Manually upgrade controller hardware running ONTAP 9.8 or later

AFF and FAS Controller Upgrade

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Overview

You can use this aggregate relocation procedure to manually upgrade controller hardware running ONTAP 9.8 or later.

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 ensure 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.

In this document, 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.
This document uses the term *systems with FlexArray Virtualization Software* to refer to systems that belong to these new platforms. It uses the term *V-Series system* to refer to the separate hardware systems that can attach to storage arrays

Important:

- This procedure is complex and assumes that you have advanced ONTAP administration skills. You also should read and understand the Guidelines for upgrading controllers with ARL and the ARL upgrade workflow 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, especially if the controllers were running Data ONTAP in 7-Mode.
- 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.
- This procedure applies to FAS systems, V-Series systems, AFF systems, and systems with FlexArray Virtualization Software. FAS systems released after ONTAP 9 can attach to storage arrays if the required license is installed. The existing V-Series systems are supported in ONTAP 9. For information about the storage array and V-Series models, refer to References to link to the *Hardware Universe* and see the *V-Series Support Matrix*.
- In addition to non-MetroCluster configurations, this procedure applies to Fabric MetroCluster four-node and eight-node configurations running ONTAP 9.8 and later.
  - For MetroCluster configurations running ONTAP 9.7 and earlier, go to References to link to *Using Aggregate Relocation to Manually Upgrade Controller Hardware Running ONTAP 9.7 or Earlier*.
  - For MetroCluster IP configurations and additional upgrade options for Fabric MetroCluster configurations, go to References to link to the *MetroCluster Upgrade and Expansion* content.

Decide whether to use the aggregate relocation procedure

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

You should use this content under the following circumstances:

- You do not want to add the new controllers as a new HA pair to the cluster and migrate the data using volume moves.
- You are experienced in administering ONTAP and are comfortable with the risks of working in the diagnostic privilege mode.
- You have a system that uses Fabric MetroCluster 4-node and 8-node configurations running ONTAP 9.8 or later.

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

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.

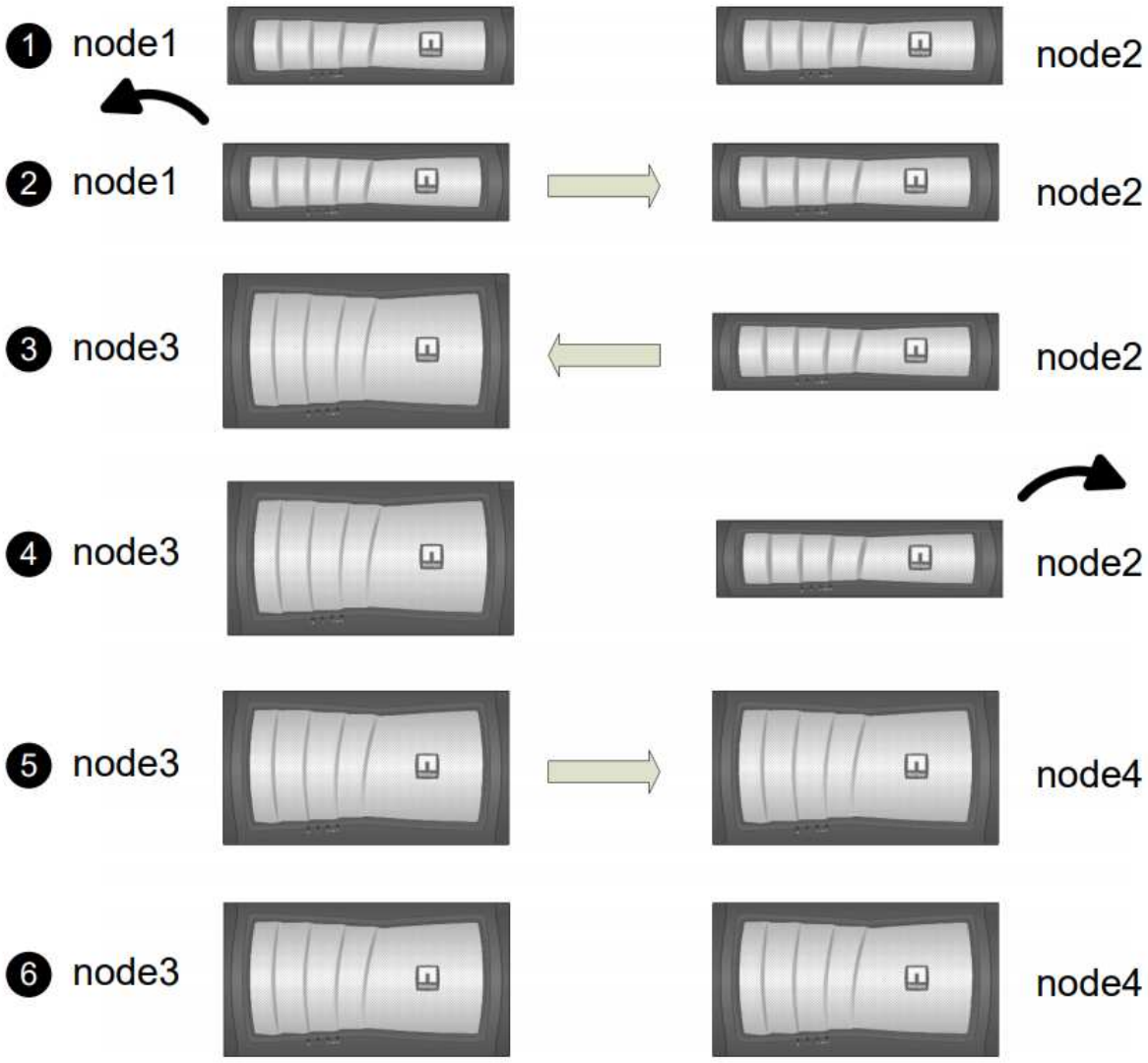
ARL upgrade workflow

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

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 illustration shows the stages of the procedure. The thick, light gray arrows represent the relocation of aggregates and the movement of LIFs, and the thinner black arrows represent the removal of the original nodes. The smaller controller images represent the original nodes, and the larger controller images represent the new nodes.



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	Steps
Stage 1: Prepare for upgrade	1. Determine whether the controller has aggregates on internal disk drives. This step is required only if you are upgrading from a controller with internal disk drive. 2. Prepare the nodes for upgrade. 3. Rekey disks for Storage Encryption. This task is required only if you are upgrading from a system with self-encrypting drives. 4. Verify the SnapMirror relationship state on the cluster and quiesce all relationships between the clusters. 5. Prepare for netboot. Aggregate ownership at the end of Stage 1: • Node1 is the home owner and current owner of the node1 aggregates. • Node2 is the home owner and current owner of the node2 aggregates.
Stage 2: Retire node1	1. Relocate non-root aggregates from node1 to node2. 2. Move non-SAN data LIFSs owned by node1 to node2. 3. Record node1 information. 4. Relocate failed or vetoed aggregates. 5. Retire node1. Aggregate ownership at the end of Stage 2: • Node1 is the home owner of node1 aggregates. • Node2 is the current owner of node1 aggregates. • Node2 is the home owner and current owner of node2 aggregates.

Stage	Steps
Stage 3: Install and boot node3	1. Install and boot node3. 2. Set the UTA/UTA2 configuration on node3. 3. Map ports from node1 to node3. 4. Move non-SAN data LIFs owned by node 1 from node2 to node3 and verify SNA LIFs on node3. 5. Relocate non-root aggregates from node2 to node3. 6. Move non-SAN data LIFs owned by node2 to node3. Aggregate ownership at the end of Stage 3: • Node2 is the home owner of node2 aggregates but not the current owner. • Node3 is the home owner and current owner of aggregates originally belonging to node1. • Node2 is the home owner and current owner of aggregates belonging to node2 but not the home owner.
Stage 4: Retire node2	1. Record node2 information. 2. Retire node2. No changes occur in aggregate ownership.
Stage 5: Install and boot node4	1. Install and boot node4. 2. Set the UTA/UTA2 configuration on node4. 3. Map ports from node2 to node4. 4. Move non-SAN data LIFs owned by node2 from node3 to node4 and verify SNA LIFs on node4. 5. Relocate node2’s non-root aggregates from node3 to node4. Aggregate ownership at the end of Stage 5: • 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	Steps
Stage 6: Complete the upgrade	1. Ensure the new controllers are set up correctly. 2. Set up Storage Encryption on the new nodes. This task is required only if you are upgrading to a system with self-encrypting drives. 3. Decommission the old system. 4. Resume NetApp SnapMirror relationships. **Note:** The storage virtual machine (SVM) disaster recovery updates will not be interrupted as per the schedules assigned. No changes occur in aggregate ownership.

Guidelines for upgrading controllers with ARL

To understand whether you can use aggregate relocation (ARL) to upgrade a pair of controllers running ONTAP 9.8 depends on the platform and the configuration of both the original and replacement controllers.

Supported upgrades for ARL

You can upgrade a pair of nodes using ARL under the following circumstances:

- Both the original controllers and the replacement controllers must be running the same version of ONTAP 9.8 before the upgrade.
- The replacement controllers must have equal or higher capacity than the original controllers. Equal or higher capacity refers to attributes, such as the NVRAM size, volume, LUN, or aggregate count limits; it also refers to the maximum volume or aggregate sizes of the new nodes.
- You can upgrade the following type of systems:
  - A FAS system to a FAS system.
  - A FAS system to a V-Series system or a system with FlexArray Virtualization Software.
  - A V-Series system to a V-Series system or a system with FlexArray Virtualization Software.
  - A V-Series system or a system with FlexArray Virtualization Software to a FAS system, provided that the V-Series system or system with FlexArray Virtualization Software has no array LUNs.
  - An AFF system to an AFF system.
- For some ARL controller upgrades you can use temporary cluster ports on the replacement controller for the upgrade. For example, if you upgrade from an AFF A300 to an AFF A400 system, depending on the AFF A400 configuration, you can use any of the two mezzanine ports or add a four-port 10 GbE network interface card to provide temporary cluster ports. After you complete a controller upgrade using temporary cluster ports, you can nondisruptively migrate clusters to 100 GbE ports on the replacement controller.
- Controller upgrade using ARL is supported on systems configured with SnapLock Enterprise and SnapLock Compliance volumes.

You should verify whether the ARL can be performed on the original and replacement controllers. You should

check the size of all defined aggregates and number of disks supported by the original system. Then compare them with the aggregate size and number of disks supported by the new system. To access this information, refer to References to link to the *Hardware Universe*. 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.

You should 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*.

Both systems are either high-availability (HA) or non-HA. Both nodes must either have the personality enabled or disabled; you cannot combine a node with the All Flash Optimized personality enabled with a node that does not have the personality enabled in the same HA pair. If the personalities are different, contact technical support.

If the new system has fewer slots than the original system, or if it has fewer or different ports, you might need to add an adapter to the new system. Refer to References to link to the *Hardware Universe* on the NetApp Support Site for details about specific platforms.

If you have a system with more than two cluster ports per node, such as an FAS8080 or an AFF8080, you must consolidate the cluster LIFs to two cluster ports per node before you start the controller upgrade. If you perform the controller upgrade with more than two cluster ports per node, cluster LIFs might be missing on the new controller after the upgrade.

Upgrades not supported for ARL

You cannot perform the following upgrades:

- To or from controllers that cannot run ONTAP 9.8 or later.
- To replacement controllers that do not support the disk shelves connected to the original controllers.

  For disk-support information, refer to References to link to the *Hardware Universe*.

- From controllers with root aggregates or data aggregates on internal drives.

  If you want to upgrade controllers with root aggregates or data aggregates on internal disk 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*.

  If you want to upgrade ONTAP on nodes in a cluster, refer to References to link to *Upgrade ONTAP*.

Assumptions and terminology

This document is written with the following assumptions:

- The replacement controller hardware is new and has not been used.

Attention: Because 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, especially if the controllers were running Data ONTAP in 7-Mode.

- You read and understand the guidelines for upgrading the pair of nodes.

Attention: Do not try to clear the NVRAM contents. If you need to clear the contents of NVRAM, contact NetApp technical support.

- You are performing the appropriate command before and after the `modify` commands and comparing the output of both `show` commands to verify that the `modify` command was successful.
- If you have a SAN configuration, you have local and partner LIFs for each storage virtual machine (SVM), on the HA pair. If you do not have local and partner LIFs for each SVM, you should add the SAN data LIF on the remote and local node for that SVM before beginning the upgrade.
- If you have port sets in a SAN configuration, you must have verified that each bound port set contains at least one LIF from each node in the HA pair.

This procedure uses the term *boot environment prompt* to refer to the prompt on a node from which you can perform certain tasks, such as rebooting the node and printing or setting environmental variables. The prompt is sometimes referred to informally as the *boot loader prompt*.

The boot environment prompt is shown in the following example:

```
LOADER>
```

Licensing in ONTAP 9.8 or Later

When you set up a cluster, the setup wizard prompts you to enter the cluster-base license key. However, some features require additional licenses, which are issued as *packages* that include one or more features. Each node in the cluster must have its own key for each feature to be used in the cluster.

If you do not have new license keys, currently licensed features in the cluster are available to the new controller and will continue to work. However, using unlicensed features on the controller might put you out of compliance with your license agreement, so you should install the new license key or keys for the new controller after the upgrade is complete.

All license keys are 28 uppercase alphabetic characters in length. Refer to References to link to the *NetApp Support Site* where you can obtain new 28-character license keys for ONTAP 9.8. or later. The keys are available in the *My Support* section under *Software licenses*. If the site does not have the license keys you need, contact your NetApp sales representative.

For detailed information about licensing, go to References to link to the *System Administration Reference*.

Storage Encryption

The original nodes or the new nodes might be enabled for Storage Encryption. In that case, you need to take additional steps in this procedure to verify that Storage Encryption is set up properly.

If you want to use Storage Encryption, all the disk drives associated with the nodes must have self-encrypting disk drives.

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

Troubleshooting

This procedure includes troubleshooting suggestions.

If any problems occur while upgrading the controllers, you can refer to the Troubleshoot section at the end of the procedure for more information and possible solutions.

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

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 also need to record information essential to completing the controller upgrade; a worksheet is provided to record information.

You need the following tools to perform the up grade:

- Grounding strap
- #2 Phillips screwdriver

Go to the References section to access the list of reference documents required for this upgrade.

Worksheet: Information to collect before and during controller upgrade

You must gather certain information to successfully upgrade the original nodes. The information includes node IDs, port and LIF details, licensing keys, and IP addresses.

You can use the following worksheet to record information for use later in the procedure:

Information needed	When collected	When used	Collected Information
Model, system ID, serial number of original nodes	Stage 1: *Prepare the nodes for the upgrade*	Stage 3: *Install and boot node3* Stage 5: *Install and boot node4* Stage 6: *Decommission the old system*	

Information needed	When collected	When used	Collected Information
Shelf and disk information, flash storage details, memory, NVRAM, and adapter cards on original nodes	Stage 1: *Preparing the nodes for the upgrade*	Throughout the procedure	
Online aggregates and volumes on original nodes	Stage 1: *Prepare the nodes for the upgrade*	Throughout the procedure to verify that aggregates and volumes remain online except during brief relocation	
Output of commands `network port vlan show` and `network port ifgrp show`	Stage 1: *Prepare the nodes for the upgrade*	Stage 3: *Map ports from node1 to node3* Stage 5: *Map ports from node2 to node4*	
(SAN environments only) Default configuration of FC ports	Stage 1: *Prepare the nodes for the upgrade*	When configuring FC ports on the new nodes	
(V-Series systems or systems with FlexArray Virtualization software only) Topology for V-Series systems or systems with FlexArray Virtualization software	Stage 1: *Prepare the nodes for the upgrade*	Stage 3: *Install and boot node3* Stage 5: *Install and boot node4*	
IP address of SPs	Stage 1: *Prepare the nodes for the upgrade*	Stage 6: *Ensure that the new controllers are set up correctly*	
License keys	Stage 1: *Prepare the nodes for the upgrade*	Stage 6: *Ensure that the new controllers are set up correctly*	
IP address for the external key management server	Stage 1: *Rekey disks for Storage Encryption*	Stage 6: *Set up Storage Encryption on the new nodes*	
Name and path of web-accessible directory where you download files to netboot the nodes	Stage 1: *Prepare to netboot*	Stage 3: *Install and boot node3* Stage 5: *Install and boot node4*	
Non-SAN data LIFs owned by node1	Stage 2: *Move nonSAN data LIFs owned by node1 to node2*	Later in the section	

Information needed	When collected	When used	Collected Information
Cluster, intercluster, node-management, cluster-management, and physical ports	Stage 2: *Record node1 information*	Stage 3: *Install and boot node3* Stage 3: *Map ports from node1 to node3*	
Ports on new nodes	Stage 3: *Map ports from node1 to node3*	Later in the section and in the section *Map ports from node2 to node4*	
Available ports and broadcast domains on node3	Stage 3: *Map ports from node1 to node3*	Later in the section	
Non-SAN data LIFs not owned by node2	*Moving non-SAN data LIFs belonging to node1 from node2 to node3 and verifying SAN LIFs on node3*	Later in the section	
Non-SAN data LIFs owned by node2	Stage 3: *Move nonSAN data LIFs owned by node2 to node3*	Later in the section	
Cluster, intercluster, node-management, cluster-management, and physical ports	Stage 4: *Record node2 information*	Stage 5: *Install and booting node4* Stage 5:_ Map ports from node2 to node4_	
Cluster network ports on node4	Stage 5: *Map ports from node2 to node4*	Later in the section	
Available ports and broadcast domains on node4	Stage 5: *Map ports from node2 to node4*	Later in the section	
Private and public SSL certificates for the storage system and private SSL certificates for each key management server	Stage 6: *Set up Storage Encryption on the new nodes*	Later in the section	

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.

Steps

1. Stage 1: Prepare for upgrade
2. Stage 2: Relocate and retire node1
3. Stage 3: Install and boot node3

4. Stage 4: Record information and retire node2
5. Stage 5: Install and boot node4
6. Stage 6: Complete the upgrade

Stage 1. Prepare for upgrade

Stage 1. Prepare for the upgrade

During Stage 1, you must prepare the nodes for the upgrade and run a series of prechecks. You might need to rekey disks for Storage Encryption. You must also prepare to netboot the new controllers.

Steps

1. Determine whether the controller has aggregates on internal disk drives
2. Prepare the nodes for upgrade
3. Get an IP address of an external key management server for storage encryption
4. Manage authentication using KMIP servers
5. Manage authentication using an onboard key manager
6. Quiesce the SnapMirror relationships
7. Prepare for netboot

Determine whether the controller has aggregates on internal disk drives

If you are upgrading controllers with internal disk drives, you need to complete several commands and examine their output to ensure that none of the internal disk drives contains root aggregates or data aggregates.

About this task

If you are not upgrading controllers with aggregates on internal disk drives, skip this section and go to the section Prepare the nodes for upgrade.

Steps

1. Enter the nodeshell, once for each of the original nodes.

   ```
   system node run -node <node_name>
   ```

2. Display the internal drives:

   ```
   sysconfig -av
   ```

   The system displays detailed information about the node's configuration, including storage, as seen in the partial output shown in the following example:

```
node> sysconfig -av
slot 0: SAS Host Adapter 0a (PMC-Sierra PM8001 rev. C, SAS, UP)
                Firmware rev: 01.11.06.00
                 Base WWN: 5:00a098:0008a3b:b0
                 Phy State: [0] Enabled, 6.0 Gb/s
                            [1] Enabled, 6.0 Gb/s
                            [2] Enabled, 6.0 Gb/s
                            [3] Enabled, 6.0 Gb/s
                ID Vendor Model FW Size
                00.0 : NETAPP X306_HMARK02TSSM NA04 1695.4GB (3907029168
512B/sect)
                00.1 : NETAPP X306_HMARK02TSSM NA04 1695.4GB (3907029168
512B/sect)
                00.2 : NETAPP X306_HMARK02TSSM NA04 1695.4GB (3907029168
512B/sect)
                00.3 : NETAPP X306_HMARK02TSSM NA04 1695.4GB (3907029168
512B/sect)
                00.4 : NETAPP X306_HMARK02TSSM NA04 1695.4GB (3907029168
512B/sect)
                00.5 : NETAPP X306_HMARK02TSSM NA04 1695.4GB (3907029168
512B/sect)
                00.6 : NETAPP X306_HMARK02TSSM NA04 1695.4GB (3907029168
512B/sect)
                00.7 : NETAPP X306_HMARK02TSSM NA04 1695.4GB (3907029168
512B/sect)
                00.8 : NETAPP X306_HMARK02TSSM NA04 1695.4GB (3907029168
512B/sect)
                00.9 : NETAPP X306_HMARK02TSSM NA04 1695.4GB (3907029168
512B/sect)
                00.10: NETAPP X306_HMARK02TSSM NA04 1695.4GB (3907029168
512B/sect)
                00.11: NETAPP X306_HMARK02TSSM NA04 1695.4GB (3907029168
512B/sect)
...
```

3. Examine the storage output of the `sysconfig -av` command to identify the internal disk drives, and then record the information.

   Internal drives have "00." at the beginning of their ID. The "00." indicates an internal disk shelf, and the number after the decimal point indicates the individual disk drive.

4. Enter the following command on both controllers:

   `aggr status -r`

   The system displays the aggregate status of the node, as shown in the partial output in the following example:

```
node> aggr status -r
Aggregate aggr2 (online, raid_dp, parity uninit'd!) (block checksums)
Plex /aggr2/plex0 (online, normal, active)
RAID group /aggr2/plex0/rg0 (normal, block checksums)

RAID Disk Device    HA SHELF BAY CHAN Pool Type RPM  Used (MB/blks)
Phys (MB/blks)
--------- --------- -- ----- --- ---- ---- ---- ---- ------------------
------------------
dparity   0a.00.1   0a   0    1  SA:B  0   BSAS 7200 1695466/3472315904
1695759/3472914816
parity    0a.00.3   0a   0    3  SA:B  0   BSAS 7200 1695466/3472315904
1695759/3472914816
data      0a.00.9   0a   0    9  SA:B  0   BSAS 7200 1695466/3472315904
1695759/3472914816
...
```

The device used to create the aggregate might not be a physical disk but might be a partition.

5. Examine the output of the `aggr status -r` command to identify the aggregates using internal disk drives, and then record the information.

   In the example in the previous step, "aggr2" uses internal drives, as indicated by the shelf ID of "0".

6. Enter the following command on both controllers:

   ```
   aggr status -y
   ```

   The system displays information about the volumes on the aggregate, as shown in the partial output in the following example:

```
node> aggr status -v
...
 aggr2   online   raid_dp, aggr    nosnap=off, raidtype=raid_dp,
raidsize=14,
                  64-bit           raid_lost_write=on,
ignore_inconsistent=off,
                  rlw_on           snapmirrored=off, resyncsnaptime=60,
                                   fs_size_fixed=off,
lost_write_protect=on,
                                   ha_policy=cfo, hybrid_enabled=off,
percent_snapshot_space=0%,
                                   free_space_realloc=off, raid_cv=on,
thorough_scrub=off
         Volumes: vol6, vol5, vol14
...
 aggr0   online   raid_dp, aggr    root, diskroot, nosnap=off,
raidtype=raid_dp,
                  64-bit           raidsize=14, raid_lost_write=on,
ignore_inconsistent=off,
                  rlw_on           snapmirrored=off,  resyncsnaptime=60,
fs_size_fixed=off,
                                   lost_write_protect=on, ha_policy=cfo,
hybrid_enabled=off,
                                   percent_snapshot_space=0%,
free_space_realloc=off, raid_cv=on
         Volumes: vol0
```

Based on the output in Step 4 and Step 6, aggr2 uses three internal drives—"0a.00.1", "0a.00.3", and "0a.00.9"—and the volumes on "aggr2" are "vol6", "vol5", and "vol14". Also, in the output of Step 6, the readout for "aggr0" contains the word "root" at the beginning of the information for the aggregate. That indicates that it contains a root volume.

7. Examine the output of the `aggr status -v` command to identify the volumes belonging to any aggregates that are on an internal drive and whether any of those volumes contain a root volume.
8. Exit the nodeshell by entering the following command on each controller:

   `exit`

9. Take one of the following actions:

If the controllers….	Then…
Do not contain any aggregates on internal disk drives	Continue with this procedure.

If the controllers….	Then…
Contain aggregates but no volumes on the internal disk drives	Continue with this procedure. **Note**: Before you continue, you must place the aggregates offline, and then destroy the aggregates on the internal disk drives. Refer to References to link to the *Disk and aggregate management with the CLI* content for information about managing aggregates.
Contain non-root volumes on the internal drives	Continue with this procedure. **Note**: Before you continue, you must move the volumes to an external disk shelf, place the aggregates offline, and then destroy the aggregates on the internal disk drives. Refer to References to link to the *Disk and aggregate management with the CLI* content for information about moving volumes.
Contain root volumes on the internal drives	Do not continue with this procedure. You can upgrade the controllers by referring to References to link to the *NetApp Support Site* and using the procedure *Upgrading the controller hardware on a pair of nodes running clustered Data ONTAP by moving volumes*.
Contain non-root volumes on the internal drives and you cannot move the volumes to external storage	Do not continue with this procedure. You can upgrade the controllers by using the procedure *Upgrading the controller hardware on a pair of nodes running clustered Data ONTAP by moving volumes*. Refer to References to link to the *NetApp Support Site* where you can access this procedure.

Prepare the nodes for upgrade

Before you can replace the original nodes, you must ensure that they are in an HA pair, have no missing or failed disks, can access each other's storage, and do not own data LIFs assigned to the other nodes in the cluster. You also need to collect information about the original nodes and, if the cluster is in a SAN environment, ensure that all the nodes in the cluster are in quorum.

Steps

1. Ensure that each of the original nodes has enough resources to adequately support the workload of both nodes during takeover mode.

   Refer to References to link to *High Availability management* and follow the *Best practices for HA pairs* section. Neither of the original nodes should be running at more than 50 percent utilization; if a node is running at less than 50 percent utilization, it can handle the loads for both nodes during the controller upgrade.

2. Complete the following substeps to create a performance baseline for the original nodes:

   a. Make sure that the diagnostic user account is unlocked.

      Important: The diagnostic user account is intended only for low-level diagnostic purposes and should be used only with guidance from technical support.

Important: For information about unlocking the user accounts, refer to References to link to the *System Administration Reference*.

b. Refer to References to link to the *NetApp Support Site* and download the Performance and Statistics Collector (Perfstat Converged).

The Perfstat Converged tool lets you establish a performance baseline for comparison after the upgrade.

c. Create a performance baseline, following the instructions on the NetApp Support Site.

3. Refer to References to link to the *NetApp Support Site* and open a support case on the NetApp Support Site.

You can use the case to report any issues that might arise during the upgrade.

4. Verify that NVMEM or NVRAM batteries of node3 and node4 are charged, and charge them if they are not.

You need to physically check node3 and node4 to see if the NVMEM or NVRAM batteries are charged. For information about the LEDs for the model of node3 and node4, refer to References to link to the *Hardware Universe*.

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

5. Check the version of ONTAP on node3 and node4.

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 *Upgrade ONTAP*.

Information about the version of ONTAP on node3 and node4 should be included in the shipping boxes. The ONTAP version is displayed when the node boots up or you can boot the node to maintenance mode and run the command:

```
version
```

6. Check whether you have two or four cluster LIFs on node1 and node 2:

```
network interface show -role cluster
```

The system displays any cluster LIFs, as shown in the following example:

```
cluster::> network interface show -role cluster
        Logical    Status     Network          Current  Current Is
Vserver Interface  Admin/Oper Address/Mask     Node     Port    Home
------- ---------- ---------- ---------------- -------- ------- ----
node1
        clus1      up/up      172.17.177.2/24  node1    e0c     true
        clus2      up/up      172.17.177.6/24  node1    e0e     true
node2
        clus1      up/up      172.17.177.3/24  node2    e0c     true
        clus2      up/up      172.17.177.7/24  node2    e0e     true
```

7. If you have two or four cluster LIFs on node1 or node2, make sure that you can ping both cluster LIFs across all the available paths by completing the following substeps:
   a. Enter the advanced privilege level:

      ```
      set -privilege advanced
      ```

      The system displays the following message:

      ```
      Warning: These advanced commands are potentially dangerous; use them
      only when directed to do so by NetApp personnel.
      Do you wish to continue? (y or n):
      ```

   b. Enter `y`.
   c. Ping the nodes and test the connectivity:

      ```
      cluster ping-cluster -node node_name
      ```

      The system displays a message similar to the following example:

```
cluster::*> cluster ping-cluster -node node1
Host is node1
Getting addresses from network interface table...
Local = 10.254.231.102 10.254.91.42
Remote = 10.254.42.25 10.254.16.228
Ping status:
...
Basic connectivity succeeds on 4 path(s) Basic connectivity fails on
0 path(s)
................
Detected 1500 byte MTU on 4 path(s):
Local 10.254.231.102 to Remote 10.254.16.228
Local 10.254.231.102 to Remote 10.254.42.25
Local 10.254.91.42 to Remote 10.254.16.228
Local 10.254.91.42 to Remote 10.254.42.25
Larger than PMTU communication succeeds on 4 path(s)
RPC status:
2 paths up, 0 paths down (tcp check)
2 paths up, 0 paths down (udp check)
```

If the node uses two cluster ports, you should see that it is able to communicate on four paths, as shown in the example.

d. Return to the administrative level privilege:

```
set -privilege admin
```

8. Ensure that node1 and node2 are in an HA pair and verify that the nodes are connected to each other, and that takeover is possible:

```
storage failover show
```

The following example shows the output when the nodes are connected to each other and takeover is possible:

```
cluster::> storage failover show
                              Takeover
Node           Partner        Possible State Description
-------------- -------------- -------- -------------------------------
node1          node2          true     Connected to node2
node2          node1          true     Connected to node1
```

Neither node should be in partial giveback. The following example shows that node1 is in partial giveback:

```
cluster::> storage failover show
                              Takeover
Node           Partner        Possible State Description
-------------- -------------- -------- -------------------------------
node1          node2          true     Connected to node2, Partial
giveback
node2          node1          true     Connected to node1
```

If either node is in partial giveback, use the `storage failover giveback` command to perform the giveback, and then use the `storage failover show-giveback` command to make sure that no aggregates still need to be given back. For detailed information about the commands, refer to References to link to *High Availability management*.

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

   `storage aggregate show -node <node_name> -is-home false -fields owner-name,homename,state`

   If neither node1 nor node2 owns aggregates for which it is the current owner (but not the home owner), the system will return a message similar to the following example:

```
cluster::> storage aggregate show -node node2 -is-home false -fields
owner-name,homename,state
There are no entries matching your query.
```

   The following example shows the output of the command for a node named node2 that is the home owner, but not the current owner, of four aggregates:

```
cluster::> storage aggregate show -node node2 -is-home false
               -fields owner-name,home-name,state

aggregate     home-name    owner-name   state
------------- ------------ ------------ ------
aggr1         node1        node2        online
aggr2         node1        node2        online
aggr3         node1        node2        online
aggr4         node1        node2        online

4 entries were displayed.
```

10. Take one of the following actions:

If the command in Step 9…	Then…
Had blank output	Skip Step 11 and go to Step 12.

If the command in Step 9…	Then…
Had output	Go to Step 11.

11. If either node1 or node2 owns aggregates for which it is the current owner but not the home owner, complete the following substeps:

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

    ```
    storage failover giveback -ofnode <home_node_name>
    ```

    b. 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.
    ```

12. Ensure that node1 and node2 can access each other's storage and verify that no disks are missing:

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

The following example shows the output when no disks are missing:

```
cluster::> storage failover show -fields local-missing-disks,partner-
missing-disks

node     local-missing-disks partner-missing-disks
-------- ------------------- ---------------------
node1    None                None
node2    None                None
```

If any disks are missing, refer to References to link to *Disk and aggregate management with the CLI*, *Logical storage management with the CLI*, and *High Availability management* to configure storage for the

HA pair.

13. Ensure that node1 and node2 are healthy and eligible to participate in the cluster:

    `cluster show`

    The following example shows the output when both nodes are eligible and healthy:

```
cluster::> cluster show

Node                  Health  Eligibility
--------------------- ------- ------------
node1                 true    true
node2                 true    true
```

14. Set the privilege level to advanced:

    `set -privilege advanced`

15. Ensure that node1 and node2 are running the same ONTAP release:

    `system node image show -node <node1,node2> -iscurrent true`

    The following example shows the output of the command:

```
cluster::*> system node image show -node node1,node2 -iscurrent true

                  Is      Is                Install
Node     Image    Default Current Version   Date
-------- ------- ------- ------- --------- -------------------
node1
         image1   true    true    9.1         2/7/2017 20:22:06
node2
         image1   true    true    9.1         2/7/2017 20:20:48

2 entries were displayed.
```

16. Verify that neither node1 nor node2 owns any data LIFs that belong to other nodes in the cluster and check the `Current Node` and `Is Home` columns in the output:

    `network interface show -role data -is-home false -curr-node <node_name>`

    The following example shows the output when node1 has no LIFs that are home-owned by other nodes in the cluster:

```
cluster::> network interface show -role data -is-home false -curr-node
node1
 There are no entries matching your query.
```

The following example shows the output when node1 owns data LIFs home-owned by the other node:

```
cluster::> network interface show -role data -is-home false -curr-node
node1

            Logical    Status     Network            Current
Current Is
Vserver     Interface  Admin/Oper Address/Mask       Node           Port
Home
----------- ---------- ---------- ------------------ -------------
------- ----
vs0
            data1      up/up      172.18.103.137/24  node1          e0d
false
            data2      up/up      172.18.103.143/24  node1          e0f
false

2 entries were displayed.
```

17. If the output in Step 15 shows that either node1 or node2 owns any data LIFs home-owned by other nodes in the cluster, migrate the data LIFs away from node1 or node2:

    `network interface revert -vserver * -lif *`

    For detailed information about the `network interface revert` command, refer to References to link to the *ONTAP 9 Commands: Manual Page Reference*.

18. Check whether node1 or node2 owns any failed disks:

    `storage disk show -nodelist <node1,node2> -broken`

    If any of the disks have failed, remove them, following instructions in the *Disk and aggregate management with the CLI*. (Refer to References to link to *Disk and aggregate management with the CLI*.)

19. Collect information about node1 and node2 by completing the following substeps and recording the output of each command:

    - You will use this information later in the procedure.
    - If you have a system with more than two cluster ports per node, such as an FAS8080 or an AFF8080, you must consolidate the cluster LIFs to two cluster ports per node before you start the controller upgrade. If you perform the controller upgrade with more than two cluster ports per node, cluster LIFs might be missing on the new controller after the upgrade.

a. Record the model, system ID, and serial number of both nodes:

```
system node show -node <node1,node2> -instance
```

ⓘ You will use the information to reassign disks and decommission the original nodes.

b. Enter the following command on both node1 and node2 and record information about the shelves, number of disks in each shelf, flash storage details, memory, NVRAM, and network cards from the output:

```
run -node <node_name> sysconfig
```

ⓘ You can use the information to identify parts or accessories that you might want to transfer to node3 or node4. If you do not know if the nodes are V-Series systems or have FlexArray Virtualization software, you can learn that also from the output.

c. Enter the following command on both node1 and node2 and record the aggregates that are online on both nodes:

```
storage aggregate show -node <node_name> -state online
```

ⓘ You can use this information and the information in the following substep to verify that the aggregates and volumes remain online throughout the procedure, except for the brief period when they are offline during relocation.

d. Enter the following command on both node1 and node2 and record the volumes that are offline on both nodes:

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

ⓘ After the upgrade, you will run the command again and compare the output with the output in this step to see if any other volumes have gone offline.

20. Enter the following commands to see if any interface groups or VLANs are configured on node1 or node2:

```
network port ifgrp show

network port vlan show
```

Make note of whether interface groups or VLANs are configured on node1 or node2; you need that information in the next step and later in the procedure.

21. Complete the following substeps on both node1 and node2 to ensure that physical ports can be mapped correctly later in the procedure:

a. Enter the following command to see if there are failover groups on the node other than `clusterwide`:

```
network interface failover-groups show
```

Failover groups are sets of network ports present on the system. Because upgrading the controller hardware can change the location of physical ports, failover groups can be inadvertently changed during the upgrade.

The system displays failover groups on the node, as shown in the following example:

```
cluster::> network interface failover-groups show

Vserver              Group              Targets
-------------------- ------------------ ----------
Cluster              Cluster            node1:e0a, node1:e0b
                                        node2:e0a, node2:e0b

fg_6210_e0c          Default            node1:e0c, node1:e0d
                                        node1:e0e, node2:e0c
                                        node2:e0d, node2:e0e

2 entries were displayed.
```

b. If there are failover groups present other than `clusterwide`, record the failover group names and the ports that belong to the failover groups.

c. Enter the following command to see if there are any VLANs configured on the node:

`network port vlan show -node <node_name>`

VLANs are configured over physical ports. If the physical ports change, then the VLANs will need to be re-created later in the procedure.

The system displays VLANs configured on the node, as shown in the following example:

```
cluster::> network port vlan show

Network Network
Node    VLAN Name Port    VLAN ID MAC Address
------  --------- ------- ------- ------------------
node1   e1b-70    e1b     70      00:15:17:76:7b:69
```

d. If there are VLANs configured on the node, take note of each network port and VLAN ID pairing.

22. Take one of the following actions:

If interface groups or VLANS are…	Then…
On node1 or node2	Complete Step 23 and Step 24.
Not on node1 or node2	Go to Step 24.

23. If you do not know if node1 and node2 are in a SAN or non-SAN environment, enter the following command and examine its output:

`network interface show -vserver <vserver_name> -data-protocol iscsi|fcp`

If neither iSCSI nor FC is configured for the SVM, the command will display a message similar to the following example:

```
cluster::> network interface show -vserver Vserver8970 -data-protocol
iscsi|fcp
There are no entries matching your query.
```

You can confirm that the node is in a NAS environment by using the `network interface show` command with the `-data-protocol nfs|cifs` parameters.

If either iSCSI or FC is configured for the SVM, the command will display a message similar to the following example:

```
cluster::> network interface show -vserver vs1 -data-protocol iscsi|fcp

         Logical    Status     Network            Current  Current Is
Vserver  Interface  Admin/Oper Address/Mask       Node     Port    Home
-------- ---------- ---------- ------------------ -------- ------- ----
vs1      vs1_lif1   up/down    172.17.176.20/24   node1    0d      true
```

24. Verify that all the nodes in the cluster are in quorum by completing the following substeps:
    a. Enter the advanced privilege level:

       `set -privilege advanced`

       The system displays the following message:

       ```
       Warning: These advanced commands are potentially dangerous; use them
       only when directed to do so by NetApp personnel.
       Do you wish to continue? (y or n):
       ```

    b. Enter `y`.
    c. Verify the cluster service state in the kernel, once for each node:

       `cluster kernel-service show`

       The system displays a message similar to the following example:

```
cluster::*> cluster kernel-service show

Master        Cluster       Quorum        Availability  Operational
Node          Node          Status        Status        Status
------------- ------------- ------------- ------------- -------------
node1         node1         in-quorum     true          operational
              node2         in-quorum     true          operational

2 entries were displayed.
```

Nodes in a cluster are in quorum when a simple majority of nodes are healthy and can communicate with each other. For more information, refer to References to link to the *System Administration Reference*.

d. Return to the administrative privilege level:

```
set -privilege admin
```

25. Take one of the following actions:

If the cluster…	Then…
Has SAN configured	Go to Step 26.
Does not have SAN configured	Go to Step 29.

26. Verify that there are SAN LIFs on node1 and node2 for each SVM that has either SAN iSCSI or FC service enabled by entering the following command and examining its output:

```
network interface show -data-protocol iscsi|fcp -home-node <node_name>
```

The command displays SAN LIF information for node1 and node2. The following examples show the status in the Status Admin/Oper column as up/up, indicating that SAN iSCSI and FC service are enabled:

```
cluster::> network interface show -data-protocol iscsi|fcp
            Logical    Status     Network                  Current
Current Is
Vserver     Interface  Admin/Oper Address/Mask             Node
Port    Home
----------- ---------- ---------- ------------------       ---------
------- ----
a_vs_iscsi  data1      up/up      10.228.32.190/21         node1     e0a
true
            data2      up/up      10.228.32.192/21         node2     e0a
true

b_vs_fcp    data1      up/up      20:09:00:a0:98:19:9f:b0  node1     0c
true
            data2      up/up      20:0a:00:a0:98:19:9f:b0  node2     0c
true

c_vs_iscsi_fcp data1   up/up      20:0d:00:a0:98:19:9f:b0  node2     0c
true
            data2      up/up      20:0e:00:a0:98:19:9f:b0  node2     0c
true
            data3      up/up      10.228.34.190/21         node2     e0b
true
            data4      up/up      10.228.34.192/21         node2     e0b
true
```

Alternatively, you can view more detailed LIF information by entering the following command:

```
network interface show -instance -data-protocol iscsi|fcp
```

27. Capture the default configuration of any FC ports on the original nodes by entering the following command and recording the output for your systems:

    ```
    ucadmin show
    ```

    The command displays information about all FC ports in the cluster, as shown in the following example:

```
cluster::> ucadmin show

                Current Current   Pending Pending   Admin
Node    Adapter Mode    Type      Mode    Type      Status
------- ------- ------- --------- ------- --------- -----------
node1   0a      fc      initiator -       -         online
node1   0b      fc      initiator -       -         online
node1   0c      fc      initiator -       -         online
node1   0d      fc      initiator -       -         online
node2   0a      fc      initiator -       -         online
node2   0b      fc      initiator -       -         online
node2   0c      fc      initiator -       -         online
node2   0d      fc      initiator -       -         online
8 entries were displayed.
```

You can use the information after the upgrade to set the configuration of FC ports on the new nodes.

28. If you are upgrading a V-Series system or a system with FlexArray Virtualization software, capture information about the topology of the original nodes by entering the following command and recording the output:

    `storage array config show -switch`

    The system displays topology information, as show in the following example:

```
cluster::> storage array config show -switch

      LUN LUN                                    Target Side Initiator
Side Initi-
Node  Grp Cnt Array Name    Array Target Port  Switch Port Switch Port
ator
----- --- --- ------------- ------------------ -----------
-------------- ------
node1 0   50  I_1818FAStT_1
                            205700a0b84772da   vgbr6510a:5
vgbr6510s164:3  0d
                            206700a0b84772da   vgbr6510a:6
vgbr6510s164:4  2b
                            207600a0b84772da   vgbr6510b:6
vgbr6510s163:1  0c
node2 0   50  I_1818FAStT_1
                            205700a0b84772da   vgbr6510a:5
vgbr6510s164:1  0d
                            206700a0b84772da   vgbr6510a:6
vgbr6510s164:2  2b
                            207600a0b84772da   vgbr6510b:6
vgbr6510s163:3  0c
                            208600a0b84772da   vgbr6510b:5
vgbr6510s163:4  2a
7 entries were displayed.
```

29. Complete the following substeps:

    a. Enter the following command on one of the original nodes and record the output:

       `service-processor show -node * -instance`

       The system displays detailed information about the SP on both nodes.

    b. Ensure that the SP status is `online`.

    c. Ensure that the SP network is configured.

    d. Record the IP address and other information about the SP.

    You might want to reuse the network parameters of the remote management devices, in this case the SPs, from the original system for the SPs on the new nodes.
    For detailed information about the SP, refer to References to link to the *System Administration Reference* and the *ONTAP 9 Commands: Manual Page Reference*.

30. If you want the new nodes to have the same licensed functionality as the original nodes, enter the following command to see the cluster licenses on the original system:

    `system license show -owner *`

The following example shows the site licenses for cluster1:

```
system license show -owner *
Serial Number: 1-80-000013
Owner: cluster1

Package           Type    Description           Expiration
----------------- ------- --------------------- -----------
Base              site    Cluster Base License  -
NFS               site    NFS License           -
CIFS              site    CIFS License          -
SnapMirror        site    SnapMirror License    -
FlexClone         site    FlexClone License     -
SnapVault         site    SnapVault License     -
6 entries were displayed.
```

31. Obtain new license keys for the new nodes at the *NetApp Support Site*. Refer to References to link to *NetApp Support Site*.

    If the site does not have the license keys you need, contact your NetApp sales representative.

32. Check whether the original system has AutoSupport enabled by entering the following command on each node and examining its output:

    ```
    system node autosupport show -node <node1,node2>
    ```

    The command output shows whether AutoSupport is enabled, as shown in the following example:

    ```
    cluster::> system node autosupport show -node node1,node2

    Node              State     From          To                Mail Hosts
    ----------------- --------- ------------- ----------------  ----------
    node1             enable    Postmaster    admin@netapp.com  mailhost

    node2             enable    Postmaster    -                 mailhost
    2 entries were displayed.
    ```

33. Take one of the following actions:

If the original system…	Then…
Has AutoSupport enabled…	a. Go to Step 34. b. Go to the section Get an IP address of an external key management server for Storage Encryption.

If the original system…	Then…
Does not have AutoSupport enabled…	a. Enable AutoSupport by following the instructions in the *System Administration Reference*. (Refer to References to link to the *System Administration Reference*.) **Note:** AutoSupport is enabled by default when you configure your storage system for the first time. Although you can disable AutoSupport at any time, you should leave it enabled. Enabling AutoSupport can significantly help identify problems and solutions should a problem occur on your storage system. b. Go to the Get an IP address of an external key management server for Storage Encryption section.

34. Verify that AutoSupport is configured with the correct mailhost details and recipient e-mail IDs by entering the following command on both of the original nodes and examining the output:

    ```
    system node autosupport show -node node_name -instance
    ```

    For detailed information about AutoSupport, refer to References to link to the *System Administration Reference* and the *ONTAP 9 Commands: Manual Page Reference*.

35. Send an AutoSupport message to NetApp for node1 by entering the following command:

    ```
    system node autosupport invoke -node node1 -type all -message "Upgrading node1 from platform_old to platform_new"
    ```

    Do not send an AutoSupport message to NetApp for node2 at this point; you do so later in the procedure.

36. Verify that the AutoSupport message was sent by entering the following command and examining its output:

    ```
    system node autosupport show -node <node1> -instance
    ```

    The fields `Last Subject Sent:` and `Last Time Sent:` contain the message title of the last message sent and the time the message was sent.

Get an IP address of an external key management server for Storage Encryption

After upgrading, you must immediately configure Storage Encryption and establish a cluster-wide authentication key to replace the previous node-level authentication keys.

Steps

1. Install the necessary client and server secure sockets layer (SSL) certificates required to communicate with key management servers:

    ```
    security certificate install
    ```

2. Configure Storage Encryption on all nodes by using the following command on each node:

```
security key-manager setup
```

3. Add the IP address for each key management server:

```
security key-manager add
```

4. Verify that the same key management servers are configured and available on all nodes in the cluster:

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

5. Create a new cluster-wide authentication key:

```
security key-manager create-key
```

6. Make a note of the new authentication key ID.
7. Rekey all self-encrypting drives with the new authentication key:

```
storage encryption disk modify -disk * -data-key-id <authentication_key_id>
```

Manage authentication using KMIP servers

With ONTAP 9.5 and later, you can use Key Management Interoperability Protocol (KMIP) servers to manage authentication keys.

Steps

1. Add a new controller:

```
security key-manager setup -node <new_controller_name>
```

2. Add the key manager:

```
security key-manager -add <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 show -status
```

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

```
security key-manager restore -node <new_controller_name>
```

5. Rekey all self-encrypting disks with the new authentication key:

```
storage encryption disk modify -disk * [-data-key-id nonMSID AK]
```

6. If you use the Federal Information Processing Standard (FIPS), rekey all self-encrypting disks with the new authentication key:

```
storage encryption disk* modify -disk * [-fips-key-id nonMSID AK]
```

Manage authentication using an onboard key manager

You can use an onboard key manager to manage authentication keys. If you plan to use an onboard key manager (OKM), you must record the passphrase and backup material before the beginning the upgrade.

Steps

1. Verify the key management servers are available to all nodes in the cluster:

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

2. Rekey all self-encrypting disks with the new authentication key:

   ```
   storage encryption disk modify -disk * [-data-key-id nonMSID AK>]
   ```

3. If you use the Federal Information Processing Standard (FIPS), rekey all self-encrypting disks with the new authentication key:

   ```
   storage encryption disk* modify -disk * [-fips-key-id nonMSID AK]
   ```

Quiesce the SnapMirror relationships

Before you netboot the system, you must ensure that all the SnapMirror relationship 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 <vserver 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 <vserver-name>
   ```

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 must put a copy of the ONTAP 9 boot image onto a web server that the system can access.

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.

However, you do not need to netboot the controllers if the same version of ONTAP 9 is installed on them that is installed on the original controllers. If so, you can skip this section and proceed to Stage 3: Install and boot node3.

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.

For…	Then…

FAS/AFF8000 series systems	Extract the contents of the `<ontap_version>_image.tgz` file to the target directory:
	
	`tar -zxvf <ontap_version>_image.tgz`
	
	Note: If you are extracting the contents on Windows, use 7-Zip or WinRAR to extract the netboot image.
	
	Your directory listing should contain a netboot folder with a kernel file:
	
	`netboot/kernel`

All other systems	Your directory listing should contain the following file: `<ontap_version>_image.tgz` **Note**: You do not need to extract the contents of the `<ontap_version>_image.tgz` file.

You will use information in the directories in Stage 3.

Stage 2. Relocate and retire node1

Stage 2. Relocate and retire node1

During Stage 2, you relocate the node1 aggregates and LIFs to node2, record node1 information, and then retire node1. This process is largely automated; the operation pauses to allow you to check its status. You must manually resume the operation.

Steps

1. Relocating non-root aggregates and NAS data LIFs owned by node1 to node2
2. Moving NAS data LIFs owned by node1 to node2
3. Recording node1 information
4. Retire node1

Relocate non-root aggregates from node1 to node2

Before you can replace node1 with node3, you need to move the non-root aggregates from node1 to node2 by using the storage aggregate relocation command and then verifying the relocation.

Steps

1. Relocate the non-root aggregates by completing the following substeps:
   a. Set the privilege level to advanced:

      ```
      set -privilege advanced
      ```

   b. Enter the following command:

      ```
      storage aggregate relocation start -node <node1> -destination <node2>
      -aggregate-list * -ndo-controller-upgrade true
      ```

   c. When prompted, enter `y`.

      Relocation will occur in the background. It could take anywhere from a few seconds to a couple of minutes to relocate an aggregate. The time includes both client outage and nonoutage portions. The command does not relocate any offline or restricted aggregates.

   d. Return to the admin level by entering the following command:

      ```
      set -privilege admin
      ```

2. Check the relocation status by entering the following command on node1:

   ```
   storage aggregate relocation show -node <node1>
   ```

   The output will display `Done` for an aggregate after it has been relocated.

   Wait until all non-root aggregates owned by node1 have been relocated to node2 before proceeding to the next step.

3. Take one of the following actions:

If relocation…	Then..
Of all aggregates is successful	Go to Step 4.

If relocation…	Then..

Of any aggregates fails or is vetoed	a. Check the EMS logs for the corrective action.
	b. Perform the corrective action.
	c. Relocate any failed or vetoed aggregates:
	`storage aggregate relocation start -node <node1> - destination <node2> -aggregate-list * -ndo-controller-upgrade true`
	d. When prompted, enter `y`.
	e. Return to the admin level:
	`set -privilege admin`
	If necessary, you can force the relocation using one of the following methods:
	◦ Override veto checks:
	`storage aggregate relocation start -override -vetoes true -ndo-controller-upgrade`
	◦ Override destination checks:
	`storage aggregate relocation start -override -destination-checks true -ndo-controller -upgrade`
	Refer to References to link to the *Disk and aggregate management with the CLI* content and the *ONTAP 9 Commands: Manual Page Reference* for more information about storage aggregate relocation commands.

4. Verify that all the non-root aggregates are online and 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>`

5. Verify that all the volumes are online on node2 by entering 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.

6. Enter the following command on node2:

   `storage failover show -node <node2>`

   The output should display the following message:

   ```
   Node owns partner's aggregates as part of the nondisruptive controller
   upgrade procedure.
   ```

7. Verify that node1 does not own any non-root aggregates that are online:

   `storage aggregate show -owner-name <node1> -ha-policy sfo -state online`

   The output should not display any online non-root aggregates, which have already been relocated to

node2.

Move NAS data LIFs owned by node1 to node2

Before you can replace node1 with node3, you need to move the NAS data LIFs owned by node1 to node2 if you have a two-node cluster, or to a third node if your cluster has more than two nodes. The method you use depends on whether the cluster is configured for NAS or SAN.

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

Steps

1. List all the NAS data LIFs hosted on node1 by entering the following command and capturing the output:

   ```
   network interface show -data-protocol nfs|cifs -curr-node <node1>
   ```

   ```
    cluster::> network interface show -data-protocol nfs|cifs -curr-node
   node1

             Logical     Status      Network             Current   Current
   Is
    Vserver  Interface   Admin/Oper  Address/Mask        Node      Port
   Home
    -------- ----------  ----------  ------------------  --------- -------
   ----
    vs0
             a0a         up/down     10.63.0.53/24       node1     a0a
   true
             data1       up/up       10.63.0.50/18       node1     e0c
   true
             rads1       up/up       10.63.0.51/18       node1     e1a
   true
             rads2       up/down     10.63.0.52/24       node1     e1b
   true
    vs1
             lif1        up/up       192.17.176.120/24   node1     e0c
   true
             lif2        up/up       172.17.176.121/24   node1     e1a
   true
   ```

2. Modify the auto revert settings of all the LIFs on node1 and node2:

   ```
   network interface modify -vserver <Vserver_name> -lif <LIF_name> -auto-revert
   false
   ```

3. Take the following steps to migrate any NAS data LIFs hosted on interface groups and VLANs on node1:

   a. Migrate the LIFs hosted on any interface groups and the VLANs on node1 to a port on node2 that is capable of hosting LIFs on the same network as that of the interface groups by entering the following command, once for each LIF:

   ```
   network interface migrate -vserver <Vserver_name> -lif <LIF_name>
   -destination-node <node2> -destination-port <netport|ifgrp>
   ```

   b. Modify the home port and the home node of the LIFs and VLANs in Substep a to the port and node currently hosting the LIFs by entering the following command, once for each LIF:

   ```
   network interface modify -vserver <Vserver_name> -lif <LIF_name> -home-node
   <node2> - home-port <netport|ifgrp>
   ```

4. Take one of the following actions:

If the cluster is configured for…	Then…
NAS	Complete Step 5 through Step 8.
SAN	Disable all the SAN LIFs on the node to take them down for the upgrade: `network interface modify -vserver <Vserver-name> -lif <LIF_name> -home-node <node_to_upgrade> -home-port <netport|ifgrp> -status-admin down`

5. Migrate NAS data LIFs from node1 to node2 by entering the following command, once for each data LIF:

   ```
   network interface migrate -vserver <Vserver-name> -lif <LIF_name> -destination
   -node <node2> -destination-port <data_port>
   ```

6. Enter the following command and examine its output to verify that LIFs have been moved to the correct ports and that the LIFs have the status of up by entering the following command on either node and examining the output:

   ```
   network interface show -curr-node <node2> -data-protocol nfs|cifs
   ```

7. Modify the home node of the migrated LIFs:

   ```
   network interface modify -vserver <Vserver-name> -lif <LIF_name> -home-node
   <node2> -home-port <port_name>
   ```

8. Verify whether the LIF is using the port as its home or current port. If the port is not home or current port then go to Step 9:

   ```
   network interface show -home-node <node2> -home-port <port_name>

   network interface show -curr-node <node_name> -curr-port <port_name>
   ```

9. If the LIFs are using the port as a home port or current port, then modify the LIF to use a different port:

   ```
   network interface migrate -vserver <Vserver-name> -lif <LIF_name>
   -destination-node <node_name> -destination-port <port_name>
   ```

```
network interface modify -vserver <Vserver-name> -lif <LIF_name> -home-node
<node_name> -home-port <port_name>
```

10. 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
<nodename> -status-admin up
```

> For MetroCluster configurations, you might not be able to change the broadcast domain of a port because it is associated with a port hosting the LIF of a destination storage virtual machine (SVM). Enter the following command from the corresponding source SVM on the remote site to reallocate the destination LIF to an appropriate port:
> `metrocluster vserver resync -vserver <Vserver_name>`

11. Enter the following command and examine its output to verify that there are no data LIFs remaining on node1:

```
network interface show -curr-node <node1> -role data
```

Record node1 information

Before you can shut down and retire node1, you need to record information about its cluster network, management, and FC ports as well as its NVRAM System ID. You need that information later in the procedure when you map node1 to node3 and reassign disks.

Steps

1. Enter the following command and capture its output:

```
network route show
```

The system displays output similar to the following example:

```
cluster::> network route show

Vserver         Destination    Gateway      Metric
 -------------- -------------- ----------- -------
 iscsi vserver  0.0.0.0/0       10.10.50.1  20
 node1          0.0.0.0/0       10.10.20.1  10
 ....
 node2          0.0.0.0/0       192.169.1.1 20
```

2. Enter the following command and capture its output:

```
vserver services name-service dns show
```

The system displays output similar to the following example:

```
 cluster::> vserver services name-service dns show
                                                                    Name
 Vserver         State     Domains                                  Servers
 --------------- --------- ---------------------------------- ---------------
 node 1 2        enabled   alpha.beta.gamma.netapp.com
10.10.60.10,

10.10.60.20
 vs_base1        enabled   alpha.beta.gamma.netapp.com,
10.10.60.10,
                           beta.gamma.netapp.com,
10.10.60.20
 ...
 ...
 vs peer1         enabled  alpha.beta.gamma.netapp.com,
10.10.60.10,
                           gamma.netapp.com
10.10.60.20
```

3. Find the cluster network and node-management ports on node1 by entering the following command on either controller:

   `network interface show -curr-node <node1> -role cluster,intercluster,node-mgmt,cluster-mgmt`

   The system displays the cluster, intercluster, node-management, and cluster-management LIFs for the node in the cluster, as shown in the following example:

```
 cluster::> network interface show -curr-node <node1>
            -role cluster,intercluster,node-mgmt,cluster-mgmt

              Logical       Status     Network            Current
Current Is
  Vserver     Interface     Admin/Oper Address/Mask       Node     Port
Home
  ----------- ------------- ---------- ------------------ --------
------- ----
  vserver1
              cluster mgmt   up/up     192.168.x.xxx/24   node1    e0c
true
  node1
              intercluster   up/up     192.168.x.xxx/24   node1    e0e
true
              clus1          up/up     169.254.xx.xx/24   node1    e0a
true
              clus2          up/up     169.254.xx.xx/24   node1    e0b
true
              mgmt1          up/up     192.168.x.xxx/24   node1    e0c
true
 5 entries were displayed.
```

Your system might not have intercluster LIFs.

4. Capture the information in the output of the command in Step 3 to use in the section Map ports from node1 to node3.

   The output information is required to map the new controller ports to the old controller ports.

5. Enter the following command on node1:

   `network port show -node <node1> -type physical`

   The system displays the physical ports on the node as shown in the following example:

```
 sti8080mcc-htp-008::> network port show -node sti8080mcc-htp-008 -type
physical

 Node: sti8080mcc-htp-008

                                                                        Ignore
                                                  Speed(Mbps)  Health   Health
 Port   IPspace  Broadcast Domain Link MTU   Admin/Oper   Status   Status
 ----   -------  ---------------- ---- ----  -----------  -------
-------
 e0M    Default  Mgmt             up   1500  auto/1000    healthy  false
 e0a    Default  Default          up   9000  auto/10000   healthy  false
 e0b    Default  -                up   9000  auto/10000   healthy  false
 e0c    Default  -                down 9000  auto/-       -        false
 e0d    Default  -                down 9000  auto/-       -        false
 e0e    Cluster  Cluster          up   9000  auto/10000   healthy  false
 e0f    Default  -                up   9000  auto/10000   healthy  false
 e0g    Cluster  Cluster          up   9000  auto/10000   healthy  false
 e0h    Default  Default          up   9000  auto/10000   healthy  false
 9 entries were displayed.
```

6. Record the ports and their broadcast domains.

   The broadcast domains will need to be mapped to the new ports on the new controller later in the procedure.

7. Enter the following command on node1:

   `network fcp adapter show -node <node1>`

   The system displays the FC ports on the node, as shown in the following example:

```
 cluster::> fcp adapter show -node <node1>
                      Connection  Host
 Node         Adapter Established Port Address
 ------------ ------- ----------- ------------
 node1
               0a     ptp         11400
 node1
               0c     ptp         11700
 node1
               6a     loop        0
 node1
               6b     loop        0
 4 entries were displayed.
```

8. Record the ports.

   The output information is required to map the new FC ports on the new controller later in the procedure.

9. If you did not do so earlier, check whether there are interface groups or VLANs configured on node1 by entering the following commands:

   ```
   network port ifgrp show

   network port vlan show
   ```

   You will use the information in the section Map ports from node1 to node3.

10. Take one of the following actions:

If you…	Then…
Recorded the NVRAM System ID number in the section Prepare the nodes for the upgrade.	Go on to the next section, Retire node1.
Did not record the NVRAM System ID number in the section Prepare the nodes for the upgrade	Complete Step 11 and Step 12 and then continue to Retire node1.

11. Enter the following command on either controller:

    ```
    system node show -instance -node <node1>
    ```

    The system displays information about node1 as shown in the following example:

    ```
    cluster::> system node show -instance -node <node1>
                                Node: node1
                               Owner:
                            Location: GDl
                               Model: FAS6240
                       Serial Number: 700000484678
                           Asset Tag: -
                              Uptime: 20 days 00:07
                     NVRAM System ID: 1873757983
                           System ID: 1873757983
                              Vendor: NetApp
                              Health: true
                         Eligibility: true
    ```

12. Record the NVRAM System ID number to use in the section Install and boot node3.

Retire node1

To retire node1, you need to disable the HA pair with node2, shut node1 down properly, and remove it from the rack or chassis.

Steps

1. Verify the number of nodes in the cluster:

   ```
   cluster show
   ```

   The system displays the nodes in the cluster, as shown in the following example:

   ```
   cluster::> cluster show
   Node                  Health  Eligibility
   --------------------- ------- ------------
   node1                 true    true
   node2                 true    true
   2 entries were displayed.
   ```

2. Disable storage failover, as applicable:

If the cluster is…	Then…

A two-node cluster	a. Disable cluster high availability by entering the following command on either node:
	
	`cluster ha modify -configured false`
	
	a. Disable storage failover:
	
	`storage failover modify -node <node1> -enabled false`

A cluster with more than two nodes	Disable storage failover: `storage failover modify -node <node1> -enabled false`

3. Verify that storage failover was disabled:

   ```
   storage failover show
   ```

   The following example shows the output of the `storage failover show` command when storage failover has been disabled for a node:

```
 cluster::> storage failover show
                                 Takeover
 Node           Partner         Possible State Description
 -------------- -------------- --------
-------------------------------------
 node1          node2          false    Connected to node2, Takeover
                                        is not possible: Storage
failover is
                                        disabled

 node2          node1          false    Node owns partner's aggregates
as part
                                        of the nondisruptive controller
upgrade
                                        procedure. Takeover is not
possible:
                                        Storage failover is disabled
 2 entries were displayed.
```

4. Verify the data LIF status:

   `network interface show -role data -curr-node <node2> -home-node <node1>`

   Look in the **Status Admin/Oper** column to see if any LIFs are down. If any LIFs are down, consult the Troublehsoot section.

5. Take one of the following actions:

If the cluster is…	Then…
A two-node cluster	Go to Step 6.
A cluster with more than two nodes	Go to Step 8.

6. Access the advanced privilege level on either node:

   `set -privilege advanced`

7. Verify that the cluster HA has been disabled:

   `cluster ha show`

   The system displays the following message:

   ```
   High Availability Configured: false
   ```

   If cluster HA has not been disabled, repeat Step 2.

8. Check whether node1 currently holds epsilon:

   `cluster show`

   Because there is the possibility of a tie in a cluster that has an even number of nodes, one node has an extra fractional voting weight called epsilon. Refer to References to link to the *System Administration Reference* for more information.

   > If you have a four-node cluster, epsilon might be on a node in a different HA pair in the cluster.
   >
   > If you are upgrading a HA pair in a cluster with multiple HA pairs, you should move epsilon to the node of a HA pair not undergoing a controller upgrade. For example, if you are upgrading nodeA/nodeB in a cluster with the HA pair configuration nodeA/nodeB and nodeC/nodeD, you should move epsilon to nodeC or nodeD.

   The following example shows that node1 holds epsilon:

   ```
   cluster::*> cluster show

   Node                  Health  Eligibility  Epsilon
   --------------------- ------- ------------ ------------
   node1                 true    true         true
   node2                 true    true         false
   ```

9. If node1 holds epsilon, then mark epsilon `false` on the node so that it can be transferred to the node2:

   `cluster modify -node <node1> -epsilon false`

10. Transfer epsilon to node2 by marking epsilon `true` on node2:

    `cluster modify -node <node2> -epsilon true`

11. Verify that the change to node2 occurred:

    `cluster show`

    ```
    cluster::*> cluster show
    Node                  Health  Eligibility  Epsilon
    --------------------- ------- ------------ ------------
    node1                 true    true         false
    node2                 true    true         true
    ```

    The epsilon for node2 should now be true and the epsilon for node1 should be false.

12. Verify whether the setup is a two-node switchless cluster:

    `network options switchless-cluster show`

```
cluster::*> network options switchless-cluster show

Enable Switchless Cluster: false/true
```

The value of this command must match the physical state of the system.

13. Return to the admin level:

    ```
    set -privilege admin
    ```

14. Halt node1 from the node1 prompt:

    ```
    system node halt -node <node1>
    ```

    Attention: If node1 is in same chassis as node2, do not power off the chassis by using the power switch or by pulling the power cable. If you do so, node2, which is serving data, will go down.

15. When the system prompts you to confirm that you want to halt the system, enter `y`.

    The node stops at the boot environment prompt.

16. When node1 displays the boot environment prompt, remove it from the chassis or the rack.

    You can decommission node1 after the upgrade is completed. See Decommission the old system.

Stage 3. Install and boot node3

Stage 3. Install and boot node3

During Stage 3, you install and boot node3, map the cluster and node-management ports from node1 to node3, verify the node3 installation, and move data LIFs and SAN LIFs belonging to node1 from node2 to node3. You also relocate all aggregates from node2 to node3, and move the data LIFs and SAN LIFs owned by node2 to node3.

Steps

1. Install and boot node3
2. Set the FC or UTA/UTA2 configuration on node3
3. Map ports from node1 to node3
4. Move NAS data LIFs owned by node1 from node2 to node3 and verify SAN LIFs on node3
5. Relocate non-root aggregates from node2 to node3
6. Move NAS data LIFs owned by node2 to node3

Install and boot node3

You need to install node3 in the rack, transfer node1's connections to node3, boot node3,

and install ONTAP. You then need to reassign any of node1's spare disks, any disks belonging to the root volume, and any non-root aggregates not relocated to node2 earlier.

About this task

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. See Prepare for netboot.

However, you do not need to netboot node3 if it has the same or a later version of ONTAP 9 that is installed on node1.

Important: If you are upgrading a V-Series system connected to storage arrays or a system with FlexArray Virtualization software that is connected to storage arrays, you need to complete Step 1 through Step 5, leave this section at Step 6 and follow instructions in Configure FC ports on node3 and Check and configure UTA/UTA2 ports on node3 as needed, entering commands in maintenance mode. You must then return to this section and resume with Step 7.
However, if you are upgrading a system with storage disks, you need to complete this entire section and then go to Configure FC ports on node3 and Check and configure UTA/UTA2 ports on node3, entering commands at the cluster prompt.

Steps

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

   If node1 and node2 were in separate chassis, you can put node3 in the same rack location as node1. However, if node1 was in the same chassis with node2, then you need to put node3 into its own rack space, preferably close to the location of node1.

2. Install node3 in the rack, following the *Installation and Setup Instructions* for your node model.

   If you are upgrading to a system with both nodes in the same chassis, install node4 in the chassis as well as node3. If you do not, when you boot node3, the node will behave as if it were in a dual-chassis configuration, and when you boot node4, the interconnect between the nodes will not come up.

3. Cable node3, moving the connections from node1 to node3.

   The following references help you make proper cable connections. Go to References to link to them.

   - *Installation and Setup Instructions* or *FlexArray Virtualization Installation Requirements and Reference* for the node3 platform
   - The appropriate disk shelf procedure
   - The *High Availability management* documentation

   Cable the following connections:

   - Console (remote management port)
   - Cluster ports
   - Data ports
   - Cluster and node management ports
   - Storage

- SAN configurations: iSCSI Ethernet and FC switch ports

> You might not need to move the interconnect card or the cluster interconnect cable connection from node1 to node3 because most platform models have a unique interconnect card model. For the MetroCluster configuration, you need to move the FC-VI cable connections from node1 to node3. If the new host does not have an FC-VI card, you might need to move the FC-VI card.

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.

   If you are upgrading to a system with both nodes in the same chassis, node4 also reboots. However, you can disregard the node4 boot until later.

   > 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.

6. Take one of the following actions:

If your system…	Then…
Has disks and no back-end storage	Skip Step 7 through Step 12 and go to Step 13.
Is a V-Series system or a system with FlexArray Virtualization software connected to storage arrays	a. Go to Set the FC or UTA/UTA2 configuration on node3 and complete the subsections Configure FC ports on node3 and Check and configure UTA/UTA2 ports on node3, as appropriate to your system. b. Return to this section and complete the remaining steps, beginning with Step 7. **Important**: You must reconfigure FC onboard ports, CNA onboard ports, and CNA cards before you boot ONTAP on the V-Series or system with FlexArray Virtualization software.

7. Add the FC initiator ports of the new node to the switch zones.

   If your system has a tape SAN, then you need zoning for the initiators. See your storage array and zoning documentation for instructions.

8. Add the FC initiator ports to the storage array as new hosts, mapping the array LUNs to the new hosts.

   See your storage array and zoning documentation for instructions.

9. Modify the World Wide Port Name (WWPN) values in the host or volume groups associated with array LUNs on the storage array.

   Installing a new controller module changes the WWPN values associated with each onboard FC port.

10. If your configuration uses switch-based zoning, adjust the zoning to reflect the new WWPN values.
11. Verify that the array LUNs are now visible to node3:

    ```
    sysconfig -v
    ```

    The system displays all the array LUNs visible to each of the FC initiator ports. If the array LUNs are not visible, you will not be able to reassign disks from node1 to node3 later in this section.

12. Press Ctrl-C to display the boot menu and select maintenance mode.
13. At the Maintenance mode prompt, enter the following command:

    ```
    halt
    ```

    The system stops at the boot environment prompt.

14. Take one of the following actions:

If the system you are upgrading to is in a…	Then…
Dual-chassis configuration (with controllers in different chassis)	Go to Step 15.
Single-chassis configuration (with controllers in the same chassis)	a. Switch the console cable from node3 to node4. b. 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. The power should already be on if both controllers are in the same chassis. **Note**: Leave node4 at the boot environment prompt; you will return to node4 in Install and boot node4. c. If you see the warning message displayed in Step 4, follow the instructions in Step 5 d. Switch the console cable back from node4 to node3. e. Go to Step 15.

15. Configure node3 for ONTAP:

```
set-defaults
```

16. If NetApp Storage Encryption (NSE) is in use on this configuration, the `setenv bootarg.storageencryption.support` command must be set to `true`, and the `kmip.init.maxwait` variable needs to be set to `off` to avoid a boot loop after the node1 configuration is loaded:

```
setenv bootarg.storageencryption.support true

setenv kmip.init.maxwait off
```

17. If the version of ONTAP installed on node3 is the same or later than the version of ONTAP 9 installed on node1, list and reassign disks to the new node3:

```
boot_ontap
```

> **Warning**: If this new node has ever been used in any other cluster or HA pair, you must run `wipeconfig` before proceeding. Failure to do so might result in service outages or data loss. Contact technical support if the replacement controller was previously used, especially if the controllers were
> running ONTAP running in 7-Mode.

18. Press CTRL-C to display the boot menu.
19. Take one of the following actions:

If the system you are upgrading…	Then…
Does *not* have the correct or current ONTAP version on node3	Go to Step 20.
Has the correct or current version of ONTAP on node3	Go to Step 25.

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

> You should use the management port and IP as the netboot connection. Do not use a data LIF IP or else 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 entering the following command at the boot environment prompt: `ifconfig e0M -auto`

If Dynamic Host Configuration Protocol (DHCP) is…	Then…
Not running	Manually configure the connection by entering the following command at the boot environment prompt: `ifconfig e0M -addr=<filer_addr> -mask=<netmask> -gw=<gateway> -dns=<dns_addr> domain=<dns_domain>` `<filer_addr>` is the IP address of the storage system. `<netmask>` is the network mask of the storage system. `<gateway>` is the gateway for the storage system. `<dns_addr>` is the IP address of a name server on your network. `<dns_domain>` is the Domain Name Service (DNS) domain name. If you use this optional parameter, you do not need a fully qualified domain name in the netboot server URL; you need only the server's host name. **Note**: Other parameters might be necessary for your interface. Enter `help ifconfig` at the firmware prompt for details.

21. Perform netboot on node3:

For…	Then…
FAS/AFF8000 series systems	`netboot http://<web_server_ip>/<path_to_webaccessible_directory>/netboot/kernel`
All other systems	`netboot http://<web_server_ip>/<path_to_webaccessible_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.

22. 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 wrong image might install. This issue applies to all releases of ONTAP.

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

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

24. Complete the following substeps:

    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 needs to be restored.

25. Select **(5) Maintenance mode boot** by entering `5`, and then enter `y` when prompted to continue with the boot.

26. Before continuing, go to Set the FC or UTA/UTA2 configuration on node3 to make any necessary changes to the FC or UTA/UTA2 ports on the node.

    Make the changes recommended in those sections, reboot the node, and go into maintenance mode.

27. Find the system ID of node3:

    `disk show -a`

    The system displays the system ID of the node and information about its disks, as shown in the following example:

```
 *> disk show -a
 Local System ID: 536881109
 DISK     OWNER                    POOL   SERIAL    HOME          DR
 HOME                                     NUMBER
 -------- -------------            -----  -------- -------------
-------------
 0b.02.23 nst-fas2520-2(536880939) Pool0  KPG2RK6F nst-fas2520-
2(536880939)
 0b.02.13 nst-fas2520-2(536880939) Pool0  KPG3DE4F nst-fas2520-
2(536880939)
 0b.01.13 nst-fas2520-2(536880939) Pool0  PPG4KLAA nst-fas2520-
2(536880939)
 ......
 0a.00.0               (536881109) Pool0  YFKSX6JG
(536881109)
 ......
```

ⓘ You might see the message `disk show: No disks match option -a.` after entering the command. This is not an error message so you can continue with the procedure.

28. Reassign node1's spares, any disks belonging to the root, and any non-root aggregates that were not relocated to node2 earlier in Relocate non-root aggregates from node1 to node2.

Enter the appropriate form of the `disk reassign` command based on whether your system has shared disks:

If disk type is…	Then run the command…
With shared disks	`disk reassign -s <node1_sysid> -d <node3_sysid> -p <node2_sysid>`
Without shared disks	`disk reassign -s <node1_sysid> -d <node3_sysid>`

For the `<node1_sysid>` value, use the information captured in Record node1 information. To obtain the value for `<node3_sysid>`, use the `sysconfig` command.

ⓘ The `-p` option is only required in maintenance mode when shared disks are present.

The `disk reassign` command reassigns only those disks for which `<node1_sysid>` is the current owner.

The system displays the following message:

```
Partner node must not be in Takeover mode during disk reassignment from
maintenance mode.
Serious problems could result!!
Do not proceed with reassignment if the partner is in takeover mode.
Abort reassignment (y/n)?
```

29. Enter `n`.

The system displays the following message:

```
After the node becomes operational, you must perform a takeover and
giveback of the HA partner node to ensure disk reassignment is
successful.
Do you want to continue (y/n)?
```

30. Enter `y`

The system displays the following message:

```
Disk ownership will be updated on all disks previously belonging to
Filer with sysid <sysid>.
Do you want to continue (y/n)?
```

31. Enter `y`.

32. If you are upgrading from a system with external disks to a system that supports internal and external disks (AFF A800 systems, for example), set the node1 aggregate as root to ensure node3 boots from the root aggregate of node1.

Warning: You must perform the following substeps in the exact order shown; failure to do so might cause an outage or even data loss.

The following procedure sets node3 to boot from the root aggregate of node1:

a. Check the RAID, plex, and checksum information for the node1 aggregate:

```
aggr status -r
```

b. Check the status of the node1 aggregate:

```
aggr status
```

c. Bring the node1 aggregate online, if necessary:

```
aggr_online <root_aggr_from_node1>
```

d. Prevent the node3 from booting from its original root aggregate:

```
aggr offline <root_aggr_on_node3>
```

e. Set the node1 root aggregate as the new root aggregate for node3:

```
aggr options <aggr_from_node1> root
```

f. Verify that the root aggregate of node3 is offline and the root aggregate for the disks brought over from node1 is online and set to root:

```
aggr status
```

> Failing to perform the previous substep might cause node3 to boot from the internal root aggregate, or it might cause the system to assume a new cluster configuration exists or prompt you to identify one.

The following shows an example of the command output:

```
-------------------------------------------------------------------
     Aggr State               Status          Options
aggr0_nst_fas8080_15 online   raid_dp, aggr   root, nosnap=on
                              fast zeroed
                              64-bit

  aggr0 offline               raid_dp, aggr   diskroot
                              fast zeroed
                              64-bit
-------------------------------------------------------------------
```

33. 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:

```
*> ha-config show
   Chassis HA configuration: ha
   Controller HA configuration: ha
```

Systems record 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.

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
```

If you have a MetroCluster configuration, use the following commands to modify the controller and chassis:

```
ha-config modify controller mcc

ha-config modify chassis mcc
```

34. Destroy the mailboxes on node3:

```
mailbox destroy local
```

The console displays the following message:

```
Destroying mailboxes forces a node to create new empty mailboxes, which
clears any takeover state, removes all knowledge of out-of-date plexes
of mirrored volumes, and will prevent management services from going
online in 2-node cluster HA configurations. Are you sure you want to
destroy the local mailboxes?
```

35. Enter `y` at the prompt to confirm that you want to destroy the local mailboxes.
36. Exit maintenance mode:

```
halt
```

The system stops at the boot environment prompt.

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

```
date
```

38. On node3, check the date at the boot environment prompt:

```
show date
```

39. If necessary, set the date on node3:

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

40. On node3, check the time at the boot environment prompt:

```
show time
```

41. If necessary, set the time on node3:

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

42. Verify the partner system ID is set correctly as noted in Step 28 under -p switch:

```
printenv partner-sysid
```

43. If necessary, set the partner system ID on node3:

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

Save the settings:

```
saveenv
```

44. Access the boot menu at the boot environment prompt:

```
boot_ontap menu
```

45. At the boot menu, select option **(6) Update flash from backup config** by entering `6` at the prompt.

The system displays the following message:

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

46. Enter `y` at the prompt.

The boot proceeds normally, and the system then asks you to confirm the system ID mismatch.

The system might reboot twice before displaying the mismatch warning.

47. Confirm the mismatch as shown in the following example:

```
WARNING: System id mismatch. This usually occurs when replacing CF or
NVRAM cards!
Override system id (y|n) ? [n] y
```

The node might go through one round of reboot before booting normally.

48. Log in to node3.

Set the FC or UTA/UTA2 configuration on node3

If node3 has onboard FC ports, onboard unified target adapter (UTA/UTA2) ports, or a UTA/UTA2 card, you must configure the settings before completing the rest of the procedure.

About this task

You might need to complete Configure FC ports on node3, or Check and configure UTA/UTA2 ports on node3, or both sections.

NetApp marketing materials might use the term "UTA2" to refer to CNA adapters and ports. However, the CLI uses the term "CNA".

- If node3 does not have onboard FC ports, onboard UTA/UTA2 ports, or a UTA/UTA2 card, and you are upgrading a system with storage disks, you can skip to the Map ports from node1 to node3.
- However, if you have a V-Series system or a system with FlexArray Virtualization software with storage arrays, and node3 does not have onboard FC ports, onboard UTA/UTA ports, or a UTA/UTA2 card, return

to *Install and boot node3* and resume at Step 22.

Choices

- Configure FC ports on node3
- Check and configure UTA/UTA2 ports on node3

Configure FC ports on node3

If node3 has FC ports, either onboard or on an FC adapter, you must set port configurations on the node before you bring it into service because the ports are not preconfigured. If the ports are not configured, you might experience a disruption in service.

Before you begin

You must have the values of the FC port settings from node1 that you saved in Prepare the nodes for upgrade.

About this task

You can skip this section if your system does not have FC configurations. If your system has onboard UTA/UTA2 ports or a UTA/UTA2 card, you configure them in Check and configure UTA/UTA2 ports on node3.

Important: If your system has storage disks, enter the commands in this section at the cluster prompt. If you have a V-Series system or have FlexArray Virtualization Software and are connected to storage arrays, enter commands in this section in maintenance mode.

Steps

1. Take one of the following actions:

If the system that you are upgrading…	Then…
Has storage disks	Go to Step 5
Is a V-Series system or has FlexArray Virtualization Software and is connected to storage arrays	Go to Step 2

2. Boot node3 and access maintenance mode:

```
boot_ontap maint
```

3. Take one of the following actions:

If the system that you are upgrading…	Then…
Has storage disks	Enter the following command: `system node hardware unified-connect show`
Is a V-series system or has FlexArray Virtualization Software and is connected to storage arrays.	Enter the following command `ucadmin show`

The system displays information about all FC and converged network adapters on the system.

4. Compare the FC settings of node3 with the settings that you captured earlier from node1.
5. Take one of the following actions:

If the default FC settings on the new nodes are…	Then…
The same as the ones you that captured on node1	Go to Step 11.
Different from the ones that you captured on node1	Go to Step 6.

6. Take one of the following actions:

If the system that you are upgrading…	Then…

Has storage disks	Modify the FC ports on node3 as needed by entering one of the following commands:
	• To program target ports:
	`system node hardware unified-connect modify -type | -t target -adapter <port_name>`
	• To program initiator ports:
	`system node hardware unified-connect modify -type | -t initiator -adapter <port_name>`
	`-t` is the FC4 type: target or initiator.

Is a V-Series system or has FlexArray Virtualization Software and is connected to storage arrays	Modify the FC ports on node3 as needed by entering the following command: `ucadmin modify -m fc -t initiator -f <adapter_port_name>` `-t` is the FC4 type, target or initiator. **Note**: The FC ports must be programmed as initiators.

7. Take one of the following actions:

If the system that you are upgrading…	Then…
Has storage disks	Verify the new settings by entering the following command and examining the output: `system node hardware unified-connect show`
Is a V-Series system or has FlexArray Virtualization Software and is connected to storage arrays	Verify the new settings by entering the following command and examining the output: `ucadmin show`

8. Exit maintenance mode by entering the following command:

```
halt
```

9. After you enter the command, wait until the system stops at the boot environment prompt.
10. Take one of the following actions:

If the system you are upgrading…	Then…
Is a V-Series system or has FlexArray Virtualization software running clustered Data ONTAP 8.3	Boot node3 and access maintenance at the boot environment prompt: `boot_ontap maint`
Is not a V-Series system or does not have FlexArray Virtualization software	Boot node3 at the boot environment prompt: `boot_ontap`

11. Take one of the following actions:

If the system that you are upgrading…	Then…
Has storage disks	• If node3 has a UTA/UTA2 card or UTA/UTA2 onboard ports, go to Check and configure UTA/UTA2 ports on node3. • If node3 does not have a UTA/UTA2 card or UTA/UTA2 onboard ports, skip Check and configure UTA/UTA2 ports on node3 and go to Map ports from node1 to node3.
Is a V-Series system or has FlexArray Virtualization Software and is connected to storage arrays	• If node3 has a card or onboard ports, go to Check and configure UTA/UTA2 ports on node3. • If node3 does not have a card or onboard ports, skip Check and configure UTA/UTA2 ports on node3, and return to *Install and boot node3* and resume at Step 7.

Check and configure UTA/UTA2 ports on node3

If node3 has onboard UTA/UTA2 ports or a UTA/UTA2 card, you must check the configuration of the ports and possibly reconfigure them, depending on how you want to use the upgraded system.

Before you begin

You must have the correct SFP+ modules for the UTA/UTA2 ports.

About this task

If you want to use a Unified Target Adapter (UTA/UTA2) port for FC, you must first verify how the port is configured.

NetApp marketing materials might use the term UTA2 to refer to CNA adapters and ports. However, the CLI uses the term CNA.

You can use the `ucadmin show` command to verify the current port configuration:

```
*> ucadmin show
          Current  Current    Pending  Pending    Admin
 Adapter  Mode     Type       Mode     Type       Status
 -------  -------  ---------  -------  ---------  -----------
 0e       fc       target     -        initiator  offline
 0f       fc       target     -        initiator  offline
 0g       fc       target     -        initiator  offline
 0h       fc       target     -        initiator  offline
 1a       fc       target     -        -          online
 1b       fc       target     -        -          online
6 entries were displayed.
```

UTA/UTA2 ports can be configured into native FC mode or UTA/UTA2 mode. FC mode supports FC initiator and FC target; UTA/UTA2 mode allows concurrent NIC and FCoE traffic sharing the same 10 GbE SFP+ interface and supports FC targets.

UTA/UTA2 ports might be found on an adapter or on the controller, and have the following configurations, but you should check the configuration of the UTA/UTA2 ports on the node3 and change it, if necessary:

- UTA/UTA2 cards ordered when the controller is ordered are configured before shipment to have the personality you request.
- UTA/UTA2 cards ordered separately from the controller are shipped with the default FC target personality.
- Onboard UTA/UTA2 ports on new controllers are configured before shipment to have the personality you request.

Attention: If your system has storage disks, you enter the commands in this section at the cluster prompt unless directed to enter maintenance mode. If you have a VSeries system or have FlexArray Virtualization Software and are connected to storage arrays, you enter commands in this section at the maintenance mode prompt. You must be in maintenance mode to configure UTA/UTA2 ports.

Steps

1. Check how the ports are currently configured entering on of the following commands on node3:

If the system…	Then…
Has storage disks	`system node hardware unified-connect show`
Is a V-Series system or has FlexArray Virtualization Software and is connected to storage arrays	`ucadmin show`

The system displays output similar to the following examples:

```
cluster1::> system node hardware unified-connect show

                 Current  Current    Pending  Pending  Admin
Node  Adapter    Mode     Type       Mode     Type     Status
----  -------    -------  ---------  -------  -------  ------
f-a   0e         fc       initiator  -        -        online
f-a   0f         fc       initiator  -        -        online
f-a   0g         cna      target     -        -        online
f-a   0h         cna      target     -        -        online
f-b   0e         fc       initiator  -        -        online
f-b   0f         fc       initiator  -        -        online
f-b   0g         cna      target     -        -        online
f-b   0h         cna      target     -        -        online
12 entries were displayed.
```

```
*> ucadmin show
          Current  Current    Pending  Pending  Admin
Adapter   Mode     Type       Mode     Type     Status
-------   -------  ---------  -------  -------  ------
0e        fc       initiator  -        -        online
0f        fc       initiator  -        -        online
0g        cna      target     -        -        online
0h        cna      target     -        -        online
0e        fc       initiator  -        -        online
0f        fc       initiator  -        -        online
0g        cna      target     -        -        online
0h        cna      target     -        -        online
*>
```

2. If the current SFP+ module does not match the desired use, replace it with the correct SFP+ module.

   Contact your NetApp representative to obtain the correct SFP+ module.

3. Examine the output of the `system node hardware unified-connect show` or `ucadmin show` command to determine whether the UTA/UTA2 ports have the personality you want.

4. Take one of the following actions:

If the UTA/UTA2 ports…	Then…
Do not have the personality that you want	Go to Step 5.
Have the personality that you want	Skip Step 5 through Step 12 and go to Step 13.

5. Take one of the following actions:

If the system…	Then…
Has storage disks and is running clustered Data ONTAP 8.3	Boot node3 and enter maintenance mode: `boot_ontap maint`
Is a V-Series system or has FlexArray Virtualization Software and is connected to storage arrays	Go to Step 6. You should already be in maintenance mode.

6. Take one of the following actions:

If you are configuring…	Then…
Ports on a UTA/UTA2 card	Go to Step 7.
Onboard UTA/UTA2 ports	Skip Step 7 and go to Step 8.

7. If the adapter is in initiator mode, and if the UTA/UTA2 port is online, take the UTA/UTA2 port offline:

   `storage disable adapter <adapter_name>`

   Adapters in target mode are automatically offline in maintenance mode.

8. If the current configuration does not match the desired use, change the configuration as needed:

   `ucadmin modify -m fc|cna -t initiator|target <adapter_name>`

   - `-m` is the personality mode, `fc` or `cna`.
   - `-t` is the FC4 type, `target` or `initiator`.

   > You need to use the FC initiator for tape drives, FlexArray Virtualization systems, and MetroCluster configurations. You need to use the FC target for SAN clients.

9. Verify the settings:

   `ucadmin show`

10. Verify the settings:

If the system…	Then…

Has storage disks	a. Stop the system:
	
	`halt`
	
	The system stops at the boot environment prompt.
	
	b. Enter the following command:
	
	`boot_ontap`

If the system…	Then…
Is a V-Series system or has FlexArray Virtualization Software and is connected to storage arrays	Reboot to maintenance mode: `boot_netapp maint`

11. Verify the settings:

If the system…	Then…
Has storage disks	`system node hardware unified-connect show`
Is a V-Series or has FlexArray Virtualization Software and is connected to storage arrays	`ucadmin show`

The output in the following examples show that the FC4 type of adapter "1b" is changing to `initiator` and that the mode of adapters "2a" and "2b" is changing to `cna`:

```
cluster1::> system node hardware unified-connect show

                Current  Current    Pending  Pending      Admin
Node  Adapter  Mode     Type       Mode     Type         Status
----  -------  -------  ---------  -------  -----------  ------
f-a   1a       fc       initiator  -        -            online
f-a   1b       fc       target     -        initiator    online
f-a   2a       fc       target     cna      -            online
f-a   2b       fc       target     cna      -            online

4 entries were displayed.
```

```
*> ucadmin show
         Current  Current    Pending  Pending    Admin
Adapter  Mode     Type       Mode     Type       Status
-------  -------  ---------  -------  ---------  ------
1a       fc       initiator  -        -          online
1b       fc       target     -        initiator  online
2a       fc       target     cna      -          online
2b       fc       target     cna      -          online
*>
```

12. Place any target ports online by entering one of the following commands, once for each port:

If the system…	Then…
Has storage disks	`network fcp adapter modify -node <node_name> -adapter <adapter_name> -state up`

If the system…	Then…
Is a V-Series system or has FlexArray Virtualization Software and is connected to storage arrays	`fcp config <adapter_name> up`

13. Cable the port.
14. Take one of the following actions:

If the system…	Then…
Has storage disks	Go to Map ports from node1 to node3.
Is a V-series system or has FlexArray Virtualization Software and is connected to storage arrays	Return to *Install and boot node3* and resume at Step 7.

Map ports from node1 to node3

You need to make sure that the physical ports on node1 map correctly to the physical ports on node3, which will let node3 communicate with other nodes in the cluster and with the network after the upgrade.

Before you begin

You must already have information about the ports on the new nodes from the *Hardware Universe*. (Go to References to link to the *Hardware Universe*). You use the information later in this section and in Map ports from node2 to node4.

The software configuration of node3 must match the physical connectivity of node3, and IP connectivity must be restored before you continue with the upgrade.

About this task

Port settings might vary, depending on the model of the nodes.

Steps

1. Perform the following steps to verify if the setup is a two-node switchless cluster:
   a. Set the privilege level to advanced:

      ```
      set -privilege advanced
      ```

   b. Verify if the setup is a two-node switchless cluster:

      ```
      network options switchless-cluster show
      ```

      For example:

      ```
      cluster::*> network options switchless-cluster show
      Enable Switchless Cluster: false/true
      ```

      The value of this command must match the physical state of the system.

c. Return to the administration privilege level:

```
set -privilege admin
```

2. Make the following changes:

a. Modify ports that will be part of Cluster broadcast domain:

```
network port modify -node <node_name> -port <port_name> -mtu 9000 -ipspace
Cluster
```

This example adds Cluster port e1b on "node1":

```
network port modify -node node1 -port e1b -ipspace Cluster -mtu 9000
```

b. Migrate the cluster LIFs to the new ports, once for each LIF:

```
network interface migrate -vserver <Vserver_name> -lif <lif_name> -source
-node <node1> -destination-node <node1> -destination-port <port_name>
```

When all cluster LIFs are migrated and cluster communication is established, the cluster should come into quorum.

c. Modify the home port of the Cluster LIFs:

```
network interface modify -vserver Cluster -lif <lif_name> –home-port
<port_name>
```

d. Remove the old ports from the Cluster broadcast domain:

```
network port broadcast-domain remove-ports -ipspace Cluster -broadcast
-domain Cluster -ports <node1:port>
```

e. Display the health state of node1 and node3:

```
cluster show -node <node1> -fields health
```

f. Each cluster LIF must be listening on port 7700. Verify that the cluster LIFs are listening on port 7700:

```
::> network connections listening show -vserver Cluster
```

Port 7700 listening on cluster ports is the expected outcome as shown in the following example for a two-node cluster:

```
Cluster::> network connections listening show -vserver Cluster
Vserver Name     Interface Name:Local Port     Protocol/Service
---------------- ----------------------------  -------------------
Node: NodeA
Cluster          NodeA_clus1:7700               TCP/ctlopcp
Cluster          NodeA_clus2:7700               TCP/ctlopcp
Node: NodeB
Cluster          NodeB_clus1:7700               TCP/ctlopcp
Cluster          NodeB_clus2:7700               TCP/ctlopcp
4 entries were displayed.
```

g. If necessary, for each cluster LIF that is not listening on port 7700, set the administrative status of the LIF to `down` and then `up`:

```
::> net int modify -vserver Cluster -lif <cluster-lif> -status-admin down;
net int modify -vserver Cluster -lif <cluster-lif> -status-admin up
```

Repeat substep (f) to verify that the cluster LIF is now listening on port 7700.

3. Modify the broadcast domain memberships of physical ports hosting data LIFs.

a. List the reachability status of all ports:

```
network port reachability show
```

b. Repair the reachability of the physical ports, followed by VLAN ports, by running the following command on each port, one port at a time:

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

A warning like the following is expected. Review and enter `y` or `n` as appropriate:

```
WARNING: Repairing port "node_name:port" might 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}:
```

c. To allow ONTAP to complete the repair, wait for about a minute after running the `reachability repair` command on the last port.

d. List all broadcast domains on the cluster:

```
broadcast-domain show
```

e. 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 correspond to any of the existing broadcast domains, ONTAP will create new broadcast domains for these ports. As required, you can delete the newly created broadcast domains if all their member ports will become member ports of the interface groups. Delete broadcast domains:

```
broadcast-domain delete -broadcast-domain <broadcast_domain>
```

f. Review the interface group configuration, and as required, add or delete member ports.

Add member ports to interface group ports:

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

Remove member ports from interface group ports:

```
ifgrp remove-port -node <node_name> -ifgrp <ifgrp_port> -port <port_name>
```

g. Delete and re-create VLAN ports as needed. Delete VLAN ports:

```
vlan delete -node <node_name> -vlan-name <vlan_port>_
```

Create VLAN ports:

```
vlan create -node <node_name> -vlan-name<vlan_port>
```

Depending on the complexity of the networking configuration of the system being upgraded, you might be required to repeat Substeps (a) to (g) until all ports are placed correctly where needed.

4. If there are no VLANs configured on the system, go to Step 5. If there are VLANs configured, restore displaced VLANs that were previously configured on ports that no longer exist or were configured on ports that were moved to another broadcast domain.

a. Display the displaced VLANs:

```
displaced-vlans show
```

b. Restore the displaced VLANs to the desired destination port:

```
displaced-vlans restore -node <node_name> -port <port_name> -destination
-port <destination_port>
```

c. Verify that all displaced VLANs have been restored:

```
displaced-vlans show
```

d. VLANs are automatically placed into the appropriate broadcast domains about a minute after they are created. Verify that the restored VLANs have been placed into the appropriate broadcast domains:

```
network port reachability show
```

5. Starting with ONTAP 9.8, ONTAP will automatically modify the home ports of LIFs if the ports are moved between broadcast domains during the network port reachability repair procedure. If a LIF's home port was moved to another node, or is unassigned, that LIF will be presented as a displaced LIF. Restore the home ports of displaced LIFs whose home ports either no longer exist or were relocated to another node.

a. Display the LIFs whose home ports might have moved to another node or no longer exist:

```
displaced-interface show
```

b. Restore the home port of each LIF:

```
displaced-interface restore -vserver <Vserver_name> -lif-name <LIF_name>
```

c. Verify that all LIF home ports have been restored:

```
displaced-interface 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 are reporting a status other than these two, repair the reachability as outlined in Step 3.

6. Verify that all LIFs are administratively up on ports belonging to the correct broadcast domains.

a. Check for any LIFs that are administratively down:

```
network interface show -vserver <Vserver_name> -status-admin down
```

b. Check for any LIFs that are operationally down:

```
network interface show -vserver <Vserver_name> -status-oper down
```

c. Modify any LIFs that need to be modified to have a different home port:

```
network interface modify -vserver <Vserver_name> -lif <LIF_name> -home-port
<home_port>
```

> For iSCSI LIFs, modification of the home port requires the LIF to be administratively down.

d. Revert LIFs that are not home to their respective home ports:

```
network interface revert *
```

Move NAS data LIFs owned by node1 from node2 to node3 and verify SAN LIFs on node3

Before you relocate aggregates from node2 to node3, you need to move the NAS data LIFs belonging to node1 that are currently on node2 from node2 to node3. You also need to verify the SAN LIFs 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. List all the NAS data LIFs not owned by node2 by entering the following command on either node and capturing the output:

```
network interface show -role data -curr-node <node2> -is-home false -home-node
```

```
<node3>
```

2. Take one of the following actions:

If node1…	Then…
Had interface groups or VLANs configured	Go to Step 3.
Did not have interface groups or VLANs configured	Skip Step 3 and go to Step 4.

3. Perform the following substeps to migrate any NAS data LIFs hosted on interface groups and VLANs that were originally on node1 from node2 to node3:

   a. Migrate any data LIFs hosted on node2 that previously belonged to node1 on an interface group to a port on node3 that is capable of hosting LIFs on the same network by entering the following command, once for each LIF:

   ```
   network interface migrate -vserver <vserver_name> -lif <LIF_name>
   -destination-node <node3> –destination-port <netport|ifgrp>
   ```

   b. Modify the home port and home node of the LIF in Substep a to the port and node currently hosting the LIFs by entering the following command, once for each LIF:

   ```
   network interface modify -vserver <vserver_name> -lif <LIF_name> -home-node
   <node3> -home-port <netport|ifgrp>
   ```

   c. Migrate any data LIF hosted on node2 that previously belonged to node1 on a VLAN port to a port on node3 that is capable of hosting LIFs on the same network by entering the following command, once for each LIF:

   ```
   network interface migrate -vserver <vserver_name> -lif <LIF_name>
   -destination-node <node3> –destination-port <netport|ifgrp>
   ```

   d. Modify the home port and home node of the LIFs in Substep c to the port and node currently hosting the LIFs by entering the following command, once for each LIF:

   ```
   network interface modify -vserver <vserver_name> -lif <LIF_name> -home-node
   <node3> -home-port <netport|ifgrp>
   ```

4. Take one of the following actions:

If the cluster is configured for…	Then…
NAS	Complete Step 5 and Step 6, skip Step 7, and complete Step 8 through Step 11.
SAN	Disable all the SAN LIFs on the node to take them down for the upgrade: `network interface modify -vserver <vserver_name> -lif <LIF_name> -home-node <node_to_upgrade> -home-port <netport|ifgrp> -status-admin down`

5. If you have data ports that are not the same on your platforms, add the ports to the broadcast domain:

   ```
   network port broadcast-domain add-ports -ipspace <IPspace_name> -broadcast
   -domain mgmt -ports <node:port>
   ```

   The following example adds port "e0a" on node "8200-1" and port "e0i" on node "8060-1" to broadcast domain "mgmt" in the IPspace "Default":

   ```
   cluster::> network port broadcast-domain add-ports -ipspace Default
   -broadcast-domain mgmt -ports 8200-1:e0a, 8060-1:e0i
   ```

6. Migrate each NAS data LIF to node3 by entering the following command, once for each LIF:

   ```
   network interface migrate -vserver <vserver_name> -lif <LIF_name> -destination
   -node <node3> -destination-port <netport|ifgrp>
   ```

7. Make sure that the data migration is persistent:

   ```
   network interface modify -vserver <vserver_name> -lif <LIF_name>-home-port
   <netport|ifgrp> -home-node <node3>
   ```

8. Ensure that the SAN LIFs are on the correct ports on node3:
   a. Enter the following command and examine its output:

      ```
      network interface show -data-protocol iscsi|fcp -home-node <node3>
      ```

      The system returns output similar to the following example:

```
cluster::> net int show -data-protocol iscsi|fcp -home-node node3
              Logical     Status      Network             Current
Current  Is
 Vserver      Interface   Admin/Oper  Address/Mask        Node
Port     Home
 -----------  ----------  ----------  ------------------
-------------  -------  ----
 vs0
              a0a         up/down     10.63.0.53/24       node3
a0a      true
              data1       up/up       10.63.0.50/18       node3
e0c      true
              rads1       up/up       10.63.0.51/18       node3
e1a      true
              rads2       up/down     10.63.0.52/24       node3
e1b      true
 vs1
              lif1        up/up       172.17.176.120/24   node3
e0c      true
              lif2        up/up       172.17.176.121/24   node3
e1a      true
```

b. If node3 has any SAN LIFs or groups of SAN LIFs that are on a port that did not exist on node1 or that need to be mapped to a different port, move them to an appropriate port on node3 by completing the following substeps:

   i. Set the LIF status to "down":

      ```
      network interface modify -vserver <vserver_name> -lif <LIF_name> -status
      -admin down
      ```

   ii. Remove the LIF from the port set:

      ```
      portset remove -vserver <vserver_name> -portset <portset_name> -port-name
      <port_name>
      ```

   iii. Enter one of the following commands:

      - Move a single LIF:

        ```
        network interface modify -vserver <vserver_name> -lif <LIF_name> -home
        -port <new_home_port>
        ```

      - Move all the LIFs on a single nonexistent or incorrect port to a new port:

        ```
        network interface modify {-home-port <port_on_node1> -home-node
        <node1> -role data} -home-port <new_home_port_on_node3>
        ```

      - Add the LIFs back to the port set:

```
portset add -vserver <vserver_name> -portset <portset_name> -port-name
<port_name>
```

> You need to ensure that you move SAN LIFs to a port that has the same link speed as the original port.

9. Modify the status of all LIFs to "up" so the LIFs can accept and send traffic on the node:

```
network interface modify -home-port <port_name> -home-node <node3> -lif data
-status-admin up
```

10. Enter the following command on either node and examine its output to verify that LIFs have been moved to the correct ports and that the LIFs have the status of "up" by entering the following command on either node and examining the output:

```
network interface show -home-node <node3> -role data
```

11. 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> -status-admin
up
```

12. Send a post-upgrade AutoSupport message to NetApp for node1:

```
system node autosupport invoke -node <node3> -type all -message "node1
successfully upgraded from <platform_old> to <platform_new>"
```

Relocate non-root aggregates from node2 to node3

Before you can replace node2 with node4, you must send an AutoSupport message for node2 and then relocate the non-root aggregates that are owned by node2 to node3.

Steps

1. Send an AutoSupport message to NetApp for node2:

```
system node autosupport invoke -node <node2> -type all -message "Upgrading
<node2> from <platform_old> to <platform_new>"
```

2. Verify that the AutoSupport message was sent:

```
system node autosupport show -node <node2> -instance
```

The fields "Last Subject Sent:"" and "Last Time Sent:"" contain the message title of the last message that was sent and the time when the message was sent.

3. Relocate the non-root aggregates:
   a. Set the privilege level to advanced:

```
set -privilege advanced
```

   b. List the aggregates that are owned by node2:

```
storage aggregate show -owner-name <node2>
```

c. Start aggregate relocation:

```
storage aggregate relocation start -node <node2> -destination <node3>
-aggregate-list * -ndo-controller-upgrade true
```

> The command locates only non-root aggregates.

d. When prompted, enter `y`.

Relocation occurs in the background. It can take anywhere from a few seconds to a couple of minutes to relocate an aggregate. The time includes both client outage and non-outage portions. The command does not relocate any offline or restricted aggregates.

e. Return to the admin privilege level:

```
set -privilege admin
```

4. Verify the relocation status of node2:

```
storage aggregate relocation show -node <node2>
```

The output will display "Done" for an aggregate after it has been relocated.

> You must wait until all of the aggregates that are owned by node2 have been relocated to node3 before proceeding to the next step.

5. Take one of the following actions:

If relocation of…	Then…
All aggregates was successful	Go to Step 6.

If relocation of…	Then…

Any aggregates failed, or was vetoed	a. Display a detailed status message:
	`storage aggregate show -instance`
	You can also check the EMS logs to see the corrective action that is needed.
	Note: The `event log show` command lists any errors that have occurred.
	b. Perform the corrective action.
	c. Set the privilege level to advanced:
	`set -privilege advanced`
	d. Relocate any failed or vetoed aggregates:
	`storage aggregate relocation start -node <node2> -destination <node3> -aggregate-list * -ndo-controllerupgrade true`
	e. When prompted, enter `y`.
	f. Return to the admin privilege level:
	`set -privilege admin`
	If necessary, you can force the relocation by using one of the following methods:
	• By overriding veto checks:
	`storage aggregate relocation start -override -vetoes true -ndo-controller-upgrade`
	• By overriding destination checks:
	`storage aggregate relocation start -override -destination-checks true -ndocontroller-upgrade`
	For more information about the storage aggregate relocation commands, go to References to link to *Disk and aggregate management with the CLI* and the *ONTAP 9 Commands: Manual Page Reference*.

6. Verify that all of the non-root aggregates are online on node3:

`storage aggregate show -node <node3> -state offline -root false`

If any aggregates have gone offline or have become foreign, you must bring them online, once for each

aggregate:

```
storage aggregate online -aggregate <aggr_name>
```

7. Verify that all of the volumes are online on node3:

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

   If any volumes are offline on node3, you must bring them online, once for each volume:

   ```
   volume online -vserver <Vserver-name> -volume <volume-name>
   ```

8. Verify that node2 does not own any online non-root aggregates:

   ```
   storage aggregate show -owner-name <node2> -ha-policy sfo -state online
   ```

   The command output should not display online non-root aggregates because all of the non-root online aggregates have already been relocated to node3.

Move NAS data LIFs owned by node2 to node3

After you relocate the aggregates from node2 to node3, you need to move the NAS data LIFs owned by 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. SAN LIFs are not moved unless they need to be mapped to new ports. You must verify that the LIFs are healthy and located on the appropriate ports after you move the LIFs from node3 to node4 and bring node4 online.

Steps

1. List all the NAS data LIFs owned by node2 by entering the following command on either node and capturing the output:

   ```
   network interface show -data-protocol nfs|cifs -home-node <node2>
   ```

   The following example shows the command output for node2:

```
cluster::> network interface show -data-protocol nfs|cifs -home-node
node2
              Logical     Status      Network             Current
Current  Is
 Vserver      Interface   Admin/Oper  Address/Mask        Node     Port
Home
 -----------  ----------  ----------  ------------------  -------
-------  ----
 vs0
              a0a         up/down     10.63.0.53/24       node2    a0a
true
              data1       up/up       10.63.0.50/18       node2    e0c
true
              rads1       up/up       10.63.0.51/18       node2    e1a
true
              rads2       up/down     10.63.0.52/24       node2    e1b
true
 vs1
              lif1        up/up       172.17.176.120/24   node2    e0c
true
              lif2        up/up       172.17.176.121/24   node2    e1a
true
```

2. Take one of the following actions:

If node2…	Then…
Has interface groups or VLANs configured	Go to Step 3.
Does not have interface groups or VLANs configured	Skip Step 3 and go to Step 4.

3. Take the following steps to migrate NAS data LIFs hosted on interface groups and VLANs on node2:
   a. Migrate any data LIFs hosted on an interface group on node2 to a port on node3 that is capable of hosting LIFs on the same network by entering the following command, once for each LIF:

      ```
      network interface migrate -vserver <Vserver_name> -lif <LIF_name>
      -destination-node <node3> -destination-port <netport|ifgrp>
      ```

   b. Modify the home port and home node of the LIFs in Substep a to the port and node currently hosting the LIFs by entering the following command, once for each node:

      ```
      network interface modify -vserver <Vserver_name> -lif <LIF_name> -home-node
      <node3> -homeport <netport|ifgrp>
      ```

   c. Migrate any LIFs hosted on VLANs on node2 to a port on node3 that is capable of hosting LIFs on the same network as that of the VLANs by entering the following command, once for each LIF:

```
network interface migrate -vserver <Vserver_name> -lif <LIF_name>
-destination-node <node3> -destination-port <netport|ifgrp>
```

d. Modify the home port and home node of the LIFs in Substep c to the port and node currently hosting the LIFs by entering the following command, once for each LIF:

```
network interface modify -vserver <Vserver_name> -lif <LIF_name> -home-node
<node3> -homeport <netport|ifgrp>
```

4. Take one of the following actions:

If the cluster is configured for…	Then…
NAS	Complete Step 5 through Step 8.
SAN	Skip Step 5 through Step 8 and then complete Step 9.
Both NAS and SAN	Complete Step 5 through Step 9.

5. If you have data ports that are not the same on your platforms, add the ports to the broadcast domain:

```
network port broadcast-domain add-ports -ipspace <IPspace_name> -broadcast
-domain mgmt -ports <node:port>
```

The following example adds port "e0a" on node "6280-1" and port "e0i" on node "8060-1" to broadcast domain "mgmt" in the IPspace "Default":

```
cluster::> network port broadcast-domain add-ports -ipspace Default
           -broadcast-domain mgmt -ports 6280-1:e0a, 8060-1:e0i
```

6. Migrate each NAS data LIF to node3 by entering the following command, once for each LIF:

```
network interface migrate -vserver <Vserver_name> -lif <LIF_name> -destination
-node <node3> -destination-port <netport|ifgrp>
```

7. Verify that NAS LIFs have been moved to the correct ports and that the LIFs have the status of up by entering the following command on either node and examining the output:

```
network interface show -curr-node <node3> -data-protocol cifs|nfs
```

8. 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> -status-admin
up
```

9. If you have interface groups or VLANs configured, complete the following substeps:

a. Remove the VLANs from the interface groups:

```
network port vlan delete -node <node_name> -port <ifgrp> -vlan-id <VLAN_ID>
```

b. Enter the following command and examine its output to determine if there are any interface groups configured on the node:

```
network port ifgrp show -node <node_name> -ifgrp <ifgrp_name> -instance
```

The system displays interface group information for the node, as shown in the following example:

```
cluster::> network port ifgrp show -node node2 -ifgrp a0a -instance
                  Node: node2
 Interface Group Name: a0a
Distribution Function: ip
        Create Policy: multimode_lacp
          MAC Address: MAC_address
    ort Participation: partial
        Network Ports: e2c, e2d
             Up Ports: e2c
           Down Ports: e2d
```

c. If any interface groups are configured on the node, record the names of the interface groups and the ports assigned to them and then delete the ports by entering the following command, once for each port:

```
network port ifgrp remove-port -node <node_name> -ifgrp <ifgrp_name> -port
<port_name>
```

Stage 4. Record information and retire node2

Stage 4. Record node2 information and retire node2

During Stage 4, you record node2 information and then retire node2.

Steps

1. Record node2 information
2. Retire node2

Record node2 information

Before you can shut down and retire node2, you need to record information about its cluster network, management, and FC ports as well as its NVRAM System ID. You need that information later in the procedure when you map node2 to node4 and reassign disks.

Steps

1. Find the cluster network, node-management, intercluster, and cluster-management ports on node2:

   ```
   network interface show -curr-node <node_name> -role
   cluster,intercluster,nodemgmt,cluster-mgmt
   ```

   The system displays the LIFs for that node and other nodes in the cluster, as shown in the following example:

```
cluster::> network interface show -curr-node node2 -role
cluster,intercluster,node-mgmt,cluster-mgmt
         Logical     Status     Network            Current     Current
Is
Vserver  Interface   Admin/Oper Address/Mask       Node        Port
Home
-------- ----------  ---------- ------------------ ----------  -------
----
node2
         intercluster up/up     192.168.1.202/24   node2       e0e
true
         clus1        up/up     169.254.xx.xx/24   node2       e0a
true
         clus2        up/up     169.254.xx.xx/24   node2       e0b
true
         mgmt1        up/up     192.168.0.xxx/24   node2       e0c
true
4 entries were displayed.
```

Your system might not have intercluster LIFs. You will have a cluster management LIF only on one node of a node pair. A cluster management LIF was displayed in the example output of Step 1 in *Record node1 port information*.

2. Capture the information in the output to use in the section Map ports from node2 to node4.

   The output information is required to map the new controller ports to the old controller ports.

3. Determine physical ports on node2:

   `network port show -node <node_name> -type physical +`

   `node_name` is the node which is being migrated.

   The system displays the physical ports on node2, as shown in the following example:

```
cluster::> network port show -node node2 -type physical

                                                                  Speed
(Mbps)
Node   Port      IPspace      Broadcast Domain Link   MTU    Admin/Oper
------ --------- ------------ ---------------- ----- ------- -----------
node2
       e0M       Default      IP_address       up       1500  auto/100
       e0a       Default      -                up       1500  auto/1000
       e0b       Default      -                up       1500  auto/1000
       e1a       Cluster      Cluster          up       9000  auto/10000
       e1b       Cluster      Cluster          up       9000  auto/10000
5 entries were displayed.
```

4. Record the ports and their broadcast domains.

   The broadcast domains will need to be mapped to the ports on the new controller later in the procedure.

5. Determine the FC ports on node2:

   `network fcp adapter show`

   The system displays the FC ports on the node2, as shown in the following example:

```
cluster::> network fcp adapter show -node node2
                     Connection  Host
Node         Adapter Established Port Address
------------ ------- ----------- ------------
node2
             0a      ptp         11400
node2
             0c      ptp         11700
node2
             6a      loop        0
node2
             6b      loop        0
4 entries were displayed.
```

6. Record the ports.

   The output information is required to map the new FC ports on the new controller later in the procedure.

7. If you have not done so earlier, check whether there are interface groups or VLANs configured on node2:

   `ifgrp show`

   `vlan show`

You will use the information in the section Map ports from node2 to node4.

8. Take one of the following actions:

If you…	Then…
Recorded NVRAM System ID number in Prepare the nodes for upgrade	Go to Retire node2.
Did not record the NVRAM System ID number in Prepare the nodes for upgrade	Complete Step 9 and Step 10 and then go to the next section, Retire node2.

9. Display the attributes of node 2:

```
system node show -instance -node node2
```

```
cluster::> system node show -instance -node node2
                              ...
                  NVRAM System ID: system_ID
                              ...
```

10. Record the NVRAM System ID to use in the section Install and boot node4.

Retire node2

To retire node2, you need to shut node2 down properly and remove it from the rack or chassis. If the cluster is in a SAN environment, you also need to delete the SAN LIFs.

Steps

1. Take one of the following actions:

If the cluster is…	Then…
A two-node cluster	Go to Step 2.
A cluster with more than two nodes	Go to Step 9.

2. Access the advanced privilege level by entering the following command on either node:

```
set -privilege advanced
```

3. Verify that the cluster HA has been disabled by entering the following command and examining its output:

```
cluster ha show
```

The system displays the following message:

```
High Availability Configured: false
```

4. Check if node2 currently holds epsilon by entering the following command and examining its output:

   `cluster show`

   The following example shows that node2 holds epsilon:

```
cluster*::> cluster show
Node                 Health  Eligibility   Epsilon
-------------------- ------- ------------  -----------
node1                true    true          false
node2                true    true          true

Warning: Cluster HA has not been configured. Cluster HA must be
configured on a two-node cluster to ensure data access availability in
the event of storage failover. Use the "cluster ha modify -configured
true" command to configure cluster HA.

2 entries were displayed.
```

   If you are upgrading a HA pair in a cluster with multiple HA pairs, you should move epsilon to the node of a HA pair not undergoing a controller upgrade. For example, if you are upgrading nodeA/nodeB in a cluster with the HA pair configuration nodeA/nodeB and nodeC/nodeD, you should move epsilon to nodeC or nodeD.

5. If node2 holds epsilon, mark epsilon as `false` on the node so that it can be transferred to node3:

   `cluster modify -node <node2> -epsilon false`

6. Transfer epsilon to node3 by marking epsilon `true` on node3:

   `cluster modify -node <node3> -epsilon true`

7. Verify if the setup is a two-node switchless cluster:

   `network options switchless-cluster show`

```
cluster::*> network options switchless-cluster show
Enable Switchless Cluster: false/true
```

   The value of this command must match the physical state of the system.

8. Verify if the setup is a two-node switchless cluster:

   `network options switchless-cluster show`

```
cluster::*> network options switchless-cluster show
Enable Switchless Cluster: false/true
```

The value of this command must match the physical state of the system.

9. Return to the admin level:

```
set -privilege admin
```

10. Halt node2 by entering the following command on either controller:
`system node halt -node <node2>`
11. After node2 shuts down completely, remove it from the chassis or the rack. You can decommission node2 after the upgrade is completed. See Decommission the old system.

Stage 5. Install and boot node4

Stage5. Install and boot node4

During Stage 5, you install and boot node4 and map the cluster and node-management ports from node2 to node4. You also move the data LIFs and SAN LIFs owned by node2 from node3 to node4, and relocate node2's aggregates from node3 to node4.

Steps

1. Install and boot node4
2. Set the FC or UTA/UTA2 configuration on node4
3. Map ports from node2 to node4
4. Move NAS data LIFs owned by node2 from node3 to node4 and verify SAN LIFs on node4
5. Relocate node2's non-root aggregates from node3 to node4

Install and boot node4

You need to install node4 in the rack, transfer node2 connections to node4, and boot node4. You must also reassign any node2 spares, any disks belonging to root, and any non-root aggregates that were not relocated to node3 earlier.

About this task

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

However, you do not need to netboot node4 if it has the same or later version of Data ONTAP 9 that is installed on node2.

Important:

- If you are upgrading a V-Series system or a system with FlexArray Virtualization Software that is connected

to storage arrays, you need to complete Step 1 through Step 7, leave this section at Step 8 and follow instructions in Set the FC or UTA/UTA2 configuration on node4 as needed, entering the commands in Maintenance mode. You then need to return to this section and resume the procedure at Step 9.

- However, if you are upgrading a system with storage disks, you need to complete this entire section and then proceed to the section Set the FC or UTA/UTA2 configuration on node4, entering commands at the cluster prompt.

Steps

1. Take one of the following actions:

If node4 will be in …	Then…
A chassis separate from node3	Go to Step 2.
The same chassis with node3	Skip Steps 2 and 3 and go to Step 4.

2. Make sure that node4 has sufficient rack space.

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

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

   The following references help you make proper cable connections. Go to References to link to them.

   - *Installation and Setup Instructions* or *FlexArray Virtualization Installation Requirements and Reference* for the node4 platform
   - The appropriate disk shelf procedure
   - The *High Availability management* documentation

   Cable the following connections:

   - Console (remote management port)
   - Cluster ports
   - Data ports
   - Cluster and node management ports
   - Storage
   - SAN configurations: iSCSI Ethernet and FC switch ports

   You do not need to move the interconnect card/FC_VI card or interconnect/FC_VI cable connection from node2 to node4 because most platform models have unique interconnect card models.

5. Take one of the following actions:

If node4 is in…	Then…
The same chassis as node3	Go to Step 8.

If node4 is in…	Then…
A chassis separate from node3	Go to Step 6.

6. Turn on the power to node4, and then interrupt the boot by pressing `Ctrl-C` to access the boot environment prompt.

   When you boot node4, you might see the following 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'
```

7. If you see the warning message in Step 6, 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 finish.

   Warning: Do not override the delay. Failure to allow the battery to charge could result in a loss of data.

8. Take one of the following actions:

If your system…	Then…
Has disks and no back-end storage	Skip Step 9 through Step 14 and go to Step 15.
Is a V-Series system or has FlexArray Virtualization Software and is connected to storage arrays	a. Go to the section *Set the FC or UTA/UTA2 configuration on node4* and complete the sections Configure FC ports on node4 and Check and configure UTA/UTA2 ports on node4, as appropriate to your system. b. Return to this section and complete the remaining steps, beginning with Step 9. **Important**: You must reconfigure FC onboard ports, UTA/UTA2 onboard ports, and UTA/UTA2 cards before you boot Data ONTAP on the V-Series system.

9. Add the FC initiator ports of the new node to the switch zones.

   See your storage array and zoning documentation for instructions.

10. Add the FC initiator ports to the storage array as new hosts, mapping the array LUNs to the new hosts.

    See your storage array and zoning documentation for instructions.

11. Modify the World Wide Port Name (WWPN) values in the host or volume groups associated with array LUNs on the storage array.

    Installing a new controller module changes the WWPN values associated with each onboard FC port.

12. If your configuration uses switch-based zoning, adjust the zoning to reflect the new WWPN values.
13. Verify that the array LUNs are now visible to node4 by entering the following command and examining its output:

    ```
    sysconfig -v
    ```

    The system displays all the array LUNs that are visible to each of the FC initiator ports. If the array LUNs are not visible, you cannot reassign disks from node2 to node4 later in this section.

14. Press `Ctrl-C` to display the boot menu and select Maintenance mode.
15. At the Maintenance mode prompt, enter the following command:

    ```
    halt
    ```

    The system stops at the boot environment prompt.

16. Configure node4 for ONTAP:

    ```
    set-defaults
    ```

17. If FDE is used in this configuration, the `setenv bootarg.storageencryption.support` variable must be set to `true`, and the `kmip.init.maxwait` variable needs to be set to `off` to avoid a boot loop after the node2 configuration is loaded:

    ```
    setenv bootarg.storageencryption.support true
    ```

    ```
    setenv kmip.init.maxwait off
    ```

18. If the version of ONTAP installed on node4 is the same or later than the version of ONTAP 9 installed on node2, enter the following command:

    ```
    boot_ontap menu
    ```

19. Take one of the following actions:

If the system you are upgrading…	Then…
Does not have the correct or current ONTAP version on node4	Go to Step 20.
Has the correct or current version of ONTAP on node4	Go to Step 25.

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

    You should use the management port and IP address as the netboot connection. Do not use a data LIF IP address 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 entering the following command at the boot environment prompt: `ifconfig e0M -auto`
Not running	Manually configure the connection by entering the following command at the boot environment prompt: `ifconfig e0M -addr=<filer_addr> mask=<netmask> -gw=<gateway> dns=<dns_addr> domain=<dns_domain>` `<filer_addr>` is the IP address of the storage system. `<netmask>` is the network mask of the storage system. `<gateway>` is the gateway for the storage system. `<dns_addr>` is the IP address of a name server on your network. `<dns_domain>` is the Domain Name Service (DNS) domain name. If you use this optional parameter, you do not need a fully qualified domain name in the netboot server URL; you need only the server's host name. **Note**: Other parameters might be necessary for your interface. Enter `help ifconfig` at the firmware prompt for details.

21. Perform netboot on node4:

For…	Then…
FAS/AFF8000 series systems	`netboot http://<web_server_ip/path_to_webaccessible_directory>/netboot/kernel`
All other systems	`netboot http://<web_server_ip/path_to_webaccessible_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.

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

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

Disregard the following message:

`"This procedure is not supported for NonDisruptive Upgrade on an HA pair"`

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

23. 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`

24. Complete the following substeps:

    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 needs to be restored.

25. Select maintenance mode `5` from the boot menu and enter `y` when you are prompted to continue with the boot.

26. Before continuing, go to Set the FC or UTA/UTA2 configuration on node4 to make any necessary changes to the FC or UTA/UTA2 ports on the node. Make the changes recommended in those sections, reboot the node, and go into Maintenance mode.

27. Enter the following command and examine the output to find the system ID of node4:

    `disk show -a`

    The system displays the system ID of the node and information about its disks, as shown in the following example:

```
*> disk show -a
Local System ID: 536881109
DISK         OWNER                      POOL   SERIAL NUMBER   HOME
------------ -------------              -----  -------------
-------------
0b.02.23     nst-fas2520-2(536880939)    Pool0  KPG2RK6F        nst-
fas2520-2(536880939)
0b.02.13     nst-fas2520-2(536880939)    Pool0  KPG3DE4F        nst-
fas2520-2(536880939)
0b.01.13     nst-fas2520-2(536880939)    Pool0  PPG4KLAA        nst-
fas2520-2(536880939)
......
0a.00.0                   (536881109)    Pool0  YFKSX6JG
(536881109)
......
```

28. Reassign node2's spares, disks belonging to the root, and any non-root aggregates that were not relocated to node3 earlier in section Relocate non-root aggregates from node2 to node3:

Disk type…	Run the command…
With shared disks	`disk reassign -s <node2_sysid> -d <node4_sysid> -p <node3_sysid>`
Without shared	`disks disk reassign -s <node2_sysid> -d <node4_sysid>`

For the `<node2_sysid>` value, use the information captured in Step 10 of the *Record node2 information* section. For `<node4_sysid>`, use the information captured in Step 23.

The `-p` option is only required in maintenance mode when shared disks are present.

The `disk reassign` command will reassign only those disks for which `<node2_sysid>` is the current owner.

The system displays the following message:

```
Partner node must not be in Takeover mode during disk reassignment from
maintenance mode.
Serious problems could result!!
Do not proceed with reassignment if the partner is in takeover mode.
Abort reassignment (y/n)? n
```

Enter `n` when asked to abort disk reassignment.

When you are asked to abort disk reassignment, you must answer a series of prompts as shown in the following steps:

a. The system displays the following message:

```
After the node becomes operational, you must perform a takeover and
giveback of the HA partner node to ensure disk reassignment is
successful.
Do you want to continue (y/n)? y
```

b. Enter `y` to continue.

The system displays the following message:

```
Disk ownership will be updated on all disks previously belonging to
Filer with sysid <sysid>.
Do you want to continue (y/n)? y
```

c. Enter `y` to allow disk ownership to be updated.

29. If you are upgrading from a system with external disks to a system that supports internal and external disks (A800 systems, for example), set node4 as root to ensure it boots from the root aggregate of node2.

Warning: You must perform the following substeps in the exact order shown; failure to do so might cause an outage or even data loss.

The following procedure sets node4 to boot from the root aggregate of node2:

a. Check the RAID, plex, and checksum information for the node2 aggregate:

```
aggr status -r
```

b. Check the overall status of the node2 aggregate:

```
aggr status
```

c. If necessary, bring the node2 aggregate online:

```
aggr_online root_aggr_from_<node2>
```

d. Prevent the node4 from booting from its original root aggregate:

```
aggr offline <root_aggr_on_node4>
```

e. Set the node2 root aggregate as the new root aggregate for node4:

```
aggr options aggr_from_<node2> root
```

30. Verify that the controller and chassis are configured as `ha` by entering the following command and observing the output:

```
ha-config show
```

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

```
*> ha-config show
   Chassis HA configuration: ha
   Controller HA configuration: ha
```

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

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.
```

If you have a MetroCluster configuration, use the following commands to correct the configuration:

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

```
ha-config modify chassis mcc.
```

31. Destroy the mailboxes on node4:

```
mailbox destroy local
```

32. Exit Maintenance mode:

```
halt
```

The system stops at the boot environment prompt.

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

```
date
```

34. On node4, check the date at the boot environment prompt:

```
show date
```

35. If necessary, set the date on node4:

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

36. On node4, check the time at the boot environment prompt:

```
show time
```

37. If necessary, set the time on node4:

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

38. Verify the partner system ID is set correctly as noted in Step 26 under option.

```
printenv partner-sysid
```

39. If necessary, set the partner system ID on node4:

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

    a. Save the settings:

```
saveenv
```

40. Enter the boot menu at the boot environment prompt:

```
boot_ontap menu
```

41. At the boot menu, select option **(6) Update flash from backup config** by entering `6` at the prompt.

    The system displays the following message:

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

42. Enter `y` at the prompt.

    The boot proceeds normally, and the system prompts you to confirm the system ID mismatch.

    The system might reboot twice before displaying the mismatch warning.

43. Confirm the mismatch.
    The node might complete one round of rebooting before booting normally.
44. Log in to node4.

Set the FC or UTA/UTA2 configuration on node4

If node4 has onboard FC ports, onboard unified target adapter (UTA/UTA2) ports, or a UTA/UTA2 card, you must configure the settings before completing the rest of the procedure.

About this task

You might need to complete Configure FC ports on node4, the Check and configure UTA/UTA2 ports on node4, or both sections.

If node4 does not have onboard FC ports, onboard UTA/UTA2 ports, or a UTA/UTA2 card, and you are upgrading a system with storage disks, you can skip to Map ports from node2 to node4.

However, if you have a V-Series system or have FlexArray Virtualization Software and are connected to storage arrays, and node4 does not have onboard FC ports, onboard UTA/ UTA2 ports, or a UTA/UTA2 card,

you must return to the *Install and boot node4* section and resume at Step 9. 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.

Choices

- Configure FC ports on node4
- Check and configure UTA/UTA2 ports on node4

Configure FC ports on node4

If node4 has FC ports, either onboard or on an FC adapter, you must set port configurations on the node before you bring it into service because the ports are not preconfigured. If the ports are not configured, you might experience a disruption in service.

Before you begin

You must have the values of the FC port settings from node2 that you saved in the section Prepare the nodes for upgrade.

About this task

You can skip this section if your system does not have FC configurations. If your system has onboard UTA/UTA2 ports or a UTA/UTA2 adapter, you configure them in Check and configure UTA/UTA2 ports on node4.

Important: If your system has storage disks, you must enter the commands in this section at the cluster prompt. If you have a V-Series system or a system with FlexArray Virtualization Software connected to storage arrays, you enter commands in this section in Maintenance mode.

Steps

1. Take one of the following actions:

If the system that you are upgrading…	Then…
Has storage disks	Go to Step 5.
Is a V-Series system or has FlexArray Virtualization Software and is connected to storage arrays	Go to Step 2.

2. Access Maintenance mode:

```
boot_ontap maint
```

3. Take one of the following actions:

If the system that you are upgrading…	Then…
Has storage disks	`system node hardware unified-connect show`
Is a V-Series system or has FlexArray Virtualization Software and is connected to storage arrays	`ucadmin show`

The system displays information about all FC and converged network adapters on the system.

4. Compare the FC settings on the new nodes with the settings that you captured earlier from the original node.
5. Take one of the following actions:

If the system that you are upgrading…	Then…

Has storage disks	Modify the FC ports on node4 as needed:
	• To program target ports:
	`system node hardware unified-connect modify -type | -t target -adapter <port_name>`
	• To program initiator ports:
	`system node unified-connect modify type | -t initiator -adapter <port_name>`
	`-type` is the FC4 type, target or initiator.

Is a V-Series system or has FlexArray Virtualization Software and is connected to storage arrays	Modify the FC ports on node4 as needed: `ucadmin modify -m fc -t initiator -f <adapter_port_name>` `-t` is the FC4 type, target or initiator. **Note**: The FC ports need to be programmed as initiators.

6. Take one of the following actions:

If the system that you are upgrading…	Then…
Has storage disks	Verify the new settings by entering the following command and examining the output: `system node unified-connect show`
Is a V-Series system or has FlexArray Virtualization Software and is connected to storage arrays	Verify the new settings by entering the following command and examining the output: `ucadmin show`

7. Take one of the following actions:

If the default FC settings on the new nodes are…	Then…
The same as the ones you that captured on the original nodes	Go to Step 11.

If the default FC settings on the new nodes are…	Then…
Different from the ones that you captured on the original nodes	Go to Step8.

8. Exit Maintenance mode:

```
halt
```

9. After you enter the command, wait until the system stops at the boot environment prompt.
10. Take one of the following actions:

If the system that you are upgrading…	Then…
Is a V-Series system or has FlexArray Virtualization software running Data ONTAP 8.3.0 or later	Access Maintenance mode by entering the following command at the boot environment prompt: `boot_ontap maint`
Is not a V-Series system and does not have FlexArray Virtualization software	Boot node4 by entering the following command at the boot environment prompt: `boot_ontap`

11. Take one of the following actions:

If the system that you are upgrading…	Then…
Has storage disks	• Go to Check and configure UTA/UTA2 ports on node4 if node4 has a UTA/UTA2A card or UTA/UTA2 onboard ports. • Skip the section and go to Map ports from node2 to node4 if node4 does not have a UTA/UTA2 card or UTA/UTA2 onboard ports.
Is a V-Series system or has FlexArray Virtualization Software and is connected to storage arrays	• Go to Check and configure UTA/UTA2 ports on node4 if node4 has a UTA/ UTA2 card or UTA/UTA2 onboard ports. • Skip the section *Check and configure UTA/UTA2 ports on node4* if node4 does not have a UTA/UTA2 card or UTA/UTA2 onboard ports, return to the section *Install and boot node4*, and resume the section at Step 9.

Check and configure UTA/UTA2 ports on node4

If node4 has onboard UTA/UTA2 ports or a UTA/UTA2A card, you must check the configuration of the ports and configure them, depending on how you want to use the upgraded system.

Before you begin

You must have the correct SFP+ modules for the UTA/UTA2 ports.

About this task

UTA/UTA2 ports can be configured into native FC mode or UTA/UTA2A mode. FC mode supports FC initiator and FC target; UTA/UTA2 mode allows concurrent NIC and FCoE traffic to share the same 10 GbE SFP+ interface and supports FC target.

NetApp marketing materials might use the term UTA2 to refer to CNA adapters and ports. However, the CLI uses the term CNA.

UTA/UTA2 ports might be on an adapter or on the controller with the following configurations:

- UTA/UTA2 cards ordered at the same time as the controller are configured before shipment to have the personality you requested.
- UTA/UTA2 cards ordered separately from the controller are shipped with the default FC target personality.
- Onboard UTA/UTA2 ports on new controllers are configured (before shipment) to have the personality you requested.

However, you should check the configuration of the UTA/UTA2 ports on node4 and change it, if necessary.

Attention: If your system has storage disks, you enter the commands in this section at the cluster prompt unless directed to enter Maintenance mode. If you have a MetroCluster FC system, V-Series system or a system with FlexArray Virtualization software that is connected to storage arrays, you must be in Maintenance mode to configure UTA/UTA2 ports.

Steps

1. Check how the ports are currently configured by using one of the following commands on node4:

If the system…	Then…
Has storage disks	`system node hardware unified-connect show`
Is a V-Series system or has FlexArray Virtualization Software and is connected to storage arrays	`ucadmin show`

The system displays output similar to the following example:

```
*> ucadmin show
                Current  Current    Pending   Pending   Admin
Node   Adapter  Mode     Type       Mode      Type      Status
----   -------  ---      ---------  -------   --------  -------
f-a    0e       fc       initiator  -          -        online
f-a    0f       fc       initiator  -          -        online
f-a    0g       cna      target     -          -        online
f-a    0h       cna      target     -          -        online
f-a    0e       fc       initiator  -          -        online
f-a    0f       fc       initiator  -          -        online
f-a    0g       cna      target     -          -        online
f-a    0h       cna      target     -          -        online
*>
```

2. If the current SFP+ module does not match the desired use, replace it with the correct SFP+ module.

   Contact your NetApp representative to obtain the correct SFP+ module.

3. Examine the output of the `system node hardware unified-connect show` or `ucadmin show` command and determine whether the UTA/UTA2 ports have the personality you want.
4. Take one of the following actions:

If the CNA ports…	Then…
Do not have the personality that you want	Go to Step 5.
Have the personality that you want	Skip Step 5 through Step 12 and go to Step 13.

5. Take one of the following actions:

If the system…	Then…
Has storage disks and is running Data ONTAP 8.3	Boot node4 and enter maintenance mode: `boot_ontap maint`
Is a V-Series system or has FlexArray Virtualization Software and is connected to storage arrays	Go to Step 6. You should already be in Maintenance mode.

6. Take one of the following actions:

If you are configuring…	Then…
Ports on a UTA/UTA2A card	Go to Step 7.
Onboard UTA/UTA2 ports	Skip Step 7 and go to Step 8.

7. If the adapter is in initiator mode, and if the UTA/UTA2 port is online, take the UTA/UTA2 port offline:

   `storage disable adapter <adapter_name>`

   Adapters in target mode are automatically offline in Maintenance mode.

8. If the current configuration does not match the desired use, enter the following command to change the configuration as needed:

   `ucadmin modify -m fc|cna -t initiator|target <adapter_name>`

   - `-m` is the personality mode: FC or 10GbE UTA.
   - `-t` is the FC4 type: target or initiator.

   > You need to use FC initiator for tape drives and FlexArray Virtualization systems. You need to use the FC target for SAN clients.

9. Verify the settings by entering the following command and examining its output:

```
ucadmin show
```

10. Perform one of the following actions:

If the system…	Then…

Has storage disks	a. Enter the following command:
	`halt`
	The system stops at the boot environment prompt.
	b. Enter the following command:
	`boot_ontap`

Is a V-Series system or has FlexArray Virtualization Software and is connected to storage arrays and is running Data ONTAP 8.3	Reboot to Maintenance mode: `boot_ontap maint`

11. Verify the settings:

If the system…	Then…
Has storage disks	Enter the following command: `system node hardware unified-connect show`
Is a V-Series system or has FlexArray Virtualization Software and is connected to storage arrays	Enter the following command: `ucadmin show`

The output in the following examples shows that the FC4 type of adapter "1b" is changing to `initiator` and that the mode of adapters "2a" and "2b" is changing to `cna`.

```
cluster1::> system node hardware unified-connect show
                Current  Current    Pending  Pending    Admin
Node  Adapter  Mode     Type       Mode     Type       Status
----  -------  -------  ---------  -------  -------    -----
f-a    1a      fc       initiator  -        -          online
f-a    1b      fc       target     -        initiator  online
f-a    2a      fc       target     cna      -          online
f-a    2b      fc       target     cna      -          online
4 entries were displayed.
```

```
*> ucadmin show
                Current Current    Pending  Pending    Admin
Node  Adapter   Mode    Type       Mode     Type       Status
----  -------   ------- ---------  -------  -------    -----
f-a    1a       fc      initiator  -        -          online
f-a    1b       fc      target     -        initiator  online
f-a    2a       fc      target     cna      -          online
f-a    2b       fc      target     cna      -          online
4 entries were displayed.
*>
```

12. Place any target ports online by entering one of the following commands, once for each port:

If the system…	Then…
Has storage disks	`network fcp adapter modify -node <node_name> -adapter <adapter_name> -state up`
Is a V-Series system or has FlexArray Virtualization Software and is connected to storage arrays	`fcp config <adapter_name> up`

13. Cable the port.
14. Perform one of the following actions:

If the system…	Then…
Has storage disks	Go to Map ports from node2 to node4.
Is a V-Series system or has FlexArray Virtualization Software and is connected to storage arrays	Return to the section *Install and boot node4*, and resume the section at Step 9.

Map ports from node2 to node4

You need to make sure that the physical ports on node2 map correctly to the physical ports on node4, which will let node4 communicate with other nodes in the cluster and with the network after the upgrade.

Before you begin

You must already have information about the ports on the new nodes, to access this information refer to References to link to the *Hardware Universe*. You use the information later in this section.

The software configuration of node4 must match the physical connectivity of node4, and IP connectivity must be restored before you continue with the upgrade.

About this task

Port settings might vary, depending on the model of the nodes.

Steps

1. Perform the following steps to verify if the setup is a two-node switchless cluster:
   a. Set the privilege level to advanced:

      ```
      set -privilege advanced
      ```

   b. Verify if the setup is a two-node switchless cluster:

      ```
      network options switchless-cluster show
      ```

      For example:

      ```
      cluster::*> network options switchless-cluster show
      Enable Switchless Cluster:  false/true
      ```

      The value of this command must match the physical state of the system.

   c. Return to the administration privilege level using the following command:

      ```
      set -privilege admin
      ```

2. Make the following changes:
   a. Modify ports that will be part of `Cluster` broadcast domain:

      ```
      network port modify -node <node_name> -port <port_name> -mtu 9000 -ipspace
      Cluster
      ```

      This example adds Cluster port "e1b" on "node2":

      ```
      network port modify -node node2 -port e1b -ipspace Cluster -mtu 9000
      ```

   b. Migrate the cluster LIFs to the new ports, once for each LIF:

      ```
      network interface migrate -vserver <vserver_name> -lif <lif_name> source-
      node node2 -destination-node node2 -destination-port <port_name>
      ```

      When all cluster LIFs are migrated and cluster communication is established, the cluster should come into quorum.

   c. Modify the home port of the Cluster LIFs:

      ```
      network interface modify -vserver Cluster -lif <lif_name> -home-port
      <port_name>
      ```

   d. Remove the old ports from the `Cluster` broadcast domain:

      ```
      network port broadcast-domain remove-ports -ipspace Cluster -broadcast
      -domain Cluster -ports <node2:port>
      ```

   e. Display the `health` state of node2/node4:

```
cluster show -node node2 -fields health
```

f. Each cluster LIF must be listening on port 7700. Verify that the cluster LIFs are listening on port 7700:

```
::> network connections listening show -vserver Cluster
```

Port 7700 listening on cluster ports is the expected outcome as shown in the following example for a two-node cluster:

```
Cluster::> network connections listening show -vserver Cluster
Vserver Name     Interface Name:Local Port     Protocol/Service
---------------- ----------------------------  -------------------
Node: NodeA
Cluster          NodeA_clus1:7700               TCP/ctlopcp
Cluster          NodeA_clus2:7700               TCP/ctlopcp
Node: NodeB
Cluster          NodeB_clus1:7700               TCP/ctlopcp
Cluster          NodeB_clus2:7700               TCP/ctlopcp
4 entries were displayed.
```

g. If necessary, for each cluster LIF that is not listening on port 7700, set the administrative status of the LIF to `down` and then `up`:

```
::> net int modify -vserver Cluster -lif <cluster-lif> -status-admin down;
net int modify -vserver Cluster -lif <cluster-lif> -status-admin up
```

Repeat substep (f) to verify that the cluster LIF is now listening on port 7700.

3. Modify the broadcast domain memberships of physical ports hosting data LIFs.

a. List the reachability status of all ports:

```
network port reachability show
```

b. Repair the reachability of the physical ports, followed by VLAN ports, by running the following command on each port, one port at a time:

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

A warning like the following is expected. Review and enter y or n, as appropriate:

```
Warning: Repairing port "node_name:port" 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}:
```

c. To allow ONTAP to complete the repair, wait for about a minute after running the `reachability repair` command on the last port.

d. List all broadcast domains on the cluster:

```
broadcast-domain show
```

e. 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 correspond to any of the existing broadcast domains, ONTAP will create new broadcast domains for these ports. As required, you can delete the newly created broadcast domains if all their member ports will become member ports of the interface groups. Delete broadcast domains:

```
broadcast-domain delete -broadcast-domain <broadcast_domain>
```

f. Review the interface group configuration, and as required, add or delete member ports.

Add member ports to interface group ports:

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

Remove member ports from interface group ports:

```
ifgrp remove-port -node node_name -ifgrp <ifgrp_port> -port <port_name>
```

g. Delete and re-create VLAN ports as needed. Delete VLAN ports:

```
vlan delete -node <node_name> -vlan-name <vlan_port>
```

Create VLAN ports:

```
vlan create -node <node_name> -vlan-name <vlan_port>
```

Depending on the complexity of the networking configuration of the system being upgraded, you might be required to repeat Substeps (a) to (g) until all ports are placed correctly where needed.

4. If there are no VLANs configured on the system, go to Step 5. If there are VLANs configured, restore displaced VLANs that were previously configured on ports that no longer exist or were configured on ports that were moved to another broadcast domain.

a. Display the displaced VLANs:

```
displaced-vlans show
```

b. Restore the displaced VLANs to the desired destination port:

```
displaced-vlans restore -node <node_name> -port <port_name> -destination
-port <destination_port>
```

c. Verify that all displaced VLANs have been restored:

```
displaced-vlans show
```

d. VLANs are automatically placed into the appropriate broadcast domains about a minute after they are created. Verify that the restored VLANs have been placed into the appropriate broadcast domains:

```
network port reachability show
```

5. Starting with ONTAP 9.8, ONTAP will automatically modify the home ports of LIFs if the ports are moved between broadcast domains during the network port reachability repair procedure. If a LIF's home port was moved to another node, or is unassigned, that LIF will be presented as a displaced LIF. Restore the home ports of displaced LIFs whose home ports either no longer exist or were relocated to another node.

   a. Display the LIFs whose home ports might have moved to another node or no longer exist:

      `displaced-interface show`

   b. Restore the home port of each LIF:

      `displaced-interface restore -vserver <vserver_name> -lif-name <lif_name>`

   c. Verify that all LIF home ports have been restored:

      `displaced-interface 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 are reporting a status other than these two, repair the reachability as outlined in Step 3.

6. Verify that all LIFs are administratively up on ports belonging to the correct broadcast domains.

   a. Check for any LIFs that are administratively down:

      `network interface show -vserver <vserver_name> -status-admin down`

   b. Check for any LIFs that are operationally down:

      `network interface show -vserver <vserver_name> -status-oper down`

   c. Modify any LIFs that need to be modified to have a different home port:

      `network interface modify -vserver <vserver_name> -lif <lif_name> -home-port <home_port>`

      For iSCSI LIFs, modification of the home port requires the LIF to be administratively down.

   d. Revert LIFs that are not home to their respective home ports:

      `network interface revert *`

Move NAS data LIFs owned by node2 from node3 to node4 and verify SAN LIFs on node4

After mapping ports from node2 to node4 and before you relocate node2 aggregates from node3 to node4, you need to move the NAS data LIFs owned by node2 currently on node3 from node3 to node4. You also need to verify the SAN LIFs 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 verify that the LIFs are healthy and located on appropriate ports after you bring node4 online.

Steps

1. List all the NAS data LIFs that are not owned by node3 by entering the following command on either node and capturing the output:

   ```
   network interface show -role data -curr-node node3 -is-home false
   ```

2. Take one of the following actions:

If node2…	Description
Had interface groups or VLANs configured	Go to Step 3.
Did not have interface groups or VLANs configured	Skip Step 3 and go to Step 4.

3. Take the following steps to migrate any NAS data LIFs hosted on interface groups and VLANs that originally were on node2 from node3 to node4.

   a. Migrate any LIFs hosted on node3 that previously belonging to node2 on an interface group to a port on node4 that is capable of hosting LIFs on the same network by entering the following command, once for each LIF:

      ```
      network interface migrate -vserver <vserver_name> -lif <lif_name>
      -destination-node node4 –destination-port <netport|ifgrp>
      ```

   b. Modify the home port and home node of the LIFs in Substep a to the port and node currently hosting the LIFs by entering the following command, once for each LIF:

      ```
      network interface modify -vserver <vserver_name> -lif <datalif_name> -home
      -node node4 home-port <netport|ifgrp>
      ```

   c. Migrate any LIFs hosted on node3 that previously belonged to node2 on a VLAN port to a port on node4 that is capable of hosting LIFs on the same network by entering the following command, once for each LIF:

      ```
      network interface migrate -vserver <vserver_name> -lif <datalif_name>
      -destination-node node4 –destination-port <netport|ifgrp>
      ```

   d. Modify the home port and home node of the LIFs in Substep c to the port and node currently hosting the LIFs by entering the following command, once for each LIF:

      ```
      network interface modify -vserver <vserver_name> -lif <datalif_name> -home
      -node <node4> home-port <netport|ifgrp>
      ```

4. Take one of the following actions:

If the cluster is configured for…	Then…
NAS	Complete Step 5 through Step 8, skip Step 9, and complete Step 10 through Step 13.

If the cluster is configured for…	Then…
SAN	Skip Step 5 through Step 8, and complete Step 9 through Step 13.
Both NAS and SAN	Complete Step 5 through Step 13.

5. If you have data ports that are not the same on your platforms, enter the following command to add the ports to the broadcast domain:

   ```
   network port broadcast-domain add-ports -ipspace <IPspace_name> -broadcast
   -domain mgmt ports <node:port>
   ```

   The following example adds port "e0a" on node "6280-1" and port "e0i" on node "8060-1" to broadcast domain mgmt in the IPspace Default:

   ```
   cluster::> network port broadcast-domain add-ports -ipspace Default
   -broadcast-domain mgmt -ports 6280-1:e0a, 8060-1:e0i
   ```

6. Migrate each NAS data LIF to node4 by entering the following command, once for each LIF:

   ```
   network interface migrate -vserver <vserver-name> -lif <datalif-name>
   -destination-node <node4> -destination-port <netport|ifgrp> -home-node <node4>
   ```

7. Make sure that the data migration is persistent:

   ```
   network interface modify -vserver <vserver_name> -lif <datalif_name> -home
   -port <netport|ifgrp>
   ```

8. Verify the status of all links as `up` by entering the following command to list all the network ports and examining its output:

   ```
   network port show
   ```

   The following example shows the output of the `network port show` command with some LIFs up and others down:

```
cluster::> network port show
                                                                  Speed
(Mbps)
Node   Port      IPspace      Broadcast Domain Link   MTU    Admin/Oper
------ --------- ------------ ---------------- ----- ------- -----------
node3
       a0a       Default      -                up       1500  auto/1000
       e0M       Default      172.17.178.19/24 up       1500  auto/100
       e0a       Default      -                up       1500  auto/1000
       e0a-1     Default      172.17.178.19/24 up       1500  auto/1000
       e0b       Default      -                up       1500  auto/1000
       e1a       Cluster      Cluster          up       9000  auto/10000
       e1b       Cluster      Cluster          up       9000  auto/10000
node4
       e0M       Default      172.17.178.19/24 up       1500  auto/100
       e0a       Default      172.17.178.19/24 up       1500  auto/1000
       e0b       Default      -                up       1500  auto/1000
       e1a       Cluster      Cluster          up       9000  auto/10000
       e1b       Cluster      Cluster          up       9000  auto/10000
12 entries were displayed.
```

9. If the output of the `network port show` command displays network ports that are not available in the new node and are present in the old nodes, delete the old network ports by completing the following substeps:

   a. Enter the advanced privilege level by entering the following command:

      `set -privilege advanced`

   b. Enter the following command, once for each old network port:

      `network port delete -node <node_name> -port <port_name>`

   c. Return to the admin level by entering the following command:

      `set -privilege admin`

10. Ensure that the SAN LIFs are on the correct ports on node4 by completing the following substeps:

    a. Enter the following command:

       `network interface show -data-protocol iscsi|fcp -home-node node4`

       The system returns output similar to the following example:

```
cluster::> network interface show -data-protocol iscsi|fcp -home-node
node4
            Logical    Status     Network            Current
Current Is
Vserver     Interface  Admin/Oper Address/Mask       Node
Port    Home
----------- ---------- ---------- ------------------ -------------
------- ----
vs0
            a0a          up/down  10.63.0.53/24      node3
a0a     true
            data1        up/up    10.63.0.50/18      node3
e0c     true
            rads1        up/up    10.63.0.51/18      node3
e1a     true
            rads2        up/down  10.63.0.52/24      node3
e1b     true
vs1
            lif1         up/up    172.17.176.120/24  node3
e0c     true
            lif2         up/up    172.17.176.121/24  node3
```

b. If node4 has any SAN LIFs or groups of SAN LIFs that are on a port that did not exist on node2, move them to an appropriate port on node4 by entering one of the following commands:

   i. Set the LIF status to down:

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

   ii. Remove the LIF from the port set:

      ```
      portset remove -vserver <vserver_name> -portset <portset_name> -port-name
      <port_name>
      ```

   iii. Enter one of the following commands:

      - Move a single LIF:

        ```
        network interface modify -lif <lif_name> -home-port <new_home_port>
        ```

      - Move all the LIFs on a single nonexistent or incorrect port to a new port:

        ```
        network interface modify {-home-port <port_on_node2> -home-node
        <node2> -role data} -home-port <new_home_port_on_node4>
        ```

      - Add the LIFs back to the port set:

        ```
        portset add -vserver <vserver_name> -portset <portset_name> -port-name
        <port_name>
        ```

You need to ensure that you move SAN LIFs to a port that has the same link speed as the original port.

11. Modify the status of all LIFs to `up` so the LIFs can accept and send traffic on the node by entering the following command:

    ```
    network interface modify -vserver <vserver_name> -home-port <port_name> -home
    -node <node4> lif <lif_name> -status-admin up
    ```

12. Verify that any SAN LIFs have been moved to the correct ports and that the LIFs have the status of `up` by entering the following command on either node and examining the output:

    ```
    network interface show -home-node <node4> -role data
    ```

13. 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> -status-admin
    up
    ```

Relocate node2's non-root aggregates from node3 to node4

Having relocated node2's non-root aggregates to node3, you now must relocate them from node3 to node4.

Steps

1. Enter the following command on either controller, and examine the output to identify which non-root aggregates to relocate:

    ```
    storage aggregate show -owner-name <node3> -home-id <node2_system_id>
    ```

2. Relocate the aggregates by completing the following substeps:
    a. Access the advanced privilege level by entering the following command on either node:

        ```
        set -privilege advanced
        ```

    b. Enter the following command:

        ```
        storage aggregate relocation start -node <node3> -destination <node4>
        -aggregate-list <aggr_name1, aggr_name2…> -ndo-controller-upgrade true
        ```

        The aggregate list is the list of aggregates owned by node4 that you obtained in Step 1.

    c. When prompted, enter `y`.

        Relocation occurs in the background. It could take anywhere from a few seconds to a couple of minutes to relocate an aggregate. The time includes both client outage and non-outage portions. The command does not relocate any offline or restricted aggregates.

    d. Return to the admin level:

```
set -privilege admin
```

3. Check the relocation status:

```
storage aggregate relocation show -node <node3>
```

The output will display `Done` for an aggregate after it has been relocated.

> Wait until all the node2 aggregates have been relocated to node4 before proceeding to the next step.

4. Take one of the following actions:

If relocation of…	Then…
All aggregates was successful	Go to Step 5.

If relocation of…	Then…

Any aggregates failed, or were vetoed	a. Check the EMS logs for the corrective action.
	b. Perform the corrective action.
	c. Access the advanced privilege level by entering the following command on either node:
	`set -privilege advanced`
	d. Relocate any failed or vetoed aggregates:
	`storage aggregate relocation start -node <node3> destination <node4> -aggregate-list <aggr_name1, aggr_name2…> ndo-controller-upgrade true`
	The aggregate list is the list of failed or vetoed aggregates.
	e. When prompted, enter `y`.
	f. Return to the admin level by entering the following command:
	`set -privilege admin`
	If necessary, you can force the relocation using one of the following methods:
	• Overriding veto checks:
	`storage aggregate relocation start -override -vetoes -ndo-controller-upgrade`
	• Overriding destination checks:
	`storage aggregate relocation start -override -destination-checks -ndocontroller-upgrade`
	For more information about storage aggregate relocation commands refer to References to link to *Disk and aggregate management with the CLI* and the *ONTAP 9 Commands: Manual Page Reference*.

5. Verify that all node2 non-root aggregates are online and their state on node4:

   `storage aggregate show -node <node4> -state offline -root false`

   The node2 aggregates were listed in the output of the command in Step 1.

6. If any aggregate has gone offline or become foreign, bring it online by using the following command for each aggregate:

   `storage aggregate online -aggregate <aggr_name>`

7. Verify that all the volumes in node2 aggregates are online on node4:

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

8. If any volumes are offline on node4, bring them online:

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

9. Send a post-upgrade AutoSupport message to NetApp for node4:

   ```
   system node autosupport invoke -node <node4> -type all -message "<node2>
   successfully upgraded from <platform_old> to <platform_new>"
   ```

Stage 6. Complete the upgrade

Stage 6. Complete the upgrade

During Stage 6, you ensure that the new nodes are set up correctly. If one of the new nodes has a unified target adapter, you must restore any port configurations and might need to change the personality of the adapter. You also should set up Storage Encryption if the new nodes are encryption-enabled. You also should decommission the old nodes.

1. Ensure that the new controllers are set up correctly
2. Set up Storage Encryption on the new controller module
3. Set up NetApp Encryption on the new controller module
4. Decommission the old system
5. Resume SnapMirror operations

Ensure that the new controllers are set up correctly

To ensure 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 ensure that node3 owns node1's aggregates and that node4 owns node2's aggregates, and that the volumes for both nodes are online.

Steps

1. Enable storage failover by entering the following command on one of the nodes:

   ```
   storage failover modify -enabled true -node <node3>
   ```

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. Take one of the following actions:

If the cluster is a…	Description
Two-node cluster	Enable cluster high availability by entering the following command on either node: `cluster ha modify -configured true`
Cluster with more than two nodes	Go to Step 4.

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

   ```
   cluster show
   ```

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

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

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

   ```
   network interface show
   ```

   If either node3 or node4 owns data LIFs home-owned by other nodes in the cluster, use the `network interface revert` command to revert the data LIFs to their home-owner.

7. 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>
   ```

8. Determine whether any volumes are offline:

   ```
   volume show -node <node3> -state offline
   volume show -node <node4> -state offline
   ```

9. If any volumes are offline, compare them with the list of offline volumes that you captured in Step 19 (d) in *Prepare the nodes for upgrade*, and bring online any of the offline volumes, as required, by entering the following command, once for each volume:

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

10. Install new licenses for the new nodes by entering 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, each license key separated by a comma.

11. If NetApp Storage Encryption (NSE) was in use on the configuration and you set the `setenv bootarg.storageencryption.support` command to "true" with the `kmip.init.maxwait` variable "off" (in Step 16 of *Install and boot node3*), you need to reset the variable:
    `set diag; systemshell -node <node_name> -command sudo kenv -u -p kmip.init.maxwait`

12. To remove all of the old licenses from the original nodes, enter one of the following commands:

    ```
    system license clean-up -unused -expired
    system license delete -serial-number <node_serial_number> -package
    <licensable_package>
    ```

    - To delete all expired licenses, enter:

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

    - To delete all unused licenses, enter:

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

    - To delete a specific license from a cluster, enter 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.

13. Verify that the licenses are properly installed by entering the following command and examining its output:

    ```
    system license show
    ```

    You might want to compare the output with the output that you captured in Step 30 of *Prepare the nodes for upgrade*.

14. Configure the SPs by performing the following command on both nodes:

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

    Go to References to link to the *System Administration Reference* for information about the SPs and the

ONTAP 9 Commands: Manual Page Reference for detailed information about the `system service-processor network modify` command.

15. Take the following actions on one of the new nodes:
    a. Enter advanced privilege level by entering the following command:

       `set -privilege advanced`

    b. Enter the following command:

       `storage failover modify -node <node-name> -cifs-ndo-duration default|medium|low`

       - Enter `medium` if the system will have workloads in which 50 percent to 75 percent of the operations will be 4 KB or smaller.
       - Enter `low` if the system will have workloads in which 75 percent to 100 percent of the operations will be 4 KB or smaller.

    c. Return to the admin level by entering the following command:

       `set -privilege admin`

    d. Reboot the system to ensure that the changes take effect.
16. If you want to set up a switchless cluster on the new nodes, go to References to link to the *Network 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 steps in Set up Storage Encryption on the new controller module. Otherwise, complete the steps in 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 show -status`

   `security key-manager query`

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 -add <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 the that the key management servers were added successfully:

```
security key-manager 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 setup -node <new_controller_name>
```

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 restore -node <new_controller_name>
```

Set up NetApp Volume Encryption on the new controller module

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

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 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 by using the following command:

```
security key-manager -add <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 the that the key management servers were added successfully by using the following command:

```
security key-manager 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 by using the following command:

      `security key-manager setup -node <new_controller_name>`

   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:

For…	Use this command…
External Key Manager (EKM)	`security key-manager external restore` This command needs the OKM passphrase
Onboard Key Manager (OKM)	`security key-manager onboard sync`

After you finish

Check if any volumes were taken offline because authentication keys were not available or external key management servers could not be reached. Bring those volumes back online by using the following command:

`volume online`

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. Click **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 ARL upgrade workflow. The information about failures that can occur is listed by the phase of the procedure.

- Aggregate relocation failures
- Reboots, panics, or power cycles
- Issues that can arise in multiple stages of the procedure
- LIF migration failure
- LIFs are on invalid ports after upgrade

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 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 properly, 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. Enter the following command to 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 Stage 2

Crashes can occur before, during, or immediately after Stage 2, during which you relocate aggregates from node1 to node2, move data LIFs and SAN LIFs owned by node1 to node2, record node1 information, and retire node1.

Node1 or node2 crashes before Stage 2 with HA still enabled

If either node1 or node2 crashes before Stage 2, no aggregates have been relocated yet and the HA 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.

Node1 crashes during or just after Stage 2 with HA still enabled

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

About this task

Ownership of aggregates that were relocated looks the same as the ownership of non-root aggregates that were taken over because home owner has not changed.
When node1 enters the `waiting for giveback state`, node2 will give back all the node1 nonroot aggregates.

Steps

1. Complete Step 1 in the section *Relocate non-root aggregates from node1 to node2* again.
2. Continue with the node-pair upgrade procedure.

Node1 crashes after Stage 2 while HA is disabled

Node2 will 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.

You might see some changes in the output of the `storage failover show` command, but that is typical and does not affect the procedure. See the troubleshooting section Unexpected storage failover show command output.

Node2 fails during or after Stage 2 with HA still enabled

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

About this task

Node1 will take over all of node2's aggregates as well any of its own aggregates that it had relocated to node2. When node2 enters the `Waiting for Giveback` state, node1 gives back all of node2's aggregates.

Steps

1. Complete Step 1 in the section *Relocate non-root aggregates from node1 to node2* again.
2. Continue with the node-pair upgrade procedure.

Node2 crashes after Stage 2 and after HA is disabled

Node1 will not take over.

Steps

1. Bring up node2.

   A client outage will occur 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 Stage 3

Failures can occur during or immediately after Stage 3, during which you install and boot node3, map ports from node1 to node3, move data LIFs and SAN LIFs belonging to node1 and node2 to node3, and relocate all aggregates from node2 to node3.

Node2 crash during Stage 3 with HA disabled and before relocating any aggregates

Node3 will not take over following a node2 crash as HA is already disabled.

Steps

1. Bring up node2.

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

2. Continue with the node-pair upgrade procedure.

Node2 crashes during Stage 3 after relocating some or all aggregates

Node2 has relocated some or all of its aggregates to node3, which will serve data from aggregates that were relocated. HA is disabled.

About this task

There will be client outage for aggregates that were not relocated.

Steps

1. Bring up node2.
2. Relocate the remaining aggregates by completing Step 1 through Step 3 in the section *Relocate non-root aggregates from node2 to node3*.
3. Continue with the node-pair upgrade procedure.

Node3 crashes during Stage 3 and before node2 has relocated any aggregates

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.

Node3 crashes during Stage 3 during aggregate relocation

If node3 crashes while node2 is relocating aggregates to node3, node2 will abort the relocation of any remaining aggregates.

About this task

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

Steps

1. Bring up node3.
2. Complete Step 3 again in the section *Relocate non-root aggregates from node2 to node3*.
3. Continue with the node-pair upgrade procedure.

Node3 fails to boot after crashing in Stage 3

Because of a catastrophic failure, node3 cannot be booted following a crash during Stage 3.

Step

Contact technical support.

Node2 crashes after Stage 3 but before Stage 5

Node3 continues to serve data for all aggregates. The HA pair is disabled.

Steps

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

Node3 crashes after Stage 3 but before Stage 5

Node3 crashes after Stage 3 but before Stage 5. The HA pair is disabled.

Steps

1. Bring up node3.

   There will be a client outage for all aggregates.

2. Continue with the node-pair upgrade procedure.

Reboots, panics, or power cycles during Stage 5

Crashes can occur during Stage 5, the stage in which you install and boot node4, map ports from node2 to node4, move data LIFs and SAN LIFs belonging to node2 from node3 to node4, and relocate all of node2's aggregates from node3 to node4.

Node3 crashes during Stage 5

Node3 has relocated some or all of node2's aggregates to node4. Node4 does not take over but continues to serve non-root aggregates that node3 already relocated. The HA pair is disabled.

About this task

There is be an outage for the rest of the aggregates until node3 boots again.

Steps

1. Bring up node3.
2. Relocate the remaining aggregates that belonged to node2 by repeating Step 1 through Step 3 in the section *Relocate node2's non-root aggregates from node3 to node4*.
3. Continue with the node pair upgrade procedure.

Node4 crashes during Stage 5

Node3 has relocated some or all of node2's aggregates to node4. Node3 does not take over but continues to serve non-root aggregates that node3 owns as well as those that were not relocated. HA is disabled.

About this task

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

Steps

1. Bring up node4.
2. Relocate the remaining aggregates that belonged to node2 by again completing Step 1 through Step 3 in *Relocate node2's non-root aggregates from node3 to node4*.
3. 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

                    Takeover
Node     Partner    Possible  State Description
-------  --------   --------- -----------------
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

                    Takeover
Node     Partner    Possible  State Description
-------  --------   --------- -----------------
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".

LIFs are on invalid ports after upgrade

After the upgrade is completed, the FC logical interfaces (LIFs) might be left on incorrect ports if you have a MetroCluster configuration. You can perform a resync operation to

reassign the LIFs to the correct ports.

Step

1. Enter the `metrocluster vserver resync` command to reallocate the LIFs to the correct ports.

```
metrocluster vserver resync -vserver <vserver_name> fcp-mc.headupgrade.test.vs
```

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
Upgrade by moving volumes or storage	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.
Fabric-attached MetroCluster Installation and Configuration	Describes how to install and configure the MetroCluster hardware and software components in a fabric configuration.
FlexArray Virtualization Installation Requirements and Reference	Contains cabling instructions and other information for FlexArray Virtualization systems.
MetroCluster Management and Disaster Recovery	Describes how to perform MetroCluster switchover and switchback operations, both in planned maintenance operations or in the event of a disaster.
MetroCluster Upgrade and Expansion	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.
ONTAP 9.0 Commands: Manual Page Reference	Describes syntax and usage of supported ONTAP 9.0 commands.
ONTAP 9.1 Commands: Manual Page Reference	Describes syntax and usage of supported ONTAP 9.1 commands.
ONTAP 9.2 Commands: Manual Page Reference	Describes syntax and usage of supported ONTAP 9.2 commands.
ONTAP 9.3 Commands: Manual Page Reference	Describes syntax and usage of supported ONTAP 9.3 commands.
ONTAP 9.4 Commands: Manual Page Reference	Describes syntax and usage of supported ONTAP 9.4 commands.

Content	Description
ONTAP 9.5 Commands: Manual Page Reference	Describes syntax and usage of supported ONTAP 9.5 commands.
ONTAP 9.6 Commands: Manual Page Reference	Describes syntax and usage of supported ONTAP 9.6 commands.
ONTAP 9.7 Commands: Manual Page Reference	Describes syntax and usage of supported ONTAP 9.7 commands.
ONTAP 9.8 Commands: Manual Page Reference	Describes syntax and usage of supported ONTAP 9.8 commands.
ONTAP 9.9.1 Commands: Manual Page Reference	Describes syntax and usage of supported ONTAP 9.9.1 commands.
ONTAP 9.10.1 Commands: Manual Page Reference	Describes syntax and usage of supported ONTAP 9.10.1 commands.
Disk and aggregate management with the CLI	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.
High Availability management	Describes how to install and manage high-availability clustered configurations, including storage failover and takeover/giveback.
Logical storage management with the CLI	Describes how to efficiently manage your logical storage resources, using volumes, FlexClone volumes, files and LUNs, FlexCache volumes, deduplication, compression, qtrees, and quotas.
Network Management	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.
SAN management with the CLI	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.
SAN configuration reference	Contains information about FC and iSCSI topologies and wiring schemes.
Decide whether to use System Manager or the ONTAP CLI for cluster setup	Describes how to set up and configure ONTAP.
Administration overview with the CLI	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.
Upgrade ONTAP	Contains instructions for downloading and upgrading ONTAP.
Use "system controller replace" commands to upgrade AFF A700 to AFF A900 running ONTAP 9.10.1 RC2 or later	Describes the aggregate relocation procedures needed to non-disruptively upgrade an AFF A700 to an AFF A900 running ONTAP 9.10.1 RC2 or later by using "system controller replace" commands.

Content	Description
Use "system controller replace" commands to upgrade controller hardware running ONTAP 9.8 or later	Describes the aggregate relocation procedures needed to non-disruptively upgrade controllers running ONTAP 9.8 by using "system controller replace" commands.
Use aggregate relocation to manually upgrade controller hardware running ONTAP 9.8 or later	Describes the aggregate relocation procedures needed to perform manual non-disruptive controller upgrades running ONTAP 9.8 or later.
Use "system controller replace" commands to upgrade controller hardware running ONTAP 9.5 to ONTAP 9.7	Describes the aggregate relocation procedures needed to non-disruptively upgrade controllers running ONTAP 9.5 to ONTAP 9.7 by using "system controller replace" commands.
Use aggregate relocation to manually upgrade controller hardware running ONTAP 9.7 or earlier	Describes the aggregate relocation procedures needed to perform manual non-disruptive controller upgrades running ONTAP 9.7 or earlier.

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.