



Transition from MetroCluster FC to MetroCluster IP

ONTAP MetroCluster

NetApp
December 06, 2022

This PDF was generated from https://docs.netapp.com/us-en/ontap-metrocluster/transition/concept_choosing_your_transition_procedure_mcc_transition.html on December 06, 2022. Always check docs.netapp.com for the latest.

Table of Contents

- Transition from MetroCluster FC to MetroCluster IP 1
 - Choosing your transition procedure 1
 - Supported platforms for nondisruptive transition 1
 - Transition nondisruptively from a MetroCluster FC to a MetroCluster IP configuration (ONTAP 9.8 and later) 2
 - Disruptively transition from a two-node MetroCluster FC to a four-node MetroCluster IP configuration (ONTAP 9.8 and later) 55
 - Disruptively transitioning from MetroCluster FC to MetroCluster IP when retiring storage shelves (ONTAP 9.8 and later) 93
 - Disruptively transitioning when existing shelves are not supported on new controllers (ONTAP 9.8 and later) 98
 - Moving an FC SAN workload from MetroCluster FC to MetroCluster IP nodes 108
 - Moving Linux iSCSI hosts from MetroCluster FC to MetroCluster IP nodes 115
 - Where to find additional information 124

Transition from MetroCluster FC to MetroCluster IP

Choosing your transition procedure

You must select a transition procedure depending on your existing MetroCluster FC configuration.

A transition procedure replaces the back-end FC switch fabric or FC-VI connection with an IP switch network. The exact procedure depends on your starting configuration.

The original platforms and FC switches (if present) are retired at the end of the transition procedure.

Starting configuration	Disruptive or nondisruptive	Requirements	Procedure
Four node	Nondisruptive	New storage shelves are supported on new platforms.	Transitioning nondisruptively from a MetroCluster FC to a MetroCluster IP configuration (ONTAP 9.8 and later)
Two node	Disruptive	New storage shelves are supported on both original and new platforms.	Disruptively transitioning from a two-node MetroCluster FC to a four-node MetroCluster IP configuration (ONTAP 9.8 and later)
Two node	Disruptive	New storage shelves are supported on both original and new platforms. Old storage shelves must be retired.	Disruptively transitioning from MetroCluster FC to MetroCluster IP when retiring storage shelves (ONTAP 9.8 and later)
Two node	Disruptive	Old storage shelves are not supported on new platforms. Old storage shelves must be retired.	Disruptively transitioning when existing shelves are not supported on new controllers (ONTAP 9.8 and later)

Supported platforms for nondisruptive transition

When transitioning to a MetroCluster IP configuration, you must have a combination of supported platform models. You should also ensure that the MetroCluster IP platform is an appropriate size for the load that you are transitioning from the MetroCluster FC configuration to the MetroCluster IP configuration.

The following table shows the supported platform combinations. You can transition from platforms in the left-hand column to platforms listed as supported in the columns to the right, as indicated by the colored table cells.

- A green cell shows that the combination is supported.
- A white (blank) cell indicates that the combination is unsupported.
- A blue cell shows that the combination is supported beginning with ONTAP 9.11.1.

For example, transitioning from a MetroCluster FC configuration consisting of AFF8060 controller modules to an IP configuration consisting of AFF A400 controller modules is supported.

						Target MetroCluster IP platform											
		FAS2750	A220	FAS500f	A250	FAS8200	A300	A320	FAS8300	A400	FAS8700	FAS9000	A700	A800	FAS9500	A900	
Source MetroCluster FC platform	FAS8020																
	AFF8020																
	FAS8040																
	AFF8040																
	FAS8060																
	AFF8060																
	FAS8080																
	AFF8080																
	FAS8200																
	A300																
	FAS8300																
	A400																
	FAS9000																
	A700																
	FAS9500																
	A900																

Transitions to a Cisco 9336C-FX2 shared switch configuration

Transitioning to a Cisco 9336C-FX2 shared switch configuration is not supported. A *shared switch configuration* is one where the switches provide both the MetroCluster connections and the storage shelf connections.

Configurations in which the Cisco 9336C-FX2 switch provides only the MetroCluster connections are supported.

Transition nondisruptively from a MetroCluster FC to a MetroCluster IP configuration (ONTAP 9.8 and later)

Transitioning nondisruptively from a MetroCluster FC to a MetroCluster IP configuration (ONTAP 9.8 and later)

Beginning with ONTAP 9.8, nondisruptive transition of workloads and data from an existing four-node MetroCluster FC configuration to a new MetroCluster IP configuration is supported.

- This procedure is supported on systems running ONTAP 9.8 and later.
- This procedure is nondisruptive.

The MetroCluster configuration can continue to serve data during the operation.

- This procedure applies only to four-node MetroCluster FC configurations.

If you have a two-node MetroCluster FC configuration, see [Choosing your transition procedure](#).

- You must meet all requirements and follow all steps in the procedure.

Prepare for transition from a MetroCluster FC to a MetroCluster IP configuration

Requirements for nondisruptive FC-to-IP transition

Before starting the transition process, you must make sure the configuration meets the requirements.

- It must be a four-node configuration and all nodes must be running ONTAP 9.8 or later.
- The existing and new platforms must be a supported combination for transition.

[Supported platforms for nondisruptive transition](#)

- It must support a switched cluster configuration.

[NetApp Hardware Universe](#)

- It must meet all requirements and cabling as described in the *MetroCluster Installation and Configuration* procedures.

[Fabric-attached MetroCluster installation and configuration](#)

[Stretch MetroCluster installation and configuration](#)

How transition impacts the MetroCluster hardware components

After completing the transition procedure, key components of the existing MetroCluster configuration have been replaced or reconfigured.

- **Controller modules**

The existing controller modules are replaced by new controller modules. The existing controller modules are decommissioned at the end of the transition procedures.

- **Storage shelves**

Data is moved from the old shelves to the new shelves. The old shelves are decommissioned at the end of the transition procedures.

- **MetroCluster (back-end) and cluster switches**

The back-end switch functionality is replaced by the IP switch fabric. If the MetroCluster FC configuration included FC switches and FC-to-SAS bridges, they are decommissioned at the end of this procedure.

If the MetroCluster FC configuration used cluster switches for the cluster interconnect, in some cases they can be reused to provide the back-end IP switch fabric. Reused cluster switches must be reconfigured with platform and switch-specific RCFs. procedures.

If the MetroCluster FC configuration did not use cluster switches, new IP switches are added to provide the backend switch fabric.

[Considerations for IP switches](#)

- **Cluster peering network**

The existing customer-provided cluster peering network can be used for the new MetroCluster IP configuration. Cluster peering is configured on the MetroCluster IP nodes as part of the transition procedure.

Workflow for nondisruptive MetroCluster transition

You must follow the specific workflow to ensure a successful nondisruptive transition.

The transition process begins with a healthy four-node MetroCluster FC configuration.



The new MetroCluster IP nodes are added as a second DR group.



Data is transferred from the old DR group to the new DR group, and then the old nodes and their storage are removed from the configuration and decommissioned. The process ends with a four-node MetroCluster IP configuration.



You will use the following workflow to transition the MetroCluster configuration.



Considerations for IP switches

You must ensure the IP switches are supported. If the existing switch model is supported by both the original MetroCluster FC configuration and the new MetroCluster IP configuration, you can reuse the existing switches.

Supported switches

You must use NetApp-provided switches.

- The use of MetroCluster-compliant switches (switches that are not validated and provided by NetApp) is not supported for transition.
- The IP switches must be supported as a cluster switch by both the MetroCluster FC configuration and the MetroCluster IP configuration.
- The IP switches can be reused in the new MetroCluster IP configuration if the MetroCluster FC is a switched cluster and the IP cluster switches are supported by the MetroCluster IP configuration.
- New IP switches are usually used in the following cases:
 - The MetroCluster FC is a switchless cluster, so new switches are required.
 - The MetroCluster FC is a switched cluster but the existing IP switches are not supported in the MetroCluster IP configuration.
 - You want to use different switches for the MetroCluster IP configuration.

See the *NetApp Hardware Universe* for information on platform model and switch support.

[NetApp Hardware Universe](#)

Switchover, healing, and switchback operations during nondisruptive transition

Depending on the stage of the transition process, the MetroCluster switchover, healing,

and switchback operations use either the MetroCluster FC or MetroCluster IP workflow.

The following table shows what workflows are used at different stages of the transition process. In some stages, switchover and switchback are not supported.

- In the MetroCluster FC workflow, the switchover, healing, and switchback steps are those used by a MetroCluster FC configuration.
- In the MetroCluster IP workflow, the switchover, healing, and switchback steps are those used by a MetroCluster IP configuration.
- In the unified workflow, when both the FC and IP nodes are configured, the steps depend on whether NSO or USO is performed. The details are shown in the table.

For information on the MetroCluster FC and IP workflows for switchover, healing, and switchback, see [Understanding MetroCluster data protection and disaster recovery](#).



Automatic unplanned switchover is not available during the transition process.

Stage of transition	Negotiated switchover uses this workflow...	Unplanned switchover uses this workflow...
Before the MetroCluster IP nodes have joined the cluster	MetroCluster FC	MetroCluster FC
After the MetroCluster IP nodes have joined the cluster, before the <code>metrocluster configure</code> command is performed	Not supported	MetroCluster FC
After the <code>metrocluster configure</code> command has been issued. Volume move can be in progress.	Unified: All remote site nodes remain up and healing is done automatically	Unified: <ul style="list-style-type: none">• Mirrored aggregates owned by the MetroCluster FC node are mirrored if storage is accessible, all others are degraded after switchover.• All remote site nodes are able to boot up.• The <code>heal aggregate</code> and <code>heal root</code> commands must be run manually.
The MetroCluster FC nodes have been unconfigured.	Not supported	MetroCluster IP
The <code>cluster unjoin</code> command has been performed on the MetroCluster FC nodes.	MetroCluster IP	MetroCluster IP

Alert messages and tool support during transition

You may notice alert messages during transition. These alerts can be safely ignored.

Also, some tools are not available during transition.

- ARS may alert during transition.

These alerts can be ignored and should disappear once the transition has finished.

- OnCommand Unified Manager may alert during transition.

These alerts can be ignored and should disappear once the transition has finished.

- Config Advisor is not supported during transition.
- System Manager is not supported during transition.

Example naming in this procedure

This procedure uses example names throughout to identify the DR groups, nodes, and switches involved.

DR groups	cluster_A at site_A	cluster_B at site_B
dr_group_1-FC	<ul style="list-style-type: none">• node_A_1-FC• node_A_2-FC	<ul style="list-style-type: none">• node_B_1-FC• node_B_2-FC
dr_group_2-IP	<ul style="list-style-type: none">• node_A_3-IP• node_A_4-IP	<ul style="list-style-type: none">• node_B_3-IP• node_B_4-IP
Switches	<p>Initial switches (if fabric-attached configuration):</p> <ul style="list-style-type: none">• switch_A_1-FC• switch_A_2-FC <p>MetroCluster IP switches:</p> <ul style="list-style-type: none">• switch_A_1-IP• switch_A_2-IP	<p>Initial switches (if fabric-attached configuration):</p> <ul style="list-style-type: none">• switch_B_1-FC• switch_B_2-FC <p>MetroCluster IP switches:</p> <ul style="list-style-type: none">• switch_B_1-IP• switch_B_2-IP

Transition from MetroCluster FC to MetroCluster IP configurations

Verifying the health of the MetroCluster configuration

You must verify the health and connectivity of the MetroCluster configuration prior to performing the transition

1. Verify the operation of the MetroCluster configuration in ONTAP:
 - a. Check whether the system is multipathed:`node run -node node-name sysconfig -a`
 - b. Check for any health alerts on both clusters:`system health alert show`
 - c. Confirm the MetroCluster configuration and that the operational mode is normal:`metrocluster`

show

- d. Perform a MetroCluster check: `metrocluster check run`
- e. Display the results of the MetroCluster check: `metrocluster check show`
- f. Check for any health alerts on the switches (if present): `storage switch show`
- g. Run Config Advisor.

[NetApp Downloads: Config Advisor](#)

- h. After running Config Advisor, review the tool's output and follow the recommendations in the output to address any issues discovered.

- 2. Verify that the cluster is healthy: `cluster show`

```
cluster_A::> cluster show
Node           Health  Eligibility  Epsilon
-----
node_A_1_FC    true   true         false
node_A_2_FC    true   true         false

cluster_A::>
```

- 3. Verify that all cluster ports are up: `network port show -ipspace cluster`

```
cluster_A::> network port show -ipspace cluster

Node: node_A_1_FC

Port           IPspace      Broadcast Domain Link MTU      Speed(Mbps) Health
-----
e0a            Cluster      Cluster      up   9000    auto/10000 healthy
e0b            Cluster      Cluster      up   9000    auto/10000 healthy

Node: node_A_2_FC

Port           IPspace      Broadcast Domain Link MTU      Speed(Mbps) Health
-----
e0a            Cluster      Cluster      up   9000    auto/10000 healthy
e0b            Cluster      Cluster      up   9000    auto/10000 healthy

4 entries were displayed.

cluster_A::>
```

4. Verify that all cluster LIFs are up and operational: `network interface show -vserver cluster`

Each cluster LIF should display "true" for "Is Home" and "up/up" for "Status Admin/Oper".

```
cluster_A::> network interface show -vserver cluster
```

Current Is	Logical	Status	Network	Current	
Vserver	Interface	Admin/Oper	Address/Mask	Node	Port
Home					
-----	-----	-----	-----	-----	
-----	-----				
Cluster					
	node_A-1_FC_clus1				
		up/up	169.254.209.69/16	node_A-1_FC	e0a
true					
	node_A_1_FC_clus2				
		up/up	169.254.49.125/16	node_A_1_FC	e0b
true					
	node_A_2_FC_clus1				
		up/up	169.254.47.194/16	node_A_2_FC	e0a
true					
	node_A_2_FC_clus2				
		up/up	169.254.19.183/16	node_A_2_FC	e0b
true					

```
4 entries were displayed.
```

```
cluster_A::>
```

5. Verify that auto-revert is enabled on all cluster LIFs: `network interface show -vserver Cluster -fields auto-revert`

```
cluster_A::> network interface show -vserver Cluster -fields auto-revert
```

Vserver	Logical Interface	Auto-revert
Cluster	node_A_1_FC_clus1	true
	node_A_1_FC_clus2	true
	node_A_2_FC_clus1	true
	node_A_2_FC_clus2	true

4 entries were displayed.

```
cluster_A::>
```

Removing the existing configuration from the Tiebreaker or other monitoring software

If the existing configuration is monitored with the MetroCluster Tiebreaker configuration or other third-party applications (for example, ClusterLion) that can initiate a switchover, you must remove the MetroCluster configuration from the Tiebreaker or other software prior to transition.

1. Remove the existing MetroCluster configuration from the Tiebreaker software.

Removing MetroCluster configurations

2. Remove the existing MetroCluster configuration from any third-party application that can initiate switchover.

Refer to the documentation for the application.

Generating and applying RCFs to the new IP switches

If you are using new IP switches for the MetroCluster IP configuration, you must configure the switches with a custom RCF file.

This task is required if you are using new switches.

If you are using existing switches, proceed to [Moving the local cluster connections](#).

1. Install and rack the new IP switches.
2. Prepare the IP switches for the application of the new RCF files.

Follow the steps in the section for your switch vendor from the [MetroCluster IP installation and](#)

configuration

- [Resetting the Broadcom IP switch to factory defaults](#)
- [Resetting the Cisco IP switch to factory defaults](#)

3. Update the firmware on the switch to a supported version, if necessary.
4. Use the RCF generator tool to create the RCF file depending on your switch vendor and the platform models, and then update the switches with the file.

Follow the steps in the section for your switch vendor from *MetroCluster IP Installation and Configuration*.

MetroCluster IP installation and configuration

- [Downloading and installing the Broadcom IP RCF files](#)
- [Downloading and installing the Cisco IP RCF files](#)

Move the local cluster connections

You must move the MetroCluster FC configuration's cluster interfaces to the IP switches.

Move the cluster connections on the MetroCluster FC nodes

You must move the cluster connections on the MetroCluster FC nodes to the IP switches. The steps depend on whether you are using the existing IP switches or you are using new IP switches.

You must perform this task on both MetroCluster sites.

Which connections to move

The following task assumes a controller module using two ports for the cluster connections. Some controller module models use four or more ports for the cluster connection. In that case, for the purposes of this example, the ports are divided into two groups, alternating ports between the two groups

The following table shows the example ports used in this task.

Number of cluster connections on the controller module	Group A ports	Group B ports
Two	e0a	e0b
Four	e0a, e0c	e0b, e0d

- Group A ports connect to local switch switch_x_1-IP.
- Group B ports connect to local switch switch_x_2-IP.

The following table shows which switch ports the FC nodes connect to. For the Broadcom BES-53248 switch, the port usage depends on the model of the MetroCluster IP nodes.

Switch model	MetroCluster IP node model	Switch port(s)	Connects to
--------------	----------------------------	----------------	-------------

Cisco 3132Q-V, 3232C, or 9336C-FX2	Any	5	Local cluster interface on FC node
		6	Local cluster interface on FC node
Broadcom BES-53248	FAS500f/A250	1 - 6	Local cluster interface on FC node
	FAS8200/A300	3, 4, 9, 10, 11, 12	Local cluster interface on FC node
	FAS8300/A400/FAS8700	1 - 6	Local cluster interface on FC node

Moving the local cluster connections when using new IP switches

If you are using new IP switches, you must physically move the existing MetroCluster FC nodes' cluster connections to the new switches.

1. Move the MetroCluster FC node group A cluster connections to the new IP switches.

Use the ports described in [Which connections to move](#).

- a. Disconnect all the group A ports from the switch, or, if the MetroCluster FC configuration was a switchless cluster, disconnect them from the partner node.
 - b. Disconnect the group A ports from node_A_1-FC and node_A_2-FC.
 - c. Connect the group A ports of node_A_1-FC to the switch ports for the FC node on switch_A_1-IP
 - d. Connect the group A ports of node_A_2-FC to the switch ports for the FC node on switch_A_1-IP
2. Verify that all cluster ports are up:

```
network port show -ip space Cluster
```

```
cluster_A::*> network port show -ipspace Cluster
```

```
Node: node_A_1-FC
```

Port	IPspace	Broadcast	Domain	Link	MTU	Speed(Mbps) Admin/Oper	Health Status
e0a	Cluster	Cluster		up	9000	auto/10000	healthy
e0b	Cluster	Cluster		up	9000	auto/10000	healthy

```
Node: node_A_2-FC
```

Port	IPspace	Broadcast	Domain	Link	MTU	Speed(Mbps) Admin/Oper	Health Status
e0a	Cluster	Cluster		up	9000	auto/10000	healthy
e0b	Cluster	Cluster		up	9000	auto/10000	healthy

```
4 entries were displayed.
```

```
cluster_A::*>
```

3. Verify that your inter-site Inter-Switch Links (ISLs) are up and the port-channels are operational:

```
show interface brief
```

In the following example, ISL ports “Eth1/15” to “Eth1/20” are configured as “Po10” for the remote site link and “Eth1/7” to “Eth1/8” are configured as “Po1” for the local cluster ISL. The state of “Eth1/15” to “Eth1/20”, “Eth1/7” to “Eth1/8”, “Po10”, and “Po1” should be 'up'.

```
IP_switch_A_1# show interface brief
```

Port	VRF	Status	IP Address	Speed	MTU
mgmt0	--	up	100.10.200.20	1000	1500

Ethernet Port Interface	VLAN	Type	Mode	Status	Reason	Speed
Eth1/1	101	eth	access	up	none	100G(D)
Eth1/2	101	eth	access	up	none	100G(D)


```

--
Eth1/3      1      eth  access  down      XCVR not inserted  auto(D)
--
Eth1/4      1      eth  access  down      XCVR not inserted  auto(D)
--
Eth1/5      1      eth  access  down      XCVR not inserted  auto(D)
--
Eth1/6      1      eth  access  down      XCVR not inserted  auto(D)
--
Eth1/7      1      eth  trunk   up        none              100G(D)
1
Eth1/8      1      eth  trunk   up        none              100G(D)
1
Eth1/9      1      eth  trunk   up        none              100G(D)
--
Eth1/10     1      eth  trunk   up        none              100G(D)
--
Eth1/11     1      eth  access  down      XCVR not inserted  auto(D)
--
Eth1/12     1      eth  access  down      XCVR not inserted  auto(D)
--
Eth1/13     1      eth  access  down      XCVR not inserted  auto(D)
--
Eth1/14     1      eth  access  down      XCVR not inserted  auto(D)
--
Eth1/15     1      eth  trunk   up        none              100G(D)
10
Eth1/16     1      eth  trunk   up        none              100G(D)
10
Eth1/17     1      eth  trunk   up        none              100G(D)
10
Eth1/18     1      eth  trunk   up        none              100G(D)
10
Eth1/19     1      eth  trunk   up        none              100G(D)
10
Eth1/20     1      eth  trunk   up        none              100G(D)
10

-----
-----
Port-channel VLAN  Type Mode   Status Reason           Speed   Protocol
Interface
-----
-----
Po1           1      eth  trunk   up        none           a-100G(D) lacp
Po10          1      eth  trunk   up        none           a-100G(D) lacp

```

```

Poll            1      eth  trunk  down  No operational  auto(D)  lacp
members
IP_switch_A_1#

```

4. Verify that all interfaces display true in the “Is Home” column:

```
network interface show -vserver cluster
```

This might take several minutes to complete.

```

cluster_A::*> network interface show -vserver cluster

      Logical      Status      Network      Current
Current Is
Vserver  Interface  Admin/Oper  Address/Mask      Node      Port
Home
-----
-----
Cluster
      node_A_1_FC_clus1
      up/up      169.254.209.69/16  node_A_1_FC      e0a
true
      node_A_1-FC_clus2
      up/up      169.254.49.125/16  node_A_1-FC      e0b
true
      node_A_2-FC_clus1
      up/up      169.254.47.194/16  node_A_2-FC      e0a
true
      node_A_2-FC_clus2
      up/up      169.254.19.183/16  node_A_2-FC      e0b
true

4 entries were displayed.

cluster_A::*>

```

5. Perform the above steps on both nodes (node_A_1-FC and node_A_2-FC) to move the group B ports of the cluster interfaces.
6. Repeat the above steps on the partner cluster “cluster_B”.

Moving the local cluster connections when reusing existing IP switches

If you are reusing existing IP switches, you must update firmware, reconfigure the switches with the correct Reference Configure Files (RCFs) and move the connections to the correct ports one switch at a time.

This task is required only if the FC nodes are connected to existing IP switches and you are reusing the switches.

1. Disconnect the local cluster connections that connect to switch_A_1_IP
 - a. Disconnect the group A ports from the existing IP switch.
 - b. Disconnect the ISL ports on switch_A_1_IP.

You can see the Installation and Setup instructions for the platform to see the cluster port usage.

[AFF A320 systems: Installation and setup](#)

[AFF A220/FAS2700 Systems Installation and Setup Instructions](#)

[AFF A800 Systems Installation and Setup Instructions](#)

[AFF A300 Systems Installation and Setup Instructions](#)

[FAS8200 Systems Installation and Setup Instructions](#)

2. Reconfigure switch_A_1_IP using RCF files generated for your platform combination and transition.

Follow the steps in the procedure for your switch vendor from *MetroCluster IP Installation and Configuration*:

[MetroCluster IP installation and configuration](#)

- a. If required, download and install the new switch firmware.

You should use the latest firmware that the MetroCluster IP nodes support.

- [Downloading and installing the Broadcom switch EFOS software](#)
- [Downloading and installing the Cisco switch NX-OS software](#)

- b. Prepare the IP switches for the application of the new RCF files.

- [Resetting the Broadcom IP switch to factory defaults **](#)
- [Resetting the Cisco IP switch to factory defaults](#)

- c. Download and install the IP RCF file depending on your switch vendor.

- [Downloading and installing the Broadcom IP RCF files](#)
- [Downloading and installing the Cisco IP RCF files](#)

3. Reconnect the group A ports to switch_A_1_IP.

Use the ports described in [Which connections to move](#).

4. Verify that all cluster ports are up:

```
network port show -ipspace cluster
```

```
Cluster-A::*> network port show -ipspace cluster
```

```
Node: node_A_1_FC
```

Port	IPspace	Broadcast	Domain	Link	MTU	Speed(Mbps) Admin/Oper	Health Status
e0a	Cluster	Cluster		up	9000	auto/10000	healthy
e0b	Cluster	Cluster		up	9000	auto/10000	healthy

```
Node: node_A_2_FC
```

Port	IPspace	Broadcast	Domain	Link	MTU	Speed(Mbps) Admin/Oper	Health Status
e0a	Cluster	Cluster		up	9000	auto/10000	healthy
e0b	Cluster	Cluster		up	9000	auto/10000	healthy

```
4 entries were displayed.
```

```
Cluster-A::*>
```

5. Verify that all interfaces are on their home port:

```
network interface show -vserver Cluster
```

```
Cluster-A::*> network interface show -vserver Cluster
```

Current Is	Logical	Status	Network	Current	
Vserver	Interface	Admin/Oper	Address/Mask	Node	Port
Home					
-----	-----	-----	-----	-----	-----
Cluster					
	node_A_1_FC_clus1	up/up	169.254.209.69/16	node_A_1_FC	e0a
true					
	node_A_1_FC_clus2	up/up	169.254.49.125/16	node_A_1_FC	e0b
true					
	node_A_2_FC_clus1	up/up	169.254.47.194/16	node_A_2_FC	e0a
true					
	node_A_2_FC_clus2	up/up	169.254.19.183/16	node_A_2_FC	e0b
true					

4 entries were displayed.

```
Cluster-A::*>
```

6. Repeat all the previous steps on switch_A_2_IP.
7. Reconnect the local cluster ISL ports.
8. Repeat the above steps at site_B for switch B_1_IP and switch B_2_IP.
9. Connect the remote ISLs between the sites.

Verifying that the cluster connections are moved and the cluster is healthy

To ensure that there is proper connectivity and that the configuration is ready to proceed with the transition process, you must verify that the cluster connections are moved correctly, the cluster switches are recognized and the cluster is healthy.

1. Verify that all cluster ports are up and running:

```
network port show -ipSPACE Cluster
```

```
Cluster-A::*> network port show -ipspace Cluster
```

```
Node: Node-A-1-FC
```

Port	IPspace	Broadcast	Domain	Link	MTU	Speed(Mbps) Admin/Oper	Health Status
e0a	Cluster	Cluster		up	9000	auto/10000	healthy
e0b	Cluster	Cluster		up	9000	auto/10000	healthy

```
Node: Node-A-2-FC
```

Port	IPspace	Broadcast	Domain	Link	MTU	Speed(Mbps) Admin/Oper	Health Status
e0a	Cluster	Cluster		up	9000	auto/10000	healthy
e0b	Cluster	Cluster		up	9000	auto/10000	healthy

```
4 entries were displayed.
```

```
Cluster-A::*>
```

2. Verify that all interfaces are on their home port:

```
network interface show -vserver Cluster
```

This might take several minutes to complete.

The following example shows that all interfaces show true in the “Is Home” column.

```
Cluster-A::*> network interface show -vserver Cluster
```

	Logical	Status	Network	Current	
Current Is					
Vserver	Interface	Admin/Oper	Address/Mask	Node	Port
Home					
-----	-----	-----	-----	-----	-----
-----	-----				
Cluster					
	Node-A-1_FC_clus1				
		up/up	169.254.209.69/16	Node-A-1_FC	e0a
true					
	Node-A-1-FC_clus2				
		up/up	169.254.49.125/16	Node-A-1-FC	e0b
true					
	Node-A-2-FC_clus1				
		up/up	169.254.47.194/16	Node-A-2-FC	e0a
true					
	Node-A-2-FC_clus2				
		up/up	169.254.19.183/16	Node-A-2-FC	e0b
true					

4 entries were displayed.

```
Cluster-A::*>
```

3. Verify that both the local IP switches are discovered by the nodes:

```
network device-discovery show -protocol cdp
```

```
Cluster-A::*> network device-discovery show -protocol cdp
```

Node/ Protocol	Local Port	Discovered Device (LLDP: ChassisID)	Interface	Platform

Node-A-1-FC				
	/cdp			
	e0a	Switch-A-3-IP	1/5/1	N3K-
C3232C				
	e0b	Switch-A-4-IP	0/5/1	N3K-
C3232C				
Node-A-2-FC				
	/cdp			
	e0a	Switch-A-3-IP	1/6/1	N3K-
C3232C				
	e0b	Switch-A-4-IP	0/6/1	N3K-
C3232C				

```
4 entries were displayed.
```

```
Cluster-A::*>
```

4. On the IP switch, verify that the MetroCluster IP nodes have been discovered by both local IP switches:

```
show cdp neighbors
```

You must perform this step on each switch.

This example shows how to verify the nodes are discovered on Switch-A-3-IP.


```
(Switch-A-3-IP)# show cdp neighbors
```

Capability Codes: R - Router, T - Trans-Bridge, B - Source-Route-Bridge
S - Switch, H - Host, I - IGMP, r - Repeater,
V - VoIP-Phone, D - Remotely-Managed-Device,
s - Supports-STP-Dispute

Device-ID ID	Local Intrfce	Hldtme	Capability	Platform	Port
Node-A-1-FC	Eth1/5/1	133	H	FAS8200	e0a
Node-A-2-FC	Eth1/6/1	133	H	FAS8200	e0a
Switch-A-4-IP (FDO220329A4)	Eth1/7	175	R S I s	N3K-C3232C	Eth1/7
Switch-A-4-IP (FDO220329A4)	Eth1/8	175	R S I s	N3K-C3232C	Eth1/8
Switch-B-3-IP (FDO220329B3)	Eth1/20	173	R S I s	N3K-C3232C	
Eth1/20					
Switch-B-3-IP (FDO220329B3)	Eth1/21	173	R S I s	N3K-C3232C	
Eth1/21					

Total entries displayed: 4

```
(Switch-A-3-IP)#
```

This example shows how to verify that the nodes are discovered on Switch-A-4-IP.

```
(Switch-A-4-IP)# show cdp neighbors
```

```
Capability Codes: R - Router, T - Trans-Bridge, B - Source-Route-Bridge  
S - Switch, H - Host, I - IGMP, r - Repeater,  
V - VoIP-Phone, D - Remotely-Managed-Device,  
s - Supports-STP-Dispute
```

Device-ID ID	Local Intrfce	Hldtme	Capability	Platform	Port
Node-A-1-FC	Eth1/5/1	133	H	FAS8200	e0b
Node-A-2-FC	Eth1/6/1	133	H	FAS8200	e0b
Switch-A-3-IP (FDO220329A3)	Eth1/7	175	R S I s	N3K-C3232C	Eth1/7
Switch-A-3-IP (FDO220329A3)	Eth1/8	175	R S I s	N3K-C3232C	Eth1/8
Switch-B-4-IP (FDO220329B4)	Eth1/20	169	R S I s	N3K-C3232C	
Eth1/20					
Switch-B-4-IP (FDO220329B4)	Eth1/21	169	R S I s	N3K-C3232C	
Eth1/21					

```
Total entries displayed: 4
```

```
(Switch-A-4-IP)#
```

Preparing the MetroCluster IP controllers

You must prepare the four new MetroCluster IP nodes and install the correct ONTAP version.

This task must be performed on each of the new nodes:

- node_A_1-IP
- node_A_2-IP
- node_B_1-IP
- node_B_2-IP

In these steps, you clear the configuration on the nodes and clear the mailbox region on new drives.

1. Rack the new controllers for the MetroCluster IP configuration.

The MetroCluster FC nodes (node_A_x-FC and node_B_x-FC) remain cabled at this time.

2. Cable the MetroCluster IP nodes to the IP switches as shown in the [Cabling the IP switches](#).
3. Configure the MetroCluster IP nodes using the following sections:

- a. [Gathering required information](#)
 - b. [Clearing the configuration on a controller module](#)
 - c. [Verifying the ha-config state of components](#)
 - d. [Manually assigning drives for pool 0 \(ONTAP 9.4 and later\)](#)
4. From Maintenance mode, issue the halt command to exit Maintenance mode, and then issue the boot_ontap command to boot the system and get to cluster setup.

Do not complete the cluster wizard or node wizard at this time.

5. Repeat these steps on the other MetroCluster IP nodes.

Configure the MetroCluster for transition

To prepare the configuration for transition you add the new nodes to the existing MetroCluster configuration and then move data to the new nodes.

Sending a custom AutoSupport message prior to maintenance

Before performing the maintenance, you should issue an AutoSupport message to notify NetApp technical support that maintenance is underway. Informing technical support that maintenance is underway prevents them from opening a case on the assumption that a disruption has occurred.

About this task

This task must be performed on each MetroCluster site.

Steps

1. To prevent automatic support case generation, send an Autosupport message to indicate maintenance is underway:

```
system node autosupport invoke -node * -type all -message MAINT=maintenance-  
window-in-hours
```

“maintenance-window-in-hours” specifies the length of the maintenance window, with a maximum of 72 hours. If the maintenance is completed before the time has elapsed, you can invoke an AutoSupport message indicating the end of the maintenance period:

```
system node autosupport invoke -node * -type all -message MAINT=end
```

2. Repeat the command on the partner cluster.

Enabling transition mode and disabling cluster HA

You must enable the MetroCluster transition mode to allow the old and new nodes to operate together in the MetroCluster configuration, and disable cluster HA.

1. Enable transition:
 - a. Change to the advanced privilege level:

```
set -privilege advanced
```

- b. Enable transition mode:

```
metrocluster transition enable -transition-mode non-disruptive
```



Run this command on one cluster only.

```
cluster_A::*> metrocluster transition enable -transition-mode non-  
disruptive
```

```
Warning: This command enables the start of a "non-disruptive"  
MetroCluster
```

```
FC-to-IP transition. It allows the addition of hardware for  
another DR
```

```
group that uses IP fabrics, and the removal of a DR group  
that uses FC
```

```
fabrics. Clients will continue to access their data during a  
non-disruptive transition.
```

```
Automatic unplanned switchover will also be disabled by this  
command.
```

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

```
cluster_A::*>
```

c. Return to the admin privilege level:

```
set -privilege admin
```

2. Verify that transition is enabled on both the clusters.

```
cluster_A::> metrocluster transition show-mode  
Transition Mode
```

```
non-disruptive
```

```
cluster_A::*>
```

```
cluster_B::*> metrocluster transition show-mode  
Transition Mode
```

```
non-disruptive
```

```
Cluster_B::>
```

3. Disable cluster HA.



You must run this command on both clusters.

```
cluster_A::~*> cluster ha modify -configured false
```

```
Warning: This operation will unconfigure cluster HA. Cluster HA must be  
configured on a two-node cluster to ensure data access availability in  
the event of storage failover.
```

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

```
Notice: HA is disabled.
```

```
cluster_A::~*>
```

```
cluster_B::~*> cluster ha modify -configured false
```

```
Warning: This operation will unconfigure cluster HA. Cluster HA must be  
configured on a two-node cluster to ensure data access availability in  
the event of storage failover.
```

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

```
Notice: HA is disabled.
```

```
cluster_B::~*>
```

4. Verify that cluster HA is disabled.



You must run this command on both clusters.

```
cluster_A::> cluster ha show
```

```
High Availability Configured: false
```

```
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.
```

```
cluster_A::>
```

```
cluster_B::> cluster ha show
```

```
High Availability Configured: false
```

```
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.
```

```
cluster_B::>
```

Joining the MetroCluster IP nodes to the clusters

You must add the four new MetroCluster IP nodes to the existing MetroCluster configuration.

About this task

You must perform this task on both clusters.

Steps

1. Add the MetroCluster IP nodes to the existing MetroCluster configuration.
 - a. Join the first MetroCluster IP node (node_A_1-IP) to the existing MetroCluster FC configuration.

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

```
You can enter the following commands at any time:
```

```
"help" or "?" - if you want to have a question clarified,
```

```
"back" - if you want to change previously answered questions, and
```

```
"exit" or "quit" - if you want to quit the cluster setup wizard.
```

```
Any changes you made before quitting will be saved.
```

```
You can return to cluster setup at any time by typing "cluster  
setup".
```

```
To accept a default or omit a question, do not enter a value.
```

This system will send event messages and periodic reports to NetApp Technical Support. To disable this feature, enter `autosupport modify -support disable` within 24 hours.

Enabling AutoSupport can significantly speed problem determination and resolution, should a problem occur on your system. For further information on AutoSupport, see: <http://support.netapp.com/autosupport/>

Type yes to confirm and continue {yes}: yes

Enter the node management interface port [e0M]:
Enter the node management interface IP address: 172.17.8.93
Enter the node management interface netmask: 255.255.254.0
Enter the node management interface default gateway: 172.17.8.1
A node management interface on port e0M with IP address 172.17.8.93 has been created.

Use your web browser to complete cluster setup by accessing <https://172.17.8.93>

Otherwise, press Enter to complete cluster setup using the command line interface:

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

Existing cluster interface configuration found:

Port	MTU	IP	Netmask
e0c	9000	169.254.148.217	255.255.0.0
e0d	9000	169.254.144.238	255.255.0.0

Do you want to use this configuration? {yes, no} [yes]: yes
.
.
.

- b. Join the second MetroCluster IP node (node_A_2-IP) to the existing MetroCluster FC configuration.
2. Repeat these steps to join node_B_1-IP and node_B_2-IP to cluster_B.

Configuring intercluster LIFs, creating the MetroCluster interfaces, and mirroring root aggregates

You must create cluster peering LIFs, create the MetroCluster interfaces on the new MetroCluster IP nodes.

About this task

The home port used in the examples are platform-specific. You should use the appropriate home port specific to MetroCluster IP node platform.

Steps

1. On the new MetroCluster IP nodes, [configure the intercluster LIFs](#).
2. On each site, verify that cluster peering is configured:

```
cluster peer show
```

The following example shows the cluster peering configuration on cluster_A:

```
cluster_A:> cluster peer show
Peer Cluster Name      Cluster Serial Number Availability
Authentication
-----
cluster_B              1-80-000011      Available      ok
```

The following example shows the cluster peering configuration on cluster_B:

```
cluster_B:> cluster peer show
Peer Cluster Name      Cluster Serial Number Availability
Authentication
-----
cluster_A 1-80-000011 Available ok
```

3. Configure the DR group for the MetroCluster IP nodes:

```
metrocluster configuration-settings dr-group create -partner-cluster
```

```
cluster_A::> metrocluster configuration-settings dr-group create
-partner-cluster
cluster_B -local-node node_A_3-IP -remote-node node_B_3-IP
[Job 259] Job succeeded: DR Group Create is successful.
cluster_A::>
```

4. Verify that the DR group is created.

```
metrocluster configuration-settings dr-group show
```



```
cluster_A::> metrocluster configuration-settings dr-group show
```

DR Group ID	Cluster	Node	DR Partner
2	cluster_A	node_A_3-IP	node_B_3-IP
		node_A_4-IP	node_B_4-IP
	cluster_B	node_B_3-IP	node_A_3-IP
		node_B_4-IP	node_A_4-IP

4 entries were displayed.

```
cluster_A::>
```

You will notice that the DR group for the old MetroCluster FC nodes (DR Group 1) is not listed when you run the `metrocluster configuration-settings dr-group show` command.

You can use `metrocluster node show` command on both sites to list all nodes.

```
cluster_A::> metrocluster node show
```

DR Group	Cluster	Node	Configuration State	DR Mirroring	Mode
-----	-----	-----	-----	-----	-----
1	cluster_A				
		node_A_1-FC	configured	enabled	normal
		node_A_2-FC	configured	enabled	normal
	cluster_B				
		node_B_1-FC	configured	enabled	normal
		node_B_2-FC	configured	enabled	normal
2	cluster_A				
		node_A_1-IP	ready to configure	-	-
		node_A_2-IP	ready to configure	-	-

```
cluster_B::> metrocluster node show
```

DR Group	Cluster	Node	Configuration State	DR Mirroring	Mode
-----	-----	-----	-----	-----	-----
1	cluster_B				
		node_B_1-FC	configured	enabled	normal
		node_B_2-FC	configured	enabled	normal
	cluster_A				
		node_A_1-FC	configured	enabled	normal
		node_A_2-FC	configured	enabled	normal
2	cluster_B				
		node_B_1-IP	ready to configure	-	-
		node_B_2-IP	ready to configure	-	-

5. Configure the MetroCluster IP interfaces for the newly joined MetroCluster IP nodes:

```
metrocluster configuration-settings interface create -cluster-name
```

See [Configuring and connecting the MetroCluster IP interfaces](#) for considerations when configuring the IP interfaces.



You can configure the MetroCluster IP interfaces from either cluster. Also, beginning with ONTAP 9.9.1, if you are using a layer 3 configuration, you must also specify the `-gateway` parameter when creating MetroCluster IP interfaces. Refer to xref:./transition/./install-ip/concept_considerations_layer_3.html.

```
cluster_A::> metrocluster configuration-settings interface create
-cluster-name cluster_A -home-node node_A_3-IP -home-port elb -address
172.17.26.10 -netmask 255.255.255.0
[Job 260] Job succeeded: Interface Create is successful.
```

```
cluster_A::> metrocluster configuration-settings interface create
-cluster-name cluster_A -home-node node_A_3-IP -home-port elb -address
172.17.27.10 -netmask 255.255.255.0
[Job 261] Job succeeded: Interface Create is successful.
```

```
cluster_A::> metrocluster configuration-settings interface create
-cluster-name cluster_A -home-node node_A_4-IP -home-port elb -address
172.17.26.11 -netmask 255.255.255.0
[Job 262] Job succeeded: Interface Create is successful.
```

```
cluster_A::> :metrocluster configuration-settings interface create
-cluster-name cluster_A -home-node node_A_4-IP -home-port elb -address
172.17.27.11 -netmask 255.255.255.0
[Job 263] Job succeeded: Interface Create is successful.
```

```
cluster_A::> metrocluster configuration-settings interface create
-cluster-name cluster_B -home-node node_B_3-IP -home-port elb -address
172.17.26.12 -netmask 255.255.255.0
[Job 264] Job succeeded: Interface Create is successful.
```

```
cluster_A::> metrocluster configuration-settings interface create
-cluster-name cluster_B -home-node node_B_3-IP -home-port elb -address
172.17.27.12 -netmask 255.255.255.0
[Job 265] Job succeeded: Interface Create is successful.
```

```
cluster_A::> metrocluster configuration-settings interface create
-cluster-name cluster_B -home-node node_B_4-IP -home-port elb -address
172.17.26.13 -netmask 255.255.255.0
[Job 266] Job succeeded: Interface Create is successful.
```

```
cluster_A::> metrocluster configuration-settings interface create
-cluster-name cluster_B -home-node node_B_4-IP -home-port elb -address
172.17.27.13 -netmask 255.255.255.0
[Job 267] Job succeeded: Interface Create is successful.
```

6. Verify the MetroCluster IP interfaces are created:

metrocluster configuration-settings interface show

```
cluster_A::>metrocluster configuration-settings interface show
```

DR

Config

Group	Cluster	Node	Network Address	Netmask	Gateway
State					

2 cluster_A

node_A_3-IP

Home Port: e1a

172.17.26.10 255.255.255.0 -

completed

Home Port: e1b

172.17.27.10 255.255.255.0 -

completed

node_A_4-IP

Home Port: e1a

172.17.26.11 255.255.255.0 -

completed

Home Port: e1b

172.17.27.11 255.255.255.0 -

completed

cluster_B

node_B_3-IP

Home Port: e1a

172.17.26.13 255.255.255.0 -

completed

Home Port: e1b

172.17.27.13 255.255.255.0 -

completed

node_B_3-IP

Home Port: e1a

172.17.26.12 255.255.255.0 -

completed

Home Port: e1b

172.17.27.12 255.255.255.0 -

completed

8 entries were displayed.

cluster_A>

7. Connect the MetroCluster IP interfaces:

```
metrocluster configuration-settings connection connect
```



This command might take several minutes to complete.

```
cluster_A::> metrocluster configuration-settings connection connect  
cluster_A::>
```

8. Verify the connections are properly established:

```
metrocluster configuration-settings connection show
```

```
cluster_A::> metrocluster configuration-settings connection show
```

DR	Source	Destination
Group	Cluster Node	Network Address
Config	State	Partner Type
-----	-----	-----
2	cluster_A	
	node_A_3-IP**	
	Home Port: e1a	
	172.17.26.10	172.17.26.11 HA Partner
completed		
	Home Port: e1a	
	172.17.26.10	172.17.26.12 DR Partner
completed		
	Home Port: e1a	
	172.17.26.10	172.17.26.13 DR Auxiliary
completed		
	Home Port: e1b	
	172.17.27.10	172.17.27.11 HA Partner
completed		
	Home Port: e1b	
	172.17.27.10	172.17.27.12 DR Partner
completed		
	Home Port: e1b	
	172.17.27.10	172.17.27.13 DR Auxiliary
completed		
	node_A_4-IP	
	Home Port: e1a	
	172.17.26.11	172.17.26.10 HA Partner
completed		

```

completed      Home Port: ela
                172.17.26.11    172.17.26.13    DR Partner

completed      Home Port: ela
                172.17.26.11    172.17.26.12    DR Auxiliary

completed      Home Port: elb
                172.17.27.11    172.17.27.10    HA Partner

completed      Home Port: elb
                172.17.27.11    172.17.27.13    DR Partner

completed      Home Port: elb
                172.17.27.11    172.17.27.12    DR Auxiliary

DR
Group Cluster Node      Source      Destination
Config State      Network Address Network Address Partner Type
-----
2      cluster_B
      node_B_4-IP
      Home Port: ela
      172.17.26.13    172.17.26.12    HA Partner
completed
      Home Port: ela
      172.17.26.13    172.17.26.11    DR Partner
completed
      Home Port: ela
      172.17.26.13    172.17.26.10    DR Auxiliary
completed
      Home Port: elb
      172.17.27.13    172.17.27.12    HA Partner
completed
      Home Port: elb
      172.17.27.13    172.17.27.11    DR Partner
completed
      Home Port: elb
      172.17.27.13    172.17.27.10    DR Auxiliary
completed
      node_B_3-IP
      Home Port: ela
      172.17.26.12    172.17.26.13    HA Partner
completed
      Home Port: ela

```

```

172.17.26.12      172.17.26.10      DR Partner
completed
Home Port: ela
172.17.26.12      172.17.26.11      DR Auxiliary
completed
Home Port: elb
172.17.27.12      172.17.27.13      HA Partner
completed
Home Port: elb
172.17.27.12      172.17.27.10      DR Partner
completed
Home Port: elb
172.17.27.12      172.17.27.11      DR Auxiliary
completed
24 entries were displayed.

cluster_A::>

```

9. Verify disk autoassignment and partitioning:

```
disk show -pool Pool1
```

```
cluster_A::> disk show -pool Pool1
```

Disk Owner	Usable Size	Shelf	Bay	Disk Type	Container Type	Container Name
-----	-----	-----	---	-----	-----	-----
1.10.4	-	10	4	SAS	remote	-
node_B_2						
1.10.13	-	10	13	SAS	remote	-
node_B_2						
1.10.14	-	10	14	SAS	remote	-
node_B_1						
1.10.15	-	10	15	SAS	remote	-
node_B_1						
1.10.16	-	10	16	SAS	remote	-
node_B_1						
1.10.18	-	10	18	SAS	remote	-
node_B_2						
...						
2.20.0	546.9GB	20	0	SAS	aggregate	aggr0_rha1_a1
node_a_1						
2.20.3	546.9GB	20	3	SAS	aggregate	aggr0_rha1_a2
node_a_2						
2.20.5	546.9GB	20	5	SAS	aggregate	rha1_a1_aggr1
node_a_1						
2.20.6	546.9GB	20	6	SAS	aggregate	rha1_a1_aggr1
node_a_1						
2.20.7	546.9GB	20	7	SAS	aggregate	rha1_a2_aggr1
node_a_2						
2.20.10	546.9GB	20	10	SAS	aggregate	rha1_a1_aggr1
node_a_1						
...						

43 entries were displayed.

```
cluster_A::>
```

10. Mirror the root aggregates:

```
storage aggregate mirror -aggregate aggr0_node_A_3-IP
```



You must complete this step on each MetroCluster IP node.


```
cluster_A::> aggr mirror -aggregate aggr0_node_A_3-IP
```

Info: Disks would be added to aggregate "aggr0_node_A_3-IP" on node "node_A_3-IP" in the following manner:

Second Plex

RAID Group rg0, 3 disks (block checksum, raid_dp)

Physical Size	Position	Disk	Type	Usable Size
-----	-----	-----	-----	-----
-----	dparity	4.20.0	SAS	-
-	parity	4.20.3	SAS	-
-	data	4.20.1	SAS	546.9GB
558.9GB				

Aggregate capacity available for volume use would be 467.6GB.

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

```
cluster_A::>
```

11. Verify that the root aggregates are mirrored:

```
storage aggregate show
```

```
cluster_A::> aggr show
```

Aggregate Status	Size	Available	Used%	State	#Vols	Nodes	RAID
-----	-----	-----	-----	-----	-----	-----	-----
aggr0_node_A_1-FC	349.0GB	16.84GB	95%	online	1	node_A_1-FC	
raid_dp,							
mirrored,							
normal							

```

aggr0_node_A_2-FC
          349.0GB    16.84GB    95% online          1 node_A_2-FC
raid_dp,

mirrored,

normal
aggr0_node_A_3-IP
          467.6GB    22.63GB    95% online          1 node_A_3-IP
raid_dp,

mirrored,

normal
aggr0_node_A_4-IP
          467.6GB    22.62GB    95% online          1 node_A_4-IP
raid_dp,

mirrored,

normal
aggr_data_a1
          1.02TB     1.01TB     1% online          1 node_A_1-FC
raid_dp,

mirrored,

normal
aggr_data_a2
          1.02TB     1.01TB     1% online          1 node_A_2-FC
raid_dp,

mirrored,

```

Finalizing the addition of the MetroCluster IP nodes

You must incorporate the new DR group into the MetroCluster configuration and create mirrored data aggregates on the new nodes.

Steps

1. Configure the MetroCluster to implement the changes:

```
metrocluster configure
```



You must run `metrocluster configure` **and not** `metrocluster configure -refresh true`

```
cluster_A::> metrocluster configure

[Job 439] Job succeeded: Configure is successful.

cluster_A::>
```

2. Verify that the nodes are added to their DR group:

```
metrocluster node show
```

```
cluster_A::> metrocluster node show
```

DR Group	Cluster	Node	Configuration State	DR Mirroring	Mode	
1	cluster_A	node-A-1-FC	configured	enabled	normal	
		node-A-2-FC	configured	enabled	normal	
	Cluster-B	node-B-1-FC	configured	enabled	normal	
		node-B-2-FC	configured	enabled	normal	
	2	cluster_A	node-A-3-IP	configured	enabled	normal
			node-A-4-IP	configured	enabled	normal
		Cluster-B	node-B-3-IP	configured	enabled	normal
			node-B-4-IP	configured	enabled	normal

8 entries were displayed.

```
cluster_A::>
```

3. Create mirrored data aggregates on each of the new MetroCluster nodes:

```
storage aggregate create -aggregate aggregate-name -node node-name -diskcount
no-of-disks -mirror true
```



You must create at least one mirrored data aggregate per site. It is recommended to have two mirrored data aggregates per site on MetroCluster IP nodes to host the MDV volumes, however a single aggregate per site is supported (but not recommended). It is support that one site of the MetroCluster has a single mirrored data aggregate and the other site has more than one mirrored data aggregate.

The following example shows the creation of an aggregate on node_A_1-new.

```
cluster_A::> storage aggregate create -aggregate data_a3 -node node_A_1-
new -diskcount 10 -mirror t
```

Info: The layout for aggregate "data_a3" on node "node_A_1-new" would be:

First Plex

RAID Group rg0, 5 disks (block checksum, raid_dp)

				Usable
Physical	Position	Disk	Type	Size
Size				
-----	-----	-----	-----	-----
-----	dparity	5.10.15	SAS	-
-	parity	5.10.16	SAS	-
-	data	5.10.17	SAS	546.9GB
547.1GB	data	5.10.18	SAS	546.9GB
558.9GB	data	5.10.19	SAS	546.9GB
558.9GB				

Second Plex

RAID Group rg0, 5 disks (block checksum, raid_dp)

				Usable
Physical	Position	Disk	Type	Size
Size				
-----	-----	-----	-----	-----
-----	dparity	4.20.17	SAS	-
-	parity	4.20.14	SAS	-
-	data	4.20.18	SAS	546.9GB
547.1GB	data	4.20.19	SAS	546.9GB
547.1GB	data	4.20.16	SAS	546.9GB
547.1GB				

Aggregate capacity available for volume use would be 1.37TB.

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

[Job 440] Job succeeded: DONE

cluster_A::>

4. Move the MDV_CRS volumes from the old nodes to the new nodes in advanced privilege.

a. Display the volumes to identify the MDV volumes:



If you have a single mirrored data aggregate per site then move both the MDV volumes to this single aggregate. If you have two or more mirrored data aggregates, then move each MDV volume to a different aggregate.

The following example shows the MDV volumes in the volume show output:

```
cluster_A::> volume show
Vserver   Volume                               Aggregate   State      Type      Size
Available Used%
-----
...

cluster_A MDV_CRS_2c78e009ff5611e9b0f300a0985ef8c4_A
          aggr_b1             -          RW          -
- -
cluster_A MDV_CRS_2c78e009ff5611e9b0f300a0985ef8c4_B
          aggr_b2             -          RW          -
- -
cluster_A MDV_CRS_d6b0b313ff5611e9837100a098544e51_A
          aggr_a1             online     RW          10GB
9.50GB    0%
cluster_A MDV_CRS_d6b0b313ff5611e9837100a098544e51_B
          aggr_a2             online     RW          10GB
9.50GB    0%
...
11 entries were displayed.mple
```

b. Set the advanced privilege level:

```
set -privilege advanced
```

c. Move the MDV volumes, one at a time:

```
volume move start -volume mdv-volume -destination-aggregate aggr-on-new-node
-vserver vserver-name
```

The following example shows the command and output for moving MDV_CRS_d6b0b313ff5611e9837100a098544e51_A to aggregate data_a3 on node_A_3.

```
cluster_A::*> vol move start -volume
MDV_CRS_d6b0b313ff5611e9837100a098544e51_A -destination-aggregate
data_a3 -vserver cluster_A

Warning: You are about to modify the system volume
"MDV_CRS_d6b0b313ff5611e9837100a098544e51_A". This might
cause severe
performance or stability problems. Do not proceed unless
directed to
do so by support. Do you want to proceed? {y|n}: y
[Job 494] Job is queued: Move
"MDV_CRS_d6b0b313ff5611e9837100a098544e51_A" in Vserver "cluster_A"
to aggregate "data_a3". Use the "volume move show -vserver cluster_A
-volume MDV_CRS_d6b0b313ff5611e9837100a098544e51_A" command to view
the status of this operation.
```

- d. Use the volume show command to check that the MDV volume has been successfully moved:

```
volume show mdv-name
```

The following output shows that the MDV volume has been successfully moved.

```
cluster_A::*> vol show MDV_CRS_d6b0b313ff5611e9837100a098544e51_B
Vserver      Volume      Aggregate      State      Type      Size
Available Used%
-----
cluster_A    MDV_CRS_d6b0b313ff5611e9837100a098544e51_B
aggr_a2      online      RW            10GB
9.50GB      0%
```

- e. Return to admin mode:

```
set -privilege admin
```

Moving the data to the new drive shelves

During the transition, you move data from the drive shelves in the MetroCluster FC configuration to the new MetroCluster IP configuration.

Before you begin

You should create new SAN LIFs on the destination or IP nodes and connect hosts prior to moving volumes to new the new aggregates.

1. To resume automatic support case generation, send an Autosupport message to indicate that the maintenance is complete.
 - a. Issue the following command: `system node autosupport invoke -node * -type all -message MAINT=end`
 - b. Repeat the command on the partner cluster.

2. Move the data volumes to aggregates on the new controllers, one volume at a time.

Use the procedure in [Creating an aggregate and moving volumes to the new nodes](#).

3. Create SAN LIFs on the recently added nodes.

Use the following procedure in [Updating LUN paths for the new nodes](#).

4. Check if there are any node locked licenses on the FC nodes, if there are, they need to be added to the newly added nodes.

Use the following procedure in [Adding node-locked licenses](#).

5. Migrate the data LIFs.

Use the procedure in [Moving non-SAN data LIFs and cluster management LIFs to the new nodes](#) but do **not** perform the last two steps to migrate cluster management LIFs.



- You cannot migrate a LIF that is used for copy-offload operations with VMware vStorage APIs for Array Integration (VAAI).
- After you complete the transition of your MetroCluster nodes from FC to IP, you might need to move your iSCSI host connections to the new nodes, see [Moving Linux iSCSI hosts from MetroCluster FC to MetroCluster IP nodes](#).

Removing the MetroCluster FC controllers

You must perform clean-up tasks and remove the old controller modules from the MetroCluster configuration.

1. To prevent automatic support case generation, send an Autosupport message to indicate maintenance is underway.
 - a. Issue the following command: `system node autosupport invoke -node * -type all -message MAINT=maintenance-window-in-hours`

 maintenance-window-in-hours specifies the length of the maintenance window, with a maximum of 72 hours. If the maintenance is completed before the time has elapsed, you can invoke an AutoSupport message indicating the end of the maintenance period: `system node autosupport invoke -node * -type all -message MAINT=end`
 - b. Repeat the command on the partner cluster.
2. Identify the aggregates hosted on the MetroCluster FC configuration that need to be deleted.

In this example the following data aggregates are hosted by the MetroCluster FC cluster_B and need to be deleted: `aggr_data_a1` and `aggr_data_a2`.



You need to perform the steps to identify, offline and delete the data aggregates on both the clusters. The example is for one cluster only.

```
cluster_B::> aggr show
```

Aggregate Status	Size	Available	Used%	State	#Vols	Nodes	RAID
-----	-----	-----	-----	-----	-----	-----	-----
aggr0_node_A_1-FC	349.0GB	16.83GB	95%	online	1	node_A_1-FC	
raid_dp,							
mirrored,							
normal							
aggr0_node_A_2-FC	349.0GB	16.83GB	95%	online	1	node_A_2-FC	
raid_dp,							
mirrored,							
normal							
aggr0_node_A_3-IP	467.6GB	22.63GB	95%	online	1	node_A_3-IP	
raid_dp,							
mirrored,							
normal							
aggr0_node_A_3-IP	467.6GB	22.62GB	95%	online	1	node_A_4-IP	
raid_dp,							
mirrored,							
normal							
aggr_data_a1	1.02TB	1.02TB	0%	online	0	node_A_1-FC	
raid_dp,							
mirrored,							
normal							
aggr_data_a2							


```

1.02TB      1.02TB      0% online      0 node_A_2-FC
raid_dp,

mirrored,

normal
aggr_data_a3
1.37TB      1.35TB      1% online      3 node_A_3-IP
raid_dp,

mirrored,

normal
aggr_data_a4
1.25TB      1.24TB      1% online      2 node_A_4-IP
raid_dp,

mirrored,

normal
8 entries were displayed.

```

```
cluster_B::>
```

3. Check if the data aggregates on the FC nodes have any MDV_aud volumes, and delete them prior to deleting the aggregates.

You must delete the MDV_aud volumes as they cannot be moved.

4. Take each of the data aggregates offline, and then delete them:
 - a. Take the aggregate offline: `storage aggregate offline -aggregate aggregate-name`

The following example shows the aggregate `aggr_data_a1` being taken offline:

```
cluster_B::> storage aggregate offline -aggregate aggr_data_a1

Aggregate offline successful on aggregate: aggr_data_a1
```

- b. Delete the aggregate: `storage aggregate delete -aggregate aggregate-name`

You can destroy the plex when prompted.

The following example shows the aggregate `aggr_data_a1` being deleted.

```
cluster_B::> storage aggregate delete -aggregate aggr_data_a1
Warning: Are you sure you want to destroy aggregate "aggr_data_a1"?
{y|n}: y
[Job 123] Job succeeded: DONE

cluster_B::>
```

5. Identify the MetroCluster FC DR group that need to be removed.

In the following example the MetroCluster FC nodes are in DR Group '1', and this is the DR group that need to be removed.

```
cluster_B::> metrocluster node show
```

DR Group	Cluster	Node	Configuration State	DR Mirroring Mode	
1	cluster_A	node_A_1-FC	configured	enabled normal	
		node_A_2-FC	configured	enabled normal	
	cluster_B	node_B_1-FC	configured	enabled normal	
		node_B_2-FC	configured	enabled normal	
	2	cluster_A	node_A_3-IP	configured	enabled normal
			node_A_4-IP	configured	enabled normal
cluster_B		node_B_3-IP	configured	enabled normal	
		node_B_3-IP	configured	enabled normal	

8 entries were displayed.

```
cluster_B::>
```

6. Move the cluster management LIF from a MetroCluster FC node to a MetroCluster IP node:

```
cluster_B::> network interface migrate -vserver svm-name -lif cluster_mgmt
-destination-node node-in-metrocluster-ip-dr-group -destination-port
available-port
```

7. Change the home node and home port of the cluster management LIF: cluster_B::> network interface modify -vserver svm-name -lif cluster_mgmt -service-policy default-management -home-node node-in-metrocluster-ip-dr-group -home-port lif-port

8. Move epsilon from a MetroCluster FC node to a MetroCluster IP node:

- Identify which node currently has epsilon: cluster show -fields epsilon

```
cluster_B::> cluster show -fields epsilon
node                epsilon
-----
node_A_1-FC         true
node_A_2-FC         false
node_A_1-IP         false
node_A_2-IP         false
4 entries were displayed.
```

- b. Set epsilon to false on the MetroCluster FC node (node_A_1-FC): `cluster modify -node fc-node -epsilon false`
- c. Set epsilon to true on the MetroCluster IP node (node_A_1-IP): `cluster modify -node ip-node -epsilon true`
- d. Verify that epsilon has moved to the correct node: `cluster show -fields epsilon`

```
cluster_B::> cluster show -fields epsilon
node                epsilon
-----
node_A_1-FC         false
node_A_2-FC         false
node_A_1-IP         true
node_A_2-IP         false
4 entries were displayed.
```

9. On each cluster, remove the DR group containing the old nodes from the MetroCluster FC configuration.

You must perform this step on both clusters, one at a time.

```
cluster_B::> metrocluster remove-dr-group -dr-group-id 1
```

Warning: Nodes in the DR group that are removed from the MetroCluster configuration will lose their disaster recovery protection.

Local nodes "node_A_1-FC, node_A_2-FC" will be removed from the MetroCluster configuration. You must repeat the operation on the partner cluster "cluster_B" to remove the remote nodes in the DR group.

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

Info: The following preparation steps must be completed on the local and partner clusters before removing a DR group.

1. Move all data volumes to another DR group.
2. Move all MDV_CRS metadata volumes to another DR group.
3. Delete all MDV_aud metadata volumes that may exist in the DR group to be removed.
4. Delete all data aggregates in the DR group to be removed. Root aggregates are not deleted.
5. Migrate all data LIFs to home nodes in another DR group.
6. Migrate the cluster management LIF to a home node in another DR group. Node management and inter-cluster LIFs are not migrated.
7. Transfer epsilon to a node in another DR group.

The command is vetoed if the preparation steps are not completed on the local and partner clusters.

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

[Job 513] Job succeeded: Remove DR Group is successful.

```
cluster_B::>
```

10. Verify that the nodes are ready to be removed from the clusters.

You must perform this step on both clusters.



At this point, the `metrocluster node show` command only shows the local MetroCluster FC nodes and no longer shows the nodes that are part of the partner cluster.

```
cluster_B::> metrocluster node show
```

DR		Configuration	DR	
Group	Cluster	Node	State	Mirroring Mode
-----	-----	-----	-----	-----
1	cluster_A			
		node_A_1-FC	ready to configure	-
				-
		node_A_2-FC	ready to configure	-
				-
2	cluster_A			
		node_A_3-IP	configured	enabled normal
		node_A_4-IP	configured	enabled normal
	cluster_B			
		node_B_3-IP	configured	enabled normal
		node_B_4-IP	configured	enabled normal

6 entries were displayed.

```
cluster_B::>
```

11. Disable storage failover for the MetroCluster FC nodes.

You must perform this step on each node.

```
cluster_A::> storage failover modify -node node_A_1-FC -enabled false
cluster_A::> storage failover modify -node node_A_2-FC -enabled false
cluster_A::>
```

12. Unjoin the MetroCluster FC nodes from the clusters: `cluster unjoin -node node-name`

You must perform this step on each node.

```

cluster_A::> cluster unjoin -node node_A_1-FC

Warning: This command will remove node "node_A_1-FC" from the cluster.
You must
    remove the failover partner as well. After the node is removed,
erase
    its configuration and initialize all disks by using the "Clean
configuration and initialize all disks (4)" option from the
boot menu.
Do you want to continue? {y|n}: y
[Job 553] Job is queued: Cluster remove-node of Node:node_A_1-FC with
UUID:6c87de7e-ff54-11e9-8371
[Job 553] Checking prerequisites
[Job 553] Cleaning cluster database
[Job 553] Job succeeded: Node remove succeeded
If applicable, also remove the node's HA partner, and then clean its
configuration and initialize all disks with the boot menu.
Run "debug vreport show" to address remaining aggregate or volume
issues.

cluster_B::>

```

13. Power down the MetroCluster FC controller modules and storage shelves.
14. Disconnect and remove the MetroCluster FC controller modules and storage shelves.

Completing the transition

To complete the transition you must verify the operation of the new MetroCluster IP configuration.

1. Verify the MetroCluster IP configuration.

You must perform this step on each cluster.

The following example shows the output for cluster_A.

```

cluster_A::> cluster show
Node                Health  Eligibility  Epsilon
-----
node_A_1-IP         true    true         true
node_A_2-IP         true    true         false
2 entries were displayed.

cluster_A::>

```

The following example shows the output for cluster_B.

```
cluster_B::> cluster show
Node                Health  Eligibility  Epsilon
-----
node_B_1-IP        true   true        true
node_B_2-IP        true   true        false
2 entries were displayed.

cluster_B::>
```

2. Enable cluster HA and storage failover.

You must perform this step on each cluster.

3. Verify that cluster HA capability is enabled.

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

cluster_A::>

cluster_A::> storage failover show
                                Takeover
Node        Partner            Possible State Description
-----
node_A_1-IP  node_A_2-IP    true     Connected to node_A_2-IP
node_A_2-IP  node_A_1-IP    true     Connected to node_A_1-IP
2 entries were displayed.

cluster_A::>
```

4. Disable MetroCluster transition mode.

- a. Change to the advanced privilege level: `set -privilege advanced`
- b. Disable transition mode: `metrocluster transition disable`
- c. Return to the admin privilege level: `set -privilege admin`

```
cluster_A::*> metrocluster transition disable

cluster_A::*>
```

5. Verify that transition is disabled:`metrocluster transition show-mode`

You must perform these steps on both clusters.

```
cluster_A::> metrocluster transition show-mode
Transition Mode
-----
not-enabled

cluster_A::>
```

```
cluster_B::> metrocluster transition show-mode
Transition Mode
-----
not-enabled

cluster_B::>
```

Sending a custom AutoSupport message after maintenance

After completing the transition, you should send an AutoSupport message indicating the end of maintenance, so automatic case creation can resume.

1. To resume automatic support case generation, send an Autosupport message to indicate that the maintenance is complete.
 - a. Issue the following command:`system node autosupport invoke -node * -type all -message MAINT=end`
 - b. Repeat the command on the partner cluster.

Restoring Tiebreaker or Mediator monitoring

After completing the transition of the MetroCluster configuration, you can resume monitoring with the Tiebreaker or Mediator utility.

1. Use the appropriate procedure for your configuration.

If you are using...	Use this procedure
Tiebreaker	Adding MetroCluster configurations
Mediator	Configuring the ONTAP Mediator service from a MetroCluster IP configuration

Disruptively transition from a two-node MetroCluster FC to a four-node MetroCluster IP configuration (ONTAP 9.8 and later)

Disruptively transitioning from a two-node MetroCluster FC to a four-node MetroCluster IP configuration (ONTAP 9.8 and later)

Beginning with ONTAP 9.8, you can transition workloads and data from an existing two-node MetroCluster FC configuration to a new four-node MetroCluster IP configuration. Disk shelves from the MetroCluster FC nodes are moved to the IP nodes.

The following illustration provides a simplified view of the configuration before and after this transition procedure.



- This procedure is supported on systems running ONTAP 9.8 and later.
- This procedure is disruptive.
- This procedure applies only to a two-node MetroCluster FC configuration.

If you have a four-node MetroCluster FC configuration, see [Choosing your transition procedure](#).

- ADP is not supported on the four-node MetroCluster IP configuration created by this procedure.
- You must meet all requirements and follow all steps in the procedure.
- The existing storage shelves are moved to the new MetroCluster IP nodes.
- Additional storage shelves can be added to the configuration if necessary.

See [Drive shelf reuse and drive requirements for disruptive FC-to-IP transition](#).

Example naming in this procedure

This procedure uses example names throughout to identify the DR groups, nodes, and switches involved.

The nodes in the original configuration have the suffix -FC, indicating that they are in a fabric-attached or stretch MetroCluster configuration.

Components	cluster_A at site_A	cluster_B at site_B
dr_group_1-FC	<ul style="list-style-type: none">• node_A_1-FC• shelf_A_1• shelf_A_2	<ul style="list-style-type: none">• node_B_1-FC• shelf_B_1• shelf_B_2
dr_group_2-IP	<ul style="list-style-type: none">• node_A_1-IP• node_A_2-IP• shelf_A_1• shelf_A_2• shelf_A_3-new• shelf_A_4-new	<ul style="list-style-type: none">• node_B_1-IP• node_B_2-IP• shelf_B_1• shelf_B_2• shelf_B_3-new• shelf_B_4-new
Switches	<ul style="list-style-type: none">• switch_A_1-FC• switch_A_2-FC• switch_A_1-IP• switch_A_2-IP	<ul style="list-style-type: none">• switch_B_1-FC• switch_B_2-FC• switch_B_1-IP• switch_B_2-IP

Preparing for disruptive FC-to-IP transition

General requirements for disruptive FC-to-IP transition

Before starting the transition process, you must make sure the configuration meets the requirements.

The existing MetroCluster FC configuration must meet the following requirements:

- It must be a two-node configuration and all nodes must be running ONTAP 9.8 or later.

It can be a two-node fabric-attached or stretched MetroCluster.

- It must meet all requirements and cabling as described in the *MetroCluster Installation and Configuration* procedures.

[Fabric-attached MetroCluster installation and configuration](#)

[Stretch MetroCluster installation and configuration](#)

- It cannot be configured with NetApp Storage Encryption (NSE).

- The MDV volumes cannot be encrypted.

You must have remote console access for all six nodes from either MetroCluster site or plan for travel between the sites as required by the procedure.

Drive shelf reuse and drive requirements for disruptive FC-to-IP transition

You must ensure that adequate spare drives and root aggregate space is available on the storage shelves.

Reusing the existing storage shelves

When using this procedure, the existing storage shelves are retained for use by the new configuration. When node_A_1-FC and node_B_1-FC are removed, the existing drive shelves are connected to node_A_1-IP and node_A_2-IP on cluster_A and to node_B_1-IP and node_B_2-IP on cluster_B.

- The existing storage shelves (those attached to node_A_1-FC and node_B_1-FC) must be supported by the new platform models.

If the existing shelves are not supported by the new platform models, see [Disruptively transitioning when existing shelves are not supported on new controllers \(ONTAP 9.8 and later\)](#).

- You must ensure you don't exceed the platform limits for drives, etc.

[NetApp Hardware Universe](#)

Storage requirements for the additional controllers

Additional storage must be added, if necessary, to accommodate the two additional controllers (node_A_2-IP and node_B_2-ip), because the configuration is changing from a two-node to a four-node arrangement.

- Depending on the spare drives available in the existing shelves, additional drives must be added to accommodate the additional controllers in the configuration.

This might require additional storage shelves, as shown in the following illustration.



You need to have additional 14 - 18 drives each for the third and fourth controllers (node_A_2-IP and node_B_2-IP):

- Three pool0 drives
- Three pool1 drives
- Two spare drives
- Six to ten drives for the system volume
- You must ensure that the configuration, including the new nodes, does not exceed the platform limits for the configuration, including drive count, root aggregate size capacity, etc.

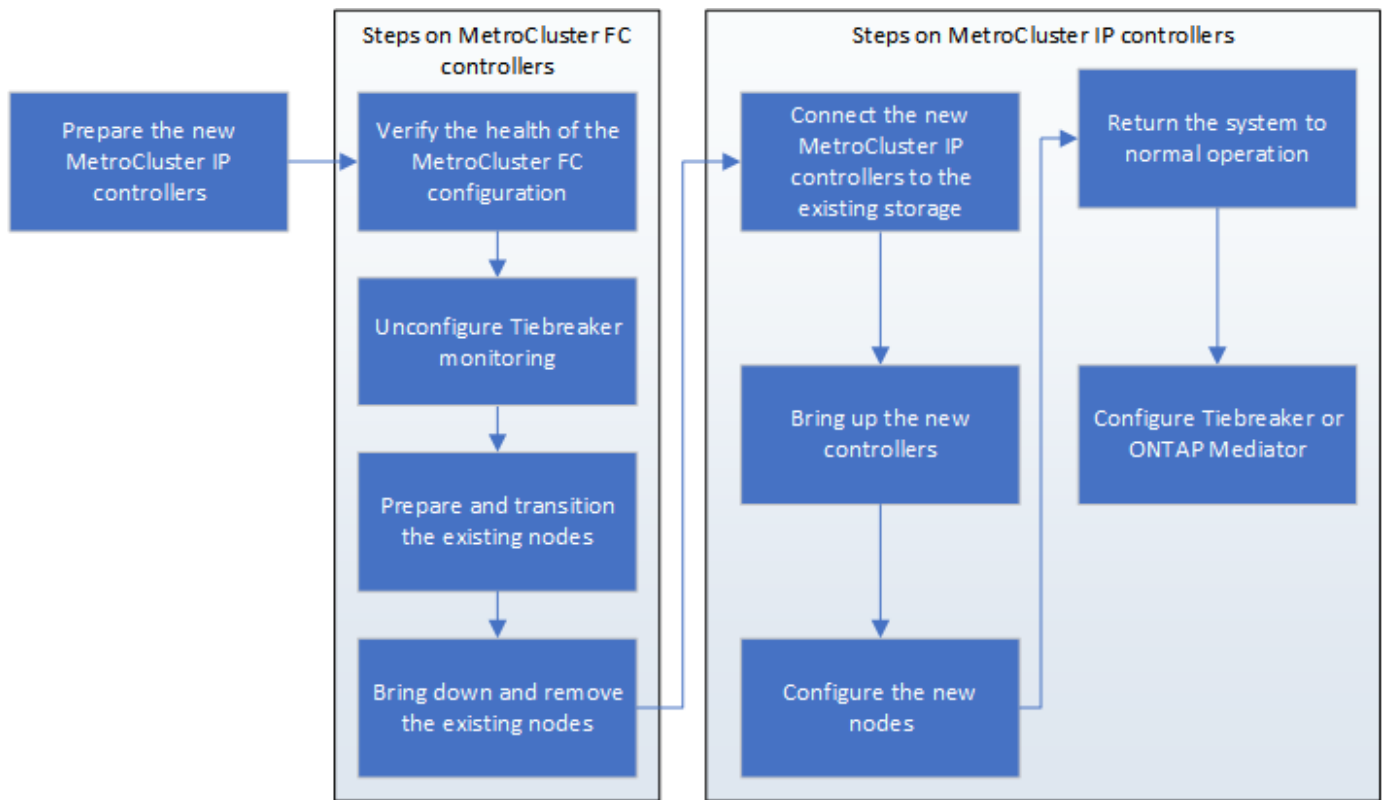
This information is available for each platform model at *NetApp Hardware Universe*.

[NetApp Hardware Universe](#)

Workflow for disruptive transition

You must follow the specific workflow to ensure a successful transition.

As you prepare for the transition, plan for travel between the sites. Note that after the remote nodes are racked and cabled, you need serial terminal access to the nodes. Service Processor access is not be available until the nodes are configured.



Mapping ports from the MetroCluster FC nodes to the MetroCluster IP nodes

You must adjust the port and LIF configuration of the MetroCluster FC node so it is compatible with that of the MetroCluster IP node that will replace it.

About this task

When the new nodes are first booted during the upgrade process, each node uses the most recent configuration of the node it is replacing. When you boot node_A_1-IP, ONTAP attempts to host LIFs on the same ports that were used on node_A_1-FC.

During the transition procedure, you will perform steps on both the old and new nodes to ensure correct cluster, management, and data LIF configuration.

Steps

1. Identify any conflicts between the existing MetroCluster FC port usage and the port usage for the MetroCluster IP interfaces on the new nodes.

You must identify the MetroCluster IP ports on the new MetroCluster IP controllers using the table below. Then check and record if any data LIFs or cluster LIFs exist on those ports on the MetroCluster FC nodes.

These conflicting data LIFs or cluster LIFs on the MetroCluster FC nodes will be moved at the appropriate step in the transition procedure.

The following table shows the MetroCluster IP ports by platform model. You can ignore the VLAN ID column.

Platform model	MetroCluster IP port	VLAN ID	
----------------	----------------------	---------	--

AFF A800	e0b	Not used	
	e1b		
AFF A700 and FAS9000	e5a		
	e5b		
AFF A320	e0g		
	e0h		
AFF A300 and FAS8200	e1a		
	e1b		
FAS8300/A400/FAS8700	e1a	10	
	e1b	20	
AFF A250 and FAS500f	e0c	10	
	e0b	20	

You can fill in the following table and refer to it later in the transition procedure.

Ports	Corresponding MetroCluster IP interface ports (from table above)	Conflicting LIFs on these ports on the MetroCluster FC nodes
First MetroCluster IP port on node_A_1-FC		
Second MetroCluster IP port on node_A_1-FC		
First MetroCluster IP port on node_B_1-FC		
Second MetroCluster IP port on node_B_1-FC		

- Determine which physical ports are available on the new controllers and which LIFs can be hosted on the ports.

The controller's port usage depends on the platform model and IP switch model you will use in the MetroCluster IP configuration. You can gather the port usage of the new platforms from the *NetApp*

NetApp Hardware Universe

3. If desired, record the port information for node_A_1-FC and node_A_1-IP.

You will refer to the table as you carry out the transition procedure.

In the columns for node_A_1-IP, add the physical ports for the new controller module and plan the IPspaces and broadcast domains for the new node.

	node_A_1-FC			node_A_1-IP		
LIF	Ports	IPspaces	Broadcast domains	Ports	IPspaces	Broadcast domains
Cluster 1						
Cluster 2						
Cluster 3						
Cluster 4						
Node management						
Cluster management						
Data 1						
Data 2						
Data 3						
Data 4						
SAN						
Intercluster port						

4. If desired, record all the port information for node_B_1-FC.

You will refer to the table as you carry out the upgrade procedure.

In the columns for node_B_1-IP, add the physical ports for the new controller module and plan the LIF port usage, IPspaces and broadcast domains for the new node.

	node_B_1-FC			node_B_1-IP		
LIF	Physical ports	IPspaces	Broadcast domains	Physical ports	IPspaces	Broadcast domains
Cluster 1						
Cluster 2						
Cluster 3						
Cluster 4						
Node management						
Cluster management						
Data 1						
Data 2						
Data 3						
Data 4						
SAN						
Intercluster port						

Preparing the MetroCluster IP controllers

You must prepare the four new MetroCluster IP nodes and install the correct ONTAP version.

About this task

This task must be performed on each of the new nodes:

- node_A_1-IP
- node_A_2-IP
- node_B_1-IP
- node_B_2-IP

The nodes should be connected to any **new** storage shelves. They must **not** be connected to the existing storage shelves containing data.

These steps can be performed now, or later in the procedure when the controllers and shelves are racked. In

any case, you must make sure you clear the configuration and prepare the nodes **before** connecting them to the existing storage shelves and **before** making any configuration changes to the MetroCluster FC nodes.



Do not perform these steps with the MetroCluster IP controllers connected to the existing storage shelves that were connected to the MetroCluster FC controllers.

In these steps, you clear the configuration on the nodes and clear the mailbox region on new drives.

Steps

1. Connect the controller modules to the new storage shelves.
2. In Maintenance mode, display the HA state of the controller module and chassis:

```
ha-config show
```

The HA state for all components should be “mccip”.

3. If the displayed system state of the controller or chassis is not correct, set the HA state:

```
ha-config modify controller mccip`ha-config modify chassis mccip
```

4. Exit Maintenance mode:

```
halt
```

After you run the command, wait until the node stops at the LOADER prompt.

5. Repeat the following substeps on all four nodes to clear the configuration:
 - a. Set the environmental variables to default values:

```
set-defaults
```

- b. Save the environment:

```
saveenv
```

```
bye
```

6. Repeat the following substeps to boot all four nodes using the 9a option on the boot menu:
 - a. At the LOADER prompt, launch the boot menu:

```
boot_ontap menu
```

- b. At the boot menu, select option “9a” to reboot the controller.

7. Boot each of the four nodes to Maintenance mode using option “5” on the boot menu.
8. Record the system ID and from each of the four nodes:

```
sysconfig
```

9. Repeat the following steps on node_A_1-IP and node_B_1-IP.
 - a. Assign ownership of all disks local to each site:

```
disk assign adapter.xx.*
```

b. Repeat the previous step for each HBA with attached drive shelves on node_A_1-IP and node_B_1-IP.

10. Repeat the following steps on node_A_1-IP and node_B_1-IP to clear the mailbox region on each local disk.

a. Destroy the mailbox region on each disk:

```
mailbox destroy local ``mailbox destroy partner
```

11. Halt all four controllers:

```
halt
```

12. On each controller, display the boot menu:

```
boot_ontap menu
```

13. On each of the four controllers, clear the configuration:

```
wipeconfig
```

When the wipeconfig operation completes, the node automatically returns to the boot menu.

14. Repeat the following substeps to again boot all four nodes using the 9a option on the boot menu.

a. At the LOADER prompt, launch the boot menu:

```
boot_ontap menu
```

b. At the boot menu, select option “9a” to reboot the controller.

c. Let the controller module complete booting before moving to the next controller module.

After “9a” completes, the nodes automatically return to the boot menu.

15. Power off the controllers.

Verifying the health of the MetroCluster FC configuration

You must verify the health and connectivity of the MetroCluster FC configuration prior to performing the transition

This task is performed on the MetroCluster FC configuration.

1. Verify the operation of the MetroCluster configuration in ONTAP:

a. Check whether the system is multipathed:

```
node run -node node-name sysconfig -a
```

b. Check for any health alerts on both clusters:

```
system health alert show
```

c. Confirm the MetroCluster configuration and that the operational mode is normal:

```
metrocluster show
```

- d. Perform a MetroCluster check:

```
metrocluster check run
```

- e. Display the results of the MetroCluster check:

```
metrocluster check show
```

- f. Check for any health alerts on the switches (if present):

```
storage switch show
```

- g. Run Config Advisor.

[NetApp Downloads: Config Advisor](#)

- h. After running Config Advisor, review the tool's output and follow the recommendations in the output to address any issues discovered.

2. Verify that the nodes are in non-HA mode:

```
storage failover show
```

Removing the existing configuration from the Tiebreaker or other monitoring software

If the existing configuration is monitored with the MetroCluster Tiebreaker configuration or other third-party applications (for example, ClusterLion) that can initiate a switchover, you must remove the MetroCluster configuration from the Tiebreaker or other software prior to transition.

Steps

1. Remove the existing MetroCluster configuration from the Tiebreaker software.

[Removing MetroCluster configurations](#)

2. Remove the existing MetroCluster configuration from any third-party application that can initiate switchover.

Refer to the documentation for the application.

Transitioning the MetroCluster FC nodes

You must gather information from the existing MetroCluster FC nodes, send an autosupport message announcing the start of maintenance, and transition the nodes.

Gathering information from the existing controller modules before the transition

Before transitioning, you must gather information for each of the nodes.

This task is performed on the existing nodes:

- node_A_1-FC

- node_B_1-FC

1. Gather the output for the commands in the following table.

Category	Commands	Notes
License	system license show	
Shelves and numbers of disks in each shelf and flash storage details and memory and NVRAM and and network cards	system node run -node node_name sysconfig	
Cluster network and node management LIFs	system node run -node node_name sysconfig network interface show -role "cluster,node-mgmt,data"	
SVM information	vserver show	
Protocol information	nfs show iscsi show cifs show	
Physical ports	network port show -node node_name -type physical network port show	
Failover Groups	network interface failover-groups show -vserver vserver_name	Record the names and ports of failover groups that are not clusterwide.
VLAN configuration	network port vlan show -node node_name	Record each network port and VLAN ID pairing.
Interface group configuration	network port ifgrp show -node node_name -instance	Record the names of the interface groups and the ports assigned to them.
Broadcast domains	network port broadcast-domain show	
IPspace	network ipspace show	
Volume info	volume show and volume show -fields encrypt	
Aggregate Info	storage aggregate show and storage aggr encryption show and storage aggregate object-store show	
Disk ownership information	storage aggregate show and storage aggr encryption show and storage aggregate object-store show	
Encryption	storage failover mailbox-disk show and security key-manager backup show	Also preserve the passphrase used to enable key-manager. In the case of external key-manager you will need the authentication information for the client and server.
Encryption	security key-manager show	

Category	Commands	Notes
Encryption	security key-manager external show	
Encryption	systemshell local kenv kmip.init.ipaddr ip-address	
Encryption	systemshell local kenv kmip.init.netmask netmask	
Encryption	systemshell local kenv kmip.init.gateway gateway	
Encryption	systemshell local kenv kmip.init.interface interface	

Sending a custom AutoSupport message prior to maintenance

Before performing the maintenance, you should issue an AutoSupport message to notify NetApp technical support that maintenance is underway. This prevents them from opening a case on the assumption that a disruption has occurred.

This task must be performed on each MetroCluster site.

1. To prevent automatic support case generation, send an Autosupport message to indicate maintenance is underway.

- a. Issue the following command: `system node autosupport invoke -node * -type all -message MAINT=maintenance-window-in-hours`

`maintenance-window-in-hours` specifies the length of the maintenance window, with a maximum of 72 hours. If the maintenance is completed before the time has elapsed, you can invoke an AutoSupport message indicating the end of the maintenance period: `system node autosupport invoke -node * -type all -message MAINT=end`

- b. Repeat the command on the partner cluster.

Transitioning, shutting down, and removing the MetroCluster FC nodes

In addition to issuing commands on the MetroCluster FC nodes, this task includes physical uncabing and removal of the controller modules at each site.

This task must be performed on each of the old nodes:

- `node_A_1-FC`
- `node_B_1-FC`
 1. Stop all client traffic.
 2. On either of the MetroCluster FC nodes, for example `node_A_1-FC`, enable transition.
 - a. Set the advanced privilege level: `set -priv advanced`
 - b. Enable transition: `metrocluster transition enable -transition-mode disruptive`
 - c. Return to admin mode: `set -priv admin`

3. Unmirror the root aggregate by deleting the remote plex of the root aggregates.

- a. Identify the root aggregates: `storage aggregate show -root true`
- b. Display the pool1 aggregates: `storage aggregate plex show -pool 1`
- c. Delete the local plex of the root aggregate: `aggr plex delete aggr-name -plex plex-name`
- d. Offline the remote plex of the root aggregate: `aggr plex offline root-aggregate -plex remote-plex-for-root-aggregate`

For example:

```
# aggr plex offline aggr0_node_A_1-FC_01 -plex plex4
```

4. Confirm the mailbox count, disk autoassign, and transition mode before proceeding using the following commands on each controller:

- a. Set the advanced privilege level: `set -priv advanced`
- b. Confirm that only three mailbox drives are shown for each controller module: `storage failover mailbox-disk show`
- c. Return to admin mode: `set -priv admin`
- d. Confirm that the transition mode is disruptive: `metrocluster transition show`

5. Check for any broken disks: `disk show -broken`

6. Remove or replace any broken disks

7. Confirm aggregates are healthy using the following commands on node_A_1-FC and node_B_1-FC: `storage aggregate show` `storage aggregate plex show`

The storage aggregate show command indicates that the root aggregate is unmirrored.

8. Check for any VLANs or interface groups: `network port ifgrp show` `network port vlan show`

If none are present, skip the following two steps.

9. Display the list of LIFs using VLANs or ifgrps: `network interface show -fields home-port,curr-port` `network port show -type if-group | vlan`

10. Remove any VLANs and interface groups.

You must perform these steps for all LIFs in all SVMs, including those SVMs with the -mc suffix.

- a. Move any LIFs using the VLANs or interface groups to an available port: `network interface modify -vserver vservice-name -lif lif_name -home- port port`
- b. Display the LIFs that are not on their home ports: `network interface show -is-home false`
- c. Revert all LIFs to their respective home ports: `network interface revert -vserver vservice_name -lif lif_name`

- d. Verify that all LIFs are on their home ports: `network interface show -is-home false`

No LIFs should appear in the output.

- e. Remove VLAN and ifgrp ports from broadcast domain:: `network port broadcast-domain remove-ports -ip-space ip-space -broadcast-domain broadcast-domain-name -ports nodename:portname,nodename:portname,...`
- f. Verify that all the vlan and ifgrp ports are not assigned to a broadcast domain: `network port show -type if-group | vlan`
- g. Delete all VLANs: `network port vlan delete -node nodename -vlan-name vlan-name`
- h. Delete interface groups: `network port ifgrp delete -node nodename -ifgrp ifgrp-name`

11. Move any LIFs as required to resolve conflicts with the MetroCluster IP interface ports.

You must move the LIFs identified in step 1 of [Mapping ports from the MetroCluster FC nodes to the MetroCluster IP nodes](#).

- a. Move any LIFs hosted on the desired port to another port: `network interface modify -lif lifname -vserver vserver-name -home-port new-homeport``network interface revert -lif lifname -vserver vservername`
- b. If necessary, move the destination port to an appropriate IPspace and broadcast domain. `network port broadcast-domain remove-ports -ip-space current-ip-space -broadcast-domain current-broadcast-domain -ports controller-name:current-port``network port broadcast-domain add-ports -ip-space new-ip-space -broadcast-domain new-broadcast-domain -ports controller-name:new-port`

12. Halt the MetroCluster FC controllers (node_A_1-FC and node_B_1-FC): `system node halt`

13. At the LOADER prompt, synchronize the hardware clocks between the FC and IP controller modules.

- a. On the old MetroCluster FC node (node_A_1-FC), display the date: `show date`
- b. On the new MetroCluster IP controllers (node_A_1-IP and node_B_1-IP), set the date shown on original controller: `set date mm/dd/yy`
- c. On the new MetroCluster IP controllers (node_A_1-IP and node_B_1-IP), verify the date: `show date`

14. Halt and power off the MetroCluster FC controller modules (node_A_1-FC and node_B_1-FC), FC-to-SAS bridges (if present), FC switches (if present) and each storage shelf connected to these nodes.

15. Disconnect the shelves from the MetroCluster FC controllers and document which shelves are local storage to each cluster.

If the configuration uses FC-to-SAS bridges or FC back-end switches, disconnect and remove them.

16. In Maintenance mode on the MetroCluster FC nodes (node_A_1-FC and node_B_1-FC), confirm no disks are connected: `disk show -v`

17. Power down and remove the MetroCluster FC nodes.

At this point, the MetroCluster FC controllers have been removed and the shelves are disconnected from all controllers.



Connecting the MetroCluster IP controller modules

You must add the four new controller modules and any additional storage shelves to the configuration. The new controller modules are added two-at-a-time.

Setting up the new controllers

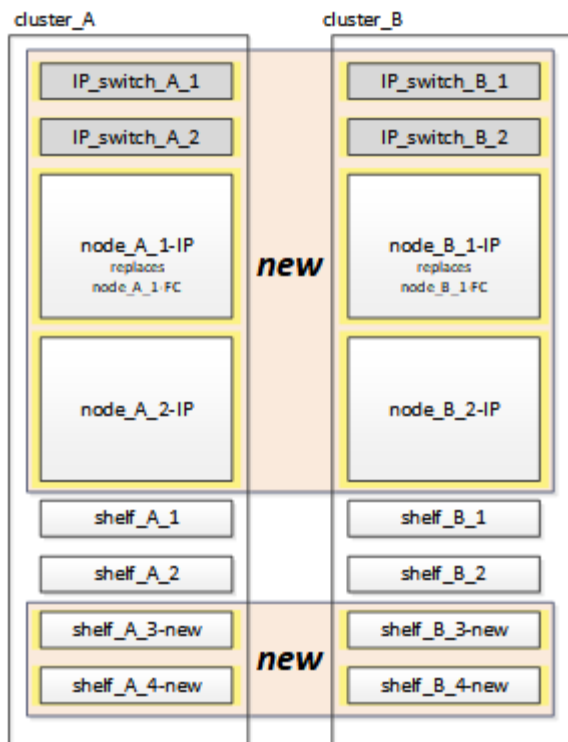
You must rack and cable the new MetroCluster IP controllers to the storage shelves previously connected to the MetroCluster FC controllers.

About this task

These steps must be performed on each of the MetroCluster IP nodes.

- node_A_1-IP
- node_A_2-IP
- node_B_1-IP
- node_B_2-IP

In the following example, two additional storage shelves are added at each site to provide storage to accommodate the new controller modules.



Steps

1. Plan out the positioning of the new controller modules and storage shelves as needed.

The rack space depends on the platform model of the controller modules, the switch types, and the number of storage shelves in your configuration.

2. Properly ground yourself.
3. Rack the new equipment: controllers, storage shelves, and IP switches.

Do not cable the storage shelves or IP switches at this time.

4. Connect the power cables and management console connection to the controllers.
5. Verify that all storage shelves are powered off.
6. Verify that no drives are connected by performing the following steps on all four nodes:

- a. At the LOADER prompt, launch the boot menu:

```
boot_ontap maint
```

- b. Verify that no drives are connected:

```
disk show -v
```

The output should show no drives.

- c. Halt the node:

```
halt
```

7. Boot all four nodes using the 9a option on the boot menu.

- a. At the LOADER prompt, launch the boot menu:

```
boot_ontap menu
```

- b. At the boot menu, select option “9a” to reboot the controller.
- c. Let the controller module complete booting before moving to the next controller module.

After “9a” completes, the nodes automatically return to the boot menu.

8. Cable the storage shelves.

Refer to the controller installation and setup procedures for your model for cabling information.

[AFF and FAS Documentation Center](#)

9. Cable the controllers to the IP switches as described in [Cabling the IP switches](#).
10. Prepare the IP switches for the application of the new RCF files.

Follow the steps for your switch vendor:

- [Resetting the Broadcom IP switch to factory defaults](#)
- [Resetting the Cisco IP switch to factory defaults](#)

11. Download and install the RCF files.

Follow the steps for your switch vendor:

- [Downloading and installing the Broadcom RCF files](#)
- [Downloading and installing the Cisco IP RCF files](#)

12. Turn on power to the first new controller (node_A_1-IP) and press Ctrl-C to interrupt the boot process and display the LOADER prompt.
13. Boot the controller to Maintenance mode:

```
boot_ontap_maint
```

14. Display the system ID for the controller:

```
sysconfig -v
```

15. Confirm that the shelves from the existing configuration are visible from the new MetroCluster IP node:

```
storage show shelf``disk show -v
```

16. Halt the node:

```
halt
```

17. Repeat the preceding steps on the other node at the partner site (site_B).

Connecting and booting up node_A_1-IP and node_B_1-IP

After connecting the MetroCluster IP controllers and IP switches, you transition and boot up node_A_1-IP and node_B_1-IP.

Bringing up node_A_1-IP

You must boot the node with the correct transition option.

Steps

1. Boot node_A_1-IP to the boot menu:

```
boot_ontap menu
```

2. Issue the following command at the boot menu prompt to initiate transition:

```
boot_after_mcc_transition
```

- This command reassigns all the disks owned by node_A_1-FC to node_A_1-IP.
 - node_A_1-FC disks are assigned to node_A_1-IP
 - node_B_1-FC disks are assigned to node_B_1-IP
- The command also automatically makes other required system ID reassignments so the MetroCluster IP nodes can boot to the ONTAP prompt.
- If the boot_after_mcc_transition command fails for any reason, it should be re-run from the boot menu.



- If the following prompt is displayed, enter Ctrl-C to continue. Checking MCC DR state... [enter Ctrl-C(resume), S(status), L(link)]_
- If the root volume was encrypted, the node halts with the following message. Halting the system, because root volume is encrypted (NetApp Volume Encryption) and the key import failed. If this cluster is configured with external (KMIP) key-manager, check the health of the key servers.

Please choose one of the following:

- (1) Normal Boot.
- (2) Boot without /etc/rc.
- (3) Change password.
- (4) Clean configuration and initialize all disks.
- (5) Maintenance mode boot.
- (6) Update flash from backup config.
- (7) Install new software first.
- (8) Reboot node.
- (9) Configure Advanced Drive Partitioning. Selection (1-9)?

``boot_after_mcc_transition``

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

MetroCluster Transition: Name of the MetroCluster FC node: ``node_A_1-FC``

MetroCluster Transition: Please confirm if this is the correct value
[yes|no]:? y

MetroCluster Transition: Disaster Recovery partner sysid of
MetroCluster FC node node_A_1-FC: ``systemID-of-node_B_1-FC``

MetroCluster Transition: Please confirm if this is the correct value
[yes|no]:? y

MetroCluster Transition: Disaster Recovery partner sysid of local
MetroCluster IP node: ``systemID-of-node_B_1-IP``

MetroCluster Transition: Please confirm if this is the correct value
[yes|no]:? y

3. If data volumes are encrypted, restore the keys using the correct command for your key management configuration.

If you are using...	Use this command...
Onboard key management	<code>security key-manager onboard sync</code> For more information, see Restoring onboard key management encryption keys .
External key management	<code>security key-manager key query -node node-name</code> For more information, see Restoring external key management encryption keys .

4. If the root volume is encrypted, use the procedure in [Recovering key management if the root volume is encrypted](#).

Recovering key management if the root volume is encrypted

If the root volume is encrypted, you must use special boot commands to restore the key management.

Before you begin

You must have the passphrases gathered earlier.

Steps

1. If onboard key management is used, perform the following substeps to restore the configuration.
 - a. From the LOADER prompt, display the boot menu:

```
boot_ontap menu
```

- b. Select option “(10) Set onboard key management recovery secrets” from the boot menu.

Respond as appropriate to the prompts:

```
This option must be used only in disaster recovery procedures. Are
you sure? (y or n): y
Enter the passphrase for onboard key management: passphrase
Enter the passphrase again to confirm: passphrase

Enter the backup data: backup-key
```

The system boots to the boot menu.

- c. Enter option “6” at the boot menu.

Respond as appropriate to the prompts:

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

Following this, the system will reboot a few times and the following
prompt will be available continue by saying y

WARNING: System ID mismatch. This usually occurs when replacing a
boot device or NVRAM cards!
Override system ID? {y|n} y
```

After the reboots, the system will be at the LOADER prompt.

- d. From the LOADER prompt, display the boot menu:

```
boot_ontap menu
```

- e. Again elect option “(10) Set onboard key management recovery secrets” from the boot menu.

Respond as appropriate to the prompts:

```
This option must be used only in disaster recovery procedures. Are
you sure? (y or n): `y`
Enter the passphrase for onboard key management: `passphrase`
Enter the passphrase again to confirm: `passphrase`

Enter the backup data: `backup-key`
```

The system boots to the boot menu.

f. Enter option “1” at the boot menu.

If the following prompt is displayed, you can press Ctrl+C to resume the process.

```
Checking MCC DR state... [enter Ctrl-C(resume), S(status), L(link)]
```

The system boots to the ONTAP prompt.

g. Restore the onboard key management:

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

Respond as appropriate to the prompts, using the passphrase you collected earlier:

```
cluster_A::> security key-manager onboard sync
Enter the cluster-wide passphrase for onboard key management in
Vserver "cluster_A":: passphrase
```

2. If external key management is used, perform the following substeps to restore the configuration.

a. Set the required bootargs:

```
setenv bootarg.kmip.init.ipaddr ip-address

setenv bootarg.kmip.init.netmask netmask

setenv bootarg.kmip.init.gateway gateway-address

setenv bootarg.kmip.init.interface interface-id
```

b. From the LOADER prompt, display the boot menu:

```
boot_ontap menu
```

c. Select option “(11) Configure node for external key management” from the boot menu.

The system boots to the boot menu.

- d. Enter option “6” at the boot menu.

The system boots multiple times. You can respond affirmatively when prompted to continue the boot process.

After the reboots, the system will be at the LOADER prompt.

- e. Set the required bootargs:

```
setenv bootarg.kmip.init.ipaddr ip-address  
  
setenv bootarg.kmip.init.netmask netmask  
  
setenv bootarg.kmip.init.gateway gateway-address  
  
setenv bootarg.kmip.init.interface interface-id
```

- f. From the LOADER prompt, display the boot menu:

```
boot_ontap menu
```

- g. Again select option “(11) Configure node for external key management” from the boot menu and respond to the prompts as required.

The system boots to the boot menu.

- h. Restore the external key management:

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

Creating the network configuration

You must create a network configuration that matches the configuration on the FC nodes. This is because the MetroCluster IP node replays the same configuration when it boots, which means that when node_A_1-IP and node_B_1-IP boot, ONTAP will try to host LIFs on the same ports that were used on node_A_1-FC and node_B_1-FC respectively.

About this task

As you create the network configuration, use the plan made in [Mapping ports from the MetroCluster FC nodes to the MetroCluster IP nodes](#) to assist you.



Additional configuration may be needed to bring up data LIFs after the MetroCluster IP nodes have been configured.

Steps

1. Verify that all cluster ports are in the appropriate broadcast domain:

The cluster IPspace and cluster broadcast domain are required in order to create cluster LIFs

- a. View the IP spaces:

```
network ipspace show
```

- b. Create IP spaces and assign cluster ports as needed.

[Configuring IPspaces \(cluster administrators only\)](#)

- c. View the broadcast domains:

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

- d. Add any cluster ports to a broadcast domain as needed.

[Adding or removing ports from a broadcast domain](#)

- e. Recreate VLANs and interface groups as needed.

VLAN and interface group membership might be different than that of the old node.

[Creating a VLAN](#)

[Combining physical ports to create interface groups](#)

2. Verify that MTU settings are set correctly for the ports and broadcast domain and make changes using the following commands:

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

```
network port broadcast-domain modify -broadcast-domain bcastdomainname -mtu mtu-value
```

Setting up cluster ports and cluster LIFs

You must set up cluster ports and LIFs. The following steps need to be performed on the site A nodes which were booted up with root aggregates.

Steps

1. Identify the list of LIFs using the desired Cluster port:

```
network interface show -curr-port portname
```

```
network interface show -home-port portname
```

2. For each cluster port, change the home port of any of the LIFs on that port to another port,
 - a. Enter advanced privilege mode and enter “y” when prompted to continue:

```
set priv advanced
```

- b. If the LIF being modified is a data LIF:

```
vserver config override -command "network interface modify -lif lifname -vserver vservername -home-port new-datahomeport"
```

- c. If the LIF is not a data LIF:

```
network interface modify -lif lifname -vserver vservername -home-port new-
```


datahomeport

- d. Revert the modified LIFs to their home port:

```
network interface revert * -vserver vservice_name
```

- e. Verify that there are no LIFs on the cluster port:

```
network interface show -curr-port portname
```

```
network interface show -home-port portname
```

- f. Remove the port from the current broadcast domain:

```
network port broadcast-domain remove-ports -ip-space ipspacename -broadcast-domain bcastdomainname -ports node_name:port_name
```

- g. Add the port to the cluster IPspace and broadcast domain:

```
network port broadcast-domain add-ports -ip-space Cluster -broadcast-domain Cluster -ports node_name:port_name
```

- h. Verify that the port's role has changed: `network port show`

- i. Repeat these substeps for each cluster port.

- j. Return to admin mode:

```
set priv admin
```

3. Create cluster LIFs on the new cluster ports:

- a. For autoconfiguration using link-local address for cluster LIF, use the following command:

```
network interface create -vserver Cluster -lif cluster_lifname -service -policy default-cluster -home-node a1name -home-port clusterport -auto true
```

- b. To assign static IP address for the cluster LIF, use the following command:

```
network interface create -vserver Cluster -lif cluster_lifname -service -policy default-cluster -home-node a1name -home-port clusterport -address ip-address -netmask netmask -status-admin up
```

Verifying LIF configuration

The node management LIF, cluster management LIF and intercluster LIF will still be present after the storage movement from the old controller. If necessary, you must move LIFs to appropriate ports.

Steps

1. Verify whether the management LIF and cluster management LIFs are on the desired port already:

```
network interface show -service-policy default-management
```

```
network interface show -service-policy default-intercluster
```

If the LIFs are on the desired ports, you can skip the rest of the steps in this task and proceed to the next task.

2. For each node, cluster management, or intercluster LIFs that are not on the desired port, change the home port of any of the LIFs on that port to another port.

- a. Repurpose the desired port by moving any LIFs hosted on desired port to another port:

```
vserver config override -command "network interface modify -lif lifname  
-vserver vservername -home-port new-datahomeport"
```

- b. Revert the modified LIFs to their new home port:

```
vserver config override -command "network interface revert -lif lifname  
-vserver _vservername"
```

- c. If the desired port is not in the right IPspace and broadcast domain, remove the port from the current IPspace and broadcast domain:

```
network port broadcast-domain remove-ports -ipspace current-ip-space  
-broadcast-domain current-broadcast-domain -ports controller-name:current-  
port
```

- d. Move the desired port to the right IPspace and broadcast domain:

```
network port broadcast-domain add-ports -ip-space new-ip-space -broadcast  
-domain new-broadcast-domain -ports controller-name:new-port
```

- e. Verify that the port's role has changed:

```
network port show
```

- f. Repeat these substeps for each port.

3. Move node, cluster management LIFs, and intercluster LIF to the desired port:

- a. Change the LIF's home port:

```
network interface modify -vserver vserver -lif node_mgmt -home-port port  
-home-node homenode
```

- b. Revert the LIF to its new home port:

```
network interface revert -lif node_mgmt -vserver vservername
```

- c. Change the cluster management LIF's home port:

```
network interface modify -vserver vserver -lif cluster-mgmt-LIF-name -home  
-port port -home-node homenode
```

- d. Revert the cluster management LIF to its new home port:

```
network interface revert -lif cluster-mgmt-LIF-name -vserver vservername
```

- e. Change the intercluster LIF's home port:

```
network interface modify -vserver vservice -lif intercluster-lif-name -home
-node nodename -home-port port
```

f. Revert the intercluster LIF to its new home port:

```
network interface revert -lif intercluster-lif-name -vserver vservice
```

Bringing up node_A_2-IP and node_B_2-IP

You must bring up and configure the new MetroCluster IP node at each site, creating an HA pair in each site.

Bringing up node_A_2-IP and node_B_2-IP

You must boot the new controller modules one at a time using the correct option at the boot menu.

About this task

In these steps, you boot up the two brand new nodes, expanding what had been a two-node configuration into a four-node configuration.

These steps are performed on the following nodes:

- node_A_2-IP
- node_B_2-IP



Steps

1. Boot the new nodes using boot option "9c".

Please choose one of the following:

- (1) Normal Boot.
- (2) Boot without /etc/rc.
- (3) Change password.
- (4) Clean configuration and initialize all disks.
- (5) Maintenance mode boot.
- (6) Update flash from backup config.
- (7) Install new software first.
- (8) Reboot node.
- (9) Configure Advanced Drive Partitioning. Selection (1-9)? 9c

The node initializes and boots to the node setup wizard, similar to the following.

Welcome to node setup

You can enter the following commands at any time:

"help" or "?" - if you want to have a question clarified,

"back" - if you want to change previously answered questions, and

"exit" or "quit" - if you want to quit the setup wizard.

Any changes you made before quitting will be saved.

To accept a default or omit a question, do not enter a value. .

.
.

If option "9c" does not succeed, take the following steps to avoid possible data loss:

- Do not attempt to run option 9a.
- Physically disconnect the existing shelves that contain data from the original MetroCluster FC configuration (shelf_A_1, shelf_A_2, shelf_B_1, shelf_B_2).
- Contact technical support, referencing the KB article [MetroCluster FC to IP transition - Option 9c Failing](#).

[NetApp Support](#)

2. Enable the AutoSupport tool by following the directions provided by the wizard.
3. Respond to the prompts to configure the node management interface.

Enter the node management interface port: [e0M]:

Enter the node management interface IP address: 10.228.160.229

Enter the node management interface netmask: 225.225.252.0

Enter the node management interface default gateway: 10.228.160.1

4. Verify that the storage failover mode is set to HA:

```
storage failover show -fields mode
```

If the mode is not HA, set it:

```
storage failover modify -mode ha -node localhost
```

You must then reboot the node for the change to take effect.

5. List the ports in the cluster:

```
network port show
```

For complete command syntax, see the man page.

The following example shows the network ports in cluster01:

```
cluster01::> network port show
```

						Speed
(Mbps)						
Node	Port	IPspace	Broadcast Domain	Link	MTU	Admin/Oper
-----	-----	-----	-----	-----	-----	
cluster01-01						
	e0a	Cluster	Cluster	up	1500	auto/1000
	e0b	Cluster	Cluster	up	1500	auto/1000
	e0c	Default	Default	up	1500	auto/1000
	e0d	Default	Default	up	1500	auto/1000
	e0e	Default	Default	up	1500	auto/1000
	e0f	Default	Default	up	1500	auto/1000
cluster01-02						
	e0a	Cluster	Cluster	up	1500	auto/1000
	e0b	Cluster	Cluster	up	1500	auto/1000
	e0c	Default	Default	up	1500	auto/1000
	e0d	Default	Default	up	1500	auto/1000
	e0e	Default	Default	up	1500	auto/1000
	e0f	Default	Default	up	1500	auto/1000

6. Exit the Node Setup wizard:

```
exit
```

7. Log into the admin account using the admin user name.

8. Join the existing cluster using the Cluster Setup wizard.

```

:> cluster setup
Welcome to the cluster setup wizard.
You can enter the following commands at any time:
"help" or "?" - if you want to have a question clarified,
"back" - if you want to change previously answered questions, and "exit"
or "quit" - if you want to quit the cluster setup wizard.
Any changes you made before quitting will be saved.
You can return to cluster setup at any time by typing "cluster setup".
To accept a default or omit a question, do not enter a value.
Do you want to create a new cluster or join an existing cluster?
{create, join}:
join

```

9. After you complete the Cluster Setup wizard and it exits, verify that the cluster is active and the node is healthy:

```
cluster show
```

10. Disable disk autoassignment:

```
storage disk option modify -autoassign off -node node_A_2-IP
```

11. If encryption is used, restore the keys using the correct command for your key management configuration.

If you are using...	Use this command...
Onboard key management	<pre>security key-manager onboard sync</pre> <p>For more information, see Restoring onboard key management encryption keys.</p>
External key management	<pre>security key-manager key query -node node-name</pre> <p>For more information, see Restoring external key management encryption keys.</p>

12. Repeat the above steps on the second new controller module (node_B_2-IP).

Verifying MTU settings

Verify that MTU settings are set correctly for the ports and broadcast domain and make changes.

Steps

1. Check the MTU size used in the cluster broadcast domain:

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

2. If necessary, update the MTU size as needed:

```
network port broadcast-domain modify -broadcast-domain bcast-domain-name -mtu
mtu-size
```

Configuring intercluster LIFs

Configure the intercluster LIFs required for cluster peering.

This task must be performed on both of the new nodes, node_A_2-IP and node_B_2-IP.

Step

1. Configure the intercluster LIFs. See [Configuring intercluster LIFs](#)

Verifying cluster peering

Verify that cluster_A and cluster_B are peered and nodes on each cluster can communicate with each other.

Steps

1. Verify the cluster peering relationship:

```
cluster peer health show
```

```
cluster01::> cluster peer health show
Node          cluster-Name          Node-Name
          Ping-Status          RDB-Health Cluster-Health Avail...
-----
node_A_1-IP
          cluster_B          node_B_1-IP
          Data: interface_reachable
          ICMP: interface_reachable true          true          true
          node_B_2-IP
          Data: interface_reachable
          ICMP: interface_reachable true          true          true
node_A_2-IP
          cluster_B          node_B_1-IP
          Data: interface_reachable
          ICMP: interface_reachable true          true          true
          node_B_2-IP
          Data: interface_reachable
          ICMP: interface_reachable true          true          true
```

2. Ping to check that the peer addresses are reachable:

```
cluster peer ping -originating-node local-node -destination-cluster remote-
cluster-name
```

Configuring the new nodes and completing transition

With the new nodes added, you must complete the transition steps and configure the MetroCluster IP nodes.

Configuring the MetroCluster IP nodes and disabling transition

You must implement the MetroCluster IP connections, refresh the MetroCluster configuration, and disable transition mode.

1. Form the new nodes into a DR group by issuing the following commands from controller node_A_1-IP:

```
metrocluster configuration-settings dr-group create -partner-cluster peer-cluster-name -local-node local-controller-name -remote-node remote-controller-name

metrocluster configuration-settings dr-group show
```

2. Create MetroCluster IP interfaces (node_A_1-IP, node_A_2-IP, node_B_1-IP, node_B_2-IP) — two interfaces need to be created per controller; eight interfaces in total:

```
metrocluster configuration-settings interface create -cluster-name cluster-name -home-node controller-name -home-port port -address ip-address -netmask netmask -vlan-id vlan-id`metrocluster configuration-settings interface show
```



Beginning with ONTAP 9.9.1, if you are using a layer 3 configuration, you must also specify the `-gateway` parameter when creating MetroCluster IP interfaces. Refer to [Considerations for layer 3 wide-area networks](#).

The `-vlan-id` parameter is required only if you are not using the default VLAN IDs. Only certain systems support non-default VLAN IDs.



- Certain platforms use a VLAN for the MetroCluster IP interface. By default, each of the two ports use a different VLAN: 10 and 20. You can also specify a different (non-default) VLAN higher than 100 (between 101 and 4095) using the `-vlan-id` parameter in the `metrocluster configuration-settings interface create` command.
- Beginning with ONTAP 9.9.1, if you are using a layer 3 configuration, you must also specify the `-gateway` parameter when creating MetroCluster IP interfaces. Refer to [Considerations for layer 3 wide-area networks](#).

The following platform models can be added to the existing MetroCluster configuration if the VLANs used are 10/20 or greater than 100. If any other VLANs are used, then these platforms cannot be added to the existing configuration as the MetroCluster interface cannot be configured. If you are using any other platform, the VLAN configuration is not relevant as this is not required in ONTAP.

AFF platforms	FAS platforms
---------------	---------------

<ul style="list-style-type: none"> • AFF A220 • AFF A250 • AFF A400 	<ul style="list-style-type: none"> • FAS2750 • FAS500f • FAS8300 • FAS8700
------------------------------------------------------------------------------------------------------	----------------------------------------------------------------------------------------------------------------------

3. Perform the MetroCluster connect operation from controller node_A_1-IP to connect the MetroCluster sites — this operation can take a few minutes to complete:

```
metrocluster configuration-settings connection connect
```

4. Verify that the remote cluster disks are visible from each controller via the iSCSI connections:

```
disk show
```

You should see the remote disks belonging to the other nodes in the configuration.

5. Mirror the root aggregate for node_A_1-IP and node_B_1-IP:

```
aggregate mirror -aggregate root-aggr
```

6. Assign disks for node_A_2-IP and node_B_2-IP.

Pool 1 disk assignments were already made for node_A_1-IP and node_B_1-IP when the `boot_after_mcc_transition` command was issued at the boot menu.

- a. Issue the following commands on node_A_2-IP:

```
disk assign disk1disk2disk3 ... diskn -sysid node_B_2-IP-controller-sysid
-pool 1 -force
```

- b. Issue the following commands on node_B_2-IP:

```
disk assign disk1disk2disk3 ... diskn -sysid node_A_2-IP-controller-sysid
-pool 1 -force
```

7. Confirm ownership has been updated for the remote disks:

```
disk show
```

8. If necessary, refresh the ownership information using the following commands:

- a. Go to advanced privilege mode and enter `y` when prompted to continue:

```
set priv advanced
```

- b. Refresh disk ownership:

```
disk refresh-ownership controller-name
```

- c. Return to admin mode:

```
set priv admin
```

9. Mirror the root aggregates for node_A_2-IP and node_B_2-IP:

```
aggregate mirror -aggregate root-aggr
```

10. Verify that the aggregate re-synchronization has completed for root and data aggregates:

```
aggr show``aggr plex show
```

The resync can take some time but must complete before proceeding with the following steps.

11. Refresh the MetroCluster configuration to incorporate the new nodes:

a. Go to advanced privilege mode and enter y when prompted to continue:

```
set priv advanced
```

b. Refresh the configuration:

If you have configured...	Issue this command...
A single aggregate in each cluster:	metrocluster configure -refresh true -allow-with-one-aggregate true
More than a single aggregate in each cluster	metrocluster configure -refresh true

c. Return to admin mode:

```
set priv admin
```

12. Disable MetroCluster transition mode:

a. Enter advanced privilege mode and enter “y” when prompted to continue:

```
set priv advanced
```

b. Disable transition mode:

```
metrocluster transition disable
```

c. Return to admin mode:

```
set priv admin
```

Setting up data LIFs on the new nodes

You must configure data LIFs on the new nodes, node_A_2-IP and node_B_2-IP.

You must add any new ports available on new controllers to a broadcast domain if not already assigned to one. If required, create VLANs or interface groups on the new ports. See [Network and LIF management](#)

1. Identify the current port usage and broadcast domains:

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

2. Add ports to broadcast domains and VLANs as necessary.

a. View the IP spaces:

```
network ipspace show
```

b. Create IP spaces and assign data ports as needed.

[Configuring IPspaces \(cluster administrators only\)](#)

c. View the broadcast domains:

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

d. Add any data ports to a broadcast domain as needed.

[Adding or removing ports from a broadcast domain](#)

e. Recreate VLANs and interface groups as needed.

VLAN and interface group membership might be different than that of the old node.

[Creating a VLAN](#)

[Combining physical ports to create interface groups](#)

3. Verify that the LIFs are hosted on the appropriate node and ports on the MetroCluster IP nodes (including the SVM with -mc vserver) as needed.

See the information gathered in [Creating the network configuration](#).

a. Check the home port of the LIFs:

```
network interface show -field home-port
```

b. If necessary, modify the LIF configuration:

```
vserver config override -command "network interface modify -vserver  
vserver_name -home-port active_port_after_upgrade -lif lif_name -home- node  
new_node_name"
```

c. Revert the LIFs to their home ports:

```
network interface revert * -vserver vserver_name
```

Bringing up the SVMs

Due to the changes if LIF configuration, you must restart the SVMs on the new nodes.

Steps

1. Check the state of the SVMs:

```
metrocluster vserver show
```

2. Restart the SVMs on cluster_A that do not have an “-mc” suffix:

```
vserver start -vserver svm-name -force true
```

3. Repeat the previous steps on the partner cluster.
4. Check that all SVMs are in a healthy state:

```
metrocluster vserver show
```

5. Verify that all data LIFs are online:

```
network interface show
```

Moving a system volume to the new nodes

To improve resiliency, a system volume should be moved from controller node_A_1-IP to controller node_A_2-IP, and also from node_B_1-IP to node_B_2-IP. You must create a mirrored aggregate on the destination node for the system volume.

About this task

System volumes have the name form “MDV_CRS_*_A” or “MDV_CRS_*_B.” The designations “_A” and “_B” are unrelated to the site_A and site_B references used throughout this section; e.g., MDV_CRS_*_A is not associated with site_A.

Steps

1. Assign at least three pool 0 and three pool 1 disks each for controllers node_A_2-IP and node_B_2-IP as needed.
2. Enable disk auto-assignment.
3. Move the _B system volume from node_A_1-IP to node_A_2-IP using the following steps from site_A.
 - a. Create a mirrored aggregate on controller node_A_2-IP to hold the system volume:

```
aggr create -aggregate new_node_A_2-IP_aggr -diskcount 10 -mirror true -node  
nodename_node_A_2-IP
```

```
aggr show
```

The mirrored aggregate requires five pool 0 and five pool 1 spare disks owned by controller node_A_2-IP.

The advanced option, “-force-small-aggregate true” can be used to limit disk use to 3 pool 0 and 3 pool 1 disks, if disks are in short supply.

- b. List the system volumes associated with the admin SVM:

```
vserver show
```

```
volume show -vserver admin-vserver-name
```

You should identify volumes contained by aggregates owned by site_A. The site_B system volumes will also be shown.

4. Move the MDV_CRS_*_B system volume for site_A to the mirrored aggregate created on controller node_A_2-IP

- a. Check for possible destination aggregates:

```
volume move target-aggr show -vserver admin-vserver-name -volume  
system_vol_MDV_B
```

The newly created aggregate on node_A_2-IP should be listed.

- b. Move the volume to the newly created aggregate on node_A_2-IP:

```
set advanced
```

```
volume move start -vserver admin-vserver -volume system_vol_MDV_B  
-destination-aggregate new_node_A_2-IP_aggr -cutover-window 40
```

- c. Check status for the move operation:

```
volume move show -vserver admin-vserver-name -volume system_vol_MDV_B
```

- d. When the move operation complete, verify that the MDV_CRS_*_B system is contained by the new aggregate on node_A_2-IP:

```
set admin
```

```
volume show -vserver admin-vserver
```

5. Repeat the above steps on site_B (node_B_1-IP and node_B_2-IP).

Returning the system to normal operation

You must perform final configuration steps and return the MetroCluster configuration to normal operation.

Verifying MetroCluster operation and assigning drives after transition

You must verify that the MetroCluster is operating correctly and assign drives to the second pair of new nodes (node_A_2-IP and node_B_2-IP).

1. Confirm that the MetroCluster configuration-type is IP-fabric: `metrocluster show`
2. Perform a MetroCluster check.
 - a. Issue the following command: `metrocluster check run`
 - b. Display the results of the MetroCluster check: `metrocluster check show`
3. Confirm that the DR group with the MetroCluster IP nodes is configured: `metrocluster node show`
4. Create and mirror additional data aggregates for controllers node_A_2-IP and node_B_2-IP at each site as needed.

Installing licenses for the new controller module

You must add licenses for the new controller module for any ONTAP services that require standard (node-locked) licenses. For features with standard licenses, each node in the cluster must have its own key for the feature.

For detailed information about licensing, see the knowledgebase article 3013749: Data ONTAP 8.2 Licensing Overview and References on the NetApp Support Site and the *System Administration Reference*.

1. If necessary, obtain license keys for the new node on the NetApp Support Site in the My Support section under Software licenses.

For further information on license replacements, see the Knowledge Base article [Post Motherboard Replacement Process to update Licensing on a AFF/FAS system](#).

2. Issue the following command to install each license key: `system license add -license-code license_key`

The license_key is 28 digits in length.

Repeat this step for each required standard (node-locked) license.

Completing configuration of the nodes

There are miscellaneous configuration steps that can be performed prior to completing the procedures. Some of these steps are optional.

1. Configure the service processor: `system service-processor network modify`
2. Set up autosupport on the new nodes: `system node autosupport modify`
3. The controllers can be optionally renamed as part of the transition. The following command is used to rename a controller: `system node rename -node <old-name> -newname <new-name>`

The renaming operation can take a few minutes to complete. Confirm that any name changes have propagated to each node prior to continuing with other steps using the `system show -fields node` command.

4. Configure a monitoring service as desired.

[Considerations for Mediator](#)

xref:./transition/./install-ip/concept_mediator_requirements.html

[Tiebreaker Software installation and configuration](#)

Sending a custom AutoSupport message after maintenance

After completing the transition, you should send an AutoSupport message indicating the end of maintenance, so automatic case creation can resume.

1. To resume automatic support case generation, send an AutoSupport message to indicate that the maintenance is complete.

- a. Issue the following command: `system node autosupport invoke -node * -type all -message MAINT=end`
- b. Repeat the command on the partner cluster.

Disruptively transitioning from MetroCluster FC to MetroCluster IP when retiring storage shelves (ONTAP 9.8 and later)

Beginning with ONTAP 9.8, you can disruptively transition a two-node MetroCluster FC configuration to a four-node MetroCluster IP configuration and retire the existing storage shelves. The procedure includes steps to move data from the existing drive shelves to the new configuration, and then retire the old shelves.

- This procedure is used when you plan to retire the existing storage shelves and move all data to the new shelves in the MetroCluster IP configuration.
- The existing storage shelf models must be supported by the new MetroCluster IP nodes.
- This procedure is supported on systems running ONTAP 9.8 and later.
- This procedure is disruptive.
- This procedure applies only to a two-node MetroCluster FC configuration.

If you have a four-node MetroCluster FC configuration, see [Choosing your transition procedure](#).

- You must meet all requirements and follow all steps in the procedure.

Requirements for transition when retiring old shelves

Before starting the transition process, you must make sure the existing MetroCluster FC configuration meets the requirements.

- It must be a two-node fabric-attached or stretch MetroCluster configuration and all nodes must be running ONTAP 9.8 or later.

The new MetroCluster IP controller modules should be running the same version of ONTAP 9.8.

- The existing and new platforms must be a supported combination for transition.

[Supported platforms for nondisruptive transition](#)

- It must meet all requirements and cabling as described in the *MetroCluster Installation and Configuration Guides*.

[Fabric-attached MetroCluster installation and configuration](#)

The new configuration must also meet the following requirements:

- The new MetroCluster IP platform models must support the old storage shelf models.

[NetApp Hardware Universe](#)

- Depending on the spare disks available in the existing shelves, additional drives must be added.

This might require additional drive shelves.

You need to have additional 14 to 18 drives for each controller:

- Three pool 0 drives
 - Three pool 1 drives
 - Two spare drives
 - Six to ten drives for the system volume
- You must ensure that the configuration, including the new nodes, does not exceed the platform limits for the configuration, including drive count, root aggregate size capacity, etc.

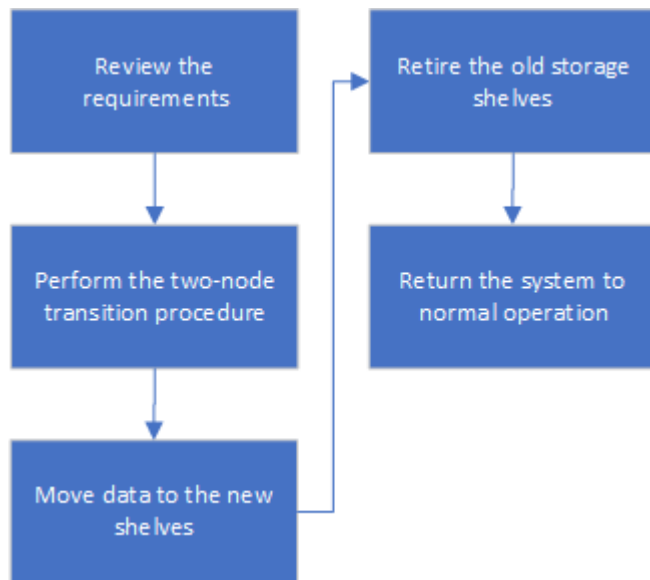
This information is available for each platform model at [NetApp Hardware Universe](#)

You must have remote console access for all six nodes from either MetroCluster site or plan for travel between the sites as required by the procedure.

Workflow for disruptive transition when moving data and retiring old storage shelves

You must follow the specific workflow to ensure a successful transition.

As you prepare for the transition, plan for travel between the sites. Note that after the remote nodes are racked and cabled, you need serial terminal access to the nodes. Service Processor access is not be available until the nodes are configured.



Transitioning the configuration

You must follow the detailed transition procedure.

About this task

In the following steps you are directed to other procedures. You must perform the steps in each referenced procedure in the order given.

Steps

1. Plan port mapping using the steps in [Mapping ports from the MetroCluster FC nodes to the MetroCluster IP nodes](#).
2. Prepare the MetroCluster IP controllers using the steps in [Preparing the MetroCluster IP controllers](#).
3. Verify the health of the MetroCluster FC configuration.

Perform the steps in [Verifying the health of the MetroCluster FC configuration](#).

4. Gather information from the MetroCluster FC configuration.

Perform the steps in [Gathering information from the existing controller modules before the transition](#).

5. Remove Tiebreaker monitoring, if necessary.

Perform the steps in [Removing the existing configuration from the Tiebreaker or other monitoring software](#).

6. Prepare and remove the existing MetroCluster FC nodes.

Perform the steps in [Transitioning the MetroCluster FC nodes](#).

7. Connect the new MetroCluster IP nodes.

Perform the steps in [Connecting the MetroCluster IP controller modules](#).

8. Configure the new MetroCluster IP nodes and complete transition.

Perform the steps in [Configuring the new nodes and completing transition](#).

Migrating the root aggregates

After the transition is complete, migrate the existing root aggregates leftover from the MetroCluster FC configuration to new shelves in the MetroCluster IP configuration.

About this task

This task moves the root aggregates for node_A_1-FC and node_B_1-FC to disk shelves owned by the new MetroCluster IP controllers:

Steps

1. Assign pool 0 disks on the new local storage shelf to the controller that has the root being migrated (e.g., if the root of node_A_1-FC is being migrated, assign pool 0 disks on the new shelf to node_A_1-IP)

Note that the migration *removes and does not re-create the root mirror*, so pool 1 disks do not need to be assigned before issuing the migrate command

2. Set the privilege mode to advanced:

```
set priv advanced
```

3. Migrate the root aggregate:

```
system node migrate-root -node node-name -disklist disk-id1,disk-id2,diskn  
-raid-type raid-type
```

- The node-name is the node to which the root aggregate is being migrated.
- The disk-id identifies the pool 0 disks on the new shelf.
- The raid-type is normally the same as the raid-type of the existing root aggregate.
- You can use the command `job show -id job-id -instance` to check the migration status, where job-id is the value provided when the migrate-root command is issued.

For example, if the root aggregate for node_A_1-FC consisted of three disks with raid_dp, the following command would be used to migrate root to a new shelf 11:

```
system node migrate-root -node node_A_1-IP -disklist
3.11.0,3.11.1,3.11.2 -raid-type raid_dp
```

4. Wait until the migration operation completes and the node automatically reboots.
5. Assign pool 1 disks for the root aggregate on a new shelf directly connected to the remote cluster.
6. Mirror the migrated root aggregate.
7. Wait for the root aggregate to complete resynchronising.

You can use the storage aggregate show command to check the sync status of the aggregates.

8. Repeat these steps for the other root aggregate.

Migrating the data aggregates

Create data aggregates on the new shelves and use volume move to transfer the data volumes from the old shelves to the aggregates on the new shelves.

1. Move the data volumes to aggregates on the new controllers, one volume at a time.

[Creating an aggregate and moving volumes to the new nodes](#)

Retiring shelves moved from node_A_1-FC and node_A_2-FC

You retire the old storage shelves from the original MetroCluster FC configuration. These shelves were originally owned by node_A_1-FC and node_A_2-FC.

1. Identify the aggregates on the old shelves on cluster_B that need to be deleted.

In this example the following data aggregates are hosted by the MetroCluster FC cluster_B and need to be deleted: aggr_data_a1 and aggr_data_a2.



You need to perform the steps to identify, offline and delete the data aggregates on the shelves. The example is for one cluster only.

```
cluster_B::> aggr show
```

Aggregate Status	Size	Available	Used%	State	#Vols	Nodes	RAID
-----	-----	-----	-----	-----	-----	-----	-----
aggr0_node_A_1-FC	349.0GB	16.83GB	95%	online	1	node_A_1-IP	
raid_dp,							
mirrored,							
normal							
aggr0_node_A_2-IP	349.0GB	16.83GB	95%	online	1	node_A_2-IP	
raid_dp,							
mirrored,							
normal							
...							
8 entries were displayed.							

```
cluster_B::>
```

2. Check if the data aggregates have any MDV_aud volumes, and delete them prior to deleting the aggregates.

You must delete the MDV_aud volumes as they cannot be moved.

3. Take each of the aggregates offline, and then delete them:

- a. Take the aggregate offline:

```
storage aggregate offline -aggregate aggregate-name
```

The following example shows the aggregate node_B_1_aggr0 being taken offline:

```
cluster_B::> storage aggregate offline -aggregate node_B_1_aggr0

Aggregate offline successful on aggregate: node_B_1_aggr0
```

- b. Delete the aggregate:

```
storage aggregate delete -aggregate aggregate-name
```

You can destroy the plex when prompted.

The following example shows the aggregate node_B_1_aggr0 being deleted.

```
cluster_B::> storage aggregate delete -aggregate node_B_1_aggr0
Warning: Are you sure you want to destroy aggregate "node_B_1_aggr0"?
{y|n}: y
[Job 123] Job succeeded: DONE

cluster_B::>
```

4. After deleting all aggregates, power down, disconnect, and remove the shelves.
5. Repeat the above steps to retire the cluster_A shelves.

Completing transition

With the old controller modules removed, you can complete the transition process.

Step

1. Complete the transition process.

Perform the steps in [Returning the system to normal operation](#).

Disruptively transitioning when existing shelves are not supported on new controllers (ONTAP 9.8 and later)

Beginning with ONTAP 9.8, you can disruptively transition a two-node MetroCluster FC configuration and move data from the existing drive shelves even if the existing storage shelves are not supported by the new MetroCluster IP nodes.

- This procedure should only be used if the existing storage shelf models are not supported by the new MetroCluster IP platform models.
- This procedure is supported on systems running ONTAP 9.8 and later.
- This procedure is disruptive.
- This procedure applies only to a two-node MetroCluster FC configuration.

If you have a four-node MetroCluster FC configuration, see [Choosing your transition procedure](#).

- You must meet all requirements and follow all steps in the procedure.

Requirements for transition when shelves are not supported on the new nodes

Before starting the transition process, you must make sure the configuration meets the requirements.

Before you begin

- The existing configuration must be a two-node fabric-attached or stretch MetroCluster configuration and all nodes must be running ONTAP 9.8 or later.

The new MetroCluster IP controller modules should be running the same version of ONTAP 9.8.

- The existing and new platforms must be a supported combination for transition.

[Supported platforms for nondisruptive transition](#)

- It must meet all requirements and cabling as described in [Fabric-attached MetroCluster installation and configuration](#).
- New storage shelves provided with the new controllers (node_A_1-IP, node_A_2-IP, node_B_1-IP and node_B_2-IP) must be supported by the old controllers (node_A_1-FC and node_B_1-FC).

[NetApp Hardware Universe](#)

- The old storage shelves are **not** supported by the new MetroCluster IP platform models.

[NetApp Hardware Universe](#)

- Depending on the spare disks available in the existing shelves, additional drives must be added.

This might require additional drive shelves.

You need to have additional 14 to 18 drives for each controller:

- Three pool0 drives
- Three pool1 drives
- Two spare drives
- Six to ten drives for the system volume
- You must ensure that the configuration, including the new nodes, does not exceed the platform limits for the configuration, including drive count, root aggregate size capacity, etc.

This information is available for each platform model at *NetApp Hardware Universe*.

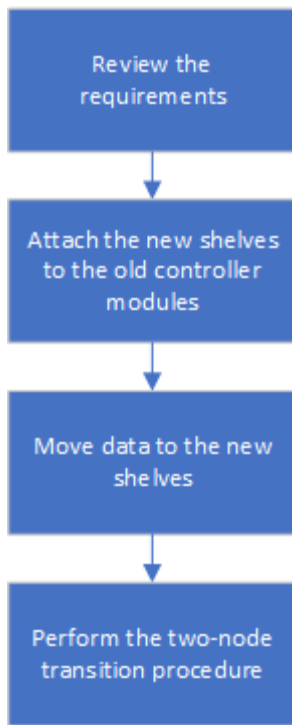
[NetApp Hardware Universe](#)

- You must have remote console access for all six nodes from either MetroCluster site or plan for travel between the sites as required by the procedure.

Workflow for disruptive transition when shelves are not supported by new controllers

If the existing shelf models are not supported by the new platform models, you must attach the new shelves to the old configuration, move data onto the new shelves, and then transition to the new configuration.

As you prepare for the transition, plan for travel between the sites. Note that after the remote nodes are racked and cabled, you need serial terminal access to the nodes. Service Processor access is not be available until the nodes are configured.



Preparing the new controller modules

You must clear the configuration and disk ownership on the new controller modules and the new storage shelves.

Steps

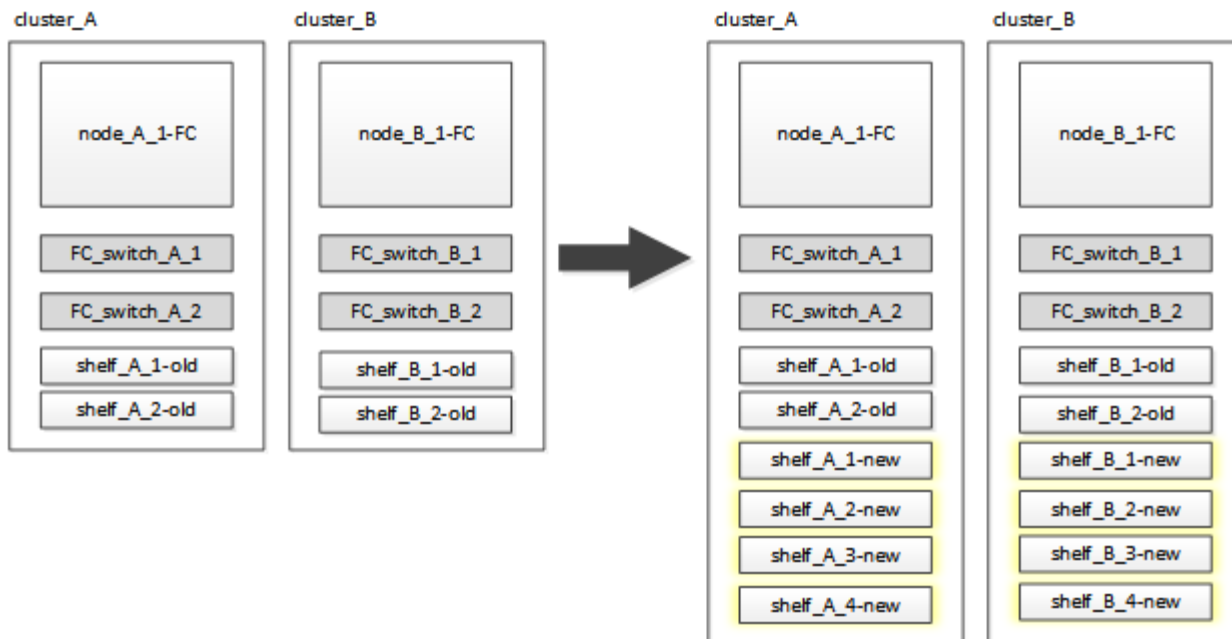
1. With the new storage shelves attached to the new MetroCluster IP controller modules, perform all the steps in [Preparing the MetroCluster IP controllers](#).
2. Disconnect the new storage shelves from the new MetroCluster IP controller modules.

Attaching the new disk shelves to the existing MetroCluster FC controllers

You must attach the new drive shelves to the existing controller modules before transitioning to a MetroCluster IP configuration.

About this task

The following illustration shows the new shelves attached to the MetroCluster FC configuration.



Steps

1. Disable disk autoassignment on node_A_1-FC and node_A_2-FC:

```
disk option modify -node node-name -autoassign off
```

This command must be issued on each node.

Disk auto-assign is disabled to avoid assignment of the shelves to be added to node_A_1-FC and node_B_1-FC. As part the transition, disks are needed for nodes node_A_1-IP and node_B_2-IP and if autoassign is allowed, disk ownership would later need to be removed before disks could be assigned to node_A_1-IP and node_B_2-IP.

2. Attach the new shelves to the existing MetroCluster FC nodes, using FC-to-SAS bridges, if necessary.

See the requirements and procedures in [Hot-adding storage to a MetroCluster FC configuration](#)

Migrate root aggregates and move data to the new disk shelves

You must move the root aggregates from the old drive shelves to the new drive shelves that will be used by the MetroCluster IP nodes.

About this task

This task is performed prior to the transition on the existing nodes (node_A_1-FC and node_B_1-FC).

Steps

1. Perform a negotiated switchover from controller node_B_1-FC:

```
metrocluster switchover
```

2. Perform the heal aggregates and heal root steps of the recovery from node_B_1-FC:

```
metrocluster heal -phase aggregates
```

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

3. Boot controller node_A_1-FC:

```
boot_ontap
```

4. Assign the unowned disks on the new shelves to the appropriate pools for controller node_A_1-FC:

a. Identify the disks on the shelves:

```
disk show -shelf pool_0_shelf -fields container-type,diskpathnames
```

```
disk show -shelf pool_1_shelf -fields container-type,diskpathnames
```

b. Enter local mode so the commands are run on the local node:

```
run local
```

c. Assign the disks:

```
disk assign disk1disk2disk3disk... -p 0
```

```
disk assign disk4disk5disk6disk... -p 1
```

d. Exit local mode:

```
exit
```

5. Create a new mirrored aggregate to become the new root aggregate for controller node_A_1-FC:

a. Set the privilege mode to advanced:

```
set priv advanced
```

b. Create the aggregate:

```
aggregate create -aggregate new_aggr -disklist disk1, disk2, disk3,... -mirror  
-disklist disk4disk5, disk6,... -raidtypesame-as-existing-root -force-small  
-aggregate true aggr show -aggregate new_aggr -fields percent-snapshot-space
```

If the percent-snapshot-space value is less than 5 percent, you must increase it to a value higher than 5 percent:

```
aggr modify new_aggr -percent-snapshot-space 5
```

c. Set the privilege mode back to admin:

```
set priv admin
```

6. Confirm that the new aggregate is created properly:

```
node run -node local sysconfig -r
```

7. Create the node and cluster-level configuration backups:



When the backups are created during switchover, the cluster is aware of the switched over state on recovery. You must ensure that the backup and upload of the system configuration is successful as without this backup it is **not** possible to reform the MetroCluster configuration between clusters.

a. Create the cluster backup:

```
system configuration backup create -node local -backup-type cluster -backup  
-name cluster-backup-name
```

b. Check cluster backup creation

```
job show -id job-idstatus
```

c. Create the node backup:

```
system configuration backup create -node local -backup-type node -backup  
-name node-backup-name
```

d. Check for both cluster and node backups:

```
system configuration backup show
```

You can repeat the command until both backups are shown in the output.

8. Make copies of the backups.

The backups must be stored at a separate location because they will be lost locally when the new root volume is booted.

You can upload the backups to an FTP or HTTP server, or copy the backups using `scp` commands.

Process	Steps
Upload the backup to the FTP or HTTP server	<p>a. Upload the cluster backup:</p> <pre>system configuration backup upload -node local -backup <i>cluster-backup-name</i> -destination URL</pre> <p>b. Upload the node backup:</p> <pre>system configuration backup upload -node local -backup <i>node-backup-name</i> -destination URL</pre>

Copy the backups onto a remote server using secure copy

From the remote server use the following scp commands:

- a. Copy the cluster backup:

```
scp diag@node-mgmt-FC:/mroot/etc/backups/config/cluster-backup-name.7z .
```

- b. Copy the node backup:

```
scp diag@node-mgmt-FC:/mroot/etc/backups/config/node-backup-name.7z .
```

9. Halt node_A_1-FC:

```
halt -node local -ignore-quorum-warnings true
```

10. Boot node_A_1-FC to Maintenance mode:

```
boot_ontap maint
```

11. From Maintenance mode, make required changes to set the aggregate as root:

- a. Set the HA policy to cfo:

```
aggr options new_aggr ha_policy cfo
```

Respond “yes” when prompted to proceed.

```
Are you sure you want to proceed (y/n)?
```

- b. Set the new aggregate as root:

```
aggr options new_aggr root
```

- c. Halt to the LOADER prompt:

```
halt
```

12. Boot the controller and back up the system configuration.

The node boots in recovery mode when the new root volume is detected

- a. Boot the controller:

```
boot_ontap
```

- b. Log in and back up the configuration.

When you log in, you will see the following warning:

Warning: The correct cluster system configuration backup must be restored. If a backup from another cluster or another system state is used then the root volume will need to be recreated and NGS engaged for recovery assistance.

- c. Enter advanced privilege mode:

```
set -privilege advanced
```

- d. Back up the cluster configuration to a server:

```
system configuration backup download -node local -source URL of  
server/cluster-backup-name.7z
```

- e. Back up the node configuration to a server:

```
system configuration backup download -node local -source URL of server/node-  
backup-name.7z
```

- f. Return to admin mode:

```
set -privilege admin
```

13. Check the health of the cluster:

- a. Issue the following command:

```
cluster show
```

- b. Set the privilege mode to advanced:

```
set -privilege advanced
```

- c. Verify the cluster configuration details:

```
cluster ring show
```

- d. Return to the admin privilege level:

```
set -privilege admin
```

14. Confirm the operational mode of the MetroCluster configuration and perform a MetroCluster check.

- a. Confirm the MetroCluster configuration and that the operational mode is normal:

```
metrocluster show
```

- b. Confirm that all expected nodes are shown:

```
metrocluster node show
```

c. Issue the following command:

```
metrocluster check run
```

d. Display the results of the MetroCluster check:

```
metrocluster check show
```

15. Perform a switchback from controller node_B_1-FC:

```
metrocluster switchback
```

16. Verify the operation of the MetroCluster configuration:

a. Confirm the MetroCluster configuration and that the operational mode is normal:

```
metrocluster show
```

b. Perform a MetroCluster check:

```
metrocluster check run
```

c. Display the results of the MetroCluster check:

```
metrocluster check show
```

17. Add the new root volume to the Volume Location Database.

a. Set the privilege mode to advanced:

```
set -privilege advanced
```

b. Add the volume to the node:

```
volume add-other-volumes -node node_A_1-FC
```

c. Return to the admin privilege level:

```
set -privilege admin
```

18. Check that the volume is now visible and has mroot.

a. Display the aggregates:

```
storage aggregate show
```

b. Verify that the root volume has mroot:

```
storage aggregate show -fields has-mroot
```

c. Display the volumes:

```
volume show
```

19. Create a new security certificate to re-enable access to System Manager:

```
security certificate create -common-name name -type server -size 2048
```

20. Repeat the previous steps to migrate the aggregates on shelves owned by node_A_1-FC.

21. Perform a cleanup.

You must perform the following steps on both node_A_1-FC and node_B_1-FC to remove the old root volume and root aggregate.

a. Delete the old root volume:

```
run local

vol offline old_vol0

vol destroy old_vol0

exit

volume remove-other-volume -vserver node_name -volume old_vol0
```

b. Delete the original root aggregate:

```
aggr offline -aggregate old_aggr0_site

aggr delete -aggregate old_aggr0_site
```

22. Migrate the data volumes to aggregates on the new controllers, one volume at a time.

Refer to [Creating an aggregate and moving volumes to the new nodes](#)

23. Retire the old shelves by performing all the steps in [Retiring shelves moved from node_A_1-FC and node_A_2-FC](#).

Transitioning the configuration

You must follow the detailed transition procedure.

About this task

In the following steps you are directed to other topics. You must perform the steps in each topic in the order given.

Steps

1. Plan port mapping.

Perform all the steps in [Mapping ports from the MetroCluster FC nodes to the MetroCluster IP nodes](#).

2. Prepare the MetroCluster IP controllers.

Perform all the steps in [Preparing the MetroCluster IP controllers](#).

3. Verify the health of the MetroCluster configuration.

Perform all the steps in [Verifying the health of the MetroCluster FC configuration](#).

4. Prepare and remove the existing MetroCluster FC nodes.

Perform all the steps in [Transitioning the MetroCluster FC nodes](#).

5. Add the new MetroCluster IP nodes.

Perform all the steps in [Connecting the MetroCluster IP controller modules](#).

6. Complete the transition and initial configuration of the new MetroCluster IP nodes.

Perform all the steps in [Configuring the new nodes and completing transition](#).

Moving an FC SAN workload from MetroCluster FC to MetroCluster IP nodes

When non-disruptively transitioning from MetroCluster FC to IP nodes, you must non-disruptively move FC SAN host objects from MetroCluster FC to IP nodes.

1. Set up new FC interfaces (LIFS) on MetroCluster IP nodes:

- a. If required, on MetroCluster IP nodes, modify FC ports to be used for client connectivity to FC target personality.

This may require a reboot of the nodes.

- b. Create FC LIFS/interfaces on IP nodes for all SAN vservers. Optionally verify that the WWPNs from newly created FC LIFs are logged into the FC SAN switch

2. Update SAN zoning configuration for newly added FC LIFs on MetroCluster IP nodes.

To facilitate moving of volumes that contain LUNs actively serving data to FC SAN clients, update existing FC switch zones to allow FC SAN clients to access to LUNs on MetroCluster IP nodes.

- a. On the FC SAN switch (Cisco or Brocade), add the WWPNs of newly added FC SAN LIFs to the zone.
- b. Update, save and commit the zoning changes.
- c. From the client, check for FC initiator logins to the new SAN LIFs on the MetroCluster IP nodes:

```
sanlun lun show -p
```

At this time, the client should see and be logged in to the FC interfaces on both the MetroCluster FC and MetroCluster IP nodes. LUNs and volumes are still physically hosted on the MetroCluster FC nodes.

Because LUNs are reported only on MetroCluster FC node interfaces, the client shows only paths over FC nodes. This can be seen in the output of the `sanlun lun show -p` and `multipath -ll -d` commands.

```

[root@stemgr]# sanlun lun show -p
ONTAP Path: vsa_1:/vol/vsa_1_vol6/lun_linux_12
LUN: 4
LUN Size: 2g
Product: cDOT
Host Device: 3600a098038304646513f4f674e52774b
Multipath Policy: service-time 0
Multipath Provider: Native
-----
-----
host vserver
path path /dev/ host vserver
state type node adapter LIF
-----
-----
up primary sdk host3 iscsi_lf__n2_p1_
up secondary sdh host2 iscsi_lf__n1_p1_

[root@stemgr]# multipath -ll -d
3600a098038304646513f4f674e52774b dm-5 NETAPP ,LUN C-Mode
size=2.0G features='4 queue_if_no_path pg_init_retries 50
retain_attached_hw_handle' hwhandler='1 alua' wp=rw
|-+- policy='service-time 0' prio=50 status=active
|  `-- 3:0:0:4 sdk 8:160 active ready running
`-+- policy='service-time 0' prio=10 status=enabled
  `-- 2:0:0:4 sdh 8:112 active ready running

```

3. Modify the reporting nodes to add the MetroCluster IP nodes

- a. List reporting nodes for LUNs on the SVM: `lun mapping show -vserver svm-name -fields reporting-nodes -ostype linux`

Reporting nodes shown are local nodes as LUNs are physically on FC nodes A_1 and A_2.

```
cluster_A::> lun mapping show -vserver vsa_1 -fields reporting-nodes
-ostype linux
```

vserver	path	igroup	reporting-nodes
-----	-----	-----	
vsa_1	/vol/vsa_1_vol1/lun_linux_2	igroup_linux	A_1,A_2
vsa_1	/vol/vsa_1_vol1/lun_linux_3	igroup_linux	A_1,A_2
vsa_1	/vol/vsa_1_vol2/lun_linux_4	igroup_linux	A_1,A_2
vsa_1	/vol/vsa_1_vol3/lun_linux_7	igroup_linux	A_1,A_2
vsa_1	/vol/vsa_1_vol4/lun_linux_8	igroup_linux	A_1,A_2
vsa_1	/vol/vsa_1_vol4/lun_linux_9	igroup_linux	A_1,A_2
vsa_1	/vol/vsa_1_vol6/lun_linux_12	igroup_linux	A_1,A_2
vsa_1	/vol/vsa_1_vol6/lun_linux_13	igroup_linux	A_1,A_2
vsa_1	/vol/vsa_1_vol7/lun_linux_14	igroup_linux	A_1,A_2
vsa_1	/vol/vsa_1_vol8/lun_linux_17	igroup_linux	A_1,A_2
vsa_1	/vol/vsa_1_vol9/lun_linux_18	igroup_linux	A_1,A_2
vsa_1	/vol/vsa_1_vol9/lun_linux_19	igroup_linux	A_1,A_2

12 entries were displayed.

b. Add reporting nodes to include MetroCluster IP nodes.

```
cluster_A::> lun mapping add-reporting-nodes -vserver vsa_1 -path
/vol/vsa_1_vol*/lun_linux_* -nodes B_1,B_2 -igroup igroup_linux
```

12 entries were acted on.

c. List reporting nodes and verify the presence of the new nodes:


```
cluster_A::> lun mapping show -vserver vsa_1 -fields reporting-nodes
-ostype linux
```

vserver	path	igroup	reporting-nodes
-----	-----	-----	-----
-----	-----	-----	-----
vsa_1	/vol/vsa_1_vol1/lun_linux_2	igroup_linux	A_1,A_2,B_1,B_2
vsa_1	/vol/vsa_1_vol1/lun_linux_3	igroup_linux	A_1,A_2,B_1,B_2
vsa_1	/vol/vsa_1_vol2/lun_linux_4	igroup_linux	A_1,A_2,B_1,B_2
vsa_1	/vol/vsa_1_vol3/lun_linux_7	igroup_linux	A_1,A_2,B_1,B_2
...			

12 entries were displayed.

- d. Rescan the scsi bus on the host to discover the newly added paths: /usr/bin/rescan-scsi-bus.sh -a

```
[root@stemgr]# /usr/bin/rescan-scsi-bus.sh -a
Scanning SCSI subsystem for new devices
Scanning host 0 for SCSI target IDs 0 1 2 3 4 5 6 7, all LUNs
Scanning host 1 for SCSI target IDs 0 1 2 3 4 5 6 7, all LUNs
Scanning host 2 for SCSI target IDs 0 1 2 3 4 5 6 7, all LUNs
  Scanning for device 2 0 0 0 ...
.
.
.
OLD: Host: scsi5 Channel: 00 Id: 00 Lun: 09
  Vendor: NETAPP Model: LUN C-Mode Rev: 9800
  Type: Direct-Access ANSI SCSI revision: 05
0 new or changed device(s) found.
0 remapped or resized device(s) found.
0 device(s) removed.
```

- e. Display the newly added paths: sanlun lun show -p

Each LUN will have four paths.

```

[root@stemgr]# sanlun lun show -p
ONTAP Path: vsa_1:/vol/vsa_1_vol6/lun_linux_12
LUN: 4
LUN Size: 2g
Product: cDOT
Host Device: 3600a098038304646513f4f674e52774b
Multipath Policy: service-time 0
Multipath Provider: Native
-----
-----

host vserver
path path /dev/ host vserver
state type node adapter LIF
-----
-----

up primary sdk host3 iscsi_lf__n2_p1_
up secondary sdh host2 iscsi_lf__n1_p1_
up secondary sdag host4 iscsi_lf__n4_p1_
up secondary sdah host5 iscsi_lf__n3_p1_

```

- f. On the controllers, move the volumes containing LUNs from the MetroCluster FC to the MetroCluster IP nodes.

```

cluster_A::> vol move start -vserver vsa_1 -volume vsa_1_vol1
-destination-aggregate A_1_htp_005_aggr1
[Job 1877] Job is queued: Move "vsa_1_vol1" in Vserver "vsa_1" to
aggregate "A_1_htp_005_aggr1". Use the "volume move show -vserver
vsa_1 -volume vsa_1_vol1"
command to view the status of this operation.
cluster_A::> volume move show
Vserver      Volume      State      Move Phase      Percent-Complete Time-To-
Complete
-----
-----
vsa_1        vsa_1_vol1 healthy  initializing
- -

```

- g. On the FC SAN client, display the LUN information: `sanlun lun show -p`

The FC interfaces on the MetroCluster IP nodes where the LUN now resides are updated as primary paths. If the primary path is not updated after the volume move, run `/usr/bin/rescan-scsi-bus.sh -a` or simply wait for multipath rescanning to take place.

The primary path in the following example is the LIF on MetroCluster IP node.

```
[root@localhost ~]# sanlun lun show -p
```

ONTAP Path: vsa_1:/vol/vsa_1_vol1/lun_linux_2
 LUN: 22
 LUN Size: 2g
 Product: cDOT
 Host Device: 3600a098038302d324e5d50305063546e
 Multipath Policy: service-time 0
 Multipath Provider: Native

```
-----
```

host	vserver		host	vserver
path	path	/dev/	adapter	LIF
state	type	node		
up	primary	sddv	host6	fc_5
up	primary	sdjx	host7	fc_6
up	secondary	sdgv	host6	fc_8
up	secondary	sdkr	host7	fc_8

h. Repeat the above steps for all volumes, LUNs and FC interfaces belonging to a FC SAN host.

When completed, all LUNs for a given SVM and FC SAN host should be on MetroCluster IP nodes.

4. Remove the reporting nodes and re-scan paths from client.

- a. Remove the remote reporting nodes (the MetroCluster FC nodes) for the linux LUNs: `lun mapping remove-reporting-nodes -vserver vsa_1 -path * -igroup igroup_linux -remote-nodes true`

```
cluster_A::> lun mapping remove-reporting-nodes -vserver vsa_1 -path
* -igroup igroup_linux -remote-nodes true
12 entries were acted on.
```

- b. Check reporting nodes for the LUNs: `lun mapping show -vserver vsa_1 -fields reporting-nodes -ostype linux`

```
cluster_A::> lun mapping show -vserver vsa_1 -fields reporting-nodes
-ostype linux

vserver path igroup reporting-nodes
-----
vsa_1 /vol/vsa_1_vol1/lun_linux_2 igroup_linux B_1,B_2
vsa_1 /vol/vsa_1_vol1/lun_linux_3 igroup_linux B_1,B_2
vsa_1 /vol/vsa_1_vol2/lun_linux_4 igroup_linux B_1,B_2
...

12 entries were displayed.
```

c. Rescan the scsi bus on the client: `/usr/bin/rescan-scsi-bus.sh -r`

The paths from the MetroCluster FC nodes are removed:

```
[root@stemgr]# /usr/bin/rescan-scsi-bus.sh -r
Syncing file systems
Scanning SCSI subsystem for new devices and remove devices that have
disappeared
Scanning host 0 for SCSI target IDs 0 1 2 3 4 5 6 7, all LUNs
Scanning host 1 for SCSI target IDs 0 1 2 3 4 5 6 7, all LUNs
Scanning host 2 for SCSI target IDs 0 1 2 3 4 5 6 7, all LUNs
sg0 changed: LU not available (PQual 1)
REM: Host: scsi2 Channel: 00 Id: 00 Lun: 00
DEL: Vendor: NETAPP Model: LUN C-Mode Rev: 9800
Type: Direct-Access ANSI SCSI revision: 05
sg2 changed: LU not available (PQual 1)
.
.
.
OLD: Host: scsi5 Channel: 00 Id: 00 Lun: 09
Vendor: NETAPP Model: LUN C-Mode Rev: 9800
Type: Direct-Access ANSI SCSI revision: 05
0 new or changed device(s) found.
0 remapped or resized device(s) found.
24 device(s) removed.
[2:0:0:0]
[2:0:0:1]
...
```

d. Verify that only paths from the MetroCluster IP nodes are visible from the host: `sanlun lun show -p`

- e. If required, remove iSCSI LIFs from the MetroCluster FC nodes.

This should be done if there are no other LUNs on the nodes mapped to other clients.

Moving Linux iSCSI hosts from MetroCluster FC to MetroCluster IP nodes

After you transition your MetroCluster nodes from FC to IP, you might need to move your iSCSI host connections to the new nodes.

In this procedure IPv4 interfaces are created.

The host commands and examples given in these procedures are specific to LINUX operating systems.

Setting up new iSCSI connections

To move iSCSI connections, you must set up new iSCSI connections to the MetroCluster IP nodes.

1. Create iSCSI interfaces on the MetroCluster IP nodes and check ping connectivity from the iSCSI clients to the new IP interfaces on the MetroCluster IP nodes.

Creating network interfaces

All iSCSI interfaces from the SVM should be reachable by iSCSI client.

2. On the iSCSI host or client, identify the existing iSCSI connections from the host to the MetroCluster FC node: `iscsiadm -m session`

```
[root@scspr1789621001 ~]# iscsiadm -m session

tcp: [1] 10.230.68.236:3260,1156 iqn.1992-
08.com.netapp:sn.58d7f6df2cc611eaa9c500a098a71638:vs.6 (non-flash)

tcp: [2] 10.230.68.237:3260,1158 iqn.1992-
08.com.netapp:sn.58d7f6df2cc611eaa9c500a098a71638:vs.6 (non-flash)
```

3. Verify the connections from the MetroCluster IP node: `iscsi session show -vserver svm-name`

```
node_A_1-IP::*> iscsi session show -vserver vsa_1
```

Tpgroup	Initiator	Initiator
Vserver Name	TSIH Name	ISID Alias
-----	-----	-----
-----	-----	-----
vsa_1 iscsi_lf__n1_p1_ 4	iqn.2020-01.com.netapp.englab.gdl:scspr1789621001	00:02:3d:00:00:01
scspr1789621001.gdl.englab.netapp.com		
vsa_1 iscsi_lf__n2_p1_ 4	iqn.2020-01.com.netapp.englab.gdl:scspr1789621001	00:02:3d:00:00:02
scspr1789621001.gdl.englab.netapp.com		

2 entries were displayed.

4. List the iscsi interfaces in ONTAP for the SVM that contains the interfaces: `iscsi interface show -vserver svm-name`

```
sti8200mcchtp001htp_siteA::*> iscsi interface show -vserver vsa_1
```

Logical	Status	Curr	Curr
Vserver	Interface	TPGT	Admin/Oper IP Address Node Port Enabled
-----	-----	-----	-----
-----	-----	-----	-----
vsa_1 iscsi_lf__n1_p1_ 1156	up/up	10.230.68.236	sti8200mcc-htp-001 e0g true
vsa_1 iscsi_lf__n1_p2_ 1157	up/up	fd20:8b1e:b255:805e::78c9	sti8200mcc-htp-001 e0h true
vsa_1 iscsi_lf__n2_p1_ 1158	up/up	10.230.68.237	sti8200mcc-htp-002 e0g true
vsa_1 iscsi_lf__n2_p2_ 1159	up/up	fd20:8b1e:b255:805e::78ca	sti8200mcc-htp-002 e0h true
vsa_1 iscsi_lf__n3_p1_ 1183	up/up	10.226.43.134	sti8200mccip-htp-005 e0c true
vsa_1 iscsi_lf__n4_p1_ 1188	up/up	10.226.43.142	sti8200mccip-htp-006 e0c true

6 entries were displayed.

5. On the iSCSI client, run discovery on any one of the iSCSI IP addresses on the SVM to discover the new targets: `iscsiadm -m discovery -t sendtargets -p iscsi-ip-address`

Discovery can be run on any IP address of the SVM, including non-iSCSI interfaces.

```
[root@scspr1789621001 ~]# iscsiadm -m discovery -t sendtargets -p
10.230.68.236:3260

10.230.68.236:3260,1156 iqn.1992-
08.com.netapp:sn.58d7f6df2cc611eaa9c500a098a71638:vs.6
10.226.43.142:3260,1188 iqn.1992-
08.com.netapp:sn.58d7f6df2cc611eaa9c500a098a71638:vs.6
10.226.43.134:3260,1183 iqn.1992-
08.com.netapp:sn.58d7f6df2cc611eaa9c500a098a71638:vs.6
10.230.68.237:3260,1158 iqn.1992-
08.com.netapp:sn.58d7f6df2cc611eaa9c500a098a71638:vs.6
```

6. On the iSCSI client, login to all the discovered addresses: `iscsiadm -m node -L all -T node-address -p portal-address -l`

```
[root@scspr1789621001 ~]# iscsiadm -m node -L all -T iqn.1992-
08.com.netapp:sn.58d7f6df2cc611eaa9c500a098a71638:vs.6 -p
10.230.68.236:3260 -l

Logging in to [iface: default, target: iqn.1992-
08.com.netapp:sn.58d7f6df2cc611eaa9c500a098a71638:vs.6, portal:
10.226.43.142,3260] (multiple)
Logging in to [iface: default, target: iqn.1992-
08.com.netapp:sn.58d7f6df2cc611eaa9c500a098a71638:vs.6, portal:
10.226.43.134,3260] (multiple)
Login to [iface: default, target: iqn.1992-
08.com.netapp:sn.58d7f6df2cc611eaa9c500a098a71638:vs.6, portal:
10.226.43.142,3260] successful.
Login to [iface: default, target: iqn.1992-
08.com.netapp:sn.58d7f6df2cc611eaa9c500a098a71638:vs.6, portal:
10.226.43.134,3260] successful.
```

7. On the iSCSI client, verify the login and connections: `iscsiadm -m session`

```
[root@scspr1789621001 ~]# iscsiadm -m session

tcp: [1] 10.230.68.236:3260,1156 iqn.1992-
08.com.netapp:sn.58d7f6df2cc611eaa9c500a098a71638:vs.6 (non-flash)
tcp: [2] 10.230.68.237:3260,1158 iqn.1992-
08.com.netapp:sn.58d7f6df2cc611eaa9c500a098a71638:vs.6 (non-flash)
tcp: [3] 10.226.43.142:3260,1188 iqn.1992-
08.com.netapp:sn.58d7f6df2cc611eaa9c500a098a71638:vs.6 (non-flash)
```

8. From the MetroCluster node, verify the login and connection with the client: `iscsi initiator show -vserver vsa_1`

```
sti8200mcchtp001htp_siteA::*> iscsi initiator show -vserver vsa_1

Tpgroup Initiator

Vserver Name          TSIH Name          ISID
Igroup Name
-----
vsa_1 iscsi_lf__n1_p1_ 4 iqn.2020-
01.com.netapp.englab.gdl:scspr1789621001 00:02:3d:00:00:01 igroup_linux
vsa_1 iscsi_lf__n2_p1_ 4 iqn.2020-
01.com.netapp.englab.gdl:scspr1789621001 00:02:3d:00:00:02 igroup_linux
vsa_1 iscsi_lf__n3_p1_ 1 iqn.2020-
01.com.netapp.englab.gdl:scspr1789621001 00:02:3d:00:00:04 igroup_linux
vsa_1 iscsi_lf__n4_p1_ 1 iqn.2020-
01.com.netapp.englab.gdl:scspr1789621001 00:02:3d:00:00:03 igroup_linux

4 entries were displayed.
```

At the end of this tasks, the client can see all iSCSI interfaces (on the MetroCluster FC and MetroCluster IP nodes) and is logged in to all those interfaces.

LUNs and volumes are still physically hosted on FC nodes. Because LUNs are reported only on MetroCluster FC node interfaces, the client will show only paths over MetroCluster FC nodes. This can be seen in `sanlun lun show -p` and `multipath -ll -d` command outputs. The next step is to add IP nodes as reporting nodes.


```
[root@scspr1789621001 ~]# sanlun lun show -p
ONTAP Path: vsa_1:/vol/vsa_1_vol6/lun_linux_12
LUN: 4
LUN Size: 2g
Product: cDOT
Host Device: 3600a098038304646513f4f674e52774b
Multipath Policy: service-time 0
Multipath Provider: Native
-----
-----
host vserver
path path /dev/ host vserver
state      type      node      adapter      LIF
-----
-----
up          primary    sdk       host3         iscsi_lf__n2_p1_
up          secondary  sdh       host2         iscsi_lf__n1_p1_

[root@scspr1789621001 ~]# multipath -ll -d
3600a098038304646513f4f674e52774b dm-5 NETAPP ,LUN C-Mode
size=2.0G features='4 queue_if_no_path pg_init_retries 50
retain_attached_hw_handle' hwhandler='1 alua' wp=rw
|-+- policy='service-time 0' prio=50 status=active
|  `-- 3:0:0:4 sdk 8:160 active ready running
`-+- policy='service-time 0' prio=10 status=enabled
   `-- 2:0:0:4 sdh 8:112 active ready running
```

Adding the MetroCluster IP nodes as reporting nodes

After setting up the connections to the new MetroCluster IP nodes, you must add new reporting nodes.

1. On the MetroCluster node, list reporting nodes for LUNs on the SVM: `lun mapping show -vserver vsa_1 -fields reporting-nodes -ostype linux`

The following reporting nodes are local nodes as LUNs are physically on FC nodes node_A_1-FC and node_A_2-FC.

```
node_A_1-IP::*> lun mapping show -vserver vsa_1 -fields reporting-nodes
-ostype linux

vserver path igroup reporting-nodes
-----
vsa_1 /vol/vsa_1_vol1/lun_linux_2 igroup_linux node_A_1-FC,node_A_2-FC
.
.
.
vsa_1 /vol/vsa_1_vol9/lun_linux_19 igroup_linux node_A_1-FC,node_A_2-FC
12 entries were displayed.
```

2. On the MetroCluster node, add reporting nodes: `lun mapping add-reporting-nodes -vserver svm-name -path /vol/vsa_1_vol*/lun_linux_* -nodes node1,node2 -igroup igroup_linux`

```
node_A_1-IP::*> lun mapping add-reporting-nodes -vserver vsa_1 -path
/vol/vsa_1_vol*/lun_linux_* -nodes node_A_1-IP,node_A_2-IP
-igroup igroup_linux

12 entries were acted on.
```

3. On the MetroCluster node, verify that the newly added nodes are present: `lun mapping show -vserver svm-name -fields reporting-nodes -ostype linux vserver path igroup reporting-nodes`

```
node_A_1-IP::*> lun mapping show -vserver vsa_1 -fields reporting-nodes
-ostype linux vserver path igroup reporting-nodes
-----
vsa_1 /vol/vsa_1_vol1/lun_linux_2 igroup_linux node_A_1-FC,node_A_2-FC,node_A_1-IP,node_A_2-IP
vsa_1 /vol/vsa_1_vol1/lun_linux_3 igroup_linux node_A_1-FC,node_A_2-FC,node_A_1-IP,node_A_2-IP.
.
.
.
12 entries were displayed.
```

4. On the host, issue the following command to rescan the scsi bus on the host and discover the newly added paths: `/usr/bin/rescan-scsi-bus.sh -a`

```
[root@stemgr]# /usr/bin/rescan-scsi-bus.sh -a
Scanning SCSI subsystem for new devices
Scanning host 0 for SCSI target IDs 0 1 2 3 4 5 6 7, all LUNs
Scanning host 1 for SCSI target IDs 0 1 2 3 4 5 6 7, all LUNs
Scanning host 2 for SCSI target IDs 0 1 2 3 4 5 6 7, all LUNs
  Scanning for device 2 0 0 0 ...
.
.
.
OLD: Host: scsi5 Channel: 00 Id: 00 Lun: 09
  Vendor: NETAPP Model: LUN C-Mode Rev: 9800
  Type: Direct-Access ANSI SCSI revision: 05
0 new or changed device(s) found.
0 remapped or resized device(s) found.
0 device(s) removed.
```

5. On the host, issue the following command to list the newly added paths: `sanlun lun show -p`

Four paths are shown for each LUN.

```
[root@stemgr]# sanlun lun show -p
ONTAP Path: vsa_1:/vol/vsa_1_vol6/lun_linux_12
LUN: 4
LUN Size: 2g
Product: cDOT
Host Device: 3600a098038304646513f4f674e52774b
Multipath Policy: service-time 0
Multipath Provider: Native
-----
-----
host vserver
path path /dev/ host vserver
state type node adapter LIF
-----
-----
up primary sdk host3 iscsi_lf__n2_p1_
up secondary sdh host2 iscsi_lf__n1_p1_
up secondary sdag host4 iscsi_lf__n4_p1_
up secondary sdah host5 iscsi_lf__n3_p1_
```

6. On the MetroCluster, move the volume/volumes containing LUNs from FC to IP nodes.

```

node_A_1-IP::*> vol move start -vserver vsa_1 -volume vsa_1_vol1
-destination-aggregate sti8200mccip_htp_005_aggr1
[Job 1877] Job is queued: Move "vsa_1_vol1" in Vserver "vsa_1" to
aggregate "sti8200mccip_htp_005_aggr1". Use the "volume move show
-vserver
vsa_1 -volume vsa_1_vol1" command to view the status of this operation.
node_A_1-IP::*> vol move show
Vserver      Volume      State      Move      Phase      Percent-
Complete    Time-To-Complete
-----
-----
vsa_1        vsa_1_vol1  healthy                    initializing  -
-

```

7. When the volume move is completed, on the MetroCluster, use the volume show command to confirm that the volume or LUN is online.
8. The iSCSI interfaces on the MetroCluster IP nodes where the LUN now resides are updated as primary paths. If the primary path is not updated after the volume move, run `/usr/bin/rescan-scsi-bus.sh -a` and `multipath -v3` or simply wait for multipath rescanning to take place.

In the following example, the primary path is a LIF on the MetroCluster IP node.

```

[root@stemgr]# sanlun lun show -p
ONTAP Path: vsa_1:/vol/vsa_1_vol6/lun_linux_12
LUN: 4
LUN Size: 2g
Product: cDOT
Host Device: 3600a098038304646513f4f674e52774b
Multipath Policy: service-time 0
Multipath Provider: Native
-----
host vserver
path path /dev/ host vserver
state type node adapter LIF
-----
up      primary  sdag  host4  iscsi_lf__n4_p1_
up      secondary sdk    host3  iscsi_lf__n2_p1_
up      secondary sdh    host2  iscsi_lf__n1_p1_
up      secondary sdah   host5  iscsi_lf__n3_p1_

```

Removing reporting nodes and rescanning paths

You must remove the reporting nodes and rescan the paths.

1. From the MetroCluster IP node, remove remote reporting nodes (the MetroCluster IP nodes) for the Linux LUNs: `lun mapping remove-reporting-nodes -vserver vsa_1 -path * -igroup igroup_linux -remote-nodes true`

In this case, the remote nodes are FC nodes.

```
node_A_1-IP::*> lun mapping remove-reporting-nodes -vserver vsa_1 -path
* -igroup igroup_linux -remote-nodes true

12 entries were acted on.
```

2. From the MetroCluster IP node, check reporting nodes for the LUNs: `lun mapping show -vserver vsa_1 -fields reporting-nodes -ostype linux`

```
node_A_1-IP::*> lun mapping show -vserver vsa_1 -fields reporting-nodes
-ostype linux
```

vserver	path	igroup	reporting-nodes

vsa_1	/vol/vsa_1_vol1/lun_linux_2	igroup_linux	node_A_1-IP,node_A_2-IP
vsa_1	/vol/vsa_1_vol1/lun_linux_3	igroup_linux	node_A_1-IP,node_A_2-IP
vsa_1	/vol/vsa_1_vol2/lun_linux_4	group_linux	node_A_1-IP,node_A_2-IP
.			
.			
.			

```
12 entries were displayed.
```

3. On the iSCSI host, rescan the scsi bus: `/usr/bin/rescan-scsi-bus.sh -r`

The paths that are removed are the paths from FC nodes.

```

[root@scspr1789621001 ~]# /usr/bin/rescan-scsi-bus.sh -r
Syncing file systems
Scanning SCSI subsystem for new devices and remove devices that have
disappeared
Scanning host 0 for SCSI target IDs 0 1 2 3 4 5 6 7, all LUNs
Scanning host 1 for SCSI target IDs 0 1 2 3 4 5 6 7, all LUNs
Scanning host 2 for SCSI target IDs 0 1 2 3 4 5 6 7, all LUNs
sg0 changed: LU not available (PQual 1)
REM: Host: scsi2 Channel: 00 Id: 00 Lun: 00
DEL: Vendor: NETAPP Model: LUN C-Mode Rev: 9800
Type: Direct-Access ANSI SCSI revision: 05
sg2 changed: LU not available (PQual 1)
.
.
.
OLD: Host: scsi5 Channel: 00 Id: 00 Lun: 09
Vendor: NETAPP Model: LUN C-Mode Rev: 9800
Type: Direct-Access ANSI SCSI revision: 05
0 new or changed device(s) found.
0 remapped or resized device(s) found.
24 device(s) removed.
[2:0:0:0]
[2:0:0:1]
.
.
.

```

4. On the iSCSI host, verify that only paths from the MetroCluster IP nodes are visible: `sanlun lun show -p``multipath -ll -d`

Where to find additional information

You can learn more about MetroCluster configuration.

MetroCluster and miscellaneous information

Information	Subject
Fabric-attached MetroCluster installation and configuration	<ul style="list-style-type: none"> • Fabric-attached MetroCluster architecture • Cabling the configuration • Configuring the FC-to-SAS bridges • Configuring the FC switches • Configuring the MetroCluster in ONTAP

Stretch MetroCluster installation and configuration	<ul style="list-style-type: none"> • Stretch MetroCluster architecture • Cabling the configuration • Configuring the FC-to-SAS bridges • Configuring the MetroCluster in ONTAP
MetroCluster management	<ul style="list-style-type: none"> • Understanding the MetroCluster configuration • Switchover, healing, and switchback
Disaster Recovery	<ul style="list-style-type: none"> • Disaster recovery • Forced switchover • Recovery from a multi-controller or storage failure
MetroCluster Maintenance	<ul style="list-style-type: none"> • Guidelines for maintenance in a MetroCluster FC configuration • Hardware replacement or upgrade and firmware upgrade procedures for FC-to-SAS bridges and FC switches • Hot-adding a disk shelf in a fabric-attached or stretch MetroCluster FC configuration • Hot-removing a disk shelf in a fabric-attached or stretch MetroCluster FC configuration • Replacing hardware at a disaster site in a fabric-attached or stretch MetroCluster FC configuration • Expanding a two-node fabric-attached or stretch MetroCluster FC configuration to a four-node MetroCluster configuration. • Expanding a four-node fabric-attached or stretch MetroCluster FC configuration to an eight-node MetroCluster FC configuration.
MetroCluster Upgrade and Expansion	<ul style="list-style-type: none"> • Upgrading or refreshing a MetroCluster configuration • Expanding a MetroCluster configuration by adding additional nodes
MetroCluster Transition	<ul style="list-style-type: none"> • Transitioning from a MetroCluster FC configuration to a MetroCluster IP configuration
MetroCluster Upgrade, Transition, and Expansion	<ul style="list-style-type: none"> • Monitoring the MetroCluster configuration with the MetroCluster Tiebreaker software

<p>AFF and FAS Documentation</p> <p>Note: The standard storage shelf maintenance procedures can be used with MetroCluster IP configurations.</p>	<ul style="list-style-type: none"> • Hot-adding a disk shelf • Hot-removing a disk shelf
<p>Copy-based transition</p>	<ul style="list-style-type: none"> • Transitioning data from 7-Mode storage systems to clustered storage systems
<p>ONTAP concepts</p>	<ul style="list-style-type: none"> • How mirrored aggregates work

Copyright information

Copyright © 2022 NetApp, Inc. All Rights Reserved. Printed in the U.S. No part of this document covered by copyright may be reproduced in any form or by any means—graphic, electronic, or mechanical, including photocopying, recording, taping, or storage in an electronic retrieval system—without prior written permission of the copyright owner.

Software derived from copyrighted NetApp material is subject to the following license and disclaimer:

THIS SOFTWARE IS PROVIDED BY NETAPP “AS IS” AND WITHOUT ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, WHICH ARE HEREBY DISCLAIMED. IN NO EVENT SHALL NETAPP BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

NetApp reserves the right to change any products described herein at any time, and without notice. NetApp assumes no responsibility or liability arising from the use of products described herein, except as expressly agreed to in writing by NetApp. The use or purchase of this product does not convey a license under any patent rights, trademark rights, or any other intellectual property rights of NetApp.

The product described in this manual may be protected by one or more U.S. patents, foreign patents, or pending applications.

LIMITED RIGHTS LEGEND: Use, duplication, or disclosure by the government is subject to restrictions as set forth in subparagraph (b)(3) of the Rights in Technical Data -Noncommercial Items at DFARS 252.227-7013 (FEB 2014) and FAR 52.227-19 (DEC 2007).

Data contained herein pertains to a commercial product and/or commercial service (as defined in FAR 2.101) and is proprietary to NetApp, Inc. All NetApp technical data and computer software provided under this Agreement is commercial in nature and developed solely at private expense. The U.S. Government has a non-exclusive, non-transferrable, nonsublicensable, worldwide, limited irrevocable license to use the Data only in connection with and in support of the U.S. Government contract under which the Data was delivered. Except as provided herein, the Data may not be used, disclosed, reproduced, modified, performed, or displayed without the prior written approval of NetApp, Inc. United States Government license rights for the Department of Defense are limited to those rights identified in DFARS clause 252.227-7015(b) (FEB 2014).

Trademark information

NETAPP, the NETAPP logo, and the marks listed at <http://www.netapp.com/TM> are trademarks of NetApp, Inc. Other company and product names may be trademarks of their respective owners.