9d)                             Reboot the node.
(9e)                             Return to main boot menu.
```

The boot device has changed. System configuration information could be lost. Use option (6) to restore the system configuration, or option (4) to initialize all disks and setup a new system.

Normal Boot is prohibited.

Please choose one of the following:

- (1) Normal Boot.
- (2) Boot without /etc/rc.
- (3) Change password.
- (4) Clean configuration and initialize all disks.
- (5) Maintenance mode boot.
- (6) Update flash from backup config.
- (7) Install new software first.
- (8) Reboot node.
- (9) Configure Advanced Drive Partitioning.
- (10) Set Onboard Key Manager recovery secrets.
- (11) Configure node for external key management.

Selection (1-11)? boot_after_controller_replacement

This will replace all flash-based configuration with the last backup to disks. Are you sure you want to continue?: yes

.
.

<output truncated>

.
.

Controller Replacement: Provide name of the node you would like to replace:

<nodename of the node being replaced>

Changing sysid of node node2 disks.

Fetchd sanown old_owner_sysid = 536940063 and calculated old sys id = 536940063

Partner sysid = 4294967295, owner sysid = 536940063

.
.

<output truncated>

.

```

.
varfs_backup_restore: restore using /mroot/etc/varfs.tgz
varfs_backup_restore: attempting to restore /var/kmip to the boot
device
varfs_backup_restore: failed to restore /var/kmip to the boot device
varfs_backup_restore: attempting to restore env file to the boot
device
varfs_backup_restore: successfully restored env file to the boot
device wrote
    key file "/tmp/rndc.key"
varfs_backup_restore: timeout waiting for login
varfs_backup_restore: Rebooting to load the new varfs
Terminated
<node reboots>
System rebooting...
.
.
Restoring env file from boot media...
copy_env_file:scenario = head upgrade
Successfully restored env file from boot media...
Rebooting to load the restored env file...
.
System rebooting...
.
.
.
<output truncated>
.
.
.
.
WARNING: System ID mismatch. This usually occurs when replacing a
boot device or NVRAM cards!
Override system ID? {y|n} y
.
.
.
.
Login:

```



In the above console output example, ONTAP will prompt you for the partner node name if the system uses Advanced Disk Partitioning (ADP) disks.

27. At the LOADER prompt, boot up:

```
boot_ontap menu
```

Now, on booting, the node can detect all the disks that were previously assigned to it and can boot up as expected.

When the cluster nodes you are replacing use root volume encryption, ONTAP is unable to read the volume information from the disks. Restore the keys for the root volume:

If the root volume is encrypted, recover the onboard key-management secrets so the system can find the root volume.

- a. Return to the special boot menu:

```
LOADER> boot_ontap menu
```

```
Please choose one of the following:
(1) Normal Boot.
(2) Boot without /etc/rc.
(3) Change password.
(4) Clean configuration and initialize all disks.
(5) Maintenance mode boot.
(6) Update flash from backup config.
(7) Install new software first.
(8) Reboot node.
(9) Configure Advanced Drive Partitioning.
(10) Set Onboard Key Manager recovery secrets.
(11) Configure node for external key management.

Selection (1-11)? 10
```

- b. Select **(10) Set Onboard Key Manager recovery secrets**

- c. Enter `y` at the following prompt:

```
This option must be used only in disaster recovery procedures. Are you sure?
(y or n): y
```

- d. At the prompt, enter the key-manager passphrase.

- e. Enter the backup data when prompted.



You must have obtained the passphrase and backup data in the [Prepare the nodes for upgrade](#) section of this procedure.

- f. After the system boots to the special boot menu again, run option **(1) Normal Boot**



You might encounter an error at this stage. If an error occurs, repeat the substeps in [Step 27](#) until the system boots normally.

Verify the node4 installation

You must verify that the physical ports from node2 map correctly to the physical ports on node4. This will enable node4 to communicate with other nodes in the cluster and with the network after the upgrade.

About this task

Refer to [References](#) to link to the *Hardware Universe* to capture information about the ports on the new nodes. You will use the information later in this section.

Physical port layout might vary, depending on the model of the nodes. When the new node boots up, ONTAP will try to determine which ports should host cluster LIFs in order to automatically come into quorum.

If the physical ports on node2 do not map directly to the physical ports on node4, the subsequent section [Restore network configuration on node4](#) must be used to repair network connectivity.

After you install and boot node4, you must verify that it is installed correctly. You must wait for node4 to join quorum and then resume the relocation operation.

At this point in the procedure, the operation will have paused as node4 joins quorum.

Steps

1. Verify that node4 has joined quorum:

```
cluster show -node node4 -fields health
```

The output of the `health` field should be `true`.

2. Verify that node4 is part of the same cluster as node3 and that it is healthy:

```
cluster show
```

3. Switch to advanced privilege mode:

```
set advanced
```

4. Check the status of the controller replacement operation and verify that it is in a paused state and in the same state it was in before node2 was halted to perform the physical tasks of installing new controllers and moving cables:

```
system controller replace show
```

```
system controller replace show-details
```

5. Resume the controller replacement operation:

```
system controller replace resume
```

6. Controller replacement will pause for intervention with the following message:


```
Cluster::*> system controller replace show
```

```
Node                Status                Error-Action
-----
Node2(now node4) Paused-for-intervention  Follow the instructions
given in
```

```
Step Details
```

```
Node2
```

```
Step Details:
```

```
-----
To complete the Network Reachability task, the ONTAP network
configuration must be
manually adjusted to match the new physical network configuration of the
hardware.
```

```
This includes:
```

1. Re-create the interface group, if needed, before restoring VLANs. For detailed commands and instructions, refer to the "Re-creating VLANs, ifgrps, and broadcast domains" section of the upgrade controller hardware guide for the ONTAP version running on the new controllers.
 2. Run the command "cluster controller-replacement network displaced-vlans show" to check if any VLAN is displaced.
 3. If any VLAN is displaced, run the command "cluster controller-replacement network displaced-vlans restore" to restore the VLAN on the desired port.
- ```
2 entries were displayed.
```



In this procedure, section *Re-creating VLANs, ifgrps, and broadcast domains* has been renamed *Restoring network configuration on node4*.

7. With the controller replacement in a paused state, proceed to the next section of this document to restore network configuration on the node.

### Restore network configuration on node4

After you confirm that node4 is in quorum and can communicate with node3, verify that node2's VLANs, interface groups and broadcast domains are seen on node4. Also, verify that all node4 network ports are configured in their correct broadcast domains.

### About this task

For more information on creating and re-creating VLANs, interface groups, and broadcast domains, refer to [References](#) to link to *Network Management*.

## Steps

1. List all the physical ports that are on upgraded node2 (referred to as node4):

```
network port show -node node4
```

All physical network ports, VLAN ports and interface group ports on the node are displayed. From this output you can see any physical ports that have been moved into the `Cluster` broadcast domain by ONTAP. You can use this output to aid in deciding which ports should be used as interface group member ports, VLAN base ports or standalone physical ports for hosting LIFs.

2. List the broadcast domains on the cluster:

```
network port broadcast-domain show
```

3. List the network port reachability of all ports on node4:

```
network port reachability show
```

The output from the command looks similar to the following example:

```

ClusterA::*> network port reachability show
Node Port Expected Reachability Reachability
Status

node1_node3
 e0M Default:Mgmt ok
 e10a Default:Default ok
 e10b - no-reachability
 e10c Default:Default ok
 e10d - no-reachability
 e1a Cluster:Cluster ok
 e1b - no-reachability
 e7a Cluster:Cluster ok
 e7b - no-reachability
node2_node4
 e0M Default:Mgmt ok
 e10a Default:Default ok
 e10b - no-reachability
 e10c Default:Default ok
 e10d - no-reachability
 e1a Cluster:Cluster ok
 e1b - no-reachability
 e7a Cluster:Cluster ok
 e7b - no-reachability
18 entries were displayed.

```

In the above example, node2\_node4 is just booted after controller replacement. It has several ports that have no reachability and are pending a reachability scan.

4. Repair the reachability for each of the ports on node4 with a reachability status other than `ok`. Run the following command, first on any physical ports, then on any VLAN ports, one at a time:

```
network port reachability repair -node <node_name> -port <port_name>
```

The output looks like the following example:

```
Cluster ::> reachability repair -node node2_node4 -port e10a
```

```
Warning: Repairing port "node2_node4: e10a" may cause it to move into a
different broadcast domain, which can cause LIFs to be re-homed away
from the port. Are you sure you want to continue? {y|n}:
```

A warning message, as shown above, is expected for ports with a reachability status that might be different

from the reachability status of the broadcast domain where it is currently located.

Review the connectivity of the port and answer `y` or `n` as appropriate.

Verify that all physical ports have their expected reachability:

```
network port reachability show
```

As the reachability repair is performed, ONTAP attempts to place the ports in the correct broadcast domains. However, if a port's reachability cannot be determined and does not belong to any of the existing broadcast domains, ONTAP will create new broadcast domains for these ports.

5. If interface group configuration does not match the new controller physical port layout, modify it by using the following steps.
  - a. You must first remove physical ports that should be interface group member ports from their broadcast domain membership. You can do this by using the following command:

```
network port broadcast-domain remove-ports -broadcast-domain
<broadcast_domain_name> -ports <node_name:port_name>
```

- b. Add a member port to an interface group:

```
network port ifgrp add-port -node <node_name> -ifgrp <ifgrp> -port
<port_name>
```

- c. The interface group is automatically added to the broadcast domain about a minute after the first member port is added.
  - d. Verify that the interface group was added to the appropriate broadcast domain:

```
network port reachability show -node <node_name> -port <ifgrp>
```

If the interface group's reachability status is not `ok`, assign it to the appropriate broadcast domain:

```
network port broadcast-domain add-ports -broadcast-domain
<broadcast_domain_name> -ports <node:port>
```

6. Assign appropriate physical ports to the `Cluster` broadcast domain:

- a. Determine which ports have reachability to the `Cluster` broadcast domain:

```
network port reachability show -reachable-broadcast-domains Cluster:Cluster
```

- b. Repair any port with reachability to the `Cluster` broadcast domain, if its reachability status is not `ok`:

```
network port reachability repair -node <node_name> -port <port_name>
```

7. Move the remaining physical ports into their correct broadcast domains by using one of the following commands:

```
network port reachability repair -node <node_name> -port <port_name>
```

```
network port broadcast-domain remove-port
```

```
network port broadcast-domain add-port
```

Verify that there are no unreachable or unexpected ports present. Check the reachability status for all physical ports by using the following command and examining the output to confirm the status is `ok`:

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

8. Restore any VLANs that might have become displaced by using the following steps:

a. List displaced VLANs:

```
cluster controller-replacement network displaced-vlans show
```

Output like the following should display:

```
Cluster::~*> displaced-vlans show
(cluster controller-replacement network displaced-vlans show)
 Original
Node Base Port VLANs

Node1 a0a 822, 823
 e10a 822, 823
```

b. Restore VLANs that were displaced from their previous base ports:

```
cluster controller-replacement network displaced-vlans restore
```

The following is an example of restoring VLANs that have been displaced from interface group `a0a` back onto the same interface group:

```
Cluster::~*> displaced-vlans restore -node node2_node4 -port a0a
-destination-port a0a
```

The following is an example of restoring displaced VLANs on port "e10a" to "e10b":

```
Cluster::~*> displaced-vlans restore -node node2_node4 -port e10a
-destination-port e10b
```

When a VLAN restore is successful, the displaced VLANs are created on the specified destination port. The VLAN restore fails if the destination port is a member of an interface group, or if the destination port is down.

Wait about one minute for newly restored VLANs to be placed into their appropriate broadcast domains.

c. Create new VLAN ports as needed for VLAN ports that are not in the `cluster controller-replacement network displaced-vlans show` output but should be configured on other physical ports.

9. Delete any empty broadcast domains after all port repairs have been completed:

```
network port broadcast-domain delete -broadcast-domain <broadcast_domain_name>
```

10. Verify port reachability:

```
network port reachability show
```

When all ports are correctly configured and added to the correct broadcast domains, the `network port reachability show` command should report the reachability status as `ok` for all connected ports, and the status as `no-reachability` for ports with no physical connectivity. If any ports report a status other than these two, perform the reachability repair and add or remove ports from their broadcast domains as instructed in [Step 4](#).

11. Verify that all ports have been placed into broadcast domains:

```
network port show
```

12. Verify that all ports in the broadcast domains have the correct maximum transmission unit (MTU) configured:

```
network port broadcast-domain show
```

13. Restore LIF home ports, specifying the Vserver(s) and LIF(s) home ports, if any, that need to be restored:

- a. List any LIFs that are displaced:

```
displaced-interface show
```

- b. Restore LIF home ports:

```
displaced-interface restore-home-node -node <node_name> -vserver
<vserver_name> -lif-name <LIF_name>
```

14. Verify that all LIFs have a home port and are administratively up:

```
network interface show -fields home-port, status-admin
```

## Restore key-manager configuration on node4

If you are using NetApp Volume Encryption (NVE) and NetApp Aggregate Encryption (NAE) to encrypt volumes on the system you are upgrading, the encryption configuration must be synchronized to the new nodes. If you do not synchronize the key-manager, when you relocate the node2 aggregates from node3 to node4 by using ARL, failures might occur because node4 does not have the required encryption keys to bring encrypted volumes and aggregates online.

### About this task

Synchronize the encryption configuration to the new nodes by performing the following steps:

### Steps

1. Run the following command from node4:

```
security key-manager onboard sync
```

2. Verify that the SVM-KEK key is restored to "true" on node4 before you relocate the data aggregates:

```
::> security key-manager key query -node node4 -fields restored -key
-type SVM-KEK
```

### Example

```
::> security key-manager key query -node node4 -fields restored -key
-type SVM-KEK
```

| node     | vserver | key-server | key-id                                 |
|----------|---------|------------|----------------------------------------|
| restored |         |            |                                        |
| -----    | -----   | -----      | -----                                  |
| -----    |         |            |                                        |
| node4    | svm1    | ""         | 0000000000000000020000000000a008a81976 |
| true     |         |            | 2190178f9350e071fbb90f000000000000000  |

## Move non-root aggregates and NAS data LIFs owned by node2 from node3 to node4

After you verify network configuration on node4 and before you relocate aggregates from node3 to node4, you must verify that the NAS data LIFs belonging to node2 that are currently on node3 are relocated from node3 to node4. You must also verify that the SAN LIFs exist on node4.

### About this task

Remote LIFs handle traffic to SAN LUNs during the upgrade procedure. Moving SAN LIFs is not necessary for cluster or service health during the upgrade. SAN LIFs are not moved unless they need to be mapped to new ports. You will verify that the LIFs are healthy and located on appropriate ports after you bring node4 online.

### Steps

1. The iSCSI LIFs automatically find the correct home ports using the reachability scan. The FC and NVMe/FC SAN LIFs do not move automatically. They continue to show the home port they were on before upgrading.

Check the SAN LIFs on node4:

- a. Modify any iSCSI SAN LIFs reporting a "down" operation status to the new data ports:

```
network interface modify -vserver <vserver> -lif <iscsi_san_lif> admin down
```

```
network interface modify -vserver <vserver> -lif <iscsi_san_lif> port
<new_port> node <node>
```

```
network interface modify -vserver <vserver> -lif <iscsi_san_lif>
```

- b. Modify any FC and NVMe/FC SAN LIFs that are home to the new controller and reporting a "down" operational status to the FCP ports on the new controller:

```
network interface modify -vserver <vserver> -lif <fc_san_lif> admin down
```

```
network interface modify -vserver <vserver> -lif <fc_san_lif> port
<new_port> node <node>
```

```
network interface modify -vserver <vserver> -lif <fc_san_lif>
```

## 2. Resume the relocation operation:

```
system controller replace resume
```

The system performs the following tasks:

- Cluster quorum check
- System ID check
- Image version check
- Target platform check
- Network reachability check

The operation pauses at this stage in the network reachability check.

## 3. Resume the relocation operation:

```
system controller replace resume
```

The system performs the following checks:

- Cluster health check
- Cluster LIF status check

After performing these checks, the system relocates the non-root aggregates and NAS data LIFs owned by node2 to the new controller, node4.

The controller replacement operation pauses after the resource relocation is complete.

## 4. Check the status of the aggregate relocation and NAS data LIF move operations:

```
system controller replace show-details
```

If the controller replacement procedure is paused, check and correct the error, if any, and then issue `resume` to continue the operation.

## 5. If necessary, restore and revert any displaced LIFs. List any displaced LIFs:

```
cluster controller-replacement network displaced-interface show
```

If any LIFs are displaced, restore the home node back to node4:

```
cluster controller-replacement network displaced-interface restore-home-node
```



6. Resume the operation to prompt the system to perform the required post-checks:

```
system controller replace resume
```

The system performs the following post-checks:

- Cluster quorum check
- Cluster health check
- Aggregates reconstruction check
- Aggregate status check
- Disk status check
- Cluster LIF status check
- Volume check

## Stage 6. Complete the upgrade

### Stage 6 overview

During Stage 6, you confirm that the new nodes are set up correctly and, if the new nodes are encryption-enabled, you configure and set up Storage Encryption or NetApp Volume Encryption. You should also decommission the old nodes and resume the SnapMirror operations.

#### Steps

1. [Manage authentication using KMIP servers](#)
2. [Confirm that the new controllers are set up correctly](#)
3. [Set up Storage Encryption on the new controller module](#)
4. [Set up NetApp Volume or Aggregate Encryption on the new controller module](#)
5. [Decommission the old system](#)
6. [Resume SnapMirror operations](#)

### Manage authentication using KMIP servers

You can use Key Management Interoperability Protocol (KMIP) servers to manage authentication keys.

#### Steps

1. Add a new controller:

```
security key-manager external enable
```

2. Add the key manager:

```
security key-manager external add-servers -key-servers
key_management_server_ip_address
```

3. Verify that the key management servers are configured and available to all nodes in the cluster:

```
security key-manager external show-status
```

4. Restore the authentication keys from all linked key management servers to the new node:

```
security key-manager external restore -node new_controller_name
```

## Confirm that the new controllers are set up correctly

To confirm correct setup, you must enable the HA pair. You must also verify that node3 and node4 can access each other's storage and that neither owns data LIFs belonging to other nodes on the cluster. In addition, you must confirm that node3 owns node1's aggregates and that node4 owns node2's aggregates, and that the volumes for both nodes are online.

### Steps

1. After the post-checks of node2, the storage failover and cluster HA pair for the node2 cluster are enabled. When the operation is done, both nodes show as completed and the system performs some cleanup operations.
2. Verify that storage failover is enabled:

```
storage failover show
```

The following example shows the output of the command when storage failover is enabled:

```
cluster::> storage failover show
 Takeover
Node Partner Possible State Description
----- -
node3 node4 true Connected to node4
node4 node3 true Connected to node3
```

3. Verify that node3 and node4 belong to the same cluster by using the following command and examining the output:

```
cluster show
```

4. Verify that node3 and node4 can access each other's storage by using the following command and examining the output:

```
storage failover show -fields local-missing-disks, partner-missing-disks
```

5. Verify that neither node3 nor node4 owns data LIFs home-owned by other nodes in the cluster by using the following command and examining the output:

```
network interface show
```

If neither node3 or node4 owns data LIFs home-owned by other nodes in the cluster, revert the data LIFs to

their home owner:

```
network interface revert
```

6. Verify that node3 owns the aggregates from node1 and that node4 owns the aggregates from node2:

```
storage aggregate show -owner-name <node3>
```

```
storage aggregate show -owner-name <node4>
```

7. Determine whether any volumes are offline:

```
volume show -node <node3> -state offline
```

```
volume show -node <node4> -state offline
```

8. If any volumes are offline, compare them with the list of offline volumes that you captured in the section [Prepare the nodes for upgrade](#), and bring online any of the offline volumes, as required, by using the following command, once for each volume:

```
volume online -vserver <vserver_name> -volume <volume_name>
```

9. Install new licenses for the new nodes by using the following command for each node:

```
system license add -license-code <license_code,license_code,license_code...>
```

The license-code parameter accepts a list of 28 upper-case alphabetic character keys. You can add one license at a time, or you can add multiple licenses at once, separating each license key by a comma.

10. Remove all of the old licenses from the original nodes by using one of the following commands:

```
system license clean-up -unused -expired
```

```
system license delete -serial-number <node_serial_number> -package
<licensable_package>
```

- Delete all expired licenses:

```
system license clean-up -expired
```

- Delete all unused licenses:

```
system license clean-up -unused
```

- Delete a specific license from a cluster by using the following commands on the nodes:

```
system license delete -serial-number <node1_serial_number> -package *
```

```
system license delete -serial-number <node2_serial_number> -package *
```

The following output is displayed:

```
Warning: The following licenses will be removed:
<list of each installed package>
Do you want to continue? {y|n}: y
```

Enter `y` to remove all of the packages.

11. Verify that the licenses are correctly installed by using the following command and examining the output:

```
system license show
```

You can compare the output with the output that you captured in the section [Prepare the nodes for upgrade](#).

12. If self-encrypting drives are being used in the configuration and you have set the `kmip.init.maxwait` variable to `off` (for example, in [Install and boot node4, Step 24](#)), you must unset the variable:

```
set diag; systemshell -node <node_name> -command sudo kenv -u -p
kmip.init.maxwait
```

13. Configure the SPs by using the following command on both nodes:

```
system service-processor network modify -node <node_name>
```

Refer to [References](#) to link to the *System Administration Reference* for information about the SPs and the *ONTAP 9.8 Commands: Manual Page Reference* for detailed information about the `system service-processor network modify` command.

14. If you want to set up a switchless cluster on the new nodes, refer to [References](#) to link to the *NetApp Support Site* and follow the instructions in *Transitioning to a two-node switchless cluster*.

### After you finish

If Storage Encryption is enabled on node3 and node4, complete the section [Set up Storage Encryption on the new controller module](#). Otherwise, complete the section [Decommission the old system](#).

## Set up Storage Encryption on the new controller module

If the replaced controller or the HA partner of the new controller uses Storage Encryption, you must configure the new controller module for Storage Encryption, including installing SSL certificates and setting up key management servers.

### About this task

This procedure includes steps that are performed on the new controller module. You must enter the command on the correct node.

### Steps

1. Verify that the key management servers are still available, their status, and their authentication key information:

```
security key-manager external show-status
```

```
security key-manager onboard show-backup
```

2. Add the key management servers listed in the previous step to the key management server list in the new controller.

- a. Add the key management server:

```
security key-manager external add-servers -key-servers
key_management_server_ip_address
```

- b. Repeat the previous step for each listed key management server. You can link up to four key management servers.

- c. Verify that the key management servers were added successfully:

```
security key-manager external show
```

3. On the new controller module, run the key management setup wizard to set up and install the key management servers.

You must install the same key management servers that are installed on the existing controller module.

- a. Launch the key management server setup wizard on the new node:

```
security key-manager external enable
```

- b. Complete the steps in the wizard to configure key management servers.

4. Restore authentication keys from all linked key management servers to the new node:

```
security key-manager external restore -node new_controller_name
```

## Set up NetApp Volume or Aggregate Encryption on the new controller module

If the replaced controller or high availability (HA) partner of the new controller uses NetApp Volume Encryption (NVE) or NetApp Aggregate Encryption (NAE), you must configure the new controller module for NVE or NAE.

### About this task

This procedure includes steps that are performed on the new controller module. You must enter the command on the correct node.

## Onboard Key Manager

Configure NVE or NAE using the Onboard Key Manager.

### Steps

1. Restore authentication keys from all linked key management servers to the new node:

```
security key-manager onboard sync
```

## External Key Management

Configure NVE or NAE using External Key Management.

### Steps

1. Verify that the key management servers are still available, their status, and their authentication key information:

```
security key-manager key query -node node
```

2. Add the key management servers listed in the previous step to the key management server list in the new controller:

- a. Add the key management server:

```
security key-manager external add-servers -key-servers
key_management_server_ip_address
```

- b. Repeat the previous step for each listed key management server. You can link up to four key management servers.

- c. Verify that the key management servers were added successfully:

```
security key-manager external show
```

3. On the new controller module, run the key management setup wizard to set up and install the key management servers.

You must install the same key management servers that are installed on the existing controller module.

- a. Launch the key management server setup wizard on the new node:

```
security key-manager external enable
```

- b. Complete the steps in the wizard to configure key management servers.

4. Restore authentication keys from all linked key management servers to the new node:

```
security key-manager external restore
```

This command needs the OKM passphrase

For more information, see the Knowledge Base article [How to restore external key manager server configuration from the ONTAP boot menu](#).

## After you finish

Check if any volumes were taken offline because authentication keys were not available or EKM servers could not be reached. Bring those volumes back online by using the `volume online` command.

## Decommission the old system

After upgrading, you can decommission the old system through the NetApp Support Site. Decommissioning the system tells NetApp that the system is no longer in operation and removes it from support databases.

### Steps

1. Refer to [References](#) to link to the *NetApp Support Site* and log in.
2. Select **Products > My Products** from the menu.
3. On the **View Installed Systems** page, choose which **Selection Criteria** you want to use to display information about your system.

You can choose one of the following to locate your system:

- Serial Number (located on the back of the unit)
  - Serial Numbers for My Location
4. Select **Go!**

A table displays cluster information, including the serial numbers.

5. Locate the cluster in the table and select **Decommission this system** from the Product Tool Set drop-down menu.

## Resume SnapMirror operations

You can resume SnapMirror transfers that were quiesced before upgrade and resume the SnapMirror relationships. The updates are on schedule after the upgrade is completed.

### Steps

1. Verify the SnapMirror status on the destination:

```
snapmirror show
```

2. Resume the SnapMirror relationship:

```
snapmirror resume -destination-vserver vserver_name
```

## Troubleshoot

### Troubleshoot

You might encounter a failure while upgrading the node pair. The node might crash, aggregates might not relocate, or LIFs might not migrate. The cause of the failure and its solution depend on when the failure occurred during the upgrade procedure.

Refer to the table describing the different phases of the procedure in the section [Overview of the ARL upgrade](#). Information about the failures that can occur is listed by the phase of the procedure.

## Aggregate relocation failures

Aggregate relocation (ARL) might fail at different points during the upgrade.

### Check for aggregate relocation failure

During the procedure, ARL might fail in Stage 2, Stage 3, or Stage 5.

#### Steps

1. Enter the following command and examine the output:

```
storage aggregate relocation show
```

The `storage aggregate relocation show` command shows you which aggregates were successfully relocated and which ones were not, along with the causes of failure.

2. Check the console for any EMS messages.
3. Take one of the following actions:
  - Take the appropriate corrective action, depending on the output of the `storage aggregate relocation show` command and the output of the EMS message.
  - Force relocation of the aggregate or aggregates by using the `override-vetoes` option or the `override-destination-checks` option of the `storage aggregate relocation start` command.

For detailed information about the `storage aggregate relocation start`, `override-vetoes`, and `override-destination-checks` options, refer to [References](#) to link to the *ONTAP 9.8 Commands: Manual Page Reference*.

### Aggregates originally on node1 are owned by node4 after completion of the upgrade

At the end of the upgrade procedure, node3 should be the new home node of aggregates that originally had node1 as the home node. You can relocate them after the upgrade.

#### About this task

Aggregates might fail to relocate correctly, having node1 as their home node instead of node3 under the following circumstances:

- During Stage 3, when aggregates are relocated from node2 to node3. Some of the aggregates being relocated have node1 as their home node. For example, such an aggregate could be called `aggr_node_1`. If relocation of `aggr_node_1` fails during Stage 3, and relocation cannot be forced, then the aggregate will be left behind on node2.
- After Stage 4, when node2 is replaced with node4. When node2 is replaced, `aggr_node_1` will come online with node4 as its home node instead of node3.

You can fix the incorrect ownership problem after Stage 6 once storage failover has been enabled by completing the following steps:

#### Steps



1. Enter the following command to get a list of aggregates:

```
storage aggregate show -nodes node4 -is-home true
```

To identify aggregates that were not correctly relocated, refer to the list of aggregates with the home owner of node1 that you obtained in the section [Prepare the nodes for upgrade](#) and compare it with output of the above command.

2. Compare the output of Step 1 with the output you captured for node1 in the section [Prepare the nodes for upgrade](#) and note any aggregates that were not correctly relocated.
3. Relocate the aggregates left behind on node4:

```
storage aggregate relocation start -node node4 -aggr aggr_node_1 -destination node3
```

Do not use the `-ndo-controller-upgrade` parameter during this relocation.

4. Verify that node3 is now the home owner of the aggregates:

```
storage aggregate show -aggregate aggr1,aggr2,aggr3... -fields home-name
```

`aggr1,aggr2,aggr3...` is the list of aggregates that had node1 as the original home owner.

Aggregates that do not have node3 as home owner can be relocated to node3 using the same relocation command in [Step 3](#).

## Reboots, panics, or power cycles

The system might crash – reboot, panic or go through a power cycle – during different stages of the upgrade.

The solution to these problems depends on when they occur.

### Reboots, panics, or power cycles during the pre-check phase

#### Node1 or node2 crashes before the pre-check phase with HA pair still enabled

If either node1 or node2 crashes before the pre-check phase, no aggregates have been relocated yet and the HA pair configuration is still enabled.

#### About this task

Takeover and giveback can proceed normally.

#### Steps

1. Check the console for EMS messages that the system might have issued and take the recommended corrective action.
2. Continue with the node-pair upgrade procedure.

### Reboots, panics, or power cycles during first resource-release phase

### **Node1 crashes during the first resource-release phase with HA pair still enabled**

Some or all aggregates have been relocated from node1 to node2, and HA pair is still enabled. Node2 takes over node1's root volume and any non-root aggregates that were not relocated.

#### **About this task**

Ownership of aggregates that were relocated look the same as the ownership of non-root aggregates that were taken over because the home owner has not changed.

When node1 enters the `waiting for giveback` state, node2 gives back all of the node1 non- root aggregates.

#### **Steps**

1. After node1 is booted up, all the non-root aggregates of node1 have moved back to node1. You must perform a manual aggregate relocation of the aggregates from node1 to node2:  

```
storage aggregate relocation start -node node1 -destination node2 -aggregate
-list * -ndocontroller-upgrade true
```
2. Continue with the node-pair upgrade procedure.

### **Node1 crashes during the first resource-release phase while HA pair is disabled**

Node2 does not take over but it is still serving data from all non-root aggregates.

#### **Steps**

1. Bring up node1.
2. Continue with the node-pair upgrade procedure.

### **Node2 fails during the first resource-release phase with HA pair still enabled**

Node1 has relocated some or all of its aggregates to node2. The HA pair is enabled.

#### **About this task**

Node1 takes over all of node2's aggregates as well as any of its own aggregates that it had relocated to node2. When node2 boots up, the aggregate relocation is completed automatically.

#### **Steps**

1. Bring up node2.
2. Continue with the node-pair upgrade procedure.

### **Node2 crashes during the first resource-release phase and after HA pair is disabled**

Node1 does not take over.

#### **Steps**

1. Bring up node2.  
  
A client outage occurs for all aggregates while node2 is booting up.
2. Continue with the rest of the node-pair upgrade procedure.

## **Reboots, panics, or power cycles during the first verification phase**

### **Node2 crashes during the first verification phase with HA pair disabled**

Node3 does not take over following a node2 crash as the HA pair is already disabled.

#### **Steps**

1. Bring up node2.

A client outage occurs for all aggregates while node2 is booting up.

2. Continue with the node-pair upgrade procedure.

### **Node3 crashes during the first verification phase with HA pair disabled**

Node2 does not take over but it is still serving data from all non-root aggregates.

#### **Steps**

1. Bring up node3.
2. Continue with the node-pair upgrade procedure.

## **Reboots, panics, or power cycles during first resource-regain phase**

### **Node2 crashes during the first resource-regain phase during aggregate relocation**

Node2 has relocated some or all of its aggregates from node1 to node3. Node3 serves data from aggregates that were relocated. The HA pair is disabled and hence there is no takeover.

#### **About this task**

There is client outage for aggregates that were not relocated. On booting up node2, the aggregates of node1 are relocated to node3.

#### **Steps**

1. Bring up node2.
2. Continue with the node-pair upgrade procedure.

### **Node3 crashes during the first resource-regain phase during aggregate relocation**

If node3 crashes while node2 is relocating aggregates to node3, the task continues after node3 boots up.

#### **About this task**

Node2 continues to serve remaining aggregates, but aggregates that were already relocated to node3 encounter client outage while node3 is booting up.

#### **Steps**

1. Bring up node3.
2. Continue with the controller upgrade.

## **Reboots, panics, or power cycles during post-check phase**

### **Node2 or node3 crashes during the post-check phase**

The HA pair is disabled hence this is no takeover. There is a client outage for aggregates belonging to the node that rebooted.

#### **Steps**

1. Bring up the node.
2. Continue with the node-pair upgrade procedure.

### **Reboots, panics, or power cycles during second resource-release phase**

#### **Node3 crashes during the second resource-release phase**

If node3 crashes while node2 is relocating aggregates, the task continues after node3 boots up.

#### **About this task**

Node2 continues to serve remaining aggregates but aggregates that were already relocated to node3 and node3's own aggregates encounter client outages while node3 is booting.

#### **Steps**

1. Bring up node3.
2. Continue with the controller upgrade procedure.

#### **Node2 crashes during the second resource-release phase**

If node2 crashes during aggregate relocation, node2 is not taken over.

#### **About this task**

Node3 continues to serve the aggregates that have been relocated, but the aggregates owned by node2 encounter client outages.

#### **Steps**

1. Bring up node2.
2. Continue with the controller upgrade procedure.

### **Reboots, panics, or power cycles during the second verification phase**

#### **Node3 crashes during the second verification phase**

If node3 crashes during this phase, takeover does not happen because the HA pair is already disabled.

#### **About this task**

There is a client outage for all aggregates until node3 reboots.

#### **Steps**

1. Bring up node3.
2. Continue with the node-pair upgrade procedure.

#### **Node4 crashes during the second verification phase**

If node4 crashes during this phase, takeover does not happen. Node3 serves data from the aggregates.

## About this task

There is an outage for non-root aggregates that were already relocated until node4 reboots.

## Steps

1. Bring up node4.
2. Continue with the node-pair upgrade procedure.

## Issues that can arise in multiple stages of the procedure

Some issues can occur during different stages of the procedure.

### Unexpected "storage failover show" command output

During the procedure, if the node that hosts all data aggregates panics or is rebooted accidentally, you might see unexpected output for the `storage failover show` command before and after the reboot, panic, or power cycle.

## About this task

You might see unexpected output from the `storage failover show` command in Stage 2, Stage 3, Stage 4, or Stage 5.

The following example shows the expected output of the `storage failover show` command if there are no reboots or panics on the node that hosts all the data aggregates:

```
cluster::> storage failover show

Node Partner Takeover
----- -
node1 node2 false Unknown
node2 node1 false Node owns partner aggregates as part of the
non-disruptive head upgrade procedure. Takeover is not possible: Storage
failover is disabled.
```

The following example shows the output of the `storage failover show` command after a reboot or panic:

```
cluster::> storage failover show

Node Partner Takeover
----- -
node1 node2 - Unknown
node2 node1 false Waiting for node1, Partial giveback, Takeover
is not possible: Storage failover is disabled
```

Although the output says that a node is in partial giveback and that storage failover is disabled, you can disregard this message.

## Steps

No action is required; continue with the node-pair upgrade procedure.

## LIF migration failure

After you migrate LIFs, they might not come online after migration in Stage 2, Stage 3, or Stage 5.

## Steps

1. Verify that the port MTU size is the same as that of the source node.

For example, if the cluster port MTU size is 9000 on the source node, it should be 9000 on the destination node.

2. Check the physical connectivity of the network cable if the physical state of the port is `down`.

## References

When performing the procedures in this content, you might need to consult reference content or go to reference websites.

- [Reference content](#)
- [Reference sites](#)

## Reference content

Content specific to this upgrade are listed in the table below.

| Content                                                                                 | Description                                                                                                                                                                                                            |
|-----------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <a href="#">Administration overview with the CLI</a>                                    | Describes how to administer ONTAP systems, shows you how to use the CLI interface, how to access the cluster, how to manage nodes, and much more.                                                                      |
| <a href="#">Decide whether to use System Manager or the ONTAP CLI for cluster setup</a> | Describes how to set up and configure ONTAP.                                                                                                                                                                           |
| <a href="#">Disk and aggregate management with the CLI</a>                              | Describes how to manage ONTAP physical storage using the CLI. It shows you how to create, expand, and manage aggregates, how to work with Flash Pool aggregates, how to manage disks, and how to manage RAID policies. |
| <a href="#">FlexArray Virtualization Installation Requirements and Reference</a>        | Contains cabling instructions and other information for FlexArray Virtualization systems.                                                                                                                              |
| <a href="#">High Availability management</a>                                            | Describes how to install and manage high-availability clustered configurations, including storage failover and takeover/giveback.                                                                                      |
| <a href="#">Logical storage management with the CLI</a>                                 | Describes how to efficiently manage your logical storage resources, using volumes, FlexClone volumes, files, and LUNs, FlexCache volumes, deduplication, compression, qtrees, and quotas.                              |

| Content                                                                                                            | Description                                                                                                                                                                                                                                          |
|--------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <a href="#">MetroCluster Upgrade and Expansion</a>                                                                 | Provides procedures for upgrading controller and storage models in the MetroCluster configuration, transitioning from a MetroCluster FC to a MetroCluster IP configuration, and expanding the MetroCluster configuration by adding additional nodes. |
| <a href="#">Network Management</a>                                                                                 | Describes how to configure and manage physical and virtual network ports (VLANs and interface groups), LIFs, routing, and host-resolution services in clusters; optimize network traffic by load balancing; and monitor the cluster by using SNMP.   |
| <a href="#">ONTAP 9.13.1 Commands: Manual Page Reference</a>                                                       | Describes syntax and usage of supported ONTAP 9.13.1 commands.                                                                                                                                                                                       |
| <a href="#">ONTAP 9.14.1 Commands: Manual Page Reference</a>                                                       | Describes syntax and usage of supported ONTAP 9.14.1 commands.                                                                                                                                                                                       |
| <a href="#">ONTAP 9.15.1 Commands: Manual Page Reference</a>                                                       | Describes syntax and usage of supported ONTAP 9.15.1 commands.                                                                                                                                                                                       |
| <a href="#">SAN management with the CLI</a>                                                                        | Describes how to configure and manage LUNs, igroups, and targets using the iSCSI and FC protocols, and namespaces and subsystems using the NVMe/FC protocol.                                                                                         |
| <a href="#">SAN configuration reference</a>                                                                        | Contains information about FC and iSCSI topologies and wiring schemes.                                                                                                                                                                               |
| <a href="#">Upgrade by moving volumes or storage</a>                                                               | Describes how to quickly upgrade controller hardware in a cluster by moving storage or volumes. Also describes how to convert a supported model to a disk shelf.                                                                                     |
| <a href="#">Upgrade ONTAP</a>                                                                                      | Contains instructions for downloading and upgrading ONTAP.                                                                                                                                                                                           |
| <a href="#">Use "system controller replace" commands to upgrade controller models in the same chassis</a>          | Describes the aggregate relocation procedures needed to non-disruptively upgrade a system, keeping the old system chassis and disks.                                                                                                                 |
| <a href="#">Use "system controller replace" commands to upgrade controller hardware running ONTAP 9.8 or later</a> | Describes the aggregate relocation procedures needed to non-disruptively upgrade controllers running ONTAP 9.8 by using "system controller replace" commands.                                                                                        |
| <a href="#">Use aggregate relocation to manually upgrade controller hardware running ONTAP 9.8 or later</a>        | Describes the aggregate relocation procedures needed to perform manual non-disruptive controller upgrades running ONTAP 9.8 or later.                                                                                                                |

## Reference sites

The [NetApp Support Site](#) also contains documentation about network interface cards (NICs) and other hardware that you might use with your system. It also contains the [Hardware Universe](#), which provides information about the hardware that the new system supports.

Access [ONTAP 9 documentation](#).

Access the [Active IQ Config Advisor](#) tool.

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